Project Summary Report: T. A. Ross

Foraging ecology of Bar-tailed Godwits (*Limosa lapponica*) upon migration arrival

Bar-tailed Godwits are a size-dimorphic shorebird species in which females are larger than males. This pattern is reflected in their bill lengths; male bills range from 7 to 9 cm whereas females range from 9 to 13 cm. As these birds forage predominantly on mudflats, this bill length variation may limit certain prey type availability especially for shorter-billed birds. This could possibly result in a systematic foraging pattern of prey choice and intake rates across the bill length spectrum. Furthermore, Bar-tailed Godwits migrate between Alaska and New Zealand every year, a journey of over 11,500 km that takes 8-9 days. These endurance flights are one of the longest known in the bird world, and are a particularly strenuous undertaking that have wide-ranging physiological implications for the birds. Godwits are known to store huge reserves of fat prior to leaving but arrive with severely depleted body mass. These reductions are pronounced not just in fat reserves but also in lean tissue such as digestive organs. Reduced organ sizes could influence both prey choice and intake rates when birds arrive from migration, but as guts 'recover' their diet might change and intake rates increase accordingly. In this study I investigated how bill length and behaviour affect resource use (i.e. diet choice) and whether there is any evidence for 'recovery' after migration, as part of a Master of Science thesis at Massey University.

Individually marked birds were digiscoped as they foraged at the Manawatu Estuary, and videos later analysed. By using individually marked birds, I was able to estimate actual sizes of prey items taken based on their known bill lengths, which could also be used to calculate actual probing depths of the birds. I could also determine from daily colour-band and leg-flag records when they arrived from migration, and therefore how long each video was from their arrival date. Biomass of prey was calculated using size-mass relationships determined from additional benthic sampling.

Of particular interest were how deeply birds probed in relation to bill length, and whether birds of different sizes had different diets and intake rates. Several major prey types were identified, including the mud snails *Potamopyrgus* and *Amphibola*, polychaete worms, crabs, juvenile flounder, and the buried bivalve *Cyclomactra*, which was taken whole in some instances but often just the long siphon could be extracted. Two clear patterns were that (not unexpectedly) deeply buried prey such as worms and bivalves were taken predominantly by long-billed birds (i.e. females) and that the tiny surface-dwelling mud snails *Potamopyrgus* were taken largely by short-billed birds (males). This was more than just long-billed birds being able to probe deeper than shorter-billed birds, however – they also probed full bill-length up to their faces much more often than the shorter-billed birds did. There was also evidence that some birds of both sexes specialised on certain prey types. Diet choice therefore involves an element of physical size but also individual preference.

Perhaps surprisingly, there was no indication that diet or intake rates changed with time after arrival, as might be expected if the digestive system was limiting intake rates and was recovering. Given that the birds would arrive in NZ in a state of reduced digestive tract mass, it was expected that they might favour softer prey or consume prey at lower rates initially, until they rebuilt full functionality of their gut. My results suggest that birds arriving from migration ate everything that was available. Other studies of migratory birds looking at mass gains following migration found an initial period of no mass gain before the birds started increasing their body mass. This could be a similar pattern to what is happening with the godwits, in that instead of being limited in their intake rates, the limiting factor could be nutrient assimilation due to gut functionality. In this case, newly arrived godwits would be inefficient at digesting prey, but this would not be apparent in intake rates as examined in this study. To determine the relative effect of this, studies of energetics and body masses would be ideal for a future study to examine.