THE SEABIRD GROUP

9th INTERNATIONAL CONFERENCE

SEABIRD POPULATIONS UNDER PRESSURE

1-3 SEPTEMBER 2006

ABERDEEN, SCOTLAND

Sponsored by

Programme

Friday 1 September 2006

1600 - 1900 Registration desk open in King's Conference Centre, set up posters

Registration includes menu choice for Conference Dinner, Booking for Monday field trip to inland NE Scotland including a whisky distillery)

1800-1900 Stand-up Buffet in King's Conference Centre

1905-1910 Welcome from Chairman

KEYNOTE – PERCEPTION OF A PRESSURE?

1910-1940 **Seabirds and marine mammals in the southern Bight, 1970-2005: major distributional shifts as a result of ... poor conditions elsewhere?**
Kees Camphuysen

1940 – 2025 BBC Film

2015-0100 Cash Bar in Crombie Hall

Saturday 2 September

0815 onwards Registration desk open in King's Conference Centre.

0900-0910 Opening of the Conference / Announcements

THEME ONE: FISHERIES INTERACTION

0910-0930 **New Zealand trawl fisheries and seabird interaction**
Christopher J.R. Robertson

0930-0950 **Patterns of attendance of seabirds at a research trawler in the Gulf of Cadiz, SW Spain**
Maria Mateos and Gonzalo M. Arroyo

0950-1010 **Comparison of seabird bycatch between the US sink gillnet and pelagic longline fisheries in the western North Atlantic**
Michelle Sims, Ramunas Zydelis, Daniel Dunn and Tara Cox

1010- 1030 **Conservation of albatrosses and petrels from South Georgia: population declines, overlap with fisheries and RFMO engagement**
Richard A. Phillips, Cleo Small, Janet R.D. Silk and John P. Croxall

1030-1100 Coffee/tea break

THEME TWO: CLIMATE CHANGE

1100-1120 **Ice seas and tysties: the decline of black guillemots due to the melting of the western Arctic**
George J. Divoky

1120-1140 **Links between climate change and the fuel loads of migrating European storm petrels *Hydrobates pelagicus***
Robert J. Thomas, Renata Medeiros and Mark Bolton

1140-1200 **Influence of ocean climate variability on kittiwake breeding success at Witless Bay, Newfoundland**
John Chardine and Greg Robertson

1200-1220 **How to deal with contrasting environments? A comparison of foraging strategies of Cape gannets from colonies within and outside an upwelling system**
Lorien Pichegru, Peter Ryan, Carl van den Lingen, Yan Ropert-Coudert and David Gremillet

1220-1240 **Changes in numbers and distribution patterns of seabirds in the North Sea: variability vs trends**
Stefan Garthe, Kees Camphuysen, Ulrike Kubetzki, Bettina Mendel, Henrik Skov and Andy Webb

1240-1355 Lunch in Elphinstone Hall

1355-1400 Announcements

THEME TWO: CLIMATE CHANGE (continued)

1400-1420 **Responding to environmental change: can a need for breeding synchrony in common guillemots (*Uria aalge)* limit individual plastic responses?**
Thomas Reed, Sarah Wanless, Michael P. Harris, Morten Frederiksen, Loeske E.B. Kruuk and Emma J.A. Cunningham

1420-1440 **Are the impacts of gulls and climate a serious threat on European storm petrel population in Brittany?**
Bernard Cadiou and Emmanuelle Cam

THEME THREE: MAMMAL PREDATION

1440-1500 **The impact of brown rats on Canna's breeding seabirds**
Bob Swann, David Aiton, Simon Foster, Kenneth Graham, Alan Graham, Andrew Ramsay and Alastair Young

1500-1520 **Canna Seabird Recovery Project - phase I: brown rat eradication**
Elizabeth Bell, Paul Garner-Richards, Kelvin Floyd, Bob Swann, Richard Luxmoore and Abbie Patterson

1520-1540 **Predation and the population status of sooty terns on Ascension Island following the recent feral cat eradication programme**
John Hughes

1540-1640 **POSTER SESSION**
Coffee/tea provided

1640-1700 **Spatial variability and heterogeneity in the distribution of individual quality in kittiwakes**
Thierry Boulinier, Elise Cellier, Rob Barrett, Karen McCoy, Julien Gasparini, Vincent Staszewski, Torkild Tveraa and Arnaud Grégoire

1700-1720 **Host specialization in the tick *Ixodes uriae* and implications for the ecological dynamics of seabirds**
Karen McCoy, Elodie Chapuis, Claire Tirard, Thierry Boulinier, Yannis Michalakis, Céline Le Bohec, Yvon Le Maho and Michel Gauthier-Clerc

1720-1740 **Recruitment in common guillemots**
Stephen C. Votier, Ben J. Hatchwell, Andrew Beckerman, Robin H. McCleery, Fiona M. Hunter, Jayne Pellatt, Mark Trinder and Tim R. Birkhead

1740-1800 **Towards a breeding seabird indicator for Scotland - modelling trends from the UK Seabird Monitoring Programme**
Matthew Parsons, Ian Mitchell, Adam Butler, Roderick Mavor, Norman Ratcliffe and Simon Foster

1900 onwards Cash Bar in Elphinstone Hall

1930-2100 Conference Dinner/Raffle in Elphinstone Hall

2100-0100 Ceilidh with The Flying Piemen

Sunday 3 September

0830 Registration desk open

0900-0905 Announcements

0905-0925 **How many "bad" years does it take to make a trend? Declines in productivity of a seabird colony in the Bay of Fundy**
Tony Diamond

0925-0945 **The German Bight: a refuge for kittiwakes in the North Sea?**
Nele Markones and Stefan Garthe

0945-1005 **Boom or bust: why do European shag populations crash so often?**
Morten Frederiksen, Francis Daunt, Michael P. Harris and Sarah Wanless

1005-1025 **Year round foraging behaviour of European shags from long-term logger deployments: identifying critical periods and pressures**
Francis Daunt, Sarah Wanless, Vsevolod Afanasyev and Janet R.D. Silk

1025-1125 **POSTER SESSION**
Coffee/tea provided

THEME FOUR: WINDFARM INTERACTION

1125-1145 **Environmental challenges and status report on North American offshore wind power as it relates to marine birds**
Richard Harris Podolsky

1145-1205 **Strategic surveys of seabirds in areas proposed for wind farms around the UK**
Andy Webb and Peter Cranswick

1205-1225 **Assessment of potential bird displacement effects arising from the construction and operation of offshore wind farms**
Henrik Skov, Ilya M.D. Maclean, Werner Piper, Mark M. Rehfisch

1225-1245 **Do offshore wind farms impact the distribution of seabirds? Results from investigations at two Danish wind farms**
Antony Fox and Ib Krag Petersen

1245-1400 Lunch in Elphinstone Hall

THEME FIVE: DISTURBANCE AND OTHER EFFECTS

1400-1420 **Ivory gulls in Canada in serious decline**
Iain Stenhouse, H. Grant Gilchrist, Mark L. Mallory and Gregory J. Robertson

1420-1440 **Interspecific interactions have major effect on great and arctic skua productivity on Handa Island**
Claire Smith and Trevor Jones

1440-1500 **Evaluation of the impact of ship traffic on sensitive seabirds, ducks and divers, in German waters**
Philipp Schwemmer, Bettina Mendel, Volker Dierschke, Nicole Sonntag and Stefan Garthe

1500-1520 **Not again! The effect of frequency of single-person approaches on the behaviour of wandering albatrosses at Marion Island**
Mariette Wheeler, Prideel A. Majiedt and Marienne S. de Villiers

1520-1550 Coffee/tea break

THEME SIX: CONTAMINANTS

1550-1610 **Patterns of mercury burden in the seabirds of Machias Seal Island, New Brunswick, Canada**
Alexander L. Bond and Antony W. Diamond

1610-1630 **Foolish foraging by fulmars contributes to ecological quality**
Jan-Andries van Franeker and SNS Fulmar Study Group

1630-1640 Close of Conference

LIST OF POSTERS

Foraging ecology and ecotoxicology in Southern Ocean seabird communities	Orea Anderson, Richard Phillips, Robbie McDonald, Richard Shore, Rona McGill and Stuart Bearhop
The SEAPOP programme - a milestone for the mapping and monitoring of seabirds in Norway	Tycho Anker-Nilssen, Robert T. Barrett, Jan Ove Bustnes, Kjell Einar Erikstad, Per Fauchald, Svein-Håkon Lorentsen, Harald Steen, Hallvard Strøm, Geir Helge Systad and Torkild Tveraa
Seabird numbers and consumption in the North Atlantic	Robert T. Barrett, , Gilles Chapdelaine, Tycho Anker-Nilssen, Anders Mosbech, William A. Montevecchi, Jim Reid and Richard R. Veit
Variation in nest attendance among years and colonies in the black-legged kittiwake *Rissa tridactyla*	André R. Breton, S. Dean Kildaw, Katie Murra and C. Loren Buck
A comparative analysis of surface wear on incoloy and darvic rings applied to juvenile and adult Atlantic puffins *Fratercula arctica*	André Breton, Antony W. Diamond and Stephen W. Kress
Assessing the impact of offshore windfarms on seabirds	Kate Brookes and Paul M. Thompson

Phenology of Balearic shearwater *Puffinus mauretanicus* along the Atlantic coast of the Iberian Peninsula.	David Cuenca, Gonzalo M. Arroyo, Antonio Sandoval and Carlos Noivo
The decline of the arctic skua on Fetlar: Using spatial analysis to evaluate the reasons for and effects of distribution changes between 1986 and 2006	Neil Dawson, Norman Ratcliffe, Malcie Smith and Colin D. MacLeod
Response to a chronic oil spill in Newfoundland – rehabilitation of oiled common and thick-billed murres	Helene Van Doninck and Eileen Gilbert
Demographic analysis of pelican populations in Greece	Aggeliki Doxa, Kostas Theodorou, Alexandre Robert, Dionyssia Hatzilacou, Giorgos Catsadorakis, Theodoros Naziridis, Harris Nikolaou and Alain Crivelli
Numerical trends of cliff-breeding seabirds in Iceland in 1985 to 2005 and a preliminary report of a new survey	Arnthor Gardarsson, Gudmundur A. Gudmundsson and Kristján Lilliendahl
Indices of abundance and migration timing from data collected by the offshore hydrocarbon industry on the Grand Banks of Newfoundland	Carina Gjerdrum, Greg Roberston, Shauna Baillie, and Urban P. Williams
Spring or winter menu? The impact of season on the diet of red-throated divers in the southern Baltic Sea	Nils Guse, Stefan Garthe and Roger Mundry
Population monitoring of seabirds on the Isles of Scilly, Cornwall	Vickie F. Heaney, Andy Brown, Leigh Lock and Norman Ratcliffe
Changes in wintering numbers of great northern divers in Shetland : 30 years of monitoring counts	Martin Heubeck and R. Mick Mellor
Results from European storm petrel monitoring on a Scottish island	Hugh Insley, Mike Hounsome, Steph Elliot, Kenny L. Graham
La Niña vs. El Niño: Differences in seabird abundance and utilisation of fishery waste in two fishing harbours in northern Chile between two different years	Jana Kotzerka, Stefan Garthe and Guillermo Luna-Jorquera
A seabird food consumption model for the North Sea: Who eats whom and how much?	Ulrike Kubetski, Kees (C.J.) Camphuysen, Robert W. Furness, Stefan Garthe and Mark L. Tasker
Trends in chronic marine oil pollution in Danish waters assessed through 22 years of beached bird surveys	Jørn Lennart Larsen, Jan Durinck and Henrik Skov

Different foraging strategies of endangered African penguins and Cape gannets facing limited food supply along the Namibian coast	Katrin Ludynia, Jean-Paul Roux, Jessica Kemper, Joan James, Rian Jones, Stefan Garthe and Benedict Dundee
Foraging behaviour and chick growth in Cape Gannets; the role of behavioural flexibility	Ralf Mullers, Rene A. Navarro, Les G. Underhill and G.Henk Visser
Fatty acid signature analysis: a new tool to describe seabird diets	Ellie Owen, Francis Daunt, Colin Moffat, Paul Thompson and Sarah Wanless
The recolonisation of mainland Ascension Island by masked boobies *Sula dactylatra* following eradication of feral cats	Tara Pelembe, Norman Ratcliffe, Mike Bell and Richard White, Sarah Sanders
Advanced methods for estimating daily survival rates of precocial chicks using live and dead encounter models implemented in the programme MARK	Norman Ratcliffe and Morten Frederiksen
Estimating abundance of seabirds with asynchronous laying phenology and high failure rates from nest counts: an example using Ascension frigatebird	Norman Ratcliffe, Tara Pelembe and Richard White
A heuristic comparison of the effects of mink management options on terns in the Western Isles	Norman Ratcliffe, Sugoto Roy, Clive Craik and Martin Scott
Modelling the effects of climate change on seabird distribution and population dynamics	Debbie J. Russell
Diet of great skuas on Handa Island, Sutherland 2003-2006	Claire Smith and Trevor Jones
Strategic aerial surveys for waterbirds and seabirds in UK inshore waters	Lucy Smith, Colette Hall, Jenny Worden, Anne L. Harrison, Lisa Allen, Gareth Bradbury and Peter A. Cranswick
Interactions between puffins and *Larus* gulls on Burhou, Channel Islands: the development of a management strategy	Louise Soanes, Phil Atkinson, Helen Booker, Jamie Hooper, Charles Michel and Norman Ratcliffe
Seabird attendance and behaviour: parental roles and responses to feeding conditions in common guillemots and razorbills	Chris Thaxter, Keith C. Hamer and Sarah Wanless
Distribution and abundance of white-faced storm petrels *Pelagodroma marina* in Victoria, Australia	Megan Underwood and Ashley Bunce

Modelling habitat preferences of albatrosses and giant petrels from South Georgia	Ewan Wakefield, Richard A. Phillips, Jason Matthiopoulos, Philip N. Trathan
Effects of radio transmitters on tufted puffin *Fratercula cirrhata* reproductive success	S. Erin Whidden, Cory T. Williams, Andre R. Breton and C. Loren Buck
Bird bycatch in coastal gillnets – local impact or significant threat to waterbird populations?	Ramūnas Žydelis, Michelle Sims and Mindaugas Dagys

Foraging ecology and ecotoxicology in Southern Ocean seabird communities

OREA ANDERSON[1], Richard Phillips[2], Robbie McDonald[1], Richard Shore[3], Rona McGill[4] and Stuart Bearhop[1]

[1] Queens University Belfast, School of Biological Sciences, 97 Lisburn Rd, Belfast, BT7 9BL, UK
[2] British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, UK
[3] Centre for Ecology and Hydrology, Abbots Ripton, Huntingdon, PE28 2LS, UK
[4] Scottish Universities Environmental Research Centre, Rankine Avenue, Scottish Enterprise Technology Park, East Kilbride, G75 0QF, UK
Email: oanderson02@qub.ac.uk

Although there has been some work describing pollutant burdens of seabirds in the Southern Ocean, the factors that drive both intra and interspecific variation in these burdens remain poorly understood. While it seems likely that differences in prey preferences and foraging locations among individuals/species are likely to play a role, the relative importance of each is unknown. We will combine stable isotope and conventional approaches to assess the importance of variables such as trophic position, foraging location and prey preferences in describing variation in tissue pollutant levels both within and between species. Pilot data demonstrate from the blood of adult petrels demonstrate that functional groups (as defined by morphology and conventional dietary analysis) within the Procellariiform community are separable using stable isotope analysis. Moreover stable carbon isotopes also give an indication of where individuals are foraging. The intention is to understand how changes in trophic position and community structure, associated with crashes in the krill population, may affect subsequent pollutant burdens of individuals both within and between species. The project will focus on heavy metals burdens of a number of Procellariiform species, mainly located at Bird Island, South Georgia and New Island in the Falklands. Further work examining the relationship between trophic positioning and Polychlorinated Biphenyls (PCBs) and Organochlorine (OCs) pesticides is also intended.

The SEAPOP programme - a milestone for the mapping and monitoring of seabirds in Norway

TYCHO ANKER-NILSSEN[1], Robert T. Barrett[2], Jan Ove Bustnes[3], Kjell Einar Erikstad[3], Per Fauchald[3], Svein-Håkon Lorentsen[1], Harald Steen[4], Hallvard Strøm[4], Geir Helge Systad[3] and Torkild Tveraa[3]

1. Norwegian Institute for Nature Research (NINA), NO-7485 Trondheim, Norway
2. Tromsø University Museum, Dept. of Zoology, NO-9037 Tromsø, Norway
3. Norwegian Institute for Nature Research (NINA), Polar Environmental Centre, NO-9296 Tromsø, Norway
4. Norwegian Polar institute, Polar Environmental Centre, NO-9296 Tromsø, Norway
Email: tycho@nina.no

SEAPOP (SEAbird POPulations), a new and long-term monitoring and mapping programme for Norwegian seabirds, was established in 2005. The programme aims to provide and maintain base-line knowledge of seabirds for an improved management of marine areas in Norway. The activities in the two initial years were restricted to the Lofoten and Barents Sea area, but the programme is designed for implementation on the full national scale within a few years. The work is organised and carried out by the Norwegian Institute for Nature Research (NINA) in close cooperation with the Norwegian Polar Institute (NP) and Tromsø University Museum. The data and knowledge is being organised for serving different users online via a SEAPOP web site.

