Arctic Shorebird Migration Workshop

Estimating population specific differences in survival in a mixed population of staging Red Knot *Calidris canutus*

Philip W. Atkinson, Allan J. Baker, Karen A. Bennett, Nigel. A. Clark, Jacquie A. Clark, Kimberly B. Cole, Amanda Dey, Simon Gillings, Patricia M. Gonzalez, Brian A. Harrington, Clive D.T. Minton, Ron Porter, Ines de Lima Serrano, Jason Newton, Lawrence J. Niles, Robert A. Robinson & Humphrey P. Sitters

British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU, UK. phil.atkinson@bto.org

Estimating population-specific demographic parameters for shorebirds is fraught with difficulties. The often dispersed nature of their distribution in the non-breeding season makes it relatively easy to estimate site-specific survival and recruitment rates, but numerous studies at different sites would be needed to generate a robust estimate of the population as a whole. Perhaps more attractive is estimating these parameters at staging sites through which a large proportion of a population may pass. However, these sites may be used by a number of different populations, thus confounding the estimates. In this study, we estimated survival of three different groups of Red Knot that pass through Delaware Bay on spring migration from wintering areas in Patagonia and Tierra del Fuego, northern Brazil and the south-eastern USA. Individually-marked birds were allocated to a 'population' using stable isotopes in flight feathers. $\delta^{15}N$ values separated the two northern populations from the southern one and $\delta^{13}C$ values were used to separate the Brazil and SE USA populations and also subdivide the Patagonian/TdF population. Stable isotopes have great potential for separating mixed populations of shorebirds, especially where mixed populations from tropical and temperate areas occur. Their application in Delaware Bay is especially valuable due to concerns about massive declines in the long-distance, rather than short-distance migrants. Intensive re-sighting effort during each spring resulted in over half the individuals alive being re-sighted each year, thus enabling survival rates to be calculated with a precision that would not have been available from an analysis of re-trapped metal-ringed birds.

Modelling the optimal flyway of arctic-breeding shorebirds using dynamic programming

Bruno J. Ens, Hans Schekkerman, Ingrid Tulp, Silke Bauer & Marcel Klaassen

SOVON Dutch Centre for Field Ornithology, Landsdiep 4, 1797 SZ 't Horntje, Texel, The Netherlands. Bruno.Ens@SOVON.NL

Optimal models of migration using dynamic programming were first conceived in the 1990s. Building such models is relatively easy. The hard part is estimating the parameters and testing if the model correctly predicts the migration schedule of the bird species for which the model was parameterized. This paper describes the derivation of parameter estimates of a dynamic migration model for an arctic breeding shorebird, the Red Knot. An important parameter is the terminal reward, which describes the fitness consequences of arriving with a particular body condition at a particular time on the breeding grounds. We derived the terminal reward from field studies in Siberia. Other parameter values, like flight costs, maintenance metabolism and predation risk were derived from the literature. We did not include wind effects and this explains why model knots could not cover more than 3,420 km in a single flight whereas knots in the real world regularly fly further. The model correctly predicted the time of arrival, but migration was too slow, i.e. the birds departed too early from their wintering grounds. An interesting prediction of the model, that requires testing, is that knots breeding in Canada migrate via Iceland, whereas knots breeding on Greenland migrate via Norway. A sensitivity analysis indicated that this prediction was quite robust.

