

North Atlantic Seabird Seminar – Fosnavåg, Norway 20-21 April 2015



Michael Hundeide (ed.)



Runde Environmental Centre

In cooperation with: Birdlife Norway (NOF) and Norwegian Biologist Association (BiO).



Report

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Sammendrag (Norsk):Rapporten er en gjengivelse av de temaer som ble presentert og diskutert på det internasjonale sjøfuglseminaret i Fosnavåg 20. og 21. april 2015: En rekke sjøfuglbestander har hatt en drastisk tilbakegang på Runde i senere år. Særlig gjelder dette artene: Krykkje, havhest, toppskarv, lomvi, alke, lunde m.fl. Med unntak av havsule, storjo og havørn som har hatt en økende tendens, har så å si samtlige av de andre sjøfuglartene gått ned. Denne situasjonen er ikke enestående for Runde og Norge, samme tendens gjør seg også gjeldende i Storbritannia, på Island og i hele Nordøst -Atlanteren. Selv om årsakene til krisen hos sjøfuglene er sammensatte og komplekse, var de fleste innleggsholderne enige om følgende punkter:

1) En vesentlig del av årsaken til krisen for sjøfuglbestandene på Runde og i Nordøst-Atlanteren skyldes mangel på egnet energirik mat (fettrik fisk av rett størrelse særlig *tobis* i Skottland, Færøyene og Sør-Vestlige Island) i hekkeseongen. Dette kan i sin tur forklares som en indirekte effekt av en liten økning i gjennomsnittstemperatur i havet. Denne temperaturøkningen skaper endringer i planktonsamfunnene (bl.a. raudåte) som påvirker fiskebestandene som sjøfuglene lever av. Det var også enighet om at såkalte "top down effekter", (dvs. predasjon) fra for eksempel makrell, mink, sjøpattedyr og havørn etc. sannsynligvis var av større betydning enn tidligere antatt.

2) *Hva kan vi gjøre?* Siden det på kort sikt er vanskelig å gjøre så mye med temperaturendringene i havet og klimaendringene, er det desto viktigere å gjøre noe med alle de andre parameterne som en kan styre på kort sikt: -

- Bifangst av sjøfugl i moderne fiskeredskaper
- Mer langsiktig og restriktiv fiskeriforvaltning
- Opprettelse av marine verneområder for sjøfugl
- Reduksjon av plastforurensning og andre forurensningskilder i havet

Samtlige av disse punktene har BirdLife International iverksatt tiltak på innen EU.

3) Det var i tillegg bred konsensus om nytten av å arrangere denne type tverrfaglige seminarer, hvor eksperter og andre involverte fra ulike land, disipliner og posisjoner får anledning til og møtes "face to face" å utveksle ideer om et fokusert tema. Et konkret eksempel på slik "nytte" kan ha oppstått under diskusjonen mellom tobisekspert Tore Johannesen og lundeekspert Sarah Wanless om hvordan det kan være mulig at lunder ved Færøyene spiser tobis midt på vinteren, når tobisen "ifølge boka" da skal være nedgravd i sand. (Se diskusjonen i Appendix 1. s 42-44). **Andre mulige funn:** Et annet interessant funn var Erpur Snær Hansens tidsserier for lundefangst på Island helt tilbake på 1800-tallet hvor to tidligere perioder av nedgang i lundebestanden (med kollaps i henholdsvis 1891 og 1931) ble korrelert med øket temperatur i havet. Dette antyder en syklisitet i havtemperatur, og i så fall er dette en supplerende (eller alternativ) forklaring til den som handler om de menneskeskapte klimaendringene. Sjøfuglekspertene fra Storbritannia var mer eksplisitte med å relatere temperaturøkningene i Nordsjøen, og derav nedgang i sjøfuglbestander, til menneskeskapte klimaendringer. (For en mer detaljert fremstilling av sammendrag og konklusjon se s 29-34).

Summary (English):

The report is an account of the summaries, presentations and discussions that took place at the International Seabird Seminar in Fosnavåg 20th and 21st of April 2015.

Many populations of seabirds have been declining at Runde over the last years. Almost all the species of seabirds except the Gannet, Great skua and White-tailed Eagle have decreased.

Kittiwakes, Shags and Fulmars have been especially hard hit over the last 20 years, but this situation is not unique for Runde or Norway, the same tendency is happening in the UK, in Iceland and in the whole of the North East Atlantic. Although the causes for this development are multiple and complex, most speakers agreed on the following points:

1) There seems to be *one common denominator, which* applies to all the seabird colonies that have been discussed in this seminar: the key here is the temperature of the sea. A slight temperature increase of the average sea temperature has had hugely negative consequences for the seabird colonies in Norway, UK and Iceland. The change in temperature influences the plankton communities (ecosystemic shift in plankton communities) which, in turn, influence the many fish species which the seabirds are living off in the breeding season, especially *Sandeels* in Scotland, The Faeroe Islands and in South- West Iceland.

There was also a general agreement about the relevance of what is called “top down effect” with the influence from predators such as Atlantic mackerel, Sea mammals, American Mink, White- tailed Eagle etc.

2) (*What can we do?*) Temperature and climate change are difficult to do much about in the short term, so in this case, it is important to do something about all the other parameters on which it is possible to take remedial action. Some of the relevant parameters are:

- Bycatch of seabirds in modern fisheries
- More long term and restricted fishery conservation
- Marine Protected Areas
- Reduction in plastic pollution and other environmental pollutants etc.

3) There was a general agreement about the usefulness of arranging meetings such as this seminar where researchers from different countries and from different disciplines come together to exchange ideas and talk face to face about a focused topic. All the speakers seemed to concur on that point.

An example that shows the feasibility of such multidisciplinary exchanges was demonstrated in the discussion between Sandeel expert Tore Johannes and Puffin expert Sarah Wanless, when they talked about how it could be possible that Puffins in the Faeroes apparently live off Sandeels in the winter, when the Sandeels “according to the book” should be buried in the sand. (See the discussion in Appendix 1. S 42-44).

A set of very interesting findings was also reported from Iceland:

Firstly: The realization that Europe’s biggest Puffin colony at the Westman Islands is going through some of the same declines as seabirds in Runde and Norway. This is a development that apparently has happened over the last 10-15 years. The reason for this is that the Sandeels have almost disappeared from the Westman Islands and the southern part of Iceland, a situation driven by the increasing temperature in the sea.

Secondly: Very interesting results were presented by Dr. Erpur Snær Hansen when he showed a time-line series of Puffin hunting in Iceland and the Westman Islands since the 1800’s. In this material he demonstrated a similar decline in Puffin populations in the 1920s and 1930s (collapse in 1931) co-ordinated with similar increases in sea-temperature as we see today (collapse in 2004). His data also suggests a much earlier period with declines in Puffins as expected (collapse in 1891). This might indicate a cyclical change in sea temperature, although the decline in the 1920-30s was less extreme than what is experienced today.

The Seabird experts from the UK were generally more explicit than the Icelanders and Norwegians in mentioning anthropogenic climate change as a significant driver behind the increased temperatures in the North Sea, and seabird declines caused by this. (For a more detailed and extensive summary and conclusion see pages 29-34).

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Seminar participants enjoying the view and close encounters with puffins atop of the Runde puffin scree. Photo: Euan Dunn.



Seminar participants listening to local ornithologist Alv Ottar Folkestad at the Runde Marches. Photo: Euan Dunn.

Introduction

Changing times for Puffins

In previous times, Puffins and other seabirds were an important food supplement to the people who lived at Runde and along the coast of the North-Atlantic. Now, instead, they have become food for the tourist's telephoto lenses! Tourists arrive in their thousands at Runde to see the spectacular birds come in from the sea in spring. But at the same time as Puffin-tourism is increasing, fewer and fewer Puffin chicks are hatched. According to many scientists something serious appears to be happening in the ocean, and with the seabird's food. However, this is not the only factor - where do the Puffins go during winter? What happens to them in their wintering habitats? There are still many unanswered questions for seabird ecologists to resolve. This was the context for the North Atlantic Seabird Seminar at Fosnavåg on the 20th and the 21st April 2015.

An experience of the Bird Cliff: Then and now

(Michael Hundeide)

Runde is the most famous sea bird cliff in Norway and I had always wanted to go there.

***Then:** In 1979 I went there with my cousin, and it was an extraordinary experience. The weather was excellent; calm, sunny and with a clear blue sky. Puffins in their best costumes were showing in huge numbers everywhere. They flew like small helicopters high above our heads and we could also see them close to the boat. In the background was the constant loud noise from the ever-present Kittiwakes and their complaining screeches: Kiiiæææhh, Kiiæææhhh (or in English: Kittiwake, kittiwake) The density of the Kittiwake colony was so overwhelming that, every time the majestic White-tailed Eagle flew by, huge flocks of Kittiwakes in their thousands dispersed from the cliff face, blocking the sky and their calls became even louder and more intense. The skipper of the boat asked us to put on raincoats, even though the sun was shining, to protect us from the droppings of these small noisy gulls.*

Masses of Guillemots, Razorbills and Shags sat lined up on every boulder and stone ledge of the bird cliff, while Fulmars and Gannets constantly came in and out of the edge of our vision towards the sea. I remember we saw a couple of Arctic Skuas too- what elegant creatures! The Great Skua was still not present at Runde at that time. (They first bred the following year).

***Now:** Today the situation is very different. This came as a shocking realisation when in 2010 I took a group of youngsters on a boat trip around the island...*

The same trip, at the same time of year, as my cousin and I had done 31 years earlier.

Compared to what we had experienced in 1979, the silence of the bird cliff was almost frightening. Where had all the Kittiwakes, Guillemots and Fulmars gone? With some very few exceptions we could hardly see or hear any Kittiwakes on the bird cliff at all. Although the Gannets, the Great Skuas and the White-tailed Eagle had increased in numbers, the situation for the other species of seabirds at Runde was of a dramatic decline, which is still currently ongoing.

Even the Puffins, which had a slight increase in population at Runde from 1980 until 2004, have started to decrease now. Like most of the other North Atlantic seabird species they have severe problems in finding the right food for their chicks. In 2010 we did see some Black Guillemots on the sea and we saw and heard perhaps some 30 Kittiwakes but, compared to the marvellous orchestra and sight my cousin and I experienced 31 years earlier, the bird cliff was silent! In the beginning we thought maybe Runde was a special case. However, in fact this was not only happening at

Runde and along the Norwegian coast, it was happening all over the North Atlantic too. I thought: Why aren't people more concerned about this? Why aren't they speaking and writing about it? Do they know it is happening right in front of their eyes?

The trip with the youngsters to Runde in 2010, and the disturbing contrast I experienced then made a huge impression, and it is an important part of the motivation that lies at the root of these seminars.

Not long after the trip in 2010 I contacted Nils Roar Hareide (the General Manager of Runde Environmental Centre), and made a proposal for The Runde Environmental Centre to focus more on the seabirds of the island. Nils Roar had been thinking in similar terms. So we realized that we had to arrange a seabird seminar in order to address these dramatic changes in the seabird populations of the island. In April 2014 we arranged the first cross-disciplinary seabird seminar "*Ingen Lunde?*" with a national focus. With this year's seminar "*Ingen Lunde II*" in 2015, we wanted to have a wider North Atlantic focus.

The contrast between the bird cliffs at Runde *then* and *now* can also stimulate us to reflect more on how processes and events that happen in nature can be communicated in different ways to a wider audience in society.

Seabirds and Runde Environmental Centre in a wider context

Runde Environmental Centre focuses on the marine environment, and seabirds are good indicators of what is happening in the marine environment.

Since Runde is the most famous (and southern) seabird cliff (fuglefjell) in Norway it should come as no surprise that the Runde Environmental Centre is concerned about what is happening to the seabirds on the island and in the North Atlantic generally. It has been the aim of the two "*Ingen Lunde?*" seminars, to try *to expose what we know about what is causing these great seabird declines and what they are indications of in the wider marine environment. How should this be communicated to young people and the public? And finally to ask what we can do about the situation.* During this year's seminar, we were lucky to be able to welcome as our guests some of the foremost experts in the seabird field from Iceland, England, Scotland and Norway, and so comparisons could be made between Runde in Norway, to The Westman Islands of Iceland, and to the Isle of May in the UK.

Are the same underlying temperature effects which indirectly seem to drive the reduction of Kittiwakes at Runde the root cause for the declining Sandeel populations around the Westman Islands in Iceland, with similar consequences for Europe's biggest Puffin colony breeding there?

Or are the temperature-driven ecosystem shifts that have made the Sandeels move from the South-West coast of Iceland to the North coast, and the Capelin from the North coast to the North East part of the island or further north, caused by slow natural variations in sea temperature, or anthropogenic climate change?

To what extent are the dramatic changes that are happening with many species of seabirds indicating a more fundamental change in the marine ecosystem? Are these changes a consequence of naturally occurring oscillations? Or rather a result of human activities such as:

- Climate change
- Industrial fishing
- By-catch of seabirds in modern fishing gear
- Pollution in the sea including plastic
- Invading predators such as rats, cats and American mink etc.
- Oil production and transport at sea

These are some of the questions we have been discussing at the “Ingen Lunde II” (or North Atlantic Seabird seminar) this year.

This extraordinary rich and important topic is something we want to follow up and focus more on in the future. Seabirds are like the “*canaries in the coalmine*” of the marine environment. According to recent research they are more threatened than any other group of birds on the planet (Croxall et al. 2012). This means that they are declining at a significantly more rapid rate than any other group of birds.

Although 70% of the earth’s surface consists of sea, the jurisdictional protection of the marine environment has slowed down dramatically compared to the protection of terrestrial environments. According to the UN’s Convention of Biological Diversity from 1992, the countries which have ratified this convention have committed themselves to protect 10% of the planet’s marine environment by the year 2020. Today in 2015 only 2.8% of the world’s oceans have some form of legal protection compared to 12.9% of the world’s terrestrial environments.

The situation for seabirds in Norway in 2015

SEAPOP¹ is a long-term research and monitoring programme on seabirds in Norway (<http://www.seapop.no/en/>).

