

SHORT NOTE

Changes in annual counts of yellow-eyed penguins (*Megadyptes antipodes*) at Sandy Bay, Enderby Island, 2001 - 2012

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New Zealand is a world hotspot for penguin biodiversity, with 6 breeding species, 4 of which are endemic (Marchant & Higgins 1990). The yellow-eyed penguin (*Megadyptes antipodes*) is a large and long-lived (20 years) species endemic to New Zealand and restricted to the south of the South Island, Stewart Island/Rakiura, the Auckland Islands and Campbell Island/Motu Ihupuku (Darby & Seddon 1990; Ellenberg & Mattern 2012). They are classified as 'Nationally Vulnerable' under the 'New Zealand Threat Classification System' (Townsend *et al.* 2008) because their estimated total population is < 2000 breeding pairs (Miskelly *et al.* 2008).

It is thought that ~60% of the entire yellow-eyed penguin population breeds on New Zealand's subantarctic islands, with an estimated 520-570 breeding pairs on the Auckland Islands, of which 260-290 pairs are found on Enderby Island (Moore 1990, 1992). Landing sites used by penguins on Enderby Island found by Moore (1992) were still active in 2008 and 2009 (Young 2009; Beer 2010), indicating a similar distribution of breeding areas between decades, although population numbers are not known. Despite this area being considered a stronghold, there are no recent estimates of

population size (Ellenberg & Mattern 2012). This note describes the results of a long-term annual count of yellow-eyed penguins at Sandy Bay, Enderby Island between 2001 and 2012.

On the New Zealand mainland, yellow-eyed penguins breed in coastal forest and scrub. Two eggs are normally laid in late September and hatch 6-7 weeks later in November (Marchant & Higgins 1990). Chicks reach adult weight in late January and then moult to juvenile plumage before fledging in February-March. Both adults attend the nest, brood and feed the chicks. Adults undertake only short (1-3 day) foraging trips away from the breeding areas (Marchant & Higgins 1990). As a result of their restriction to breeding areas between November and February, beach counts can be undertaken of yellow-eyed penguins as an index of breeding population size, as usually at least 1 adult is commuting between the nest and ocean regularly or daily.

To estimate the number of yellow-eyed penguins on Enderby Island, the Department of Conservation has annually conducted beach counts on 16 February from 2001 to 2012, except in 2002 and 2008, when counts were run on 19 and 12 February, respectively, due to poor weather or other work commitments. Surveys began at 12 pm and finished at ~10.15 pm, when it became too dark to see the birds. All surveys were conducted by a

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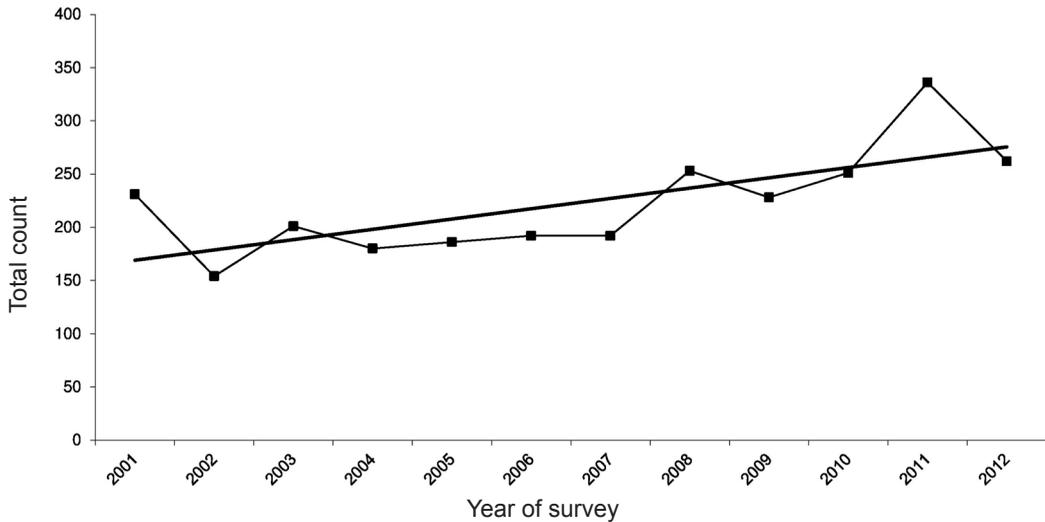