Shorebird migration across the Pacific: satellite technology, skilled hands, and good karma

R. Gill[1], D. Tibbitts, D. Mulcahy, B. McCaffery, D. Ruthrauff & D. Douglas

[1]U.S. Geological Survey, 1011 E, Tudor Road, Anchorage, AK99503-6119, USA. robert_gill@usgs.gov

That a suite of arctic-breeding shorebird species migrates across the Pacific Ocean is well known; how they accomplish such flights – presumed to be non-stop and greater than 10,000 km for some species – has largely been speculative. But with recent advances in satellite tracking technology, large shorebird species can now be fitted with satellite radios (Platform Transmitting Terminals or PTTs). In spring 2005, we tested PTTs on Bar-tailed Godwits in Alaska but the units stopped transmitting prior to the migration due to transmitter failure. However, birds were subsequently seen in New Zealand and eastern Australia, demonstrating they could complete such a flight carrying a PTT. Bolstered by this limited success, in spring 2006 we instrumented 7 Bar-tailed Godwits, 10 Bristle-thighed Curlews, and 1 Whimbrel with either redesigned battery-powered implantable or external mounted solar-powered PTTs. Units were programmed to begin a daily reporting cycle around the average departure date of the species. As of 16 August, all birds had left their nesting areas and moved to staging sites and the PTTs were all functioning. Tracking data have shown the southern Yukon–Kuskokwim River delta to be an important staging site for all three species, but two curlews subsequently moved to the Alaska Peninsula to stage. On 6 Aug, one of them embarked on its southern migration. On 13 Aug, after 160 h in the air, the curlew landed in French Polynesia, a great circle distance of 8,200 km from its starting point (9,200 km from its breeding site). Satellite tracking data indicated that not

only was the flight non-stop over at least 7,500 km, but that the bird apparently adjusted its flight path to find favourable winds en route, travelling at one point 1,000 km east of a direct route. On 16 Aug, as this abstract was written, the other curlew on the Alaska Peninsula had headed south over the Gulf of Alaska.

Population scale drivers of individual arrival times in Icelandic Black-tailed Godwits

T. Gunnarsson[1], J. Gill, G. Gélinaud, P. Potts, P. Atkinson, R. Croger, G. Gudmundsson, G. Appleton & W. Sutherland

[1]Snæfellsnes Research Centre, University of Iceland, Hafnargata 3, 340 Stykkishólmur, Iceland
tomas@hi.is

In migratory species, timing of spring migration is a key process because early arrival on the breeding grounds can enhance breeding success. Arrival times can be influenced by individual factors, such as migration distance and winter and breeding habitat quality locations, and by annual variation in weather conditions. The Icelandic Black-tailed Godwit *Limosa limosa islandica* population is currently expanding into poorer quality breeding areas throughout Iceland. Using a dataset of arrival times in Iceland in different years for individuals of known breeding and wintering locations, we explore the relative importance of individual factors and weather patterns in determining arrival times. We show that between-individual variation is a stronger predictor of arrival time than weather, and that habitat quality is the strongest individual predictor of arrival, whereas migration distance does not influence arrival times. Timing of migration appears to be a key component of the intricate relationship between wintering and breeding grounds in this migratory system. Whilst annual variation in timing of migration is influenced by climatic factors, the pattern of individual arrival is primarily related to breeding and winter habitat quality. These habitat effects on arrival patterns are likely to operate through variation in individual condition and local-scale density dependent processes.

Bird migration in the Beringia and beyond

Anders Hedenström, Thomas Alerstam, Johan Bäckman, Gudmundur Gudmundsson, Sara Henningsson, Håkan Karlsson, Mikael Rosén & Roine Strandberg

Department of Animal Ecology, Ecology Building, Lund University, 22362 Lund, Sweden
anders.hedenstrom@teorekol.lu.se

Bird migration was tracked by radar in the Beringia region in summer 2005. The data suggest that migration from Siberia was towards the Americas, as well as migration from North America towards Asia. Many birds involved are likely to be shorebirds. Large scale migration routes are discussed on the basis of the pattern of radar echoes as recorded in Beringia.