The monitoring of population trends, reproduction, adult survival rates and diets of selected seabird species on the four previously established key-sites Røst (the SW tip of the Lofoten Islands),

Hjelmsøya (30 km W of North Cape), Hornøya (the extreme NE point of Norway) and Bjørnøya (i.e. Bear Island, halfway between the mainland and Spitsbergen) has been extended and further adjusted to meet the general design of the programme. In addition, two new key-sites have now been established, one on Anda in Vesterålen (between Røst and Hjelmsøya) and the other on western Spitsbergen. The latter was divided among several localities because there is no suitable single site in the area that holds a sufficient variety of breeding species. On the basis of time series that date back many years, a number of interesting trends for different species and parameters are now being uncovered, both within and between the colonies.

The programme represents a new initiative for the mapping and monitoring of seabirds in Norway, and also includes studies of seabirds at sea through participation on ecosystem surveys led by the Institute of Marine Research. The data analyses aim at developing further the modelling of seabird distribution and population dynamics from different environmental parameters and to explore the degree of co-variation across different sites and species. This is essential knowledge in order to distinguish man-made influence from that caused by natural variation.

Seabird numbers and prey consumption in the North Atlantic

ROBERT T. BARRETT[1], Gilles Chapdelaine[2], Tycho Anker-Nilssen[3], Anders Mosbech[4], William A. Montevecchi[5], James B. Reid[6] and Richard R. Veit[7].

1. Tromsø University Museum, Dept. of Zoology, NO-9037 Tromsø, Norway.
2. Canadian Wildlife Service, 1141 route de l'Eglise, PO Box 10100, 9th floor, Ste-Foy, Quebec G1V 4H5, Canada.
3. Norwegian Institute for Nature Research, NO-7485 Trondheim, Norway.
4. Dept. of Arctic Environment, National Environmental Research Institute, Frederiksborgvej 399, PO Box 358, DK-4000 Roskilde, Denmark.
5. Cognitive and Behavioral Ecology Program, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X9, Canada.
6. Joint Nature Conservation Committee, Dunnet House, 7 Thistle Place, Aberdeen AB10 1UZ, Scotland.
7. Biology Dept., College of Staten Island, 2800 Victory Boulevard, Staten Island, NY 10314, USA.
Email: robb@tmu.uit.no

We compared seasonal composition, abundance and biomass of seabirds between the northeast (ICES) and northwest (NAFO) Atlantic fisheries regions to identify differences in community assemblages and prey consumption. The abundance of birds was higher in the northwest Atlantic, but biomass was greater in the northeast. This disparity resulted from enormous numbers of little auks *Alle alle* breeding in West Greenland and of Leach's storm-petrels *Oceanodroma leucorhoa* breeding in Newfoundland, plus large numbers of non-breeding shearwaters *Puffinus* spp. entering southern NAFO areas in summer. The northeast Atlantic communities were dominated numerically by northern fulmars *Fulmarus glacialis* and large auks *Uria* spp. and the Atlantic puffin *Fratercula arctica*. Seabirds occupying the North Atlantic consume approximately 11 x 10^6 t of food annually. Overall consumption rates peak during summer as a result of increased breeding activity and seasonal movements of birds into the North Atlantic. Due to the higher biomass of birds in the northeast, consumption (mainly by piscivores) in ICES areas was approximately 20% higher than in NAFO areas where planktivores dominate. NAFO areas had, however, a much higher consumption rate per unit area than ICES areas. Comparative studies such as these could prove highly informative in assessing large predator responses to fisheries influences and ocean-scale climate change.

Canna Seabird Recovery Project - phase I: brown rat eradication

ELIZABETH BELL[1], Paul Garner-Richards[1], Kelvin Floyd[1], Bob Swann[2], Richard Luxmoore[3] and Abbie Patterson[3].

1. Wildlife Management International Limited, PO Box 14-492, Wellington, New Zealand
2. 14 St Vincent Road, Tain, Ross-shire, IV19 1JR, Scotland.
3. National Trust for Scotland, 28 Charlotte Square, Edinburgh, EH2 4ET, Scotland
Email: wmil@clear.net.nz

The seabird populations (in particular shag *Phalacrocorax aristotelis* and Manx shearwater *Puffinus puffinus*) present on Isle of Canna have been declining for several years. In addition to other factors, rats were identified as influencing this decline. The Canna Seabird Recovery Project, which was developed as a result of this information, is a three year project incorporating a brown rat eradication (Phase I) followed by long-term monitoring and quarantine and contingency for rats (Phase II) and long-term monitoring of the seabird populations (Phase III). The National Trust for Scotland contracted Wildlife Management International Limited to direct the first phase of the project, with the assistance of NTS volunteers.

The first phase of the project, the eradication of brown rats, was undertaken between August 2005 and April 2006. Over 4200 bait stations were established on a fifty to one hundred metre grid over the island (including rock stacks and steep cliffs). Cereal-based wax blocks (active ingredient diphacinone at 0.005% w/w) were used. Rats consumed over 500 kg of bait throughout the poisoning operation. It appears that the rat population was lower than suggested by earlier studies, but their distribution on the coastal slopes would have been having a significant impact on the seabird populations present on the Isle of Canna. Some of the offshore islets harboured rats, although some of the more sheer stacks did not. Interference of bait stations by non-target species was moderate to high, and bait stations required extra strengthening to exclude cows, ponies, sheep, rabbits and hooded crows.

From the intensive monitoring (January to April 2006) it appears that all rats have been removed from the Isle of Canna. However, long-term monitoring for a further two years will have to be completed by NTS staff and volunteers before the island can be declared rat-free. The complete removal of rats from the Isle of Canna will be a major achievement and will provide the opportunity to restore the seabird communities of the island.

Patterns of mercury burden in the seabirds of Machias Seal Island, New Brunswick, Canada

ALEXANDER L. BOND and Antony W. Diamond

Atlantic Cooperative Wildlife Ecology Research Network, Department of Biology University of New Brunswick, PO Box 45111, Fredericton, New Brunswick, E3B 6E1 Canada
E-mail: Alex.Bond@unb.ca

Mercury is a pervasive environmental contaminant, produced mainly anthropogenically and transported great distances atmospherically. It bioaccumulates, and is biomagnified through seabird food, resulting in reproductive and embryonic failure or malformation, sterility, and reduced hatching success and growth of chicks. Mercury levels have remained relatively constant in recent times in some Atlantic seabirds, while increasing in others, and some remain unevaluated. Since input of mercury must come from the diet, stable isotope ratios help to pinpoint the sources of mercury. Nitrogen stable isotope ratios can determine at what level in the food web an organism is feeding, while carbon stable isotopes reflect the source of nutrients as inshore carbon sources are enriched in ^{13}C when compared to offshore sources. The major excretory pathway for mercury is via feather

growth, and stable isotope ratios reflect the diet when the feathers were grown on the wintering grounds. Conversely, blood reflects the local diet while breeding. We measured mercury in feathers and blood in six species nesting on Machias Seal Island, Bay of Fundy, Canada. Each species has slightly different feeding habits, which permits sampling most of the marine food web. Razorbills dive deepest for fish, followed by Atlantic puffins, which also have a higher proportion of invertebrates in their diet. Common and arctic terns feed on shrimp and small fish near the surface. Leach's storm-petrels are surface plankton feeders, and common eiders dive for benthic mussels and echinoderms. While both tern species forage similarly during the breeding season, they segregate geographically and by trophic level during the winter. Since each of these species has different feeding habits and distributions, they are subject to differing mercury burdens throughout their annual cycle. Using stable isotopes to reconstruct the diet of these seabirds at different periods, we provide insight into how these species obtain and manage their mercury burden.

Spatial variability and heterogeneity in the distribution of individual quality in kittiwakes

THIERRY BOULINIER[1], Elise Cellier[1], Rob Barrett[2], Karen McCoy[3], Julien Gasparini[4], Vincent Staszewski[5], Torkild Tveraa[1] and Arnaud Grégoire[1]

1. Centre d'Ecologie Fonctionnelle et Evolutive – CNRS, UMR 5175, 34000 Montpellier France
2. Tromsø University Museum, Dept. of Zoology, NO-9037 Tromsø, Norway
3. Génétique et Evolution des Maladies Infectieuses, IRD - CNRS UMR 2724, IRD, Montpellier, France
4. Department of Ecology and Evolution, University of Lausanne, CH-1015 Lausanne, Switzerland
5. Norwegian Institute for Nature Research (NINA), Polar Environmental Centre, NO-9296 Tromsø, Norway
Email: thierry.boulinier@cefe.cnrs.fr

By definition, various factors can affect the phenotypic characteristics of individuals. Within a given breeding season, positive correlations between individual characteristics showing a high investment in reproduction have underlined that individuals can differ in what can be called 'quality'. Whatever the causes of these apparent differences, the spatial pattern of distribution of individuals of different levels of quality can have various implications. In particular, if individuals of better quality show better breeding performances relative to others in given environmental conditions, then an heterogeneous distribution of high quality individuals among breeding areas may affect (1) the pertinence of monitoring programs that do not account for such an heterogeneity, and (2) the evolutionary ecology of the use of conspecific performance (public information) in breeding habitat selection. After checking that mean egg size can be a relevant measure of individual quality in black-legged kittiwakes *Rissa tridactyla*, we investigated the spatial variability of mean egg size among study plots over 7 years within a large colony of this species. The analyses underline the usefulness of seabird colonies to investigate the various constraints and strategies involved in the response of animal populations to environmental variability at different scales.

Variation in nest attendance among years and colonies in the black-legged kittiwake *Rissa tridactyla*

ANDRÉ R. BRETON, S. Dean Kildaw, Katie Murra and C. Loren Buck

School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 245 O'Neill Building, 99775-7220, USA
Email: abreton@sfos.uaf.edu

Two popular assumptions are that seabird demographic parameters are colony dependent and that species comparisons are valid even when estimates do not account for among-colony variation. In order to assess these assumptions and their implications, we are investigating spatiotemporal variation in black-legged kittiwake (*Rissa tridactyla*; hereafter, "kittiwake") nest attendance – a behavioural parameter thought to reflect food availability and parental effort in seabirds. Individuals were fitted with radio transmitters and monitored using colony-based, automated, data-logging stations from 2001-2005 in Chiniak Bay, Kodiak Island, Alaska. Kittiwake colonies in Chiniak Bay are all within 24 km of each other suggesting a common food source and the possibility that they might share a common nest attendance pattern. After careful data screening, our dataset consists of 462,000 detections of 187 breeding kittiwakes at nine colonies. Here we report on preliminary, multiple regression analyses of two indices of nest attendance, proportion of time spent present and mean duration present at the nest, fitted to three non-explanatory (mechanism unknown) effects: year; colony; stage (incubation, early chick): in the full analysis, we will add clutch size, sex, nest success or failure, and corticosterone level immediately following capture. Employing AICc, model effect sizes and all possible models (interactions excluded due to sparse data), we found a biologically important and statistically significant effect of stage but only a weak colony effect (if any) on mean duration present: $\hat{\mu}_{duration}$ = 6.05 hrs ± 2.08, 0.98 SD across stages and colonies respectively from the top model (colony+stage, AICc weight = 0.52). The same analysis for proportion of time spent present at the nest weakly favored the colony only model: $\hat{\mu}_{proportion}$ = 0.44 ± 0.03 SD across colonies. Over the spatial scale of our study, results provide only marginal support that variation in nest attendance is a function of effects associated with the adult kittiwakes making up a particular colony. Similarly, an estimate of nest attendance from a single kittiwake colony may be enough to generalize to nearby colonies. In order to assess whether species comparisons and management decisions are sensitive to popular assumptions provided herein, we recommend that researchers propose and funding agencies support fewer short-term, single-site studies in favor of more collaborative multi-site or multi-regional studies.

A comparative analysis of surface wear on incoloy and darvic rings applied to juvenile and adult Atlantic puffins *Fratercula arctica*

ANDRÉ R. BRETON[1], Antony W. Diamond[2] and Stephen W. Kress[3]

1. School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 245 O'Neill Building, 99775-7220, USA
2. Atlantic Cooperative Wildlife Ecology Research Network and Department of Biology, University of New Brunswick, Bag Service 45111, Fredericton, NB, E3B 6E1 Canada
3. Seabird Restoration Program, National Audubon Society, 159 Sapsucker Woods Road, Ithaca, NY, 14850 USA
Email: abreton@sfos.uaf.edu

Often capture-mark-reencounter (CMR) models are used to analyze bird ringing data. CMR models share two mark-related assumptions: marks are not lost or worn to illegibility; and no heterogeneity in the detectability of individuals within groups. Data that fail to meet these assumptions can cause CMR results to be biased, e.g., estimates of survival confounded by ring loss or illegibility. These assumptions can be particularly problematic when studies focus on long-lived seabirds that use coarse nesting substrates, which can result in severe surface wear on rings. Using data from incoloy and darvic rings applied to juvenile and adult Atlantic puffins *Fratercula arctica*, we compared surface wear from abrasion against island bedrock using wear scores. These data were collected by three agencies at five breeding colonies on islands in the Gulf of Maine and Bay of Fundy in 2003 and 2004. Prior to analysis, our ring wear scores were reduced to two, worn or not worn: not worn = no wear, or some wear but all engraved characters easily read; worn = one or more characters difficult to read or obliterated. Using two data subsets and logistic regression, we fitted the probability of being worn to ring age, ring type and bird status (marked as juvenile or adult). One analysis considers our longest

running dataset – scores from darvic rings applied to juveniles and aged up to ten years post-application. Another analysis uses scores from darvic and incoloy rings aged up to five years from adults and juveniles. AIC_c and effect sizes provided strong support for all effects - ring age, ring type and bird status. As a consequence of delaying return to colonies and avoiding contact with abrasive bedrock for 2-3 years, estimated wear probabilities for birds marked as juveniles were delayed on both ring types by four years compared to birds marked as adults. For darvic rings applied to juveniles and adults, 25% and 87% were worn after five years respectively. In contrast, estimated wear probabilities for incoloy rings were reduced by 71% (juveniles) and 87% (adults) compared to darvic rings. Given their poor performance over five and ten years and to meet CMR model assumptions, we recommend that darvic rings be replaced with incoloy in studies of long-lived seabirds – especially those spanning more than about five years when rings are exposed to coarse substrates.

Assessing the impact of offshore windfarms on seabirds

KATE BROOKES[1] and Paul M. Thompson[1]

1. University of Aberdeen, Lighthouse Field Station, Cromarty, Ross-shire, IV11 8YJ, UK
Email: k.brookes@abdn.ac.uk

During the summer of 2006, two large wind turbines are to be installed 25km offshore, in the Moray Firth, Northeast Scotland. The turbines are situated further offshore and in deeper water than has ever been attempted before in Europe. This demonstrator project aims to further research on the potential for offshore wind power generation as part of the EC supported DOWNVInD project. One of the aims of this project is to understand the environmental impacts of deepwater windfarms.

Much of the previous work on windfarms both on- and offshore has focused on assessing the risks to birds of collision with the structures. However, where windfarms are situated in areas used for feeding, long term impacts may include disruption of fine scale movements related to foraging. Typically, good data are available on the large scale distribution of seabirds in UK waters, but limited information on the fine scale distribution or movements exists. To address this issue, several methods are being investigated with the aim of providing baseline data for comparison post-construction: 1. Boat-based surveys were carried out in spring 2006, on a 10km transect line and repeated six times over three months. These surveys provide high resolution data on the changes in distribution during the early breeding season and will be compared with data from the same transect and period collected in the year following turbine installation; 2. A marine surveillance radar installed on the Beatrice Alpha platform, overlooking the turbine site, to track bird movements through the area. The radar is capable of tracking birds under conditions when it would not be possible to use a visual observer, such as during hours of darkness. Commercially available software is currently being used, but several other methods have been trialled, as used by other researchers and as suggested by the radar manufacturers. The merits and constraints of these different techniques are discussed and initial results are presented.

Are the impacts of gulls and climate a serious threat on European storm petrel population in Brittany?

BERNARD CADIOU[1] and Emmanuelle Cam[2]

1. Bretagne Vivante - SEPNB, 186 rue Anatole France, BP 63121, F-29231 BREST cedex 3, France
2. Laboratoire Evolution et Diversité Biologique, UMR-CNRS 5174, Bât. 4R3, Salle 209, Université Paul Sabatier - Toulouse III, 118, route de Narbonne, F-31062 TOULOUSE Cedex 04, France
Email: conservation@bretagne-vivante.asso.fr

After a period of increase in the 1990s, the whole breeding population of European storm petrel *Hydrobates pelagicus* in Brittany was estimated to around 880 AOS in 2001-2002. However, a recent

decreasing trend was recorded and the latest estimate was 730 AOS in 2005. The decrease was mainly noted in the largest colonies, located in the Molène archipelago and holding 78% of the regional population. These colonies are well studied with regular monitoring (censuses and breeding biology) and annual ringing of chicks and full grown birds. Huge predation by great black-backed gulls *Larus marinus* occurred and 2500-3000 petrels have been killed over the last decade. Birds killed were prebreeding prospectors as well as local experienced breeders. The potential impact of predation on survival will be investigated using capture-recapture models. Climate changes can induce an increase in the frequency of adverse weather events during the incubation period, lowering annual production in burrows due to flooding or moisture after heavy rain. Climate changes also are suspected to induce fluctuations in marine food resources, pronounced interannual variability of laying phenology, and potentially variations in recruitment, intermittent breeding or survival of storm petrels. These several hypotheses will be discussed. As a planktivorous species, the storm petrel appears as a valuable sentinel species to study the impact of climate changes on the marine environment and the development of a coordinated research programme in the NE Atlantic should be considered as a useful tool for long-term ecosystem monitoring.

