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Annual survival rate and mean life-span of Lemon-bellied White-eyes *Zosterops chloris flavissimus* on Kaledupa island, Wakatobi, south-east Sulawesi, Indonesia

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White-eyes (Zosteropidae) are known to be the most rapidly speciating family of birds on the planet (Moyle *et al*. 2009). One of the reasons that white-eyes manage to adapt and exploit new habitats so well is because of their relatively short generation time (and greater Darwinian fitness); some *Zosterops* species may breed within six months of hatching (Moyle *et al*. 2009). However, while the breeding age of white-eyes appears to be relatively well known, there is less information on the longevity of these species. One might anticipate that such small species are destined to have rather short life-spans (Hulbert *et al*. 2007).

Our team makes regular trips to south-east Sulawesi, Indonesia, as part of a long-running island biogeography project on local bird species, in cooperation with Operation Wallacea Limited. As part of this work, we mist-net and colour-ring birds in the area. Recently (August 2010), we retraced the footsteps of a previous expedition (August 2007) with great precision. This allowed us the opportunity to assess site-fidelity and longevity of a number of regularly trapped small passerine species, notably: Lemon-bellied White-eye *Zosterops chloris*, Olive-backed Sunbird *Cinnyris jugularis*, Grey-sided Flowerpecker *Dicaeum celebicum* and Island Monarch *Monarcha cinerascens*. We visited three sites (Bakau, Air Nounou, Latafe) on the island of Kaledupa, Wakatobi, south-east Sulawesi in both 2007 (using yellow colour rings) and 2010 (using mauve colour rings) and mist-netted with similar equipment in similar habitats. As many of the local shrubs grow at remarkable speeds, it was not always possible to identify previous net-ride locations. However, local guides and GPS co-ordinates confirmed the accuracy of our site selection. During our 2010 visit we trapped four birds bearing the yellow rings we had used during our 2007 visit. All of these birds were Lemon-bellied White-eyes.

We are confident that the Lemon-bellied White-eyes trapped in 2007 were adult birds. We have occasionally trapped white-eyes in juvenile plumage on the Wakatobi islands (5/548 white-eyes trapped), but have rarely trapped beyond early September. The breeding season for Lemon-bellied White-eyes on the nearby islands of Muna and Buton is between September and October (van Balen 2008). It therefore seems likely that the breeding season for the Wakatobi island white-eyes is similar. If this is the case, then the retrapped birds, when they were trapped in 2007, must have been at least one calendar year old. So, when the birds were retrapped in 2010, they must have been at least four years old. We used these ages to calculate a minimum adult survival rate for the Kaledupa birds.

We trapped a total of 48 Lemon-bellied White-eyes in 2007 and retrapped four of those birds in 2010. This gives a minimum percentage of 8.3% of birds surviving into their fourth calendar year on Kaledupa. In order to allow 8.3% of the adult population to survive into their fourth calendar year, the minimum annual survival rate of the local population must be 43.6%. This value is in excess of the annual survival rates recorded for African Yellow White-eye *Z. senegalensis* (34%) near Jos, Nigeria (McGregor *et al*. 2007) and Silvereyes *Z. lateralis* (24–26%) in central Victoria, Australia (Burton 1996). Longevity may be derived from annual survival rate, where mean life-span = –1/ln(annual survival rate) (Seber 1982). Applying this formula, we get a mean life-span for the Lemon-bellied White-eyes of Kaledupa of 2.2 years (1.2 years from survival rate + 1 year at initial capture). As the survival rate value is a minimum, the calculated life-span is a minimum value too. However, this minimum value for the Kaledupa birds is greater than the mean life-spans of the African Yellow White-eyes near Jos (1.92 years = 0.92 years from survival rate + 1 year at initial capture) and the Silvereyes in central Victoria (9.8–10.2 months) (Burton 1996).

It is likely that the value cited by Burton (1996) includes birds born during the year of capture. Annual survival rates of adults are usually higher than those of fledglings (Freed & Cann 2009). The Capricorn White-eye of Heron Island *Z. lateralis chlorocephalus* has an annual adult mortality of 38.5% (Brook & Kikkawa 1998). This is equivalent to an annual adult survival of 61.5% (a value in excess of the Kaledupa birds) and translates to an average life span of 3.1 years (2.1 years from survival rate + 1 year at initial capture).

