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SHORT NOTE

Sudden decline in numbers of starlings (*Sturnus vulgaris*) nesting at Belmont

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Documentation of changes in animal abundance is important because it may lead to an understanding of the underlying causes, such as predation, disease, competition, and changes in land use or climate. Introduced species like starlings are especially useful for this, since they live in urban areas, take readily to artificial nest sites which can be inspected or manipulated, and have a wide distribution over most continents.

The breeding biology of a population of starlings at Belmont (41° 10′ S, 174° 54′ E) has been monitored since 1970, when a 10 year study of artificial selection for increased clutch-size began (Flux & Flux 1982). One hundred nest boxes were put up in 1970, and 100 more each year until there were 500 boxes available. The boxes were placed in the centre of 1500 ha of open pasture. For a detailed description of the study area and methods see Flux & Flux (1981).

The boxes were made of asbestos board placed on the outside of concrete ventilation shafts in the walls of 42 munition storage buildings, with wooden backs on the inside for inspection from inside the buildings. The materials are durable to weather and deterioration and have mostly stayed intact since their placement except for vandalised boxes, which have not been replaced since 1993. By 2009 a total of 227 boxes remained that were considered from previous experience to be acceptable by starlings: of these, 192 were still in excellent condition.

Starlings at Belmont never occupied all the boxes. Despite the high resident population of about 3000 birds (Flux & Flux 1992), dominant males defended 2 or even 3 boxes. This was probably due to the close proximity of boxes as many were only 2 m apart. Time series analyses of occupancy rates in different years did not shown any relation to environmental factors allied to climate; instead, occupancy rates followed a random oscillation about the mean of 50% (range 23-81%) for 35 years until 2004 (Flux *et al*. 2009).

In 2005 the occupancy rate was 56%, and thus similar to previous years. However, over the next 4 years occupancy rates crashed: 33% in 2006; 23% in 2007; 13% in 2008 and 2009. These rates are based on a subset of 50 boxes examined each year since 1985, when field work was scaled down. (Comparisons of the occupancy and breeding season results produced by the subset and the entire 500 boxes in 1981 and 1982 indicated that 50 boxes gave sufficiently reliable results.) But in Oct 2009 all

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remaining boxes were examined: only 8 pairs of starlings laid eggs in the 200 boxes available, giving an occupancy rate of only 4%. Most of the munition buildings were unoccupied by even a single pair of starlings, and even the local shepherd had noticed the disappearance of starlings from the surrounding farm. Yet, starlings were apparently still present in the area in large numbers at times, as I saw a flock of 200-500 starlings feeding on the study area on 16 May 2010 at 1500 hr. This is not during the breeding season, and the birds may have been from the Hutt Valley on their way to roost on the west coast. On average, 68% of the starlings nesting each year were birds recruited from outside the study area (Flux & Flux 1982) and these birds must also have abandoned Belmont as a nesting area.

It is difficult to determine the cause of this decline, or whether it is widespread. The New Zealand Garden Bird Survey (Spurr 2010) showed little change in starling numbers from data collected over the whole country since 2006, so urban areas seem unaffected. One reason for a local decline may be the marginal conditions at Belmont, which is mostly bare grassland on hills very exposed to wind. However, these conditions were present at the start and throughout the study. Farm management and the pesticides used have not apparently changed and cannot account fo the rapid decline. Unlike the starlings nesting at a low elevation site at Ohau, the breeding season of the Belmont starling population is correlated with ENSO weather patterns (Tryjanowski *et al.* 2006). This may be a result of the food supply being less varied in composition, and more variable in abundance, than on the mixed agriculture at Ohau. This could have triggered the decline if the collapse coincided with an unfavourable ENSO event from 2006-2009. It is also possible that changes in predator numbers or composition led to the decline. The main predators of nesting starlings at Belmont are stoats *(Mustela erminea*) and ship rats (*Rattus rattus*), which may have increased in numbers because feral cats (*Felis catus*) have been trapped in land adjacent to the study area (W. Milne, *pers. comm.*). Increased predation risk, especially on nests, may lead to birds abandoning the area as a nesting site. Finally, as starlings are social nesters, and the synchrony of nesting and fledging success at Belmont was positively correlated with the numbers of birds nesting in the same building and within 500 m (Evans *et al.* 2009), once some birds start abandoning an area and a decline starts, it may progress rapidly through a form of positive feedback. At present, it is not clear what has caused the sudden crash at Belmont, and further work is needed to determine the reasons for such dramatic population changes

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LITERATURE CITED
Evans, L.E.; Ardia, D.R.; Flux, J.E.C. 2009. Breeding synchrony through social stimulation in a spatially segregated population of European starlings. *Animal Behaviour 78*: 671-675.

Flux, J.E.C.; Flux, M.M. 1981. Population dynamics and age structure of starlings (*Sturnus vulgaris*) in New Zealand. *New Zealand Journal of Ecology 4*: 65-72.

Flux, J.E.C.; Flux, M.M. 1982. Artificial selection and gene flow in wild starlings, *Sturnus vulgaris*. *Naturwissenschaften 69*: 96-97.

Flux, J.E.C.; Flux, M.M. 1992. Nature red in claw: how and why starlings kill each other. *Notornis 39*: 293-300.

Flux, J.E.C.; Bull, P.C.; Zduniak, P.; Tryjanowski, P. 2009. Lack of synchrony between breeding in two neighbouring starling (*Sturnus vulgaris* L.) populations in New Zealand: evidence of no regional effect of the ENSO? *Polish Journal of Ecology 57*: 363-369.

Spurr E.B. 2010. Results of the New Zealand Bird Survey (http://www.landcareresearch.co.nz/research/biocons/gardenbird)

Tryjanowski, P.; Flux, J.E.C.; Sparks, T.H. 2006. Date of breeding of the starling *Sturnus vulgaris* in New Zealand is related to El Nino Southern Oscillation. *Austral Ecology 31*: 634-637.

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