In March 2015 a report was released (Fauchald, Anker –Nilssen et.al 2015) where they sum up some of their results showing *the status and trends of seabirds breeding in Norway and Svalbard*. The report documents large-scale changes in the seabird communities along the coasts of Norway and Svalbard. They show that 13 of the 35 regional seabird populations² assessed have declined by more than 50% in the last 25 years. 5 regional populations increased by more than 100% in the same period, while 8 populations showed large decadal fluctuations. Of the 17 seabird species that were studied in the report we pick out 4 species as examples:

Atlantic Puffin is declining in the North Sea- and Norwegian Sea region, but the population in the Barents Sea is stable or increasing slightly. (Since 1980 until now the population of Puffins in the Norwegian Sea has declined from *1.6 million* pairs to *600,000* pairs).

Black-legged Kittiwake has declined substantially in all regions except on Bjørnøya. On the Norwegian mainland the population has declined from about 280,000 pairs in 1980 to 82,000 pairs in 2013.

¹ SEAPOP (SEAbird POPulations) is a new and long-term monitoring and mapping programme for Norwegian seabirds that was established in 2005. The programme represents a new initiative for these activities in Norway, Svalbard and adjacent sea areas and will provide and maintain base-line knowledge of seabirds for an improved management of this marine environment. The data analyses aim to develop further models of seabird distribution and population dynamics using different environmental parameters, and to explore the degree of covariation across different sites and species. This knowledge is urgently needed to distinguish human influences from those caused by natural variation.

¹ SEAPOP arranged their 10-year anniversary seminar for their research and monitoring activity on seabirds in Norway. Here they presented the results of all the data they have collected over the last 10 years.

² The studied seabird populations were divided into 5 geographical regions: North Sea & Skagerrak, Norwegian Sea, Barents Sea, Bjørnøya, and Spitsbergen.

Northern Gannet has been increasing in Norway since the establishment of the species on Runde in 1944. The species has expanded northward and has recently established a small colony as far north as Bjørnøya.

Common Guillemot The population in the Norwegian Sea has been steadily declining since the early 1980s (more than 75% since the early 1980s). However, in the Barents Sea the species has been increasing since the 70-90% collapse in the winter of 1986-87. Although the Barents Sea populations have more than doubled, the populations are still low compared to the estimates before the collapse.

The report also details serious declines in most of the gull species in Norway over the last 30 years. More details can be found here:

<http://www.nina.no/archive/nina/PppBasePdf/rapport/2015/1151.pdf>

Red listed seabirds in Norway

The IUCN³ Red list of threatened species is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plants and animal species. There are three different levels of red lists of threatened species that might be relevant in this case: There is a Norwegian red list at a national level, and a European IUCN red list on the regional level, and then there is the international IUCN red list on the global level.

The *Puffin* for instance now has proposed status as **Endangered** (EN) on the European IUCN red list from 2015, but it still has the status **Least Concern** (LC) on the international IUCN red list. In the Norwegian red list from 2010 it has the status of **Vulnerable** (VU).

The *Black-legged Kittiwake* has proposed status as **Vulnerable** (VU) in the European IUCN red list, but on the International IUCN list it is still **Least Concern** (LC) In the Norwegian red list the status for *Kittiwake* was changed from **Vulnerable** (VU) in the 2006 red list to **Endangered** (EN) in 2010. The population of *Kittiwakes* has been reduced by 75% in 5 main breeding areas in Norway over the last 30 years (From 1980-2010).

Three new seabird species were added to the national Norwegian red list from 2010: *Razorbill*, *Common Gull* and *Fulmar* and three other seabird species, *Black Guillemot*, *Brünnich's Guillemot* and *Kittiwake* were classified as more threatened than before (with a more critical conservation category on the list). Between 1980 and 2010 all the 5 species of the *Alcidae* family have suffered a dramatic decline in Norway. By far the worst is the situation for the *Guillemot* with an 80% decline in this period. In Norway it has been categorized as **Critically Endangered** (CR) in both the 2006 and the 2010 editions of the national red list.

If we add mainland Norway together with Svalbard we have 58 regularly occurring seabirds in Norway, of which 27 are red listed. In other words, 46% of all the regularly occurring seabirds in Norway are on the national red list (either the mainland red list or the Svalbard red list).

³ <http://www.iucn.org> IUCN, International Union for Conservation of Nature ... "helps the world find pragmatic solutions to our most pressing environment and development challenges."

PRESENTATIONS:

I. SUMMARIES PREPARED BY THE SPEAKERS

Puffins in the UK

Professor Sarah Wanless:

(CEH Centre for Ecology & Hydrology in Scotland).

[\(Link to presentation \(pdf\)\)](#)

I will start by reviewing changes in Puffin numbers in the UK over the last 120 years. However, my talk will mainly focus on Puffins on the Isle of May, a major colony in the northwestern North Sea. Using data from this long-term study I will demonstrate how Puffins are being affected by climate change both during and outside the breeding season. We still know very little about Puffins when they are away from the breeding colonies but bird-borne devices are highlighting important wintering areas and providing the first data on patterns of diving activity. Long-term studies and targeted logger work are playing key roles in identifying natural and anthropogenic threats to North Sea Puffins and predicting how abundance and distribution will change in the future.

Sandeels as prey for seabirds in the North Sea

Professor Sarah Wanless:

(CEH Centre for Ecology & Hydrology in Scotland).

[Link to presentation \(pdf\)](#)

Sandeels are abundant, shoaling, small-sized, lipid-rich fish that are eaten by a wide range of marine predators in the North Atlantic including seabirds. As part of long-term population studies of seabirds on the Isle of May, extensive information on diet of Puffins, Guillemots, Kittiwakes and Shags have been collected. These data have highlighted 1) the changing importance of Sandeels in seabird diet, 2) advanced our knowledge of Sandeel biology, and 3) improved our understanding of links between Sandeel abundance/availability and seabird population dynamics.

The Puffin as an icon for conserving UK Seabirds

Dr. Euan Dunn

Principal Marine Advisor, RSPB (Royal Society for the Protection of Birds).

[Link to presentation \(pdf\)](#)

As a charismatic and socially interactive bird, the Atlantic Puffin (hereafter referred to throughout this presentation simply as Puffin) resonates with the human condition, touching the sense of theatre, comedy and community in us all. For the UK public, this makes the Puffin one of the most instantly recognisable, best known and best loved of any birds, not just seabirds. This, in turn, makes the Puffin the ideal marine icon for raising public awareness about the need to safeguard the wider seabird community and our seas.

The UK's seabird populations are of major importance in European and global terms, e.g. supporting 90% of the world's Manx Shearwaters and perhaps 10% of its Atlantic Puffins. A minority of the UK's seabird species are stable or increasing but most are declining dramatically. In the last 25 years, Scotland has lost about half of its breeding seabird population, with the Northern Isles (Orkney and Shetland) particularly badly hit. An overview of the Puffin's status throughout the UK shows

considerable regional variation in population trends but overall an apparent decline in recent years (a national census is overdue).

The Puffin and the UK's other seabirds face a variety of threats of which the most concerning is sea warming and its impact on the food chain, especially for Sand-eel feeders like the Puffin. Climate change models predict a future contraction of the Puffin's European breeding range to the north-east, resulting in loss and weakening of colonies in the south. Given that reversing climate change is a long-term challenge, it is vital to tackle the other, more tractable threats to strengthen the resilience of Puffin populations and give them a fighting chance against climate change.

This calls for measures both on land and at sea. Firstly, there is a significant programme to rid the UK's seabird islands of rats and then apply effective biosecurity – the progress of the RSPB's efforts is illustrated for a number of islands. At sea, part of the potential remedy is to identify, designate and effectively manage the critical foraging areas of Puffins and other seabirds as Marine Protected Areas. The RSPB's tracking work to pinpoint critical offshore areas is described, as well as our campaign in Scotland to gain public and government support for MPAs.

Management of Sandeel and general fish recruitment problems in the North Sea and Norwegian coastal waters

Dr. Tore Johannesen

(Senior researcher at The Institute of Marine Research in Norway).

Sandeel fishing grounds are spread like a patchwork in the North Sea due to the burial behaviour of the fish in suitable sandy substrate. Evidence from the Norwegian sector of the North Sea suggests that Sandeel grounds are demographically disconnected over relatively short distances (10-20 nautical miles), i.e. the exchange of Sandeels between neighbouring fishing grounds is generally too low to have significant impact on the population dynamics of one another. Depletion of Sandeel grounds may thus have long-term implications by causing local recruitment failure and slow recovery of the stock.

Long time data series from the south coast of Norway (since 1919) have shown repeated incidents of abrupt and persistent recruitment collapses in gadoid fishes. Evidence suggests that these events were linked to abrupt changes in the plankton community that deprived young-of-the-year gadoids of adequate planktonic prey. Shifts in the plankton community have been observed in relation to both gradually increasing nutrient loads and increasing temperatures. Regime shifts and fish recruitment problems were observed in the North Sea and Norwegian coastal waters around the turn of the century. This may have affected breeding success in seabirds.

Present and past changes in Icelandic seabird populations, emphasizing the Westman Islands Atlantic Puffin

Dr. Erpur Snær Hansen

(Researcher at the South Iceland Nature Centre)

The Lesser Sandeel (*Ammodytes marinus*) was the predominant seabird prey in the temperate south and west coasts of Iceland during the last cold regime (1967-1996), whilst capelin (*Mallotus villosus*) was the predominant prey in arctic north and east coasts. The current warm regime began in 1996 with sea temperatures peaking in 2003 when the capelin moved its main nursery grounds to SW Greenland but the

sedentary Sandeel population in the S&W soon collapsed. The large recent population changes of Icelandic seabirds are reviewed in this perspective. The changes differ regionally within and between species. A five-year study of the Atlantic Puffin chick production and prey abundance on a national level serves as a general exploratory model. Sandeel in the S&W has not recovered or been replaced by an alternative prey and chick production has remained very poor (for 12 years). Sandeel has replaced capelin in the north where chick production has been high. Local capelin population has been growing in the cold non-stratified east waters while the Sandeel has declined, simultaneously the Puffin chick production has grown from poor to high. In search for an explanation of the Sandeel collapse the complete pole netting harvest record (1880-2014) of Puffins in the Westman Islands was examined together with seasonal sea surface temperatures (SST). Variation in harvest reflects past production until age of maturity & colony attendance of immature birds, both reflecting availability of the key prey, the Lesser Sandeel. The Puffin harvest time series, together with summer SST and Sandeel length threshold for wintering (based on winter SST) were subjected to pre-whitening and split into regimes by a sequential *t*-test. Comparison of the regime timing and level of change between the three variables indicates three large production crashes in 1891, 1931 and 2004, following two growth regimes <1891 and >1967.

The results suggest the existence of an eco-physiological tolerance limit ($L_{th} = 7.7$ cm) imposed by warm winter SST regimes off S&W Iceland, above which the Sandeel population collapses. Local Sandeel life history is composed of summer growth period in May-July, and dormant winter period in August-April spent buried in sand. In winter, increased SST accelerates the Sandeel's metabolism & their rate of reserve depletion, but reduces energy allocation to growth & reserves during summer.

Conservation measures for seabirds in Norway and the role of the Important Bird and Biodiversity Area (IBA) network.

Paul Shimmings

(Senior Consultant. The Norwegian Ornithological Society (NOF)/ BirdLife Norway)

[Link to presentation\(pdf\)](#)

Many of our bird species, not least many of our seabirds, have declined in numbers in recent years- Some of these have experienced dramatic declines. BirdLife Norway has identified 93 sites which qualify as "Important Bird and Biodiversity Sites" (IBAs). These sites are selected based upon criteria from BirdLife International. Around one-third of these are sites which qualify based upon IBA-criteria alone. A report is now available detailing all of the IBAs in Norway:

<http://birdlife.no/prosjekter/nyheter/?id=1513>

Seabird conservation in Europe: Threats, Progress, & Challenges in the EU: Conservation by incremental steps

Marguerite Tarzia

(European Marine Conservation Officer for BirdLife International).

[Link to presentation\(pdf\)](#)

In this presentation I outline work undertaken by BirdLife's marine programme in Europe, which focuses on both site based and non-site based approaches to seabird conservation as well as advocacy at National Government and regional level to protect seabirds.

BirdLife's site based work includes the identification of marine Important Bird Areas (marine IBAs) which are based on rigorous scientific and standardised techniques (tracking, at sea surveys, modelling) to identify sites according to population threshold criteria (1% of global/biogeographic population contained in a site). Marine IBAs can be identified for breeding colonies, at sea areas immediately surrounding the colony, non-breeding aggregations, migratory bottlenecks and pelagic sites. BirdLife Partners across the European region apply the approaches outlined in BirdLife's [Marine IBA Toolkit](#)⁴ to identify these sites. Globally there are now over 3000 marine IBAs identified, and close to 700 sites have been identified across the European region. These sites are collated and publically displayed in the online [Marine E-Atlas](#)⁵ providing information on the species triggering the site. Furthermore, tracking data from both BirdLife Partners and external scientists are collated on BirdLife's [Seabird Tracking Database](#)⁶, providing a rich GIS layer of information on seabirds which can be used for identification of offshore areas across ocean basins. Owners of seabird tracking data are urged to contribute to this database to help our ongoing conservation efforts. Marine IBAs are used by the BirdLife Partnership in their lobbying and advocacy of National Governments for Marine Protected Area (MPA) designation. Within the European Union, marine IBAs are recognised as a 'shadow list' for the Natura 2000 network (under the EU Bird's Directive), for [Special Protection Areas for Birds](#)⁷, and I provide examples of countries where the two networks (IBAs and Natura 2000) closely align⁸, and ones where progress is still required. [Spain](#) is presented as a case study, as the marine IBA network was determined by the BirdLife Partner (SEO/BirdLife) over a number of years, and following sustained lobbying of Government resulted in the designation of 39 new marine Special Protected Areas (Natura 2000) in 2014, closely aligned to the boundaries of the marine IBA areas. I also provide a summary of the progress for site designation in the UK, including the National Marine Protected Area network, which has seen designation of sites for Sandeels off Scotland. I provide a summary of the lessons learnt from the EU process outlining the effectiveness of using marine IBAs as the basis for MPA designation. I also provide an outline of BirdLife's strategic plans for site identification in the European region as a whole- including the identification of transboundary sites shared between countries and participation in the Convention of Biological Diversity's [Ecologically and Biologically Significant Areas](#)⁹.

