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Correlates of extinction risk and hunting pressure in gamebirds (Galliformes)

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Abstract

The 284 species of Galliformes are a highly threatened group of birds subject to direct exploitation for food, sport and cultural practices. The impact of hunting is often assumed to contribute to the high percentage of species (26.4%) listed as threatened with extinction in the IUCN Red List. We take a macroecological approach to examine the anthropogenic and ecological correlates of extinction risk and hunting pressure using linear and stepwise regression. Independent contrasts are analysed, as well as raw species data, to control for the potential confounding influence of phylogenetic trends. Extinction risk is found to be predicted both by the ecological factors considered (e.g., latitudinal range, body mass, elevational range, habitat use) and secondarily by human factors (e.g., human population density, total calorie intake, composition of diet). Hunting pressure itself is also predicted well for the threatened species by several of the anthropogenic and ecological variables. The study demonstrates that human variables can be used successfully to predict extinction risk, and represent an improvement upon methods which examine ecological variables alone. Furthermore, we show that individual threats can be explored using similar techniques, providing a more detailed insight into the processes leading to extinction. As applied to the Galliformes, both approaches provide evidence supporting the hypothesis that hunting pressure has contributed to the high proportion of threatened species in this group, and thus reinforce the case for urgent measures to reduce the impacts of direct exploitation upon these birds.

Keywords: IUCN Red Lists; Pheasants; Grouse; Megapodes; Human population density; Bird body mass

1. Introduction

1.1. The roots of the extinction crisis

Convincing evidence suggests that current extinction rates have been elevated by the actions of humans to a point many times the normal background level (e.g., Pimm et al., 1995; Mace and Kunin, 1994; Smith et al., 1993). This extinction 'crisis' appears to be ongoing and intensifying (Lawton and May, 1995). Many factors have been identified which help to push a species towards extinction. Recently, attention has been directed at the potential effects of climate change on species' distributions (Thomas et al., 2004). Similarly, pollutants and chemicals that are released into the environment by industry and agriculture affect a variety of species. For example, dramatic declines in the populations of vultures in the Indian subcontinent (Prakash et al., 2003) have been linked to the widespread use of a veterinary drug, diclofenac (Oaks et al., 2004). However, while climate change and pollution are relatively modern threats, humans have caused extinctions for much longer through what Diamond (1989) described as an 'Evil

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Quartet' of processes, namely habitat destruction, overkill, the impact of alien species and chains of extinction. A recent assessment of the conservation status of globally threatened birds (GTBs) cited one of these – 'habitat destruction or degradation' – as a factor in 86% of cases (BirdLife International, 2004a). Nonetheless overkill, which was probably the most important factor driving prehistoric megafaunas to their extinction as humans first expanded their global range (Flannery, 2002), remains a very serious threat today. Overexploitation is now considered the second most prevalent anthropogenic threat to birds, affecting nearly 30% of GTBs (BirdLife International, 2004a). Despite the global impact of these factors, their importance relative to one another varies from place to place and between different groups of species.

1.2. The Galliformes

As a group particularly affected by direct exploitation, the Galliformes (game birds) provide a good illustration of this variation. The order comprises five families, with 284 species currently recognised (del Hoyo et al., 1994). These families are diverse and together occupy almost every terrestrial habitat on earth. The megapodes (Family = Megapodiidae) are found in South-East Asia and Australasia, including many small islands. They, in common with the cracids (Family = Cracidae), are thought to retain many ancestral features (Jones et al., 1995) but are probably best known for their unique breeding biology which usually involves constructing large, incubating mounds in which to lay their eggs. The cracids are found in tropical forests ranging from South America to Mexico (Delacour and Amadon, 1973). The third family, the New World quails (Family = Odontophoridae), also inhabits South American forests, although some species live as far north as southern Canada. They are generally smaller than the cracids. The fourth family, the Guineafowl (Family = Numididae), contains only five species, all of which are found in Africa. The last family (Family = Phasianidae) is the most diverse and includes the francolins, partridges, Old World quails, pheasants, and grouse. Phasianids are found in Africa, Asia, Europe and Northern America (Johnsgard, 1999), including many well-known species such as the Indian peafowl (*Pavo cristatus*), ring-necked pheasant (*Phasianus colchicus*) and the domestic chicken, whose wild ancestor is the red junglefowl (*Gallus gallus*).

The Galliformes are economically and socially important to humans the world over. In the United Kingdom pheasant shooting earns approximately £600 million per year and employs over 25,000 people in the rural economy (Game Conservancy Trust, 2004). Another hunted species is the helmeted guineafowl (*Numida meleagris*), Africa's most important game bird (Little and Crowe, 2000). The global significance of the domestic chicken is enormous – over 65 million metric tons of chicken meat were produced worldwide in 2003 (FAO-Stat data, 2004). Even the tribal societies of Australasia used yolk from megapode eggs as a valuable source of protein (Dekker et al., 2000).

Thus economists and ecologists are likely to agree on the importance of the Galliformes, albeit from different standpoints. Despite this, Galliformes are one of the most threatened groups of birds. In 2004, 12.4% of all extant bird species were considered to be globally threatened (IUCN, 2004b). The equivalent figure for the Galliformes is much higher, at about 26.4% (BirdLife International, unpublished data). The difference may be explained by overexploitation but there is little hard evidence to confirm this supposition (McGowan, 2002).

1.3. Identifying the threats

In undertaking this study, our aims were to identify ecological and anthropogenic correlates of (1) extinction risk and (2) hunting pressure in the Galliformes, to understand better the processes which are jeopardising these species and to explore the perception that overexploitation is a key problem for the group as a whole.

Several approaches have been used to identify threatened and potentially threatened species, and the problems that confront them. The International Union for the Conservation of Nature and Natural Resources' (IUCN) Species Survival Commission (SSC) produces the Red List of Threatened Species (hereafter referred to as the Red List) which aims to assess species systematically and assign them to a threat category according to their perceived risk of extinction. The assessments for birds are carried out by BirdLife International according to the Red List Categories and Criteria (IUCN, 2001). BirdLife International also maintains the World Bird Database containing information on threatened and near-threatened species and the threats they face. The Red List is hugely influential, and has often been a useful catalyst for conservation action (Fuller et al., 2003) but, on its own, it tells us little about the factors underlying extinctions. Considerable effort has also been directed at elucidating factors which can predict extinction in species (e.g., Laurance, 1991; Harcourt, 1998; Purvis et al., 2000; Duncan and Lockwood, 2001; Norris and Harper, 2004). These studies have tested hypotheses about biological traits which might make a species more susceptible to human disturbance and extinction (see Simberloff, 1998). Similar hypotheses can be erected about the relationship between the anthropogenic variables associated with an area and the extinction risk faced by the species living there, and between ecological/anthropogenic variables and specific threats such as hunting. While this study follows other authors in modelling extinction risk, it gains