



## 1ST WORLD SEABIRD CONFERENCE Seabirds: Linking the Global Oceans

# Poster Session 1 Abstracts

The 1st World Seabird Conference has the distinct pleasure of presenting over 700 presentations during the conference September 7 to 11, 2010 in Victoria, Canada. These presentations include over 120 Invited Sessions, over 120 Contributed Sessions, and over 380 Posters. A series of Legacy Workshops, other Workshops and a Legacy Plenary round out the conference program. This document presents the full abstracts for the Contributed Session.

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## Behavior & Breeding Biology

### P1-1 Patricia Baird

#### Group adherence, age structure, pair bonds and changes in prey in a Least Tern colony

“At one of the larger sink colonies of California least terns, where I had marked most of the adult population, I found that during poor food years, pairs nesting near each other the previous year often switched colonies as a group. Additionally, other seemingly monogamous pairs entered into a loose bond with a third adult during food-poor years. These three adults did not remain together the next year, and the original pair often returned to breed. Most of the birds that had moved en masse also returned to the breeding colony the next year. There did not appear to be an effect on reproductive success by either strategy.”

### P1-2 Kelly Boadway

#### Comparisons of breeding ecology: range-centre versus range-edge of a ground-nesting seabird

“Studies of the variation in breeding ecology of several species across their breeding ranges have led to the abundant-centre hypothesis, which states that species are more abundant in the centre of their range. However, a considerable number of species do not conform to it, which may mean that the many ecological hypotheses that have been developed based on the abundant-centre could be incorrect. At a time when Arctic waters are increasingly open to human activities, assumptions about the breeding ecology of seabirds in the Arctic based on research conducted in temperate colonies at the southern edge of their range may prove detrimental if management decisions are incorrectly applied to Arctic colonies. We are conducting research on the breeding ecology of Arctic terns (*Sterna paradisaea*) on a small, unnamed island in the High Arctic of Nunavut. We present data comparing Arctic terns breeding in the High Arctic and those well-studied terns breeding near the southern extent of their range in the temperate Gulf of Maine, North America. This research will allow managers to make better decisions relevant to ground-nesting seabirds breeding in the High Arctic of Canada, and increase our understanding of the variation in breeding ecology of Arctic terns across different oceanic regions within their breeding range.”

Antony Diamond; Mark Mallory

### P1-3 Sergei Kharitonov

#### Behavioral structure of Little Auk (*Alle alle*) and Crested Auklet (*Aethya cristatella*) colonies

“Study was conducted in 2005 at Bear Island (74 23 N, 19 02 E); in 1987-88, 2008 Talan Island (59 20 N, 146 05 E); 1974, 2009 Saint Jonah's Island (56 24 N, 143 23 E). In both species

most social interactions that create a behavioral structure of the colony occur in clubs, or arenas on the surface of talas, apart from nesting crevices. Not enough room for arenas is available under stones. Both non-breeders and breeders attend these arenas. Little Auks (LA) create very unusual two-level territorial system. A number of birds participate in the higher territory level: they hold territories up to 15 m in diameter. Each owner protects its territory from other such owners. Most LA hold smaller territories (1-2 m in diameter) for breeding within mentioned larger territories. Larger territory owners control the content of breeding pairs on their territory, allowing them to breed there or not. The formers interfere conflicts between breeding birds, supporting one of competing pairs; stop fights between pairs or chase a pair away. Crested Auklets (CA) can stop other pair conflicts, as well. The territorial system of CA looks very ambitious: males try to strengthen themselves not only on their main demonstration territory on stones, but also, more or less temporarily, on the territories of neighboring males, trying to subordinate them. Sometimes, there could be a kind of display order near tops of local elevations (filmed). However, the dominant status is never permanent: singing order may occasionally reverse. The denser arena, the male activity is more spread among greater number of neighboring territories.”

### P1-4 Maria Ushakova

#### Modern distribution, number in colonies of Rhinoceros Auklet, Tufted Puffin and Spectacled Guillemot on South Kurils and methods of their number estimation”

“We research day and night activity, number in colonies of South Kuril of Rhinoceros auklet (*Cerorhinca monocerata*), Spectacled guillemot (*Cepphus carbo*) and Tufted Puffin (*Lunda cirrhata*) in 2002-2005. We found that number of birds near the colonies on South Kurils is different for each period of reproductive cycle and time of the day. There is the best time for nesting pairs number monitoring. Morning activity is always predominated for Spectacled guillemot and Tufted Puffin. We found empiric coefficients of difference between number of nesting birds and birds one can observe near the colony and used it for colony size estimation. The number of nesting pairs Rhinoceros auklet may be hold only during late evening (2 hours before darkness) accumulation of rhinoceros auklet near the colonies in late incubation and chick rearing periods, using our empiric coefficient equaled from 10 to 20, because most birds arrive during night in darkness. There are about 25 colonies and more than 375 000 nesting pairs of Rhinoceros auklet (*Cerorhinca monocerata*), 38 colonies and more than 2300 nesting pairs of Spectacled guillemot *Cepphus carbo*; 18 colonies and about 800 nesting pairs of Tufted Puffin (*Lunda cirrhata*) on South Kurils by 2005. It greatly differs from their earlier estimations.”



### P1-5 Hirata Kazuhiko

#### The factors to affect landing of Rhinoceros Auklets: the risk of kleptoparasitism by gulls and the distance to nest

“During chick-rearing period, Rhinoceros Auklets (*Cerorhinca monocerata*) are often robbed fish for their chick by gulls. Rhinoceros Auklets land synchronously in crepuscule to reduce the risk of kleptoparasitism. However none show how Rhinoceros Auklets behave to reduce the risk in fine scale. In this study, the landing behavior of Rhinoceros Auklets was observed in high risk condition (e.g. on bare area and in light hour) on Teuri Island. I focused synchrony and the distance to nest and gulls. I presumed the probabilistic distribution of interval of time between landings of Rhinoceros Auklets as index of synchrony. Rhinoceros Auklets did not land synchronously on any vegetative and brightness condition. On bare area, Rhinoceros Auklets landed near their own nest and away from gulls. The distance from nest did not impact the level of the risk of kleptoparasitism. On the other hand, the nearer from gulls, the higher risk. Why did not Rhinoceros Auklets land away from gulls? Rhinoceros Auklets land only once a day intensively. At crepuscule, landing rush hour, the level of the risk might be low because it was enough dark for visual predator such as scale. It is suggested that Rhinoceros Auklets accorded landing near their own nest priority over landing away from gulls. Then Rhinoceros Auklets have a greater tendency to be kleptoparasitized when there are gulls near nest contingently.”

Yutaka Watanuki

### P1-6 Megumi Shikata

#### Intraspecific kleptoparasitism in an alcids: Rhinoceros Auklet *Cerorhinca monocerata*

“Intraspecific kleptoparasitism, the stealing of food from members of the same species, is often reported in seabird species that breed at high density and bring food in the bills, i.e. terns, but not yet in alcids that share these characteristics. Rhinoceros Auklets *Cerorhinca monocerata* breed at high density (>1 nests/m<sup>2</sup>), forage during the daytime and bring fish in their bills to the chicks once per night. Black-tailed gulls steal fish from the auklets often. We found that the auklets also stool fish each other. To investigate the intraspecific kleptoparasitism in detail, we observed birds landing with fish, captured and measured auklets participating intraspecific kleptoparasitism and video-taped birds coming into the nest boxes in 2006-2009. Seventy percent of birds landing with fish were attacked by gulls and 13% by the auklets. 88% of birds participating in kleptoparasitism was males. Body Size of males participating wasn't different from average males. However, bill size of males that succeeded in stealing fish was larger than those failed. Among 20 video-taped pairs, 7 parents (6 males and 1 female) often (0.2-0.6 times per night) brought fish more than

two times during the night; indicating that they stool fish from other birds. These suggest that 1) the auklets got some amount of food by stealing from other parents, 2) there was large sex and individual variation in taking this foraging strategy that was not reported before in alcids.”

Motohiro Ito; Kazuhiko Hirata; Yutaka Watanuki

### P1-7 Shandelle Henson

#### Socially-induced synchronization of egg-laying in a seabird colony

“Spontaneous oscillator synchrony has been documented in a wide variety of electrical, mechanical, chemical, and biological systems, including the menstrual cycles of women and estrous cycles of Norway rats. It has been unknown, however, whether the analog of menstrual synchrony occurs in birds, that is, whether avian ovulation cycles can synchronize. We report every-other-day egg-laying synchrony in a breeding colony of Glaucous-winged Gulls (*Larus glaucescens*) and show that the level of synchrony declined with decreasing colony density. We also pose a mathematical model based on the hypothesis that preovulatory luteinizing hormone surges synchronize through social stimulation. Model predictions are consistent with observations.”

James Hayward

### P1-8 Nora Rojek

#### Use of video and time-lapse cameras to monitor nest fate of Steller's Eiders near Barrow, Alaska”

“Breeding effort and success of Steller's eiders (*Polysticta stelleri*) and their predators near Barrow, Alaska varies widely from year to year in response to fluctuations in abundance of brown lemmings (*Lemmus trimucronatus*). Predation is believed to be the main cause of low eider nest success (averaging 27% 1991-2008). Understanding causes of nest failure is important to recovery efforts for the Alaska-breeding Steller's eider, a population listed as threatened in the United States. From 2005-2008, we monitored 25 Steller's eider nests using video and time-lapse digital cameras. Seven nests failed due to predation or partial predation prior to nest abandonment: 4 by pomarine jaegers (*Stercorarius pomarinus*), 1 by arctic fox (*Alopex lagopus*), 1 by combination of fox and jaeger, and 1 by common raven (*Corvus corax*). Two additional nests were partially depredated by jaegers, but hens successfully resumed incubation. The study was confounded by fox control in all years. With fox control, small numbers of nesting jaegers were an important predator in years with moderate lemming numbers (2005 and 2007). In high lemming years (2006 and 2008), no camera-monitored nests failed despite the presence of several hundred nesting jaegers. We documented predators removing whole eggs from nests and scavenging nest bowl contents after hens successfully departed with broods. Fate of



nests, or cause of nest failure, therefore, cannot be determined with certainty based on after-the-fact examination of nest sites.”

**Philip Martin; Ted Swem**

### **P1-9 Glenn Crossin**

#### **Egg provisioning decisions by Black-browed Albatrosses are made before their arrival at a breeding colony**

“Like most seabirds, albatrosses possess a slow life-history characterized by delayed reproduction, a small clutch size, and prolonged parental care. Consistent with life-history theory, albatrosses make decisions year to year about whether to breed, and if intrinsic and (or) extrinsic conditions in a given year are unfavourable, birds will defer in favour of future reproductive opportunities. Such reproductive tactics have been well documented in breeding black-browed albatrosses (*Thalassarche melanophrys*), and at the start of a breeding season birds will inevitably experience one of three possible fates: birds will either defer reproduction until the next year, or they will attempt reproduction and either fail or succeed at fledging a chick. The physiological mechanisms underlying this variation however are poorly known. Here we present data which show that in female albatrosses, the decision to begin egg-formation, as indicated by variation in circulating sex steroid and yolk precursor concentrations, is made prior to their arrival at a breeding colony (Bird Island, South Georgia). Arriving females who ultimately lay and fledge chicks have indicators of vitellogenesis that are more than twice those of deferring birds. Furthermore, females that lay eggs that fail to hatch have basal vitellogenic profiles that are the same as in deferring birds rather than successful birds. The implications of this are discussed in relation to female pre-breeding condition and to migratory carry-over effects.”

**Richard Phillips; Phil Trathan; Derren Fox; Katherine Wynne-Edwards; Alistair Dawson; Tony Williams**

### **P1-10 Kentaro Kazama**

#### **Individual variation in aggressiveness and breeding success in colonial breeding Black-tailed Gulls**

“Individual variations in some behavioral traits (e.g. aggressiveness) have been documented in many animals including bird species recently. However, function of these individual variations in colonial breeding is still unclear. In Black-tailed gull (*Larus crassirostris*) breeding colonially at Rishiri Island, Japan, it is known that some particular males mob against predators always aggressively and the others never mob. To examine the function of this individual variation in colonial breeding, we investigated relationships among individual aggressiveness against a predator decoy (crow), intensity of territorial defense, and breeding success

of male gulls. Approximately 30% of all males mobbed against predator decoys aggressively. Such aggressive males reduced egg predation risks not only of own nest but also of their neighbors’ nests. They vigorously defended the area around their territory including neighbor nests against conspecific intruders. As a result they increased fledging success not only of own chick but also of their neighbors’ chicks by reducing the risk of conspecific chick killing. Our results highlighted that benefit of colonial breeding vary with neighbors’ aggressiveness.”

**Yasuaki Niizuma; Yutaka Watanuki**

### **P1-11 James Hayward**

#### **Effects of climate, habitat, and predation on hatching success in Glaucous-winged Gulls**

“Female Glaucous-winged Gulls (*Larus glaucescens*) typically lay between one and three eggs per season. We determined hatching success, a measure of fitness, for Glaucous-winged Gulls at a large breeding colony on Protection Island, Washington, USA for each of five consecutive breeding seasons, 2006-2010. This interval spanned two inormal years (2006 and 2009), two El Niño events (2007 and 2010), and one La Niña event (2008). Data were based on at least 367 eggs per year in at least 184 nests distributed over five habitat types. Tentative conclusions are summarized as follows: Hatching success is 1) reduced during El Niño events partly due to egg cannibalism, 2) increased during La Niña events when excess food is available, 3) higher for nests located by logs or small shrubs than elsewhere, 4) higher for multi-egg nests than for single-egg nests, 5) higher for A-eggs with delayed incubation than for A-eggs with non-delayed incubation, 6) unrelated to nearest-neighbor nest distance, and 7) increasingly impacted by Bald Eagle predation. Moreover, eggs in nests located at the edges of or within stands of tall beach grass are more vulnerable to Bald Eagle predation but less vulnerable to egg cannibalism than nests located elsewhere. In short, hatching success varies widely in this species depending on factors of climate, habitat, and type of predation.”

**Shandelle Henson**

### **P1-12 Trevor Haynes**

#### **Dynamics of multispecies seabird forage flocks near Juneau, Alaska**

“During the summer of 2008, we examined the dynamics of multispecies forage flocks near Juneau, Alaska. We conducted 700 m wide strip transects to determine seasonal and regional differences in forage flock occurrences and species composition. We conducted focal observations on 39 flocks to determine which bird species were present at initiation, how species composition changed through time, and how each flock was terminated. Capelin (*Mallotus villosus*), sampled by



dipnet (N = 44), were the only prey targeted by forage flocks. Flock densities ranged from an average of  $0.02 \pm 0.03$  flocks/km<sup>2</sup> in Stevens Passage to  $0.24 \pm 0.19$  flocks/km<sup>2</sup> in Tracy Arm. Of 174 flocks observed on transects or incidentally, 172 were multispecies flocks and 170 of those involved at least one species of diving bird. During focal observations we saw 22 of 39 flocks initiate. Diving birds initiated 16 of the 22 flocks with murrelets (*Brachyramphus* sp.) initiating 14, Pacific loons (*Gavia pacifica*) initiating one, and both murrelets and Pacific loons initiating one. Surface feeders, including gull species and bald eagles (*Haliaeetus leucocephalus*), initiated six flocks. Thirty-one of the 39 focal flocks terminated when diving birds stopped foraging and dispersed, followed by the dispersal of surface feeders. Eight flocks were terminated by humpback whales (*Megaptera novaeangliae*) lunge feeding at the center of the flock. Forage flocks appear to play an important role in the foraging ecology of birds in this region and provide feeding opportunities for species that would otherwise not be available.”

S. Kim Nelson; Veronica Padula

### P1-13 Kyle Morrison

#### Sexual conflict over parental care and timing of moult in Cassin's Auklet on Buldir Island, Alaska

“Parental care is energetically costly. Sexual conflict over parental care is a consequence of each parent trading-off investment in its current breeding attempt with its own condition and the likelihood of future breeding attempts. Sexual conflict occurs when the reduced effort by one parent decreases the reproductive success of the other parent in the current breeding attempt (reduced offspring number or condition) or in future breeding attempts (reduced condition of parent). Molt of flight feathers is another energetically costly process that is temporally separate from breeding in most bird species. However, molt-breeding overlap may be advantageous in species constrained by environmental conditions. In passerine bird species with molt-breeding overlap, earlier molt initiation by males has been linked to sexual conflict over parental care. Molt-breeding overlap occurs in Cassin's Auklet (*Ptychoramphus aleuticus*) in California, with males initiating primary feather molt before females in most years. Sexual conflict over parental care has not been examined in Cassin's Auklets, nor whether molt-breeding overlap occurs in north-western populations. I examined these questions on Buldir Island, Alaska in 2009 by following auklet molt and fledging success. Males began molting before their mate in 14 of 18 pairs. Molt initiation was earlier in males mated to late-laying females. Fledging success was high, and I did not detect an effect of male molt initiation date on success, nor on female or offspring condition. A similar study in a year of lower fledging success or use of another measure of condition may demonstrate

sexual conflict in Cassin's Auklets.”

