Conservation of Leach's storm-petrels

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Field data collected in 2011 by:
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Introduction

Many marine taxa are experiencing significant population declines, including Leach's storm-petrel (*Oceanodroma leucorhoa*; hereafter storm-petrel; Stenhouse et al. 2000, Bicknell et al. 2012, G Robertson, Env Can, pers comm). Causes of the latter species' declines are unclear, but among the suspected causes are high levels of mercury and cadmium exposure (N Burgess and J Elliott, Env Can, pers comm), and within-breeding-season and carryover effects from perturbations of marine ecosystems and food sources (Hannah 2011), all of which may impair immune function, reduce reproductive success, and lower survival (Scheuhammer et al. 2007, A Hedd, Memorial Univ, unpublished).

Since 2005, my lab has been monitoring reproduction in a colony of storm-petrels, and one objective of this research is to identify causes of population declines. We have been watching for signs of predation, quantifying diets, and monitoring movements of birds within and outside breeding seasons to learn about potential threats to, for example, their food supply, and how these threats relate to reproduction.

Methods

An estimated 50,000 pairs of Leach's storm-petrels breed on Bon Portage Island, Nova Scotia. Leach's storm-petrels are one of the most abundant seabirds breeding in the northwest Atlantic. Adults of this species breed almost exclusively on marine islands, incubating a single egg for 37-50 d that produces a nestling that spends 56-79 d in burrows (Huntington et al. 1996). Breeding adults forage at sea for several days per trip to provision themselves and their nestlings; foraging locations are presumed to be >100 km from breeding colonies. In short, energetic commitment to reproduction is extreme in this species, so that even small changes to their environment may have significant consequences for their breeding success.

Since 2005 we have monitored reproduction (nest initiation date, egg size, egg mass, chick growth rate, nest fate, feeding rates) at permanently marked, GPS-referenced storm-petrel burrows (~250 in 2012). We inspect all burrows that fall within twelve 12- x 12-m quadrats. Quadrats are situated roughly 10 m apart on a 0.5-km-long transect. To track survival, adults are captured in burrows, measured (head length, culmen, tarsus bone, wing length, tail length), and are given uniquely numbered bands if not already banded. When adults are feeding nestlings, they may also be trapped in their burrows (Mauck and Grubb 1995) without provoking abandonment.

Blood samples (quantified, to a maximum volume of 200 µl; Voss et al. 2010) are obtained from nestlings (that reach 40 g) and adults for molecular sexing (Griffiths et al. 1998, Han et al. 2009) and stable isotope analysis (Stable Isotopes in Nature Laboratory at UNB).

In 2010 and 2011, transmitters were deployed on 62 different adults; in 2011 effort was made to capture pairs (12 pairs and 6 individuals). Transmitters weighed 0.29 g and measured 10 x 4 x 2 mm with an external aerial measuring 180 x 0.2 mm. These were mounted mid-dorsally with Tesa® tape (4651) cut to fit the length of the device and glue (Loctite® 402). Storm-petrels were returned to their burrows immediately after transmitters were affixed.

Two towers, each supporting four 9-element Yagi antennae, were erected on the island. Receivers were synchronised for time using a built-in GPS system. Data recorded for each detection included transmitter number, date, time, antenna, and signal strength. Plots of signal strength of all 8 antennae against time for each individual bird were generated.

Data were analyzed in R (R Core Development Team 2009).

Results

Results are still being analysed as part of Doctoral thesis; what follows is a brief summary. Reproductive success has been highly variable from year to year, although there has been no clear directional trend. Although there has also been significant variation in nestling growth rates from year to year, variation in growth rates do not appear to explain variation in reproductive success

Nest success (likelihood of producing a nestling that likely fledged) was not statistically different for nests where both, one, or neither parent was outfitted with a transmitter. Return rates of birds given transmitters was slightly higher than it was for birds that did not receive transmitters. Thus, no significant effects of transmitters have been detected yet; we continue to test for these.

Of 62 transmitters we have deployed in the last two years, 26 have provided data for some of the incubation period, and 24 have provided data for some part of the chick-provisioning stage. Some transmitters were deployed towards the end of the incubation period and covered part of both stages. Some incubating storm-petrels stayed continuously on eggs, whereas some appeared to make brief forays of up to one day in the middle of incubation shifts. Total time spent incubating eggs did not differ between successful and unsuccessful incubations. Durations of individual incubation shifts were also not significantly different between successful and unsuccessful incubations.

The correlation between duration of recess (when a parent has been relieved by its partner) and the duration of the subsequent incubation shift was not significant. There was a non-significant negative correlation between incubation constancy and incubation shifts.

Male and female storm-petrels returned to their burrows only at night to provision chicks. On average, intervals spent with chicks and intervals between visits did not differ significantly between males and females. Parents spent more time in their burrows when their nestlings were smaller, presumably to brood them. For nestlings where both parents had transmitters, one parent visited on 43% of nights, two parents visited on 16% of nights, and no parents visited on 41% of nights.

Feather isotope data were consistent with the hypothesis that foraging opportunities differ by latitude; individuals that probably foraged closer to Antarctica also foraged at a higher trophic level (e.g., more fish and fewer crustaceans).

In summary, our results are well on the way to meeting important objectives of identifying causes of storm-petrel declines.

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