Seabirds and marine mammals in the southern Bight, 1960-2005: major distributional shifts as a result of ... poor conditions elsewhere?

KEES (C.J.) CAMPHUYSEN[1,2]

1. Royal Netherlands Institute for Sea Research, P.O. Box 59. 1790 AB Den Burg, Texel, The Netherlands
2. Dutch Seabird Group (sections *Marine Mammal Database*, *Club van Zeetrekwaarnemers*, and *Nederlands Stookolieslachtofferonderzoek*), c/o Ankerstraat 20, 1794BJ Oosterend, Texel, The Netherlands
Email: camphuys@nioz.nl

The causes of recent changes in seabird populations have been blamed on a number of factors, including climate change, fishing, pollution, development, and disease. In this presentation a number of historical and more recent changes in seabird and marine mammal abundance in the Southern North Sea will be evaluated in the context of local, regional, and international shifts in distribution and abundance. Several strong case studies will be presented, in which only a single (or dominant factor) influenced rather dramatic changes in abundance of a single or a few species. It will be shown that information must be derived from various sources, while looking at data from various angles. The importance of long-term monitoring programmes will be demonstrated. The results suggest that marine top predators are experts in the utilisation of even short-lived opportunities. Often, the cause and effect were clear. In some recent cases, however, marked shifts in the distribution and abundance of seabirds and marine mammals were much harder to explain from local conditions.

Influence of climate variability on kittiwake breeding success at Witless Bay, Newfoundland

JOHN CHARDINE[1] and Greg Robertson[2]

1. Wildlife and Landscape Science Directorate, Environment Canada, P.O. Box 6227, Sackville, New Brunswick, E4L 1G6, Canada
2. Canadian Wildlife Service, Environment Canada, 6 Bruce Street, Mount Pearl, Newfoundland, A1N 4T3, Canada
Email: john.chardine@ec.gc.ca

We have monitored black-legged kittiwake breeding success on two islands (Gull and Great) near Witless Bay, Newfoundland annually since 1990. Prior to this, published and unpublished data were available from 1969, 1970 and 1989. At this location, most seabirds rely on capelin to feed their

chicks. Black-legged kittiwakes experienced large variation in breeding success over this period, with high success seen in the early years, low success in the early-mid 1990s, and increasing success since then. Years of low breeding success were associated with late kittiwake breeding, very late capelin arrival inshore, a greater difference in the timing of kittiwakes and capelin, and high rates of egg and chick loss, some of which was caused by predation by *Larus* gulls. *Larus* gulls also experienced low breeding success in these years. In this paper we report the results of an investigation of the role of climate variability as an ultimate driver of this variation. Candidate independent variables were the state of the North Atlantic Oscillation (NAO) in the winter prior to breeding (Dec-Jan-Feb-Mar), depth-integrated sea temperatures in the vicinity of Witless Bay in the winter prior to breeding (Dec-Jan-Feb-Mar) and during the breeding season (May-Jun-Jul), and breeding-season air temperatures (May-Jun-Jul) and rainfall (Jul) at nearby St. John's airport. The dependent variable was the weighted average breeding success of Gull and Great Island kittiwakes measured as chicks fledged per nest. Independent variables all passed collinearity analyses. A stepwise linear regression analysis retained: (1) depth-integrated sea temperatures for Dec-Jan-Feb-Mar prior to breeding (standardised beta = 0.48, p = 0.003), (2) the state of the NAO for Dec-Jan-Feb-Mar prior to breeding (standardised beta = -0.448, p = 0.005), and (3) July rainfall (standardised beta = -0.308, p = 0.024), and the model explained 74% of the annual variation in breeding success. Poor kittiwake breeding success at Witless Bay was associated with colder water and a more positive NAO index in the winter prior to breeding, and higher rainfall in July.

Phenology of Balearic shearwater *Puffinus mauretanicus* along the Atlantic coast of the Iberian Peninsula

DAVID CUENCA[1], Gonzalo M. Arroyo[1], Antonio Sandoval[2] and Carlos Noivo[3]

1. Fundación MigreS. CN-340, Km. 96. Pelayo, Algeciras. Cadiz. Spain.
2. Terranova Interpretación y Gestión Ambiental S.L. Apdo. de Correos 1057. A Coruña, Spain.
3. Urb. Q. da Silvã, 132-5º D. 2350-106 Torres Novas. Portugal
Email: david.cuenca@fundacionmigres.org

The Balearic shearwater *Puffinus mauretanicus* is an endemic to the western Mediterranean where it breeds on the Balearic Islands. This species has a tiny breeding range and a small population that is undergoing an extremely rapid population decline. Last counts estimated a maxima population of 9,000 individuals and a breeding population around 2,000 pairs. This fact makes this species priority for conservation and it has been evaluated by BirdLife International as Critically Endangered (CR) using the IUCN criteria. Balearic shearwaters have a different migration pattern from other seabirds. Most birds leave the Mediterranean during June for a post-breeding moult in the Bay of Biscay, the main wintering area, though some remain in the Alboran Sea. Their migratory path is through the Straits of Gibraltar and northwards off the Atlantic coast of Iberia. They return to their breeding colonies during autumn and winter.

It is very important to know the phenology of their movements outside the breeding season as a fundamental part of the coordinated monitoring and conservation strategy. At the same time, we think that, due to the difficulty of making annual counts at the breeding colonies, systematic monitoring during migration in some fixed points of the coast can help to evaluate the population of this species in a reliable way. Moreover, a long-time monitoring from these places could give very useful information on population trend.

This poster reviews the phenology of Balearic shearwaters off the Atlantic coasts in its migration route. We have selected three spots: the Straits of Gibraltar (in the south of Andalusia, Spain), Ponta da Atalaia (in the north of Algarve, Portugal) and Estaca de Bares (in the north of Galicia, Spain). Using systematic counts we have made some figures with number of birds/hour as principal variable. Besides this, we discuss about the possibility of doing an estimate of the total birds passing during each migrating period in order to give a new way to approximate the total population of this species.

Year round foraging behaviour of European shags from long-term logger deployments: identifying critical periods and pressures

FRANCIS DAUNT[1], Sarah Wanless[1], Vsevolod Afanasyev[2] and Janet R.D. Silk[2]

1. Centre for Ecology & Hydrology, Hill of Brathens, Banchory AB31 4BW, Scotland
2. British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK
Email: frada@ceh.ac.uk

Winter presents temperate seabirds with a number of challenges to find sufficient food, including depressed prey abundance, increased daily energy requirements, higher frequency of extreme weather events and shortened daylength. Overcoming these constraints is critical to survival and future breeding. Recent technological developments have enabled year round foraging behaviour and location to be recorded in larger seabird species. We deployed location-activity loggers over two non-breeding seasons in adult European shags *Phalacrocorax aristotelis*, with the aim of identifying critical periods in the annual cycle for survival and future reproduction. In line with data from ringing recoveries, the birds remained in close proximity to the colony throughout the study period. In both years, foraging time was higher immediately after the chicks had fledged than during the chick-rearing period. This is likely to reflect parents regaining body condition lost during breeding, and weather and prey availability at this time may be important in enabling birds to prepare for winter. Foraging time declined markedly after this period, before increasing to a peak of over 90% of available daylight during the winter solstice in both years. Foraging time was particularly high during periods of onshore wind, suggesting that the high mortality recorded in this species during strong winds in winter is mediated through combined constraints on foraging time and foraging efficiency. In the first year of the study, daily foraging time during February and March decreased and was correlated with subsequent timing of breeding, such that birds that spent less time foraging bred earlier. This suggests that foraging efficiency was higher in early breeders, which accords with previous studies that have shown that high quality individuals breed early and more successfully. During the second year, foraging time in spring did not decline, but remained at the same levels as mid-winter. In accordance with this, a large proportion of the population did not breed, and the remainder bred later and much less successfully than the previous year. Furthermore, the foraging time of instrumented birds that did not breed was higher than those that did, suggesting that probability of breeding was linked to foraging efficiency. Thus, our results suggest that survival and breeding performance are driven by a complex interplay between environmental conditions and intrinsic ability on over-wintering foraging performance.

The decline of the arctic skua on Fetlar: Using spatial analysis to evaluate the reasons for and effects of distribution changes between 1986 and 2006

NEIL M. DAWSON[1], Norman Ratcliffe[2], Malcie Smith[3] and Colin D. MacLeod[1]

1. Department of Zoology, University of Aberdeen, Tillydrone Avenue, Aberdeen, AB24 3EE, Scotland
2. Royal Society for the Protection of Birds, 10 Albyn Terrace, Aberdeen, AB10 1YP, Scotland
3. Royal Society for the Protection of Birds, The Baelans, Fetlar, Shetland, ZE2 9DJ
Email: neilm_dawson@yahoo.co.uk

The UK is at the southern limit of the arctic skua's global range. Complete censuses of the UK population reveal a decline of 37% between 1985 and 2001 to 2,136 apparently occupied territories. Eighty to ninety percent of these birds nest on the Northern Isles and the fall has been more dramatic at some traditionally large colonies. The major reasons put forward for the decline are reduced food availability and competition for territory with increasingly abundant great skuas. Abundance and productivity of host birds around the Northern Isles, such as arctic terns, has been low in recent years due to poor sandeel availability. The kleptoparasitic feeding habits of arctic skuas are inflexible compared with those of the larger great skua, which takes advantage of fisheries discards and may

prey on both adults and young of a number of seabirds. Great skuas arrive back on territories earlier than arctic skuas and are rarely displaced once established. In this study, the colony on Fetlar will be used as a case study of changes in population and range. A full census of breeding skuas on the island will be undertaken in 2006 and nest locations for each census of both species plotted using GIS. The relationships between changes in the arctic skua population between census dates, great skua abundance and food availability (inferred from host birds) will be analysed. The objective is to evaluate the role of changes in host availability and increasing range of great skuas in the local contraction of range and decline in status of the arctic skua.

How many "bad" years does it take to make a trend? Declines in productivity of a seabird colony in the Bay of Fundy.

TONY DIAMOND

Atlantic Cooperative Wildlife Ecology Research Network, University of New Brunswick, Fredericton N.B., E3B 6E1, Canada.
Email: diamond@unb.ca

I describe some results of 12 years of research and monitoring of most of the seabird community on Machias Seal Island, Bay of Fundy, focusing on bird responses that are likely to reflect changes in the marine ecosystem. We track breeding success, chick growth, and chick diet in common and arctic terns, razorbill and Atlantic puffin. All these parameters varied from year to year, with occasional "bad" years, until 2001, when diet changed substantially. 0-group herring declined sharply in the diets of all four species, and have not (2005) returned except in razorbill. The other species now take increasing proportions of krill and hake/rockling. Chick growth and breeding success did not reflect the change in diet until 2004, when both declined sharply in both terns and less obviously in puffins. In 2005 puffins grew slowly and fledged late; examination of the full 12-year set of puffin fledging data showed the 2005 results confirmed the significance of a slight trend towards later fledging and poorer fledging condition that previously had been obscured by year-to-year variation. The overall objective of our research is to determine links between seabird biology and environmental change, so the ability to distinguish confidently between "noise" (year-to-year variation) and "signal" of longer-term changes is integral to achieving this objective. I discuss some of the ways we are exploring to achieve this and the degree of confidence we can have in our success.

Ice Seas and tysties: the decline of black guillemots in the melting Western Arctic

GEORGE J. DIVOKY

Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, AK, 99723 USA
Email: fngjd@uaf.edu

The black guillemots *Cepphus grylle mandtii* now breeding in northern Alaska are the descendants of individuals that survived in a refugium in the ice-covered Arctic Ocean during the Last Glacial Maximum. Lacking nearshore demersal fish, important prey to subarctic *Cepphus* populations, the guillemots in the ice-covered Chukchi and Beaufort seas have been dependent on arctic cod *Boreogadus saida*, a species adapted to living near the underside of ice. Since the late 20th century the extent of the summer Arctic pack ice has been decreasing at a rate of nine percent per decade with the most dramatic decreases occurring in the Western Arctic. A black guillemot colony in northern Alaska that was growing and productive in the 1970s and 1980s began to decrease in size and productivity in the 1990s as pack ice began to retreat earlier during the August nestling period. In two recent years (2003 and 2004) the complete disappearance of ice from the foraging area during breeding forced parent birds to turn to less abundant and lower quality nearshore demersal fish. In both years wide-scale breeding failure occurred, including universal brood reduction and starvation of young in the nest. While black guillemots are struggling to breed successfully as the ice retreats, a subarctic species, the horned puffin, has expanded its breeding range northward in the last 20 years,

apparently benefiting from the decrease in pack ice and an increased abundance or availability of forage fish in the water column. Because the puffins compete with black guillemots for nesting cavities, their northward expansion has resulted in decreased guillemot breeding success as prospecting puffins displace eggs and kill guillemot nestlings. The rapid decrease in summer pack ice extent, which is both decreasing the preferred ice-associated prey and allowing the expansion of a nest competitor, will likely lead to reduced numbers of black guillemots in the near future.

Response to a chronic oil spill in Newfoundland – rehabilitation of oiled common and thick-billed murres

HELENE VAN DONINCK and Eileen Gilbert

Cobequid Wildlife Rehabilitation Centre, RR#1 Brookfield, Nova Scotia, B0N 1C0, Canada and Tri-State Bird Rescue and Research Inc.
Email: hvandoninck@cwrc.net

In November 2004, there was a mystery spill of oil near Placentia Bay, Newfoundland which resulted in the appearance of beached oiled seabirds. Species involved were primarily common *Uria aalge* and thick- billed *U. lomvia* murres. Dovekies *Alle alle*, and a long-tailed duck *Clangula hyemalis* were also recovered for rehabilitation. This paper will discuss the response, veterinary care, and rehabilitation of birds impacted by this chronic oiling incident. Topics of discussion will include measured parameters, presenting and release conditions, rehabilitation techniques and release rates of birds. Logistical issues encountered while responding to oiled wildlife in a remote location will also be outlined. This incident provided an opportunity for cooperation between industry and local and international organizations. Oiled bird response plans were activated and later evaluated by the involved responders. These efforts resulted in the overall successful rehabilitation (as measured by release rates) and release of murres affected by chronic oiling in the North Atlantic Ocean.

Demographic analysis of pelican populations in Greece

AGGELIKI DOXA[1], Kostas Theodorou[2], Alexandre Robert[1], Dionyssia Hatzilacou[3], Giorgos Catsadorakis[4], Theodoros Naziridis[5], Harris Nikolaou[6] and Alain Crivelli[7]

1. Conservation des Espèces, Restauration et Suivi des Populations, Museum National d'Histoire Naturelle, UMR 5173 MNHN-CNRS, 55 rue Buffon, 75005 Paris, France
2. Biodiversity Conservation Laboratory, Department of Environment, University of the Aegean, University Hill - GR 81100 Mytilene, Greece
3. National Center for the Environment and Sustainable Development, Villa Kazouli, Kifissias Avenue & G. Lampraki 1, GR- 145 61 Athens, Greece
4. Dadia, GR-68400 Soufli, Greece
5. Vironia, GR-620 43 N. Petritsi, Greece
6. Society for the Protection of Prespa, Prespa, GR- 530 77 Agios Germanos, Greece
7. Station Biologique de la Tour du Valat, Le Sambuc, 13200 Arles, France
Email: doxa@mnhn.fr

European populations of Dalmatian *Pelecanus crispus* and great white pelicans *Pelecanus onocrotalus*, the only two species of pelicans present in Europe, are stable or declining, except for the Greek populations that is increasing. While ringing and monitoring programs have been undertaken since the early 1980s for several European colonies, no long-term estimations demography has been undertaken of these protected species. In this study, we use extensive data from marked individuals collected between 1984 and 2005 from two colonies of Dalmatian pelican in south-western and northern Greece (Amvrakikos Gulf and Lake Mikri Prespa respectively) in order to estimate age-dependent survival rates, through capture-recapture models. Moreover, we conduct a comparative analysis of annual breeding success and population trends for the two species, the Dalmatian pelican

being in allopatry in one colony and in sympatry with *P. onocrotalus* in the other colony. These estimations will allow us to conduct a population viability analysis and to propose specific measures for the conservation of the two species at a European level.

Do offshore wind farms impact the distribution of seabirds? Results from investigations at two Danish wind farms

ANTONY D. FOX and IB KRAG PETERSEN

Dept for Coastal Zone Ecology, National Environmental Research Institute, Kalo, Denmark
Email: tfo@dmu.dk and ikb@dmu.dk

From 1999 until 2005 a demonstration programme was carried out in Denmark with the aim to describe the environmental impact from offshore wind farms. Investigations of impacts on birds was part of this programme, including comparison of pre- and post-construction bird abundances and distributions in and around two wind farms, one at Nysted in the Baltic and one at Horns Rev in the coastal parts of the North Sea. Bird distributions were surveyed by aerial surveys. The investigations showed displacement effects on the distribution of divers, long-tailed duck and common scoter. These species utilised the area of the wind farms and their near surroundings to a lesser degree after the construction of the wind farm. No bird species could be confirmed to be attracted to the wind farms.