⁴ (<http://maps.birdlife.org/marineIBAs/default.html>)

⁵ (<http://maps.birdlife.org/marineIBAs/default.html>)

⁶ <http://www.seabirdtracking.org/>

⁷ http://ec.europa.eu/environment/nature/natura2000/sites_birds/index_en.htm

⁸ See BirdLife Europe's Natura 2000 Progress Assessment, here: <http://www.birdlife.org/europe-and-central-asia/marine-natura-2000-network>

⁹ <https://www.cbd.int/ebsa/>

I finish the presentation providing a description of the non-site based work that BirdLife is involved in, particularly in relation to mitigation and reduction of seabird bycatch. Our new '[Seabird Task Force](#)¹⁰' which was launched at the beginning of 2015 is a collaborative project between seabird bycatch experts and fishermen. Observers work with fishermen to understand bycatch in a range of different fishing gears, and then collaboratively develop mitigation measures which are appropriate and efficient for the fishermen and which reduce the numbers of birds caught. In order to successfully protect seabirds both site and non-site based work is needed and the case for dedicated work to understand seabird bycatch in Norway and across the NE Atlantic region is discussed.

II. SUMMARIES OF PRESENTATIONS PREPARED BY EDITOR.

What has happened to the Seabirds at Runde?

Alv Ottar Folkestad

(Researcher and for many years leader of NOF (the Norwegian Ornithological Society or - BirdLife Norway)

Alv Ottar Folkestad's interest in seabirds goes back to the 1950s when he was a teenager. He joined a group of birders who had the opportunity to participate in fieldwork on the bird cliff of Runde.

Alv Ottar Folkestad and the birders witnessed a good period when the seabird species at Runde were increasing, but later declined from the 1970s onwards.

What has happened to the seabirds on Runde?

In the 1700s when Norway was under Danish rule, Hans Strøm (1762) was a skilled naturalist at the time and he reported to the King of Denmark about the situation among the people and nature. Hans Strøms work from the area was published in 1762 and is very interesting to use as a reference even today.

Fishermen in the region knew about the Fulmar and Gannet, but only from the open sea. (Ed: They didn't breed in Runde and Norway at that time).

The Kittiwake was well known but it did not breed in the area at that time.

The Kittiwake established itself in the area in the first half of the 1800s.

Interestingly, even the Great Auk was mentioned in these reports as a bird that was known by local people. (That was before the final extermination of the species).

In the first half of the last century, the Fulmar was recorded as a breeding bird at Runde, with breeding confirmed first in 1924. Alv Ottar and friends talked to elderly people in the 1950s and they could tell that the Fulmar was already present several years before 1924. So Alv Ottar thinks the Fulmar established itself at Runde about 1900. In 1926 the first estimate of the Kittiwake population concluded that there were 100, 000 breeding pairs. (Alv Ottar stresses that this is an over-estimate).

Key points about the seabirds at Runde after the Second World War:

¹⁰ Seabird Task Force website (www.seabirdbycatch.com)

The first Gannets breeding in 1946.

In 1955 naturalists tried to estimate the numbers of seabirds at Runde.
Per Einar Myklebust started a ringing program for the seabirds between 1956 and 1982. 61, 000 seabirds were ringed on this island alone.

In 1972 a project was started looking at Gulls and Terns on the island. The very year the project started there was a breeding failure in the colony of the Kittiwakes. This was a new situation. During that year there was very high mortality of Kittiwake chicks. Hardly any chicks were fledged. That has been mainly the situation during the whole period since then for the Kittiwake.

In 1979 there was a collapse in the Shag population which numbered 5000 breeding pairs at that time. (Ed: the world's biggest Shag colony at the time). The population crashed by 2/3 within 4 years. Something was wrong.

On the other hand the Gannet started breeding at Runde from 1946 onwards and in 1980 the Great Skua started to breed on the island.

In 1979 Runde was included as a study plot in the national seabird-monitoring programme. Study plots were established for a number of species. Mike Harris was one of the people from abroad who came over to Runde to help with this in 1979. He helped to establish the study plots.

A report was made in 1985 from this monitoring programme, and everything seemed to be stabilized at that time, but in the middle of the 1980s things changed and high mortality was found among the Guillemots wintering in the sea. The breeding of Guillemots at Runde was declining too.

The Fulmar increased in the 1980s, but in 2002 there was a breeding failure of Fulmars on Runde and 2001 was the last year the Fulmar produced fledglings at Runde. *From 2005 onwards breeding failures have typified the situation for most seabird species at Runde.*

Summary of the seabird species at Runde

Fulmar: Established in 1900 increased to up to 5,000 pairs in 1985. There were no more breeding from 2001. In 2013 there were 10-15 pairs prospering. Since then (2014 and 2015) none have been seen.

Shag: In 1975 in the main colony at Skarveura was estimated to 5000 pairs. Four years later it was reduced to 1650 nests. The population stabilized at that level for many years, but in 2011 a new rapid decline was observed, and in 2014 there were no breeding Shags at the main colony on Skarveura.

But the situation was not completely black, because a new colony was starting to establish itself on the west part of the island. In 2014 Alv Ottar and friends counted about 300 pairs in this newly established colony.

Gannet: Steady increase in population.

1946: 4 nests

1963: 230 nests

2013: 3100 nests- The largest Gannet colony in Norway.

The reproduction is extremely high: in 2014, 0.96 chick/nest.

“When the Gannet does well then the Great Skua too will tend to do well.”

Great Skua:

1980: 1 pair
2013: 100 pairs.

Kittiwake:

(Breeding failure first in 1972)
1970: approximately 100,000 pairs
2014: 200 pairs?
2014: 6 chicks fledged.
The kittiwake is just on the edge of disappearing.

Guillemot:

Increasing until 1984, when it was the largest Guillemot colony in Norway, at a time when previously larger colonies farther north had either declined or been abandoned completely.
1984: 10,000 pairs
2014 < 1000 pairs (?)

Puffin:

1995: 100,000 pairs nesting
2014: 50-70,000 pairs *estimate*.
Reproduction (Chicks pr. nest):
2010: 0 N= 100
2011: 0.46 N=50
2012: 0.40 N=50
2013: 0.14 N=50
2014: 0.45 N=50

Summary of reproduction in 2014:

Fulmar: No breeding
Shag: "good" in new colony on the western cliffs (300 pairs)
Gannet: 0.96 chick / nest
Great Skua: Not quantified
Kittiwake: 6 chicks (at Brandehola)
Guillemot: Impossible to quantify.
Black guillemot: good (not quantified)
Puffin: 0.40-0.46 chick/nest

You can see the changes in the bird cliff at Runde at a far distance. At the peak the bird cliffs were white from top to bottom. Now the bird cliffs at Runde are grey. There are still some white patches due to the increase in the Gannet colony.

Runde is placed in one of the most important spawning areas for several important fish species in Norway. The Norwegian Spring Spawning Herring stock spawns in this area, but the hatching of Herring larvae in this area does nothing for the seabirds at Runde. It is the Herring larvae from further south that partly can feed Runde's seabirds.

Herring are spawning in the area where the Gulf Stream hits the coast, and meets the coastal current in Norway which flows along the coast from the Baltic Sea. Everything is moving northwards as a result of this coastal current.

The Herring larvae that hatch on the southwest coast are the key production supporting the seabirds at Runde, and not the ones hatching close to Runde, because the latter start to drift north from the end of May to June and July, too early to benefit most of Runde's seabird chicks.

Herring was the main species found in the diet of Puffin chicks. Overall, the prey spectrum included Herring and Sprat, and in some years Cod, Haddock, Saithe, and of course Sandeels. During some periods it was quite clear that the Sprat was the main prey for the Puffin and the other seabirds at Runde. Landings from Sprat fisheries declined from 12-14 000 tons in the 1970s to 2 tons today.

Some people have suggested that the White-tailed Eagle has recovered so much that they must contribute to the decline of the other seabirds, following its return to Runde after being lost between 1930 and 2010. In 2014 and 2015, three pairs established. According to Alv Ottar, the eagles are not responsible for the seabird declines. White-tailed Eagles are scavengers and fish eaters. We have lost the Great Cormorant in this area which was breeding here until the 1920s. The Gannet has established well, despite the presence of the White-tailed Eagle. Some of the other species have declined substantially and the Lesser Black-backed Gull has disappeared completely from the island. Great Skua is increasing as a newcomer.

The Eagle Owl has been lost from the island. It was formerly a regular breeding bird with several pairs. The Common and Arctic Tern were lost for some years but they newly established two years ago.

Alv Ottar has a good overview of the changes that have happened to the seabirds on Runde: some few positive, but mainly negative changes. It is the cause of these changes that Alv Ottar finds interesting.

A visual journey among seabird cliffs in the North Atlantic **Halgeir Skjellstad**

(Journalist and author of the books *Runde the Bird Island* and *Seabird*).

“Every Crane dance should have it's sparrow and here I am. My ambition to become a scientist started way back in the 1970's, as journalism grabbed me with both hands and never let me go. However, my interest in birds has not faded either. My fascination with seabirds dates back to just before I entered primary school. Runde and Røst were familiar names since I was 6, but I never knew which one was in Sunnmøre and which one was in Lofoten.”

Halgeir takes us on a spectacular seabird world tour, no less, with special emphasis on the island Runde and the Gannet(s).

The journey starts with a black and white picture of Halgeir standing in front of his tent as a teenager in the early 1970s on his first trip to Runde. The next picture is from *Kaldekloven* on the same trip, one of Runde's most spectacular views. This is really where the story begins. He says “Little did I know then that Runde was going to leave a mark on me that would influence the rest of my life.” Since he came to Runde for the first time in 1972 he has visited the island every year since. For him the seabirds have been true travel companions in his life voyage and he is no amateur either when it comes to storytelling or wilderness photography.

I believe that Darwin's voyage with the HMS Beagle lasted for 5 years.

Halgeir's journey extends over a longer period of time, but covers much of the same geographical terrain as Darwin's did.

While Darwin spent many years writing the book (23 years) from his trip "The Origin of Species", Halgeir had already written his first book about the seabirds at Runde: *Runde Fugleøya på 62* published in 1980, and then another about seabirds in general: *Havfugl* from 1987.

Halgeir doesn't only tell us about the seabirds themselves, he also shows and tells us a whole lot about the people who have inspired him on his seabird voyage.

For instance, he paints a moving picture of the local self-made tourist guide: Ola Goksøyr, a man many people will remember. Ola Goksøyr was probably the first seabird guide at Runde. He says;

*"In his boat and his company I had some of the finest nature moments in my life"...
"There is nothing that will tighten your bonds with nature as much as a summer night in a small boat under the bird cliff".*

He flips to the next picture showing two Herring gulls fighting over a still living Eider chick... Commenting:

"But nature is not all romantic beauty..."

Then he tells the story of the famous Gannet specialist, *Bryan Nelson (who died aged 83 on 29 June 2015)*, who with his new bride *June*, spent the first 3 years of married life living in a primitive shed at Bass Rock, which is now the world's largest single Gannetry on the east coast of Scotland. Halgeir also spent time on Bass Rock every summer for the last eleven years. (David Attenborough has called the Bass one of the 7 natural wonders of the world, and Halgeir understands why). He continues to tell the story of how Bryan and June Nelson packed all their belongings and went on to the Galapagos Islands to study the three species of Gannets which breed there. Halgeir followed in the Nelson's footsteps to the Galapagos, so we can see the pictures of the birds and seascapes ourselves. First, the Nelsons went to the island of *Genovesa* where they studied the *Red-footed booby* (the smallest of the sulids breeding in trees). For the last four months of their journey they lived on the island of *Española* where they studied the *Blue-footed booby*. On both islands they also studied the *Nazca booby*, often called the whitest bird in the world. (We get to see spectacular pictures of all these 3 tropical cousins of the Gannet, while Halgeir is talking).

From Runde, via Bass to the Galapagos Islands, Halgeir takes us back again to the main seabird colonies of the North East Atlantic in Norway, Scotland, Iceland and the Faroes:

He takes us to *Foula*, the westernmost Island of the Shetlands with the world's biggest population of Great Skuas, 25 miles west of the rest of the Shetlands...."I have seen quite a few Islands in the North Atlantic through the years, but hardly any as beautiful as Foula". He says while showing us fantastic pictures of the island.

From northern Norway he shows pictures and talks about:

**Nordfugløyen* known for its large Puffin colony and cliffs that according to local mythology had cost the lives of more than one hundred egg collectors.

**Sværoholdtklubben*, **Syltefjordstauran*: one of the largest and most picturesque bird cliffs in Norway. **Skarvklakken*, the first Gannetry in North of Norway, which is now long deserted.

In the UK he mentions *Hermaness* at the North tip of the Shetland Archipelago with its large Gannetry and its many Puffins.

He shows us *Mykjenes* at the western extreme of the Faroes, holding a population of 300 people at the most; only a handful of them remained in the late 1990s.

Halgeir joined the locals fetching puffins with *Fleyarstong* which has been used to catch hundreds of thousands Puffins down through the ages.

Despite the Puffin hunt, *Mykjenes* has a Puffin population of 100,000 pairs, partly thanks to the absence of rats.

He also shows us the cliffs of *Westmannabjörgini* on the Faroes, once a huge bird cliff but now deserted. Enormous amounts of birds had been caught here with *Fleyastong*, fishing nets etc... Soon he experienced some of the same only much closer to home (Runde).

Then we see *Grimsey* on Iceland, the cradle of the North Atlantic Fulmar explosion.

Here he also found the last pair of Little Auks breeding on Iceland.

He joined the local fowler, Finnur, and shared a meal of smoked Puffin, which has been smoked on dried sheep manure.

Then in 1999, he finally got the chance to visit what must be the most epic seabird site in Europe: *St Kilda*, with its double world heritage status as a site of both natural and historical interest. *St Kilda* was the only known aviculture in the northern hemisphere where people lived on a diet of bird meat and eggs. Fish was emergency food. Sheep were kept for wool. For perhaps more than 5,000 years, people lived on these islands, leaving a wealth of memories now long gone. He shows us one of 1,200 stone 'cleats' (stone igloos) used for keeping food from the cliff fowling. *St. Kilda* consists of about seven islands or stacks... two of them together holding the largest gannetry in the world. In the 1930s all the people moved away from *St. Kilda*.

He tells about his friendship with famous seabird artist John Busby (who died on 3 June 2015, aged 87). Halgeir also draws and paints seabirds.