The Lemon-bellied White-eyes, when retrapped in 2010, appeared to be in breeding pairs (one male and one female bird caught in the same net at the same time). We caught two 'breeding' pairs, one at each of two different sites (Bakau and Latafe). If we consider the retrapping rates at the two sites independently (Bakau–12.5%, Latafe–20%), this gives us annual survival rates of 50% and 58.5% respectively and mean life-span estimates of 2.4 years (1.4 years from survival rate + 1 year at initial capture) and 2.9 years (1.9 years from survival rate + 1 year at initial capture) respectively. These values approach those of the Heron Island Silvereyes (3.1 years). The Heron Island white-eyes are known to show density dependence in their breeding success (McCallum *et al*. 2000), but it is unclear whether the local population density has any effects on annual survival (Kikkawa 1980).

We did not attract birds to the nets with recorded calls or songs on our trips to Kaledupa, so it is unlikely that we caught all of the local population on either of those visits. It is unclear whether catching a larger sample would have increased or decreased our longevity estimate. The presence of 'breeding' pairs at two of the netting sites suggests a high degree of site fidelity, at least by some individuals. Other data demonstrate that there is little or no movement of the Wakatobi Lemon-bellied White-eyes between islands (Kelly *et al*. unpubl. data), supporting the idea that the Lemon-bellied White-eyes of the Wakatobi are generally sedentary in nature.

While we mist-netted on other islands across the Wakatobi archipelago during our 2010 field season (Wangi-Wangi, Hoga, Tomia and Binongko), those other islands had only been visited previously in 2005, not 2007. Furthermore, we did not make the same effort on those other islands to revisit our former netting sites. The only birds we retrapped in 2010, from previous expeditions, were those on Kaledupa. Therefore, it is unclear if the Lemon-bellied White-eyes of Kaledupa are especially long-lived in comparison to the populations of the species on the other Wakatobi islands. Irrespective of this, it does appear that the Lemon-bellied White-eyes of Kaledupa are longer-lived than mainland populations of African Yellow White-eye and Silvereye.

While the current dataset is rather small, there appears to be a tendency for populations of *Zosterops* species to live longer on oceanic islands than on the mainland. We will endeavour to collect more data on the longevity of the Wakatobi bird populations to allow further investigation of these findings.

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Migrating dragonflies: famine relief for resident Peregrine Falcons *Falco peregrinus* on islands

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The diet of the Peregrine Falcon *Falco peregrinus* has been well documented around the world. Peregrines are powerful predators which feed mainly on birds, and more than 1,000 avian species ranging from 10 to 3,000 g in weight have so far been recorded as prey (Ferguson-Lees & Christie 2001). However, there are also many reports of occasional consumption of insects (e.g. Pruett-Jones *et al.* 1980, Ritchie 1982, White & Brimm 1990, Oro & Tella 1995, White *et al*. 2002) as well as reptiles (Oro & Tella 1995) and mammals (e.g. bats and rodents: Byre 1990, Bradley & Oliphant 1991). Although insects are an uncommon food for Peregrines, such prey are diverse from small ones like the Plecoptera (stoneflies: Sumner & Davis 2008) to large ones, which include some Hemiptera (cicadas: Pruett-Jones *et al.* 1980, Ellis *et al.* 2007), Orthoptera (grasshoppers and crickets: Pruett-Jones *et al.* 1980, White & Brimm 1990, White *et al.* 2002) and Odonata (dragonflies and damselflies: White *et al*. 2002). Insects may be more important in Peregrine diets than is commonly believed (Snyder & Wiley 1976, Ellis *et al*. 2007). This article reports two adult Peregrines hunting migratory dragonflies, and discusses the implications of dragonflies being a food source for falcons on remote islands.

Hongdo, the study area, is a small island in the Republic of Korea located c.120 km south-west of the Korean Peninsula and 430 km from mainland China at 34°41´N 125°12´E, and is a key stopover site for migratory birds that cross the Yellow Sea. More than 327 bird species (about 63% of the total recorded in Korea) have been recorded on this island, but only ten, including a pair of Peregrines, are resident (NPRI 2009).

The first observation of an adult Peregrine foraging on dragonflies in flight was on 27 August 2009; it took three dragonflies during 8 minutes of observation. Over the next few days, the foraging activities of two adults hunting dragonflies were occasionally but repeatedly observed, including at least 20 more dragonfly captures (Figure 1). Most such foraging attempts were made in foggy conditions with still air, apparently irrespective of