Leaving the Arctic: how Sharp-tailed Sandpipers prepare for southward migratory flights of 10,000 km

Marcel Klaassen, Åke Lindström, Sarah Jamieson, Brian McCaffery & Robert E. Gill

Netherlands Institute of Ecology, PO Box 1299, 3600 BG Maarssen, The Netherlands
m.klaassen@nioo.knaw.nl

The coastal zone of Alaska is an important refuelling and staging area for a great number and variety of migratory High Arctic shorebirds. Many birds are on their way from the Nearctic tundra to areas further south in the Americas, but the coastal wetlands of Alaska also host shorebirds en route from N Siberia to Australia and New Zealand! Notably juvenile Sharp-tailed Sandpipers, born in Siberia, use the Yukon delta in large numbers to fuel and prepare for what might be a spectacular trans-Pacific flight. The Sharp-tailed Sandpipers may well make one of the longest uninterrupted flights in the avian world (approx. 10,000 km), and such flights necessitate storage of large fuel loads. We aimed to elucidate the ecological conditions that enable these birds to fuel up fast and efficiently, by studying their fuelling rates, diet choice and local movements, in relation to fuelling performance.

Migratory fuelling of Sharp-tailed Sandpipers in Alaska

Åke Lindström[1], Marcel Klaassen, Bob Gill Jr, Sarah Jamieson & Liv Wennerberg

[1]Department of Ecology, Lund University, Ecology Building, 223 62 Lund, Sweden
ake.lindstrom@zooekol.lu.se

Sharp-tailed Sandpipers breed in NE Russia and winter mainly in Australia. In autumn, the adults migrate due south over the Asian continent towards their wintering grounds. In contrast, first-year birds first make a long detour to coastal Alaska, where they prepare for what is likely to be a very long trans-oceanic flight. We studied the details of this fuelling phase in the Yukon delta, SW Alaska, during 3–13 Sept 2004 and 1–26 Sept 2005. A total of 357 Sharp-tailed Sandpipers (all juveniles) were trapped in mist-nets and walk-in traps. As males are clearly bigger than females, we sexed them on wing length, later confirmed by molecular sexing.

There was a significant surplus of males (61%), despite the fact that the trapping methods would be more likely to bias the sex ratio towards females. Fat score was a good predictor of body mass. Body mass increased throughout the study period, but was significantly higher in late September. Up to 12 Sept, body mass increased only slowly at 0.6% per day. From 13 Sept, fuelling rates were dramatically higher reaching 6.5% per day, which is among the highest ever found in waders of similar size.

The highest body masses, all found in the last days of September, were truly impressive, indicating that Sharp-tailed Sandpipers before departure have fuel stores of about 120–130% in proportion to lean body mass. This is far more than

the fuel loads of well-known long-distance migrants like Red Knots and is probably only matched by the Bar-tailed Godwits staging in the very same area. We conclude that the coastal areas of SW Alaska allow very high fuelling rates and that the first-year Sharp-tailed Sandpipers staging there most likely embark on very long trans-oceanic flights.

Autumn departure of shorebirds from Alert, Ellesmere Island, Canada

R.I. Guy Morrison

Environment Canada (STB WLSD WR), National Wildlife Research Centre, Carleton University, 1125 Colonel By Drive (Raven Road), Ottawa, Ontario, Canada K1A 0H3. guy.morrison@ec.gc.ca

Relatively little is known about the departure condition of shorebirds from breeding areas in the north-east Canadian High Arctic. This paper will present information on body masses and potential flight ranges of shorebirds departing from Alert, Ellesmere Island, following attempted breeding.

Survival of the fattest: late spring body stores and survival in Red Knots *Calidris canutus islandica*

R.I. Guy Morrison, Nick C. Davidson & Jim R. Wilson

Environment Canada (STB WLSD WR), National Wildlife Research Centre, Carleton University, 1125 Colonel By Drive (Raven Road), Ottawa, Ontario, Canada K1A 0H3. guy.morrison@ec.gc.ca