Two years ago he finally got the chance to meet his hero Bryan Nelson, (we see the picture of Bryan together with his lifelong working companion John Busby, with Bass Rock on the horizon). Through his seabird drawing interest he was also invited to the *Isle of May* to spend drawing weeks with another master: Keith Brockie, one of the world's finest bird illustrators, and the author and illustrator of two books about the *Isle of May*. Keith also illustrated Mike Harris' and Sarah Wanless' Puffin monograph. Halgeir tells us about the times he met Mike Harris, the world authority on Puffins, and he tells and shows pictures from the legendary *Isle of May*.

Then he returns to Runde, communicating the great contrast of how it was when he went there for the first time in 1972 (with 100, 000 pairs of Kittiwakes). Among other things, he gives a detailed account of how the Kittiwakes, Shags and Fulmars almost disappeared from the Island. "Not a single Fulmar has been seen on Runde this year. Most of the Norwegian Guillemot population has collapsed, and the Razorbill struggles. Gannets and Great Skuas are increasing."

"And still the Puffins flock in cool march evenings- hopefully they will continue to do so in the years to come."

"Runde in the sunset will always be one of the most beautiful places in Norway. But I will leave you with the words of the *Isle of May* warden: "*Lets enjoy what we have got as long as we have got it for however long that may be.*"

Seabird management in Norway

Magnus Irgens

(Advisor at the Norwegian Environment Agency/ Miljødirektoratet)

The Norwegian Environmental Agency is the agency with the responsibility for seabirds in Norway.

Magnus was originally going to speak about seabird management and oil activities, but instead he brought in some important elements from the SEAPOP -seminar that took place the 15th and 16th of April near Oslo.¹¹

We have 6 million pairs of seabirds in Norway: that is ¼ of all the seabirds in the North Atlantic region. Norway is a big seabird nation in the North Atlantic. Our concern is that many of these species are on the national, as well as the global, red list. Of the 58 species of seabirds that regularly occur in Norway, about 40% are on the national red-list (46% when the red lists of both mainland Norway and Svalbard are included). We also have so-called responsibility for species which are at least 25% of the European population.

Miljødirektoratet /The Norwegian Environmental Agency: The authority for seabird management in Norway that includes Svalbard and Jan Mayen as well.

The Norwegian Environmental Agency is advisors on concerns and questions related to seabird conservation and communicators of knowledge used in petroleum activity management, planning and environmental risk analysis and so forth. This also includes a broad collaboration with other countries, the Arctic Council etc.

Magnus explains:

“It’s a lot of factors which influence the seabird populations, and it’s not easy to just come up with one measure to do anything about the on-going reduction of the seabird populations that we see.”

He also tells that one of the measures they have been taking is to designate a seabird expert group together with marine researchers, to see how the fish stocks correspond with the reduction in populations of seabirds. From this work two reports have recently been published by NINA.¹²

*One: New estimates of populations of seabirds from the SEAPOP programme (“*The status and trends of seabirds breeding in Norway and Svalbard*” NINA-Report 1151. 2015) <http://www.nina.no/archive/nina/PPPBasePdf/rapport/2015/1151.pdf>

* The other report synthesis the measures pointing out how to deal with this. <http://www.seapop.no/opencms/export/sites/SEAPOP/no/filer/pdf/seapop-seminar-2015/13-Fauchald-Ekspertgruppa.pdf>

Magnus says that there is a need to integrate different time series much better. Such as different fish stocks time series along with seabird time series.

What kind of information is needed to do anything about the situation?

¹¹ SEAPOP arranged their 10-year anniversary seminar for their research and monitoring activity on seabirds in Norway. Here they presented the results of all the data they have collected over the last 10 years.

¹² NINA (Norwegian institute for nature research) is a research institution in Norway. <http://www.nina.no/english/Home>

A couple of years ago, a programme were designed by the Norwegian Polar Institute and NINA: (*Sea-Track*). A new co-ordinated logger programme was established as part of this in order to monitor the birds outside the breeding season. It is important to identify important bird areas (IBAs) outside the breeding seasons (in the winter season for instance). There is also collaboration with other counties in the North-East Atlantic, so seabirds are being mapped in order to find out how they are using the area and how they are using Norwegian waters. This is also relevant data for controlling the oil activity.

(Geologgers¹³: 180 Km accuracy)... At least you can see the different areas, which they are using. Loggers will be put on birds from 21 colonies! All these studies will be co-ordinated.

- *One example is a big collaborative study on the Kittiwake:*

Kittiwake studies co-ordinated between many countries show that the birds use waters off Newfoundland during winter. If anything happens in this area it's going to affect Kittiwakes from all over the North-East Atlantic. Some go to the North Sea and the West of the UK, but for the most part they are all going across the Atlantic.

- Another example is the Little Auk showing the moulting period in the autumn.

The Sea-Track programme is a three-year programme that already started last year. It also coordinates on-going studies. 2000 loggers have been used until now (the plan was 2,900), and the plan is to increase this number to 10, 000 loggers in this 3 year period. This generates lots of data and SEAPOP will generate a database that will show the results from this programme. This will be available from SEAPOP's webpage (<http://www.seapop.no/no/>).

One will show breeding data, and another one will show tracking data. The database was not ready at the time of the presentation.

SEAPOP: Basic monitoring program.

SEAPOPs 16 key sites, including Runde.

Different types of data that are sampled:

Diet data, breeding success data, survival data and population data.

Divided between pelagic species and coastal species.

- Arisan incident when a huge ore carrier (Arisan) ran aground with huge spills of oil just outside of Runde in 1992.

- Recovery time.

- Decreasing plankton production and the composition of the plankton (a factor that needs to be considered in seabird management).

- SEAPOP tries to have an ecosystem perspective and approach.

Puffin: 200 Km range from colony makes this a pelagic species, while the Black Guillemot is a coastal diving species (Cd).¹⁴

Magnus gives us some of the population estimates for several of the most significant seabird species we have been discussing: Kittiwake, Guillemot and Puffin. When it comes to the Kittiwake:

¹³ Geolocators are small technical devices which can be attached to birds in order to map their geographical positions.

¹⁴ Seabirds are often divided into 5 ecological groups: Pelagic surface-feeding (Ps), Pelagic diving (Pd), Coastal surface-feeding (Cs), Coastal benthic- feeding (Cb) and Coastal diving (Cd).

The only colony that is showing some positive development is the Bear Island colony in Svalbard and a smaller colony at Anda. The rest are declining rapidly. Reduction rate *Kittiwake*: 40% each year for the last 10 years! The same number for the *Guillemot* is 27%. And the *Puffin*: 7% reduction every year the last 10 years.

Most of the populations are decreasing. 40 populations are decreasing and only 15 are increasing. 52% of the pelagic species have been in decline since 2004. The coastal species have also been in decline by 23%. This also happens elsewhere in the North Atlantic –one of the main focuses in this seminar.

Kittiwakes go to Newfoundland in the winter because of the abundance of sea butterflies as prey.¹⁵ (*Thecosomata*) This is important for adult survival.

Kittiwake adult survival at Hornøya depends on sea butterflies in the Labrador Sea outside of Newfoundland in December, combined with the Capelin in the autumn east of Svalbard which affects the adult survival on the Kittiwakes in Hornøya.

Puffin: (Decline of Puffins in the Norwegian Sea, but in the Barents Sea it is doing slightly better).

Estimate for Puffins in Norway 2005: 1.7 million.

Estimate for Puffins in Norway 2015: 1.4 million.

In the last 10 years the Puffin has declined with approximately 300, 000 in Norway. This is an example of the data you can get if you enter SEAPOP's new webpage. (<http://www.seapop.no/no/>) and you can choose the key site you are interested in etc....The Puffin has been stable for quite a while and then it started to decline in 2002. (Showing on the graph). Larvae drift of Herring is important along the coast, and it explains why the colonies are there in the first place. (Shows a good year and a poor year in larval drift).

The conclusion that the seabird research network *SEAPOP* came to after summing up 10 years of data from the Norwegian seabird situation was that *seabirds in Norway are in crisis*, and this was indeed the headline of their 10 year anniversary seminar in Asker outside of Oslo in 15-16 April 2015.

Seabirds and plastic pollution: With special emphasis on the Fulmar

Alice Trevail (The Norwegian Polar Institute).

[Link to the presentation \(pdf\)](#)

Alice has worked with Plastic pollution in Fulmars on Svalbard. In this presentation she will talk more about the wider monitoring work of plastic pollution in the North Atlantic.

Global plastic production is still continuing to increase ever since its onset in the beginning of the 1950s.

The earliest reports about plastic in the food chain came from reports from the 1960s when plastic production really was only a fraction of what it is today.

¹⁵ Seabutterflies (*Thecosomata*) are a taxonomic suborder of small pelagic swimming sea snail. They include some of the world's most abundant gastropod species.

Approximately 5 trillion pieces of plastic are floating in our oceans at the moment. The origin of plastics in the sea is predominantly from terrestrial sources: 80% from sources such as improper waste management, irresponsible human behaviour, and micro-plastics. 20% comes from marine sources such as accidental loss of fishing gear and so on. It is estimated that 12.7 million tonnes of marine litter are discarded in the oceans every year. These plastic pieces persist in the environment.

Alice quotes a report where entanglement in plastic in the sea has affected 30,896 individual animals of 243 species.

Plastic pollution comes from:

- * Improper waste management,
- * Irresponsible human behaviour,
- * Micro- plastic from cosmetic products.

Micro-plastics: Cosmetic products are a major source of pollution.

Plastic pieces will persist in the environment.

Marine plastic litter: Costs the UK economy 15 million pounds per year.

Nowadays every Albatross chick is found with plastic pollution in its digestive tract.¹⁶ Not only seabirds ingest plastic, also many vertebrates.

Effects of plastic ingestion in seabirds:

- *Starvation
- *Loss of appetite and dehydration
- *Lower fledging mass
- *Decreased fat deposition
- * Uptake of chemicals

Chemicals come from both the plastic itself or they can come from the environment and stick on the surface of the plastic.

In the North Sea this monitoring has been going on since the 1980s.

94% of birds (Fulmars) have plastic in their stomach in the North Sea.

“99% of Fulmars in the English Channel have plastic pollution in their stomach.” (The area with highest fraction of birds with plastic 99%).

Nearly 90% of all seabirds in Svalbard and the Arctic region have plastic in their stomachs. At the moment 94% of seabirds (Fulmars) have plastic in their stomachs. Average 28 fragments per bird.

¹⁶ Referring to Laysan albatross on Midway Island

Arctic Tern research and seabird monitoring methods: Experiences from Iceland

Dr. Freydis Vigfusdottir (University of Exeter (UK) and The Icelandic Institute of Natural History)

Freydis hopes that her presentation can contribute to ideas about which methods and analysis can be used in future seabird research on Runde.

She presents her PhD work about Arctic Terns in Iceland. The data has been collected in Iceland between 2008-2011. Currently she is working on a different species (Brent Goose/ Ringgås) using methods that can be applicable at Runde. (Stress hormones). A previous speaker (Erpur) showed that seabird populations in Iceland have been suffering.

Iceland: 30 million seabirds and 300, 000 people

Iceland hosts: 35% of Guillemot population, 72 % of Razorbill, 22-32% of Brünnich´s guillemot, 23% of Kittiwake, 32-48% of Fulmars and 46% of Puffins in the North Atlantic. Despite these great populations, monitoring has not been great, still in these two decades there has been a huge decline of these once massive populations.

Decline in Icelandic seabirds from 1980- 2006:

Guillemot:	-30%
Razorbill:	-18%
Brünnich´s guillemot:	- 43%
Kittiwake:	-16%
Fulmar:	-31%
Puffins:	?
Arctic terns	?

Iceland´s seabirds are definitely suffering.

In a wide context the mechanisms driving those negative trends are unidentified. What we do know is that seabird breeding-cliffs are empty in late summer and there is mass mortality of chicks. So, these are the things that tell the researchers that seabirds are suffering and something is happening in the breeding area.

There are some indications that the north is doing slightly better than the south.

Arctic waters in the north, boreal waters in the south.

“Regional differences in seabird environments on Iceland. *Sandeels in the south west, and mainly Capelin and Krill in the north*” Recent trends: since the 1990s the Sandeels have been disappearing and the Capelin have been moving north.

“We decided to ask these questions using the Arctic Terns.

The Arctic Tern is easily accessible and breeds all along the coast. It depends upon the Sandeels in the south and the Capelin and krill on the North coast. It´s a long distance migrant and a surface feeder and has a short feeding range. In theory it should be a sensitive “barometer” for environmental change, more so than many other seabird species.”

Freydis studied Arctic Terns in two areas:

1. Snow Mountain Peninsula in the west
2. Arctic Fox plateau in the north

Within these areas, she tells us, there are multiple colonies ranging from a few hundred pairs to many thousand pairs. Individual nests are fenced off. She also claims that good co-operation with farmers is vital because they work on farmer's land. This is a good thing because the general public does not come into their breeding colonies. There is great respect for the project. Arctic Terns, Freydis tells us, are generally seen as the heralds of summer in Iceland, so there is a general interest for the species, and the project's outcome.

Questions they ask:

*What was the level of productivity in the different regions?
Does the level of productivity differ between the years? Between the two regions?
And within the regions? What are the main drivers of the observed productivity? Can the mechanisms underlying the patterns on temporal scale, time within the season and between the seasons as well as on a spatial pattern, be identified?*

Breeding success in the Snow Mountain Peninsula was particularly bad. Working hypothesis: Everything should be better in the north (capelin thriving etc.). A surprise that within a year the breeding success in the north was also very bad. What are the drivers of these trends, and can the time periods when this happens be identified?

*Clutch size: Can be indicators of conditions in pre-laying season. The poor productivity is not a result of pre-laying season.

*How about hatching success?
All the eggs hatched chicks. (Problem does not seem to be during that season).

*Fledging success? (Chicks fledged per Chicks hatched?)
This is where you find the problem! Many of the chicks that are hatched will not survive until fledging.
So why is this?

What are the drivers of this development?

Could it be predation?
It is not predation that can explain most of this. (Only 20%).
20% possibly explained by predation. Predation might be lower than this because they did not find all the chicks. Predation is not the main driver of the observed productivity failure.

