

## PREFACE

Humans have altered and created entirely new environments to which animals have either adapted or been extirpated. Urban environments are one of the most extreme examples of how humans have changed previous habitats. Urban environments present massive challenges for birds living in these spaces and the impacts can be seen on all aspects of their behavior including how they communicate with one another. This book discusses how seabirds and songbirds have adapted for life in urban areas, how it has impacted their migratory behavior, and also examines the ecology and conservation of these two species.

Chapter 1 - Worldwide, bird migration plays a definitive role in the wide dispersal of bird-transported ticks. As spring unfolds in the Northern Hemisphere, wild migratory birds move northward en route to the boreal forest spanning central and eastern Canada, and become parasitized by bird-feeding ticks when they make landfall at tick endemic areas. Their bird-tick studies reveal engorged Neotropical ticks, which are indigenous to Central America and the northern region of South America, on migratory flycatchers, thrushes, and warblers. With their versatile mobility and vast distribution, migratory birds can act as maintenance hosts for the wide dispersal of pathogenic microbes. Certain passerines, such as the American Robin, *Turdus migratorius* L., can act as reservoir hosts of the Lyme disease bacterium, *B. burgdorferi* sensu lato (s.l.), and help to perpetuate spirochetal infection within a tick population. These hematophagous ectoparasites can transmit infectious microorganisms (i.e., bacteria, piroplasms, viruses) to avian hosts and, subsequently, after bird parasitism, can transmit these pathogenic microbes to vertebrate hosts, including humans. Ticks may simultaneously be co-infected with one or more pathogens that can have a broad diversity of genotypes. When birds become heavily infested with ticks, these avian hosts have the capacity to initiate a new population of ticks. Within an ecosystem, songbirds may be involved in a multi-tick enzootic cycle consisting of several tick species. Within one West Coast bioregion, the authors show that songbirds amplify *B. burgdorferi* s.l. in a 5-tick enzootic cycle. One heavily infested Fox Sparrow, *Passerella iliaca* (Merrem), in this Pacific Northwest locality was parasitized by avian coastal ticks, *Ixodes auritulus* Neumann, and had a *B. burgdorferi* s.l. infection rate of 81%. Canada-wide the authors have discovered *B. burgdorferi* s.l. in six different *Ixodes* species of ticks collected from passerine birds. Since wild birds widely disseminate *B. burgdorferi* s.l.-infected ticks, people do not have to frequent an endemic area to contract Lyme disease.

Chapter 2 - Seabirds can serve as fundamentally important components of biodiversity of insular ecosystems, playing an important role as vectors of marine-derived nutrients, increasing primary production which in turn is transferred through the food web, and

influencing the numbers and types of primary and secondary consumers. The status and trends of seabirds can be an excellent indicator of the impacts of human activities on their populations and communities. These impacts include loss of breeding sites through trampling and grazing by introduced domesticated animals; mortality by introduced mammalian predators such as rats, dogs and cats; egg and chick harvest; and interactions with local and regional fisheries. These impacts have occurred on most human-inhabited islands, ranging from the tropics to the sub-polar regions. Until the 1990s, the general state of knowledge about seabirds of oceanic islands in Chile was poor, since virtually no basic ecological information such as population size, breeding biology or the extent of conservation problems had been compiled for many species.

Human communities of oceanic and coastal insular systems in Chile currently possess only a small percentage of people who retain local traditional ecological knowledge, as a result of the recent influx of immigrants during the second half of the 20<sup>th</sup> century and the progressive decline of the ancestral native population. The relationship of recently arrived human communities with the biodiversity of the insular systems has been restricted to the use and exploitation of resources to satisfy basic needs for the human population (e.g. heating, food). Many of these activities have a negative impact on the biodiversity of the island, including seabirds. As a resource, seabirds were usually ignored by island communities because they did not provide any immediate benefit. In the 1990s, initiatives of national and foreign researchers began in different islands of Chile to elucidate basic aspects of the ecology and conservation status of several seabird species. The information generated was shared with the island communities associated with these seabird species in order to increase awareness and build support for conservation actions. This community engagement was undertaken based on the understanding that island communities, especially isolated ones, have particular characteristics that distinguish them from the inhabitants of the continent. These include a strong sense of belonging to the place, a heightened sense of community among residents, a detachment from the nearby continental areas, and a sense of not belonging to the central government that manages the island.

