

## Selection of nocturnal roost sites by waders in the Hunter Estuary

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During the winter of 2004 a study was conducted on the niche of the Bar-tailed Godwit *Limosa lapponica* in the Hunter River Estuary, i.e. about the details of all its interactions with the various habitats it uses and with other species, avian and otherwise. This species was chosen, because it uses the estuary in good numbers and is gregarious with other waders, so any findings might be used as a starting point to propose studies into the wider wintering wader flock. The study sought to answer fundamental questions about the way Bar-tailed Godwit use the estuary. This included the identification of all sites it uses for roosting and foraging, and whether changes in environmental conditions, including night/day, high/low-tide, and different weather conditions, changed the way the birds used the estuary (Richardson 2004).

Up until the 2004 study, local bird researchers had gained a general understanding of the way migratory waders used the estuary, supported by a study conducted by David Geering (1995). Yet much of the observation was limited to daylight hours. As a consequence of remaining gaps in knowledge of nocturnal habits, our winter 2004 study employed many more radio transmitters. This allowed observation of the activities of 15 Bar-tailed Godwit around the clock to determine if there were areas of important foraging and roosting habitat that were previously unknown. The study also hoped to determine if wintering Bar-tailed Godwit solely used sites on the Hunter Estuary. Would there be times when the estuary could not fulfil all their requirements and they might move to another?

The key findings of the study (Richardson 2004) were that Hunter Bar-tailed Godwit remain in the estuary throughout the austral winter, and in relation to their foraging habits they are essentially birds of the tide. However, the study showed that while there was a reliable predictability regarding their foraging on the same low-tide mudflats, despite differences in time of day or different weather conditions, the usage of roosting habitats

was an entirely different matter. Time and again the birds observed a clearly demarcated difference in the use of roosting habitats between daylight and night-time hours. This aspect of their behaviour, involving the complete rejection of their diurnal roosts at night, had not been previously documented in the Hunter Estuary.

During daylight hours Bar-tailed Godwit habitually used the same roosting habitats that were close to the areas in which they foraged, such as Kooragang Dykes and Stockton Sandspit; yet at night they used a range of different locations spread across the Ash and Kooragang Islands for unpredictable periods of time. So strong was the impetus to vacate daylight roosts during the hours of darkness that even when they were settled on the dykes before sunset, they would leave for the island roosts before it was completely dark.

Every other part of their daily regime was governed by the tide, yet the reason for their exclusive use of more distant roosts away from the foraging areas at night, remained unresolved and the number of consecutive nights they spent at any one of their night-time roosts appeared completely random. They might use one roost for two weeks, or another for three days, and then inexplicably discard those roosts for another, with no tidal, day cycle or weather cues to suggest a reason for the shift.

However, as the study progressed the reason the birds avoided day roosts at night emerged and it had nothing to do with the tide or the weather, but appeared to be influenced by the time of day. Many of the roost sites the birds were using had signs of fox use. Equipment left on the dykes was marked by foxes; fox scats and footprints were found at Stockton Sandspit; the beach at Barry Shearman's farm in Fullerton Cove had apparently been discarded as a roost site and there were fox footprints in the beach's sand; and one night on Ash Island's Wader Pond a fox casually loped through the pond before us as if it was part of its

nightly regime. Further to these observations an oyster fisherman had related to me a first-hand observation of a fox swimming across a wide stretch of the Hunter River, so it was obvious that water was no barrier to foxes. Although foxes sometimes forage during the day the majority of foraging movements by foxes locally are undertaken at night. The threat of foxes might thus be the reason behind the nocturnal roost-site selection of the birds.

Although it was beyond the resources of the 2004 study to scientifically verify all the findings, here was a mechanism that could explain why diurnal roosts such as Stockton Sandspit and the dykes, which are used every day by waders, were avoided as important roost sites at night. Such places would likely be visited every evening by foxes, for the bird-scent induced hope of the easy meal, which a sick, deceased or nesting bird would represent.

Furthermore, only the fox hypothesis appeared to be capable of explaining the random nocturnal roost changing conundrum. It appeared that the birds would only remain at one of the nocturnal roost sites as long as it took the foxes to find where the birds were roosting. The birds would be flushed from the current roost, and then the fox and wader interaction clock would reset.

Aggregations of wading birds roosting at night would likely represent an important food resource for foxes to target, so the limited number of suitable roost sites close to the foraging areas could mean that the birds would be disturbed too regularly for these sites to be useful for them at night. Diurnal use of these roosts is apparently safer, since the same fox surprise-attack circumstances would not be present in daylight hours because the birds would easily see foxes approaching from a distance. On the other hand, during nocturnal hours it appeared that Ash Island represented a large area encompassing many potential roosting sites, a number of which were associated with water. Shallow water roosts may make the approach of foxes more detectable by the birds, while the larger area and number of potential roost sites offered by Ash Island may make the birds more difficult for foxes to find.

While the 2004 Hunter Estuary study's data establishes that Bar-tailed Godwits' diurnal and nocturnal roost selection is markedly different, there have been no direct observations to conclusively establish that fox behaviour is the prime driver in the birds' strategy to vacate diurnal roosts during nocturnal hours, nor that foxes are solely responsible for the birds' seemingly random changes of nocturnal roosting habitats. While the reasoning postulated appears quite plausible, and likely to be at least part of the explanation, these hypotheses are based on circumstantial evidence, which requires validation. Therefore there remains a gap in the data, which may be filled easily by setting up remote cameras at nocturnal roost sites in order to determine the fit of these hypotheses.

The implication of the study's findings is that migratory waders within the Hunter Estuary require a much greater area for roosting than is apparent from daytime survey data alone. This would appear to be the case even if foxes are not as important a factor as our provisional conclusion has postulated. Furthermore, if such a dependence on different roosting habitats during nocturnal hours applies in the Hunter Estuary, then the same greater variety of roosts will likely be required in other estuaries.

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