Could it be foul weather?
Timing is a key issue. They use forensic science on dead chicks. (Blowfly larvae)
If weather is the problem; clumping of death should be expected, but it does not happen. Chicks are dying all the time. There are interesting spikes nonetheless. But mainly the weather is not the main driver.

Differences between chick death-rate of inner part and outer part nests on peninsula colony.

Each chick must gain 2 grams per day in order to survive.
Later: 5 grams per day. (Detailed growth rate on the individual chick!).

Looking at feeds per time unit.

Looking at foods they are fed with. Using photography. Arctic Terns are single load carriers so they are easy to do this with. Using photography they can identify species and size of prey.

Did these colonies vary in diet?

The most common food item: Sandeel: Accounting for very little of the calorific input to the chick.

Terns with access to estuary systems have a more variable diet and better fledging success.

The colony in northeast provides a highly variable diet but still not good fledging success. Why? Not enough Capelin feeds. The alternative diet is too tiny and not enough nutritional content for the chicks to sustain.

Conclusion:

Seabird populations on Iceland are declining, but why they are declining needs further exploration.

They know that the productivity of Arctic Terns is very poor and they also know this is not caused by predation or weather events. But it is the food from the marine habitat that seems to be the main problem. The northeast was doing surprisingly poorly from what they expected. This is primarily due to the prey.

Identifying the mechanisms of these drivers of seabird productivity helps them to identify the areas and species of possible concern.

More about methods:

The Brent Goose that breeds up in the high Canadian arctic, and winters on Iceland. Freydis looks at their stress via their level of stress hormones. "This is definitely a new tool to use and ask what is happening to our seabird populations. You would need feathers or blood from the seabird."

Geology and bird cliffs: How can geological knowledge be relevant in seabird ecology?

Sigrid Elvenes (NGU- The Geological Survey of Norway)

[Link to the presentation \(pdf\)](#)

Or: "*The Geology of Seabirds*"

Sigrid is a marine geologist who mainly works with seabed sediments. She is part of an ambitious mapping project in the Runde area, and she will show some preliminary results from this project and maybe indicate how the seabird research can benefit from the results they get from the mapping.

The aim of NGU's Marine Base Maps project is to produce seabed type maps from five municipalities in Søre Sunnmøre: Hareid, Ulstein, Herøy, Sande and Vanylven. This is a joint project between NGU, the municipalities and Fylkesmannen i Møre og Romsdal (The County Administration).

The Geological Survey of Norway is based in Trondheim. Fieldwork for coastal marine geology projects is conducted by the organisation's own research vessel, the

17-metre long RV “Seisma”. For Søre Sunnmøre, seabed mapping benefits greatly from extensive multibeam echosounder survey data collected by the Norwegian Mapping Authorities with the purpose of improving the accuracy of navigational charts. The level of detail attainable through high-resolution multibeam surveys vastly increases our knowledge of seabed topography. A relative measure of seabed hardness can also be read from the multibeam data, as the acoustic signal from an echosounder will be reflected differently from different kinds of sediment. These *backscatter* data are very useful when planning fieldwork, and they are the foundation for interpreting the distribution of seabed types.

Fieldwork in Søre Sunnmøre started in August 2014 and continues in August 2015. The RV “Seisma” has a crew of three, and is equipped with a sediment grab and a towed camera. Sigrid shows examples of the video recordings from the study area, which are primarily used to determine seabed type in order to interpret the backscatter and bathymetry data.

The distribution of different seabed types is relevant to seabirds if they feed on prey that is linked to specific seabed types. An example is the Sandeel, which requires sand. Sand fields off the coast of Søre Sunnmøre are of limited extent, and can be mapped very precisely from backscatter data. Other types of seabed are homes for other types of marine life. Sigrid shows video still images of rocky seabed types with sponges, of soft mud with Norway Lobster and of kelp forest growing on bedrock.

“When we have these more detailed maps based on the data we now are collecting, this will be a very useful tool for us to build other research upon.” Examples from the seabed in Søre Sunnmøre show how information from echosounder, video and grab samples come together in a marine base map that classifies the seabed into a set of defined seabed types that can later be translated into thematic maps for management and other interests.

This work is well under way now. NGU hopes to finish it by next year, and when it is finished, the maps will be published online for everyone to use as they wish.

Summary and conclusion

As noted in the Introduction there has been a dramatic decline in many of the seabird populations at Runde over the last 30-40 years. People who live in the area have started to notice that the Kittiwake and the Fulmar have disappeared from the bird cliff over the last 15-20 years. Although there has been an increase in the population of Gannets, Great Skuas and White-tailed Eagles, all the other seabirds such as Guillemots, Puffins, Shags, Kittiwakes and others that live off small energy rich fish in the pelagic zone are decreasing.

An ornithologist in the region, Alv Ottar Folkestad, has been following the seabird situation at Runde closely over the last 50-60 years and he can tell us that this is a long-term development which started in the beginning of the 1970s.

Already in 1972 there was a breeding failure of Kittiwakes and later in 1979 there was a huge breeding failure in the Shag population at Runde which was the largest Shag population in the world in 1975 counting 5,000 pairs. In the years from 1975-1979 the Shag population declined by two thirds (67%). From the beginning it was clear that these first breeding failures were caused by lack of food. Since this was not so long after the collapse of the Norwegian Herring stock, this was thought to be the main cause. However, other seabird populations at Runde thrived in the same period, so it was clear that alternative food sources also existed. The decline could not be entirely dependent on the Herring. Later the Herring stock in Norway was built up again... Alv Ottar said "*We hoped that when the Herring stock was back the seabird populations would recover, but they didn't!*"...

The situation at Runde is not a special case. A similar development has happened among seabirds all along the Norwegian coast, in the UK, in Iceland and apparently all over the North Atlantic.

Many of the speakers at the seminar have been referring in more detail to the following processes which seem to happen in many seabird species ecology in a whole range of colonies all over the North Atlantic region:

The seabirds (Kittiwake, Arctic Tern, Fulmar, Puffin, Guillemot, Razorbill etc.) which live off small energy rich fish (full of lipids) like Sandeels, Herring, Sprat and Capelin all appear to be in decline in England, Scotland, Norway and Iceland. The species which live off fish near the surface (the surface feeders) seem to be having the greatest problem (Kittiwake, Arctic Tern, Common Tern and Fulmar), whilst the diving seabirds like Guillemot, Razorbills and Puffins, are more resilient since they have a deeper water column where they can catch fish.

According to Alv Ottar Folkestad, the seabirds which live off fish bigger than 20cm seem to thrive and expand, not only at Runde but also in the North Sea and the Norwegian Sea region. This especially applies to the Gannet, and to a certain degree it also applies to the Great Cormorant. The southern continental subspecies (*sinensis*) of the Great Cormorant has recently moved in to the southern parts of Norway since 1997. In some areas, such as Runde, the Great Skua, and the White-tailed Eagle are continuing to increase.

The limiting factor seems to be the ability to find sufficient energy rich food in the breeding season. The seabirds need to find fish of the right size, and with the right proportion of energy to feed their chicks. This fish resource needs to be within the

right distance from the sea bird cliff. It needs to be within commuting distance from the colony/bird cliff. For the Puffin this means within 100 km from the breeding grounds. For other species it is a much shorter range. For the seabird parents the process of getting seabird chicks on the wing depends significantly on a very finely tuned energy balance (Gaston 2004).

Sea – Temperature: a common denominator?

Although there are many potential reasons for seabird declines in the region, such as by-catch, oil spills, environmental poisons, plastic pollution, overfishing etc, there appears to be *one common denominator, which applies to all the seabird colonies that have been discussed in this seminar, in all the different countries: the key here is the temperature of the sea.*

A slight temperature increase of the average sea temperature by about 1-2 degrees Celsius has had hugely negative consequences for the seabird colonies in Norway, UK and Iceland. In Iceland for instance, the increased temperature in the waters near the Westman islands has made the Sandeels almost disappear. When the Sandeels disappear, then the Puffin (as well as many other seabirds) eventually disappears.

The way that these small temperature changes in the sea affect the seabirds can, for instance, be through ecosystem shifts in the plankton communities. When *Calanus finmarchicus* decreases by 70% in the North Sea¹⁷, this might have huge consequences for the Sandeels.

Highlights from the discussion

(For a more complete account of the panel discussion: See appendix 1)

Interestingly, many of the most unexpected and exciting points appeared during the panel discussion at the end of the seminar.

Erpur Snær Hansen and Freydis Vigfusdottir contributed with some very interesting results from the seabird situation in Iceland. I will mention two of these results:

Firstly: The realization that Europe's biggest Puffin colony at the Westman Islands in south-west Iceland is going through some of the same declines as seabirds in Runde and Norway. This is a development that apparently has happened over the last 10-15 years. The reason for this is that the Sandeels have almost disappeared from the Westman Islands and the southern part of Iceland, a situation driven by the increasing temperature in the sea.

Temperature-driven ecosystem shifts seem to have happened in both the North and the South Icelandic waters. In the south- temperate zone, increased temperatures have led to a dramatic decrease in the significant planktonic Copepod *Calanus finmarchicus*, which has been linked with the reduced abundance of Sandeels. The Capelin and Krill-based systems which used to exist in the Arctic waters of the north coast of Iceland have, to a large extent, been replaced by a Sandeel-based system as a result of increased temperature. Although the situation is better for the seabirds in the north and north-east coasts of Iceland than in the south, the development in breeding success of many seabirds has also been surprisingly low here during recent years. (Freydis' Arctic terns)

¹⁷ We know its biomass has decreased by more than 70% since the 1960s.

Secondly: Very interesting results were presented by Dr. Erpur Snær Hansen when he showed a time-line series showing Puffin hunting in Iceland and the Westman Islands since the 1800's. In this material he demonstrated a similar decline in Puffin populations in the 1920s and 1930s (collapse in 1931) co-ordinated with similar increases in sea-temperature as we see today (collapse in 2004). His data also suggests a much earlier period with declines in Puffins as expected (collapse in 1891). This might indicate a cyclical change in sea temperature, although the decline in the 1920-30s was less extreme than what is experienced today.

Professor Sarah Wanless is more explicit than Erpur Hansen in her account of the situation for the Puffin in the UK in mentioning anthropogenic climate change as a significant driver behind the increased temperatures in the North Sea, with the indirect negative consequence this has had on seabird populations via corresponding declines in Sandeels and in *Calanus finmarchicus*.

Where do they go and what are they eating during winter?

Another exciting line of research deals with the seabirds' winter diet and their adult survival.

* Geolocators are small technical devices which can be attached to birds in order to map their geographical positions. These devices have gone through some technological changes lately that have made them smaller, lighter and cheaper, and generally much easier to use in ornithological research. Very interesting results are starting to emerge from researchers applying this technology. Two examples from the seminar are:

i) Sarah Wanless and Mike Harris's research on where Puffins from the Isle of May and the east coast of the UK go during the winter. A surprising discovery was that so many Puffins travelled far towards the west into the middle of the Atlantic Ocean, and even further west. (See Harris & Wanless 2011).

Another good example was referred to in:

ii) Magnus Irgen's presentation of results from the SEAPOP seabird research groups Sea-Track programme, especially the study where geolocators were used on Kittiwakes from Hornøya showing how these tiny gulls travel all the way to Newfoundland in order to feast on sea butterflies (winged snails), before moving on to other locations. These were new and highly intriguing results, which would be almost impossible to discover without geolocators.

*Another interesting hypothesis appeared in the panel discussion initiated by Alv Ottar when he questioned Tore Johannesen's (and other Sandeel experts) common assumption that Sandeels in the North Sea are unlikely to influence the breeding of seabirds at Runde. Alv Ottar questioned this notion and brought forward the point that we know little about where the seabirds from Runde are distributed during winter and even less about where they are during the preparation period before they appear at the colonies in the spring to breed. Surely they could be as far away as the Viking bank (Vikingbanken) and beyond in the North Sea?

Tores reply was that Sandeels are buried in sand for the whole of the winter, except during a short period at the turn of the year where they are spawning. The Sandeels emerge again from the sand in mid-April.

So, this makes it highly unlikely that seabirds from Runde can reach any Sandeels at Vikingbanken or other Sandeel grounds in the North Sea before April.

However, at this point, Sarah Wanless revealed some extremely interesting results from her and Mike Harris's recent investigation of the winter diet in Puffin stomachs from the Faroe Islands (where they still hunt Puffins, so the birds' stomachs are readily available to investigate).

The surprising result they found was that Sandeels made up a very high proportion of the Puffin's stomach contents during winter in November and December. She also told us that the Faroes are an important wintering area for Puffins from Norway and the North Sea.

Tore asked whether it was certain that it was the species *Lesser Sandeel* which they found in the Puffin's stomachs and Sarah confirmed that this was the case.

I think this last point is a good example which confirms the relevance of much of what has been said in the seminar about how important it is that people with different backgrounds start to talk to each other and co-operate. Here we saw a very concrete example in the discussion between ornithologist Alv Ottar Folkestad and Sandeel expert and marine biologist Tore Johannesen and seabird ecologist Sarah Wanless. Discussing from their different experiences, data and knowledge and coming up with new surprising findings during the discussion. (For a more detailed account of the discussion the reader can find a transcription of the panel discussion in *Appendix 1*). New surprising facts emerged about possible unknown aspects of the Sandeel's lifecycle in the Faeroes, and also new surprising facts about the winter diet of Atlantic Puffins in the waters of the Faeroe Islands (Where many of the Puffins from Runde most likely spend the winter).

Conclusion

Factors omitted and some concluding remarks from other sources:

A quick glance at the information and discussion in a recent publication about the status and trends of seabirds in Norway from 2015 (Fauchald, Anker-Nilssen et al. 2015) tells us that a major issue, to a large extent, was left out of both the program and discussions during the seminar at Fosnavåg. We are referring to the so-called *top down effect*, or predation. Euan Dunn also commented on this in the discussions in the end of the seminar.

Traditionally ecologists have looked at food and the trophic level below an animal population as more important and basic for the animal's population dynamic than the level above, but this orthodoxy is possibly under some revision? However, it is interesting that when Fauchald, Anker-Nilssen et al. (2015) sum up what they believe to be the two main drivers behind the huge declines in Norway and Svalbard's seabird populations over the last 30 years, then *top down effect* (predation) is considered to be one of them.

