

Seabirds play a key role in Arctic ecosystems. They feed on marine resources over vast areas of the pelagic zone, but necessarily breed on land, often in colonies of several hundred thousand individuals. During their reproductive season seabirds effectively transport huge amounts of organic matter, produced in the marine environment, to the nutrient-poor land where they deposit it mainly in the form of guano, thus stimulating lush vegetation growth, and enriching higher trophic levels around the colonies. Further, ornithogenic nutrients not incorporated into the terrestrial ecosystem can return to the sea, and concentrate within the relatively small coastal area immediately adjacent to a colony. This way, nutrients supplied by seabirds may constitute a locally important resource for marine producers and subsequent consumers. Although this phenomenon is of great importance for the coastal food webs, it is very poorly recognised.

Arctic is one of the regions most seriously endangered by ongoing and dramatically fast progressing climate changes. At the same time, Arctic seabirds are at the forefront of organisms most spectacularly reacting on the climate-induced processes. The inflow of Atlantic water and fluctuations of the Polar Front result in dramatic alteration of zooplankton and fish communities, which leads to seabird populations decrease or collapse, or movement to another region, as historically happened to the Iceland and south Greenland population of little auks, and more recently to kittiwake and guillemot populations from northern Norway. The proposed research should fill some of the gaps in the knowledge of the mechanisms of organic matter cycle and energy flow through the Arctic coastal ecosystems, for which seabirds have undoubtedly considerable meaning, what is absolutely necessary for effective conservation of this unique environment.

The aim of the study is to determine the influence of seabird colonies on Arctic marine coastal communities' structure and functioning, by: (1) tracking gradient of changes in resources generated by seabirds for marine producers, i.e. sea water chemistry along the distance from the shore (seabird colony) and depth; (2) assessing the contribution, and following the flow of ornithogenic nutrients concentrated around seabird colonies, measured as nitrogen stable isotope ratio, in the main components (successive trophic levels) of the coastal food web; (3) tracking changes in the abundance and diversity of coastal primary producers and consumers along the seabird colony impact gradients. The aims will be fulfilled thanks the very comprehensive approach and high interdisciplinarity of the proposed research, by including chemical, isotopic, and taxonomic analyses, and following the flow of ornithogenic nutrients through different trophic levels of both terrestrial, planktonic, and benthic food webs. With using wide spatial scale, i.e. two distant Svalbard areas hosting two typical seabird colonies, the project will show the general extent of influence that seabirds may exert on Arctic coastal communities, and at the same time it will provide understanding of the Arctic nearshore, multi-trophic systems functioning. Generally, we hypothesize that seabirds influence marine coastal communities in the Arctic through concentration of nutrients in the vicinity of their large colonies, though the observed changes are less pronounced comparing to neighbouring terrestrial ecosystem.

Success in getting the results and drawing momentous conclusions from this research is guaranteed by using precise sampling, and modern analytical and statistical techniques (including scuba diving, stable isotope analysis, and advanced, multivariate modelling), and cooperation of both terrestrial and marine biologists/ecologists from Poland and abroad (Norway, Belgium). Exceptional competence of this specialist team results from their broad knowledge on Arctic terrestrial and benthic food webs functioning, and potential seabird colonies effects, though sparsely studied, observed worldwide. Due to participation in numerous scientific expeditions to polar regions, all the project members are experienced in team-working in harsh environmental conditions, familiar with the Arctic flora and fauna, local coastland and bottom topography, and different types of seabird colonies, and those of the marine team are excellent, highly practised divers.