Foolish foraging by fulmars contributes to ecological quality

JAN A. van FRANEKER and SNS Fulmar Study Group

IMARES – Texel, PO Box 167, 1790AD Den Burg, Texel, The Netherlands
Email: Jan.vanFraneker@wur.nl

Indiscriminate foraging enables the northern fulmar *Fulmarus glacialis* to successfully exploit the variable food resources in changing marine environments. But flexibility can be taken too far. By the early 1980s it became evident that most fulmars in the North Atlantic and Pacific Oceans were flying around with man-made litter in their stomachs, in particular plastics. Ingested litter occasionally causes death through complete blockage of the digestive tract. However, indirect effects are of greater concern: decreased body-condition and the absorption of toxic chemicals will affect virtually all individuals. Ingestion of plastics is most pronounced in tubenosed seabirds worldwide, but they are definitely not the only ones to suffer from human wastes carelessly dumped into the oceans. Almost any group of marine organisms suffers from litter, through entanglement and ingestion. However, the fulmar is a 'convenient' story-teller. Firstly, the fulmar is extremely common over large areas. Unlike many other species, it does not regurgitate indigestible items, but accumulates them in the stomach, gradually wearing them down. Finally, the fulmar forages exclusively at sea. These characteristics make the species a convenient monitoring instrument, with stomach contents that reflect the litter situation in its foraging area.

International policy increasingly acknowledges the serious environmental and economic threats from marine litter. In 2002 the North Sea Ministerial Conference decided to tackle marine problems through the concept of 'Ecological Quality Objectives (EcoQO's)'. An EcoQO provides a monitoring system as well as a target for 'acceptable ecological quality'. For the marine litter issue, an EcoQO based on the amount of plastic in stomachs of beached fulmars was selected. The target for acceptable ecological quality has been (provisionally) formulated as "less than 2% of fulmars having more than 10 pieces (~ 0.1 gram) of plastic in the stomach".

Implementation of this 'fulmar-Litter-EcoQO' became possible in the EU project 'Save the North Sea'. Data from beachwashed fulmars collected during 2002-2004 show that, depending on location, 40% to 60% of individuals in the North Sea exceeded the critical value of 0.1 gram of plastic in the

stomach. Geographical patterns in different categories of plastic indicate shipping to be an important source. These results show that substantial additional policy measures are needed with a focus on particular sources of marine litter. At the same time, the message of 'birds with plastic in their stomach' is easily conveyed to increase public awareness and promote changes in behaviour. Thus, while fulmars are foolish foragers, by being 'quantifiable fools', they can contribute to improved ecological quality for the benefit of all.

Boom or bust: why do European shag populations crash so often?

MORTEN FREDERIKSEN, Francis Daunt, Michael P. Harris and Sarah Wanless

Centre for Ecology and Hydrology, Hill of Brathens, Banchory, AB31 5SS, UK
Email: mfr@ceh.ac.uk

Seabird populations are traditionally viewed as remarkably stable, at least in temperate shelf seas. However, European shags are notoriously more prone to crashes in breeding numbers than most other seabirds in the NE Atlantic, occasionally experiencing declines of up to 85% from one year to the next. Some of these crashes indicate non-breeding events, whereas others are caused by unusually high mortality of adults. The most recent crash in North Sea colonies occurred in 2005 and was preceded by large-scale mortality of adults. The speed at which populations recover from crashes depends on which type of crash has occurred. We use forty years of data on ringed shags from the Isle of May to estimate adult survival, calculate expected breeding population size from a matrix model and compare with observed population size, and thus attribute observed crashes to these two types. In the next step, we examine which environmental factors are linked to non-breeding and mortality of adult shags, and thus what causes the boom-and-bust dynamics typical of the species. We also evaluate whether the decline in shag populations in many parts of the UK over the last twenty years is due to an increased frequency or severity of one or both types of crashes, and explore underlying environmental reasons.

Numerical trends of cliff-breeding seabirds in Iceland in 1985 to 2005 and a preliminary report of a new survey

ARNTHOR GARDARSSON[1], Gudmundur A. Gudmundsson[2] and Kristján Lilliendahl[3]

1. University of Iceland, Institute of Biology, Askja Sturlugata 7, IS-101 Reykjavik, Iceland
2. Icelandic Institute of Natural History, P.O. Box 5320, IS-125 Reykjavik, Iceland
3. Marine Research Institute, Skulagat 4, IS-101 Reykjavik, Iceland
Email: arnthor@hi.is

Iceland supports very large populations of seabirds, in particular northern fulmar *Fulmarus glacialis*, black-legged kittiwake *Rissa tridactyla*, common guillemot *Uria aalge*, Brünnich's guillemot *Uria lomvia*, razorbill *Alca torda* and Atlantic puffin *Fratercula arctica*. A survey covering all bird-cliffs in the mid-eighties yielded total breeding numbers for the kittiwake, the two guillemots and the razorbill. Numbers of these species and fulmar were monitored at 5-10 year intervals on two cliffs, Krisuvikurberg and Hafnaberg, in SW-Iceland, and one cliff, Skoruvikurbjarg, in NE-Iceland. The cliffs were selected for accessibility and because they are at opposite sides of Iceland, separated by 600 km along the coast, and surrounded by boreal Atlantic and cold Arctic waters, respectively. These counts were supplemented by repeated counts at Snæfellsnes, W-Iceland, and Drangey, NW-Iceland. Three patterns emerge from the counts: common guillemot and razorbill were stable or increased slowly up to 1999, but in 2005 both were at very low levels both on the SW and NE cliffs. The low numbers of common guillemot and razorbill in 2005 coincided with a curtailed migration of capelin

Mallotus villosus and an apparent crash in sandeel *Ammodytes marinus*. Numbers of kittiwake varied regionally, they trended up in SW Iceland where comparatively low levels had been noted in 1985, but at Skoruvik in the NE, kittiwake numbers were at first relatively high and crashed in 2005 to about a quarter of previous levels. Fulmar and Brünnich's guillemot decreased in both regions throughout the period, the fulmar at a rate of 2-3% per annum, the Brünnich's guillemot at nearly 7%. The long-term decreases of these two species are presumably caused by large scale changes in their food supply associated with global climatic change. Studies in progress include a repeat survey of all bird-cliffs in Iceland using a combination of aerial photography and ground surveys. In 2006, the SW and W coasts were surveyed, including the Vestmann Isles and Látrabjarg. We hope to complete the survey in 2008 and, at the same time, to improve food web studies and monitoring programmes.

Changes in numbers and distribution patterns of seabirds in the North Sea: variability vs trends

STEFAN GARTHE[1], Kees Camphuysen[2], Ulrike Kubetzki[3], Bettina Mendel[1], Henrik Skov[4] and Andy Webb[5]

1. Research & Technology Centre (FTZ), University of Kiel, Hafentörn 1, D-25761 Büsum, Germany
2. Royal Netherlands Institute for Sea Research, P.O. Box 59, NL-1790 AB Den Burg, The Netherlands
3. Leibniz Institute for Marine Sciences, Dept. Fisheries Biology, Düsternbrooker Weg 20, D-24105 Kiel, Germany
4. DHI Water & Environment, Agern Alle 5, Hørsholm, 2970-DK, Denmark
5. Joint Nature Conservation Committee, Dunnet House, 7 Thistle Place, Aberdeen AB1 1UZ, UK
Email: garthe@ftz-west.uni-kiel.de

The distribution and abundance of seabirds in the North Sea has been studied intensively over the last few decades. Data from ship-based surveys are collected in a standardised manner and stored since 1991 in the European Seabirds at Sea Database (ESAS). In the course of the EU project BECAUSE we are analysing spatial and temporal trends in seabird numbers in the North Sea as related to food consumption models for the upper trophic levels of the North Sea. The current ESAS database version 4.1 contains data from seabirds at sea counts over the period 1979 to 2004. Coverage of the North Sea over years and seasons was unequal. Annual distances travelled ranged from 4,407 to 301,293 km. Summer months have been studied much better than winter months. In some quarters in some years, hardly any effort at sea was done, while during some years the coverage of the sea was almost complete. No area of the North Sea was studied consistently, coverage was rather done in blocks of years; mainly because of funding possibilities and research interests. Because of the overall data background it was considered possible to estimate total at-sea numbers for the North Sea for each quarter of a year only for two time periods, 1979-1991 and 1992-2004. However, some sub-areas allow for more detailed considerations.

In this talk, the main focus is on numbers outside the breeding season. In a first analysis for the winter period, substantial declines were found for herring gulls and greater black-backed gulls, and less strong for northern fulmars. Numbers of common gulls and northern gannets did not change much.

The quality of the data and the stability of trends will be discussed in the context of natural variability in distribution and abundance patterns. Furthermore, possible reasons for the observed trends will be highlighted.

Indices of abundance and migration timing from data collected by the offshore hydrocarbon industry on the Grand Banks of Newfoundland

CARINA GJERDRUM[1], Greg Roberston[2], Shauna Baillie[3], and Urban P. Williams[4]

1. Canadian Wildlife Service, 45 Alderney Drive, Dartmouth, NS B2Y 2N6, Canada
2. Canadian Wildlife Service, 6 Bruce Street, Mount Pearl, NL A1N 4T3, Canada
3. Department of Biology, St. Francis Xavier University, PO Box 5000, Antigonish, NS, Canada
4. Petro-Canada, East Coast Operations, 235 Water Street, Scotia Center, St. John's, NL A1C 1B6, Canada
Email: carina.gjerdrum@ec.gc.ca

We used data collected from a fixed oil platform from 1999 through 2005 to evaluate annual attendance patterns of seabirds using the Grand Banks of Newfoundland, Canada. In general, three 20-min counts were conducted each day using a field of view of 180˚ and an unlimited observation radius. More than 130,000 birds were counted over this time period representing 25 species. Greater shearwaters arrived on the Grand Banks at the end of May and formed over 90% of the species assemblage during the northern summer (June – August). The relatively high numbers observed through the fall likely reflected non-breeders. Large numbers of black-legged kittiwakes arrived in late September and over-wintered through early January. More than 80% of all birds counted during the winter were black-legged kittiwakes. Northern fulmar were observed throughout the year, but were more common during spring and fall migration. Greater black-backed gull, herring gull, common murre, and thick-billed murre contributed a combined 8% to the overall annual count. Observations made from offshore oil platforms can be used to describe patterns of abundance, distribution, and migration timing, and to monitor the effects of ecosystem change due to offshore development and climate.

Spring or winter menu? The impact of season on the diet of red-throated divers in the southern Baltic Sea

NILS GUSE[1], Stefan Garthe[1] and Roger Mundry[2]

1. Research and Technology Centre Westcoast (FTZ), University of Kiel, Hafentörn 1, 25761 Büsum, Germany
2. Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, 04103 Leipzig, Germany
Email: guse@ftz-west.uni-kiel.de

So far information on the diet of red-throated divers outside the breeding season has been scarce or old. Thus, the analysis of a substantial sample of stomach and gut contents of by-caught red-throated divers from the Pomeranian Bight provided an excellent possibility to gain information on winter and spring diet of these birds. During migration the Pomeranian Bight holds seabird numbers of international importance and also hosts the largest numbers of red-throated divers in the German part of the Baltic Sea. Accordingly, a large marine reserve has been established. As food is assumed to be a key factor governing the distribution of seabirds the knowledge obtained from red-throated divers might lead to direct management obligations. The analysis comprised birds of one winter and two spring periods. The numerous samples allowed to analyse the composition of the at-sea diet of red-throated divers and to compare the results between years, seasons and sexes. In total, 11 different fish species from eight fish families could be recovered. While some fish species were consumed in similar amounts in all analysed periods, the consumption of zander *Sander lucioperca* and herring *Clupea harengus* showed pronounced seasonal changes. Overall, zander and ruffe *Gymnocephalus cernuus* representing the perch family were the most important prey during the investigated winter whereas herring was the top prey species in both analysed spring periods. The fish species consumed by the divers only comprised a fraction of the local fish fauna. The patterns found gave insight into the dietary choice of red-throated divers regarding abundance, habitat, behaviour and size of preferred prey.

Population monitoring of seabirds on the Isles of Scilly, Cornwall

VICKIE F. HEANEY[1], Andy Brown[2], Leigh Lock[1] and Norman Ratcliffe[3]

1. RSPB South West Regional Office, Keble House, Southernhay Gardens, Exeter, EX1 1NT, UK
2. English Nature, Northminster House, Peterborough, PE1 1UA, UK
3. RSPB East Scotland Regional Office, 10 Albyn Terrace, Aberdeen, AB10 1YP, UK
Email: vickie.heaney@rspb.org.uk

The Isles of Scilly form an archipelago of over 200 low-lying granite islands and rocks situated 45 km south-west of Land's End at the extreme south-west of England. The Isles support some 20,000 seabirds and with 13 breeding species is the most important site for seabirds in the south-west of England, representing a breeding seabird assemblage of European importance. They are the sole breeding locality of storm petrels in England and have internationally important numbers of breeding lesser black-backed gulls and nationally important numbers of shags and great black-backed gulls. In recognition of this seabird status, much of the islands' land area is designated as Sites of Special Scientific Interest (SSSI) and a Special Protection Area (SPA). The last full census of all seabird species was carried out as part of Seabird 2000, including the first full census of storm petrels and Manx shearwaters using daytime playback. This poster will present a preliminary analysis of the results of the 2006 Isles of Scilly Seabird Survey which includes the second full census of petrels and shearwaters to be compared to the baseline figures obtained in 2000. Changes in breeding populations for all species will be discussed in relation to Seabird 2000 data and previous studies of the islands' seabirds and in relation to possible threats. The results of this summer's survey will be a good indicator of the health of this natural environment, ensuring appropriate conservation and management continues so that the sites remain in optimum condition for wildlife.

This 2006 Isles of Scilly Seabird Survey forms part of the Action for Birds in England programme a partnership between English Nature and the RSPB, and is in collaboration with The Isles of Scilly Wildlife Trust and the Isles of Scilly Bird Group.

Changes in wintering numbers of great northern divers *Gavia immer* in Shetland: 30 years of monitoring counts

MARTIN HEUBECK and R. Mick Mellor

University of Aberdeen, c/o Sumburgh Lighthouse, Virkie, Shetland ZE3 9JN, UK
Email: martinheubeck@btinternet.com

In Europe, great northern divers winter along the Atlantic seaboard from Spain to Norway. Population estimates are uncertain for some regions, but 3,500-4,500 may winter in Britain and Ireland; breeding grounds are assumed to be in Iceland, Greenland and extreme north-eastern Canada. There has been no published European study of great northern diver wintering ecology, but in Shetland, with its rocky coast and deep water, birds are found in enclaves of suitably shallow, sheltered water. Few first-year birds are thought to over-winter and individual adults are believed to return to the same locations in successive winters. Due to their highly aquatic habits, the species has a high oil vulnerability index, witnessed by the numbers found oiled in recent inshore tanker incidents in winter. In Shetland, standardised counts of great northern divers were made before the opening of the Sullom Voe oil Terminal in 1978 and have continued since. In 1977, the Shetland wintering population was (almost certainly under-) estimated at 300-400 birds. The most comprehensive data are from the two former strongholds in north-east Shetland, Yell Sound (adjacent to Sullom Voe) and Bluemull Sound. Two major oil spills, and localised reductions in numbers have occurred in the past 30 years. Following the *Esso Bernicia* oil spill and other incidents in early 1979, 184 oiled great northern divers were found dead, 131 in Yell Sound and most of the remainder in north-east Shetland. This is the largest recorded

oiled mortality for the species in Europe. Pre-spill wintering numbers in Yell Sound and Sullom Voe were probably c.150 birds, but never recovered after the spill and 27 years later no more than 15 birds probably winter in the area. Bluemull Sound was largely unaffected by *Esso Bernicia* oil, only five oiled divers were found in the area, and post spill counts (50-60 in good conditions) were similar to those pre-spill. However, numbers declined progressively there from 1983/84 to single figures by 1986/87 and have remained low since, with none recorded in January 2006. There was no explanation for this local decrease, which was not reflected in counts elsewhere in Shetland. Only 12 great northern divers were found oiled in the 1993 *Braer* oil spill in south-west Shetland due to the location and circumstances of the incident and there was little apparent impact on wintering numbers. Extensive surveys in 2001/02 produced a new estimate of 430 wintering birds, c.10-12% of the British and Irish population, but resurveys in 2005/06 of 13 areas that held 70% of the population in 2001/02 found overall numbers down by 45%. Oil pollution has not caused this latest decrease, but recent disturbance around mussel farms (common eiders are regularly chased by boats from some sites) may be a contributory factor.

Predation and the population status of sooty terns on Ascension Island following the recent feral cat eradication programme

JOHN HUGHES

Wideawake Surveys, The Old Shop, High Street, Shipton Bellinger, Hampshire, SP9 7UE, UK
E-mail: Wideawake@rasuk.org

Despite the eradication of feral cats *Felis catus,* the sooty terns *Sterna fuscata* on Ascension Island continue to experience high levels of predation from non native species. The elimination of feral cats, a major component of the islands ecosystem, has the potential for unforeseen results. Thus, long term monitoring using precise baselines is a vital component of the conservation management plan. We report on cat predation rates and changes in predatory pressure that we have recorded during the five breeding seasons following the eradication programme.

Ship rats *Rattus rattus* plagued the island before man arrived and when HMS Ascension was garrisoned many exotics were introduced to control pests and help feed and house the Marines. These included domestic cats, the myna bird *Acridotheres tristis* that now predate on sooty tern eggs and Mexican thorn *Prosopis juliflora* that encroaches onto the breeding colony reducing the available space for nest sites. Evidence of rat predation on sooty terns was first recorded in 2002 and we completed our first rat index the following year. The myna population continues to increase and each season the bird destroys some 20,000 sooty tern eggs. We started monitoring the spread of Mexican thorn when it first appeared in the colony in 1998.