Severe summer weather in Greenland and Arctic Canada in 1972 and 1974 caused very poor breeding success and elevated adult mortality in Red Knots *Calidris canutus islandica*. Those individual knots that are known to have survived these summers were in better than average nutritional condition shortly before departure from their late spring staging area in west Iceland. Furthermore, the condition index of both previously banded and subsequently reported birds captured in Iceland was positively related to the number of summers they were known to have survived. Body stores carried from the final spring staging area to the breeding grounds appear to offer Arctic-breeding shorebirds significant selective advantages: they are used for physical transformation from migration to breeding condition, and in years when weather is difficult may enable survival after arrival on the breeding grounds. Although it may be increasingly difficult to find other datasets comparable to the 1970s situation, for which large numbers of birds were caught and weighed just prior to severe summers, there are likely to be a larger number of banding datasets upon which our finding of correlations between condition and length of survival for both previously-banded birds (during 'normal' arctic summers) and those reported subsequent to ringing (with severe summers) offers potential for testing. It would be instructive to run comparable analyses to establish the extent to which this is a widespread phenomenon. Is it restricted to only Red Knots, to only high-arctic breeders, to only waders or also to other waterbirds, to only late – or also early spring staging areas, etc.?

Finding optimal strategies for migration with density-dependent processes

Caz Taylor & David Lank

Department of Biological Sciences, Simon Fraser University, Burnaby, B.C. V5A 1S6, Canada
caz_taylor@sfu.ca

We introduce a method for finding optimal migration strategies that can be used for a population of migratory birds in which density dependent processes are acting. We use an individual-based model of migration; simulating daily movements of birds between discrete stopover sites. At each site, food or energy intake is influenced by the density of other birds at the stopover site; mortality due to predation is influenced by both numbers of conspecifics at the site and by individual fuel stores of the migrating birds; and flight distance is affected by wind conditions and individual fuel stores. Movement between sites and foraging intensity are controlled by individual behavioural rules that determine how to combine information about the environment and the individual's state to produce decisions. We use a genetic algorithm to evolve optimal behavioural rules for a given terminal reward that depends on arrival time and arrival fuel. We determine how optimal behaviour is affected by density dependent processes; by types of information available; by the configuration of the stopover sites; and by the variability of fuel deposition rates and predation along the flyway. We run simulations with optimal rules to predict patterns of fuel deposition and conditions under which we expect to see overloads and site skipping.

Can we use winter recovery data to determine where young Dunlin *Calidris alpina* migrating along the Norwegian coast come from?

E. Tjørve & K.M.C. Tjørve

Lillehammer University College, 2626 Lillehammer, Norway. even.tjorve@hil.no

There have been many studies of the migration of Dunlin *Calidris alpina* mostly based on ring-recovery data. Some may argue that such data have not much more to tell us than is already known. We looked at 2,109 recoveries from Dunlins ringed in Norway between 1938 and 2005. The aim was to see if this dataset could be used to discuss the origin of young Dunlins on autumn migration down the Norwegian coast. Most of the Dunlins taking this route are young. It is believed that the origin of some, if not most of them is western Siberia, as far east as the Yamal peninsula or even further east.

Recoveries from S Europe and N Africa were studied based on the assumption that Scandinavian populations migrate earlier than Siberian. We found that birds subsequently recovered in NW Africa had passed the Norwegian coast significantly earlier in the autumn than birds recovered in the Mediterranean. Median ringing dates for birds recovered as first winter were 24 Aug for birds recovered in Mauretania, 4 Sept for the W Mediterranean and 2 Oct for mid and E Mediterranean.

We then looked at the recoveries of Dunlins ringed as migrating young in Norway and later recovered along flyways and on breeding grounds. The Baltic flyway to W Siberia provided most of these recoveries, but there were also several recoveries north and east of the Black Sea, along the Mediterranean/Black Sea flyway and in the Yamal area. Recovery rate along the easternmost of these routes is probably very low, indicating that a significant number of the young birds migrating down the Norwegian coast may follow this route as adults. The birds ringed early and recovered in NW Africa must belong to the subspecies *schinzii* breeding in Scandinavia.

