Are shorebirds sometimes forced to roost on water in thick fog?

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Observations were made of single birds and small flocks of Red Knots flying up from 1.1-m-deep water when disturbed by spotlight in thick fog on 14 January 2002. This occurred in moonless darkness at ca. 21 h (about an hour before high tide) ca. 1 km north of their normal shoreline roosts on the island of Griend in the western Dutch Wadden Sea. In addition to Red Knots, individual Dunlins were picked up by the searchlight as they flew up from, or low over, the water and around our ship. Many Curlews, Oystercatchers and Bar-tailed Godwits were also heard then and in the previous two hours. All of this happened after an afternoon of low water and rising tide that had been very foggy. We suggest that the birds were disturbed by the lighted ship and the searchlights as they were floating on the water surface, perhaps having been unable to find the onshore roost sites in the thick wet fog. This suggestion seemed confirmed by the repeated night-time and high-tide offshore presence of Red Knots on 17 January, and the absence of offshore shorebirds on 15 January when thick fog only set in shortly before high tide. We review other anecdotal evidence for shorebirds spending high tide roosting on water, and consider the possibility that shorebirds, along with swans and geese, share a capacity to stop and rest on the sea during transoceanic migratory flights.

INTRODUCTION

In midwinter, when air temperatures are close to zero and water temperatures not much higher, few of us have the opportunity or inclination to venture into the field, let alone to places at sea in the vicinity of shorebird roosts. Our research programme at the Netherlands Institute for Sea Research (NIOZ) on Red Knots *Calidris canutus* and Bar-tailed Godwits *Limosa lapponica* took us to the island of Griend in the Dutch Wadden Sea on the NIOZ research vessel *Navicula* on 14 January 2002. All the way, from leaving the island of Texel at 10 h until arriving in the channel north of Griend around 16 h, we had been in thick fog, a fog that persisted when night fell soon after 17 h. We witnessed near Griend something that none of us had anticipated: several shorebird species roosting by swimming together on the sea in rafts.

OBSERVATIONS

The wind was from the southwest, 4–5 Beaufort, the air temperature 2–3°C, and the fog was still thick with a visibility of 30–50 m, when at 19 h the *Navicula* attempted to come closer to the island with the incoming tide. At this point we were still 3–4 km north of Griend, but on the basis of the calling we heard, it was clear that many Oystercatchers *Haematopus ostralegus* and Curlews *Numenius arquata* were flying around the ship. With a spotlight we were unable to find them within the 50 m range of visibility, but instead we found several individual Red Knots, flying just above the water surface in a hovering manner. A few of these birds, probably dazzled by the spotlight, approached the ship before turning away at close range. As it was then still about three hours before high tide, all these birds might be moving onshore to roost.

At 21 hr, an hour before high water when the fog had become thinner with visibility at ca. 100 m, we tried to move the ship closer to the island. At 1–1.5 km north of Griend, the *Navicula* (draft 1.1–1.2 m) hit bottom. Here we anchored. We were still hearing Curlews and less often Oystercatchers. With the ship's searchlight, we found a flock of ca. 20 Red Knots as they flew up from the water and started flying around in a fluttering, haphazard manner, a few times almost colliding with the ship. With a handheld spotlight we also found several individual Red Knots and Dunlins *Calidris alpina* that seemed to be floating on the water until they were caught in the beam of the spotlight and then flew up instantly. In addition Bar-tailed Godwits were heard around the ship and one, hovering above the ship, was caught in the spotlight. We concluded that many shorebirds had not made it to the usual high-tide roosting sites on the island in the foggy and windy conditions.

On the following day, 15 January, the afternoon and nightfall when the tide was starting to come in was clear, though there was some sleet and rain. Around 21 h, however, about an hour before high tide, thick fog set in again. We made observations from the stationary *Navicula* anchored north of Griend and from an inflatable boat cruising the water between there and the island. Despite the dense fog we were not able to detect any shorebirds rafting on or flying over the water. It was a still night and we did not hear any shorebirds call-

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ing in flight over the water. The only bird-sounds we heard came from the roosts on the island. The evening of 16 January was clear and windy and no unusual observations were made. During the evening of 17 January, however, the incoming tide again coincided with rain and dense fog (visibility: 50–100 m). From 21.00–21.25 h (an hour and a half before high tide), as we sailed westwards over the submerged mudflats, we again encountered many hundreds of fluttering Red Knots, mostly in flocks of 20–30 birds. Their movements, 2–3 km from the nearest shoreline roosts, were mostly undirected suggesting a lack of orientation. In total, we must have seen several thousands. On two occasions, we could positively identify flocks of Knots flying up from the water surface. Except for Herring Gulls *Larus argentatus*, no other species were seen on this occasion. These gulls may have been a threat for the floating birds (shorebird remains commonly turn up in Herring Gull pellets from the Dutch Wadden Sea, B. Koks pers. comm.).

INTERPRETATION

The finding of small flocks and single Red Knots and Dunlins floating on the surface of the water on 14 and 17 January, and the abundance of the same species as well as Curlews, Oystercatchers and Bar-tailed Godwits flying over the water on the evening of 14 January, is interpreted by us as an incident where large numbers of shorebirds had been *forced either to roost on water or to spend the entire high-water period in flight* as a consequence of being unable to find the shoreline roosts on Griend due to thick fog. On 15 January, thick fog set in only after the birds had reached the vicinity of the island so they did not become lost.