They write:

We conclude that the two most likely candidates to explain the recent declines in Norwegian seabird populations are

1) Increased predation in the seabird colonies from avian and mammalian predators (Ravens, large gulls, White-tailed Eagle, American Mink and Red Fox is mentioned).

2) Eco-systemic changes affecting the availability of prey. The impact from these drivers might be difficult to document and even more challenging to control. In contrast, more easily managed anthropogenic stressors such as fisheries bycatch, pollution, hunting and disturbance have either been constant or have shown a decreasing trend. Although these drivers cannot explain the recent population declines, they certainly contribute to the cumulative impact on seabird populations and these stressors are therefore especially important to control and minimize in rapidly declining and threatened populations.

(Fauchald, Anker-Nilssen et al 2015:54).

In their review of diet studies, they emphasise the importance of the young age classes of *cod fish*, and of pelagic forage fish species in particular *Sandeel*.

But they also stress that; "...the differences in diet among ecological groups (ecological groups of seabirds: See footnote 14) combined with the fact that declining seabird populations were found in all regions and included all major ecological groups suggest that recent changes in Norwegian seabird communities cannot be explained by changes in the abundance of a single group of resources alone" (Fauchald, Anker- Nilssen et al 2015:3).

Some final concluding remarks

1). There was a general agreement about the usefulness of arranging meetings such as this (the seminar in Fosnavåg in April 2015) where researchers from different countries and from different disciplines come together to exchange ideas and talk face to face about a focused topic like this. All the speakers seemed to concur on that point.

One question we asked in the invitation to this seminar was: What do we know about the seabird situation? (and what do we not know?):

2). Most participants seemed to agree that a great part of the problems which the seabird populations are facing in the North-East Atlantic appear to be related to lack of sufficient food resources in the breeding season. It was also agreed that this situation, to a large extent, is most likely the indirect effect of a small increase of average temperature in the sea. The temperature increase brings about shifts in the plankton communities with effects for the fish that the birds are feeding on. In addition to this bottom- up effect and temperature-driven ecological regime shifts referred to above. Euan outlined 4 points (i, ii, iii and iv). He suggested these as being critical to our understanding of the seabird situation throughout the whole of the North Atlantic:

i) Top down effects (predation) of piscivorous fish

Predation from, for instance, Mackerel and Cod on the forage fish species the seabirds prey on during the breeding season. (This comes in addition to direct predation on the seabirds by mammals and birds, which is mentioned as a main topic in Fauchald and Anker Nilsen et al. 2015).

ii) Adult survival of the seabirds (a topic that has not been covered much in this seminar although it has been mentioned many times as an important

parameter).

iii) We need to learn more about the winter diet of the seabirds, and linked to this,

iv) Where are the Puffins (or seabirds in general) before they start to breed? Where are they during winter?

(The relevance of points iii, iv (and i.) from this list, was emphasised at the end of the panel debate (se Appendix 1) in some exciting exchanges between Alv Ottar Folkestad, Tore Johannesen and Sarah Wanless, where new unknown topics in Sandeel biology were addressed during the discussions).

Another question we asked in the invitation to the seminar was: What can we do about the situation? :

3). Since there was a general agreement among the speakers that increased temperature in the seas was most likely an important indirect driver behind a huge proportion of the seabird declines in the North Atlantic, many of the speakers expressed the following answer to this question:

Temperature and climate change are difficult to do much about (in the short term), so in this case, it's important to do something about all the other parameters on which it is possible to take remedial action in the short term. (This answer is also very much in accordance with one of Fauchald, Anker-Nilssen's (et al 2015: 54) concluding points above).

Marguerite Tarzia from Birdlife International showed us a range of different conservation measures that are being taken presently in Europe and the rest of the world. Some of the relevant parameters are:

- *Bycatch of seabirds* in modern fisheries
Birdlife International is involved in many initiatives aiming at reducing seabird bycatch (<http://seabirdbycatch.com>).
- *More restricted fishery conservation*
- *Marine Protected Areas* where the seabirds breed, and also where they stay outside the breeding season. (These protected areas are based on new research-based knowledge about the seabirds and where they go). Identification of marine IBAs (Important Bird Areas), or marine SPAs (Special Protected Areas) within the EU Natura-2000 network.
- Reduction in plastic pollution and other environmental pollutants etc.

*A third question asked in the invitation for the seminar was:
How can we communicate the message about the declining seabird populations to i) the public? and to ii) young people?*

This is an important question and we barely touched up on it in this seminar. Maybe this could be a topic for a future seminar at Runde Environmental Centre.

References

- K.H. Alfsen, D.O. Hessen, E. Jansen (2014) Klimaendringer i Norge
Oslo: Universitetsforlaget
- Coulson, J.C. (2011) The Kittiwake
London: T&ADPoyser
- Croxall, J. et al. (2012) Seabird conservation status, threats and priority actions: a global assessment
Bird Conservation International (2012) 22:1–34.
- Dunn, E. (2014) Puffins (RSPB Spotlight)
London: Bloomsbury
- Gaston, A.J. (2004) Seabirds A Natural History
Yale University Press.
- Mike. P. Harris & Sarah Wanless (2011) The Puffin
London: T&ADPoyser
- Fauchald, Anker- Nilssen, Barret et. al. (2015) The status and trends of seabirds breeding in Norway and Svalbard.
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APPENDIX 1:

Transcription of the Panel discussion

PARTICIPANTS IN THE PANEL: Euan Dunn (RSPB), **Alv Ottar Folkestad** (Ornithologist from Sunnmøre), **Erpur Snær Hansen** (South Iceland Nature Centre) and Professor **Sarah Wanless** (CEH Centre for Ecology & Hydrology)

Introduction by the discussions facilitator: Dr. Euan Dunn

(“To distil out a few essentials...”)

-What do we know?

-What do we need to know?

-What do we do about it?

How are we going to do this? We have had a very wide-ranging series of talks, it is challenging for us to digest these things in a relatively short space of time.

But one thing we will try to do is to reflect on the different situations we have heard from the different countries: Alv Ottar from Norway, Erpur from Iceland, Sarah from Scotland where most of the UK seabirds are, and myself from England.

What we will try to do is to look at the different situations we have come across and try to get some kind of commonality between them and maybe come to some few conclusions about what are the fundamentals.

From Sarah’s talk we heard about regional variation within the UK and how a lot of the different species are responding in different ways. The Kittiwake for example is clearly in a very bad way. In fact, all the surface feeders: the Arctic Skua, the Kittiwake and the Arctic Tern and Fulmar are the surface feeders that can only skim the Sandeels from the first metre of the water. They are the ones that are in the biggest difficulty. The ones that can dive deeper, like the Auks, have a slightly more varied diet (or a slightly more varied trajectory of fate if you like). So it is complicated, but it is nice if we can distil out maybe just a few essentials. Trying to find commonalities between the different countries, bearing in mind these limitations, between inter-country variations regionally and between species. So that’s what we are going to try to do.

We might also think a little about what we can do with that common information. Is there anything we can build on? Will we then have created some kind of platform from which we might be able to develop a bigger picture we can all work with?

Bearing in mind the limitations of all our working capacities and that we are not really committed to do anything. It’s more about trying to describe what can be possible if all the conditions were in our favour. So, with that, what I will do is to ask each of the panellists to give a short reflection on their own experience of the last two days and each of them will have about 5 minutes bearing on the theme that I just outlined.

Then we will open up the whole issue to discussion to see if we can get some of your feedback. To see what the way forward might be. So with that I think I will ask our most northern host Erpur to start us off.

Erpur:

Well thank you for that. Like you said, we have been over a lot and I only spoke about the situation in Iceland and I think those long-term data are quite interesting in giving us this long term perspective meaning that these things can be repeated. Certainly these stocks don't stay forever the same. For example the Mackerel is not doing this for the first time at all. When the sea temperature reached 9 degrees this species really rocketed in Icelandic waters in the 1920s, 30s and 40s. We do know a lot about the changes in seabirds particularly here in Norway and England, less so in Iceland unfortunately... But I think the knowledge is very good. What really causes these changes is really where the focus should be, and that is what we have been trying to tell you about from our own perspectives I guess. It is the Sandeel (tobis/sil) which is the key species as you know in the North Sea and Iceland where the Capelin (lodde), but Norway is more dominated by the Herring and in the US you have a Herring, Capelin and Sandeel system as well which we also should learn a little bit from.

Temperature is really a key thing here, and there has been a lot of work on Sandeels, but also on Herring too. One thing is sure that comparative studies in the North Sea with the Faroes and Iceland, for example you have different natural histories, there is a long wintering period in Iceland, which might make them more vulnerable to temperature change, while in the Faroes and the North Sea, they have longer growth time and can buffer any increased heat. Those are different temperature regimes. What I understand is there is a temperate mismatch here for why the Puffins are not being fed. In Lofoten there has been breeding failure of Puffins for over a decade even if the Herring stock now should be big enough. There should be enough fish around and this has to do with temperature for sure. Even if you are interested in seabirds the answers are probably eco-physiology I am afraid. Well, part of the answers at least.

What to do about these things ...? I think you have probably done everything here in Norway that is possible. You are not killing these birds any more, that's a problem back home. They have reduced the catch quite a bit, but it's a question of ethics to keep on doing this while we are having these problems at these scales. It's also interesting to see the figures that were shown. The reduction of the Norwegian populations are quite drastic compared to ours, but I also fear that in Iceland there are so few counts so they actually are much higher. So that's one of our problems it is a very few people doing these things and a long time between the different counts. But overall, I think collaboration connecting temperature and fish biology together with seabirds is really good and it already happens. Norwegians have probably the best data (together with Isle of May) connecting survival with interesting environmental features, and also to understand what is happening in the wintering grounds. So what to do about these things is a really a tough question because I don't think there are many solutions. If the Faroes were getting rid of the brown rat it would help a lot but... People are also a problem so? The Sandeel is a key species there (In the Faroes) nothing else. I think we are on the right path of trying to comprehend what is going on. *This is becoming a great concern because people like seabirds, they are very spectacular these colonies and they are all going down so it's a great concern about global warming etc. but I think we just draw the line there.*"

Euan:

That is very helpful to start with and I think you have posed a challenge there to Alv Ottar in saying that pretty much everything has been done in Norway. Maybe you would like to respond to that Alv Ottar?.. and then we go to Sarah?

Alv Ottar:

I have happened to be on this theme from the very beginning in Norway back in the 1970s and the first tiny attempt to monitor seabirds in Norway, particularly so on Runde and Røst. Then we looked to UK and partly to Canada so what we did then is what they had already done in the UK and on the opposite side of the Atlantic. So, I feel we built a lot of experience from before there. But what was clear then, after the very first years, was that the problem was the food. The lack of food for the seabirds. We concluded in Norway rather rapidly and this was also the conclusion in UK and Canada.

In Norway then this was also a rather short time after the collapse of the Norwegian Herring stock and so the picture was that this was the dire effect of losing the Herring stock, but for the colonies at Runde it was quite obvious at that time that there were alternatives (food) for the seabirds. The surface feeders were suffering but the ones diving for food were in a much better situation. But little by little the picture became more complicated: even the diving birds had problems, and when the Herring stock was built up once more we did not get a new increase: ***We hoped that when the Herring stock was back then everything should go right but it didn't!*** And that has been the situation later on. I think it's important to look at what has happened in the UK, in Iceland, and on the opposite side of the Atlantic. On the American side, because when you have things in common... We have to look for a common cause, there may be details locally and regionally, but the main thing is that something has to be in common. Therefore it is important to have gatherings like this and to summarise what we know in different parts of the North Atlantic and what is happening with our seabirds there and use the sum of the knowledge we have gathered over the years. But then I think we have much knowledge. I remember my time as a student at the university of Trondheim we had a teacher from Sweden called Kai Kurre Linddal, he was a lecturer for us there. He had been in Africa looking at what was going on there in nature management and he said "We know already more than enough to take measures if we are using what we already know"... We need more knowledge, but we still have more than enough to handle (act). By now, it is more than 40 years since then. I think we should think in that way even now. Of course, there are things we do not know, but there is a lot we do know. It is the question of how to collaborate and how to use the sum of what we know. I think we have the chance there.

Sarah:

Well, I think my two colleagues have said many of the things that I was thinking of saying. I think the first thing is, from what we have heard over the last couple of days, is just to be really impressed by how much we do know. We do know a great deal, and we know a lot in terms of changes in numbers. I mean, even in Iceland I would say it is actually pretty impressive given the scale that you are working on. We are tracking changes in numbers and we are doing a pretty good job in terms of tracking changes in productivity. It does concern me that we have to know enough about the survival of these birds and I think that this may be a gap we need to recognize and try getting better information on survival because for a lot of these populations adult survival is a key part of what is going to tell you about those population trajectories. I think the other thing, also, that did come out is just the importance of food and what the birds are actually eating and some of the things we just heard after lunch in terms of what is happening lower down in the food chain like Jellyfish and alternatively other predatory fish. We have not really talked about **marine mammals** very much over the last couple of days. So we have talked about seabirds as predators but we do need to recognize that there are other major predators in the system. Whilst we are concerned about climate and very often these bottom up effects we also have to

recognize there are other predators in the system and that they can exert major pressures.

My take home message from the last days is it's been great and we have had a good geographic spread. We are looking at birds through a whole lot of different marine systems. What we must not do is to be too focused on the seabird's side of things. All this time we have got to recognize what is happening in that wider system because some of that is going to be very influential. So, the challenge of that is that it is an awful lot of balls to have in the air at any one minute so what we are trying to do is very challenging. I think we have made huge progress in establishing some baselines, while I think these sorts of collaborations are joining things up, and by joining up then we create that kind of *synergy that adds value* and by joining up what we know which other parts of the system are really where we will make the progress and really get those insights which will then help us get it right.

Euan:

Sarah, that is very useful and I think you put your finger there on at least two gaps that we haven't properly drilled down to... *adult survival*, and the whole *top down issue*, which is suddenly one which we have not touched on very much at this conference. Although we just did have reflections from Johannes Hamre for this panel session, you were speaking precisely about top down there with the potential effect of a recovering Mackerel stock on spring Herring, and indeed we did hear that Sarah and I were in a meeting in December where one of the Fishery scientists was saying that the top down effect was absolutely critical for example in the North Sea where we have a recovering stock of predatory *gadoids* and pelagic fish like Mackerel, than the pressure on prey fish will become intense. Indeed it was, really to my understanding, the overfishing of gadoid fish in the North Sea which allowed this Sandeel fishery to really take off in the first place because they had what the behavioural ecologists call competitive release, they didn't have the predatory pressures bearing down on them, so that is certainly part of the equation. I am going to ask for one more reflection from one of our panel members and then we will open it up, but I will just ask Erpur to pick upon Sarah's point because I know you are quite interested in population dynamics... What Sarah said: We don't know enough about adult survival. Do you want to pick up on that Erpur from your Icelandic perspective?