Fig. 1. Changes in the number of yellow-eyed penguins counted at Sandy Bay, Enderby Island between 2001 and 2012. The increase is statistically significant.

single observer sitting in the shelter of a boat shed at the western end of Sandy Bay. From this vantage, it was possible to watch the entire length of Sandy Bay (~400 m) and the adjoining eastern cliffs. Binoculars and a spotting scope we used to observe the beach and every penguin either entering the water from land (out) or exiting the water to head inland (in) was recorded. Survey shifts varied between 1 to 2 hours and no attempt was made to distinguish between adult or juvenile penguins. These surveys provided an annual standardised index of yellow-eyed penguin numbers on Sandy Bay, rather than absolute population size.

Counts ranged across the 12 year period from 154 penguins (154 in, 0 out) in 2002 to 336 penguins (334 in, 2 out) in 2011. There was a significant increase in the number of penguins observed between 2001 and 2012 (Fig. 1; $y = 9.69x + 159.2$, $r^2 = 0.51$, $P = 0.009$), after an initial decrease between 2001 and 2002. If individual birds are assumed to be one member of a breeding pair, this indicates 154 to 336 nests within the Sandy Bay area, a count similar to or higher than the entire Enderby Island count undertaken by Moore in 1992 (Moore 1992). These counts need to be interpreted with the understanding that they likely underestimate daily movement due to the need to stop observation when it gets dark. It is known that yellow-eyed penguins forage into late evening and night on Stewart Island and Otago Peninsula (Ellenberg & Mattern 2012), so late-evening returning penguins would not have been observed.

Nest or beach counts are usually conducted in late November each year as this is when nests are established and chicks need to be fed daily and brooded. This means that there is likely to be at

least one adult in residence with the other foraging or coming and going to the nest on a daily basis. However, by late February some older chicks no longer require constant attendance and are no longer being fed daily. Therefore, it is unlikely that every penguin counted equates to a pair, and it is possible that if both members of a pair were foraging at sea, the total number of birds would over-estimate breeding pair numbers. However, this bias occurred across all years and probably cannot account for the apparent increase in the population. With the use of individually marked birds, this assumption could be tested in the future.

The 2002 count was the lowest recorded (154 penguins) as well as the latest (19 February). This result could be product of a later sampling date, however, considering the difference was only 3 days and the following 5 years also showed low counts, this decline appears to be real. Counts using the same methods in the 3 years prior to 2001, but on 31 January 1998, 25 January 1999 and 5 February 2000, showed counts of 245, 256 and 237 penguins, respectively. This further confirms the hypothesis that penguin numbers declined between 2001 and 2002. This drop occurred in the same year as a severe drop in New Zealand sea lion (*Phocarctos hookeri*) pup production (Chilvers *et al.* 2007), which also breed on Sandy Bay, and was thought to be caused by an outbreak of *Klebsiella pneumoniae* (Wilkinson *et al.* 2006). The reason for the outbreak remains unknown, but it resulted in a 20% decrease in pup production and 30% mortality of pups within their first month of life (Chilvers *et al.* 2007). It is not known if this disease crossed to penguins in the Auckland Islands (K. McInnes, *pers. comm.*; Department of Conservation Veterinarian),

however disease does play a major role in yellow-eyed penguin population regulation in other parts of New Zealand (Alley *et al.* 2004).

Another possible explanation for the decline of penguins in 2002 is that environmental conditions that summer or in the previous winter may have caused a decrease in population. During the late 1990's and early 2000s, the yellow-eyed penguin populations on the Otago Peninsula showed a decline in population numbers due to a strong La Niña effect (July 1998 to January 2001; M. Young, *pers. comm.*, Department of Conservation), however unlike Enderby, that decline was seen over several years. On Enderby, the decline appears restricted to the period between 2001 and 2002.