### P1-14 Ginger Rebstock

#### Parental behavior determines egg temperature and incubation period in Magellanic Penguins

“Magellanic penguins (*Spheniscus magellanicus*) lay two eggs usually four days apart but on average the second egg hatches only two days after the first. Why is the incubation period of the second egg two days shorter than that of the first egg? We hypothesized that incubation behavior of the adults controls the incubation period by controlling egg temperature. Adults only partially incubate the first egg until the second egg is laid so development is delayed for the first egg. We tested this hypothesis by swapping first and second eggs between nests so that first eggs were incubated immediately and second eggs had delayed incubation. We returned the eggs to their original nests after the second egg was laid. In addition, we removed first eggs and placed them in storage, replacing them with artificial eggs, until the second eggs were laid. As predicted, the incubation period of the swapped first eggs (N = 40) decreased significantly to 39 days compared to 41 days in control eggs (N = 18). Incubation period of second eggs (N = 42) increased significantly to 40 days compared to 39 days. Incubation period of first eggs kept in storage (N = 47) increased to 43 days, with 30 of 45 eggs hatching after the second egg in their nests. Swapped first eggs developed as rapidly as control second eggs and swapped second eggs developed as slowly as control first eggs, showing that adults' attention to eggs, not some intrinsic property of the eggs, determines incubation period.”

Dee Boersma

### P1-15 Cecilia Soldatini

#### Parental care in the European Storm-Petrel (*Hydrobates pelagicus melitensis*)

“We have studied the European storm petrel (*Hydrobates pelagicus melitensis*) in the Mediterranean since 2007. We used infrared cameras to record the feeding activities in the colony during the chick rearing period and in absence of human disturbance. We also studied the diet of the species by collecting regurgitated material from adults returning to the colony at night. We sexed adults by analysing their vocalizations from the video. We found that in 2008 there is a higher probability of finding a male on the nest compared to females, while on good condition years there is a 50% chance of finding each sex. We also found that during 2008 males feed the chick longer than females on all years. Referring to same results obtained in other petrel species, we assumed 2008 to be a bad condition year. This would also confirm our recent hypothesis that in storm petrel there is a slight reversed sexual size dimorphism and reversed sex-roles. Regarding the diet, we found that chicks are fed mainly Mediterranean sand



eel, *Gymnammodites cicereus* (Rafinesque, 1810) and adults dive down to 5 m in search of prey. From the videos we observed that chicks are fed several times during the night by both adults and they are also fed entire fish, not only partially digested material.”

**Yuri Albores-Barajas; Bruno Massa**

### **P1-16 Perviz Marker**

#### **Location, location, location - It makes all the difference to nesting success of Little Penguins in Tasmania”**

“Little Penguins, *Eudyptula minor*, breed in a variety of habitats on land. The characteristics of the nesting habitat: vegetation cover and substrate, as well as the degree of human disturbance and proximity to urban development may all have a significant influence on their breeding success. GPS and GIS have been widely used to track and analyse the movements of birds at sea but these tools can also be very useful for investigating habitat requirements of birds in terrestrial breeding colonies. This project combines two scales of data and analysis  $\bar{n}$  landscape GIS layers and fine scale on-ground data collected using Differential GPS at a decimetre level. The breeding habitat of several Little Penguins colonies in North West Tasmania, Australia has been mapped. A combination of spatial and multivariate analysis was used to investigate the range of habitats in which Little Penguins nest. The density of nesting burrows is highest in sites with greater vegetation cover and with a substrate in which the penguins can burrow easily. The significance of this may have implications for land managers and conservation of Little Penguin habitat.”

### **P1-17 Blake Barbaree**

#### **Breeding ecology of Marbled Murrelets in Port Snettisham, southeast Alaska**

“Little is known about the reproductive biology of Marbled Murrelets (*Brachyramphus marmoratus*) in Alaska and new data on nest location and breeding success are important to understanding the life-history strategies and conservation needs of this elusive seabird. In the southern portion of its range, a combination of ground-based forest surveys, radio-telemetry, and roads have allowed researchers to locate and gain access to Marbled Murrelet nests. In largely inaccessible areas, such as Port Snettisham, a mainland fjord in Southeast Alaska, a combination of radio-telemetry survey methods was necessary to locate nesting areas, monitor breeding behavior, and determine nesting success. During 2006-2008, we captured and radio-marked 119 Marbled Murrelets at Port Snettisham. Thirty-seven inland nest locations were identified during aerial surveys; 16 in trees, 19 on cliffs, and 2 in unknown habitat types. Hatching success was 45.2% (n = 42; includes 4 re-nest attempts and 1 nest attempt with unknown

location) and fledging success was 40.0% (n = 15; 4 nest attempts with unknown fate not included). Overall breeding success was 0.176 chicks fledged per breeding pair per year (n = 34). Our estimate of breeding success is the first for Alaska and is similar to estimates from other areas, but is lower than expected for an area with limited anthropogenic disturbance. A low reproductive rate within relatively pristine and remote nesting habitat indicates the need for further research investigating marine resource trends and causes of low breeding success, including comparisons with murrelets in other parts of Southeast Alaska.”

**Kim Nelson; Bruce Dugger; Scott Newman**

### **P1-18 Matthieu Le Corre**

#### **Seasonal and inter-annual variations in the breeding parameters of tropical seabirds in the Seychelles (Cousin Island), in relation to the marine environment”**

“Seabirds are very sensitive to natural and man-induced changes of their marine environment. In the western Indian Ocean the two main changes which occurred during the last 30 years are global warming and the increase of industrial tuna fishery. We initiated in 2005 a monitoring research program to study the effects of these changes on seabird breeding parameters. The study was conducted in the Seychelles, which hold almost half of the seabird biomass of the western Indian Ocean. The duration of the foraging shifts, chick growth, body condition at fledging and breeding success were monitored annually on six seabird species and linked with forcing of the environment. Results suggest that there is a seasonal effect of the oceanic conditions only on the duration on the foraging trips. Environmental perturbations, such as El Niño and positive Indian Ocean Dipole, affect almost all breeding parameters of the studied species. The correlation between breeding parameters and tuna catches was unclear, as tuna abundance is also affected by the marine environment. Coastal and nearshore foragers like noddies were more affected by environmental perturbations than offshore foragers, like tropicbirds and shearwaters. These observations highlight the importance of multi-species monitoring programs to understand the ecological consequences of environmental variability. Over the long term, this monitoring will be useful to better understand the impact of natural and anthropogenic perturbations on the functioning of the marine ecosystems in the tropical Indian Ocean.”

**Kevin Coustaut; Sebastien Jaquemet; Nirmal Shah**



### P1-19 Walter Svagelj

#### Interactive effects of timing and nest placement on the reproductive performance of the Imperial Shag

“Breeding success in seabirds usually declines over the course of the season. Also, the distance of the nest from the edge of the colony has been reported as an important factor affecting breeding success in colonial birds, with peripheral nests usually suffering higher disturbance and depredation than internal ones. We evaluated the influence of timing (laying date) and nest placement (distance to the edge of the colony) on the reproductive performance of the Imperial Shag (*Phalacrocorax atriceps*) for 632 nests monitored during three breeding seasons (2004, 2005 and 2006) at Punta Leòn, Argentina. Breeding success consistently decreased with laying date during the three seasons. We found an interactive effect between laying date and the distance to the edge of the colony. Such distance was not related to breeding success of shags nesting either early or at the peak of the season. However, the breeding success of the late breeders increased with the distance to the edge. Our results suggest that low-quality (young or less-capable) pairs with low abilities in nest defense that breed late in the season, could take some reward nesting away to the colony edge, diminishing disturbance and/or nest-predation risk.”

Flavio Quintana

### P1-20 Martina Kadin

#### A distinct pattern for maturation in Common Murres is influenced by condition as chick

“Common murres *Uria aalge*, ringed as chicks, have been studied when returning to their natal colony in the Baltic Sea, resulting in detailed observations of more than 1000 individuals since 2002. There was a clear pattern in how immature birds successively developed adult behavior (finding a breeding ledge, establishing a pair-bond and breeding). In contrast to findings from other murre colonies, 1-year-olds were observed, commonly on clubs and occasionally on breeding ledges. 2-year-olds were the most frequently observed at breeding ledges, possibly due to high return rates and mobility between ledges. Some 2-year-olds repeatedly visited a single ledge, but this behavior was more common for older birds. Pair bonds were first seen among 3-year-olds and the first breeding attempts occurred at age four. No differences were found between males and females in developing adult behavior. Contrary to expectations, murres defined as ‘early maturity’-individuals (n=33) were lighter at fledging than birds defined as ‘normal maturity’-individuals (n=316). We find two possible explanations for this counter-intuitive result. Low quality individuals have reduced life expectancy or reproductive performance and for them, early investments in reproduction (analogous to the ‘early maturity’ individuals) are more likely to pay off rather than saving

resources for the future. Assuming that fledging weight is positively correlated to quality, individuals with low fledging weight are thus expected to mature at younger ages. An alternative explanation is that fledging weight does not reflect individual quality, but that both weight and maturity are physiologically controlled by the same mechanism.”

Jonas Hentati Sundberg; Olof Olsson; Henrik ÷sterblom

### P1-21 Scott Hall

#### Common Tern chick diet in the Gulf of Maine

“Colony based seabird diet studies generally present longitudinal data for a single species and colony but rarely include multi-site comparisons over the same sampling period. The Gulf of Maine Seabird Working Group was formed in 1984 to restore, manage and monitor tern colonies throughout the region. Here we present a sub-set of chick diet data from Common Terns (*Sterna hirundo*) nesting in 12 managed colonies encompassing three states (Massachusetts, New Hampshire, Maine) and one Canadian province (New Brunswick). Tern chick diet studies were initiated in 1987; in 2009, colony managers were tracking diet for four species of terns at eleven sites ñ overall Common Tern chick diet data are available from 14 islands. Diet information is collected from blinds using binoculars; for each feeding, the number of prey delivered, size (relative to culmen length), type of prey and recipient (by hatch sequence) were recorded. Common Terns in the Gulf of Maine have principally utilized three types of fish (Atlantic herring *Clupea harengus*; Sand Lance *Ammodytes americanus*; “Hake” *Urophycis tenuis* and/or *Enchelyopus cimbrius*) and one marine invertebrate (Euphasiid - *Meganyctiphanes norvegica*); overall, diet breadth includes a minimum of 26 types of fish, 8 terrestrial and 7 categories of marine invertebrates. Prey use varies spatially (by colony and geographically) and temporally (by year and within a season). Although Common Terns are categorized as feeding generalists, diet was relatively consistent within colonies across years. The loss of principal prey at individual colonies has resulted in decreased reproductive success and has contributed to colony abandonment.”

Stephen Kress; Linda Welch; Antony Diamond; Stephanie Koch; Dan Hayward; John Kanter; Diane DeLuca

### P1-22 Abdulmula Hamza

#### The diet of Lesser Crested Tern *Sterna bengalensis* chicks at Elba and Gara islands, Libya

“Diet composition of Lesser Crested Tern *Sterna bengalensis* chicks was studied via the sampling of chick regurgitations at breeding colonies on the Gara and Elba islands, during 2009 breeding season. Ten species of epipelagic and mesopelagic fish were reported from checks of both populations, with 4



other fish species found at nests but not consumed, due to fish size or shape. Prey composition was varied and only two species were found to be recorded at both sites; the round sardine *Sardinella aurita* (34% of fish regurgitated in Gara checks, and 7% in Elba), the Mediterranean Flyfish *Chilopogon heterurus* (31% in Gara and 32% in Elba). The Half beak Hemiramphus far (39% in Elba), which was recently reported in Libya, seems to have an established population around the Elba island waters. The study revealed differences in prey structure (frequency, total length and biomass) at each study site, and added new species to the list of known prey items of the species. More sampling is needed to compile the final list of food items used in provisioning lesser crested tern chicks in Libya.”

**Mike Elliott; Nick Cutts**

### **P1-23 Jeroen Creuwels**

#### **Chick provisioning and growth in Antarctic Fulmarine Petrels**

“Seabirds at high latitudes breed in environments with short, but often highly productive, summers. Not many species can utilise these narrow windows of time to complete the full breeding cycle, but fulmarine petrels appear particularly well adapted through a relatively short period in which they raise their chick. We developed an automatic weighing system with artificial nests to study food provisioning and chick growth. During three seasons (1996-1999), we collected data on chick provisioning of Southern Fulmars (*Fulmarus glacialis*) and Antarctic Petrels (*Thalassoica antarctica*) on Ardery Island (66°S 110°E) near the Australian Antarctic station Casey. Although Southern Fulmars were breeding about 2.5 weeks later than Antarctic Petrels, both were similar in total duration of the breeding period (97 days). Southern Fulmars delivered meals about every 14 hours to their chicks, almost twice as frequently as Antarctic Petrels. Meal sizes varied between the seasons and species, but averaged from 111g to 152g. Antarctic Petrels compensated their lower feeding rate not through larger meals, but probably by a more efficient use of the food by the chicks. By using a “double Gompertz” growth model, we were able to investigate chick growth until peak mass and mass recession until fledging. We investigated the differences in growth between species and how the provisioning and growth parameters were correlated. Earlier studies showed that the diet was similar in both species. We suggest that Antarctic Petrels were able to retract more water during their longer foraging trips and, consequently, deliver food of a higher energy density.”

**Georg Engelhard; Jan van Franeker**

### **P1-24 Tyler Flisik**

#### **Effects of a partial diet of pipefish, a low quality prey, on the growth of captive Elegant Tern chicks**

“The recent increase of pipefish in the diets of seabirds nesting in southern California and eastern Scotland has raised concern about the effects of this low-quality prey on growth rate and fledging success of these energy-demanding birds. The effects of pipefish in the diet of the Elegant Tern (*Thalasseus elegans*) was investigated by raising chicks in the laboratory on a diet of 10% bay pipefish (*Syngnathus leptorhynchus*) and 90% northern anchovy (*Engraulis mordax*), a diet based on the prey composition and provisioning rate of this tern. We predicted chicks fed 10% pipefish would weigh less at fledging (35 days posthatch) than chicks fed 100% northern anchovy. Chicks were raised from day 9 to day 35 post-hatch on one of three diet treatments (n=8): (1) 100% northern anchovy for 25 days, (2) 10% pipefish and 90% anchovy for 16 days, then 100% anchovy for the remaining 10 days of the trial period, and (3) 10% pipefish and 90% northern anchovy for 25 days. Specific body growth and wing growth did not differ among the three treatments. These findings, together with ongoing analysis of chick body composition, indicate that Elegant Tern chicks may be able to buffer the apparent negative effects of low-quality prey if high-quality prey species remain prominent within the diet. In a continuing study, prey energy content, along with prey composition data are being used to provide estimates of fish biomass and energy delivered to the chicks at the colony.”

**Mike Horn**

### **P1-25 Megan Rector**

#### **Singing for your supper: Atlantic Puffin (*Fratercula arctica*) chick begging call types and adult provisioning behaviour**

“Parents and offspring employ different strategies in order to maximize inclusive fitness, resulting in parent-offspring conflict. We investigated one strategy, chick begging, in the Atlantic Puffin (*Fratercula arctica*) using audiovisual recordings of parent-offspring interactions taken using burrow scopes deployed in 11 burrows. Two different chick call types were identified: a medium frequency cheeping call (type I) and a high frequency screeching call (type II). A comparison of call types across parent burrow-visit types indicated that type I calls occur during both fish and no-fish visits to the burrow, while type II calls occur almost exclusively during no-fish visits. In addition, the proportion of type II calls made by individual chicks increased with average time between parent burrow visits. These findings suggest that chicks adjust signals in response to their level of hunger and to parental provisioning behaviour.”

**Carolyn Walsh; Anne Storey**



### **P1-26 Lisa Sztukowski**

#### **Sooty Tern chick survival in the presence of rats**

“Rat predation on seabird colonies is widely recognized as a major threat to seabird populations. Previous rat eradication efforts have shown increased seabird reproductive success, indicating the utility of such efforts for seabird conservation. A rat eradication program is planned for Wake Island, an atoll complex in the central Pacific Ocean. Sooty Terns (*Sterna fuscata*) are tropical and subtropical ground nesting species present on Wake Island, whose nest survival may be affected by rat predation. We used mark-resight methods to estimate Sooty Tern chick survival prior to eradication efforts in two treatment plots with rodenticide and two control plots without rodenticide. In 2009, we estimated daily survival and resight probabilities of 545 Sooty Tern chicks over 64 days and Akaike’s information criteria (AICc) will be used to rank possible factors affecting chick survival. Preliminary model results indicate daily plot survival rates of 0.934-0.978 and resighting rates varied by plot through time. Models will also examine factors such as age at banding, body condition, treatment vs. control, indices of rat use, nest density within plots, colony attendance, and vegetation cover. Survival estimates can be compared to post-eradication results as one metric of island recovery and management.”

**Dylan Kesler**

### **P1-27 Freydis Vigfusdottir**

#### **Using forensic ecology to explore synchrony of mortality in Arctic Tern chicks**

“Recent breeding failure and population declines among many N-Atlantic Arctic Tern (*Sterna paradisaea*) populations are widely suspected to be linked to a lack of sufficient prey resources. Resource limitations for tern chicks are often characterised by low growth rates and highly visible mass mortality within colonies. The extent to which resource limitation drives large-scale patterns of breeding failure may be explored by quantifying the spatial scale of synchrony of mortality across colonies. We have developed a method to explore the synchrony of chick mortality, in which time of death is estimated from growth rates of blowfly larvae on chick carcasses. These techniques are used to explore the synchrony of chick mortality among colonies, and the implications for the relative importance of large- and local-scale variation in climatic and resource conditions in driving breeding success. Chick carcasses were collected from 12 colonies in W-Iceland in 2008-2009, along with measures of breeding success and chick growth rates. Persistent food shortage throughout the season was indicated by low breeding success and growth rates of chicks across colonies. However, geographic variation in growth rates suggested between-colony differences in food type or abundance, with inshore colonies typically experiencing greater success than colonies

with more exposed feeding grounds. This information and forensic analyses of the extensive chick mortality that was evident in both years are used to assess the 1) scale of synchrony of mortality, 2) role of regional and local-scale variation in climatic conditions and 3) evidence for widespread resource limitation driving Arctic Tern productivity.”

