Penguin parents: Inability to share roles increases their vulnerability to climate change

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The fixed division of labor between crested penguin parents increases their chicks' vulnerability to food shortages made ever more common by climate change. Credit: Kyle Morrison

The fixed division of labour between crested penguin parents increases their chicks' vulnerability to food shortages made ever more common by climate change. The parents have been unable to adapt their habits to the challenges of increasingly frequent years of limited food supply and, as a result, will become further threatened by extinction. So says Kyle Morrison of Massey University and the National Institute of Water & Atmospheric Research in New Zealand, who led a study published in Springer's journal *Behavioral Ecology and Sociobiology*.

The main duties of all penguin parents are to provide food and to defend their offspring against predatory seabirds and other intruding penguins. While on guard duty, parents fast and do not go off to sea to feed. Most penguins avoid long fasting periods by alternating brooding and chick-provisioning duties between the sexes. However, the seven species of *Eudyptes* penguins (the crested penguins, including rockhopper penguins) are an exception. Males guard and fast for the first three to four weeks after eggs have hatched. During this time, females are the sole providers. During the next six weeks, chicks gather together in crèches and can be fed by both parents. During this crèche phase, both sexes may make extended multi-day trips to sea to regain weight.

These parental roles never vary, no matter what the environmental conditions. However, how frequently each sex brings food to their chick can change drastically between years, depending on how much krill, fish, and squid the parents can find. *Eudyptes* populations have already seen worrying long-term declines, especially because of climate-induced food shortages.

The researchers studied Eastern Rockhopper Penguins (*Eudyptes* chrysocome filholi) on New Zealand's sub-Antarctic Campbell Island over two consecutive breeding seasons. During the 2011 season, abundant food was available, but 2012 was a lean year. The researchers noted how often chicks were fed, their subsequent size at one month old,

and the colony's overall success in raising chicks. Data-loggers installed along a narrow travel pathway from the sea were used to gather accurate data on how much time tagged adult birds spent away from the island and how frequently they returned to feed their chicks.

Morrison and his team found that chicks were hatched and reared more successfully during the 2011 season than in 2012's lean months. During the 2012 crèche phase, males in particular spent more time at sea in search of food to regain the mass they lost during their chick-guarding fast ashore. This made males less likely to regularly bring food to their offspring. Chicks that were fed less also grew more slowly.

The results show that these penguins' rigid division of parental roles is not suited to ensure that their chicks grow and survive as well as possible, especially in times of poor food supply. The situation is expected to become worse with increasing climate change. The researchers estimate that if *Eudyptes* penguins were to share guarding and foraging duties equally, up to 34.5 percent more feeds could be provided to their chicks. However, changing their breeding strategy isn't a simple matter, because the smaller, less aggressive females would be less effective in the role of guarding chicks.

"*Eudyptes* penguins, ostensibly anchored in a reproductive strategy maladapted to a marine environment where food availability is less predictable, will continue to be highly threatened by climate change," warns Morrison.

More information: Kyle W. Morrison et al. The canalized parental roles of a Eudyptes penguin constrain provisioning and growth of chicks during nutritional stress, *Behavioral Ecology and Sociobiology* (2016). DOI: 10.1007/s00265-016-2060-z

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