


BIRDS, THE SEA, AND THE EMERALD GLOW OF SPITSBERGEN



Spitsbergen is not just an island of massive glaciers, but also a land of lush, low-growing tundra, reminiscent of a verdant carpet covering the coastline, and colonies of birds that fill the air with a cacophony of cries. How are these green mountain carpets and birds connected with the sea?

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In late spring, when Spitsbergen is slowly emerging from under the snow, birds return to the colonies they left back in the autumn – a truly magnificent sight that defies comparison. Ornithologists and scientists studying the tundra ecosystems on Spitsbergen have long argued that the fjord coastlines offer a textbook illustration of the basic relations between the sea, birds, and tundra ecosystems.

Summer is coming

Birds play a key role in Arctic regions, which combine both nutrient-rich marine ecosystems and nutrient-poor land ecosystems. In the summer, birds feed in the sea and nest on land in large colonies located on mountain slopes or cliffs. These colonies have a tremendous impact on the adjacent land ecosystems. How exactly? The birds produce large amounts of guano, or bird droppings, which are a splendid natural fertilizer for the many species of plants living in the tundra.

However, first let's consider the whole food-chain network. The constant daylight of the polar summer facilitates the growth of phytoplankton in the Arctic waters. Phytoplankton are microscopic plants that float in oceanic water and can be described as the en-

gine driving everything happening in the marine ecosystems in the Arctic. These tiny organisms serve as food for zooplankton, or microscopic animals that live in water. Zooplankton, in turn, are eaten by fish and birds, which are sources of food for seals, foxes and other representatives of avifauna. Seals are eaten by bears, and the surplus phytoplankton fall to the bottom of the sea and there serve as food for benthic organisms (those dwelling on the seabed). In turn, benthic organisms are eaten by such animals as walrus.

The precious resource of phytoplankton, therefore, is harnessed either directly or indirectly by all birds living in the Arctic. Summer trips to Spitsbergen offer an opportunity to encounter a number of attention-grabbing bird species. Despite the harsh Arctic conditions these birds simply thrive on Spitsbergen, with one reason being the good access to food resources (ultimately all thanks to the above-mentioned phytoplankton). First, let's consider one of the most charismatic species, namely the little auk (*Alle alle*). Also known as the dovekie, it is one of the most frequently found bird species in the Arctic.

The little auk

This black-and-white bird, about the size of a human fist, nests on mountain slopes, amidst a maze of small tunnels and rock debris. These seemingly clumsy birds are crucially important for the functioning of Arctic ecosystems. They feed on copepods, a group of small crustaceans found in marine habitats. If we get near a colony of little auks, we can observe many of them constantly flying out to sea and back, making the sky look like a busy highway – here there is no danger of

Barnacle geese



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inhaling smoke from exhaust pipes, but the risk of getting pooped on is very high indeed.

Researchers from the University of Gdańsk have spent many years studying these birds and their impact on tundra ecosystems. Thanks to their work, we know that during one summer the little auk colony located near the Polish Polar Station at Hornsund may produce more than 10 tons of guano, which is a rich source of nutrients for the foot and slope of the mountain and facilitates the growth of lush vegetation. This bright-green carpet is surprisingly thick – step on it, and you'll sink in knee-deep! Apart from guano, the area around a colony is also strewn with feathers, egg shells, and dead birds, all of which decompose and help further enrich tundra ecosystems with nutrients (phosphorus and nitrogen compounds).

The plant biomass near a little auk colony is significantly greater than in areas further afield. This also translates into the greater biomass and population size of microscopic animals found in tundra, such as springtails (*Collembola*) or tardigrades (*Tardigrada*), also known as water bears. These tiny animals, although invisible to the naked eye, serve an important function in the matter flow in polar ecosystems and considerably boost local biodiversity. If one strolls near a bird colony, one is likely to come across Svalbard reindeer (*Rangifer tarandus platyrhynchus*), which readily visit the area to nibble on the lichens generously fertilized by the colony's airborne occupants. One might also catch a glimpse an Arctic fox (*Vulpes lagopus*) in its summer coat, waiting for chicks unable to make it to the sea to literally fall at its feet.

Other birds are also attracted in by little auks, or more specifically by the local consequences of their nesting. For example, the barnacle geese (*Branta leucopsis*), which are large herbivorous birds of the family Anatidae, treat the areas near such colonies as feeding-stations. Large glaucous gulls (*Larus hyperboreus*), in turn, visit to hunt the little auk, which they feed to their own young.

Birds on the cliffs-edge

Spitsbergen's rock ledges, in turn, are home to fish-eating birds such as guillemots and black-legged kittiwakes. The birds that nest on such ledges have a somewhat different impact on the terrestrial ecosystem than little auks, which nest on gentle mountain slopes. Because guillemots and kittiwakes live on a different diet than little auks, their guano is also different, and so are the plants found around their nesting sites. Moreover, guillemot and kittiwake colonies are generally located right on the coast, which means that some of the nutrients quickly go back to where they came from – that is to say, to the sea. The different plant species and different pH than in the



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areas surrounding little auk colonies also support different, unique invertebrate assemblages.

Polar bears (*Ursus maritimus*) depend on sea ice as a platform for hunting seals. Unfortunately, recent years have seen drastic shrinking in the extent of sea ice. As a result, polar bears are finding it increasingly difficult to catch seals during the summer months. There is some scientific data indicating that starving polar bears occasionally visit bird cliffs to look for plants rich in vitamin C. This may come as a surprise, but bears do have plants on their menu and this includes both marine and terrestrial plant species. In the water, bears often feed on brown algae known as *Laminaria*, while on land they seek out lyme grass (*Leymus arenarius*). Polar bears also treat colonies of guillemots and kittiwakes as excellent sources of polar scurvy grass (*Cochlearia groenlandica*), a plant especially rich in vitamin C – it was used in the past by travelers and by the Inuit to prevent scurvy.

Global temperatures continue to rise, with the Arctic warming much faster than other regions of the Earth. Scientists have long noticed that rising water temperatures in the Arctic are coupled with growing amounts of zooplankton typically found in warmer areas. For example, little auks feed on the high-energy and fat-rich Arctic copepods called *Calanus glacialis*. But as temperatures increase, the amount of such high-energy food drops, to be replaced by smaller, “warmth-loving” species, less nutritious and harder to catch. Little auk colonies may therefore shrink in the future, which will unfortunately affect the functioning and form of these beautiful, green carpets that cover the slopes of Spitsbergen's mountains.

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Little auks from the colony at Adventfjorden on Spitsbergen

Further reading:

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