Here the authors document community engagement experiences and results on five significant Chilean seabird islands distributed in a wide latitudinal range: (1) Robinson Crusoe, Santa Clara and Alejandro Selkirk islands (the Juan Fernández Archipelago) (34° S), inhabited by six species of procellariids (Pink-footed Shearwater *Puffinus creatopus*, Kermadec Petrel *Pterodroma neglecta*, De Filippi's Petrel *Pterodroma defilippiana*, White-bellied Storm-Petrel *Fregetta grallaria*, Juan Fernández Petrel *Pterodroma externa* and Stejneger's Petrel *Pterodroma longirostris*); (2) Mocha Island (38° S) where the Pink-footed Shearwater *Puffinus creatopus* breeds; (3) Puñihuil Island, Chiloé (42° S) with a mixed-colony of Humboldt (*Spheniscus humboldtii*) and Magellanic (*Spheniscus magellanicus*) penguins; (4) Guafo Island, Quellón town (44°S) with the largest colony of Sooty Shearwater *Puffinus griseus* in the world; and (5) Navarino Island (55°S), Cape Horn Biosphere Reserve, that is inhabited by rich ensembles of seabirds and shorebirds, including cormorants, plovers, sandpipers, steamer-ducks and geese. On all of these islands, islanders have participated in initiatives that support the conservation of resident seabird species, including the cessation of chick and egg harvests, development of special interest tourism around birds, removal of introduced animals and responsible pet ownership, and as a general rule, inclusion of birds as co-inhabitants of the community.

Chapter 3 - Interactions between pelagic seabirds (albatrosses and petrels, Procellariiformes) and fisheries occur in all oceans of the globe, virtually in all fisheries, and are dominated by the effect of fishing on birds. Despite the fact that provisioning of fishery discards and offal to birds can be viewed as beneficial, incidental mortality in fisheries is by far the main at-sea threat albatrosses and petrels are facing nowadays, and certainly the main cause of declinations in populations recorded in modern days. This chapter offers an overview of interactions between pelagic seabirds and high-seas Argentine fishing fleets, including longliners, trawlers and jiggers. The first section of this review looks into the nature of interactions between seabirds and fisheries, particularly in the Southwest Atlantic Ocean. The second section seeks to define the fishing effort of the different fleets operating in national waters providing a summary of extant fishery regulations and management measures related to the main target species, the Argentine hake *Merluccius hubbsi*. The third section explores available information regarding conservation status and use of marine space by seabirds attending and interacting with a number of high-seas fisheries, including bycatch levels and mitigation measures, as well as issues dealing with the implementation and compliance of conservation and management measures. The fourth section provides insight into the use of fishery discards and offal by non-breeding pelagic seabirds attending vessels, taking the Black-browed Albatross *Thalassarche melanophris* as a case study. Finally, the fifth section reviews the up-to-date scientific, legal, and political actions taken to protect seabirds in Argentine waters, referring to possible steps for implementing an ecosystem approach to national fisheries within the frame of Argentina's National Plan of Action - Seabirds.