COMPARABLE ANECDOTES

On 28 February 1984, the small NIOZ vessel *Griend* sailed from the NIOZ harbour on the southern point of Texel on the ebbing tide to make a reconnaissance of an area of intertidal flat at Balgzand. It was rather foggy, but the scientists hoped that it would clear up (P. Duiven pers. comm.). When the *Griend* entered the main gully bordering the Balgzand flats, the first swimming Oystercatcher was seen. It was hauled on board with a net. Soon many other Oystercatchers followed, all swimming and lying very deep in the water, their heads just above the surface. The people on board (P. Duiven, C. Swennen and skipper E. Adriaans) started recovering all swimming shorebirds and some carcasses of birds that had drowned. They were later assisted by J. van Dijk on the surveillance ship *Phoca*. Some birds that were still alive were resuscitated, but many died. During the following days many carcasses were found on the Texel shoreline, having been carried there by the outgoing tide. In total, the corpses of several hundred Oystercatchers, more than 200 Curlews, some Grey Plovers *Pluvialis squatarola* and more than 50 Red Knots were collected after the incident. The reason for the drowning of all these shorebirds was clear, as the water was "fatty" and covered by the dirty froth typical of a declining/dying *Phaeocystis* (a colonial algae) bloom (Brussaard 1997). In the interpretation of those present at the time, the birds had left the high-tide roost for the nearby musselbeds and then, due to the misty conditions, mistaken the foamy mats on the water as the place to land (P. Duiven pers. comm.).

During the hot afternoon of 13 February 1993 (air temperature ca. 38°C, water temperature ca. 32°C), just east of the island of Maio in the Bijagos Archipelago, Guinea-Bissau, about 3,000 Bar-tailed Godwits and a few Red Knots spent high tide roosting in a dense flock on the water. They remained afloat for at least 1.5 hours, and certainly looked more like of flock of ducks than a flock of shorebirds (TP pers. obs.). This floating flock was captured on film as part of the BBC production *Untangling the knot*, a film directed by Richard Brock (1993). We interpreted this behaviour as evidence that during really hot periods (when operative temperatures as high as 60°C were measured on the beaches using copper models; Kersten & Piersma 1998), the shorebirds avoided roosting on the "tannes", barren sand- and saltflats surrounded by mangrove forest.

It is well known that Avocets *Recurvirostra avosetta* readily roost by swimming in flocks on the sea (Cramp & Simmons 1983). Spotted Redshanks *Tringa erythropus* have also frequently been recorded to spend several hours afloat on open water (seen in the Dutch Wadden Sea and Ghana; pers. obs., B. Koks pers. comm.).

DISCUSSION

The only shorebirds with a truly pelagic lifestyle are the phalaropes, and these birds have a very dense, duck-like plumage (pers. obs.). In our experience in the NIOZ mudflat aviaries with a tidal regime, captive Red Knots become quite waterlogged after about half an hour of accidental swimming (usually during the trials when they have to learn to recognise the "high-tide roosting-section" of the aviary). Such a water-resistance would not get them through a 4–5-hr-long roosting period, unless (a) the plumage of free-living birds in winter is more waterproof than our captive birds, and/or (b) the surface tension of the Wadden Sea water encountered on 14 January is higher than that of the seawater on offer in the aviaries. The surface tension of the water in the aviaries is typically less than 60 dyne/cm (Swennen 1977); this would be insufficient to keep even real seabirds like Guillemots *Uria aalge* and Razorbills *Alca torda* afloat (cf. Swennen 1977). This suggests that water tension on the sea may be higher than in the aviaries. If so, Red Knots may be able to stay afloat without becoming waterlogged for somewhat longer than half an hour. Perhaps it also helps if the birds occasionally take flight and shake the water off their feathers. When water has a low surface tension, for example as a consequence of dead floating algae (easily yielding surface tension values as low as 40 dyne/cm; Swennen 1977), birds would become waterlogged quickly. A local algal bloom that made the water surface tension drop to very low levels indeed (coincident with a day of thick fog) may have caused the Balgzand incident of February 1984.

Recent information collected on the long-distance migration of swans and geese by means of satellite telemetry indicates that such birds routinely spend periods resting at sea or on lakes during their long flights (Butler *et al.* 1998, Pennycuick *et al.* 1999, Green *et al.* 2002). Whether our present observations mean that shorebirds can and do spend similar periods of rest at sea during their really long trans-oceanic flights (e.g. Piersma & Gill 1998) remains to be seen. It probably awaits the development and application of even more miniaturised satellite tags.

A last point for discussion is whether shorebirds lost in fog should not simply stay in the air for the whole period of high tide, a behaviour repeatedly described for Dunlin heavily disturbed by raptors at their high-tide roosts (Dekker

1998, Hötker 2000). In fact, this may have been the case, as we cannot exclude the possibility that periods on the water were not interspersed by periods in the air. However, if thick fog makes it particularly difficult to stay together in flight (and if being in a flock is important), then birds may elect to land on the water surface and spend time swimming closely together in a raft.

We finish by considering the implications of our observations, in relation to the risks of bird mortality from large vertical structures in the open landscapes used by shorebirds. The government of The Netherlands is keen to develop plans for large groups of 100-m-high wind turbines right in the flight lines of Wadden Sea birds. Germany has already built many such structures in coastal areas. Such turbines may only be a threat to naïve migrant birds, but under the weather conditions encountered by us on 14 and 17 January 2002 (thick fog and strong winds) even locally experienced birds could easily fall victim to such structures. The relative scarcity of these weather phenomena make the risks associated with turbines hard to quantify. However, that is not good enough reason to omit them from ecological risk assessments. For a start, it might be useful to analyse weather conditions in relation to bird mortality around long-standing vertical structures such as the Westerhever lighthouse in the Wadden Sea of Schleswig-Holstein.

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