The sooty tern is the only seabird to breed on the main land of Ascension in any numbers (175,000 pairs). Most of the other seabirds that are returning to Ascension previously nest on Boatswain Bird Island and the other cat and rat free offshore stacks. During the last 15 years we completed ten population surveys, measuring the area occupied by breeding birds and multiplying by nest density. These surveys provide a solid base line from which to measure trends in the population and to date we have found no up turn in the breeding population. In October 2005 we completed the latest surveys and found that Mexican thorn continues to encroach onto the Waterside study site but as yet is not a threat, myna birds carry on with their destruction of many thousands of eggs and rats possibly *Rattus norvegicus* the new menace took more than half of the 200 sooty tern chicks we ringed at our Mars Bay study site. The data we have collected points to a rapid increase in rat predation and the need for further careful monitoring.

Results from European storm petrel monitoring on a Scottish Island

HUGH INSLEY[1], Mike Hounsome[2], Steph Elliott[3] and Kenny L. Graham[3]

1. 1 Drummond Place, Inverness, IV2 4JT, UK
2. Hooper's Farm, Offwell, Honiton, Devon EX14 9SR, UK
3. RSPB North Scotland Office, Etive House, Beechwood Park, Inverness IV2 3BW, UK
Email: steph.elliott@rspb.org.uk

This paper describes the results of attempts, using mark recapture techniques, to monitor the populations of storm petrels *Hydrobates pelagicus* breeding on Priest Island and Eilean Hoan, both in the north-west of Highland Region, Scotland. Priest Island holds the third biggest Storm Petrel breeding colony in Britain. On both islands work to estimate and measure the Storm Petrel populations started in 1998. At the much larger Priest Island colony work has been standardised on a single core site since 2002. For Priest Island this paper is based on six years of data collection at this core site, and contains 5 annual population estimates, 4 annual survival rates and 3 annual recruitment rates. For Eilean Hoan the results of nine season's fieldwork are included. Calculation of survival rates together with the recovery rates of birds ringed both at and away from these two breeding colonies suggest that around 90% of the birds being caught in this study are established breeders. The survival rates calculated in this study are remarkably consistent with those found by other studies and indicate that on average birds caught at Priest Island will live for a further 6.1 years. As Storm Petrels do not breed until they are three to five years old it is estimated that if the poor breeding season on the west coast of Scotland in 2005 affected Storm Petrels it will take until 2009 for the effects to become apparent in the data collected.

La Niña vs. El Niño: Differences in seabird abundance and utilisation of fishery waste in two fishing harbours in northern Chile between two different years

JANA KOTZERKA[1], Stefan Garthe[1] and Guillermo Luna-Jorquera[2]

1. Research and Technology Center Westcoast Buesum, University of Kiel, Hafentoern 1, 25761, Buesum, Germany
2. Departamento de Biología Marina, Universidad Católica del Norte, Larrondo 1281, Coquimbo, Chile
Email: kotzerka@ftz-west.uni-kiel.de

Fishery waste, i.e. discard and offal, is a major food resource for seabirds in areas with extended fishing activities. We conducted seabird censuses and carried out so-called discard experiments in two fishing harbours in northern Chile in the summer 1999 (La Niña) and 2002 (El Niño) using fishery waste items regularly discharged by local fishermen.

The study describes quantitative experiments with various kinds of fish and offal. The seabirds exploited discard with different success in the two harbours and between the two years. In 1999, the most abundant species in the fishing harbour in Coquimbo was the kelp gull *Larus dominicanus*, followed by the Franklin´s gull *Larus pipixcan*. Very few Peruvian pelicans *Pelecanus thagus* were observed. The two gull species were also the most successful species in consuming both discarded fish and offal. In 2002, the situation was quite different in this harbour. The most abundant species was the kelp gull but the second abundant species was the Peruvian pelican. The most successful species in obtaining discard in the fishing harbour in Coquimbo was the Peruvian pelican. Kelp gulls very rarely succeeded in obtaining discards in this harbour in 2002. In the small fishing harbour of Guayacan, kelp gulls had the highest foraging success index closely followed by the Peruvian pelican in 2002. Franklin´s gulls played only a minor role in both harbours in 2002. We examined the differences between the two years and present information on abundance, foraging success index and robbery index for each seabird species. Additionally, we evaluated oceanographic parameters to explain these substantial differences.

A seabird food consumption model for the North Sea: who eats whom and how much?

ULRIKE KUBETZKI[1], Kees (C.J.) Camphuysen[2], Robert W. Furness[3], Stefan Garthe[4] and Mark L. Tasker[5]

1. Institute of Marine Research, Dept. Fishery Biology, Duesternbrooker Weg 20, D-24105 Kiel,
2. NIOZ, Postbus 59, NL-1790 AB Den Burg, Texel,
3. University of Glasgow, Graham Kerr Building, Glasgow G12 8QQ, UK,
4. FTZ, Research & Technology Centre, University of Kiel, Hafentörn 1, D-25761 Büsum
5. Joint Nature Conservation Committee, Dunnet House, 7 Thistle Place, Aberdeen AB1 1UZ, UK
Email: ukubetzki@ifm-geomar.de

On our poster we present interim results from the project BECAUSE, calculations about fish-eating seabird populations in the North Sea, their food requirements and how much fish and which species were eaten. BECAUSE (Critical Interactions BEtween species and their implications for a preCAUtionary FiSheries Management in a variable Environment - a Modeling Approach) is funded by the EU over 3 years (March 2005-February 2007) and investigates the quantitative role of species interactions as a first step towards the implementation of the ecosystem approach into fisheries management. The focus is on simple but critical interactions in the upper trophic levels of marine food webs. This refers specifically to the interactions between exploited prey fish populations, exploited fish predators and wild life such as seabirds and marine mammals dependent on the same prey fish populations. In most European shelf ecosystems fish predator populations are severely depleted, and this has released predation pressure on prey fish populations substantially. In part, man has taken over the role and harvests this part of the prey fish production either for human consumption or for reduction to fish meal. An exact quantitative understanding of these interactions becomes essential, once recovery plans for the overfished predator stocks become operational and effective. Our data were included in optimised multi-species models which will finally be used to produce forecast predictions for different management scenarios taking into account environmental regimes and the food requirements of seabirds and marine mammals.

Trends in chronic marine oil pollution in Danish waters assessed through 22 years of beached bird surveys

JØRN LENNART LARSEN[1], Jan Durinck[2] and Henrik Skov[3]

1. Finlandsgade 33, 5. tv., DK-2300 Copenhagen S, Denmark
2. NEPCon, Svankjærvej 6, DK-7752 Snedsted, Denmark
3. DHI Water & Environment, Agern Allé 11, DK-2970 Hørsholm, Denmark
Email: jornllarsen@get2net.dk

Twenty-two years of beached bird surveys along Danish coasts have accumulated data to allow an assessment of the trends in chronic marine oil pollution levels. Oily substances on the sea surface is the most significant observable cause of death for a wide range of waterbird species and pose a serious threat to seabird populations wintering in large concentrations near shipping lines and oil production facilities. Beached bird surveys provide an important tool for monitoring the level of oil pollution at sea using the proportion of oiled bird corpses of the total number of beached birds found. Observations showed significantly negative trends for the proportion of oiled northern fulmar and auks in the west coast of Jutland indicating a decline in the oil pollution level in offshore areas of the Eastern North Sea and Skagerrak. Trends for the Kattegat were significantly negative for wildfowl but significantly positive for common scoter. Although common eider and gulls showed tendencies for

negative trends in the Danish part of the Wadden Sea the remaining trends were non-significant indicating no-change situations in the oil pollution level or insufficiency of data. The results show an improvement in the oil pollution situation in the offshore parts of the North Sea, in the Wadden Sea and in near-shore parts of the Kattegat but a worsening in offshore areas of the Kattegat. This is detrimental for species like common scoter, velvet scoter, eider and razorbill for which the Kattegat serves as a globally important wintering area. It is recommended that surveillance is intensified in inner Danish waters and that action is taken to make responses towards polluters faster and penalties for these offences higher.

Different foraging strategies of endangered African penguins and Cape gannets facing limited food supply along the Namibian coast

KATRIN LUDYNIA[1], Jean-Paul Roux[2], Jessica Kemper[3], Joan James[2], Rian Jones[2], Stefan Garthe[1] and Benedict Dundee[2].

1. Research and Technology Center Westcoast, University of Kiel, Hafentörn 1, 25761 Büsum, Germany
2. Ministry of Fisheries and Marine Resources, Lüderitz, Namibia
3. Avian Demography Unit, University of Cape Town, P.Bag, Rondebosch 7701, South Africa
Email: ludynia@ftz-west.uni-kiel.de

Populations of African penguins *Spheniscus demersus* and Cape gannets *Morus capensis* along the Namibian coast have sharply decreased during the last century, mainly due to the limited prey availability after anchovy and sardine stocks collapsed in the early 1970s. With the absence of their main prey species, the birds had to rely on different prey. A strong upwelling cell off Lüderitz and differences in the local hydrography influence the prey availability for birds breeding on different islands around Lüderitz. Except for penguins breeding at Halifax Island, numbers of penguins and gannets at all breeding colonies (Possession, Ichaboe and Mercury Islands, Namibia) are decreasing dramatically with some colonies facing extinction in the near future.

We compared the foraging strategies of African penguins and Cape gannets breeding on several islands along the southern coast of Namibia. We used GPS-data loggers, focusing on differences in foraging strategies not only between the species, but also within the same species breeding along a latitudinal gradient. Due to the hydrographic differences along the coast, the birds from distinctive colonies differ in their foraging behaviour concerning parameters such as foraging trip length, diving behaviour and prey composition.

Penguins at Mercury Island use a very limited area of about 15 – 20 km north of the island to feed mainly on pelagic goby, whereas birds at Possession stay close to the island where they feed almost exclusively on small fish larvae. More adequate food does not seem to be available in the vicinity of the island, which is probably the main reason for the continuing decline in numbers of birds.
Gannets are able to commute to more distant areas to locate suitable prey and use a much wider area north of Mercury and south of Possession to forage. They reach waters with a different fish species assemblage, feeding mainly on horse mackerel, saury and pilchard.

This example shows that, within a larger ecosystem such as the Benguela Upwelling Region, small-scale hydrography substantially influences prey availability for seabirds. Whether different foraging strategies enable bird populations to survive in areas with limited food resources has to be further investigated.

The German Bight: a refuge for kittiwakes in the North Sea?

NELE MARKONES and Stefan Garthe

Research and Technology Centre Westcoast (FTZ), University of Kiel, 25761 Büsum, Germany
Email: markones@ftz-west.uni-kiel.de

While black-legged kittiwakes recently suffer severe declines in the north-western North Sea, the breeding population in the German Bight on Helgoland maintained relatively stable numbers throughout the years. The high importance of this sea area for North Sea kittiwakes is furthermore underlined by long-term studies that show concentrations of this species in the German Bight during late summer. This pattern seems to have become more obvious recently as indicated by counts of ship-following seabirds in the North Sea during late summer 2005 that contrast earlier results. While hauls in the German Bight were on average accompanied by several hundred kittiwakes, stern counts of kittiwakes comprised none or only single individuals along Norwegian and Scottish coasts. In order to reveal the characteristics that are responsible for the attraction of kittiwakes to this area, we studied distribution patterns at sea and diet composition of kittiwakes in the German Bight. The distribution of kittiwakes is significantly influenced by hydrographic features, especially frontal activity in the area of the post-glacial Elbe valley. Concentrations of birds were found at river plume fronts as well as upwelling fronts. These fronts presumably concentrate prey at the sea surface and thus lead to locally high food availability for kittiwakes. Both frontal types occur within the foraging ranges of kittiwakes breeding on Helgoland and thus are likely to play a vital role in foraging activities of these birds. Moreover, these predictable food concentrations seem to attract also substantial numbers of kittiwakes in the non-breeding season. In accordance, long-term studies show concentrations of kittiwakes in the German Bight from spring to autumn constantly along the post-glacial Elbe valley where frontal activity is generally highest.

Patterns of attendance of seabirds at a research trawler along the Gulf of Cadiz, SW Spain

MARIA MATEOS and Gonzalo M. Arroyo

University of Cadiz, Department of Biology University of Cadiz, P.O. Box 40, 11510, Pto.Real Cádiz,Spain
Email: maria.mateos@uca.es

The present study assesses the association of seabirds with fishing trawlers. Fieldwork was conducted on board of a research trawler along the Gulf of Cadiz, Spain, from November 2005 to March 2006. A total of 40523 seabirds belonging to 15 species were recorded during 57 fishing operations in November 2005 and March 2006. The most common species were the yellow-legged gull *Larus michaelis* and the lesser black-backed seagull *L. fuscus*, the northern gannet *Morus bassanus*, the Balearic and Cory's shearwater *Puffinus mauretanicus* and *Calonectris diomedea*, the great skua *Catharacta skua* and the Audouin's gull *Larus audouinii*. Other species occurred in small numbers: the Pomarine and parasitic skuas *Stercorarius pomarinus* and *S. parasiticus*, the Mediterranean gull *Larus melanocephalus,* the black-headed gull *Larus ridibundus*, the blackj-legged kittiwake *Rissa tridactila*, the Sandwich and common tern *Sterna sandvicensis* and *S. hirundo* and the sooty shearwater *Puffinus griseus*. Three species were recorded during the fishing operations, but never associated to the ship: the Atlantic puffin *Fratercula arctica*, the razorbill *Alca torda* and the great shearwater *Puffinus gravis*. The maximum number of seabirds recorded at a haul was 5222. The percentage of presence of some species (proportion of hauls in which the species was recorded) was similar between seasons: yellow-legged and lesser black-backed gull *Larus michaelis* and *L. fuscus* (100% in both), northern gannet *Morus bassanus* (90%, 95%), but for other species was significantly different: Cory's shearwater *Calonectris diomedea* (0%, 63%). We analysed the factors that affect the patterns of attendance: temporal factors, distance to coast, meteorological conditions and the number of trawlers in the area. Our results indicate that fishing trawler discards might constitute an opportunistic food source for several seabird species in our area.

Host specialization in the tick *Ixodes uriae* and implications for the ecological dynamics of seabirds

KAREN D. McCOY[1], Elodie Chapuis[2], Claire Tirard[3], Thierry Boulinier[4], Yannis Michalakis[1], Céline Le Bohec[5], Yvon Le Maho[5] and Michel Gauthier-Clerc[6]

1. Génétique et Evolution des Maladies Infectieuses, IRD - CNRS UMR 2724, IRD, Montpellier, France
2. Department of Ecology and Evolution, University of Lausanne, CH-1015 Lausanne, Switzerland
3. Laboratoire de Parasitologie Evolutive, Université Paris VI – CNRS UMR 7103, Paris, France
4. Centre d'Ecologie Fonctionnelle et Evolutive – CNRS, UMR 5175, 34000 Montpellier, France
5. Centre d'Ecologie et Physiologie Energétiques, UPR 9010 CNRS, Strasbourg, France
6. Station Biologique de la Tour du Valat, Le Sambuc - 13200 Arles, France
Email: mccoyk@mpl.ird.fr

Ectoparasites can have profound effects on their hosts, both directly via their negative effects on host body condition and indirectly, by acting as disease vectors. The tick *Ixodes uriae* is a common ectoparasite found in polar seabird colonies and has been shown to vector to numerous microparasites. This tick has always been assumed to be a seabird generalist. However, recent observational work suggested that cryptic divergence may be present. Here, we tested for host-associated specialisation in *I. uriae* using a population genetic approach. We sampled ticks from 30 populations of six different seabird species, three in the Southern hemisphere (*Aptenodytes patagonicus*, *Eudyptes chrysocome*, *E. chrysolophus*) and three in the Northern hemisphere (*Rissa tridactyla*, *Fratercula arctica*, *Uria aalge*). We show that host-associated parasite races have evolved independently in both hemispheres. Moreover, the degree of differentiation among tick races varied spatially within each region and suggests that the divergence of tick races is an ongoing process that has occurred multiple times across isolated areas. As *I. uriae* can directly affect the reproductive success and habitat selection decisions of seabirds and is vector to numerous pathogenic agents, host specialisation in this tick may have important consequence for both host population dynamics and the epidemiology of avian disease.

Foraging behaviour and chick growth in Cape gannets; the role of behavioural flexibility

RALF H. E. MULLERS[1], Rene A. Navarro[2], Les G. Underhill[2] and G.Henk Visser[1,3]

1. University of Groningen, Kerklaan 30, 9751 NN Haren, The Netherlands
2. Avian Demography Unit, University of Cape Town, Rondebosch 7701, South Africa
3. Centre for isotope Research, University of Groningen, 9750 AA Haren, The Netherlands
E-mail: R.H.E.Mullers@rug.nl

Traditionally, the breeding ecology of marine birds is considered to be an adaptation to sparse, patchy and unreliable food availability. The breeding season of Cape gannets *Morus capensis* on Malgas Island, South Africa extends from the end of September until the end of March, and during this long period oceanic conditions and fish abundance around the colony can change dramatically. The unpredictability and variability of food resources on both a temporal and spatial scale require great behavioural flexibility. During two breeding seasons we studied the consequences of oceanographic changes by looking at the feeding behaviour of the adults and the effect on the growth and survival of the chicks within and between seasons. Adult birds were deployed with GPS-dataloggers, providing detailed information about the foraging behaviour. The average trip duration was 22.0 hours (n = 78, sd = 11.7) in the first season and 23.9 hours (n = 85, sd = 13.1) in the second, varying between 3.1 hours and 54.0 hours. Distances covered during those trips were 423 km (sd = 200) and 460 km (sd = 255) respectively, with a maximum trip length of 1221 km. During both seasons chicks of different

ages and therefore different energetic requirements were measured for growth at weekly intervals. We calculated an average growth index for every measuring period and our method clearly shows that growth performance can change from week to week, most probably an indirect indication of the prey availability around the colony. Our data show the effects of the long breeding season on both the foraging behaviour and the consequential growth performance of the chicks. Although the gannets seem to show a high flexibility in foraging behaviour, they cannot always compensate for less profitable periods, as their chicks experience weeks of very poor growth.