Chapter 4 - The importance of ocean pollution, including pollution from plastics, has been recognized for a long time. However, the current generation and disposal of plastic worldwide has no precedent. Plastic litter accounts for 50-80% of waste items stranded on beaches, floating on the ocean surface and lodged in the seabed. Floating plastic debris is usually ingested by marine animals by mistake, or because it resembles their natural food. This plastic intake by animals such as seabirds can produce entanglement, intoxication, internal wounds, digestive tract blockage and ulcers among other conditions. While these damages are important, further concerns have arisen about plastics sorbing potentially hazardous hydrophobic chemicals. These compounds found in the waters where plastics are, can be plastic additives from other degrading plastics such polychlorinated biphenyls (PCBs) or chemicals from other sources like persistent organic pesticides (POPs), both with the capacity of being sorbed by plastics. However, the importance of the ingestion of plastic-derived chemicals present in the natural prey of seabirds through biomagnification, compared with the amount of these chemicals intake via plastic debris is still being studied. The finding of PCBs and POPs in the ingested plastic pellets and plastic fragments, have led to additional research aimed at assessing the relative potential of plastic as a vector of pollutants transport. The results of these studies are until now contradictory, largely because the role of the dilution and cleaning mechanisms of the studied chemicals are under debate. The impact of plastic debris on individuals is well known although it is not entirely clear how plastic ingestion at the individual level could impact the whole population and how this will impact entire ecosystems. For example, one strategy to mitigate damage caused by ingested plastics is to regurgitate them, so the transference of these plastics to chicks is not uncommon while being fed. As most chicks are unable to regurgitate plastic fragments, these accumulate in their stomachs eventually causing death. At present, the implications of chemicals sorbing on the population size of seabirds is unknown. The effectiveness of using seabirds as monitors

has increased considerably in recent years. Sampling the stomach contents of beached birds, birds killed accidentally by fishing activities or by examining regurgitated pellets of predators that feed on seabirds can be useful as well. Nonetheless, there are still questions to answer before the authors can confidently assess the impact of plastic waste on the environment through seabirds. For example: Is there a linear relationship between pollutants sorbed and the surrounding plastic debris? Or do birds reach a point where they become saturated by these chemicals independently of their plastic ingestion? Throughout this chapter the authors will evaluate the progress made to answer the open questions about the impact of plastic debris on seabirds and discuss the future of seabirds as a group and their use as monitors of plastic pollution to evaluate the health of ecosystems.

Chapter 5 - Recently, humans have altered and created entirely new environments to which animals have either adapted or been extirpated. Urban environments are one of the most extreme examples of how humans have changed previous habitats. Urban environments present massive challenges for birds living in these spaces and the impacts can be seen on all aspects of their behavior including how they communicate with one another. Here, I review how birds have adapted their singing behavior for life in urban areas. First, I examine how birds' diets in urban areas differ from their diets in other environments and the implications of these differences for birds' song quality and production. I also briefly examine some of the effects that urban environments have on the ecology of avian species, which can affect avian singing behavior. I will then review some of the differences between urban and other environments and relate these differences to the birds' singing behavior. Finally, I conclude that urban environments can dramatically affect avian ecology and communication and I suggest that this may ultimately affect evolution in urban bird populations.

Chapter 6 - Socotra Cormorants (*Phalacrocorax nigrogularis*) are regionally endemic, vulnerable seabirds limited to the Arabian Gulf and Sea of Oman regions. Global populations have undergone catastrophic declines, with several major colonies gone completely extinct in the central western Arabian Gulf. Major threats include breeding habitat loss due to oil exploitation, disturbance at breeding colonies, fisheries by catch and occasional hunting. Six of 12 large colonies have become extinct in the United Arab Emirates. Colonies in the western Gulf seemingly have suffered considerably, with much lower numbers compared to historic records. In comparison, the single colony on Siniya Island, Umm Al Quwain, in the eastern Arabian Gulf is arguably the largest in the UAE and possibly the entire Gulf with an increasing population of about 35,000 breeding pairs. Breeding studies indicate variable reproductive success possibly linked with habitat features, weather, diet and impact of predators. Planted trees on the island provide protection from soaring temperatures early in the breeding season and improve breeding performance. The island hosts native Red Foxes (*Vulpes vulpes*) and feral cats (*Felis catus*) that have a negative impact on the breeding performance. Additionally, ample evidence exists of conflict with fishermen. Many birds die annually to fishermen's nets or lines and fishermen generally perceive them to be competitors. Diet studies indicate that fish taken by cormorants have almost no overlap with commercially important species. The island is subjected to periodic disturbance by fishermen collecting sea grass from lagoons. Additionally, the island is littered with a wide range of plastic and other debris. Current trends in the population could be offset if any or all of the threats continue to increase. Conservation and management of this population must focus on removing plastics, eliminating disturbance during breeding seasons, engaging local

fishermen to reduce by-catch mortality, protecting coastal areas to safeguard foraging sites, and creating awareness.