Modern techniques in survival analyses uncover hidden population declines in Red Knot

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The estimation of demographic parameters with the capture-recapture framework has now become common practice. The most important parameter obtained from capture-recapture analysis – annual survival − is regarded as a good indicator of the conservation status of a population. Although in case of highly mobile animals such as migrating birds, annual survival is an important and interesting vital statistic, it lacks information on where in the annual cycle and where in space the population suffers the greatest losses. Currently, only a handful of studies have looked at seasonal and spatial variation in the survival of migrants. Here we use mark-resight data over a period of 15 years to estimate space- and time-dependent variation in survival of Red Knots (*Calidris canutus islandica*) breeding in Arctic Canada and Greenland and wintering in Europe. Birds were ringed primarily in the Dutch Wadden Sea but were resighted at all staging and stopover areas except on the breeding grounds. We found that: (1) Annual apparent survival for the whole population according to the CJS model indicated a strong (and previously undetected) decline in the *islandica* population. (2) Seasonal apparent survival (CJS model) indicated that the autumn and winter periods are the most critical (i.e. the seasons with the lowest survival rate). A closer look at Wadden Sea Red Knot counts confirms this pattern: in the absence of a general pattern in bird numbers across years, singling out 13 winter seasons (1998/99 – 2010/11) revealed a significant decline in numbers.