Fatty acid signature analysis: a new tool to describe seabird diets

ELLIE OWEN[1], Francis Daunt[1], Colin Moffat[2], Paul Thompson[3] and Sarah Wanless[1]

1. Centre for Ecology and Hydrology, Hill of Brathens, Banchory, Aberdeenshire AB31 4BW, Scotland
2. Fisheries Research Service Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB, Scotland
3. Department of Zoology, School of Biological Sciences, University of Aberdeen Lighthouse Field Station, George Street, Cromarty, Ross-shire IV11 8YJ, Scotland
Email: eow@ceh.ac.uk

To understand the degree to which seabirds are affected by changes in the availability of particular prey species, we first need to gain a full knowledge of seabird diets. Valuable information on seabird diets has been obtained using regurgitate or pellet sampling and by directly observing prey brought to colonies. Regurgitate and pellet sampling are biased by differences in the rates of digestion of soft and hard prey items and direct observation techniques are limited to times of the year when birds are carrying display fish or feeding chicks. Both methods are only representative of the last meal consumed. A new technique, fatty acid signature analysis, attempts to overcome some of these biases and limitations by using fatty acid molecules as markers of diet and is based on the principle that fatty acids from the bodies of prey are laid down in a predictable manner in the tissues of a predator. We have sampled seabird blood, adipose tissue and procellarid stomach oil and conducted fatty acid analysis. Here we describe the techniques and present two examples to show potential uses for fatty acid signature analysis in studying seabird diet. The first illustrates seasonal differences in the diet of the northern fulmar *Fulmarus glacialis* on Eynhallow, Orkney. The second demonstrates variation in the diet of black-legged kittiwakes *Rissa tridactyla* on the Isle of May, Scotland.

Towards a breeding seabird indicator for Scotland - modelling trends from the UK Seabird Monitoring Programme

MATTHEW PARSONS[1], Ian Mitchell[1], Adam Butler[2], Roderick Mavor[1], Norman Ratcliffe[3] and Simon Foster[4]

[1] Joint Nature Conservation Committee, Dunnet House, 7 Thistle Place, Aberdeen, AB10 1UZ, UK
[2] Biomathematics & Statistics Scotland, The King's Buildings, Edinburgh EH9 3JZ, UK
[3] Royal Society for the Protection of Birds, East Scotland Regional Office, 10 Albyn Terrace, Aberdeen, AB10 1YP, UK
[4] Scottish Natural Heritage, Great Glen House, Leachkin Road, Inverness, IV3 8NW, UK
Email: matt.parsons@jncc.gov.uk

There is currently a high demand from policy-makers to provide summary statistics, known as indicators, that provide a 'short-hand' statement of the health of bird populations and their environments. Here we present recent work on options for a seabird indicator for Scotland, based on population trends modelled using Bayesian statistical methods from count data collected by the UK Seabird Monitoring Programme during 1986-2004. Compared with the Bayesian model, the

traditional method of presenting trends, using a chaining index, over-estimated population size for northern gannet *Morus bassanus*, common guillemot *Uria aalge* and razorbill *Alca torda*, because annual monitoring of these species is biased towards small colonies, which showed greater per capita rates of population change than did large colonies. The modelled trends for most species closely agreed with the trend revealed by the complete censuses in the mid 1980s and 1998-2002. However, the method was not suitable for terns (*Sterna spp.*) and great cormorant *Phalacrocorax carbo*, which show very marked year to year variation in colony size, and alternative methods of calculating trends are required for these species. We could not detect any significant regional differences in trend (i.e. within Scotland), except for kittiwakes in Shetland and for great skuas. Strengths and limitations of the resultant indicator are presented and the potential drivers of change in seabird populations in Scotland are discussed.

The recolonisation of mainland Ascension Island by masked boobies *Sula dactylatra* following eradication of feral cats

TARA PELEMBE[1], Norman Ratcliffe[2], Mike Bell[3] Richard White[1] and Sarah Sanders[4]

1. Ascension Island Government Conservation Department, Georgetown, Ascension Island, ASCN IZZ, South Atlantic.
2. RSPB Scotland, 10 Albyn Terrace, Aberdeen, AB10 1YP, UK
3 Wildlife Management International Ltd PO Box 14 492, Wellington, New Zealand.
4. RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK
Email: tara.pelembe@ascension.gov.ac

Ascension Island was formerly home to large seabird colonies, but the introduction of cats in the 1800s led to rapid population declines. Relict populations survived on inaccessible cliff ledges and offshore stacks, the largest of which is Boatswainbird Island. In 2001, a feral cat eradication programme was initiated and the last known animal was removed from the mainland in March 2004. Seabird recolonisation of the mainland was first recorded in May 2002 and numbers have increased steadily since. Most species, including masked boobies *Sula dactylatra* have occupied main island sites immediately adjacent to existing colonies. Although masked boobies nest virtually all year round, there is a marked peak in May. Overall breeding success was relatively low compared to estimates elsewhere and possible reasons for this will be discussed. We developed population models to assess demographic mechanisms of recolonisation. These indicate that a putative floating population that might have colonised the mainland rapidly did not in fact exist, probably owing to cat predation of recruiting birds attempting to recolonise the mainland prior to eradication.

Conservation of albatrosses and petrels from South Georgia: population declines, overlap with fisheries and RFMO engagement

RICHARD A. PHILLIPS[1], Cleo Small[2], Janet R.D. Silk[1] and John P. Croxall[2]

1. British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK
2. BirdLife International, Wellbrook Court, Girton Road, Cambridge CB3 0NA, UK
Email: raphil@bas.ac.uk

Many albatrosses and petrels, and particularly those breeding in the South Atlantic, are currently experiencing rapid population declines wholly or partly as a consequence of high rates of incidental mortality in long-line and trawl fisheries. The new (2004) multilateral Agreement on the Conservation of Albatrosses and Petrels (ACAP) provides a framework for the implementation of effective

conservation measures for listed species. High quality tracking and demographic data are critical for identifying where and when albatrosses and petrels at different life-history stages (fledgling, prebreeder, breeder, nonbreeder) are most vulnerable to bycatch, and to diagnose adequately the causes of population decline. We review current knowledge of the status of the seven ACAP species breeding at South Georgia (wandering, black-browed, grey-headed and light-mantled albatross, northern and southern giant petrel, and white-chinned petrel), and examine their at-sea distribution during summer and winter (based on detailed tracking data obtained using satellite-transmitters, GPS and GLS loggers) in relation to recorded effort in major Southern Ocean longline fisheries. Notwithstanding the gaps in our knowledge for certain species and groups (particularly fledglings and pre-breeders), we can identify many regions where adverse fisheries interactions are likely to take place. We also review the most recent information on rates of bycatch in these areas. We summarize relevant activities of the BirdLife Global Seabird Program in particular engagement with the relevant Regional Fisheries Management Organisations (RFMOs) to encourage implementation of improved mitigation practices.

How to deal with contrasting environments ? A comparison of foraging strategies of Cape gannets from colonies within and outside an upwelling system

LORIEN PICHEGRU[1], Peter Ryan[2], Carl van den Lingen[3], Yan Ropert-Coudert[4] and David Gremillet[1]

1. Centre National de la Recherche Scientifique, Institut pluridisciplinaire Hubert Curien, Département Ecologie, Physiologie et Ethologie, Strasbourg, France.
2. Percy FitzPatrick Institute of African Ornithology, University of Cape Town, South Africa.
3. Department of Environmental Affairs and Tourism, Marine and Coastal Management, Cape Town, South Africa.
4. National Institute of Polar Research, Tokyo, Japan.
E-mail: lorien.p@c-strasbourg.fr

The entire world population of Cape gannets *Morus capensis* breeds on six islands. Five islands are located within the Benguela upwelling system in the Atlantic Ocean, while one is situated in the Indian Ocean and under the influence of the Aghulas Current. According to Ashmole's hypothesis (1963), the population dynamics of seabirds is conditioned by food availability during the breeding season. The Benguela upwelling system is one of the most productive in the world, characterised by deep nutrient-rich water. In contrast, the Aghulas current is a less productive warm-water system. We studied the foraging strategies of Cape gannets from two colonies located in these different oceans and investigated how birds of the same species adjust their foraging behaviour to contrasting environments.

During the 2005-2006 breeding season, we deployed GPS data loggers on birds breeding on two different islands with a similar colony size: Malgas, in the Benguela, and Bird Island, Algoa Bay, in the Aghulas current. Simultaneously, an acoustic survey determined the distribution and abundance of common prey items for gannets within the area. Diet samples of birds were also collected and analysed.

Our results indicate that birds breeding on Malgas, within the upwelling system, worked harder (greater time spent foraging, greater travel distance) than those breeding on Bird Island. The acoustic survey found that prey abundance was much less in the Benguela system. This was confirmed by our diet samples, which consisted primarily of fisheries discards on Malgas and sardines *Sardinops ocellatus* on Bird Island.

One possible explanation for these surprising results is the greater temporal variability of the environmental conditions within an upwelling system. Although it is very productive on a large scale, it may be less predictable on a smaller scale, forcing birds to spend more energy to find profitable food patches. Hence, contrary to expectations, Cape gannets breeding within the productive system of the

Benguela are under great environmental pressure, which may be exacerbated by competition with fisheries and predation by fur seals *Arctocephalus pusillus*.

Environmental challenges and status report on North American offshore wind power as it relates to marine birds

RICHARD HARRIS PODOLSKY

PO Box 1066, Rockport, Maine 04856-1066 USA
Email: podolsky@att.net

Emerging environmental regulations are shaping the development of the offshore wind power projects in North America with implications for marine birds. These regulations in concert with significant physical environmental differences in near shore waters are resulting in North America lagging behind Europe in the development of its significant offshore wind resources. Regarding regulatory landscape, there has been a shift in the lead agency for offshore project from the Army Corp of Engineers to the Mineral Management Services. This shift has caused several large offshore projects to essentially start anew with regards to the public scoping process. Environmentally, the continental shelf of North American is narrow resulting in proportionally less shallow water shelf available for both marine birds and offshore wind developers alike. The upshot is that offshore wind power projects invariably end up vying for the same shallow water sites that provide key feeding habitat for marine birds and mammals. The result being that avian resources are becoming a focal point for both regulators and the public alike in the scoping of offshore wind power in North America.

Advanced methods for estimating daily survival rates of precocial chicks using live and dead encounter models implemented in the programme MARK

NORMAN RATCLIFFE[1] and Morten Frederiksen[2]

1. RSPB Scotland, 10 Albyn Terrace, Aberdeen, AB10 1YP. UK
2. Centre for Ecology and Hydrology (CEH), Hill of Brathens, Banchory, Aberdeenshire, AB31 4BW. UK
Email: norman.ratcliffe@rspb.org.uk

The success of avian nesting attempts is generally estimated visiting nests repeatedly to determine their fate and estimating daily nest survival rates. Standard nest survival analyses assume encounter rates of one, but this is invalid for semi-precocial species such as Stercorarids and Larids because chicks are able to disperse from the nest and hide from observers. Some studies of Larid chick survival have employed wire enclosures to confine chicks to an area that can be searched thoroughly, but these reduce chick mobility and interaction with the wider environment and hence their survival. Commonly, free-ranging chicks are classed as fledging if they survive to an age at which they can disperse from the nest, but this overestimates fledging success where significant mortality occurs in older chicks. Survival rates of free ranging chicks can be modelled more robustly from live-dead capture-mark-recapture data using the Burnham method. This paper presents a method of setting the parameter index and design matrices in MARK to allow modelling to allow for staggered age-entry and permanent emigration at fledging age. An analysis of a data set generated by a Monte Carlo programme, in which the rates of survival, recapture and recovery were known a priori, demonstrates that the method yields accurate parameter estimates over a variety of survival and recapture values and for an range of encounter period frequencies. The application of this method to the estimation of semi-precocial chick survival rates and elucidating the factors affecting these are discussed.

Estimating abundance of seabirds with asynchronous laying phenology and high failure rates from nest counts: an example using Ascension Frigatebird

NORMAN RATCLIFFE[1], Tara Pelembe[2] and Richard White[2]

1. RSPB Scotland, 10 Albyn Terrace, Aberdeen, AB10 1YP. UK.
2. Ascension Island Conservation Office, Georgetown, Ascension Island, South Atlantic.
Email: norman.ratcliffe@rspb.org.uk

Many censuses of seabirds rely on counts of apparently occupied nests. For seabirds nesting in temperate or polar latitudes, laying is synchronous and failure rates on eggs are generally low, such that in excess of 90% of nests are present to be counted during the peak of incubation activity. However, some species in tropical latitudes have asynchronous nesting seasons that may span an entire year and high failure rates, such that only 20% of the nests laid over the course of a season might be present at the peak of incubation. Repeated censuses of nests containing eggs that are separated by the duration of the incubation period can be used to overcome this problem. This avoids double counting owing to any eggs present on the previous visit having failed or hatched. However, where nest failure is high a large proportion of nests will both be laid and fail between censuses, resulting in underestimates of breeding numbers. Further complications arise where species relay following failure, double brood within a year or exhibit biennial breeding. Ascension frigatebird *Fregata aquila* is an endemic species to Boatswain Bird Island off Ascension, S. Atlantic. It nests in scrapes on the ground, exhibits asynchronous laying phenology, has high nest failure rates, high turnover in site occupancy, renesting following failure and (probably) biennial breeding. We present a simulation model that estimates the population status of Ascension frigatebirds from periodic nest censuses by correcting for the biases described above.

A heuristic comparison of the effects of mink management options on terns in the Western Isles

NORMAN RATCLIFFE[1], Sugoto Roy[2], Clive Craik[3] and Martin Scott[4]

1. RSPB Scotland, 10 Albyn Terrace, Aberdeen, AB10 1YP. UK.
2. Central Science Laboratory, Sand Hutton, York, YO41 1LZ. UK.
3. The Scottish Association for Marine Science, Dunstaffnage Marine Laboratory, Dunbeg, Oban, Argyll. PA37 1QA, UK.
4. RSPB Scotland, Office 2, Clintons Yard, Rigs Road, Stornoway, Isle of Lewis, HS1 2RF. UK.
Email: norman.ratcliffe@rspb.org.uk.

American mink *Mustela vison* were introduced to Lewis in the 1950s and 60s, and their range expanded south to colonise the whole of the Uists by 1999. Mink eradication was initiated in 1999 and the Uists and S Harris were almost entirely cleared by 2004, but numbers in North Harris and Lewis remain intact. There are three options available: 1. a cessation of control, which would allow recolonisation of the archipelago, 2. maintaining the current mink range using a trapping cordon in S Harris and 3. extending eradication to N Harris and Lewis. In order to evaluate the effects of these options on tern numbers, a population model was developed based on tern distribution and status, mink-dependent variations in productivity, published survival and recruitment estimates and rates at which mink spread if unchecked. Abandoning control would result in all tern habitat in the archipelago, except for the Monachs and Haskier, being occupied by mink with associated declines in tern population and range. Holding the current mink range at the narrow isthmus between S and N Harris would result in loss of the tern populations in N Harris and Lewis, although local control around the few remaining colonies could prevent this occurrence. However, the commitment to management in perpetuity and the potential porosity of the mink cordon reduce the appeal of this

option. Extending the eradication project into N Harris and Lewis allows potential for populations to remain stable or increase, depending on the patterns of productivity when mink are absent. The latter option is the one that has been selected, and a complete eradication of mink from the Western Isles is likely to be initiated in Sep 2006.

Responding to environmental change: can a need for breeding synchrony in common guillemots (*Uria aalge)* limit individual plastic responses?

THOMAS E. REED[1], Sarah Wanless[2], Michael P. Harris[2], Morten Frederiksen[2], Loeske E.B. Kruuk[1] and Emma J.A. Cunningham[1]

1. Institute of Evolutionary Biology, King's Buildings, University of Edinburgh, Edinburgh, EH9 3JT, UK.
2. Centre for Ecology and Hydrology, Hill of Brathens, Banchory, Aberdeenshire, AB31 4BW, UK
Email: tom.reed@ed.ac.uk

The impact of environmental change on population dynamics may be mitigated by an ability of individuals to plastically adjust key life-history events. Breeding time is a critical life-history trait that affects fitness and potentially adaptive phenological responses to climate shifts have been reported across a wide range of taxa. Phenotypic plasticity represents one important mechanism by which this may be achieved in the short-term, where individual-level adjustment of breeding time allows populations as a whole to track rapidly changing conditions. There is therefore considerable interest in establishing the degree of plasticity in traits, how this impacts on fitness and how selection acts on plasticity in natural populations. Recent studies in birds and mammals have found that females vary significantly in their breeding time-environment relationships, with selection often favouring individuals exhibiting stronger plastic responses. In contrast, here we show that although breeding time in the common guillemot, *Uria aalge*, is highly plastic at the population level in response to a large-scale environmental cue (the North Atlantic Oscillation), there is very little between-individual variation, demonstrating that most individuals respond to this important climate cue very similarly. This species differs significantly from those previously studied in being a colonial breeder, in which reproductive synchrony has a substantial impact on breeding success; we show this generates strong stabilising against individuals that deviate from the average population-level response to NAO, both limiting individuals in their response and the potential for directional selection to act. This finding highlights the importance of considering the relative costs and benefits of highly plastic responses in assessing the likely responses of colonially breeding seabird populations to environmental change. More generally, we argue that improvements in our understanding of factors influencing the rate of phenology evolution will aid enormously in making meaningful ecological predictions and management decisions during a period of rapid climate change.

