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Saving Seabirds: Monitoring and Long-Term Studies

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The common guillemot *Uria aalge* is one of the most abundant seabirds in the northern hemisphere, breeding in both the North Atlantic and North Pacific Oceans. Less charismatic and hence less well known than its cousin the Atlantic Puffin *Fratercula arctica*, the common guillemot is a far more interesting bird. Before I tell you why, I need to say that there are two closely related species of guillemot, the common guillemot, which is the one that breeds around Britain's coasts, and Brünnich's guillemot *Uria lomvia*, which breeds further north. The geographic ranges of the two species overlap so that in a few locations, such as Bear Island off the northern coast of Norway the two species breed side by side.

Side-by-side, literally, for both species breed at high density and usually in physical contact with neigbouring guillemots. Neither species makes a nest and both lay their single egg on a bare rock ledge. The main difference between the two species in terms of breeding biology is that common guillemots often breed on broad ledges and often at incredible densities. I once recorded seventy pairs in a single square metre. For a bird that weighs around a kilo, that's pretty remarkable.

I have studied both species, but most of my research has been focused on the common guillemot and mainly on the Welsh Island of Skomer – a National Nature Reserve. In fact, I have been visiting Skomer since I began my PhD studies there in 1972. Since I shall confine myself here to writing about the common guillemot, I will refer to it simply as the guillemot.

The purpose of my PhD was to try to understand the guillemot's population dynamics – that is to establish what makes a population increase, decrease or remain stable. With hindsight this was overly optimistic on my supervisor's part because a three-year PhD is very short relative to how long the average guillemot might live.

The reason for needing to know about the guillemot's population dynamics was because of widespread concern in the 1960s that their populations were decreasing. This in turn was because of on-going oil pollution, caused for example, by the sinking of the *Torrey Canyon* tanker in 1967, which killed at least 30,000 seabirds, most of which were guillemots. I can think of almost no worse way to die than having your feathers coated in crude oil, losing your insulation and dying of hypothermia. Add to this the poisoning that would result from ingesting crude oil as the birds tried to remove the glutinous muck by preening, and you have a horrible scenario.

As though a succession of oiling incidents — some large like the Torrey Canyon, but most small and chronic — were not enough, in 1969 there was a massive die-off of guillemots in the Irish Sea, reducing guillemot populations still further. The 1969 incident, referred to as the Irish Seabird Wreck, coincided with very stormy conditions, but fears were further raised by the discovery that many of victims – all of which had obviously starved to death – contained very high levels of toxic chemicals known as PCBs or polychlorinated biphenyl (an organic, hydrocarbon chemical) used for various industrial purposes. PCBs were eventually banned in 1979.

As a result of these two major incidents, guillemot numbers on Skomer (and elsewhere in the Irish Sea) were at their lowest in 1970, causing widespread concern — hence my PhD.

We knew that numbers were at their lowest level because the warden on Skomer, David Saunders had been counting them each year since 1962.

What was not known that was, what those numbers meant: how many pairs did a hundred individual birds on the cliffs actually mean? Also, did it matter when those counts were made – when during the birds' breeding season, and what time of day? Looking back, our level of ignorance about such things now seems remarkable.

So that was my first task. Reducing three years of fieldwork into a few sentences, the most reliable time to count guillemots is while they are incubating their eggs, which means June. The best time of day was between 1000h and 1600h. And, one hundred birds on the cliffs represent about 67 pairs. This is because the birds on the cliffs comprise a mixture of those incubating their egg, some off-duty partners and a few immature birds.

My next task was to discover how long guillemots live. What I needed to know was their *average* life span rather than the maximum, which while interesting doesn't help us much in terms of understanding the population dynamics. The way one gets information on average lifespan is to ring a number of birds – a couple of hundred ideally - with unique colour rings so that the birds can be identified as individuals, and then see how many survive from one year to the next. Most seabirds, including guillemots return to breed at exactly the same tiny spot on the cliff face year after year so in principle this is straightforward. In the guillemot's case it is less straightforward because their high density breeding makes it difficult to see their legs! Once one has an estimate of proportion of birds surviving between years than can be used to estimate the average life span. In the guillemot's case, about 95% survive between years, which translates into an average breeding life span of around twenty years. Some individuals survive for less time than this and some for longer. Our oldest guillemots on Skomer are over thirty years old.

The next question was to establish how old guillemots are when they first start to breed. The only way to do this is to mark a large numbers of chicks with colour-rings and follow those birds until they start breeding. Doing this over many years we found that the average age of first breeding was seven years but again some started sooner – once at three, and others later: over ten. Luckily, many of the chicks we marked on Skomer return there to breed, making it possible to both establish how old they are when they start, and how many of them survive to breeding age.