Erpur:

Sure, we have poor data on survival ... it is sort of a hard one to pull off. Adult survival is difficult to deal with We do have some ringing data there which is hard to deal with it is gigantic and proportions of Puffin, which is the best one. It is going to be dealt with hopefully soon enough. But my feeling is that, and this is not only from Iceland but through my access and reading of the literature, although survival is most important for these populations, the variation is not that great in comparison to fluctuation in production. Sarah has actually shown us very nicely that there have been some survival changes in Puffins for instance. Very slow but long term lowering of survival and 1% increase in survival is huge... (It shortens their lifespan by years...) so it's a key measure to have, but my feeling is that the food and production of chicks is really what is driving this long term curve that I was showing you, spanning 100 years or so, rather than adult survival, but of course you can't tell. You can actually infer from the actually (temporal?) pace of the curve if it is survival or production, if it is survival or production which is sort of predominant, because if you lower survival, you really get the upper ledges down?? It is a long time to climb up, so the pattern would be a bit different which indicates that this is most likely production. But, it is such an important key parameter it really has to be measured. So, we are trying to face that fact and trying to get something done back home. But

we are few. Here in Norway though you are measuring survival from most species for most of your key colonies which is amazing stuff and this has been going on for decades, 30 years or more in the longest series, and I think it is becoming one of the most impressive datasets on earth on seabirds actually.

Sarah:

I do agree with that except; of what we do see when we are looking at our long term data, and I stress this is only from one colony from the Isle of May, but you can see it in quite a few other species, that yes, the survival rate tends to be consistently high and the amount of variation is reasonably small, but periodically you do see some really big decreases in survival, and the other thing that I think we ought to be doing a little bit more of is to link in more with statisticians and population modellers with very good quantitative skills. We have got some fantastic empirical data, we also then need to bring that together with some of the quantitative skills and do some models which are able, even with sparse data with gaps in them, to actually quantify some of those uncertainties. So, there are some things we know for sure, there are other things we are less certain of, but quantifying uncertainties, knowing what we are less certain about, is also really, really important. So, I think, bringing our empirical data together with cutting edge statistics and quantitative studies could get us forward and help us pinpoint where we should be looking in more detail, and as I said, quantifying uncertainty.

Euan:

Thank you Sarah, well, there you have had a good round of reflections from our panel. I think we could have continued this, but we don't want to internalize it within the panel...

So, I think that at that point, it would be helpful to hear from you what you have heard from the panel if this skims with your own thoughts? If you have additional thoughts to bring forwards?... Nils Roar Hareide has, throughout this meeting, constantly said that the Sandeel is a long overlooked issue in Norwegian waters and he feels that more needs to be done maybe we could put some flesh on the bones of that? What is it exactly we need to have done if it is an alternative prey for spring Herring? I don't know, but there are some things that have come up as constant themes over the last two days that some of you wish to pick up on so the floor is open...

Tore:

(**Tore Johannesen:** Seniorresearcher at Institute of Marine Research in Norway)

I have been working on Sandeels for many years and I have actually been responsible for Sandeels from the Norwegian side and there is one thing that is important, and that is you have Sandeel grounds in the North Sea and they are actually quite far away from the Norwegian coast. The closest is Viking Banken, and that was depleted already around 1980. It was out of the fisheries until the middle of the 1990s, and then it was depleted again. That is the closest Sandeel ground. So I don't agree with my dear colleague Johannes Hamre that fisheries are the main problem for seabirds along the coast. What we have seen is you need local parents to have good recruitment. Every time you fish down a Sandeel ground, you have... even though there are Sandeels on closely situated Sandeel grounds, you see that they have recruitment failure on the one that was depleted.

So the reason for this, and we also have data to suggest that it is the reason, that is you have homing in the Sandeel larvae. Then you have local stocks of Sandeel along

the coast here and these are not recruited, there is no evidence to suggest that these are recruited from the North Sea. So, that means that we have to manage these local stocks that we don't have a fishery on. So, if these stocks collapse there must be other reasons and what we have seen is that around the year 2000 we have evidence from our waters in the south coast of Norway, but also in the North Sea, we had huge recruitment problems. (...) And we also see changes in the plankton community. *Calanus finmarchicus* which is one of the most important species in this system has decreased dramatically in the North Sea, particularly in the northern part of the North Sea. This corresponds with what has been mentioned here earlier today. The northern area of the North Sea seems to suffer more than areas further south.

Obviously the reduction in *Calanus finmarchicus* will affect your recruitment. But there is also another group of plankton that has been reduced *Pseudocalanus* and *Paracalanus*, they have also been reduced substantially and they are also very important for recruiting fish. And you see there have been environmental changes, increases in temperature that not only affect birds and fish directly it also affects competition in zooplankton and if we look historically we have seen this shift, repeated shifts that we can demonstrate that are probably a result of gradual environmental changes that suddenly induce shifts in the plankton community. And these shifts (influence... ?) high thropic levels.

So, when we have problems now along the coast of Norway, for me it seems likely that it is a result of shifts in the plankton community. We can't actually do much about it unfortunately. We like to solve the problems we are seeing but it's very difficult to solve these problems, but people like to do something but if it is not worth anything there is no reason why we should. So perhaps we should focus and inform about these things we are seeing, perhaps as a result of climate change (?) There is one thing we can do, and that is to reduce other environmental impacts because these shifts are probably the results of a sum of impacts, for instance nutrient loads in our waters combined with increase in temperatures, and also overfishing of planktivorous fishes can affect the competition of plankton. So we can't do much about climate change in the short term, but what we can do is to reduce, for instance, nutrient loads where this is a problem, and also reduce overfishing of planktivorous fishes. And I think it's very important to understand these mechanisms, and in order to understand these mechanisms it's also very important to study the local Sandeel stocks. So, I think it should be lots of focus on the local Sandeel stocks around the coast here, even though we can't do much about it. But we need to understand the mechanisms that are the most important thing in order to do something that will actually work. Thank you.

Euan: Thank you, that was very helpful. Nils Roar, would you like to pick up on that?

Nils Roar:

(**Nils Roar Hareide:** General Manager Runde Environmental Centre).

I agree with Tore on his last statement there. It is very important to gather the whole of our knowledge. I am a fishery biologist, so I see things from the sea and not from the bird side of it. The seabirds are part of the marine ecosystem. In order to understand the marine ecosystem you need to understand very many factors and you need to bring in people with different types of knowledge. You need geologists, you need oceanographers, and you need fishery biologists and social scientists to understand the fisherman and the fisheries as well as bird biology modellers. You

need to understand the fisheries. So all these are factors that we need to study and also we need the co-operation between these people working together -this is also very vital I think, to get an overview of what is possible. So, what I think we can do is to start a multidisciplinary programme. (Or interdisciplinary programme) and what we want to do here is to use the Runde area as a case study because now we have data, different types of data, but we also have these detailed maps showing the sea bottom, and then we can start to build here. In the middle of this we also have the bird-cliff, which is unique from many other places along the Norwegian coast. So that my idea, is what we think should be done, to develop this as a multidisciplinary programme with Runde as a case and to have co-operation along the North Atlantic and bring in all types of scientists from Norway and abroad.

Euan:

So, that is the challenge: to encourage this co-operation and it is probably beyond the scope of this workshop/ this seminar to think how that might happen but it's a name that we have to think about and how you actually can begin to implement such a co-operation around the Runde case. It does seem to me that what we have here is a complex of Nordic countries. It does seem that Runde, with its long history of observation, can act as a sort of focal point for that collaboration. Just how you build it is a sort of second order question that we need to come back to or at least aspire to.

Erpur:

It's sort of a comment really:

I thank Sarah again for pointing out the statistical side of life. It is more necessary now than ever. But what I think I would do in your case with Runde: I would actually go out with a camera this summer and try to **photograph the Puffins with bill-loads**, and you would get a really good prospect of what they are bringing in. This is working very nicely for us, and it is actually surprisingly little photographic effort. The work is actually in sorting out the good pictures from the bad. But I think it's worth trying to add this to your diet data. It multiplies your data tremendously. And it will be worthwhile getting a feeling if that is something you would like to do or not. That is my comment.

Euan: Would you like to respond to that Alv Ottar?

Alv Ottar:

I think Mr Ingar from the audience could comment on that. He has been photographing here for the last few years. (...) But, the terrain in Runde makes some challenges to get the right angle of the light and there are very many problems with the birds coming straight in to their burrows among the boulders. They come in at a terribly high speed and are disappearing in the next moment -they are not sitting down and showing the catch. So, there are some practical problems but I think Ingar is working with it and he has already got some experience and I think also some thoughts on how to do it.

But I had another comment for Tore ... he and a lot of others say that the Sand-eels in the North Sea could not influence the breeding on, for example, Runde. I will ask a question about that: What do we know about that? Because the preparation for the breeding season is not starting the day the birds are landing at Runde. They are rather slow birds to build up the resources to produce their eggs and to develop their motivation for breeding and they have to be somewhere when they are starting the

process. The question is: What do we know about where our seabirds are during winter time, and in this preparing period before they show up at the colonies. Once they are in the colonies then they are dependent on what they have in reach and at Runde it means mostly what they have within about 100 Km from the colonies into the fjords, along the coast or out in the sea. Everything for seabirds is starting in good time before they are back at the colony so then we need to know where they are starting and where they have their first building up towards the breeding season. We know at least that many of our seabirds may migrate down to the North Sea or west to the Faroe Islands, and even crossing the North Atlantic so it's a question about monitoring.

Tore:

Can I answer that?

Well, first of all I got the impression that the natural mortality of old birds is not that high. Is that correct? There could be locations where there is high mortality ... but if you look at the Sandeel during winter, except for a short period in the turn of the year, it is burrowed in sand. So they come out of the sand, typically in the middle of April that is, I guess, when the birds are here. So, I don't think it matters because they must feed on something else, except for those that can dive to the bottom about 60 meters or something like that. They come out of the sand mainly in April. There are hardly any huge fisheries before mid-April so I don't think it matters. The distance is too far, except for Viking Banken which is not that far. The drift of larvae... the coastal current and current systems will not bring the larvae into these waters when they are pelagic. The Sandeel larvae are pelagic for a period, but then they seem to return to their natal grounds to settle. There are problems with the fisheries and the Sandeel fisheries which have actually depleted most of the Norwegian Sandeel grounds and that is a really big problem, but I don't think this can explain the problems we have here with seabirds on the west coast of Norway.

Euan: I think Sarah will probably have some thoughts on this, because I happen to know that you have been looking at Puffin stomachs from the Faroes...

Sarah:

Well, I think these exchanges are really nice examples of highlighting some of the key questions that we really need answers to, and where we are getting at the moment is really work in progress. There are certain things we haven't been talking about over the last couple of days because we are all still sitting with data that we are actually analysing, so we are in this situation... So relevant to this discussion: A couple of years ago with Mike Harris we were in contact with people in the Faroes who were involved in that hunt of Puffins during the winter. They were shooting the Puffins, so what they kindly did was to take the stomachs out of those Puffins and then post them down to us in Scotland so we could have a look at what was in those stomachs. These were from Puffins wintering round about the Faroes. Most of the stomachs were from November, December time, so right in the middle of the winter. We know that quite a lot of Puffins from the North Sea winter around about the Faroes, as do quite a lot of the Norwegian Puffins, so, it's an important wintering ground for Puffins from a wide range of different colonies. One of the things, when we looked in those stomachs, is that there are a very high proportion of Sandeels in those stomachs in November -December!! We haven't got diving information from those birds that were being shot, but we have from some Puffins and what we know is that from that time of year, most of the dives Puffins do are very shallow. Most of the dives are less than 20 metres. So, again, that to us flags up some real questions.

Because you are absolutely right, fishery biologists tell us that Sandeels are not in those surface waters at that time of year.

Tore: Except for spawning.

Sarah: Would they be up at 10 meters in November - December around the Faroes for spawning? For Puffins to catch them?

Tore:

I think if there were a lot of Sandeels in the water column at that time of year, it would certainly be those they would be fishing.

Sarah:

But there are lots of things we don't fully understand. There are Puffins there, and a very large proportion of their stomach content is Sandeels and if you look at the biomass of those diets, then Sandeels figure from those Puffins wintering around the Faroes. So, the question for us is how are those Puffins actually catching these Sandeels in the winter? To me this flags up that there are still many things we don't understand about Sandeel biology.

Tore:

Can I ask one question? Are you certain that this is *Lesser Sandeel* and not one of the other species?

Sarah:

Yes, that is one of the things we looked at, of all the Sandeels that are in pristine condition they have all have been identified as *Lesser Sandeel*.

Tore:

Surprise, Surprise!!

Sarah: I know! Believe me, this surprised us and it wasn't just the Sandeels that were surprising, they were also periodically feeding on Polychaete worms (mangebørstemark) and that we were talking to a Polychaete specialist and again for him he just did not expect those worms to be up in those surface layers of the water. So, again we need to fill in the knowledge gap and find out more on what the birds are feeding on in the winter. Because we need to know that, but it also raises some surprises about the biology of some of these other prey species and of how they are behaving so there are an awful lot of quite fundamental things we still need to find out.

Tore:

Could I ask one more question?

What was the size? Could this be the 0- group, because the 0-group continues to feed until the autumn, so could this be 0- group?

Sarah:

You are asking the questions that we have been going through over the last time, because it has taken us several years to pull this story together, and to get things identified and ask all those questions. They are feeding on small fish, and small Copepods, including 0-group Sandeels, but in biomass terms the majority is those

much bigger fish, at least 1- group Sandeels and other fish that are also obvious. It's a combination of both.

We have to believe what came out of these stomachs. That's what is there. The sample size is over 100 stomachs from 3 different winters... (It was well over 100 stomachs so it was a big sample, compared to what we had before).

Euan:

I think we are not going to resolve this here, but I think it's a really important question.

