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Assessing the risks of introduced chickens and their pathogens to native birds in the Galápagos Archipelago

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Abstract

Poultry production is an important economic activity on inhabited islands of the Galápagos archipelago. There has been a recent surge in both small-scale backyard chickens and larger scale broiler production associated with growth in the human population and the tourist industry. With increased poultry production, concerns have been expressed about the increasing risk of transfer of disease from chickens to native Galápagos bird species that may have little resistance to introduced pathogens [Wikelski, M., Foufopoulos, J., Vargas, H., Snell, H., 2004. Galápagos birds and diseases: invasive pathogens as threats for island species. Ecology and Society 9(5). Available from: URL:http://www.ecologyandsociety.org/vol9/iss1/art5]. This study evaluates risks posed by chicken disease to endemic and native Galápagos bird species, based on empirical evidence of pathogens present in chickens on the islands and a literature review of effects of these pathogens in wild species. Pathogens identified in domestic chicken populations of immediate avian conservation concern are Newcastle disease, *Mycoplasma gallisepticum*, and the proventricular parasite *Dispharynx* sp. Newcastle disease (avian paramyxovirus-1) poses an imminent threat to Galápagos penguins (*Spheniscus mendiculus*), flightless cormorants (*Phalacrocorax harrisi*), and lava gulls (*Larus fuliginosus*), species with very small population sizes (less than 1500 animals each). Additionally, litter from broiler farms could affect ecological processes in local ecosystems. Improved poultry biosecurity measures are urgently needed on the Galápagos Islands for avian disease management, yet developing these strategies presents political, social, and economic challenges.

Keywords: Galápagos islands; Native birds; Avian conservation; Pathogens; Chickens; *Gallus gallus*; Disease risk

1. Introduction

The Galápagos archipelago, located approximately 1000 km west of continental Ecuador (Fig. 1), is renowned for its endemic flora and fauna whose study has greatly influenced modern evolutionary theory (Darwin, 1859; Grant and Grant, 2003). From the 19th century to the present, human activities, including the introduction of invasive animal and plant species, have negatively impacted Galápagos ecosystems (Snell et al., 2002; MacFarland and Cifuentes, 1996). In other island ecosystems, such as Hawaii, anthropogenic introduction of exotic vertebrate and invertebrate species is linked to the emergence of infectious disease (e.g., avian malaria and avian pox) and subsequent decline in

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many native bird species (Van Riper III et al., 1986; Atkinson et al., 1995).

Disease carried by any bird species introduced to the Galápagos Islands (chickens *Gallus gallus*, pigeons *Columba livia*, smooth-billed anis *Crotophaga ani*, Guinea fowl *Numida meleagridis*, and farmyard ducks of genus *Cairina* or *Anas*) may threaten its native avifauna, comprising 58 resident species (22 endemic and 36 native). However, little published information is available on diseases present in domestic, introduced, or native birds in the Galápagos archipelago (Wikelski et al., 2004). Chickens (*G. gallus*) and pigeons (*C. livia*) are the principal avian species introduced to the Galápagos by human colonists. Feral pigeons have inhabited Santa Cruz, San Cristobal, and Isabela islands. Current eradication efforts are rapidly reducing the numbers of introduced pigeons (Phillips et al., 2003).

In contrast, the numbers of domestic chickens are increasing in inhabited areas of the Galápagos. Domestic chickens are present on Santa Cruz, Isabela, San Cristobal, Floreana, and Baltra (Fig. 1). Three types of poultry farming are practiced on the Galápagos Islands: small-scale backyard meat chickens (1–40 birds per farm) (Fig. 2), small to medium-scale egg layers, and medium to relatively large-scale commercial broiler operations (2000–4000 birds) (Fig. 3). Currently, there are 23 broiler chicken farms on Santa Cruz, 6 on San Cristobal, and 4 on Isabela. In the past five to ten years, poultry production has intensified due to demand from the growing human population and tourist industry. Under Galápagos law, broiler chickens, brought to Galápagos at 1–5 days of age, must be unvaccinated and certified as healthy by approved aviculture facilities on the Ecuadorian mainland. Currently, no livestock vaccinations are permitted on the Galapagos Islands (David Cruz, SICGAL, personal communication). Feral populations of chickens exist on Santa Cruz, Isabela, San Cristobal, and Floreana. In addition to the risk of introducing disease into native Galapagos avifauna, waste from domestic poultry operations may have detrimental effects on local plant and animal communities in the Galapagos due to nutrient enrichment and water contamination.

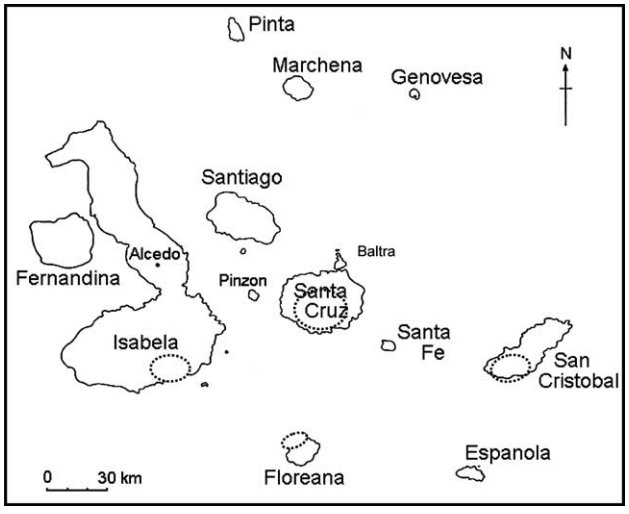

Fig. 1. Map of the Galápagos Islands. Areas shown in dashed circles represent general locations of chicken farming activities.

Fig. 2. Backyard chickens mingling with Darwin's ground finches (*Geospiza* sp.) on Floreana Island, Galápagos.

Fig. 3. Typical broiler pen, Isabela Island, Galápagos.

In 2001, the Saint Louis Zoo and the University of Missouri – St. Louis, in cooperation with the Galápagos National Park Service and the Charles Darwin Research Station, initiated an avian disease surveillance program in the Galápagos Islands. This monitoring serves to identify pathogens that pose a particular risk to native populations and helps to target certain pathogens for future disease surveillance. A similar approach to identifying high-risk pathogens has been performed for killer whales (*Orcinus orca*) (Gaydos et al., 2004). Here, we present results of poultry disease surveys from 2001 to 2003 in relation to their threat to native birds, discuss ecological threats of broiler aviculture and backyard chickens to Galápagos ecosystems, identify disease