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

CHANG-YONG CHOI & HYUN-YOUNG NAM

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

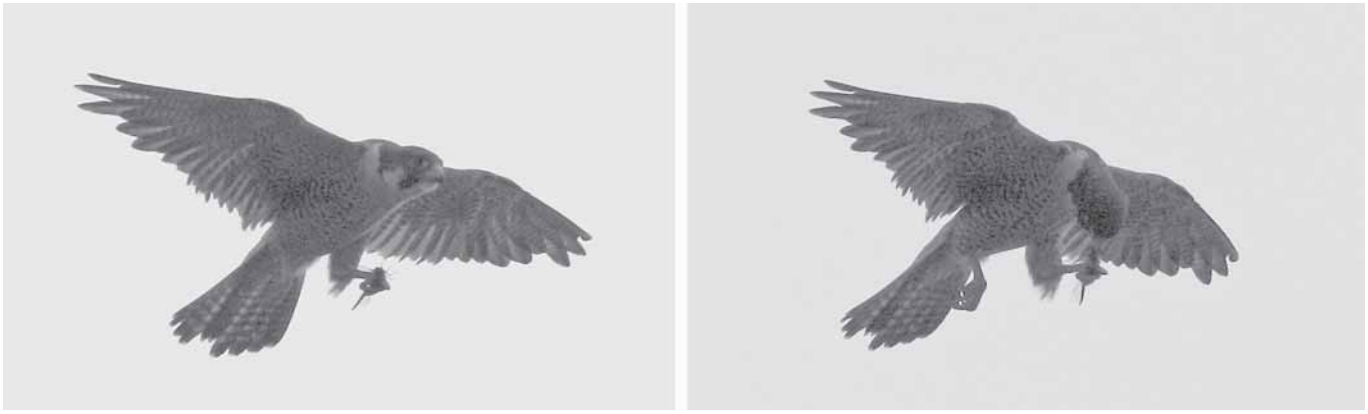


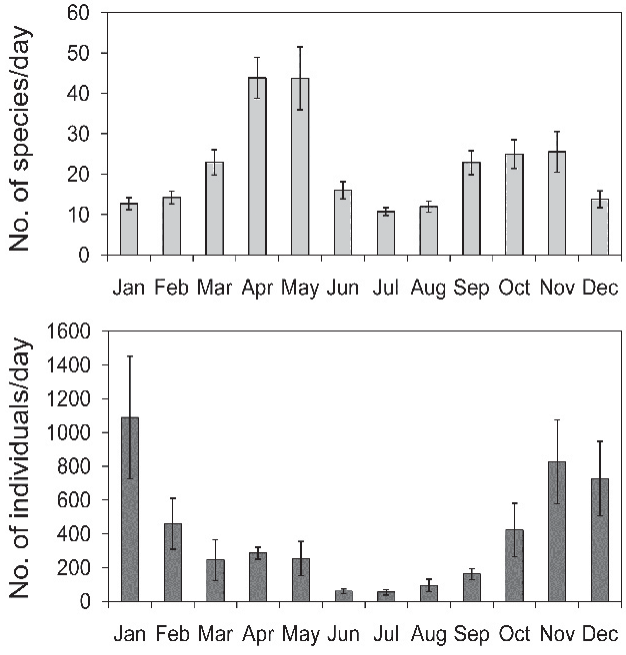
Figure 1. A Peregrine Falcon *Falco peregrinus* feeding on a dragonfly (Lesser Emperor *Anax parthenope*) on Hongdo, Republic of Korea.

time of day. No such foraging was seen after 30 August, even though the survey continued right through the year.

On 29 November 2009, close examination of the pair's plucking perches at the top of some rocky cliffs revealed the remains of a dragonfly wing amidst the feathers and carcasses of diverse avian species. Newly fledged Peregrines often pursue flying insects, to improve their hunting skills rather than for any energetic reward (Dekker 1999, Razafimanjato *et al.* 2009); however, the chasing of dragonflies by these adults on Hongdo was clearly unnecessary for such learning, and indicates that these Peregrines were targeting dragonflies as a food source.

In the study area, based on field collection and observations, the dominant migratory dragonflies in August were Globe Skimmers *Pantala flavescens*. Scarlet Skimmers *Crocothemis servilia*, Lesser Emperors *Anax parthenope* and a species of meadowhawk or darter *Sympetrum kunckeli* were also recorded but more rarely. Since Hongdo lacks wetlands, none of the dragonfly species breeds there, but huge (more than tens of thousands) swarms of them routinely pass over the study site during their southward migration from July to September. Although it was impossible to identify to species all dragonflies taken, the two species confirmed as prey were the largest, Lesser Emperor, and the most abundant, Globe Skimmer. Like many dragonflies that cover distances of hundreds or thousands of kilometres, both species are intercontinental long-distance migrants with worldwide distributions, forming big swarms during ocean crossings (Corbet 2004, Anderson 2009, Borisov 2009).

Figure 2. Monthly changes in the number of bird species and abundance counted every day in 2007 on Hongdo.



As residents of Hongdo, we conducted daily bird counts throughout the year and managed a bird-ringing programme to monitor bird migration. There are no breeding seabird colonies nearby, so the Hongdo Peregrines rely mainly on the diverse transient birds in spring (March to May) and autumn (September to November) and on the abundant wintering seabirds from November to January. The lowest numbers of bird species and individuals have been recorded in summer, particularly from June to August, between the two migratory seasons (Figure 2), and this pattern of occurrence results in a reduced availability of birds in the diets of the two Peregrines when large numbers of migratory dragonflies arrive at Hongdo whilst crossing the Yellow Sea.