Euan notes 3 topics that are critical to our understanding of the seabird situation over the whole of the north Atlantic:

- The top down effects of piscivorous fish
- Adult survival of the seabirds
- We need to learn more about winter diet of the seabirds.
- Where are they (Puffins/ seabirds) before they start to breed? Where are they in the winter?

A good example of the last point (point 3) was the anomaly that the Puffins in the Faroes are eating Sand eels that are supposed to be burrowed down in the sand at that time of year.

So I think these are very useful additions to the challenges that we have to distil out from this discussion.

Honoriea Hamre:

Which years are you talking about? Which three years did Sarah find the Sand-eels in the stomachs?

Sarah:

I think was 2009, 10 and 11. It is not the most recent years because it has taken a rather long time to try to pull all this together.

Hamre:

(Johannes Hamre has been working at the Institute of Marine Research in Bergen since the early 1960s with fish stock assessment and management. Especially has he been responsible for the pelagic stocks such as mackerels, herring and tuna.)

The question is actually quite simple. The question is: Is the reduction in Sand-eel population a result of the over exploitation? If it is caused by fisheries then we can do something. If it is not, if it is a consequence of the environment, then we cannot do anything, then we can sit on our back and just wait, but then we risk that if my view is correct... then the Cod and the Herring might be lost. So it is a question of the future of the Norwegian fisheries. If it is a consequence of environment, than we cannot do anything. But if it is a consequence of the fishery, than we can change. Thank you.

Euan:

Well that's a very clear binary situation...

Tore:

When it comes to the Sandeel in particularly the Norwegian sector of the North Sea it was definitely a very negative impact of the fisheries and because of that we have regulated the fisheries to rebuild the stocks of all known Sandeel grounds.

Unfortunately it is problematic because they don't spread. So even though you have lots of Sandeels in one area today they will not contribute to the recruitment of for instance, Viking Banken (another area that has been "fished down"). The answer to this: Is it the fisheries or is it environmental changes? In most cases it is both. We have strong influence on the environment and on the fishery activity, but there are also environmental changes, and what I don't buy: making the Mackerel the scapegoat (the problem), I think that is a far too easy way of thinking about ecosystems, and we are back again to the wolf and all the damage it does to nature, and I am afraid I don't buy that argument. I think we have to look at things in a more holistic perspective, not look at these direct impacts between the organisms (?!). That's why I asked about the rats etc. I don't think we should fish down the Mackerel, then we just keep on doing what we have done for hundreds and hundreds of years ... kill the one species we don't like.

Michael:

(**Michael Hundeide:** Runde Environmental Centre).

Well this comment is not directly related to the issue that is discussed here, it is more related to a comment Nils Roar had a while ago about using Runde and the seabird colonies as cases so I just wanted to emphasise Runde or seabird colonies also as cases of education and the communication of environmental science and general ecology. The suitability of using, for instance, Runde and the whole system at Runde as a case in education and to promote engagement. Because we have to remember that it is not only about the recruitment of different fish stocks, we also have to remember the recruitment of youngsters that want to go into the field of nature conservancy, or fishery biology also for that matter...

Nils Roar:

We have four teachers here. Let us hear their comments... Is that ok?

Euan:

Just while you are doing that.... Having gone up to the Runde mountain the other night and living at the centre for the last two days I really think all of the ingredients are here to make a fantastic showcase for youngsters, I can imagine you can have web cameras there on the cliffs, showing Gannet behaviour. There are so many things you could do with perhaps not a huge amount of investment.

Nils Roar:

Excuse me, they won't say anything, but they completely agree.

Euan:

So, if Runde wanted to develop, I am sure it would be a lot of things and help in a lot of things that I spoke about in my talk too. To help Runde, to do that, we could arrange exchange visits and share best practice as they say in the jargon. I can well imagine this being very easy and very inspiring for both of us. I can imagine, for example, the Herring film we saw last night being shown back in the UK, and causing a huge amount of interest and with parallels with lots of the things happening here. So I think that that would be a relatively easy thing to develop on the back of this seabird seminar. That is my feeling about that. I would encourage it.

Marguerite:

(**Marguerite Tarzia:** Birdlife International).

I just wanted to make a quick comment. The last two days have been so interesting. To see all the different work that's being done and while I realize there is a lot still to understand: the prey-predator relation, I think it is still important to remember that we are seeing massive decline right now. You can see it is happening, and so we can't lose sight of the need for action right now and part of that, as I was saying in my talk, are *Marine Protected Areas*. Not just within country boundaries, but also trans-boundary and also high seas. There are a lot of processes that are happening just now, so I hope that all the scientists and all the people that are here today who are tracking birds, who are working out where they are going in the winter, will participate in some sort of collaborative way of feeding into those processes. I mentioned in my talk about the Convention on Biological Diversity and the Ecologically and Biologically Sensitive Areas, the EBSA process is on-going. Scientists are identifying sites in the high seas that should then hopefully be protected in some way so please, it is a plea to all of you here that are involved in this work, to really think about what we can do right now with the information we already have, because I think it is really exciting the work that's being done. That's all.

Euan:

Marguerite, that's great, can you spell out what the acronyms are and where we are at it in terms of the international effort?

Marguerite:

OK, so the Convention on Biological Diversity has developed a programme called EBSA which stands for *ecologically and biologically sensitive area* and these areas are just for the high seas and they are holding regional workshops. So, last year there was one in the Mediterranean, and there has also been a workshop in the North East Atlantic, however that process happened in 2010 and the proposed sights did not go forwards. So it is stalled at the moment. Birdlife International is trying to reinvigorate the process and pull together new information on where seabirds are in the seabird component of this EBSA.

So we are looking, in the next year or so, into putting together information in the high seas in the North Atlantic, and I think much of the work that has been shown in the last two days could be extremely relevant.

Erpur:

As has been mentioned, this Norwegian Sea-Track programme that is putting out 10,000 loggers on seabirds in these 3 years, it is going to be a very impressive mapping of seabirds of different species. Birdlife should talk to the Sea-Track people, I think there is a databank there that you might get access too. This could be very interesting.

Euan:

Can I ask? The Sea-Track; there was a really good presentation we had just before lunch... (Magnus Irgens). The SEAPOP work at the Sea-Track, and it was quite a focus on web portals and websites and databases and things. When this is a 3 year study, I think you said, with the 10,000 loggers. Is there any intention of convening a collaborative workshop on the end of that study too? To distil that knowledge and how it can be translated into policy implementation because that is where the Americans say "the rubber hits the road". This is the kind of meeting here today that might make things like that happen in the future.

Erpur:

“I was in a meeting about this last November in Tromsø and it sounds like it is work in progress, so people will have rights of a sharing sense, but overall the ownership of the data belongs to the Sea-Track programme... (...) About a paper from Sea-Track work already being published.”

Euan:

I would like to hear a bit more from Nils Roar Hareide. If you could flesh out a little bit. You are looking for a multi-disciplinary cooperation? Using Runde as a sort of focal point or case study. I think it would be really useful and you might get some feedback from this gathering on how you might think that is going to happen. Who should lead on it? How would you develop that process of collaborative building? Do you have any thoughts on that because otherwise it will just hang in the air as a detached goal that would be nice to have, but I mean some ideas of how you would take that idea forwards? Because it is perhaps the critical next step apart from the data gaps and the knowledge gaps that Sarah has shown us.

Nils Roar:

There is a problem at least in the scientific world but also maybe in other parts of this issue. The fishery biologists and the bird scientists don't talk to each other. They don't belong to the same cultures, they are separate. Also administrative: the department of environment and the department of fisheries - they don't have a tradition to communicate, and I think the problem we have with the coastal Sandeel, why it was not investigated, is that it was not necessary for the fishery biologists because the fishing industry didn't need to know. The bird specialists and the birdwatchers need to know, but there was not enough communication so: Organize that communication much better into workshops and to meet that is one thing. Another thing we think is very important is, as we do now, to start with this map, the basic map, and we will build more and more information on that oceanography but also the knowledge of fishermen. Sigrid was sitting on Sunday with a fisherman with an excellent knowledge ... they totally agreed... To organize this exchange of information and to pull it together and also make people take the risk to work in a multidisciplinary way, work with things they don't know anything about. That's a big risk. To train people so that everybody will learn, and then to fill the gaps, the knowledge gaps together. I think that's a big issue... also there are others... Social scientists: they interview people about alcohol, drugs etc. There is enormous information out there among people about birds, fish etc.: To use these types of methods to get information and then analyse them in a good way. Then you need statisticians so you have to have all these groups involved at the same time. And then we have to join this congregation into one chapel.

Euan:

I think you have identified all the right actors, my only caveat or plea would be that you would have to give a group like that very specific questions, and not too many... one or two. So that the parameters of the discussion are very clearly defined because otherwise it will go off in all directions and you will not actually get so much out of it. If you put all of these people in a room and give them a very clear set of questions and a very small set of questions to address, then I think you will begin to develop that cross-fertilization of thoughts and knowledge sharing and things. I wouldn't leave it too open.

But if the Runde Centre wanted to put up such a collaboration as a first seminar that could be a good start, but with very ,very tight parameters, and very tight framework to get something out of it.

I know we have had a long couple of days and it has been very stimulating, we probably are running out of steam a little bit.

Alv Ottar:

I think I caught in the summary that to meet people face-to-face and to talk along the table or across the table is a very constructive way to change thoughts and to get knowledge, and the need of coming together. That is important. We can communicate electronically that is very efficient, but there is something in being present. (...) We have started processes and it's important to continue this now.

Sarah:

Well, funnily enough, I came to exactly the same conclusion, to some extent we talked a lot about climate change and one of the things we are very conscious about is not traveling too much and flying too much, but I think it is important to keep travelling and travel when you have the opportunity to interact with people because I hope the air-miles we have used have been worth using. So, I try not to use too many air-miles a year but I am really pleased this was a meeting where I used my part. ... Using those resources wisely and coming together in a very constructive way and to try to get as much out of it, existing information and new information and just try to create more than what was initially, that just must be the way forward.

Erpur:

I am lucky being the last, so people have pretty much told everything I was thinking of. It has been really fun being with you all and I share pretty much everything they said in terms of the excellent talks that we had. Quite diverse and a very nice setting as well. Beautiful place! I hope you enjoyed it as much as I did. Thanks everybody for being here.

Euan:

Great to have consensus, I just want to say something to Alv Ottar. I cannot agree more that face-to-face is important and critical and it's about 10 years ago now that we started the Advisory Councils in the EU. I sit on the North Sea Advisory Council in the Spatial Planning Working Group and I well remember the first day when the NGOs sat down with the fishermen and it was like you could smell the sulphur in the air, and after 10 years we don't agree about everything, we have our differences, but we talk to each other. We respect each other and we have a fertile dialogue, and we have learned a lot about each other's point of view and that has helped to find compromises and that could not have happened without sitting down around the table, going to the bar after the meeting, having a drink, just the one: "Because as you know fishermen don't like to drink!" ... (laughter) And it has been brilliant!

My only other thought is... coming from the UK, and from the European Union, I suppose where times have been a bit hard lately, we think of Norway as a sort of bastion of good sense and also with some resources to do things. We are in awe of your ability to be thrifty and to use money in a very diligent and careful way; we have seen the products of that. We have been driven around and we are enormously impressed by how everything seems to work beautifully, and all the resources that must have gone into constructing those bridges and those islands etc. It's fantastic, so I just think that... What I am getting around to in a round- about way is that, if you can persuade your politicians to invest just a small sum into this incredibly vital issue of conserving your marine heritage, the legacy for the children that come to Runde... those kids need to have a future and the same sort of chance to see Kittiwake colonies and Fulmars and all that we have done in our lives. ... Norway should be

investing in that, and that is one of the things that I feel strongly that is that everybody has a part to play in this and we need to help to get our decision makers involved through our children, through our teaching, through our workshops, everything. Try to get people to realize of what a vital importance this issue is. The loss of the seabird populations and the loss of the trophic food chain that supports them so... that's a little bit of rhetoric, but I feel it in here!

So, anyway, I will just personally like to say thank you to Michael and Nils Roar and those who helped to organize this meeting. I think it has been fantastic, and like Sarah I think it has been a very good use of my time, I feel very stimulated and inspired and I will go home with fresh thoughts and fresh energy to do things, so thank you for inviting me I am very grateful and I will finish by thanking the panel, who at relatively short notice have come up with all these relatively well formed sentences! We have had a good debate I think, so please join us thanking them.

APPENDIX 2:

List of Bird- and Fish names in English and Norwegian:

Birds:

Ducks and Geese /Ender og Gjess:

Brent Goose	Ringås
(Common) Eider	Ærfugl
(Common) Shelduck	Gravand

”Tubenoses”/Stormfugler:

(Northern) Fulmar	Havhest
Manx Shearwater	Havlire
Balearic Shearwater	Balearlire
Storm Petrel	Havsvale
Leach`s Storm Petrel	Stormsvale

Gannets/Suler:

(Northern) Gannet	Havsule
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Cormorants/Skarver:

(Great) Cormorant	Storskarv
European Shag/ Shag	Toppskarv

Birds of Prey/Rovfugler:

White-tailed Eagle	Havørn
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Skuas/Joer:

Arctic Skua	Tyvjo
Great Skua	Storjo

Gulls/Måker:

Black-headed Gull	Hettemåke
Common gull (Mew Gull)	Fiskemåke
Glaucous Gull	Polarmåke
Great Black backed gull	Svartbak
Lesser Black-backed gull	Sildemåke
Herring gull	Gråmåke
(Black-legged) Kittiwake	Krykje

Terns/Terner:

Arctic Tern	Rødnebbterne
Common Tern	Makrellterne

Auks/Alker:

Little Auk	Alkekonge
Great Auk	Geirfugl
(Atlantic)Puffin	Lunde
Black Guillemot	Teist
(Common) Guillemot / Murre	Lomvi
Brünnich`s guillemot /Thick – Billed Murre	Polarlomvi
Razorbill	Alke

Fish:

Herring
Sprat
Capelin

"Gadoids"

Cod
Saithe
Haddock
Pollock
Arctic Cod

Sandeel
Lumpsucker
Atlantic mackerel

Sild
Brisling
Lodde

Torskefisker

Torsk
Sei
Hyse/ Kolje
Lyr
Polartorsk

Slekt: Sil/ tobis

Rognkjeks
Makrell