**Gudmundur Gudmundsson; Tomas Gunnarsson;  
Jonas Jonasson; Jennifer Gill**

## **Contaminants & Pollution**

### **P1-28 Edison Barbieri**

#### **Assessment of trace metal concentration in feathers of seabird (*Larus dominicanus*) sampled in the Florianópolis, SC, Brazilian coast**

“Cd, Co, Cr, Cu, Mn, Ni, Zn, and Pb were measured in feather samples of adult, subadult, and juvenile of *Larus dominicanus*, sampled in the south of Brazil in December 2005, by flame atomic absorption spectrophotometry. The average of the distribution of Cd concentration in adult feathers (0.072 micrograms g<sup>-1</sup>) was significantly different than that found in juvenile feathers (0.021 micrograms g<sup>-1</sup>). Cu concentration averages were not significantly different between adults (13.30 micrograms g<sup>-1</sup>), subadults (9.67 micrograms g<sup>-1</sup>), and juveniles (13.76 micrograms g<sup>-1</sup>). For adults and juveniles there was significant difference in feather concentrations for Cd, Co, Cr, Ni, and Pb. The distribution of Mn concentration averages in feathers differs between adults (11.36 micrograms g<sup>-1</sup>) and juveniles (1.184 micrograms g<sup>-1</sup>). Ni concentration averages of adults (5.92 micrograms g<sup>-1</sup>) were significantly higher than those of juveniles (2.23 micrograms g<sup>-1</sup>). For Pb, concentration averages were significantly higher in adults (7.53 micrograms g<sup>-1</sup>) than in juveniles (1.47 micrograms g<sup>-1</sup>). The concentration of Co and Cr in juvenile and subadults are statistically different when compared with the adults. In the present study, levels of Cd, Co, Cr, Mn, Ni, Zn, and Pb increased with age. The concentrations of essential trace elements in *L. dominicanus* were generally comparable to values reported in other studies. With non-essential metals (Cd, Pb, and Ni), in our study, *L. dominicanus* had lower values than those reported for their northern Atlantic counterparts.”

**Elisangela Passos; Carlos Garcia; Izaias Santos;  
Alexandre Filippini**



### **P1-29 Lisa Helgason**

#### **Absorption, distribution and biotransformation of halogenated organic compounds in arctic seabirds and Arctic Fox**

“Arctic animals are thought to be vulnerable to halogenated organic compounds (HOCs) because of their seasonal changes in lipid reserves resulting in contaminant redistribution towards vital organs. Further, contaminant biotransformation may enhance the risk of biological effects due to the formation of biologically active metabolites. Few studies have investigated the effect of emaciation on HOC toxicokinetics. The main objective of these studies was to investigate and compare absorption, distribution and biotransformation of HOCs in fat and emaciated arctic seabirds and arctic fox (*Alopex lagopus*). Biotransformation enzymes and HOCs were analyzed in wild northern fulmar (*Fulmarus glacialis*) and black-legged kittiwake (*Rissa tridactyla*) chicks from Svalbard. The same analyses were conducted on captive herring gull (*Larus argentatus*) chicks and domesticated arctic fox that were given either a control diet or a diet containing a HOC mixture found in their natural environment. The experimental studies also involved a reduced energy intake in order to simulate emaciation. These studies have provided new knowledge on differences in HOC toxicokinetics within arctic seabirds and between arctic seabirds and arctic fox. More specifically this presentation will give insight in: (1) HOC absorption and tissue- and congener-specific HOC distribution, (2) presence and activity of biotransformation enzymes, and (3) changes in biotransformation and HOC tissue distribution due to fasting.”

### **P1-30 Joanna Burger**

#### **Lead, mercury and cadmium in seabirds: Effects, spatial patterns, and temporal Patterns using gulls and terns as bioindicators**

“Seabirds, especially those breeding and foraging in coastal waters are exposed to both anthropogenic and natural lead, mercury and cadmium. While seabirds have evolved with natural levels of mercury in seawater, they are currently exposed to higher levels because of human activities. Herring Gulls exposed experimentally to lead in the laboratory and the field (at naturally-occurring levels) showed behavioral deficits that involved locomotion, balance, foraging, learning, and recognition. When exposed experimentally to lead in the field, Herring Gull chicks had lower survival, were less able to beg for food from their parents, were less able to recognize their parents and siblings, and some were killed by neighbors when they wandered into their territories. While lead and cadmium levels in the eggs of terns and other coastally nesting birds have declined from 1971 to the present (data from Barnegat Bay), mercury levels have remained relatively constant. Fish brought to the nest by Common Terns had higher mercury levels than conspecific fish of the same size caught nearby with seines, suggesting that coastal seabirds may be exposed

to higher levels than thought (based on usual sampling methods). Spatial patterns of contaminants often, even within one bay, depending upon local sources.”

**Michael Gochfeld**

### **P1-31 Douglas Causey**

#### **Comparison of contaminant levels in seabirds from the Near Islands: A comparison with seabirds from other islands in the Aleutian Island Archipelago**

“Rising levels of organic contaminants and heavy metals in marine ecosystems are of growing concern as they are being transported to the Arctic through atmospheric processes, oceanic currents and riverine input from industrialized regions. Contaminants have been detected in tissues from seabirds that inhabit the high Arctic, and a growing body of research has shown that seabirds from the Aleutian Islands have been exposed to organic contaminants and heavy metals. Research over two decades indicates that seabird populations are decreasing in the most western group of islands in the Aleutians (the Near Islands), while they are relatively stable in all of the other regions of the Aleutians. However, contaminant levels in tissues from seabirds breeding in the Near Islands have not been examined, and may possibly play a role in population declines. Because the ecosystems in the Near Islands are exposed to different environmental conditions from other islands in the Aleutian archipelago, seabirds in this region may also be exposed to different contaminant levels. Strong tidal-driven gyral currents could be a major force driving the ecological structuring of the Near Islands bird, fish, and plankton populations. We analyze tissues collected from 30 seabirds representing seven species that breed in the Near Islands for organic contaminant (PCBs) and heavy metal (Hg) concentration and compare the results to contaminants data published for other islands in the Aleutian archipelago. We expect that contaminants levels at the Near Islands will be different from other islands, indicating that the Near Islands are ecologically decoupled from other islands in the archipelago.”

**Brian Baker; Veronica Padula; Breanna Mahoney**

### **P1-32 Fernanda Colabuono**

#### **Organochlorine contaminants in Great and Manx Shearwaters collected in Southern Brazil**

“Polychlorinated biphenyls (PCBs) and organochlorine pesticides (OCPs) were analysed in fat, liver and muscle of six Great shearwaters (*Puffinus gravis*) and six Manx shearwaters (*P. puffinus*) collected in southern Brazil during their non-breeding season. PCBs and OCPs concentrations varied greatly between fat and liver among individuals, while muscle presented less variable concentrations and the lowest mean values. PCBs concentrations on wet weight basis found in the tissues analysed were: Great shearwater (fat-620-8,032



ng g- $\pi$ ; liver-291-8,331 ng g- $\pi$ ; muscle-88-371 ng g- $\pi$ ); Manx shearwater (fat-910-4,408 ng g- $\pi$ ; liver-42-18,320 ng g- $\pi$ ; muscle-46-834 ng g- $\pi$ ). The predominant PCBs congeners were similar in all tissues with high concentrations of pentachlorobiphenyls (PCB 118), hexachlorobiphenyls (PCBs 138 and 153) and heptachlorobiphenyls (PCBs 170 and 180). HCB, Dieldrin, Oxychlorane and p'p'-DDE were detected in all specimens analysed. Great and Manx shearwaters are transequatorial migrants and despite their differences in breeding and wintering grounds, PCBs and OCPs concentrations presented the same orders of magnitude in both species, with exception of a Manx shearwater, which had the highest levels of PCBs (18,320 ng g- $\pi$ ) and of p'p'-DDE (3,711 ng g- $\pi$ ) in liver. Levels of PCBs and OCPs in birds' tissues can be affected by differences in body conditions and by the use of fat reserves as a source of energy during migration, when contaminants stored in fat deposits are mobilized and redistributed to other body tissues."

**Satie Taniguchi; Rosalinda Montone**

### **P1-33 Heidi Geisz**

#### **Persistent organic pollutants as tracers of Antarctic seabird ecology**

"Antarctic seabirds, including Adèlie penguins (*Pygoscelis adeliae*), south polar skuas (*Catharacta maccormicki*) and southern giant petrels (*Macronectes giganteus*), are high trophic level predators that accumulate persistent organic pollutants (POPs) present in the marine food webs in which they forage. Here we examine POP levels within the three bird species based on migratory patterns and trophic level using stable isotope analysis of  $^{15}\text{N}$  and  $^{13}\text{C}$ . Eggs, tissues, blood and preen oil from all three seabird species were collected throughout the austral summer breeding seasons of 2004-2008 on the Western Antarctic Peninsula. Samples were analyzed for stable isotope natural abundances and POPs including, organochlorine pesticides, polychlorinated biphenyls (PCBs), and brominated diphenyl ethers (BDEs). Multiple regression analysis of POP concentrations with  $^{15}\text{N}$  and  $^{13}\text{C}$  indicate that both diet and migration influence POP concentrations that are several orders of magnitude higher in southern giant petrel and south polar skuas than in Adèlie penguins. Differences in the relative abundance of POPs may provide a new venue for insight into migratory Antarctic seabird ecology. For example, significantly higher p,p'-DDE/HCB ratios found in petrel eggs relative to Antarctic organisms, such as Adèlie penguins and Antarctic krill, may indicate that female giant petrels transfer a large fraction of lipid reserves and lipophilic POPs acquired outside of Antarctica to their eggs. Subsequently, these birds appear to rebuild lipid stores while in Antarctica with the lower p,p'-DDE/HCB indicative of the Antarctic marine food web."

**Rebecca Dickhut; Michele Cochran; Donna Patterson-Fraser; William Fraser; Hugh Ducklow**

### **P1-34 Robert Henry**

**Note: Poster being presented as a talk (V3-6)**

#### **Albatross appetite for pelagic plastics: Patterns across the North Pacific and relationship to organic contaminants**

"We analyzed marine debris and organic contaminant exposure in Laysan (*Phoebastria immutabilis*) and black-footed (*Phoebastria nigripes*) albatrosses in the North Pacific Ocean. Contaminant data were overlaid on a 5-year tracking dataset of at sea distribution. Examination of 407 boluses collected from Laysan (central and eastern Pacific colonies) and black-footed (central Pacific colonies) chicks revealed that central Pacific black-footed chicks had the highest mean marine debris volume levels ( $82.4 \pm 48.2$  ml/bolus), 1.5 and 5 times those found central Pacific Laysan ( $55.4 \pm 39.6$  ml/bolus) and eastern Pacific Laysan ( $17.1 \pm 21.3$  ml/bolus) chicks, respectively. Organic contaminant analyses (DDTs, other pesticides, and PCBs) of blood samples collected from the same populations showed that central Pacific black-footed albatrosses had the highest organic contaminant levels ( $120.9 \pm 32.7$  ng/ml plasma), followed by eastern Pacific Laysans ( $75.4 \pm 43.1$  ng/ml plasma). Central Pacific Laysan albatrosses had the lowest organic contaminant levels ( $34.8 \pm 23.47$  ng/ml plasma). Overall ranking of marine debris incidence across populations (central Pacific BFAL > central Pacific LAAL > Eastern Pacific LAAL) was different than that for organic contaminant concentrations (central Pacific BFAL > Eastern Pacific LAAL > central Pacific LAAL). Results show differential contaminant exposure, with high marine debris levels in the central Pacific vs. high organic contaminant levels in the Eastern Pacific."

**Suhash Harwani; Donald Croll; Bernie Tershy; June-Soo Park; Myrto Petreas; Scott Shaffer; Michelle Kappes; Yann Tremblay; Daniel Costa**

### **P1-35 Kjetil Sagerup**

#### **Persistent organic pollutants as immune-stressor in seabirds**

"The immune system is one of several biomarker endpoints used to investigate effects of persistent organic pollutants (POPs) in seabirds. In an observational study of breeding glaucous gulls (*Larus hyperboreus*) in the mid 1990's, a positive correlation was found between the intensity of intestinal nematodes and POP levels. The larger number of parasites in the more polluted gulls was probably a result of a suppressed immune system. To examine the relationship between POPs and the immune system, a laboratory study was carried out using glaucous gull chicks given either a control diet or a diet containing an environmental relevant contaminant mixture. The results showed a reduced response to infections (vaccine) and reduced levels of immunoglobulins (IgG and IgM) in exposed birds, indicating a negative causal



relationship between immune function and POP contamination. In a study of intestinal parasites in wild non-breeding adult glaucous gulls and a study of circulating IgG in breeding black-legged kittiwakes (*Rissa tridactyla*) and Atlantic puffins (*Fratercula arctica*), no correlations between the immunological endpoints and POPs were found. The POP levels were, however, lower than those in the breeding glaucous gulls. We conclude that the high levels of POPs found in some seabird species from the Barents Sea may affect the immune system.”

**Anuschka Polder; Robert Barrett; Geir Gabrielsen**

### **P1-36 Stacy Vander Pol**

#### **Long-term monitoring of contaminants using Alaskan seabird eggs**

“In 1999, a multi-agency decadal-long program, the Seabird Tissue Archival and Monitoring Project (STAMP), was initiated to collect and bank seabird egg contents from Alaskan marine ecosystems that may be used for both real-time and retrospective analyses. STAMP is currently targeting eggs from four species important in rural subsistence diets: common murre (*Uria aalge*), thick-billed murre (*U. lomvia*), glaucous gull (*Larus hyperboreus*), and glaucous-winged gull (*L. glaucescens*). Almost 1500 clutches have been banked to date. Mercury and organic legacy contaminants as well as emerging potentially harmful contaminants, such as brominated flame retardants (BFRs) and perfluorinated compounds (PFCs), are currently being analyzed using a murre egg control material developed by STAMP. During the past decade, research has revealed regional differences, with Gulf of Alaska eggs generally containing higher contaminant levels than Bering and Chukchi sea eggs, and species-specific differences within individual colonies. Some evidence also indicates that levels of polychlorinated biphenyls (PCBs), DDE, and hexachlorobenzene have declined since 1999. As a portion of all of the samples collected are banked for long-term use, future researchers will be able to reanalyze samples after more sophisticated equipment and techniques have been developed, and they will also be able to conduct retrospective analyses for new emerging contaminants. STAMP plans to continue collecting and banking seabird egg contents and monitoring long-term trends in contaminant levels in these tissues to assess changing environmental conditions.”

**Paul Becker; Rusty Day; Amanda Moors; Rebecca Pugh; David Roseneau**

### **P1-37 Marina Codina Garcia**

#### **Marine plastic debris in Mediterranean seabirds**

“Plastic debris are often ingested and accumulated by seabirds and can cause health disorders, particularly in chicks. Despite the Mediterranean is clearly exposed to plastic pollution from surrounding industrialized countries, no attempt to quantify plastic ingestion in Mediterranean seabirds have been made so far. In this study we quantified and measured plastics accumulated in the stomach of 9 species of seabirds accidentally caught by longliners in the western Mediterranean from 2003 to 2009: 50 Scopoli’s (*Calonectris diomedea*), 46 Balearic (*Puffinus mauretanicus*) and 33 Mediterranean (*P. yelkouan*) shearwaters ; 6 gannets (*Morus bassanus*); 14 Audouin’s (*Larus audouinii*), 3 black-headed (*L. melanocephalus*) and 12 yellow-legged (*L. michahellis*) gulls; 4 kittiwakes (*Rissa tridactyla*) and 3 great skuas (*Catharacta skua*). Scopoli’s shearwater showed very high occurrence (94%) and large numbers of small plastic particles in the stomach (on average N=15.3 and length=3.4mm), followed by Balearic (70%, N=3.6, 3.8mm) and Mediterranean (70%, N=7, 6.5mm) shearwaters. Occurrence and mean individual numbers in the rest of species were lower than 33% and 2.7 particles, respectively. Number of particles, mean size of plastics or weight did not differ between sexes and were not related to the condition of the birds. Our results suggest shearwaters, specially the Scopoli’s shearwater, are particularly exposed to accumulate and suffer potential detrimental effects from plastic accumulation and place the Mediterranean Sea among the most contaminated basins by plastic pollution.”

**Javier Moreno Calvo; Teresa Milit.,o; Jacob Gonz-lez-Solis**

### **P1-38 Andrew Titmus**

#### **Plastic ingestion by Black-footed and Laysan Albatross on Kure Atoll, Hawaii**

“North Pacific albatrosses ingest plastic at sea, which they deliver to chicks on breeding colonies. We characterized the amounts and types of ingested plastic and the foraging grounds of Black-footed Albatross (*Phoebastria nigripes*) on Kure Atoll, the westernmost colony in the Hawaiian Archipelago. Analysis of regurgitated chick boluses in 2008 and 2009 yielded information on the volume and mass of seven plastic and food categories. In 2008, four provisioning adults were satellite tracked in May–June, totaling 39 days and 8 complete foraging trips. Adults foraged in deep water (median: 4300–5000m) and relatively close to their colony (maximum range: 1103 km). We compared 2008 data with Black-footed and Laysan Albatross (*P. immutabilis*) boluses regurgitated in 2009. The proportion (mass and volume) of plastic and natural food in boluses was not different between years for Black-footed Albatross. Between species, Black-footed Albatross showed higher mass and volume of; sheets (mass- mean=1.07g range=1.2, volume- mean=1.14ml



range=1.5), line (mass- mean=9.16g range=9.8, vol- mean=10.71ml range=13) and foam (mass- mean=8.69g range=12.8, vol- mean=19.21ml range=26) and less fragments (mass- mean=8.3g range=13.1, vol- mean=8.43ml range=15). By contrast Laysan albatross had less sheets (mass- mean=0.07g range=0.1, vol- mean=0.07ml range=0.1), line (mass- mean=0.33g range=1.5, vol- mean=0.49ml range=2.0) and foam (mass- mean=1.36g range=5.2, vol- mean=4.6ml range=20.9) but more fragments (mass- mean=26.34g range=21.6, vol- mean=29.64ml range=22.0). Towards improving our understanding of plastic ingestion risks and diet variability in relation to foraging differences, we will analyze additional years and colonies and compare with other concurrent studies.”

