# DISEASE OUTBREAKS AMONG PENGUINS AT SUB-ANTARCTIC MARION ISLAND: A CONSERVATION CONCERN

JOHN COOPER[1,2], ROBERT J.M. CRAWFORD[1,3], MARIENNE S. DE VILLIERS[1], BRUCE M. DYER[3], G.J. GREG HOFMEYR[4] & ANNELIZE JONKER[5]

[1]*Animal Demography Unit, Department of Zoology, University of Cape Town, Rondebosch, 7701, South Africa*
[2]*Centre for Invasion Biology, Department of Botany and Zoology, Stellenbosch University, Pvt Bag X1, Matieland, 7602, South Africa (John.Cooper61@gmail.com)*
[3]*Marine and Coastal Management, Department of Environmental Affairs, Private Bag X2, Roggebaai, 8012, South Africa*
[4]*Mammal Research Institute, Department of Zoology and Entomology, University of Pretoria, Pretoria, 0002, South Africa*
*Current address: Port Elizabeth Museum, Bayworld, PO Box 13147, Humewood, 6013, South Africa*
[5]*Western Cape Provincial Veterinary Laboratory, Private Bag X5020, Stellenbosch, 7599, South Africa*

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**SUMMARY**

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In 1992 and 1993, unknown diseases killed 250–300 King Penguins *Aptenodytes patagonicus* and an estimated 5–10 thousand Macaroni Penguins *Eudyptes chrysolophus* at sub-Antarctic Marion Island. At the same island, an outbreak of avian cholera *Pasteurella multocida* during November 2004 killed approximately 2000 Macaroni Penguins at Kildalkey Bay. Other breeding colonies of Macaroni Penguins and other species of seabirds at the island were not affected at the time. Procedures for reporting and dealing with such outbreaks are now being developed.

Key words: Macaroni Penguin, *Eudyptes chrysolophus,* King Penguin, *Aptenodytes patagonicus,* avian cholera, *Pasteurella multocida,* disease, sub-Antarctic

## INTRODUCTION

Until relatively recently, disease outbreaks amongst vertebrate wildlife in the Southern Ocean and Antarctica have not been regarded as a serious conservation concern, given the assumed isolation of breeding colonies of seabirds and seals from sources of infection at lower latitudes. However, increasing levels of tourism and scientific research within the region, coupled with the predicted effects of global warming, have now led to concern that this situation may be changing (e.g. Kerry *et al.* 1999, Harvell *et al.* 2002, Frenot *et al.* 2004, Rolland *et al.* 2009).

Knowledge of outbreaks of disease is needed to help develop biosecurity protocols for the sites where such outbreaks occur. Here, we report on avian disease outbreaks at sub-Antarctic Marion Island, one of South Africa's Prince Edward Islands in the south-west Indian Ocean, and consider what procedures should be adopted to reduce the risks of further outbreaks at the island group. The Prince Edward Islands are well protected as a Special Nature Reserve and as a Wetland of International Importance in terms of the Ramsar Convention (Prince Edward Islands Management Plan Working Group 1996, South Africa 2007), but they still face threats from a number of external sources, including from alien introductions and the effects of global warming (e.g. Crawford & Cooper 2003, Rouault *et al.* 2005, de Villiers & Cooper 2008).

## OBSERVATIONS AND IDENTIFICATION

Approximately 250–300 King Penguin *Aptenodytes patagonicus* corpses were observed in the breeding colony at Goodhope Bay, Marion Island, in late October 1992. Most corpses were of adults, some of which had attendant live chicks still trying to be brooded (N.L. Avenant pers. comm. to JC). The cause of this event is unknown. During 15–25 March 1993, large numbers of Macaroni Penguins *Eudyptes chrysolophus* died at Bullard Beach, Marion Island, during their moulting period, from what was suspected to be an outbreak of disease. Affected birds had suppurating eyes. A few birds in this condition were also observed in the Kildalkey Bay colony, but not in other smaller Macaroni Penguin colonies on the island. When visited by JC on 11 May 1993, rotting corpses of what appeared to be pre-moulters ("fats") at Bullard Beach covered a discrete part of the colony at an estimated density of 2–5 birds/$m^2$, totalling a roughly estimated 5000–10 000 birds. The cause of death may have been suppurative conjunctivitis resulting from bacterial infection. In 1979, this disease caused the deaths of about 5000 Cape Cormorant *Phalacrocorax capensis* chicks and 100 Bank Cormorant *P. neglectus* chicks at Mercury Island, Namibia (Crawford *et al.* 1980).

On 5 November 2004, dead Macaroni Penguins were found at the edge of the Kildalkey Bay colony. On 17 November, 2023 dead

birds were counted adjacent to and within the breeding area. Two birds were collected for necropsy, undertaken by the Western Cape Provincial Veterinary Laboratory in Stellenbosch, South Africa. No other colonies of Macaroni Penguins at Marion Island and no other seabirds there were observed to be affected at the time.

During necropsy of the two Macaroni Penguin carcasses, samples of liver, spleen and kidney were collected using sterile forceps and scissors. Each sample was placed in a separate sterile container. The samples were individually inoculated on plates of sheep blood agar and MacConkey agar. Sheep blood agar plates were incubated under 5%–10% $CO_2$ at 37°C for 24–48 hours. MacConkey plates were incubated under normal atmosphere at 37°C for 24 hours. Suspect isolates were obtained from five of the six organ samples. Two isolates, one from each bird, were selected for confirmation and further identification. Typical macroscopic and microscopic appearance as well as typical biochemical reactions were used to confirm and identify the isolates as *Pasteurella multocida multocida* (Quinn *et al.* 1999).