New Zealand trawl fisheries and seabird interaction

CHRISTOPHER J. R. ROBERTSON

Wild Press Laboratory, P O Box 12397, Wellington, New Zealand.
Email: 100244.1012@compuserve.com

New Zealand trawl fisheries have been officially observed for seabird interactions from 1996–2005 and 1995 seabirds (1085 'albatrosses' and 910 'petrels') killed as incidental bycatch (49% from trawlers and 51% from longline fisheries) were returned to an official autopsy/necropsy programme. Study of these specimens provides the background to a review of fishing practices and avenues for avoidance of interaction. In all observed fishery types (both trawl and longline), 40–60% of observed vessels annually did not kill seabirds. In the trawl fisheries, 90% of observed non-factory vessels without offal/discard discharge did not kill seabirds. Overall, (in all fishery types) a small number (<20%) of observed vessels killed >80% of the seabirds returned, both annually and for the whole

period. 'Albatrosses' were killed primarily by trawl warp contact, and 'petrels' by recovery in the net, reflecting the food source being targeted. The risk of interaction was positively correlated with factory processing waste/offal/discards lost or discharged during fishing operations and demonstrated by the stomach contents of the birds killed. Avoidance methods for high bycatch vessels are now focused on operational and factory methods, ship design, operating plant and various types of mitigation. The fundamental questions for avoiding seabird bycatch must be focused on "why are birds attracted to the fishing vessel" and "why do so few observed vessels catch the majority of the birds"? Avoiding the creation of interaction risk, rather than mitigation to reduce interaction, should always be the primary concept for the long-term change of practices and attitudes.

Modelling the effects of climate change on seabird distribution and population dynamics

DEBBIE J RUSSELL

Faculty of Biological Sciences, University of Leeds, Leeds, LS2 9JT
Email: d.j.russell05@leeds.ac.uk

Climate change is one of the main pressures acting on seabird populations today. Thus it is imperative that the extent and way in which each seabird species are affected by climate change be established so that steps can be taken to attempt to limit any detrimental effects of climate change on vulnerable species. This can be problematic as the rate of climate changes varies significantly geographically; there are many different ways in which climate change can effect species (indirectly through food availability for example or directly) and the different life history strategies of different species all complicate the effect of climate change on seabird species. Thus this study aims to incorporate a wide range of species over a relatively large area to ascertain the way in which climate change affects each species.

To conduct the static part of this project I have used gridded European Scale data on species presence/absence to produce climate response surface models to ascertain the relationship between climate and seabird distribution in Europe. I will then use climate data along with the Operation Seafarer, Seabird Colony Register and Seabird 2000 data to examine how climate suitability variables geographically and temporally. Furthermore I will incorporate fisheries data to ascertain the independent and interactive effects on fisheries and climate change on UK seabird species. These results can then be used to infer the state of our ecosystems and also to predict future effects of fisheries and climate change on the internationally important UK seabirds.

Evaluation of the impact of ship traffic on sensitive seabirds, ducks and divers in German waters

PHILIPP SCHWEMMER, Bettina Mendel, Volker Dierschke, Nicole Sonntag and Stefan Garthe

Forschungs- und Technologiezentrum, University of Kiel, Hafentörn 1, 25761 Büsum, Germany
Email: schwemmer@ftz-west.uni-kiel.de

German waters are an important migration and wintering area for seabirds such as ducks and divers. The Baltic sea holds a high proportion of the north-western European breeding populations of common eider *Somateria mollissima*, velvet scoter *Melanitta fusca*, common scoter *M. nigra* and long-tailed duck *Clangula hyemalis*, while high numbers of red-throated divers *Gavia stellata* use the North Sea during winter. Increasing ship traffic (also expected in connection with the construction of offshore wind farms) has the potential to cause disturbance to resting and foraging seabirds. We therefore started to evaluate the effects of ship traffic on the four sea duck species by experimental work. Flush distances of each species were measured following the method of Lerczak and Hobbs (1998). Additionally, we investigated areas of potential conflict between commercial or non-

commercial shipping and abundance of sea ducks and divers using aerial census techniques. Finally, densities of ducks were recorded before and after disturbance by the observer vessel in order to verify whether possible habitat losses occur. Long-tailed ducks and common eiders showed the smallest flush distances, followed by velvet scoters. Common scoters generally flew off more than 1 km ahead of the ship. Indications were found that flush distances increased with flock size. Aerial surveys indicated an avoidance of commercial shipping lanes by divers. Numerical abundance values (expressed as density) of all duck species immediately after the disturbance by a ship were tending to zero, eiders and long-tailed duck reached similar densities as before the disturbance after ca. 2 hours time (velvet scoter ca. 3, common scooter > 4 hours). Areas of high shipping intensity revealed smaller flush distances of all species, indicating habituation. However, our results suggest that effects of enhanced ship traffic due to constructions of wind farms particularly on shallow feeding and resting sites may lead to significant habitat loss especially in common scoters and divers.

Spatial modelling of seabird bycatch in the western North Atlantic

MICHELLE SIMS, Ramunas Zydelis, Daniel Dunn and Tara Cox

Duke University Marine Laboratory, Nicholas School of the Environment and Earth Sciences,135 Duke Marine Lab Road, Beaufort, NC 28516, USA
Email: m.sims@duke.edu

Fisheries bycatch has been identified as a significant source of seabird mortality. Sound conservation strategies to mitigate seabird bycatch require not just the determination of these bycatch rates, but also the spatial variation within those rates. Maps of bycatch rates are useful for describing the geographic distribution of bycatch in order to identify 'hot-spots', or areas of relatively high bycatch rates. The sources of these elevated rates may then be investigated to establish possible causes. However, maps of raw bycatch rates in small geographic areas may be imprecise, particularly for areas of low fishing effort. This talk describes how estimates of bycatch rates may be improved by spatial modelling of the data. To accomplish this we map seabird bycatch at two spatial scales. At the scale of the western North Atlantic, we compare the spatial distribution of bycatch from the US longline and sink gillnet fisheries in relation to their fishing effort. Although there is very little overlap in the spatial distribution of fishing effort between the two fisheries, bycatch from both fisheries appears to be clustered in one common region. We then focus on this region and bycatch from the gillnet fishery alone, since very few birds were caught in the longline fishery, and develop a spatial model to estimate small area bycatch rates. Our model gives more stable estimates of bycatch rates for each area by making use of rates in neighbouring areas that may be similar due to shared environmental factors. We then compare the similarity in spatial distribution of seabird bycatch to that of marine mammal bycatch and explore possible environmental features causing the observed spatial variability. Finally, we show how the more precise bycatch rates generated by our model can be applied to bycatch assessment and mitigation.

Assessment of potential bird displacement effects arising from the construction and operation of offshore wind farms

HENRIK SKOV[1], ILYA M.D. MACLEAN[2], Werner Piper[3] and Mark M. Rehfisch[2]

1. DHI Water & Environment, Agern Alle 5, DK-2970 Hørsholm, Denmark
2.British Trust for Ornithology, The Nunnery, Thetford, IP24 2PU, UK
3. Biologisch-landschaftsökologsche Arbeitsgemeinschaft, Gotenstraße 4, D-20097 Hamburg, Germany
Email: hsk@dhi.dk and Ilya.Maclean@bto.org

The aim of the project commissioned by COWRIE (Collaborative Offshore Wind Research Into the Environment) is to determine whether the existing or modified aerial surveying methods can deliver

statistically robust data on possible changes in seabird and seaduck numbers in UK offshore windfarm areas. We will start by briefly evaluating the existing methods for the aerial survey of seabirds. We will report back on the results of power analyses carried out to identify the shortcomings and strengths of the existing DTI aerial survey programme that aims to describe the numbers of seabirds and waterbirds in offshore areas of the United Kingdom where wind farm developments could occur. We will conclude by discussing whether such survey methods could form the basis of a practical programme for the monitoring of bird displacement and, if so, describe in detail the methodology to be used by such a programme.

Interspecific interactions have a major impact on great and arctic skua productivity on Handa Island.

CLAIRE SMITH[1] and Trevor Jones[2]

1. Handa Island skua monitoring programme, Handa Island, Sutherland, IV27 4TG, Scotland.
2. Environmental Sciences Research Centre, Anglia Ruskin University, East Road Cambridge, SP1 1PT, UK.
Email: clairesmith81@yahoo.co.uk

Handa Island in Sutherland contains populations of arctic and great skuas and great black-backed gulls (GBBs), breeding in close proximity. Since 2003, we have studied the effects of inter-specific interactions on productivity in the two skua species. With the exception of 2005, arctic skua productivity has been consistently high, yet the number of arctic AOTs has fallen by 60% since 2001, and density of pairs nesting in the species' stronghold has dropped since 2003, resulting in a breakdown of cooperative defence. Juvenile arctic skuas are most vulnerable to predation during the first few days after fledging, when they are conspicuously weak fliers, and annual post-fledgling mortality during this period ranges from 40-60%. Observations confirmed that most if not all of this mortality is attributable to great skuas. We also looked at the impact of GBBs on breeding great skuas, through a comparison of productivity and breeding parameters of pairs nesting in sites where there are many versus few GBBs in their midst. The effects of proximity to GBBs on breeding adult behaviour (i.e. foraging trip length, amount of on-territory flying and number of times each adult left the territory) were also investigated through detailed observations. GBBs were found to have impacts on all stages of great skua productivity, across all years. GBBs exhibit cooperative defence whilst great skuas do not, and the majority of interactions were initiated by the larger gull. Great skuas nesting near GBBs spent less time incubating, and more time engaged in on-territory flapping flight, and males spent less time off-territory. Incidences of predation of great skua chicks and eggs by GBBs were observed in all years. In 2005, great skua productivity hit an all time low, attributable to increased losses at both chick and egg stage. While reduced foraging efficiency was almost certainly the primary cause, evidence indicates that the effect of predation by GBBs also increased as a result of chicks being left unattended more frequently than in other years. However, in contrast to the arctic skua, in spite of predation pressure from its larger, aggressive neighbours, the great skua is not in decline on Handa.

Diet of great skuas on Handa Island, Sutherland 2003-2006

CLAIRE SMIITH[1] and Trevor Jones[2]

1. Handa Island skua monitoring programme, Handa Island, Sutherland, IV27 4TG, Scotland.
2. Environmental Sciences Research Centre, Anglia Ruskin University, East Road Cambridge, SP1 1PT, UK.
Email: clairesmith81@yahoo.co.uk

Diet of great skuas nesting on Handa Island, Sutherland has been monitored since 2003 through the analysis of regurgitated pellets collected along transects passing through breeding pairs' territories, and from the 'club site' where non-breeding birds congregate. All prey items were identified to at

least family level and from 2005 fish species were identified from otoliths removed from pellets. The contents of food regurgitated by chicks while being handled on territory were also noted. In all years birds comprised at least 40% of breeders' diet and 60% of non-breeders' diet. Non-breeders' diet consistently contained a lower proportion of fish. Unsurprisingly given the size of the Handa populations, auk species were the dominant bird prey type in all years. In 2005, the worst year on record for great skua productivity on Handa, breeding pairs consumed a higher proportion of fish than the previous 2 years. This may be due to successful pairs having a fish-dominated diet, or because the high failure rate of cliff species meant there were simply less birds around to eat. Norway pout was the dominant fish in the diet of both breeders and non-breeders, followed by whiting and poor cod. This suggests that Handa's great skuas are deriving the majority of fish as discards, consistent with the diet of colonies on St Kilda and Shetland. The composition of great skua diet is discussed in the context of their potential impact on the other important seabird populations of Handa, and recommendations for further research are made.

Strategic aerial surveys for waterbirds and seabirds in UK inshore waters

LUCY SMITH, Colette Hall, Jenny Worden, Anne L. Harrison, Lisa Allen, Gareth Bradbury and Peter A. Cranswick

Wildfowl and Wetlands Trust, Slimbridge, Gloucestershire GL2 7BT, UK
Email: lucy.smith@wwt.org.uk

Data on the numbers and distribution of waterbirds and seabirds in UK marine waters are required for a variety of purposes, including identification of Special Protection Areas (SPAs), monitoring of numbers and distribution, and for strategic environmental assessment for developments such as offshore windfarms (OWF). To address the gaps that exist in data for waterbirds and seabirds in many nearshore waters in England and Wales, the Department of Trade and Industry commissioned large-scale surveys of strategic areas proposed for OWF development, and of adjoining areas identified as potentially important for birds.

Surveys covering inshore waters off Northwest England, the Greater Wash and the Thames were undertaken by experienced teams from the Wildfowl & Wetlands Trust. Seven synchronised surveys were undertaken during the course of the year, covering winter, breeding and moulting periods. Distance-sampling surveys were undertaken using transects spaced at 2-km intervals. The location and numbers of all waterbird species encountered were recorded. Surveys undertaken between October 2004 and August 2005 represent the most comprehensive coverage to date of many of these areas. Significant findings are presented.

Interactions between puffins and *Larus* gulls on Burhou, Channel Islands: the development of a management strategy.

Louise Soanes[1]; Phil Atkinson[2], HELEN BOOKER[3], Jamie Hooper[4], Charles Michel[5] and Norman Ratcliffe[6]

1 Alderney Wildlife Trust, 34 Queens Street, St Anne, Alderney GY9 3TA, UK
2 c/o BTO, The Nunnery, Thetford, Norfolk IP24 2PU, UK
3 RSPB, Keble House, Southernhay Gardens, Exeter, Devon EX1 1NT, UK
4. La Société Guernesiaise, Candie Gardens, St Peter Port, Guernsey GY1 1UG, UK
5 Biomedical Sciences, Imperial College, London SW7 2AZ, UK
6. RSPB, 10 Albyn Terrace, Aberdeen AB10 1YP, UK
Email: Helen.booker@rspb.org.uk

In 2005, data were collected to investigate the causes of the decline of Atlantic puffins *Fratercula artica,* on the small island of Burhou off the coast of Alderney in the Channel Islands. The 1969

Operation Seafarer survey reported 1028 puffins on Burhou, which had declined to 180 by the Seabird 2000 census. An increase in *Larus* gulls on Burhou has lead to local pressure for culling of gulls, deemed by many to be the main cause of the puffin decline. Conservation organisations, supported by the Government of Alderney, initiated the study to ensure any management was evidence based. The study investigated the populations, density and distribution of gulls and puffins, the interaction between them in the form of direct predation, disturbance and kleptoparasitism.

The level of predation of puffins by great black-backed gulls was found to account for 40% of the expected annual mortality. The densities of lesser black-backed gulls were at levels that have been shown to reduce the recruitment of puffins to the breeding colony on the Isle of May. Kleptoparistism did not occur at a rate significant enough to affect puffin chick survival, although provisioning rates were somewhat low compared to the Isle of May. In 2006, limited control of predatory great black-backed gulls and disturbance of herring and lesser-black backed gulls out of the puffin colony area will be conducted. The effects of this on puffin predation rates, recruitment and kleptoparasitism will be presented.

Ivory gulls in Canada in serious decline

IAIN J. STENHOUSE[1], H. Grant Gilchrist[2], Mark L. Mallory[3] and Gregory J. Robertson[4]

1. Audubon Alaska, Anchorage, Alaska, USA.
2. Canadian Wildlife Service, National Wildlife Research Centre, Ottawa, Ontario, Canada
3. Canadian Wildlife Service, Prairie & Northern Region, Iqaluit, Nunavut, Canada
4. Canadian Wildlife Service, Atlantic Region, St. John's, Newfoundland & Labrador, Canada.
Email: istenhouse@alaska.net

Ivory gulls *Pagophila eburnea* breed only in the High Arctic and remain in the northern oceans to forage amongst pack-ice in winter. Thus, it is not surprising that the ecology of this species is largely unknown. The world population is estimated at 14,000 breeding pairs, and Canada was believed to host up to 1,200 breeding pairs in the early 1980s. In 2002, in response to the concerns of Arctic residents, who reported fewer sightings around their communities, the Canadian Wildlife Service initiated annual colony surveys. Over the last 5 years, results have consistently indicated a decline of 80-85% in ivory gulls breeding in Canada. Numbers at colonies across the range have been consistently low, and colonies appear to be used only intermittently. These results prompted Russia and Norway to survey their colonies in 2006. The cause for such a drastic decline is unknown, however, and the population is likely to be influenced by a number of different factors. Eggs collected in 2005 showed a high mercury level. There are also several potential risks to their breeding habitat - changes in the distribution, seasonal extent, and thickness of pack-ice are likely to have a considerable effect on ivory gulls, which forage on ice-associated invertebrates and fish. Natural and human-induced disturbance may also be detrimental to breeding success. Prospecting and exploratory drilling for mineral resources has increased rapidly in Canada, especially in areas where ivory gulls nest and previously devoid of human disturbance.

