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WHAT LIMITS long-range migrants?

Growth in North Pacific salmon stocks impacts Short-tailed Shearwater numbers

Birds are the most mobile organisms on earth and the population trends of long-distance migrants can be influenced by factors that occur across their vast ranges. One of the neatest examples of this comes from studies of migrant shorebirds in South Africa. In the 1980s, Ron Summers and Les Underhill showed how the numbers of Curlew Sandpipers, Sanderlings and Knots wintering in South Africa are determined largely by the abundance of lemmings on their Siberian breeding grounds. Similar cycles are also seen in the numbers of tundra-breeding geese wintering in the northern hemisphere.

It works like this: in peak lemming years, most Arctic predators feed on these creatures, enabling bumper crops of bird chicks to survive and migrate south. The predators – Arctic foxes, skuas and gulls – also do well, resulting in even more predators. But the following year, when lemming numbers crash, the large numbers of predators target shorebird and goose nests. As a result, few first-year waders or geese survive to migrate. Predator numbers also crash, permitting both lemmings and birds to have a better breeding season the following year.

Historically, lemming populations underwent fairly predictable boom-and-bust cycles every three years or so. However, in the past few decades, the magnitude of these cycles has diminished, possibly as a result of changes in winter conditions in the tundra. This has seen changes in the population dynamics of many tundra-breeding migrant birds, with lower breeding success and resultant population declines in many species.

Migrant bird populations also can be limited by conditions on their wintering grounds. Again, shorebirds provide a plausible example of this. In 1992, Phil Hockey's research group showed how shorebird densities on their estuarine wintering grounds were directly related to the productivity of the estuaries, which varied with latitude. Waders occur at the highest densities in the southern hemisphere because southern estuaries are more productive in the austral summer – when most migrant shorebirds are present – than northern estuaries.

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A new paper by Alan Springer and colleagues (*Proceedings of the National Academy of Sciences USA*, 2018, 115: E5038–E5045) argues that a long-range trophic cascade is causing the vast population of Short-tailed Shearwaters to decline. With an estimated population of 23 million birds, the Short-tailed Shearwater is the fifth most important seabird globally in terms of food demand. It has achieved this success by exploiting some of the most productive waters on earth.

During the austral summer, the shearwaters travel thousands of kilometres south from their colonies in Tasmania and south-east Australia to forage on Antarctic krill. Then, after breeding, they migrate rapidly to the North Pacific, where they congregate in the Bering and Chukchi seas to feed on the bloom of zooplankton during the northern summer.

In a long-term study, numbers of shearwaters on Montague Island off Australia halved during the 1980s and there is now evidence of ongoing declines at several other colonies. The recent decreases coincide with frequent strandings of shearwaters on their wintering grounds and when they arrive back in Australia after the non-stop return trip from the North Pacific, during which they rely on stored food reserves for two to three weeks.

Springer et al. argue that the growing population of pink salmon in the North Pacific is responsible for the shearwater's woes. Numbers of pink salmon returning to spawn in rivers around the North Pacific started to increase in the mid-1970s, aided by favourable climatic conditions and releases from hatcheries. This burgeoning stock competes with other predators for zooplankton, with adverse effects on other salmon species, including the valuable king or Chinook salmon, and seemingly the Short-tailed Shearwaters.

Like lemmings, pink salmon numbers fluctuate between years, thanks to their two-year egg-to-adult life cycle. In recent years, numbers of salmon returning to spawn have been 60 per cent greater in odd years than in even years. And it is in the odd years when most shearwaters are wrecked, having run out of food. Odd years also see far fewer shearwaters breeding. As long-lived birds that only lay a single egg each year, shearwaters elect to skip breeding when times are tough in order to maximise their chances of surviving to breed again in subsequent years.

It seems that the vast numbers of pink salmon that forage voraciously at sea in preparation for their spawning runs are reducing the amount of zooplankton in the shearwater's wintering grounds to the point that the birds struggle to get enough food to sustain them to migrate and breed. This is having knock-on effects for the Aboriginal community that exploits shearwater chicks as 'mutton-birds', with the commercial harvest falling by 95 per cent in 2013, following a massive wreck.

It is unusual for competition rather than predation to have such clear-cut demographic consequences. Springer et al. argue that it is time to re-evaluate the release of more than one billion juvenile pink salmon from Alaska's hatcheries each year. Although the salmon fishery generates significant income and employment, the researchers contend that the ecological, economic and cultural impacts, which extend right across the Pacific Ocean, more than outweigh the local benefits in Alaska.

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above *Short-tailed Shearwaters remain abundant, but their numbers are decreasing due to artificially inflated numbers of pink salmon.*

THE HIGH COST OF TRACKING

Bird tracking has revolutionised our understanding of how birds move, thanks to the development of miniature transmitters and data-loggers over the past few decades. Transmitters are particularly attractive to researchers because a bird only has to be caught once for its location to be sent straight to their electronic device.

Sometimes you get more than you bargained for. A case in point was the recent recovery of an Endangered Wildlife Trust truck after it was stolen near Johannesburg, thanks to a GPS tag destined to be deployed on a Grass Owl. The thieves were canny enough to disable the truck's GPS recovery system, but failed to recognise the tiny, solar-powered device as a threat to their location.

The first long-range transmitters relied on sending signals via the ARGOS satellite network, but that is expensive and increasingly researchers are moving to cellphone networks to receive their tracking data, provided the birds remain in areas that have reasonable cellphone coverage. Such devices contain SIM cards to transmit their data, making them potential targets for unscrupulous individuals.

The Polish environmental group EkoLogicsna was recently shocked to receive a R35 000 phone account for 20 hours of calls made on a SIM card in a GPS tracker placed on a White Stork. The adult stork was equipped with the tag in April 2017 and tracked until its tag stopped transmitting in eastern Sudan at the end of April 2018. It is unclear what happened to the bird, but whoever found it must have taken the tracker apart, discovered the SIM card and used it to make calls at the environmental group's expense.

There have already been several incidents of birds carrying trackers being caught or shot because they are suspected of spying; if word gets out that bird tags can provide free SIM cards, there will be another incentive to target tagged birds.

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