**Cynthia Vanderlip; Michelle Hester; David Hyrenbach**

### **P1-39 Stephanie Avery-Gomm**

#### **Ingestion of plastic by Northern Fulmars (*Fulmarus glacialis rogdgersii*) collected in Canadian Pacific waters**

“Plastic ingestion by Northern Fulmars (*Fulmarus glacialis rogdgersii*) has been widely reported; however, at present there is no information on the extent of plastics ingestion by fulmars found within Canadian Pacific waters. In November 2009, 40 beached fulmars were collected following a wrecking event on the west coast of Vancouver Island. I examined stomach contents of 26 birds for plastic particles. Plastics were found in 25 (96%) of the birds examined. The average number of plastic particles and the average weight of all plastic found in each stomach was  $53 \pm 22$  particles and  $0.28 \pm 0.09$  g, respectively. Ingested plastic particles ( $n = 1384$ ) were characterized and user plastics were found to dominate (97%) over industrial plastics (3%). The incidence of plastic ingestion, the amount of plastic ingested and the percentage of user plastics are greater than previously reported. These results are consistent with evidence suggesting that there is an increased prevalence of plastic pollution in the marine environment. This study is the first to document the level of plastic ingestion by Northern Fulmars occurring in Canadian Pacific waters during the non-breeding season. The biological impacts of plastic ingestion by fulmars deserve further study.”

## **Databases & Programs**

### **P1-40 Vidar Bakken**

#### **Monitoring Database and Seabird Colony Register**

“The Norwegian Polar Institute has developed an integrated Monitoring Database and Seabird Colony Register for use as an administration tool and data registration in the field. The main objective is for all data to be registered and quality checked in the field thereby reducing the time needed to register data and increasing the data quality. The Seabird Colony Register covers Svalbard and the Russian part of the Barents Sea. It was first developed in the 1990s, but has been rebuilt using the format defined by the Nordic countries. The register contains data concerning Colony Descriptions, Total Counts, Colony Documentation (images), Monitoring Data (study plots) and References. The Monitoring part of the database has modules for Adult Survival, Breeding Success, Diet, Fauna Registrations and Non-breeding Distribution. The first three modules are integrated with respect to marked individuals that can be identified in all modules. The Fauna Registrations are for general species observations in the field. The Non-breeding Distribution module covers point registrations of non-breeding individuals, especially intended for coastal surveys outside the breeding season. The system is built in Visual Basic and the database format is Access. We have experienced an improvement in data quality as all input data are checked with respect to valid colour codes etc. when entered into the database. The system gives also a total overview of all existing data, and all historical data are available in the field.”

**Hallvard Strøm**

### **P1-41 Rob Barrett**

#### **SEAPOP: Norway’s long-term seabird mapping and monitoring programme**

“With a seabird population of around 6 million breeding pairs, Norway (including Svalbard) is responsible for 25% of the Northeast Atlantic seabird community. Until SEAPOP (SEAbird POPulations) started in 2005, Norway’s monitoring was limited to annual population counts. Collection of parallel data on reproduction, survival and diets was limited to ad hoc studies of a few species at a few sites. Little was known of the cause(s) of the significant changes in numbers of various species that had been documented since the 1960s. With increasing focus on biodiversity and impacts of anthropogenic activities, improved and more precise documentation of the ecological parameters that control Norwegian seabird populations became necessary. This resulted in the SEAPOP programme, a long-term (minimum 10 years), comprehensive and cost-efficient study of seabird distribution and ecology in Norwegian waters. Through its results ([www.seapop.no](http://www.seapop.no)), we



aim to satisfy the general information needs of the management authorities, offshore industry, scientific community and society at large in their various roles as managers, exploiters, consultants and researchers of the marine environment. Across 20° of latitude from the Skagerrak to the Arctic Ocean, SEAPOP maps coastal-residing seabirds in all seasons on a 10-year cycle, monitors the performance of 17 breeding species on 12 key sites, counts wintering seabirds in 17 coastal areas, carries out extensive surveys and modelling of seabird distribution at sea and process-orientated studies of seabird ecology, movements and population dynamics. The programme has already documented far-reaching relationships between seabirds and factors such as changes in fish stocks and climate.”

**Tycho Anker-Nilssen; Hallvard Strøm; Geir Systad**

### **P1-42 David Boertmann**

#### **The Greenland Seabird Colony Register**

“The Greenland seabird colony register is a database holding information on all known seabird colonies in Greenland. It was established in 1992 as a tool for environmental impact assessment of off shore oil exploration activities. All available information on historical and current - was incorporated and since 1992 it has been updated annually with new information, both from dedicated surveys and from opportunistic visits. Currently the database holds 9426 records on 1988 colony sites. Twenty colonial species are included and in addition a few solitary breeding species which often breed in the colonies. The database consists of two main tables for sites and observations, and nine additional lookup tables. It is stored on a central SQL server from where users and editors can access it by an MS Access application with linked tables and user forms. It will become accessible to the public through a web form. The register has so far supplied data to three strategic environmental impact assessments of off shore oil exploration, to three oil spill sensitivity atlases, and it is used for management and planning of coastal activities as well as management and conservation of seabirds and seabird habitats. The register has been the base for several status reports on colonial Greenland seabirds: Great cormorant, Kittiwake, Ivory Gull and for assessment of climate change impacts on seabirds. The structure of the database was recently harmonized to a common Nordic standard, including the seabird colony databases from Norway (Svalbard and Jan Mayen), Iceland, Faeroe Islands and Greenland.”

**Anders Mosbech; Morten Bjerrum; Flemming Merkel; Aili Labansen**

### **P1-43 Bernard Cadiou**

#### **Decennial national censuses and other projects coordinated by the GISOM - French Seabird Group**

“Created in 1986, the French Seabird Group (GISOM ‘groupement d’intérêt scientifique oiseaux marins’) is an NGO who aims to develop contacts and exchanges among seabird specialists, both amateur and professional, and to promote or realise ecological studies on seabirds and their environment. In particular, GISOM has published proceedings of its meetings and bibliographies of seabirds inhabiting metropolitan France and French overseas territories. More recently, GISOM has published in 2004 the first synthesis on the distribution and trends of breeding seabird populations in France, including results of the 4th national census conducted in 1997-2001, with about 241,000 breeding pairs for 28 species exhibiting contrasting population trends. A new national census is now under way for the 2009-2011 period, carried out with funding from the French ministry of environment (MEEDDM) and the French marine protected areas agency (AAMP). Additionally, the project will contribute to promote seabird population trends as an index of seabird community health, as developed within the framework of the OSPAR Convention for the Protection of the Marine Environment of the Northeast Atlantic. At the same time, another goal to be achieved will be to set up a network of stakeholders involved in the monitoring of seabird populations, focusing on the marine component of seabirds’ life. Lastly, our objective is to contribute to a marine biodiversity portal in the framework of the SINP (Information System on Nature and Landscape), jointly developed by the French ministry of environment, the marine protected areas agency and the national museum of natural history (MNHN).”

Nicolas Sadoul

### **P1-44 Gary Drew**

#### **North Pacific Pelagic Seabird Database version 2.0: Size does matter**

“Long-term Data on the pelagic distribution and abundance of seabirds are critical for understanding the basic ecology of marine birds, monitoring population trends, assessing impacts of human activities, identifying critical marine habitats, and educating the public on seabird conservation. However, the broad scale at which seabirds operate and the cost of conducting at-sea surveys has been an impediment to our understanding of seabird ecology. To address this data gap, we consolidated at-sea survey data collected by numerous researchers and federal agencies over 35 years into a single database that provides counts as well as densities for 213 marine bird taxa. Data were imported into a Microsoft Access database and standardized to allow for integration. Numerous data quality issues were encountered and protocols to address them were developed. The Initial version of the NPPSD (v.



1.0) had observation data from 465 individual surveys with 57,294 samples collected between 1974 and 2002. We found the original flat file format to be too inefficient. Instead, the NPPSD 2.0 relies on a relational database structure. Our redesigned NPPSD version 2.0 includes a fourfold increase in samples, filling large data gaps near Russia, British Columbia, and California. Version 2.0 of the database has 284,818 samples, with a total surveyed area of 222,559 km<sup>2</sup>. This expanded database contains observations of 19,210,462 seabirds from 213 taxa and 211,040 marine mammals from 41 taxa. Multi-decadal data is available for more than 40% of the area sampled. This dataset is under review and when distributed will provide a powerful new tool for examining broad spatial and temporal scale questions.”

**John Piatt**

### **P1-45 Maria Gavrilov**

#### **Atlas of the marine biodiversity in the Russian Arctic: Focus on seabirds and ice habitats**

“GIS-based Atlas of the Russian Arctic seas containing information on distribution of key elements of marine habitat and biological diversity as well as on major threats to them has been developed recently by expert group coordinated by WWF-Russia. Atlas is aimed to provide background information for spatial marine conservation planning in the Russian Arctic under conditions of changing climate. Climate change impacts first of all energetically active frontiers, such as contact zones between sea and land (salt marshes and laidas), river and sea (deltas and estuaries), water and ice (polynyas and marginal ice zones). Seabirds is a key component of marine biodiversity, and many Arctic seabirds are known to be ice-dependent species thus considered vulnerable to the climate change. A series of maps providing information on seabird colonies and migration paths against polynyas is a core segment of the Atlas. Importance of flaw polynyas for maintaining seabird populations are described by regions. Increasing potential hazard to polynyas as a key seabird ice habitat under conditions of current industrial development of the Arctic shelf is emphasized. A selection of maps showing seabird distribution, ice habitats and SPAs network is presented. Existing marine SPAs network is evaluated in terms of relevance for seabird protection in the Russian Arctic. Extension of existing SPAs, creation of the new ones as well as spatial and temporal regulations for shipping and marine tourism aimed at minimizing impact on seabirds are discussed on the basis of Atlas materials.”

**Vassiliy Spiridonov; Natalia Nikolaeva**

### **P1-46 Andrew Gilbert**

#### **Increasing our knowledge of seabird distribution in the U.S. Atlantic: Development of a relational database of seabird occurrence and survey effort**

“Increasing pressure for alternative energy sources requires that we improve our understanding of the potential impacts of offshore development on seabirds. A wealth of information is available on seabird occurrence for the northwest Atlantic but there is no mechanism to scientifically evaluate these data. Many studies have been conducted on seabirds but they are often localized or on a fine-scale, making inference across large regions impossible. To address this lack of cohesion, we compiled all available data from seabird surveys into a single metadata-compliant catalog and relational database to allow spatially explicit distribution modeling for a variety of species. To date, we have amassed ~75 datasets containing >250,000 observations and >82,000 transects of survey effort. Disparity in survey techniques and recording methods required that we standardize each dataset using new algorithms developed in Visual Basic. This allowed us to characterize survey effort across a broad scale and provided a framework to examine variation in survey effort both spatially and temporally. Initial results from our work indicate that the number of locally intensive surveys increased over the last decade in response to proposed energy development in contrast to larger, region wide surveys of the 20th century. This work has been essential for providing a foundation for determining sea bird distributions by 1) unifying many disparate datasets into a single relational geospatial database, 2) standardizing survey information so that comparisons and modeling can be achieved and 3) enable scientists and managers to make efficient use of the current state of knowledge and make science-based decisions.”

**Allan O’Connell, Jr.; Beth Gardner; Kevin Laurent; Scott Johnston; Sally Valdes**

### **P1-47 Ben Gustafson**

#### **Creation of a comprehensive Pacific Coast GIS Fisheries Resource Database**

“Pacific Coast fisheries information is currently available only from wildlife agencies in disparate databases. To maximize the value of these data, the Minerals Management Service and US Geological Survey combined data from several sources into a single comprehensive database that would allow resource managers to easily extract species or catch information according to temporal and spatial queries. From 2008 to 2010, fisheries and coastal spatial data were collected from agencies in California, Oregon, and Washington and compiled into a geographic information system. In order to incorporate all of these data into one resource, varying data content, location accuracy, reporting methods, and use restrictions between agencies had to be addressed via data



summary, formatting, and geoprocessing methods. Custom query tools were developed for use in an ArcMap document to allow users to make spatial selections and view associated data. In addition to ten commercial, sport, survey, and fish-count databases, we have included seabird and marine mammal distribution data from Southern California. We will highlight the comprehensive fisheries geodatabase design, the functionality of the interactive ArcMap document and custom tools, and the challenges involved with requesting data from multiple agencies that collect, maintain, and administer their data according to their own unique policies. We will also demonstrate how this GIS-based model can incorporate other types of information (such as the included seabird and marine mammal data) or be applied to other projects to organize and distribute spatial data.”

**William Perry; John Takekawa; Greg Sanders**

### **P1-48 Falk Huettmann**

#### **Merging Pelagic Seabird Databases worldwide? Beyond a Circumpolar Arctic IPY experience**

“Pelagic seabird surveys are done world-wide, and using different sampling protocols. Many seabirds are global citizens, and it is widely acknowledged that their sustainable management can only be achieved efficiently when done across borders and based on data that follow best available science-based adaptive management. A direct link with ongoing ocean monitoring schemes is critical. For over six decades pelagic seabirds get surveyed world-wide, but merging their (raw) databases seamless and fast across jurisdictions and projects is not well achieved, yet. Some progress can be tracked at online webarchives such as OBIS-Seamap or GBIF. But key items of discussion remain centered around public data availability, metadata, survey design, detectability, density indices, statistical variances, database design and software for instance. In addition, examples will be provided from a spatial GIS model prediction application done during the International Polar Year (IPY) for over 20 circumpolar seabird species. IPY has more than 60 nations participating and is based on a Data Information Service (DIS) promoting global open access to raw data for public and scientific research use. Global progress, as well as stumbling blocks, are presented, regarding in-time, high-quality, compatible and geo-referenced pelagic seabird density and species richness databases served freely online for a global seabird research and management. Specific technical, statistical and administrative details are highlighted (XML, cross-walking, ISO, Google Ocean, NOAA, SCAR, ICSU, Web2, GEOSS), and a future outlook is given towards a ‘Sustainable Digital Ocean’.”

**Yuri Arthukin; Maria Gavrilov; Olivier Gilg; Grant Humphries**

### **P1-49 Ben Lascelles**

#### **The BirdLife International Seabird Foraging Range Database**

“Since 2007 BirdLife International has been compiling a database of seabird foraging ranges and ecological preferences in the marine environment. The aim of the database is to provide an authoritative global dataset that can be used as a key tool to help delimit the extent of marine Important Bird Areas (IBAs) adjacent to major breeding colonies, as well as highlight gaps in our knowledge of foraging behaviour and help identify key areas for future research. Compiling the database has involved a comprehensive review and collation of published information. Additional information has been sought from a large number of seabird experts worldwide, who have helped identify and fill gaps via the provision of further references or of unpublished information. The results of the literature review have been transferred to the database where entries include information on: date and location of the study, stage of the breeding season, foraging distance, trip duration, dive depth, habitat associations, data quality and survey methods. The database contains over 4000 entries for 250 species obtained from more than 1000 references, with information for every seabird family. Information contained in the database has been provided to, and used and tested by, a growing number of BirdLife Partners undertaking marine IBA analysis. Species and/or family specific fact sheets providing information from key foraging studies and references are being created to highlight how the distances can be used for marine planning purposes.”

### **P1-50 Ben Lascelles**

#### **Gadfly Petrel Conservation Group**

“The Gadfly Petrel Conservation Group was established in 2009 by the Global Seabird Programme of BirdLife International with the aim of improving knowledge and conservation status of one of the most threatened and least known groups of seabirds. Thus: 1. 3 out of 4 Pseudobulweria are Critically Endangered, the other is Near Threatened. 2. In Pterodroma, of 32 species, 4 species are Critically Endangered, 7 Endangered, 10 Vulnerable, 4 Near Threatened; only 7 are Least Concern. 3. A few species have substantial active conservation programmes; many species have little or no effective action at the present time. 4. At sea distributions, and the foraging ecology of many species are unknown. Many of the species in these groups are known or thought to share similar ecological requirements on the breeding grounds where threats from introduced predators, habitat loss/alteration and vulnerability due to limited numbers of known nesting sites are some of the common threats. This makes sharing knowledge of management successes (and failures) of disproportionate importance to the future conservation of these species. The main aims of the



Group are to: 1. Improve conservation status through better knowledge and associated practical action 2. Improve estimates of population size and trends 3. Determine success of existing management measures at IBAs for these species 4. Identify conservation priorities (especially those of a collaborative nature and relevant to multiple taxa) and develop appropriate fundraising proposals 5. Improve knowledge of at sea distribution 6. Improve Identification/Taxonomy”

**WITHDRAWN P1-51 Andrew Symes**

**The Red List process, and how you can help**

The IUCN Red List is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. As the official Red List Authority for birds, BirdLife International coordinates a partial annual update and a full four-yearly reassessment of the status of all bird species. Information is collated from the published and grey literature and from a worldwide network of experts. This is used to evaluate the status of each species using the IUCN Red List categories and criteria. In 2009, of 9,998 recognised bird species 1,227 (12%) were placed in one of the threatened categories, with 192 (2%) placed in the highest threat category (Critically Endangered). Among seabirds, the proportion of threatened species is higher, at 28%, with 18 (5%) of seabirds classified as Critically Endangered, reflecting the perilous state of many albatross, petrel and penguin populations. New information on a species, or the threats impacting it, may indicate that it warrants uplisting or downlisting to higher or lower categories of threat. In such cases, BirdLife’s web-based Globally Threatened Bird Forums are used to advertise the proposed change and to solicit relevant information or comment from a wide network of experts and organisations. The forums are open to all and provide an opportunity for both professional and amateur birdwatchers and conservationists to contribute information relevant to the assessment of threat status and conservation. Contributions to the discussions, at [www.birdlifeforums.org](http://www.birdlifeforums.org) or by email to [science@birdlife.org](mailto:science@birdlife.org), are welcomed.”

