WSC3
WORLD SEABIRD CONFERENCE 2021

3rd World Seabird Conference

October 4 – 8, 2021

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This is the first such study of contaminant levels in Gannet, or in any seabird egg in Ireland. Stable isotopes of carbon (d13C) and nitrogen (d15N) were measured in each egg to understand the influence of diet in contaminant levels detected. Significantly higher levels of PCBs, PBDEs and mercury were detected near Dublin (Ireland's industrialized capital city and location of its largest port) compared to Wexford. No differences were observed in levels of OCs and heavy metals between the two colonies. Stable isotope analysis demonstrated that Gannets in both locations occupy the same dietary niche excluding a difference in diet as the driver of differing contaminant levels in the two feeding areas. Though Gannets travel significant distances when foraging for food (~200km) tracking studies have shown that Gannets colonies maintain exclusive feeding areas with little overlap between neighbouring colonies. Differences between colonies within the feeding range of Gannets can therefore be detected despite Gannet's high dispersal ability. These results are in concurrence with elevated levels of contaminants in lower trophic level organisms that have been found in Dublin Bay compared to the rest of Ireland, indicating potential for Gannets as a higher trophic level indicator - though variability in their diet, including feeding on fishing discard, may lead to unacceptable levels of variability for an indicator species.

Plastic ingestion in seabirds of the western Indian Ocean

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Ingestion of plastic by marine fauna has been reported all around the world and affects a large number of seabirds including albatrosses, petrels, shearwaters, seagulls and boobies. Most of the studies on plastic ingestion by seabirds realized so far have been focusing in the Pacific and Atlantic Oceans but no information has been published on this issue in the western Indian Ocean. In this study we investigated plastic ingestion in nine seabird species breeding or foraging at Reunion Island and at Juan de Nova (Mozambique Channel), among which two species are endemic and endangered (the Barau's Petrel, Pterodroma baraui) or critically endangered (the Mascarene petrel, Pseudobulweria aterrima). We analyzed the stomach contents of 222 individuals and showed the most affected species are tropical shearwaters (79%) and Barau's petrels (59%). The average number of plastic particles per contaminated bird was higher in Barau's petrels (6.10 ± 1.29) than in tropical shearwaters (3.84 ± 0.59) and all other studied species also showed plastic presence in their stomach contents to a lesser extent. We analyzed differences in plastic ingestion between juveniles and adults for three different species: Barau's petrels, tropical shearwaters and white-tailed tropicbirds. We showed significantly more plastic particles in juveniles of Barau's petrels than in adults and a significantly higher mass of plastic particles both in juveniles Barau's petrels and tropical shearwaters than in adults of these two species. These results demonstrate that the foraging areas of seabirds of the western Indian Ocean have a high level of plastic pollution. In Reunion Island, hundreds of tropical shearwaters and Barau's petrels are attracted by urban lights and die each year so we suggest to take advantage of this situation by using these species as long-term indicators of plastic marine pollution in the region. Keywords: plastic ingestion, seabird, marine pollution, Indian Ocean, Pterodroma baraui, Puffinus bailloni.

Sex, age class, and foraging strategy of the Southern Giant Petrel might influence the hazard of plastic ingestion on the Patagonian shelf

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Plastic circulates at sea threatening marine megafauna. Southern Giant Petrels (SGP, Macronectes giganteus) are known to consume plastic, but the source and accumulation areas of marine litter remain unknown. The goal of this study is to understand how foraging behavior of SGP will impact their risk of plastic ingestion by mimicking the circulation of floating debris. We tracked 34 adult and juvenile birds using either PTTs or GPS, from Arce (45°00'S; 65°29'W) and Gran Robredo Islands (45°80'S; 66°03'W). To mimic plastic circulation at sea we employed the output of 15 years of daily-forcing simulations using ROMS-Agrif. We designed lagrangian simulations of particles (individual based model) using off-line particle-tracking model. Simulations incorporate physical characteristics of plastic that reaches the area from coastal cities and ships. Dual foraging strategy was recorded for all breeding birds. During short trips (N=108, recorded with GPS), both sexes foraged at 38.5 ± 12.9 km from the colony. During long trips (N= 60), males mainly foraged along the coast at 382 ± 65 km from the colony, while females moved to the shelf break and the middle shelf (459 ± 58 km). Throughout austral fall and winter, adults remained on the Patagonian shelf, but juveniles moved north using the shelf break as a corridor. The drift model showed how simulated particles generated a plastic corridor along the Patagonian shelf until reaching the Malvinas-Brazil confluence, concurring with juveniles' migration path. Accumulation hot spots occurred in the mid shelf and along the shelf break with a strong seasonal variation, overlapping with breeding females. Litter coming from cities and fisheries accumulated near the colony, corresponding with adult foraging areas during short trips, which may explain the 50 to 73% of plastic items found in chicks' diet. Our results showed that marine litter dispersed by ocean circulation, will threat SGP, depending on sex, age class, and breeding stage. Understanding where marine organisms come into contact with plastic, could help elucidate negative effects at population-levels to design management strategies that mitigate this environmental issue.

The shearwater and the bottlecap: understanding the broader impacts of plastic ingestion on seabirds

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While the problem of plastic pollution in the oceans has received wide media and public attention in the last decade, the scientific basis for our knowledge of its effects and consequences is still limited, despite meeting the irreversibility and global ubiquity criteria of being a planetary boundary threat. Since 2005, the Adrift Lab has studied the impact of plastics pollution on shearwaters (Ardenna spp) in Australia with an aim to understand the nature, extent, and consequences of plastics for the birds and their island ecosystems. We have employed a variety of tools, including contaminant analysis, nutritional biochemistry, histology, and blood chemistry combined with annual surveys of the frequency and intensity of plastic pollution, focusing on Flesh-footed Shearwaters (Ardenna carneipes) on Lord Howe Island. Here, we review the progress in knowledge around how plastics may be affecting individuals, populations, and communities. Birds with more plastics tend to have slower growth rates, higher contaminant burdens, altered physiology, and show tissue damage to the gastrointestinal tract compared with less-affected individuals. Birds also transport considerable volumes of plastic to the island and deposit it through regurgitation, and decomposition of carcasses. As one of the longest-running plastics monitoring research programmes in the world, we are able demonstrate the annual variability in plastic ingestion, and leverage this knowledge to begin to explore the broader effects of plastics on marine wildlife.