This is the only long-term dataset of the yellow-eyed penguin population for Enderby Island and the Auckland Islands. Although the data are not direct population counts, they can provide an index of trends in the population over longer periods of time. Nevertheless, it should be kept in mind that the survey only covers one area of Enderby Island, when breeding is known to occur in other places around the island (Moore 1990; Young 2009; Beer 2010). Surveys using the same methodology could be expanded to include other areas of Enderby but they need to be conducted at the same time of year to ensure comparability. Despite the simplicity of the survey method, its ease and low cost could enable it to be used more extensively. As this study demonstrates, beach surveys can be a valuable index to measure population trends of yellow-eyed penguins in the Auckland Islands area.

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LITERATURE CITED

Alley, M.R.; Morgan, K.J.; Gill, J.M.; Hocken, A.J. 2004. Diseases and causes of mortality in yellow-eyed penguins, *Megadyptes antipodes*. *Kokako* 11: 18–23.

- Beer, K.J. 2010. Distribution of yellow-eyed penguins (*Megadyptes antipodes*) on the Auckland Islands: November–December 2009. Dunedin, New Zealand: Department of Zoology, University of Otago.
- Chilvers, B.L.; Wilkinson, I.S.; Childerhouse, S. 2007. New Zealand sea lion, *Phocarctos hookeri*, pup production - 1995 to 2005. *New Zealand Journal Marine and Freshwater Research* 41: 205–213.
- Darby, J.T.; Seddon, P.J. 1990. Breeding biology of yellow-eyed penguins (*Megadyptes antipodes*). Pp. 45–62 in Davis, L.S.; Darby, J.T. (Eds) *Penguin biology*. San Diego: Academic Press.
- Ellenberg, U.; Mattern, T. 2012. *Yellow-eyed penguin – review of population information*. Conservation Services Providers Report Contract 4350. <http://www.doc.govt.nz/conservation/marine-and-coastal/conservation-services-programme/csp-reports/yellow-eyed-penguins-a-review-of-population-information/>.
- Marchant, S.; Higgins, P.J. 1990. (Eds) *Handbook of Australian, New Zealand and Antarctic birds*. Melbourne: Oxford University Press. 1400 p.
- Miskelly, C.M.; Dowding, J.E.; Elliott, G.P.; Hitchmough, R.A.; Powlesland, R.G.; Robertson, H.A.; Sagar, P.M.; Scofield, R.P.; Taylor, G.A. 2008. Conservation status of New Zealand birds, 2008. *Notornis* 55: 117–135.
- Moore, P.J. 1990. Population survey of yellow-eyed penguins on the Auckland Islands, Nov–Dec 1989. Department of Conservation Science and Research Internal Report No. 73. Wellington, New Zealand: Department of Conservation.
- Moore, P.J. 1992. Population estimates of yellow-eyed penguins (*Megadyptes antipodes*) on Campbell and Auckland Islands 1987–90. *Notornis* 39: 1–15.
- Townsend, A.J.; de Lange, P.J.; Duffy, C.A.J.; Miskelly, C.M.; Molloy, J.; Norton, D. 2008. *New Zealand threat classification system manual*. Wellington: Department of Conservation. 35 p.
- Young, M. 2009. Beach counts (total counts of yellow-eyed penguins on Enderby Island, Auckland Islands, December 2008 – February 2009. Invercargill, New Zealand: Department of Conservation Southern Islands Area Office. 8p.
- Wilkinson, I.S.; Duignan, P.J.; Grinberg, A.; Chilvers, B.L.; Robertson, B.C. 2006. *Klebsiella pneumoniae* epidemics: Possible impact on New Zealand sea lion recruitment. Pp. 385–404 In: *Sea lions of the world*. Trites, A.W.; DeMaster, D.P.; Fritz, L.W.; Gelatt, L.D.; Rea, L.D.; Wynne, K.M. (Eds). Lowell Wakefield Fisheries Symposium, Alaska.

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