The nutrient of soils on Skomer Island and the impacts of allochthonous nutrient inputs by seabirds

by Harriet Sleight

During my time on Skomer I undertook a research project to investigate how seabirds affect the nutrient status of the soils and how this might influence vegetational patterns across the island. Whilst nutrient cycling is significant in the structure of most ecosystems, the case of seabird islands is particularly interesting because seabirds facilitate nutrient fluxes from the ocean to the land. This is unique as many other examples of cross-habitat nutrient transfer occur from the land to the ocean and are anthropogenically driven, such as eutrophication. The soils of Skomer influence, and are affected by, all the flora and fauna on the island, yet have been comparatively understudied.

I sampled from three areas; Skomer Head, the Wick and Shearing Hays and analysed the samples for bioavailable phosphorus, nitrate, organic matter content, pH, and electrical conductivity. I modified some of the conventional lab methods to allow me to take portable equipment to conduct some measurements in situ. Although not the most advanced technology, the most fascinating piece of equipment I took was a manual centrifuge – which turned out to be a spectator sport!

I am also conducting stable isotope analysis on the samples as previous studies have shown that the presence of marine derived nutrients has led to increased δ^{15}N. Most nitrogen deposited into terrestrial systems (as a result of in-situ fertilisation or in precipitation) has an isotopic ratio (δ^{15}N : δ^{14}N) close to zero. However, transfers between trophic levels result in an enrichment (an increase in δ^{15}N relative to δ^{14}N) of approximately 3-5%. As seabirds consume prey fairly high in the food chain, the guano is substantially enriched and this enrichment is then transferred to the soils through guano deposition. Determining the isotopic ratio of the soils allows for the differentiation of marine and terrestrially derived nutrients.

My results show that the phosphorus concentrations in the soils on Skomer are up to 10 times greater than those on the deer park at Martin's Haven. The nitrate concentrations are also up to 5 times greater in comparison to the soils at Martin's Haven. The pH of the soils were all acidic, but comparable, ranging between 4.4 and 5. These results reflect the Jenkins and Owen report from 1995 which is the original study of the islands soils. I aimed to further this work with modern lab techniques and dense, localised sampling.

These results are significant as the soil nutrient status is instrumental in determining the type and abundance of vegetation present in certain areas. I recorded all the vegetation species found in each of my sample locations and analysed the nutrient data in relation to the vegetation present. Some correlation was identified between nitrophilous species and areas with soil enriched in marine nitrogen. It is also likely that these nutrients are leached from the soil to the surrounding marine environment.

I would like to thank the Skomer island team: Bee, Ed, Sarah-Kay, Sarah, Sylwia and Nathan for facilitating my project and supporting me during my time on the island. Also Mike Alexander and Dr John Crosse (Lancaster Environment Centre) for sharing all their knowledge and experience.