Guillemots lay a single egg. This is typical of many seabirds and is part of the 'package' of what we call life-history traits. A small clutch (of one) goes with a late start to breeding, and high adult survival. Around 70 or 80% of guillemot pairs on Skomer successfully manage to rear their chick to fledging age. Guillemot chicks don't really 'fledge', instead at about 21 days old and weighing a quarter of adult weight they jump off their breeding ledge — unable to fly — into the sea below, accompanied by their father. Well, in most cases it is their father. Guillemots are socially monogamous, meaning that a male and female pair up – usually for as long as both do live – and rear a chick together. But despite being monogamous, there's some promiscuity and we found (using DNA fingerprinting) that about 7% of chicks have been fathered by the male next door. A 7% level of extra-pair paternity, as it is called, is roughly the same as occurs in modern human societies.

After three years of PhD research I knew how to count guillemots, and very roughly what proportion of guillemots successfully reared a chick to fledging. I also had an estimate of the survival. But three years of data for a bird that lives for over twenty seemed inadequate somehow. Did those estimates vary very much from year to year? If I was going to be taken seriously as a scientist my estimates needed to be robust and based on large sample sizes and many more years of research.

After completing my PhD (in 1976) and getting a lectureship at the university of Sheffield (in 1976) - where I have been ever since - I decided that the study should

continue. Initially this was relatively straightforward because funding for research was relatively easy to acquire at that time. I was also fortunate to have Ben Hatchwell as a PhD student who helped to put the guillemot study on a firm footing with his excellent work during the mid 1980s.

Skomer Island National Nature Reserve was almost unique in the 1960 - 1980s, as somewhere where research and conservation functioned harmoniously and very effectively side-by-side. The Nature Conservancy Council (NCC), who owned and managed Skomer had an extraordinary philosophy. But then in 1988, concerned that conservation bodies like NCC had too much power and were constraining capitalist ventures, Malcolm Rifkin and Nicolas Ridley wrecked it by hacking it into three. These three bodies became the Countryside Council for Wales (CCW), Natural England and Scottish Natural Heritage.

I was always amazed and impressed that despite this dreadful and insulting blow to conservation, members of these organisations simply (or, not so simply) doubled their efforts to carry on. It worked, and thanks to a number of exceptional individuals I was fortunate to obtain funds from CCW to be able to carry on with the guillemot project. The dual strands of conservation monitoring and science were able to continue under CCW's leadership. Funding was modest but adequate, although at that time my university took a bit of persuading that accepting such modest funds and conducting the research was worth the university bureaucrats' while. My persistence paid off.

It took another decade or so until I felt we had sufficient data to see whether we knew how the guillemot population worked. The amount of man- and woman-hours that went into that data collection was pretty remarkable, comprising around 500 hours of fieldwork each season between April and July (some 20,000 hours in total), plus the ringing of several hundred birds each season (with over 13,000 birds ringed so far). After the field season there were many hours of data analysis and writing. My colleagues and I produced a succession of peer-reviewed scientific

papers published in top quality journals. I also published a number of popular articles to publicise the value of long term studies. Maintaining a long-term study requires tenacity: sustained enthusiasm and care to ensure that the methodology is both robust and consistently employed. I'm not complaining, simply stating the facts.

From the mid 1980s guillemot numbers started to increase, and they have continued to increase at a steady 5% per annum. In 2015 the whole island population comprised around 20,000 pairs. This increase has been wonderful at one level – the population restored. But at another, it has been a curse because some 'managers' have questioned the need to spend money on a healthy, increasing population. In terms of funding for the study, the 'best' thing that could have happened would have been an oil-spill or other disaster than halved the population. In fact, the increase from around 2000 pairs in 1970 to over 20,000 in 2015 is relative, for in the 1930s, I estimated that there may have been as many as 100,000 guillemots on Skomer.

The idea that you do not have to spend money on a healthy, increasing population misses the point. What my study does comes under the umbrella of 'monitoring'. To many, the term monitoring implies 'counting', but counting is only one aspect of monitoring. The guillemot population on Skomer is monitored, by counting, using 'study plots' that I established in 1973. These are counted ten times each year to obtain a mean or average number of birds on a specified area of cliff. In addition, a 'whole island count' is conducted each year, but only once. Because whole island counts are conducted just once and because some of the counts take place from a boat (less than ideal for using binoculars), the whole island provides a much cruder estimate of population change. It does however, allow us to record the distribution of birds around the island and note whether any new colonies have been started, or any lost.

My long-term study of guillemots also monitors: (i) the survival of adult guillemots; (ii) the survival of immature guillemots; (iii) the timing of breeding (susceptible to climate change); (iv) breeding success, and (vi) the number and species of fish that adult guillemots feed to their chicks. Together this represents a comprehensive system of monitoring and importantly, some of our measures are much more sensitive than counts alone.

Inevitiably with counts, some margin of error exists, and that means that they are not always the *most* sensitive indicators of change. We saw this following each of four oil spills: our survival data showed a marked drop in survival as a result of the oil spill, but the counts did not.

I view our monitoring system as being rather like a routine, comprehensive human health check – an entire body scan. Counts alone are rather like trying to assess someone's health merely by taking their pulse.

The value of our comprehensive health monitoring for Skomer guillemots became apparent in early 2104 when another huge wreck of seabirds occurred off the western shores of Britain and elsewhere in Europe.