Orea Anderson

**WITHDRAWN P1-52 Scott Newman**

**A Global Seabird Morbidity and Mortality Monitoring Network and Database: A future priority to understand impacts to seabird populations**

“Mortality data over the past 30yr suggest that biotoxins, viral, and bacterial diseases may have impacted >5 million aquatic birds in North America alone and yet we have very little ability to understand the potential implications of diseases on seabirds at a global level. A series of beached bird

monitoring programmes are in place in North America and Europe, but there are relatively few monitoring programs in other locations globally. Beached bird monitoring programs provide valuable insight into causes of seabird mortality ranging from petroleum exposure to disease, to garbage ingestion or entanglement. While data is collected and stored in databases for specific programmes, there is no standard methodology applied to collection of morbidity or mortality data, and there is no globally integrated database that can allow a broader analysis and understanding of causes of seabird mortality at a global scale. Better support should be provided to developing countries where seabirds inhabit coastal waters, over-winter, roost or breed. Standards for beached bird surveys should be developed and training programmes implemented to facilitate standardised data collection. Databases need to be integrated or at least communicate with one another to allow for a more thorough evaluation of anthropogenic impacts and diseases on seabirds, and finally, new programmes should engage both the resource managers responsible for bird monitoring, and veterinarians responsible for conducting necropsies, sample collection and diagnostic testing. It is only through this one health or multi-disciplinary approach, that we will gain better insight into the disease and pollution related conservation challenges to seabird populations world-wide.”

**P1-53 Philip Taylor**

**Global Procellariiform Tracking Database**

“Created in 2004, the Global Procellariiform Tracking Database (GPTD) held at Birdlife International is the largest single database of Procellariiform tracking data in existence. The database contains around 500 datasets with nearly 5 million records for 38 species, covering most of the world’s oceans. Data is owned by the scientists and institutes who collected them, and is submitted subject to terms and conditions of data access. The aim of the database is to provide a complete Procellariiform tracking dataset that can be used to identify marine conservation prioritisation areas such as marine IBAs, to be used in fishery overlap analysis for the FAO Regional Fisheries Management Organisations, and to provide a central repository from which people with tracking data needs can request and gain access to the data. Recently the database has gone through a phase of development which has, amongst other things, included its progress onto a web based platform. The intention of these developments have been to streamline the procedure of data submission so that submitted data may be rapidly processed and returned to the data owner (thereby providing a service to the tracking community and increasing submissions), to improve data owners access to their own data (so that they may see, edit and monitor requests within the database) and to improve the profile of the database by hosting the website publicly on the internet and allowing coverage and metadata to be visible to all.”



**WITHDRAWN P1-54 Kerry-Jayne Wilson**  
**New Zealand's Seabird Colony Database: What do we know and what don't we know?**

“About 86 species of seabirds breed in New Zealand yet there is reliable, recent data on colony location, population size and trends only for Australasian gannet, some albatross taxa, some other species impacted by fisheries bycatch and those critically endangered. For most species the location of breeding sites is poorly documented and few colonies have been reliably censused. The available information was scattered through hundreds of published and unpublished sources. Work on a New Zealand Seabird Colony Database commenced late 2008. The database currently contains over 2300 records of a seabird species breeding at a known location in a known year. It lists over 300 locations at which seabirds are/were known to breed. Our priority has been records from the last 50 years but many older records are included. Data entry continues. Most of the available information was obtained between the mid-1960's and early-1980's by the now defunct Wildlife Service. Few distributional or population data have been obtained during the last 25 years. The least known group is the burrow-breeding petrels, for some of them all we have is a list of islands on which they were once recorded. The database will allow us to identify species and sites in need of management and help identify conservation priorities. The database will be used to identify candidate sites for Important Bird Areas. The database will permit a more robust documentation of the decline of seabird populations since European colonisation in the mid-nineteenth century. We have not included pre-European seabird distribution records.”

Robyn Blyth; Susan Waugh

**P1-55 Ricardo Ornellas**

**Analysis of possible effects of tourist boats on seabirds in Paraty Bay - RJ, Brazil**

“There are reports of the disappearance of entire colonies of nesting seabirds on islands disturbed by human presence. Tourism as a source of disturbance to these birds has been investigated in several countries, but in Brazil we do not know anything about it. This work was carried out in Paraty Bay, south of Rio de Janeiro, located between 23° 18'S, 44° 30'W and 23° 04'S, 44° 36'W, with an area of approximately 24,347 km<sup>2</sup>. We conducted a survey on possible effects of tourist boats on seabirds. Interviews were conducted with 30 sailors that travel with vessels of different sizes, carrying between 7 and 174 passengers. We gathered some information on bird sightings (50% of interviews) and reports of the depletion of local marine birds. According to all respondents, passengers like to see the marine animals and occasionally ask them to bring the boat near birds perched on islands (such as cormorants, *Phalacrocorax brasilianus*), to take pictures. It

is suggested designing of a training program for sailors to transfer information about seabirds to the users of the tourist boats in Paraty bay.”

Valeria Moraes-Ornellas

**P1-56 Trudy Chatwin**

**Set-back distances to protect nesting and roosting seabirds off Vancouver Island from boat disturbance**

“With increasing recreational boat traffic worldwide, there is a need for scientifically based regulations that sustain both seabirds and wildlife viewing. The effects of boat-based disturbance to nesting and roosting seabirds off Vancouver Island were quantified. A rangefinder was used to measure the distance that roosting and nesting birds showed an agitation response to motor boats or kayak. The potential factors of species sensitivity, vessel type, habituation and seasonal effects affecting agitation distance were examined with survival analysis to provide recommendations for set-back distances. At a distance of 40 m nesting Double-crested Cormorants (*Phalacrocorax auritus*), Pelagic Cormorants (*Phalacrocorax pelagicus*), Glaucous-winged Gulls (*Larus glaucescens*), Pigeon Guillemots (*Cephus columba*) and Black Oystercatchers (*Haematopus bachmanii*) had less than an 8% probability of being agitated with either a kayak or motorboat approach, while at 50 m there was less than a 5% probability of agitation. Roosting birds had longer response distances. Harlequin Ducks were particularly sensitive with a 25% probability of agitation at distances less than 50 m. Agitation distances were reduced by habituation to boat traffic and a single kayak could approach closer than a motor boat without disturbing seabirds. A general set-back guideline of 50 m would protect most nest and roost sites in the study area while allowing viewers to appreciate seabirds. Set-backs could be adjusted to protect locally sensitive sites or species such as roosting aggregations of Harlequin Ducks.”

**P1-57 Monika Parsons**

**Comparing colony attendance to incubation constancy in the presence of disturbance: Methods for remotely monitoring gull activity**

“Studying the responses of seabird breeding colonies to disturbance is difficult, especially when disturbance events are infrequent and short in duration. As part of a study of behavioral responses of nesting seabirds to a suite of disturbance types in coastal Maine we examined the responses of incubating and non-incubating Great Black-backed Gulls (*Larus marinus*) and Herring Gulls (*Larus argentatus*) to Bald Eagle (*Haliaeetus leucocephalus*) flyovers and boat activity. To record responses of non-incubating gulls we placed Reconyx game cameras overlooking four nesting areas on Jordan's Delight Island, Maine set to record one picture per



minute for the entire nesting period in 2008 and 2009. Gulls standing on territories were counted in the photographs taken before, during and after disturbance events. To determine responses of incubating gulls we installed Hobo temperature loggers equipped with external probes (Onset computer corp.) in 27 Herring Gull and 29 Great Black-backed Gull nests in 2009. Temperature records at nests enabled us to determine departure and return times of incubating gulls. A complete record of boat activity was obtained using 5 cameras overlooking the water surrounding the island. Observers recorded other activity including 35 eagle and 158 raven flyovers in 2008 and 52 eagle and 340 raven flyovers in 2009. Both incubating and non-incubating gulls responded to eagles by taking flight. The number of gulls attending territories increased slightly from the pre-disturbance number immediately following the eagle's departure. Boat and raven activity did not influence the number of gulls present on the colony."

**Cynthia Loftin; Frederick Servello**

## Disturbance

### P1-58 Ursula Ellenberg

#### Just get used to it!? Factors driving habituation and sensitisation

"Recreational pressures continue to increase even in remote places. However, factors facilitating the habituation of wild animals to human disturbance are currently not well understood. We measured behavioural and physiological stress responses of Humboldt (*Spheniscus humboldti*), Snares (*Eudyptes robustus*) and Yellow-eyed penguins (*Megadyptes antipodes*) to experimental human disturbance. We found the initial stress response and habituation potential of penguins varied between species and differed individually, depending on sex, character and previous experiences with humans. Hence, habituation of disturbed wildlife to even apparently minor disturbance stimuli cannot be assumed. Quite the contrary, we have only just started to realise the complex interactions that may cause an animal to adapt or over-react to a certain stimulus. Therefore, habituation does need to be carefully considered until we have a better understanding of the factors that mediate habituation and sensitisation in a particular species and setting. We need more research and good cooperation with managers to appropriately make use of habituation as potential visitor management tool."

**Thomas Mattern; Philip Seddon**

### P1-59 Mike Demarchi

#### Diving birds and underwater noise: A cause for concern?

"The upward trend of anthropogenic noise in the world's marine environments warrants concern. Weapons and ship testing, geophysical seismic surveys, pile driving, and decommissioning of offshore structures are examples of activities that yield underwater noises reaching levels known or suspected to be capable of causing injurious effects to marine biota, including diving birds. Lethal effects, and to a lesser extent the injurious and behavioural effects, of underwater blasting on diving birds have been documented. Harmful effects of noise generated by sources other than chemical explosions are less clear. Although diving birds are believed to be able to hear underwater, little if anything is conclusively known about their underwater hearing abilities and sensitivities, or about their dependence on underwater sounds. Although formalized impact assessments are often conducted for military and industrial projects, the certainty of impact predictions is limited concerning adverse behavioural (e.g., communication and predator or prey detection) and physiological (e.g., temporary or permanent threshold shifts in hearing) effects. Reasons for the current state of knowledge and level of concern are explored, as is the extent to which adverse effects might cause direct, indirect, or cumulative impacts on diving birds. Despite notable information gaps, it is unlikely that research in this area will be a priority for the foreseeable future. This might be justifiable considering more pressing demands on research funding. As based on empirical data, models, incidental observations, and professional opinion, a number of (interim[?]) best practices for avoiding or mitigating known or hypothesized effects are presented."

### P1-60 Pedro Rodrigues

#### Light pollution impact on *Calonectris Diomedea* populations on S<sub>o</sub> Miguel Island, Azores Archipelago - Comparing ground collection data with satellite observations of artificial night lighting

"The continued development worldwide entails a considerable increase in artificial lighting, both in terms of spatial extent and intensity. This form of pollution causes changes in the reproductive physiology, migration, foraging and ultimately leads to loss of biodiversity. Seabirds are intimately linked with the light features of their environments since they are nocturnally active. In this paper we report light-induced falls of *Calonectris diomedea* during 2-year study (2008 and 2009) on São Miguel Island, in the Azores archipelago. A total of 779 birds were found grounded, more than 80% of which were still alive. These in-situ reference data are set in relation to satellite-observed nighttime lights as derived from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS). An annual composite of stable lights is used in order to analyze and highlight spatial



correlations of altered environmental conditions and reported impact cases. To minimize light pollution stress on *Calonectris diomedea* and marine birds in general, we strongly recommend conservation management measures such as reduction and control of lighting intensity near colony places, especially during the fledging peaks while continuing and re-enforcing rescue campaigns. Ultimately, legal formalization would be highly favorable for coastal areas as sustainable lighting control measures are expected to significantly limit adverse effects of light pollution on these biodiversity hotspot.”

**Christoph Aubrecht; Artur Gil**

### **P1-61 Joshua Stumpf**

#### **Flight height distribution of the Marbled Murrelet (*Brachyramphus marmoratus*) and relative risk of collision**

“Current plans for wind energy development along coastal areas within the breeding range of the federally listed Marbled Murrelet (*Brachyramphus marmoratus*) increases the need for basic information on their inland flight behaviors to understand the relative risk of collision for this species. Modified, X-band marine radars were used to quantify flight heights, passage rates, and flight behavior of murrelets on the Olympic Peninsula Washington to assess the collision risk associated with future coastal wind developments. Over three mornings, 287 heights were collected. Mean height above ground level was  $238.6 \pm 4.6$  m. The lowest murrelet target was detected at 61.1 m while the highest was recorded at 646.9 m. Fifty percent of targets were detected between 187 m and 276 m. Five percent of murrelets were recorded flying at or below the average wind turbine rotor-swept height of 130.5 m as they transit to and from nest sites. We are now collecting additional data on murrelet flight heights to determine how the relative risk of collision changes with topography and weather conditions. This information will allow initial predictions of Marbled Murrelet collision risk at potential energy development sites.”

**Nathalie Denis; Thomas Hamer; Glenn Johnson**

### **P1-62 Sally Valdes**

#### **A review of Minerals Management Service’s contribution to seabird science**

“The Minerals Management Service (MMS) is responsible for managing use of mineral and energy resources in U.S. Federal waters. This includes oil and gas exploration and development, wind power development and the mining of sand and gravel. MMS supports research in the offshore marine environment to support informed decision-making, including research on seabirds. This poster provides a review of historical, current and proposed seabird research. Studies from the Arctic, Pacific, Gulf and Atlantic are included.”

## **Fisheries and Forage Fish**

### **P1-63 Jaime Silva**

#### **Assessing the impact of the application of a fishery regime on the reproductive performance of Guanay Cormorant**

“Several studies assess how industrial fisheries could affect the reproductive performance of seabirds. In Peru, the main industrial fishery is based on the exploitation of the Peruvian anchovy *Engraulis ringens* which is the main prey of the guanay cormorant *Phalacrocorax bougainvillii*, whose population has decreased dramatically over the last 40 years. Nowadays, the anchovy fishery regime is given by individual vessel quotas (IVQ). However, until 2008 the anchovy fishery regime had been the global quota (on average 6 million tons per year) therefore the fleet caught as much anchovy as they could in a short period of time due to great competition among fishing companies (e.g., 1 million tons in 9 days). This fishing regime could have affected the reproductive performance of guanay by reducing drastically the local food availability, especially if given during the breeding season. Our work aims to assess the impact of anchovy fishing under the global quota regime in the reproduction of guanay, to achieve this goal we examine data collected on Macabí Island in northern Peru during the breeding season 2006/2007 and anchovy landings recorded in a port near the breeding colony (at 14km from the island). We found that high anchovy catch levels registered nearby Macabí Island influenced the reproductive performance of guanay cormorant, affecting body condition and survival of chicks. We also discuss about the first year of the application of the new fishing regime and if this could improve the perspectives of guanay conservation.”

**Elisa Goya**

### **P1-64 Margot Stiles**

#### **Starving seabirds: Unseen consequences of overfishing**

“Hundreds of bird species feed on marine fish, and humans are now exploiting these prey fish at the highest rates in history. Seabirds are especially vulnerable to prey shortages due to overfishing that overlaps temporally and spatially with their long-distance migrations, nesting requirements, and target prey. Even seabirds with a varied diet may rely seasonally on one or a handful of species of small schooling fish to fill their energetic needs. During prey shortages, hungry seabirds face reduced nesting success, competition for food with other birds, and decreased resilience to climate impacts on their food supply. However, current fisheries management practices do not account for the needs of natural predators. This review identifies seabirds most likely to be



affected by commercial fishing of their prey, with recommendations to restrict fishing near seabird nesting areas, set more conservative catch limits, and suspend the establishment of new fisheries targeting prey fish.”

**Paul Elsen; Michael Hirshfield**

### **P1-65 Eric Wagner**

#### **Are fisheries changing seabird communities?**

“Fisheries can impact seabirds by killing them, feeding them, competing with them, or changing the interaction among species. We considered the impact of fisheries on three seabird guilds: kleptoparasites (e.g., skuas and jaegers), scavengers (e.g., gulls and albatrosses), and divers (e.g., penguins and alcids). For the first two guilds, to trail a fishing vessel or fleet entails a cost/benefit analysis: both kleptoparasites and scavengers are occasionally killed by fishing gear, but the benefits of food may outweigh the risk of incidental mortality, and both the costs and benefits are direct. For divers, however, few benefits are derived from fisheries, and the costs diving seabirds bear are both direct and indirect: direct, in that divers are caught in fishnets and occasionally on fish hooks; and indirect, in that the bycatch subsidy may increase populations of kleptoparasites and scavengers, which in turn prey on divers and their eggs or young at breeding colonies. Punta Tombo, Argentina, is a case study of some of these impacts. It has the largest breeding colony of Magellanic Penguins (*Spheniscus magellanicus*) in the world, as well as a growing colony of Kelp Gulls (*Larus dominicanus*). Imperial Cormorants (*Phalacrocorax atriceps*), and Magellanic penguins have declined steeply while Kelp Gulls have increased. Kelp gulls are the most frequent predator of penguin and cormorant eggs and chicks. Fishing is likely one of the most important indirect drivers of changes in abundance among seabird species.”