## DISCUSSION

Three subspecies of *P. multocida* are recognized—*P. m. multocida, P. m. septica* and *P. m. gallicida*—and may be differentiated on the basis of physiologic differences. All three subspecies have the ability to cause avian cholera, also known as fowl cholera or avian pasteurellosis (Glisson *et al.* 2003).

*P. multocida* is an extremely contagious bacterium to which a wide range of domesticated and wild birds (as well as other animals) are susceptible (Botzler 1991). Infection by a virulent strain of *P. multocida* usually leads to an acute septicaemic disease with high morbidity and mortality. Birds may die within a few hours of the onset of clinical symptoms (Botzler 1991, Friend 1999). However, the disease may also occur in a chronic form. Birds with chronic avian cholera constitute a major reservoir of disease in a population (Songer & Post 2005). Diseased birds contaminate their environment, food and water mainly via respiratory excretions. Dead birds and equipment used by humans may also serve as sources of infection (Glisson *et al.* 2003, Songer & Post 2005).

This is the first documented outbreak of avian cholera at the Prince Edward Islands and apparently the first for the Macaroni Penguin. In 2002/03, it was estimated that about 356 000 pairs of Macaroni Penguins bred at Marion Island. Especially large colonies bred at Kildalkey Bay (181 000 pairs) and Bullard Beach (144 000 pairs) (Crawford *et al.* 2003b). In the 2008/09 breeding season, the number of Macaroni Penguins estimated for Marion Island had shrunk to 290 000 pairs (Crawford *et al*. 2009). The Macaroni Penguin is a globally threatened species, with a category of Vulnerable (BirdLife International 2008).

Elsewhere, avian cholera has caused the mortality of several species of seabirds at islands in the Southern Ocean and in Antarctica, including Adélie *Pygoscelis adeliae,* Chinstrap *Py. antarctica* and Southern Rockhopper *E. chrysocome* penguins, Indian Yellow-nosed Albatrosses *Thalassarche carteri,* a Southern Giant Petrel *Macronectes giganteus,* Kelp Gulls *Larus dominicanus* and Subantarctic *Catharacta antarctica* and South Polar *C. maccormicki* skuas (Parmelee *et al.* 1979; Moors *et al.* 1988; de Lisle *et al.* 1990; Leotta *et al.* 2003, 2006; Weimerskirch 2004; GSGSSI 2005; R. McKee *in litt.*; see also Montalti *et al.* 1996).

The meteorology station at Marion Island is supplied from Cape Town, Western Cape, South Africa, a potential source of avian disease. However, live domestic poultry—a likely source of avian diseases in the region (de Lisle *et al.* 1990, Kerry *et al.* 1999, Weimerskirch 2004)—have not been taken to and kept at the island since the early 1970s (Watkins & Cooper 1986). Waste poultry products (including shells from irradiated eggs) have been kept frozen at the meteorology station and returned annually to South Africa since the mid-1990s to reduce the risk of introducing alien diseases (Prince Edward Islands Management Plan Working Group 1996, de Villiers *et al.* 2005).

A second possible source of the disease is from migratory birds (Frenot *et al.* 2004, Weimerskirch 2004, Leotta *et al.* 2006). Based on band recoveries, two predatory seabirds that breed and prey upon penguins at Marion Island, the Northern Giant Petrel *M. halli* and the Subantarctic Skua, have reached African continental waters on migration (Brown & Oatley 1982, Gartshore *et al.* 1988), where they could have come in contact with sources of avian cholera. Avian cholera has been reported from a number of southern African resident seabird species on islands off the Western Cape, South Africa (Kaschula & Truter 1951, Crawford *et al.* 1992, Williams & Ward 2002, Waller & Underhill 2007).

At the time of the 1992 and 1993 incidents, no measures were taken to contain the outbreaks. In 2004, once it became apparent that the number of deaths was unusually high, the Macaroni Penguin colony at Kildalkey Bay was visited as infrequently as possible. Following advice received from the Prince Edward Islands Management Committee, the colony was placed "out of bounds" for the rest of the breeding season to all personnel on the island, save for two ornithological field assistants. Additionally, outer clothing and footwear of all field workers visiting the site and surrounds were disinfected with a bleach (sodium hypochlorite) solution after each visit and were stored at a nearby field hut.

Procedures for preventing, reporting and dealing with wildlife disease outbreaks at sub-Antarctic islands and in Antarctica have been developed (Kerry *et al.* 1999, Curry *et al.* 2005, AAD 2006; see also Waller & Underhill 2007). It is intended to produce similar procedures for the Prince Edward Islands, concentrating on identification of the causative organism or organisms and on quarantine requirements to deter the arrival of further diseases and the spread of outbreaks (C.A. Jacobs *in litt.*). The ensuing document will then be adopted as part of the management policies for the islands. Such action is especially important considering the decreasing population of the globally threatened Macaroni Penguin (and of several other similarly threatened seabird species) at Marion Island (Crawford & Cooper 2003; Crawford *et al.* 2003a, 2003b, 2009) and more generally the concerns raised that climate change causing global warming may exacerbate the spread of avian diseases at high latitudes (e.g. Harvell *et al.* 2002, Weimerskirch 2004, Rolland *et al.* 2009).

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