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SHORT NOTE

Seabird predation by vagrant leopard seals (*Hydrurga leptonyx*) at Otago, New Zealand

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Seabirds are an important prey of leopard seals (*Hydrurga leptonyx*) within their Antarctic breeding distribution. In Antarctica, leopard seals are reported to eat a variety of prey including fish, cephalopods, crustaceans, penguins and other seals, and that diet composition varies between seasons and regions (Harcourt 2005; Southwell *et al*. 2012). At Bird Island (South Atlantic), Antarctic fur seals (*Arctocephalus gazella*) and macaroni penguins (*Eudyptes chrysolophus*) are important prey items in the summer and gentoo penguins (*Pygoscelis papua*) are important in the winter. Diving petrel (*Pelecanoides* sp.) and cape petrel (*Daption capense*) were incidental in the diet (Walker *et al*. 1998). Vagrant leopard seals disperse north during the austral winter and are often seen hauled out on the South Island (Harcourt 2005). This note collates recent observations of leopard seal feeding within and off Otago Harbour in 2007 and 2012.

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The first set of observations relates to a pelagic trip on the 7 October 2012. A party of 14 was on the *Caprice*, a charter boat from Dunedin, at sea off Taiaroa Head. Conditions were mild with a westerly breeze and a 2 m southerly swell. At the time of these observations we were watching groups (*c*.500 individuals) of sooty shearwater (*Puffinus griesus*), smaller groups of fairy prions (*Pachyptila turtur*), and groups of 1-10 southern royal albatross (*Diomedea epomophora*), cape petrels, and white-capped *(Thalassarche cauta)*, Salvin's (*T. salvani*), and Buller's albatrosses (T. *bulleri*). The sooty shearwaters were foraging in large groups and moving in the area response in to "boilups" of food (O'Driscoll *et al*. 1998). The area where these observations took place is a mixing area for eddies created by Cape Saunders (Murdoch *et al*. 1990).

We first saw a leopard seal at about 850 h and 7.74 km east of the Taiaroa Head lighthouse (45° 46.2′S, 170° 49.6′ E). The seal was heading at a steady pace from the northeast towards a flock of roosting and feeding sooty shearwaters. A pod

of Hectors dolphins (*Cephalorhynchus hectori*) was nearby. We observed it for about a minute before it disappeared. The next time we observed the seal it was near a flock of roosting sooty shearwaters and it had a sooty shearwater in its mouth. The leopard seal appeared to hold the bird underwater for *c*.5 minutes and only coming up for short breaths. This action was repeated as it manipulated the carcass. Approximately 30 minutes later we again spotted the seal and carcass (at about 45° 45.59'S, 170°49.5'E). The seal had abandoned the bird and we were able to retrieve it. The head of the bird had been removed although the neck was still attached but skinned. The gut cavity was empty with the exception of the kidney. The breast meat had been mostly removed by gnawing, as there were laceration marks on the remaining meat. A large lump of meat was left on the right breast. The right humerus was broken. The legs and hips were intact with muscle exposed where the skin had been removed but the flesh unmarked. The remains of the bird weighed 470 g compared to published weight ranges of 650-950 g (Marchant & Higgins 1990). Cape pigeons were observed around the carcass and also a injured sooty shearwater that we assumed was another victim of the leopard seal (near 45°46.27S, 170°49.7E). We were able to confirm that it was the same leopard seal as the animal we initially observed had distinctive lateral cuts near the middle of its back that were visible in photographs.

Another set of observations involving a leopard seal in Otago Harbour display a different set of attributes. Between 3 July and 8 August 2007, a leopard seal was present in the Otago Harbour during which time it caught and ate a large number of Stewart Island shags (*Leucocarbo chalconotus*). Observations of these events were made from the *M.V. Monarch* a tourist vessel on the harbour and it was not possible to estimate of how often the seal would kill in a day. The seal appeared to catch the shags by the tail or the back of the body. The predation events that were observed seemed to follow a pattern: the shag was caught below the water, usually not long after the shag had dived below the surface. There was no obvious indication that the shags were avoiding the seal. When hunting or swimming, each dive lasted 2-3 min and only covered a small distance. Often the dives started and ended in the same spot. The seal seemed to watch the shags on the surface before it dived to catch them, diving when the shags dived. The seal would then bring the shag to the surface to eat it. The shag was "de-gloved" before it was eaten. "De-gloving" was a process in which the seal gave the shag's body a series of quick flicks until all of the flesh was visible. It appeared that the seal grabbed the shag's skin around the breast or neck in order to shake the body out of the skin. In nearly every instance the seal would kill the shag by crushing its head. Often the seal would bring the live shag near to the boat to kill it. The sound of the skull cracking was very clear.

Fig 1. Sooty shearwater (*Puffinus griseus*) remains after predation by leopard seal (*Hydrurga leptonyx*) off Taiaroa Head, Otago 7 October 2012.

A number of the other kills of shags were observed in the Upper Harbour with several birds caught under the wharves near Dunedin City. The seal seemed to ignore people. Shipping movements seemed to have no effect on the seal. In the time it was in the harbour the seal was not observed taking any species other than shags. Each kill was eaten quite slowly, and took about 15 to 20 minutes per bird. The seal would pick small bits of flesh from the carcass, either with a flick of the carcass, or by chewing off small bits of flesh. Compared to the sooty shearwaters, in nearly all circumstances there was only a spine and a set of wings left. Particular attention was paid to see whether there was a difference in rate that the colour morphs (bronze or pied) of Stewart Island Shags were caught. Both morphs were caught in the same proportions.

Nearly all of the shags we observed being caught by seals were taken in the shipping channel. When the shags were caught we also noted a number of gulls (*Larus sp.*) present. This gull activity meant that observers were alerted to kills from a distance. There was no noticeable pattern relating to the state of tide when the birds were being caught.

Our observations of differences in behaviour between the 2 leopard seals are consistent with reports that individual leopard seals have different hunting strategies (Harcourt 2005). In both cases the leopard seal did not swallow either the sooty shearwater, or the Stewart Island shags whole. Instead, seals seemed to manipulate and kill shearwaters, not on the surface but just under it. In the case of the shags, the birds were caught under the surface and then killed on the surface. The sooty shearwater gut cavity was completely empty. The style of the seal observed in the harbour was to pick small bits of flesh from the carcass, either with a flick of the carcass to tear the flesh off, or to just chew small bits of flesh from the carcass.

Recent research has investigated the dental morphology of leopard seals to determine how an apex predator can feed on both micro and macro prey in Antarctic waters (Hocking *et al*. 2012). The relatively delicate morphology of the leopard seal's multi-cusped postcanines may constrain their predatory capacity by forcing them to use a shaking, grip-and-tear handling technique when dealing with large prey. This method involves holding large prey with the robust anterior teeth during shaking and thus limits postcanine abrasion or fracture, which could otherwise reduce efficiency of the postcanine teeth in retaining small prey during the water expulsion and sieving that follows suction (Hocking *et al*. 2012). The unusual ability to switch between suction and sieving (which allows leopard seals to exploit krill), and the raptorial grip-and-tear feeding style (which allows leopard seals to exploit larger prey such as seabirds), appears to be key to the success of leopard seals by allowing them to feed on locally available prey. With 2 disparate feeding modes, leopard seals simultaneously function as both a top predator and a planktivore within the Antarctic ecosystem (Hocking *et al*. 2012). Such restrictions on the ability of the seal to masticate whole carcasses might also explain the protracted degloving of bird prey items observed by us. This short note extends the list of reported bird species consumed by leopard seals.

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