**P Dee Boersma**

### **P1-66 Carles Carboneras**

#### **Trawlers, gulls and the ‘weekend effect’: Discard-feeding seabird follows weekly cycle of human fishing activities**

“Fishing activities in Spain are regulated to follow an activity cycle of 5-days ‘on’ 2-days ‘off’. This pattern determines the availability of trawler discards, so we hypothesised that the number of seabirds associated to a fishing port might follow the same weekly cycle. By recording the number of marked birds present over 5 winter seasons 2005-2010 (n = 1991 readings; 219 occasions), we investigated the pattern of daily attendance of Mediterranean gulls *Larus melanocephalus*, a species whose winter diet is based on a combination of fish discards, invertebrates and vegetable matter, and which does not visit rubbish dumps. Birds were consistently more numerous at the site on weekdays and, remarkably, significantly most numerous on Mondays, coinciding with the

start of the 5-day ‘on’ cycle. There was a significant decrease of bird numbers over the weekend, when the resource was less available and human pressure on the coast was highest. The build-up of gull numbers near the harbour on Mondays may indicate that alternative food sources (at sea or on land) would not be currently sufficient, in the absence of fish discards, to sustain a population that has otherwise remained stable for at least 3 decades. Our findings point to *Larus melanocephalus* being considerably dependant on human fishing activities and, presumably, vulnerable to a major shift in this regime. We interpret this as evidence of incipient environmental stress and habitat deterioration at the site. Mediterranean gull is of European conservation concern and the area is internationally important for the species.”

### **P1-67 Shannon Fitzgerald**

#### **The use of fisheries bycaught marine birds in investigations of natural feeding strategy**

“National Marine Fisheries Service (NOAA Fisheries) certified fisheries observers deployed to commercial fishing vessels have been collecting marine bird carcasses periodically from 2000-2009. Observers have returned well over 400 marine birds from these fisheries, which include the Hawaiian pelagic longline fisheries and the Alaskan groundfish trawl and demersal longline fisheries. Marine birds were necropsied and stomachs were examined. The stomach contents of three species of marine birds were analyzed for this study, including 180 Northern Fulmars (*Fulmaris glacialis*), 40 Laysan Albatross (*Phoebastria immutabilis*), and 25 Black-footed Albatross (*P. nigripes*). The preliminary results from this study revealed that commercial fisheries-related food items such as bait and discarded catch remains (offal) were readily separable from the remains of naturally occurring prey. Though the dietary composition of the birds is undoubtedly altered by the concentration of available food generated by fisheries activities, the large sample size of birds examined and the incidence of naturally occurring prey items provide valuable information about feeding strategies in the absence of fisheries and will help guide future collections and analysis.”

**William Walker**

### **P1-68 Bettina Mendel**

#### **Fast food restaurants in the German North Sea: Lesser Black-backed Gulls searching for trawlers**

“Over the last two decades, the number of breeding Lesser Black-backed Gulls in the German Bight has increased considerably. They are surface-feeders that predominantly forage in offshore areas and show a widespread distribution during all seasons and occur in both coastal and offshore waters. They are known to feed on discards from bottom fisheries as well as on naturally obtained pelagic fish and crustaceans. Even though comprehensive information exists



on their distribution and behavioural patterns at sea, differences at individual levels are unknown. To understand individual foraging strategies in general, and the importance of fisheries discards for choosing foraging areas in particular, we conducted a field study with GPS data loggers to investigate whether habitat choice is affected by the distribution of fish trawlers. In 2008 and 2009 we attached miniGPS data loggers to the tail feathers of 9 incubating Lesser Black-backed Gulls on Helgoland (German Bight, offshore island). These data loggers (earth&OCEAN Technologies, Kiel) store geographic position, date, time and flight speed. Additionally we analysed distribution of fishing vessels from the Vessel Monitoring System (VMS). The VMS detects all fishing vessels > 15m. All 9 Lesser Black-backed Gulls used different areas around their breeding colony on Helgoland for foraging, with a maximum foraging range of 50 km. Preliminary analyses show that the gulls occurred preferentially in areas with trawling activities, but that individuals attended fishing vessels to a different degree.”

**Stefan Garthe; Heino Fock**

#### **P1-69 Cristián Suazo**

##### **The artisanal demersal fisheries in the subantarctic Chilean archipelagos: Implications of their actors' knowledge, perceptions and actions for austral seabird conservation**

“Seabirds from fjords and archipelagos in Chilean Patagonia (Southeastern Pacific) are frequently interacting with several human activities, such as artisanal fishing, unregulated tourism, salmon farming, and naval traffic associated to this industry. A human group strongly associated to seabird in this region corresponds to artisanal fishermen of demersal resources. Their fishing activities consider extensive areas in the complex system of Chonos archipelago (45°21' S; 73°40' W). However, the effects and perceptions from this representative human group have not been evaluated. By means of questionnaires and direct observations during fieldwork, it was possible identifying negative effects toward endangered species such as Black-browed albatross *Thalassarche melanophrys*. Nevertheless, it was only observed a case of bycatch mortality during southern hake *Merluccius australis* fishing with line. Also, we have registered egg collection and hunting for bait of Magellan penguins *Spheniscus magellanicus*. From fishermen, the positive perception existed toward seabirds for the heating waste service (e.g. offal) and their utility as indicators of the presence and concentration of fish (e.g. Clupeidae). It is necessary considering simultaneously interactions during fishing and over breeding colonies as integrated information to evaluate the health of this complex environment and/or the application of appropriate administrative strategies in territorial use by several human activities.”

**Roberto Schlatter; Aldo Arriagada; Luis Cabezas; Jaime Ojeda**

#### **P1-70 Cédric Cotté**

##### **Monitoring two decades of interactions between Procellariiforms and fisheries in EEZs of the Southern Indian Ocean**

“There is mounting evidence that longline fishing is a major cause of observed decrease of seabird populations, particularly albatrosses and petrels. Following the implementation of a subset of the mitigation measures suggested by CCAMLR in the French exclusive economic zones (EEZs) fisheries, mitigation efforts have led to reduce this mortality from 10.000s individuals in the late 1990s to 100s in the late 2000s. Since two decades, seabirds are monitored simultaneously to the fishery activities in the Kerguelen EEZ. We used satellite tracking of four species of procellariiforms (wandering albatross, black-browed albatross, white-chinned petrel and grey petrel) to investigate their spatial interactions with fisheries distributions. We distinguished three periods in the fishery activity: trawling only (before 1992), trawling and longlining (between 1992 and 2002), and longlining only (after 2002 - ongoing). We estimated overlap indices for each species - origin - fishery period. The indices increased during the whole tracking period for breeding wandering albatrosses in response to the growing fishing effort and area prospected by longline vessels. Black-browed albatross present low overlap despite a shift of the distribution that may be linked to the change of fishery activity and area. A low overlap is reported for white-chinned and grey petrels. A dynamic analysis of seabird and vessel locations showed strong interactions and supports the hypothesis that foraging activity of albatrosses is increasingly linked to the fishery activities. These results have strong implications in terms of conservation of seabirds.”

**Karine Delord; Henri Weimerskirch; Guy Duhamel; Patrice Pruvost; Nicolas Gasco; Alexis Martin; Charles-Andr  Bost**

#### **P1-71 Kristin Mabry**

##### **Spatial planning to minimize fisheries and seabirds interactions in Alaska waters**

“During 2007-2009, NOAA Fisheries Alaska region completed several analyses of satellite-tracking data depicting marine habitat use of the endangered short-tailed albatrosses and the distribution of hook-and-line fisheries' effort in Alaska's exclusive economic zone. These analyses were integral in two National Environmental Policy Act Environmental Assessments of revisions to seabird avoidance measures used in the hook-and-line fisheries. Analysts concluded that the requirement of using seabird avoidance measures in a portion of the Bering Sea and most of the inside waters of southeast Alaska were unnecessary due to limited use of this area by seabirds of conservation concern and due, in particular, to a low probability of fishing vessels encountering short-tailed albatrosses. Conversely, the requirement to use seabird avoidance measures in several



transition zones and areas of more frequent usage by short-tailed albatrosses was considered necessary to decrease the risk of incidental take. Also, performance standards were specified for the use of avoidance gear in areas where interactions are more likely to occur. These changes were intended to relieve an unnecessary regulatory burden on fisheries that do not need seabird avoidance measures and to improve the effectiveness of avoidance measures in the fisheries that do.”

**Rob Suryan; Gregory Balogh; Kim Rivera**

## **P1-72 Catriona MacLeod**

### **Grey-faced Petrel distribution in relation to fisheries and ecological zones**

“We used satellite telemetry to determine the at-sea distribution of 32 adult (non-breeders and failed breeders) Grey-faced Petrels, *Pterodroma macroptera gouldi*, during July–October in 2006 and 2007. Adults were captured at breeding colonies on the Ruamaahua (Aldermen) Islands, New Zealand. Tracked birds ranged almost exclusively over offshore waters >1000 m depth, across the southwestern Pacific Ocean and Tasman Sea between 20–49°S and 142°E and 130°W. Area use revealed three general “hotspots” within their overall range: waters near the Ruamaahua Islands, the central Tasman Sea; and, the area surrounding the Chatham Rise off eastern New Zealand. Areas of petrels at sea tended to overlap disproportionately more than expected with the Australian Exclusive Economic Zone and less than expected with multinational High Seas. Accordingly, multiple nations are responsible for determining potential impacts resulting from fisheries by-catch and potential resource competition with Grey-faced Petrels. As a first step towards understanding the at-sea habitat requirements of this species, we will explore here the relative use of different ecological provinces within grey-faced petrel home ranges.”

**Josh Adams; Phil Lyver**

## **P1-73 Samantha Patrick**

### **Consistent individual strategies in northern gannets**

“The unique impact of fisheries on seabird populations makes understanding this relationship crucial for conservation, policy decisions and behavioural studies. While past research has shown that the relationship between seabirds and fisheries is both species and gear (fishery type) specific, spatial data has only recently become available at a sufficiently fine scale. GPS tracking data has been collected on a large range of species and Vessel Monitoring System (VMS) provides GPS level spatial information on fleet movements. Studies have shown a relationship between seabird foraging and vessel location, but the recent release of gear type offers huge

potential to examine gear specific relationships. In addition the ability to isolate vessels which impact on seabirds, will allow a more precise, accurate analyses. Northern gannets are known to scavenge on fisheries discards and here, using VMS data, we are able to show that gannets are associated with vessels with high discard rates. Using depth profiles and track analysis we show birds vary extensively in their association with vessels. We also provide clear evidence that birds undertake individual foraging strategies, with respect to fisheries, with varying reliance on discards. These results support evidence that seabird-fishery interactions are species, gear and individual specific, and understanding such behavioural specialisation may be crucial to seabird conservation.”

**David Gremillet; Stuart Bearhop; Stephen Votier**

## **P1-74 Tawna Morgan**

### **Linking hydroacoustic surveys with winter seabird distribution to assess seabird-herring interactions in Prince William Sound, Alaska**

“Pacific Herring (*Clupea pallasii*) has been identified as a resource injured by the 1989 Exxon Valdez Oil Spill in Prince William Sound (PWS) and based on population trends, shows no sign of recovery. Concurrent with a decline in Pacific herring abundance, several seabirds wintering in PWS have demonstrated a reduced capacity to recover post-oil spill; a phenomena that may be related to reduced forage fish availability. Despite the dynamic association between seabirds and forage fish, few studies have addressed specific seabird-herring relationships during winter months and the potential for synergistic effects on population recovery. In this study we conducted seabird transects concurrent with hydroacoustic herring surveys in PWS to address associations between herring and seabirds in winter. Data were collected in PWS during November and March over a three-year period (2007–2010). Hydroacoustic surveys were used to ascertain factors which may influence herring availability to avian predators including biomass, depth, and age class. Associations between seabird distribution and forage fish availability were analyzed using spatio-temporal models for count data. For Common Murre (*Uria aalge*) and Marbled Murrelet (*Brachyramphus marmoratus*) we found species-specific associations by herring age class. Glaucous-winged Gull (*Larus glaucescens*) and Pelagic Cormorant (*Phalacrocorax pelagicus*) did not discriminate between herring age classes. Optimal models describing seabird associations with herring availability are presented and considered in light of the concurrent decline of both Pacific herring and several seabird species.”

**Mary Ann Bishop; Kathy Kuletz; Richard Thorne**



### P1-75 Brian Hoover

#### Correlating diel prey patterns with pelagic seabird distributions: Elucidating the diurnal and nocturnal distribution patterns of Thick-billed Murres (*Uria lomvia*) and Black-legged Kittiwakes (*Rissa tridactyla*) in the Bering Sea

“We documented the diurnal and nocturnal distribution patterns of pelagic seabirds in the southeastern Bering Sea during July and August 2009. Our study area encompassed three distinct island colonies (St. Paul; St. George; Bogoslof), during chick-rearing periods for Thick-billed Murres and Black-legged Kittiwakes. Seabirds were surveyed in 10-kilometer strip-transects, with transects randomly assigned throughout the study area and equally apportioned through time. We conducted 114 transects, recording the number, behavior, and distance bins in which seabirds were sighted. Transects were first vetted for biases in detection distance due to strip width and sea state, and then binned into 1000m horizontal segments. Seabird densities within each bin were correlated with physical and environmental features such as bathymetry, distance to nearest colony, sea surface temperature, and Chl A. Environmental variables were recorded during each transect, or were acquired from satellite data. Bathymetry and distance to colony accounted for much of the variability in distribution patterns, as breeding birds are limited in foraging range and deep shelf breaks may provide more productive prey resources. Thick-billed Murres were concentrated in shallow areas near the Pribilof Islands during the day, and at night were concentrated around deep shelf breaks west of St. Paul and southwest of St. George. Black-legged Kittiwakes were concentrated in shallow waters north of St. Paul and along the shelf break during the day, and at night were concentrated around shelf breaks and near the deep Pribilof Canyon.”

Kathy Kuletz

### P1-76 Jerome Fort

#### Inter-breeding diet and foraging behaviour of Little Auks provides new insights about copepods winter ecology

“Copepods are essential components of marine food webs worldwide. In the North Atlantic, they are thought to perform vertical migration in the fall to enter diapause, and to spend all winter in deep water (>500m) where they are out of reach from predators. By investigating the winter foraging behaviour, diet and energetics of the little auk (*Alle alle*), a highly abundant planktivorous seabird, we challenge this concept. We present indirect evidence that during winter, swarm of copepods are still available to their predators in water surface layers of the northwest Atlantic, even during short daylight periods. Indeed, by combining stable isotopic analyses and biotelemetry (implanted Time-Depth Recorders),

we showed that wintering little auks perform hundreds of dives daily (> 1 min duration and to 12m water depth), to consume copepods. This study is the first to record the winter diving behaviour of such a small seabird and highlight the impressive diving performance of this tiny species. Furthermore, using a new bioenergetic model (Niche Mapper<sup>®</sup>), we estimated that the little auk population wintering off southwest Greenland (estimated to 20-40 million birds) consumes 3600-7200 tonnes of copepods daily, strongly suggesting substantial zooplankton stocks in surface waters of the North Atlantic in the middle of the boreal winter, with far-ranging consequences for regional food webs and energy flow.” Yves Cherel; Ann Harding; Carsten Egevang; Harald Steen; Grègoire Kuntz; Warren Porter; David Grémillet

### P1-77 David Gremillet

#### Impacts of shifting fish stocks on seabirds in the Southern Benguela upwelling ecosystem

“Small pelagic fish are key components of marine food webs, especially in upwelling ecosystems. Marked fluctuations in the abundance of these fish frequently occur at various spatio-temporal scales, with major consequences for local marine top-predators such as seabirds. Here we investigate the impact of a spatial shift in pelagic fish stocks on the foraging conditions of the three main avian predators of the Benguela upwelling region: African penguin (*Spheniscus demersus*), Cape gannet (*Morus capensis*) and Cape cormorant (*Phalacrocorax capensis*). All three species mainly breed along the west coast of South Africa, where they depend upon sardines (*Sardinops sagax*) and anchovies (*Engraulis encrasicolus*) close to their colonies. These prey have shifted east and into the Indian Ocean over the last decade, supposedly due to the combined effects of climate change and overfishing. During 2002-2009 we collected data on avian demography, diet, reproductive performance and foraging behaviour (the latter via GPS tracking of the three species at all major breeding sites); the abundance and distribution of sardines and anchovies derived from hydro-acoustic surveys; and the locations and sizes of catches made by purse-seine and bottom trawl fisheries. We use this information to demonstrate that (1) the eastward shift in pelagic fish effectively starves seabirds breeding on the west coast of South Africa. (2) fisheries targeting the remaining west-coast pelagic fish exacerbate food shortage to seabirds. (3) philopatry and lack of alternative breeding sites on the south coast preclude rapid adaptation of seabirds to the redistribution of their main food resource.”

Lorien Pichegru; Carl van der Lingen; Rob Crawford; Peter Ryan



## Foraging & Tracking

**WITHDRAWN P1-78 Tom Evans**

### The foraging movements and behaviour of breeding Common Murre at Stora Karls<sup>ö</sup> in the Baltic Sea, Sweden

“The breeding ecology of common murre (*Uria aalge*) in the Baltic Sea has been studied in detail in the colony, but little is known of the behaviour during foraging trips or the location of foraging during breeding. This is of interest in predicting spatial and temporal overlap with their prey, potential conflicts with commercial fisheries, and responses to changes in environmental conditions. As a preliminary study a principal aim was to develop methods to investigate the location of foraging sites, temporal variation in behaviour, and diving activity. Device deployments took place during the chick rearing period. Six birds were successfully fitted with a small back mounted GPS logger and a leg mounted time-depth recorder (TDR), one individual with only a TDR. This combination gave detailed position and depth data, with high temporal and spatial resolution. Foraging activity was concentrated to the west of the colony over a wide range of distances ( $15.0 \pm 11.3$  km). Diving behaviour peaked around sunrise and sunset, with dive depths lowest at night ( $23.2 \pm 7.6$  m), and highest during the daytime ( $30.7 \pm 15.9$  m). GPS data suggested goal orientated flight, with outward and homeward flights having high straightness indices (0.995 and 0.986 respectively). With slight modification this method will allow a detailed picture of behaviour at sea. The relatively short foraging trip distances may suggest locally abundant food during the investigated season.”