The impact of brown rats on Canna's breeding seabirds

BOB SWANN[1], David Aiton[2], Simon Foster[3], Kenneth Graham[4], Alan Graham[4], Andrew Ramsay[5] and Alastair Young[6]

1. 14 St.Vincent Road, Tain, Ross-shire IV19 1JR,UK
2. 17 Tor View, Contin, Ross-shire IV14 9EF, UK
3. 8 St Johns Avenue, Inverness, IV3 5AB, UK
4. Col Bheinn Road, Brora, Sutherland, KW9 6NZ, UK
5. Lower Courthill, by Tain, Ross-shire IV19 1NE, UK
6. Inchberry School House, Orton, by Fochabers, Moray IV32 7QB, UK
Email: robert.swann@homecall.co.uk

Canna's breeding seabird populations have been monitored annually since 1969. Throughout the 1970s and into the early 1980s there were large increases in the number of breeding European shags, herring gulls, great black-backed gulls, black-legged kittiwakes, common guillemots and razorbills. Through the late 1980s and into the 1990s these increases stopped and populations began to decline. This talk will examine the causes of these declines.

The first species affected was Manx shearwater, where there was much evidence of predation of eggs and young by rats. The main colony, which had contained 1500 pairs, had been abandoned by 1999. At the same time major declines in shag, gull and auk breeding numbers were taking place at the Nunnery colony. These declines then began to spread to other colonies on the island, and became more severe.

On Canna many seabirds nest under boulders at the base of large tallus slopes on a raised wave cut platform about 25m above present day sea level. In such situations they are very prone to predation by mammals. Stashes of depredated eggs and remains of depredated chicks were found under the boulders. This increase in predation had two main effects, which will be described during the talk. Firstly a decline in overall numbers and secondly a redistribution of nesting birds. Birds nesting on inaccessible cliffs showed no decline in numbers, indeed black-legged kittiwakes underwent a rapid increase in numbers up till 2004. Other factors that may have affected seabird numbers on Canna, particularly food supplies. An update will be given on the 2006 breeding season on Canna, following the winter 2005/06 rat eradication campaign on the island.

Seabird attendance and behaviour: parental roles and responses to feeding conditions in common guillemots and razorbills

CHRIS B. THAXTER[1], Keith C. Hamer[1] and Sarah Wanless[2]

1. Ecology and Evolution Group, Institute of Integrative and Comparative Biology, University of Leeds, Leeds. LS2 9JT, UK
2. Centre for Ecology and Hydrology, Hill of Brathens, Banchory, Aberdeen. AB21 4BW, Scotland
Email: bgycbt@leeds.ac.uk

Changes in the abundance and quality of seabird prey can have a profound influence on populations, productivity, and behaviour of birds at the colony. These changes are driven by external extrinsic factors such as over-fishing, and also climatic variables such as the North Atlantic Oscillation, which in turn can reverberate up through the trophic levels reaching seabirds. Detection of altered behaviour of seabirds at the colony, for example in the food they bring back to chicks, is therefore a valuable tool for assessing the quality of feeding conditions and prey out at sea. Likewise, the variation in the responses of different species of seabird to such changes can also highlight species more at risk from potential pressures. This paper examines two sympatric breeding alcids, on the Isle of May, Scotland, the common guillemot *Uria aalge* and razorbill *Alca torda*, both of which have negligible sexual-size dimorphism, for parental effort and attendance behaviour. We recorded a significantly higher provisioning rate to chicks by female guillemots (male: 0.07 feeds/chick/hr^{-1}; female: 0.11 feeds/chick/hr^{-1}), but not for razorbills (male: 0.17 feeds/chick/hr^{-1}; female: 0.22 feeds/chick/hr^{-1}), and a higher overall razorbill provisioning rate possibly due to shorter foraging trips to feeding grounds; guillemots provisioned chicks mainly on sprats *Sprattus sprattus* and herring *Clupea harengus*, whereas razorbills fed chicks primarily on larval lesser sandeels *Ammodytes marinus*. We also observed a larger amount of time devoted by females of both species to incubation whereas time spent with the chick decreased with chick age. Males spent longer periods in discretionary "off-duty" time, which can potentially be allocated to foraging for chicks. This indicated sexual segregation of roles during the breeding season that was not mediated by a competitive sexual size advantage. A greater amount of time was spent off-duty in razorbills than guillemots, and guillemots also chose to leave chicks unattended or "neglected" at the nest, whereas no razorbill chicks were left unattended. This again highlights key differences between the two species. The paper concludes with a contextual comparison of guillemots and razorbills, the possible reasons for variations observed, and the implications this has for both in relation to food supplies out at sea.

Links between climate change and the fuel loads of migrating European storm petrels *Hydrobates pelagicus*

ROBERT J. THOMAS[1], Renata Medeiros[1] and Mark Bolton[2]

1. Cardiff School of Biosciences, Cardiff University Main Building, Museum Avenue, Cardiff, Wales, CF10 3TL, UK.
2. Royal Society for the Protection of Birds, Sandy, Bedfordshire, SG19 2DL, UK.
Email: ThomasRJ@Cardiff.ac.uk

We describe large between-year fluctuations in the level of body reserves carried by the smallest Atlantic seabird -the European storm petrel *Hydrobates pelagicus* - during their northward migration past the coast of SW Portugal. Rather than varying erratically, the pattern of body mass changes over the 16-year study period (1990-2005) follows a remarkably smooth oscillation. There is no trend in body mass over the brief (~4-6 weeks) period of passage past Portugal, so these oscillations are not artefacts of small differences between years in the distribution of capture effort, etc. Multivariate analyses reveal local sea surface temperature (SST) off SW Portugal to be the prime factor associated with between-year changes in body reserves. SST is itself influenced by a whole suite of climatic and oceanographic processes, including the North Atlantic Oscillation (NAO) the latitude of the Gulf Stream, and recent air temperatures. Furthermore, it is not SST during the time of migration past Portugal (June) that best explains the level of body reserves carried, but sea temperatures in the 2-7 months beforehand. At this time, the storm petrels themselves are still many hundreds of miles to the south, but primary and secondary productivity in Atlantic waters off Iberia is reaching its peak. This time-delay in the relationship suggests that the link between SST and body reserves is not due to a direct thermal effect, but is likely to be mediated by the climate-driven effects of SST on marine productivity, and hence on food supply of storm petrels during migration.

Distribution and abundance of the white-faced storm petrel *Pelagodroma marina* in Victoria

MEGAN UNDERWOOD[1] and Ashley Bunce[2]

1. Deakin University, School of Life & Environmental Sciences, Pigdons Road, Geelong, Victoria, 3217, AUSTRALIA
2. Deakin University, School of Life & Environmental Sciences, 221 Burwood Hwy, Burwood, Victoria, 3125, AUSTRALIA
Email: megan.underwood@deakin.edu.au

Habitat loss and modification is a major factor driving reductions of seabird populations. The white-faced storm petrel *Pelagodroma marina* is restricted to three breeding colonies within Victoria: Mud Islands and South Channel Fort in Port Phillip Bay, and Tullaberga Island off Mallacoota. The numbers of storm petrels breeding on Mud Islands and South Channel Fort have declined considerably, possibly a result of the significant vegetation changes, together with increases in local populations of other species of birds, most notably, silver gulls *Larus novaehollandiae*. On Mud Islands the breeding area available to the storm petrels appears to be limited by the recent arrival of the Australian white ibis *Threskoirnis molucca*, and straw-necked ibis *T. spinicollis* which now breed on the islands in large numbers (approximately 15,000 pairs). The impact of these changes on the storm petrels is poorly understood. The current status of storm petrels at Tullaberga Island is unknown. This study estimated the size of the breeding population at all three sites by determining burrow densities. Burrow density was found to be related to vegetation type and other habitat factors. This study has highlighted important information on the breeding habitat of the white-faced storm petrel and the implications for management are discussed.

Recruitment in common guillemots

STEPHEN C. VOTIER[1], Ben J. Hatchwell[2], Andrew Beckerman[2], Robin H. McCleery[3], Fiona M. Hunter[2], Jayne Pellatt[2], Mark Trinder[4] and Tim R. Birkhead[2]

1. Marine Biology and Ecology Research Centre, School of Biological Sciences, University of Plymouth, Drake Circus, Plymouth, PL4 8AA, UK
2. Department of Animal and Plant Sciences, University of Sheffield, Sheffield S10 2TN, UK
3. Department of Zoology, South Parks Road, Oxford, OX1 3PS, UK
4. Wildfowl and Wetlands Trust, Slimbridge, Gloucestershire, GL2 7BT, UK
Email: stephen.votier@plymouth.ac.uk

Recruitment is an essential component of population processes, but for seabirds that do not typically commence breeding until they are several years old, it has proved especially difficult to estimate this vital rate. The development of multistate models has now enabled the accurate modelling of accession to reproduction and here we use observations of birds ringed as chicks later resighted at the breeding colony, to construct such a mark-recapture model for a large colony of common guillemots *Uria aalge* at Skomer Island, Wales. We evaluate the relationship between recruitment probability and a number of environmental factors (NAO, SST, availability of forage fish) and population density, as well as the incidence of four major oil spills that occurred within the bird's wintering range.

Modelling habitat preferences of albatrosses and large petrels from South Georgia

EWAN D. WAKEFIELD[1], Richard A. Phillips[1], Jason Matthiopoulos[2] and Philip N. Trathan[1]

1. British Antarctic Survey, Natural Environment Research Council, High Cross, Madingley Road, Cambridge CB3 0ET, UK
2. Sea Mammal Research Unit, Gatty Marine Laboratory, University of St Andrews, Fife KY16 8LB, UK
Email: ewdw@bas.ac.uk

Albatrosses and large petrels are the most threatened group of seabirds in the world yet until recently the at-sea movements of the majority of species remained obscure. Over the past fifteen years tracking devices have been used to locate the foraging areas most frequently visited by albatrosses and petrels from South Georgia. Some of these core areas coincide with meso/macro scale environmental features such as the Patagonian Shelf break, the Antarctic Polar Frontal Zone and the South Scotia Arc, which are characterised by high levels of primary and secondary production. Despite increasing evidence of the importance of frontal zones, eddies, warm core rings and other oceanographic phenomena for these and other populations, it is unclear to what extent and by which mechanisms heterogeneity in the physical environment gives rise to preferred habitat for albatrosses and petrels. This is a serious shortcoming, as the consequences of fisheries interactions and environmental change cannot be adequately predicted without an understanding of the processes underlying observed distributions. This poster presents a population level framework for modelling the habitat preferences of albatrosses and large petrels as a function of their use of space. Key concepts incorporated into this framework include: the choice of environmental variables that meaningfully describe pelagic habitats; the relative accessibility of different points in space, taking into account distance and wind induced costs; variation in behaviour with habitat and how this can be inferred from telemetry data; the scales at which it is practicable to collect data and at which the distribution of albatrosses and petrels may be coupled to the underlying physical structure of their environment.

Strategic surveys of seabirds in areas proposed for wind farms around the UK

ANDY WEBB[1] and Peter Cranswick[2]

1. Joint Nature Conservation Committee, Dunnet House, 7 Thistle Place, Aberdeen AB10 1UZ, UK
2. Wildfowl and Wetlands Trust, Slimbridge, Gloucestershire GL2 7BT, UK
Email: andy.webb@jncc.gov.uk

The UK government is committed to the use of renewable energy as part of its contribution to reducing carbon dioxide emissions as part of the Kyoto Treaty, and has extended planning of wind farms from land into the marine environment. Wind turbines are known to impact on bird populations in the terrestrial environment, mainly because of collisions when wind farms are sited inappropriately. Collision risk, disturbance and displacement are the main potential threats from wind farms for seabirds, yet the true magnitude of these threats in the marine environment is not well understood. A number of initiatives are under way to investigate these potential impacts. As part of a more strategic approach to licensing new wind farm developments, the UK government required a good understanding of the numbers and distribution of seabirds in areas where wind farms may be located. At the same time, the JNCC was identifying a series of Special Protection Areas (SPAs) at sea under the EU Birds Directive. Information on the location of SPAs was needed for this strategic approach to licensing wind farm developments. An integrated approach was adopted for data collection where these areas overlapped. Much of the available information, particularly for inshore species such as seaduck *Anatidae*, divers *Gaviidae* and grebes *Podicipedidae*, was unsuitable for providing a strategic overview or for identifying SPAs. Aerial surveys have provided large quantities of distribution data including a number of important discoveries. Considerably greater numbers of common scoter *Melanitta nigra* were found in Liverpool Bay (up to 79,000) than were known previously to occur, and a high proportion were found to occur within the limits of the proposed wind farm development on Shell Flats. A similar discovery was made in the Thames Estuary for red-throated divers *Gavia stellata* where 8,200 were estimated to spend the winter, compared with an old population for the whole of Great Britain of 4850.

Not again! The effect of frequency and nature of pedestrian approaches on the behaviour of wandering albatrosses at Marion Island.

MARIETTE WHEELER, Prideel A. Majiedt and Marienne S. de Villiers

Avian Demography Unit, Department of Statistical Sciences, University of Cape Town, Rondebosch, South Africa
Email: mbause@adu.uct.ac.za

The wandering albatross *Diomedea exulans* has been classified as Vulnerable, with numbers fluctuating due to both environmental and anthropogenic effects. The Prince Edward Island group (consisting of Marion and Prince Edward) is an important breeding ground of this species, with 44% of the global population breeding there. Human disturbance may divert parental attention from fitness-enhancing activities such as feeding, care of offspring or mating displays. Disturbed birds may also leave their nests, leading to increased exposure of nest contents to the elements or to predators. On Marion Island, such disturbance may be due to biological research, logistic activities and incidental disturbance by island personnel. The degree of tolerance to disturbance may vary according to the frequency and nature of the disturbance. In this study, the reaction of wandering albatrosses to standardised single- and two-person approaches was tested during the brooding phase. Single-person approaches were performed to birds that are seldom disturbed by humans (A), birds close to a field hut that are more often exposed to incidental disturbance (B), birds in one of the long-term study colonies (C), and birds close to the permanent research station (D). Birds in group A were subdivided into three treatment groups, and approached either four times on a single day; twice a day for three consecutive days; or once on the first day as well as once on the third day of the study. Nests in groups A and B were monitored two weeks later to assess differences in breeding success. Two-

person approaches were performed to seldom-visited birds (E), and birds from which blood had recently been drawn as part of another research program (F). Birds in groups A and E exhibited less intense behavioural responses than those more regularly exposed to human disturbance. While the responses of birds approached four times a day had not changed much by the fourth approach, birds approached twice daily exhibited more intense responses on the third day. This latter treatment also had the largest proportion (25%) of nest failures. Responses were in general greater during two-person than single-person approaches. The results of the study are discussed in terms of the Prince Edward Islands Management Plan.

Effects of radiotransmitters on tufted puffin *Fratercula cirrhata* reproductive success

S. ERIN WHIDDEN[1], Cory T. Williams[1], André R. Breton[1] and C. Loren Buck[1]

1. School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 245 O'Neill Bldg., Fairbanks, AK 99775, USA
Email: whidden@sfos.uaf.edu

Radio telemetry devices are useful in monitoring patterns of nest attendance and the foraging range and distribution of breeding birds. Results may be biased, however, if the attachment of these devices affects reproductive behaviour. In 2003, as part of a multifaceted study on the feeding ecology of tufted puffins *Fratercula cirrhata*, we captured twenty-five breeding adults at two colonies in Chiniak Bay, Kodiak Island, Alaska and fitted them with subcutaneously anchored radiotransmitters (< 1.2 % of body mass). We determined presence of radio-marked birds at each study site using detections from automated, remote radio telemetry systems. Using nest monitoring data, we compared rates of nestling growth, fledging mass and success for chicks with (treatment group) and without (control group) one radio-marked parent. Although telemetry data indicate that most radio-marked adults continued to attend the colony in the weeks following capture and attachment of radios, we found that nestlings with a radio-marked parent had exhibited lower growth rates (6.88 ± 2.62 g/day *vs.* 14.36 ± 0.96 g/day) and fledging success (0.33 ± 0.19 % *vs.* 0.84 ± 0.09 %) compared to chicks in the control group. These results suggest that transmitters did not induce high mortality in adults; instead, colony attendance by adults fitted with transmitters declined sharply or completely and this led to high nestling mortality. Given the strong negative effects of applying radiotransmitters detected here and elsewhere in alcids (Family Alcidae) and other seabirds, we suggest that extreme caution be applied in the planning and analysis stages of a radio telemetry study when monitoring these species.

Bird bycatch in coastal gillnets – local impact or significant threat to waterbird populations?

RAMŪNAS ŽYDELIS[1], Michelle Sims[1] and Mindaugas Dagys[2]

1. Duke Center for Marine Conservation, Duke University Marine Laboratory, Nicholas School of Environment and Earth Sciences, 135 Duke marine Lab Rd, Beaufort, NC 28516, USA
2. Institute of Ecology of Vilnius University, Akademijos 2, Vilnius, LT-08412, Lithuania
Email: zydelis@duke.edu

Gillnet fisheries take place in coastal waters of many countries in northern Europe. A number of waterbird species aggregate in coastal habitats during winter and migration seasons. Therefore, there is high potential for bird bycatch to occur. Comprehensive assessment of gillnet fishery impact on waterbirds populations is lacking, however there was a number of case studies conducted in different countries around Europe, which aimed to evaluate bycatch mortality. We present a case study from Lithuania, Eastern Baltic. Sea ducks, particularly long-tailed ducks, were found to be the most frequent victims; however divers were identified as the most vulnerable group of birds with regards to their bycatch relative to number of individuals occurring in the area. Net mesh size appeared to be the most important gear characteristic determining bird entanglement rates. We also summarize and map reported bird bycatch studies from other countries in northern Europe. We conclude that bird bycatch

mortality could be relatively high locally, and discuss how this could reflect on populations at a larger scale.

Author Index