Almost a year earlier, in April 2013 there was anther kind of wreck when CCW was engulfed by a new quango – a Welsh Government body called Natural Resources Wales (NRW). Also engulfed were the Environment Agency Wales and the Forestry Commission Wales. The idea was that this merger would save £158 million over ten years. On the other hand there was grave concern that none of three original bodies would be adequately heard under the new structure.

As part of their cost-cutting, NRW slashed the funding for guillemot study – completely. When I protested, pointing out the value of our comprehensive monitoring, I was informed that some monitoring in the form of counts and measures of breeding success would continue, but funded by another body, the

Joint Nature Conservancy Council (JNCC). I already knew that JNCC did this as part of a UK-wide monitoring programme for seabirds, but two years previously I had made JNCC and CCW aware that: (i) the methodology for JNCC's measures of breeding success were seriously flawed, and (ii) the counting study plots needed to be re-assessed - after thirty years of population increase they were simply to large to be manageable (i.e. too large to count).

Remarkably, despite my pointing out that the JNCC measures of breeding success were wrong, they insisted on continuing with them. Money down the conservation drain. I tried repeatedly to get them to rectify the situation, but to no avail. I've given up on that score. In this instance, as is so often the case politics won over common sense.

Then, when the seabird wreck occurred in early 2014, with thousands of dead guillemots, puffins and other seabirds, the need for (i) the data from our long-term study, and (ii) for continued monitoring to establish the full consequences of the wreck, was obvious, I wrote again to the director of NRW asking if they would reconsider their decision. They didn't reply.

I was not alone in my concern over the loss of our guillemot monitoring, all seabird biologists in the UK were concerned. Some of them wrote to NRW – again no response. We organised a one-day conference in Cardiff in April 2014, to which we invited representatives from NRW. Some came, but they didn't talk to any of the biologists. Appalled by NRW's decision, Iolo Williams came to our conference and despite his impassioned plea to NRW they refused to budge.

With no funding for the 2014 field season things looked bleak. Knowing what happened in the season immediately following the wreck was essential if we were to understand its effects. Equally important, in a long-term study, each year of results adds disproportionately to the overall value of the data, so missing a year is very damaging. A year of missed data cannot be recovered.

The Skomer long-term study has operated, as I said, on a pretty modest budget, around £12,00 -£14,000 a year – much of which goes to pay the salary of a field assistant. Even for cash-strapped NRW this is a drop in the ocean especially since the study represents remarkably good value for money both in terms of the quality and quantity of information we provide.

Luckily, my university came to my rescue for the 2014 season and allowed me to employ a field assistant. This is unusual and I am extremely grateful to them. But one year wasn't enough, what I had asked NRW for was on-going funding. That's what monitoring is: on-going. If you want to know what's going on, you have to monitor continuously. I also argued that it was their moral responsibility to monitor *their* – Welsh – bird populations. The situation for me was made worse by their public statement that all was well since JNCC was doing the monitoring – because, I have said that particular methodology was flawed and hence a waste of time, effort and money.

What happened next was remarkable. Someone in university suggested crowd sourcing. I was skeptical. I knew little about it and the University of Sheffield had not done this before. However a lucky set of circumstances helped to make this happen. The university prepared the way for crowd-sourcing – using JustGiving - just in case I changed my mind. I was involved in an outreach project (on guillemots) with the University's 'Festival of the Mind' and there was considerably national publicity associated with that. The publicist employed by the university got to hear of NRW's cut to our funding, and unbeknown to me wrote to the scientific journal *Nature* to ask if they were interested in an opinion piece by me. They were and I was. *Nature* is one the world's premier scientific journals so I knew that my article would attract worldwide attention. It all happened very quickly. *Nature* contacted me, wanted the article a few days later and published it the following week. I realized that this was trigger that could launch the JustGiving appeal, so I went back to University and said 'let's start'.

The Nature article emphasised the disproportionate value of long-term studies in general, and was plea for on-going funding for all such projects.

The effect of this and other publicity was electric. My computer didn't stop buzzing for a fortnight by which time we had accumulated the £14,000 target (to fund the work for 2015). Not only that some of the donors were students I had taught in the past and along with their contribution sent messages of support –cursing NRW. It was a truly inspirational few weeks.

In addition to the 2015 funds raised through crowd sourcing I received a number of other donations from individuals who wished to remain anonymous, that will help support the study over the next three years. I am extremely grateful to everyone who contributed. Indeed, I have been overwhelmed by people's generosity, and their strength of feeling against those authorities that clearly do not value conservation. I am convinced that a strong motivator for those that contributed was frustration, anger and despair that the one body that is supposed to be caring for Welsh wildlife, has made such a clear statement that it doesn't care. Concern over the way NRW has developed and done its business is widespread, and a recent analysis published by Kerry Lewis in the *Environmental Law Review* (2015) makes it abundantly clear that NRW could have done better.

Just in case anyone feels they would like to contribute to the guillemot study, here's the JustGiving website address: https://www.justgiving.com/skomerguillemots2015