**Martina Kadin; Jonas Sundberg ; Olof Olsson;  
Henrik Österblom; Susanne Åkesson**

**P1-79 Morten Frederiksen**

### Details of individual foraging behavior of breeding Thick-billed Murres in NW Greenland

“Little is known about foraging areas and behavior of the large breeding populations of thick-billed murres (*Uria lomvia*) in northern Baffin Bay. We used satellite transmitters ( $n = 3$ ), GPS data loggers ( $n = 5$ ) and time-depth recorders (TDRs,  $n = 23$ ) to record foraging locations, time budgets and diving behavior of chick-rearing adults at Kippaku, NW Greenland ( $74^{\circ} 43'N$ ,  $56^{\circ} 37'W$ , approx. 10,000 pairs) in 2008 and 2009. Three birds were simultaneously equipped with TDRs and GPS loggers. Contrary to expectations, most birds foraged inshore in fjords, bays and sounds within 35 km of the colony, with fewer offshore trips up to 45 km recorded. Some foraging locations were extremely close to shore ( $< 200$  m), but nevertheless included dives of  $> 100$  m. Most foraging bouts consisted of relatively deep dives (80-135 m),

but some bouts had large numbers of shallow dives (10-15 m). All individuals tracked showed evidence of individual preference for specific foraging areas, often returning to within 500 m of previous locations on successive trips, even after intervening brooding stints. However, some individuals also switched to other areas up to 40 km away. All trips made were towards SW, S, SE and E, perhaps indicating avoidance of competition with birds from a much larger murre colony 8 km NNW of Kippaku. We have limited data on prey deliveries, but it seems likely that birds targeted mostly polar cod (*Boreogadus saida*) during deep dives, and spawning capelin (*Mallotus villosus*) during shallow dives.”

**Knud Falk; Jannie Linnebjerg; Tim Guilford;  
Anders Mosbech**

**P1-80 Ann Harding**

### Flexibility in foraging behavior of Thick-billed Murres breeding at three colonies in the Bering Sea

“Studies have shown that proximity to highly productive habitats is important for breeding seabirds. We report on the first time bird-borne GPS devices have been used to examine the foraging strategies of Thick-billed Murres (*Uria lomvia*). We studied three colonies in the Bering Sea in 2009. The colonies are located at varying distance from productive oceanographic features; Bogoslof Island is an oceanic colony, lying in deep water north (ca 30km) of the Aleutian chain, whereas the two Pribilof Islands are located on the continental shelf at different distances from the shelf-edge (St George ca 25km, St Paul ca 90km). We examined how differences in proximity to oceanographic habitats influenced parental foraging strategy and diets. Murres at each colony exhibited directional flight to aggregated foraging areas, suggesting predictable prey distributions. There was little among-colony variation in daytime foraging range; parents at all three colonies foraged relatively close to the colony ( $< 20$  km), presumably constrained by frequent needs to feed their young. During night trips, murres at St. George travelled longer distances to deep water to feed on squid, whereas birds on St Paul continued to forage on the shelf and fed on pollock. These results suggest that murres depend on prey resources that occur in close proximity to the colonies for chick-provisioning, whereas they may use highly productive areas with predictable prey for self-provisioning.”

**Rosana Paredes; Dan Roby; David Irons; Rob Suryan;  
Rachael Orben; Heather Renner; Sasha Kitaysky**



### **P1-81 Jannie Linnebjerg**

#### **Preliminary insight into the geographic variation in foraging behaviour of Thick-billed Murres in Western Greenland**

“Time-depth recorders (TDRs) were used to compare foraging behaviour of thick-billed murres (*Uria lomvia*) during the breeding season at four sites in Western Greenland (Saunders Island, Kippaku, Ritenbenk, and Ydre Kitsissut). At Kippaku, foraging behaviour was also examined during incubation and during chick rearing at-sea. Preliminary results indicate a clear difference between mean dive depth at Saunders Island, Kippaku, Ritenbenk and Ydre Kitsissut ( $31.76 \text{ m} \pm 1.07 \text{ S.E.}$ ,  $47.08 \pm 0.32$ ,  $23.53 \pm 0.35$  and  $58.28 \pm 2.25$  respectively). As expected, chick rearing birds at Kippaku foraged much deeper than incubating and at-sea rearing birds ( $47.08 \text{ m} \pm 0.32 \text{ S.E.}$ ,  $30.01 \pm 0.42$  and  $24.78 \pm 0.25$  respectively). Thus, birds are working harder during chick rearing than during incubation. We do however see a marked change in diving behaviour at-sea. Not only do we see a decline in diving depth, we also see an increase in dives per day compared to chick rearing at the colony ( $336.2 \pm 3.66 \text{ S.E.}$  and  $93.39 \pm 0.30$  respectively). The results indicate that the accompanying male during swimming migration does not need to dive so deep to find food for the chick, but is able to find sufficient food nearer the surface. Taken together, these data indicate differences in patterns of foraging behaviour between thick-billed murres at different locations, and also clear differences between incubating, rearing and at-sea rearing males.”

**Knud Falk; Flemming Merkel; Anders Mosbech; Morten Frederiksen**

### **P1-82 Paul Regular**

#### **Moonlight affects the nocturnal foraging activities of pursuit-diving Common Murres**

“The foraging abilities of visually hunting seabirds are strongly affected by light levels. We examined how light influenced the foraging behaviour of breeding common murres in Newfoundland, Canada, using temperature-depth recorders (TDRs), temperature-depth-light recorders (TDLRs) and models of light availability. Dive data revealed that murres foraged through the day and night. During the day, light does not appear to be a limiting factor; though they dive to impressive depths (up to 180 m), often under cloudy skies, minimum light levels experienced remain relatively high ( $\sim 10^{-2} \text{ Wm}^{-2}$ ). At night however, murres adjusted their diving activity according to moonlight availability. Diving efficiency was significantly greater under moonlight ( $\sim 10^{-4} \text{ Wm}^{-2}$ ) than under starlight ( $\sim 10^{-8} \text{ Wm}^{-2}$ ) conditions. The birds also increased their diving depth as night-time light levels increased, possibly as a response to improved vision at deeper depths. Alternatively, such behavioural adjustments may be indicating that their prey are suppressing their vertical

migration in response to lunar light. Our results demonstrate the striking behavioural flexibility of breeding common murres. We suspect that these birds are not adapted to both diurnal and nocturnal foraging, because retinal adaptations for high daytime visual acuity are incompatible with sensitive night vision. Thus, murres diving at night are likely foraging on the edge of their visual abilities, implying that they may be using non-visual cues to capture prey under extremely low light conditions.”

**April Hedd; William Montevecchi**

### **P1-83 Sarah Spencer**

#### **Foraging behavior of Atlantic Puffins in the Gulf of Maine**

“During 2008-2009, we quantified foraging behavior of adult Atlantic puffins (*Fratercula arctica*) by deploying temperature depth recorders (TDRs) on 18 adults nesting on Petit Manan Island, Maine. Dive data were successfully retrieved from 5 birds in 2008, and 8 birds in 2009. Of the 7,906 dives recorded, 57% occurred during 0400-0800 and 1600-2000, while no dives were made between midnight and 0400. Mean ( $\pm \text{SE}$ ) dives per day, pooled across years, was 271 ( $\pm 23.6$ ), with bouts of diving lasting 61.12 ( $\pm 4.63$ ) seconds and consisting of 10.2 ( $\pm 1.3$ ) dives per bout. During 2009, we observed the departure of 26 puffins from their burrows, followed by their subsequent return with food. Based on a mean foraging trip length of 60.1 ( $\pm 7.5$ ) minutes, and flight speeds reported in the literature, we estimate that birds were foraging within 27 km of the colony. Dive depth was less than 9 m for 50% of the dives, and less than 15 m for 80% of the dives. Mean maximum dive depth was 9.9 ( $\pm 0.45$ ) m, with the deepest dive being 40.7 m. No difference in dive behavior was noted for males and females.”

**Paul Sievert; Linda Welch**

### **P1-84 Aly McKnight**

#### **Using radio telemetry to examine at-sea movement and behavior of a rare and poorly understood seabird**

“The productivity and survival of higher trophic level organisms, such as seabirds, is highly dependent upon their ability to locate prey. With colonially nesting species, it is generally possible to examine directly the relationship between prey resource quality and/or availability and productivity/survival. However, Kittlitz’s murrelets (*Brachyramphus brevirostris*) are remote and solitary nesters, making direct study of breeding parameters prohibitively expensive and subject to small sample sizes. For such species, collecting telemetry data on time/energy budgets can help assess the effort spent in foraging and possibly shed light on causes of recent population declines. During summer 2009,



we deployed 12 radio transmitters on Kittlitz's in Prince William Sound in a pilot effort to 1) conduct intensive behavior watches to generate partial time budgets and 2) remotely monitor their use of one glacial fjord system. Both efforts proved to be effective methods for collecting behavioral data on this species. The intensive behavior watches showed relatively short bursts of foraging in between longer spans of loafing behavior. Remote monitoring showed daily and seasonal changes in birds' use of the fjord system; in addition, we documented birds spending their nights far from known daytime hotspots, which may be critical when making management decisions. Our 2009 work suggests that remote data logging in conjunction with intensive behavior watches of radio tagged Kittlitz's may provide a reasonably effective method for building time and energy budgets for Kittlitz's."

**Andrew Allyn; David Irons**

### **P1-85 Sebastian Cruz**

#### **Survival and foraging movements of Swallow-tailed Gulls in the Galapagos Islands**

"The breeding biology of swallow-tailed gulls, a Galapagos endemic, is known only from the early work of Harris and Snow in the 1960s. Their data indicated several surprising characteristics, including obligate nocturnal foraging and adult survival across 9-month breeding cycles of 0.97. We used techniques unavailable to those researchers to evaluate both propositions. We used GPS/acceleration loggers to track foraging trips during the breeding season in three island populations during 2008 and 2009. Preliminary analysis confirmed that all foraging trips were nocturnal, with birds generally leaving the colony at dusk. Foragers usually returned well before dawn: the mean duration of the trips on Española Island was 6.9 (s.d. 4.0 h; n = 56), and on Genovesa Island was 3.0 (s.d. 2.2 h; n = 34). Birds from Española foraged at an average range of 105.2 (s.d. 47.3) km, while birds from Genovesa foraged at average range of 42.7 (s.d. 22.9) km. These differences are highly significant, and we suspect they are related to the different oceanographic regimes of the archipelago. Since 2008, we have marked 500 adult individuals on Española Island, and conducted seven re-sight surveys at 3-4 month intervals. Mark-re-sight CJS modeling yielded an estimate of adult survival over 9 month breeding cycles of approximately 0.86, a dramatically lower figure than that of 40 years ago. We discuss the conservation implications of these results for this most unusual gull."

**Dave Anderson; Carolina Proaño; Martin Wikelski**

### **P1-86 Philip Whittington**

#### **Movements of adult Kelp Gulls from a south coast colony, South Africa**

"To investigate the source of adult Kelp Gulls *Larus dominicanus* that move into Port Elizabeth during the autumn months, 295 were colour-ringed at the Keurbooms River mouth, Plettenberg Bay, during the 2006/2007 and 2007/2008 breeding seasons and five adults were caught and colour-flagged at the Gamtoos River mouth in November 2006. All were caught while incubating eggs using a walk-in trap placed over the nest. Monthly searches were made in Port Elizabeth for colour-ringed birds between February and September in both 2007 and 2008. Sightings in other areas were made opportunistically by the author and some contributed by members of the public. By January 2010, 110 of the birds ringed in 2006 and 90 of those ringed in 2007 at the Keurbooms River were re-sighted (76% and 59% of those ringed respectively). Three (60%) of the Gamtoos River birds were re-sighted. The recovery rate of ringed birds was 0.014 and the re-sighting rate was 0.6. Birds were re-sighted between Mossel Bay, 119 km west of the Keurbooms, and East London, 450 km to the east. The average distance travelled by Keurbooms birds was 52 km and the maximum 450 km. This compares with averages of less than 10 km and a maximum of 30 km travelled in other studies in South Africa and may be a function of the low numbers of Kelp Gulls ringed as adults. Many birds appeared to be site-faithful to areas visited outside of the breeding season and returned to the same locality 2-3 years running"

### **P1-87 Ruben Fijn**

#### **Radio telemetry as a tool to study spatial distribution, breeding and feeding ecology of Sandwich Tern *Sterna sandvicensis* and Common Tern *Sterna hirundo* in the shallow coastal zone of the Netherlands**

"Sandwich and Common Terns were radio-tagged in two different colonies during the 2009 breeding season in the 'Voordelta', a shallow coastal zone designated as SPA in the southwestern part of the Netherlands. Colony based, automated receivers as well as aerial radio tracking made it possible to study the spatial distribution and time budgets of both species, both in the colonies and at sea. Furthermore, an aerial survey programme was carried out to monitor monthly densities of terns in the marine environment. In addition, detailed colony based 'enclosure' research was carried out on breeding biology, breeding success and foraging behaviour. Spatial distribution differed between the two species, with Sandwich Terns foraging more pelagic. Breeding success of both species turned out to be low. Predation as well as rapid vegetation growth seemed to be the main causes, but chick growth rate and adult nest attendance further indicated poor food availability (diet dominated by clupeid fish). Radio



telemetry figures on daily number of foraging flights and foraging duration in the course of the season revealed a strong influence of tide, weather and chick age on the behaviour of the adult birds and ultimately on chick growth. The multi-disciplinary set-up has proven to be effective as it gives a complete insight in the breeding ecology processes, including the behaviour of birds at sea, far away from the colonies. This approach can also be used to define protected areas for birds in the marine environment like marine IBA's or marine SPA's."

**Martin Poot; Wouter Courtens; Hilbran Verstraete; Eric Stienen**

### **P1-88 Carlos Zavalaga**

#### **First GPS-tracking of small seabirds: Peruvian Diving-petrels and Inca Terns**

"We report the first GPS tracks of one inca tern (*Larosterna inca*, 210 g) and three Peruvian diving-petrels (*Pelecanoides garnotii*, 190 g) in Peru. To our knowledge, these are the first GPS-tracks of small seabirds. The GPS logger (GiPSy-2, Technosmart) and its battery weighed < 5 g; housing and tape added an additional weight of 3 g. Both species are burrow nesters and diurnal foragers, but diving-petrels spent a much higher proportion of time of their feeding trips on the water surface and diving, which restricted the number of fixes captured by the GPS loggers. As a result, more accurate spatial data were obtained in terns than in diving-petrels. The Inca tern track was completed in 5.5 h, traveling 69 km south of the colony. The bird foraged close to the maximum foraging distance as indicated by the increase of the path sinuosity and decrease in flight speed. Truncated tracks of three diving-petrels showed that the maximum foraging distance were at least 15.5, 16 and 46 km from the colony. A close inspection of the tracks suggested that diving-petrels alternate long periods of sitting/swimming with short periods of flying. These preliminary results suggest that detailed spatial data can be collected using small GPS loggers also in small seabirds (~200 g), but the amount of data gathered can be affected by the foraging behavior at sea. Ongoing technological advancements in miniaturization and performance of the units as well as more suited attachment of the tags and setting of the recoding features will allow the tracking of small seabirds for more extended periods in the near future."

**Joanna Alfaro; Giacomo Dell'Omo**

### **WITHDRAWN P1-89 Jacopo G. Cecere**

#### **Movement patterns and selection of foraging areas by breeding Cory's Shearwater in Central Mediterranean**

"In the Mediterranean Sea human activities strongly affects the availability of large fish stocks, thereby competing actively with seabirds. To identify and conserve those areas most exploited by seabirds, Birdlife International launched the Marine Important Bird Areas project in all European Countries. Using GPS telemetry we analysed the foraging activity and located the fishing areas of 86 Cory's Shearwaters (*Calonectris diomedea diomedea*) from two distant colonies in the Italian Mediterranean Sea during incubation and chick rearing. During incubation, female birds undertook longer foraging trips compared to males. During chick rearing both sexes undertook on average shorter trips, and their lengths were positively correlated to chick age. The Kernel analysis identified the foraging areas of both colonies, which changed within a breeding season. For example, in the colony of Linosa (Sicily), the main kernel areas during incubation were situated along the coast of Lybia and Tunisia, up to 150 km far away, while during the first part of chick rearing, foraging areas were located mainly close to the colony. These results highlight the importance of monitoring foraging activity during all phases of the breeding period. Finally, with Maximum Entropy models (MaxEnt), we found that Cory's Shearwaters select foraging areas mainly based upon the concentration of chlorophyll-a and winter and spring sea surface temperature. These models allowed us to build habitat suitability maps, useful for the identification of marine IBAs and to plan specific conservation actions."