Unknowns in population structure and migratory links of Palaearctic Bar-tailed Godwits

Pavel S. Tomkovich

Ornithological Dept., Zoological Museum, Moscow University, Bolshaya Nikitskaya Str. 6, 125009 Moscow K-9, Russia. pst@zmmu.msu,ru

Four or five subspecies are currently recognized in the Bar-tailed Godwit *Limosa lapponica*. One of them, *L. l. baueri*, occurs in the Palaearctic only on migration while visiting the Pacific coasts of Asia on the way from E Australia and New Zealand to Alaska. Up to six isolated breeding populations of Bar-tailed Godwits may occur in N Eurasia. However, flyways and wintering grounds have been determined for only three of these populations based on ring recoveries and sightings of colour-marked birds. We can only speculate about the migratory links of the other three populations. The taxonomic status of Bar-tailed Godwits inhabiting the Anadyr Lowland in Chukotka needs re-evaluation. Birds wintering in W Africa breed on the Taimyr Peninsula in north-central Siberia, and visit W Siberia probably only on migration. It is likely that godwits breeding on the W Siberian Plain use the Central-Asian Flyway. It is possible that the species has more subspecies than are currently recognised.

The annual cycle of the Curlew Sandpiper

Les G. Underhill[1], Pavel S. Tomkovich & Clive D.T. Minton

[1]Avian Demography Unit, Univ. of Cape Town, Rondebosch 7701, South Africa Les.Underhill@uct.ac.za

The Annual Cycle of the Curlew Sandpiper *Calidris ferruginea* was published as International Wader Studies 19 in July 2006. Each of the 37 papers in this overview presented one aspect of the annual cycle of this species. In this presentation, we start the process of synthesising these papers into an overall review. Curlew Sandpipers breed in the arctic tundra subzone across northern Asia, from about 70°E to 156°W in Alaska. Densities at breeding sites have large annual fluctuations. The non-breeding areas lie mainly in sub-Saharan Africa, India, Indian Ocean islands and Australia. The migration routes to and from these destinations intersect Eurasia from its western to its eastern limits. We also identify some of the major gaps in our current knowledge of the species.

The spring migration of Red Knots *Calidris canutus* through Porsangerfjord, N Norway

Jim Wilson

Granveien 46, 1911 Flateby, Norway jimwils@frisurf.no

The paper reports on the results of the Porsangerfjord Knot research project for the years 2005 and 2006. The timing of migration, departure directions, biometrics, banding recoveries and sightings of colour marked birds proved that most, if not all, birds are of Nearctic origin (*C. c. islandica*). The population was estimated at 38,000 in 2005 and 32,000 in 2006. The timing of arrivals was later than at staging areas in Iceland and at Balsfjord, Norway, but timing of departures was similar. In 2005, peak arrivals were 17–18 May and peak departures 1–3 June; in 2006 peak arrivals were 19–20 May and peak departures 29–31 May. Arrival masses were similar to those in Iceland and Balsfjord at 143 g, but mean mass on 26 May, near departure time, was 162 g, much lower than at the other staging sites. Sightings of colour marked individual birds from East Greenland (1) and Alert, Ellesmere Island (2) indicate the breeding origins of Porsanger Knots. Fifty-seven birds banded and/or colour-marked in Europe outside Norway and two birds from Mauritania have been recorded. One out of 137 birds uniquely flagged in Porsangerfjord in 2006 was in Texel, Holland, on 17 July and was probably an early returning female. The distribution in Porsangerfjord is not the same from year to year. This possibly indicates annual changes in the quality and quantity of food resources. The distribution may also be affected by the several pairs of Peregrines which nest around the fjord and depredate knots. The late arrival compared with Iceland may arise because of the lower early spring temperatures, but with a similar departure date the birds cannot attain the same high departure masses as the birds that stage in Iceland. If Porsanger knots mainly breed in East and North Greenland, they have a shorter final flight to the breeding grounds than Icelandic birds which have to cross the Greenland icecap, probably to more westerly parts of the breeding range.