The wet weights of the Lesser Emperors and Globe Skimmers at the study site were only 0.95±0.26 g (n=6) and 0.31±0.04 g (n=16), respectively. However, migratory dragonflies in swarms, particularly Globe Skimmers, have been suggested to be a potential food source for migrating raptors, particularly Amur Falcons *Falco amurensis*, which cross the Indian Ocean without any other identified prey (Anderson 2009). The Hongdo Peregrines' behaviour suggests that dragonflies migrating in large numbers may also be famine relief food for sedentary raptors on remote islands.

Prey abundance is an important factor in prey selection of Peregrines (Bradley & Oliphant 1991), and they may take advantage of the easily obtainable prey occurring in large concentrations (Byre 1990), even though the prey is not part of their usual diet. The proportion of dragonflies in the overall diet of Peregrines is probably low in both frequency and biomass, and the energetic reward from hunting dragonflies is unclear; nevertheless, this report implies that migratory and swarming insects may be important in Peregrine diets under certain circumstances such as low preferred-prey abundance and limited visibility.

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Breeding of the Japanese Murrelet *Synthliboramphus wumizusume* in South Korea

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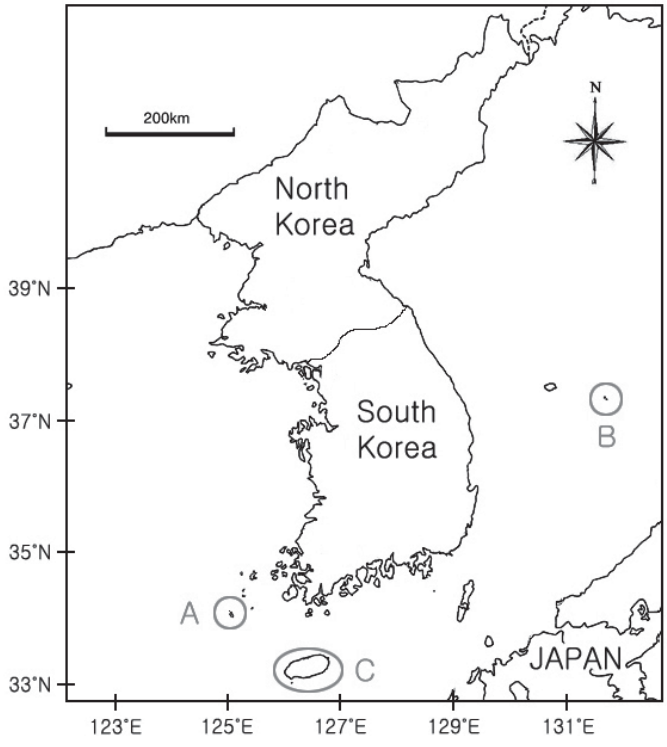
The global population of Japanese Murrelet *Synthliboramphus wumizusume* is believed to number only 4,000–10,000 birds, and owing to a rapid population decline the species has been designated as Vulnerable on the IUCN Red List (Carter *et al*. 2002, BirdLife International 2011, IUCN 2011). Almost all of the population breeds on uninhabited rocky islands in Japan, mainly in Kyushu and on the Izu Islands, between mid-February and early May (BirdLife International 2001, Carter *et al*. 2002). There is also evidence of breeding in Russia: a dead juvenile was found in Boysman Bay in July 1984 (BirdLife International 2001).

Figure 1. Map of South Korea and the locations of (A) Daegugul Island, (B) Dok Island, and (C) Jeju Island.



In South Korea, breeding was first recorded at Daegugul Island (Daeguguldo), Shinan county, Jeollanam province, off the south-west coast of South Korea (Figure 1): three breeding pairs were found here for the first time on 10 May 1983 (*Kyunghyang Shinmun* 1983, Won 1992). The Korean Government designated Daegugul Island as National Monument no. 341 in 1984 for the protection of breeding seabirds, and designated the species itself as no. 450 in March 2005.

Subsequent records in both breeding and non-breeding seasons were restricted to the south coast of South Korea (Park 2002, Oh 2004) until the discovery of a second breeding site: Dok Island (Dokdo), Ulleung county, Gyeongsangbuk province. Dok Island is located in the East Sea (Sea of Japan), c.220 km from mainland South Korea, and is composed of two main islands (Dong Island and Seo Island) and dozens of small islets (Figure 1). On 28 May 2005, an adult and a chick were found dead on Dong Island (37°14′21″N 131°52′07″E) and Seo Island (37°14′35″N 131°51′53″E), respectively, by YSK. The dead adult was lying on the shore and the dead chick was floating on the sea with its head pecked by an unknown predator (Figure 2a; Kwon & Yoo 2005). In 2009, a fledgling and two adults were filmed leaving the island at night by the Seoul Broadcast System in a programme entitled *Dokdo, Saengmyeong-ui Ddang* [Dok Island, the Land of Life] (see http://www.pandora.tv/video.ptv?c1=08&c2=0175&ch_userid=loveasia&prgid=39061826 and http://www.pandora.tv/video.ptv?c1=08&c2=0175&ch_userid=loveasia&prgid=39061822). Subsequently, a dead adult was found on Dong Island on 15 July 2010 by JYP. These records suggest that Japanese Murrelet breeds on the island, although active nests have not yet been found.

Here, we report a third breeding area of this species in South Korea: Jeju Island in Jeju Special Self-Governing Province (hereafter 'Jeju province'), which is the southernmost island in South Korea (Fig. 1). The possibility of Japanese Murrelet breeding on Jeju Island was anticipated owing to regular observation of adults during the breeding season at sea between Gapa and Mara Islands south-west