

S37-1 Fishery impacts on the food supplies of seabirds

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Abstract Commercial fisheries can impact on seabirds by taking fish and other seafood that the birds might otherwise harvest. We compare, at global scale, the quantities of prey taken by fisheries and seabirds from information of global seabird populations and available metabolic equations. From two case studies in the tropical east Pacific Ocean and North Sea, we give examples of circumstances in which fisheries can impact deleteriously on seabird populations or can be beneficial through effects on the marine food chain.

Key words North Sea, Pacific Ocean, Prey consumption, Tuna, Sand-eels, Seabirds, Commercial fisheries

1 Introduction

Seabirds and commercial fisheries that harvest the same prey are affected mutually by their food supply. Noting this two-way interaction, we begin by comparing, at a global scale, the quantities of prey taken by fisheries and seabirds. The latter can be calculated using improving knowledge of the global populations of seabirds (del Hoyo et al., 1992, 1996; Gaston and Jones, 1998; Brooke, 2003), and available equations for their metabolic requirements (Nagy, 1987). We find that the annual take by seabirds and fisheries is of the same order of magnitude, in the range 50–100 million tonnes a year. Among seabirds, dominant consumers in order of consumption are penguins, procellariiforms and auks. Pre-eminent among the top 20 species, and responsible for 74% of seabird consumption, are the macaroni penguin (*Eudyptes chrysolophus*) and thick-billed murre (*Uria lomvia*). Under current conditions, neither interact significantly with commercial fisheries.

At global level, this conclusion masks distinct regional differences in bird-fishery interactions, as illustrated by two case studies here. One hints at a potentially deleterious impact of fisheries on seabirds, whereas the other documents a beneficial effect mediated through changes in the wider marine ecosystem.

2 The case studies

In the eastern tropical Pacific Ocean, the most widespread and abundant nekton-feeding seabirds are the Juan Fernandez petrel (*Pterodroma externa*), wedge-tailed shearwater (*Puffinus pacificus*), sooty tern (*Sterna fuscata*), and red-footed booby (*Sula sula*). All feed at or close to the surface, where they are largely dependent on predatory tu-

nas (*Thunnus* spp.) to drive smaller prey fish to the surface (Au and Pitman, 1986; Ballance et al., 1997). These four bird species consume 83% of prey caught above an average tuna shoal, the remaining 17% being captured by other, less numerous seabirds. The regional annual consumption of the four species combined is 350 000 tonnes, suggesting that the annual consumption of all seabirds is about 430 000 tonnes. This total is similar to the annual catch of the tuna fishery of 420 000 tonnes (IATTC 2000). Whereas the seabirds themselves do not consume any tuna, the impact of commercial fisheries on tuna populations could affect seabirds indirectly by diminishing the tuna schools, and so reducing available prey patches for the seabirds. This potential impact is not currently recognized in tuna management decisions.

In the temperate North Sea, one important impact of commercial fisheries on seabirds has been via ecosystem links. From a very small-scale fishery in the early 1950s, a million-tonne a year industrial fishery for sand-eels (*Ammodytes marinus*) has developed. Over the same period many seabird populations have increased. This counter-intuitive result may be explained by huge reductions in food-fish consumption by overfished stocks of predatory fish, notably gadoids and mackerel (*Scomber scombrus*). This has resulted in decreased predation of sand-eels, despite the increase in fishing and birds (Furness, 2002). The overwhelming importance of food-fish consumption by predatory fish in determining food web structure appears to be a common feature of shelf food webs. Consumption of offal and discards from trawlers, especially during winter, also sustains seabird populations, particularly the scavenging species (Ojowski et al., 2001). The imbalance in seabird community composition caused by decades of provid-

ing offal and discards can lead to severe predator-prey interactions if discard volumes are subsequently reduced (Oro and Furness, 2002).

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