**Carlo Catoni; Giulia Casasole; Carlo Rondinini; Pedro Geraldes**

### **P1-90 Scott Shaffer**

#### **Winds and prey availability determine shearwater foraging distribution in the Southern Ocean**

"Sooty (*Puffinus griseus*) and short-tailed (*P. tenuirostris*) shearwaters are abundant seabirds that range widely across global oceans. Understanding the functional roles of these species in the Southern Ocean is important for ecosystem conservation and management. Tracking data from sooty and short-tailed shearwaters from three regions of New Zealand and Australia were combined with at-sea observations of shearwaters in the Southern Ocean, physical oceanography, near-surface copepod distributions, pelagic trawl data, and synoptic near-surface winds. Shearwaters from all three regions foraged in the Polar Front zone, and showed particular overlap in the region around 140°E. Short-tailed shearwaters from South Australia also foraged in Antarctic waters south of the Polar Front. The spatial distribution of



shearwater foraging effort in the Polar Front zone was matched by patterns in large-scale upwelling, primary production, and abundances of copepods and myctophid fish. Oceanic winds were found to be broad determinants of foraging distribution, and of the flight paths taken by the birds on long foraging trips to Antarctic waters. The shearwaters displayed foraging site fidelity and overlap of foraging habitat between species and among populations that may enhance their utility as indicators of Southern Ocean ecosystems. “

**Ben Raymond; Serguei Sokolov; Eric Woehler; Daniel P; Luke Einoder; Mark Hindell; Graham Hosie; Matt Pinkerton; Paul M; Darren Scott; Adam Smith; David R; Caitlin Vertigan; Henri Weimerskirch**

### **P1-91 Carolina Proaño**

#### **At-sea movements of breeding Galapagos Petrels from Santa Cruz Island, Ecuador**

“Using satellite telemetry, we studied for the first time, the breeding movements of the critically endangered Galapagos Petrel (*Pterodroma phaeopygia*). Although much has been done for the conservation of this seabird at its colonies, little information exists regarding its movements and threats at-sea. Here we provide a preliminary overview of the species foraging range and behavior in relation to the spatial usage of the Galapagos Marine Reserve (GMR) protectorate. We report the foraging movements during the first three months of the 2009 breeding season for 12 adult petrels that were provisioning chicks at the Media Luna colony, Santa Cruz Island. We used solar platform terminal transmitters (PTTs) with continuous transmissions and ARGOS data to quantify trip duration, foraging area, and total distance covered (TDC). Provisioning petrels occupied a ~1.4 million km<sup>2</sup> area bounded by 81°E to 102°E and 1.5°N to -10.4°S. Frequency distribution of trips show an alternation between long foraging trips, dispersing outside the GMR, and short foraging trips, staying within the GMR boundaries. The mean TDC was 5281km lasting 14.6 ± 2.5 days each (n = 9) for the long trips and 836km at a smaller scale lasting 4.87 ± 2.2 days (n = 20). These results show that Galapagos petrels travel immense distances to reach distant, patchy food resources. Tracked petrels spent most time at sea outside the Galapagos Marine Reserve; this presents a challenge for large-scale conservation of this critically endangered species.”

**Sebastian Cruz; Josh Adams; Martin Wikelski**

### **P1-92 Michelle Kappes**

#### **Evidence of resource partitioning in sympatric tropical boobies**

“Interspecific competition for resources may be especially pronounced in low productivity environments, such as tropical oceanic waters, and when access to resources are

constrained, such as in central place foraging seabirds. We investigated the foraging behavior and diet of masked (*Sula dactylatra*) and red-footed (*S.sula*) boobies during the brooding period to examine the role of resource partitioning in the foraging strategies of these sympatric species. We deployed GPS loggers on 13 individuals of each species at Tromelin Island, western Indian Ocean, to determine foraging locations at sea. We used first passage time analysis to identify zones of area-restricted search (ARS), kernel density analysis to determine the utilization distribution (UD) of each species, and discriminant analysis to investigate interspecific segregation of environmental characteristics of ARS zones. Based on randomization tests, the foraging range of each species (95% UD) overlapped significantly, however at core foraging areas, there was significant interspecific segregation (p = 0.010, 50% UD; p = 0.004, 25% UD). Environmental characteristics of ARS zones differed significantly between species (p = 0.02), with masked boobies utilizing warmer, deeper, less windy and less productive oceanic environments than red-footed boobies. This spatial and environmental segregation of core foraging areas was reflected in differences in diet composition of regurgitates obtained from adults. Masked boobies consumed primarily flying fish, whereas red-footed boobies consumed mostly squid. These results suggest that boobies are able to partition resources by spatial segregation of core foraging areas at a fine scale, despite significant overlap of their overall foraging range.”

**Henri Weimerskirch; David Pinaud; Matthieu Le Corre**

### **P1-93 Sabrina Harris**

#### **Search behavior of a small-range marine predator: The Imperial Cormorant**

“Predators must make optimal decisions about where and how to forage in order to maximize both their efficiency and, ultimately, their fitness. Our main objective is to characterize the search strategy of Imperial Cormorants (*Phalacrocorax atriceps*) breeding at Punta León colony (3° 04' 40''S, 64° 29' 45''W) Chubut, Argentina. Specifically, to determine if birds perform Area-Restricted Search (ARS) through the use of first-passage time analysis (fpt). Consequently, to study if the detected search scales are nested, if initiation of this behaviour is triggered by prey detection and pursuit, and characterize ARS areas. GPS information was gathered from 26 foraging trips (11 males and 15 females), during 2008 breeding season. In 88% of the trips at least one search scale was detected (range = 25.25 - 4343.43m), in some cases more than one and even nested scales were found. Individuals used as many as three ARS areas (average size = 2.4km) throughout the trajectory, spending on average 35% of total time within them. ARS was performed in shallow waters, with a mean bathymetry of 29 ± 14 m (range: 5-57 m). In 48% of the trips the highest proportion of dives occurred within the ARS and all but one trip presented dives within the 10



minutes prior to entering an ARS. We conclude that Imperial Cormorants that breed at this colony perform ARS, some individuals present a nested search strategy and prey detection may trigger ARS. However, behavioral differences were found which could be related to individual specialization or age/experience related divergences.”

**Andrea Raya Rey; Flavio Quintana**

### **P1-94 Kumi Nagai**

#### **Foraging behavior of Adèlie Penguins under contrasting sea-ice conditions**

“The Adèlie penguin is an important component of the Antarctic marine ecosystem, particularly in the sea-ice zone, where it feeds extensively on krill and fish. Seasonal sea-ice can sometimes remain around the colony during the breeding season and in some years this can affect the travelling and foraging activity of breeding birds. To examine the foraging responses of Adèlie penguins to different sea-ice conditions, we compared their diving behavior between areas and years by using depth-speed-acceleration data loggers. The study was conducted at two sites: Hukuro Cove, Lützw-Holm Bay, Antarctica in 1999 and at Signy Island, South Orkney Islands in 2001, 2002 and 2007. Foraging depths were mainly shallow (5-25m) when the sea was covered by fast ice (Hukuro Cove 1999) or extensive pack ice (Signy Island 2007). In contrast, when almost no sea-ice was observed around the colony, foraging depths were more variable and deeper (20-75m) (Signy Island 2001 and 2002). The horizontal distances travelled by penguins during a single dive were significantly longer at Hukuro Cove 1999 (157m, on average) than at Signy Island (2001: 108m, 2002: 107m, 2007: 88m). Penguins apparently alter their diving depth and their horizontal range, possibly to feed upon prey such as krill that are commonly found in association with sea-ice. Our results suggest that Adèlie penguins alter their foraging behavior under contrasting sea-ice conditions.”

**Akinori Takahashi; Shinichi Watanabe; Katsufumi Sato; Yutaka Watanuki; P Trathan; M Dunn**

## **Habitat Use**

### **P1-95 Pamela Michael**

#### **Describing dispersion and habitat associations of Black-footed Albatross in central California marine sanctuaries**

“We utilized five years (2004-2008) of vessel-survey data collected as part of the PRBO Conservation Science Ecosystem Study program, in conjunction with Gulf of the Farallones and Cordell Bank National Marine Sanctuaries. We evaluated the seasonal (chick-rearing, post-breeding) and interannual variation in Black-footed Albatross (*Phoebastria nigripes*; BFAL) distribution and abundance within the productive continental shelf/slope system of central California. The presence, density, and aggregation of BFAL were evaluated in relation to dynamic (water mass, local windscapes, upwelling, remote atmospheric forcing) and static (banks, shelf-break, bathymetry) habitat features. Variation in local (SST: 9.0 to 16.0 Co) and basin-wide (PDO: -1.52 to 1.86) conditions allowed us to investigate BFAL response to environmental changes. Analyses involved 121 replicate surveys of 7 individual onshore-offshore lines (mean length: 35.1 km) and 1436 3km bins, including 208 sightings of 408 BFAL. Analyses were performed at two distinct spatial scales: 1) survey lines, where we created a multivariate model quantifying the direct and indirect influences of the aforementioned variables on BFAL aggregation and 2) 3km bins, where we modeled and identified water mass characteristics associated with BFAL occurrence and concentration. Our evaluation of BFAL habitat use across multiple temporal and spatial scales has direct management implications for the Sanctuaries within the study region.”

**Jaime Jahncke; K. David Hyrenbach; Lisa Etherington**

### **P1-96 Trevor Joyce**

#### **Determining the marine range and habitat use of Newell’s Shearwaters from Kauai, Hawaii**

“The Newell’s Shearwater (*Puffinus newelli*), an IUCN endangered petrel, has experienced an apparent population decline of 75% in the past 2 decades. In addition an estimated 90% of the world population breeds only on the island of Kauai, Hawaii. Determining the Newell’s Shearwater’s pelagic range and marine habitat use pattern during the non-breeding season are integral components of assessing potential marine threats to this seabird and providing a comprehensive recovery program. Here we describe a project proposal to 1) document marine range, 2) determine marine habitat use pattern, and 3) assess the effect of climate change on habitat. To improve current information on marine dispersal we propose deploying of British Antarctic Survey Mk14 geolocation dataloggers on adult Newell’s shearwaters



on Kauai. Tags weighing 1.5g will be pre-attached to a tarsal band, giving a total payload weight of 3.0g representing <1% of the 390g Newell's Shearwater, well below the threshold suitable for extended deployments. Marine habitat use patterns will be determined using general additive, state-space, and regression tree modeling approaches. Spatial predictions from standard global climate models utilized in the IPCC process will be used to quantitatively model potential changes in marine habitat quality resulting from climate change."

**Nick Holmes; Richard Phillips**

### **P1-97 Jeff Troy**

#### **Development of a breeding habitat suitability model for the Newell's Shearwater**

"The island of Kauai in the Hawaiian Archipelago is the stronghold of the federally threatened Newell's Shearwater, or 'A'o (*Puffinus newelli*). This endemic seabird experienced a dramatic population decline during the past two decades, accompanied by a breeding range contraction on Kauai. Few locations of active breeding sites are known and the existence of additional sites is difficult to determine because of inaccessibility due to steep terrain and remoteness of certain regions. In an attempt to quantify potential breeding habitat for this species and aid future searches, we developed the first breeding habitat suitability model for the Newell's Shearwater using distributional data from systematic surveys, a suite of remotely sensed environmental variables, ArcGIS, and a novel method of suitability model production. The habitat suitability model and maps produced from this effort will aid in prioritizing areas for future surveys and habitat protection, a critical component in the conservation of this imperiled species."

**Nick Holmes; Joseph Veech; M. Clay Green**

### **P1-98 Robert Ronconi**

#### **Scales of resource and habitat partitioning between two sympatric shearwater species: Evidence from stable isotopes and satellite telemetry**

"During the summer in the North Atlantic Ocean, Greater (*Puffinus gravis*) and Sooty (*P. griseus*) shearwaters are two of the most abundant avian predators. They nest on distinct breeding colonies in the southern hemisphere, but overlap considerably during non-breeding seasons in the northern hemisphere. Using stable isotope analysis and satellite telemetry, we investigated dietary and habitat partitioning between species at local (Bay of Fundy) and global (oceanic basins) scales. Blood samples show similar diets in Canadian waters where krill and herring are dominant dietary items. Feather samples show inter-specific dietary differences during wing moult but not during body moult, suggesting species

perform these activities during different times of the year and in different locations. Satellite telemetry data from 24 Greater and 4 Sooty shearwaters show similar patterns of habitat use in the Bay of Fundy, but markedly different migration routes. Greater shearwaters migrate with oceanic winds from the North Atlantic to the Patagonian Shelf. By contrast, Sooty shearwaters reach Europe before following the African coastline to the South Atlantic. At local scales, within the Bay of Fundy, these species show considerable overlap in diet and habitat. Resource and habitat partitioning occurs on global scales across entire oceanic basins."

**Andrew Westgate; Sarah Wong; Heather Koopman**

### **P1-99 Nicole Schumann**

#### **Does habitat limit population size in diving-petrels? Habitat selection of breeding Common Diving-petrels in south-eastern Australia**

"Seabird populations are commonly thought to be limited by prey distribution and abundance, although available nesting habitat may also constrain their populations. In light of worldwide declines in seabird abundance and the potential for global environmental change to cause further perturbations in the marine environment, it is vital to gain an understanding of the factors driving population dynamics. It is, therefore, necessary to identify breeding habitat preferences of seabirds to assess their role in population regulation. The present study modelled nesting habitat selection in common diving-petrels *Pelecanoides urinatrix*, a burrowing species which is particularly vulnerable to climate change due to its limited foraging range, and sympatric fairy prions *Pachyptila turtur*, also a burrowing species, on islands in Bass Strait, south-eastern Australia. We identified slope angle as the most important variable influencing burrow site preferences of both species. Given that the two species have similar nesting habitat requirements and occupy burrows of similar dimensions, there is potential for the smaller diving-petrels to be excluded from suitable nesting areas by fairy prions. Monitoring of common diving-petrel abundance is crucial in order to determine the population response of this species to climate change and the potential for competitive exclusion to occur."

**Peter Dann; John Arnould**

### **P1-100 Richard Sherley**

#### **Don't bank on a sea view: Is unsuitable habitat limiting breeding success of an endemic cormorant on Robben Island, South Africa?**

"The Endangered bank cormorant *Phalacrocorax neglectus* is endemic to the Benguela ecosystem of southern Africa. Most breeding colonies occur on offshore rocks or islands close to the high-water mark, but man-made structures are also used. Despite adaptations for breeding close to the water, nests can



be lost to storms. Using data from two colonies where food is not considered limiting, we present a comparative study on nest survival in bank cormorants. A modified version of the Mayfield method was employed to compare nests at two sub-colonies on Robben Island, South Africa, from 2007 to 2009 with nests from a naturally occurring, but artificially sheltered colony (in 2005 and 2008) and a number of unsheltered sub-colonies (2005 only) at Mercury Island, Namibia. Overall, nest survival did not differ significantly between years at each island but was lower at the exposed colonies compared to the sheltered colony at Mercury Island. The probability of a nest surviving the breeding attempt was lower at Robben Island than at Mercury Island. Nest failures at Robben Island were related to wave heights and air temperature, with trends to suggest reduced chick survival in years where major storm events occurred during peak breeding. A heat wave caused major chick mortality at Mercury Island in 2005. Winter breeding at Robben Island appears to increase the risk of losses during storms but also reduces the risk of heat exposure. The provision of additional nesting habitat sheltered from storm events should allow Robben Island to support a larger breeding colony.”

**Katrin Ludynia; Les Underhill; Rian Jones; Jessica Kemper**

### **P1-101 Leif Nilsson**

#### **The importance of offshore banks for seabirds in Swedish waters**

“The Baltic Sea together with Swedish west coast areas constitutes a highly important staging and wintering area for various seabirds migrating from vast breeding areas in Fennoscandia and European Russia including seaducks such as Longtailed Duck and divers. The Baltic also has important populations of alcids that remain in this enclosed sea for the entire year, whereas the west coast forms an important part of the North Sea wintering area for seabirds. The Baltic is characterized by brackish water and as a result of this has a marine fauna with a few dominant common species. The main parts of the offshore Baltic is quite deep but there are a number of shallow (15 - 30 m) offshore banks both in the Baltic and the Kattegatt formed by moraine or by underwater mountains with a very rich fauna of the dominant *Mytilus* but that are also important nursery grounds for fishes. The dominant species on the banks is the Long-tailed Duck with about 10 - 20% of the total western palearctic population found on three of these banks. The offshore banks also constitute important feeding grounds for staging and wintering alcids and divers. On behalf of the Swedish EPA large scale studies have recently, for the first time, been undertaken on a selection of the more important offshore banks surveying benthic fauna and flora, fish populations and birds with the aim to establish the importance of the banks in the marine life of the Baltic and to model the different roles in the ecosystems of the banks different organisms might have. The contribution will present some first results of this study.”

### **P1-102 Ramunas Zydalis**

#### **Predicting effects of habitat alteration on seaducks using individual-based models**

“The objective of our study was to predict potential impacts of a fixed link construction across Fehmarn Belt, Southern Baltic, on common eiders and other seaduck species wintering in the study area. We used an individual-based modelling approach to evaluate habitat carrying capacity and make predictions about seaduck responses to habitat alteration. The baseline model was created using generic information compiled in producing earlier individual-based models for seaducks, and collecting study-area specific data on bird food resources and functional relationships between birds and their habitats. The baseline model was calibrated so it corresponded to bird numbers and distribution observed in the study area. Habitat carrying capacity has been assessed by ‘allowing’ more individuals to enter the model system and then evaluating the fitness of these virtual birds at the end of wintering season. Three different scenarios of environmental impacts were run to assess their possible impacts on wintering seaducks. Impact scenarios described various degrees of habitat loss, and the individual-based modelling approach allowed us to evaluate changes in fitness of wintering seaducks relative to baseline conditions.”

**Georg Nehls; Monika Dorsch; Richard Stillman; Richard Caldow**

### **P1-103 Andrew Allyn**

#### **Population status, preferred habitat and diet of Kittlitz’s Murrelets in Prince William Sound, Alaska**

“Kittlitz’s murrelets (*Brachyramphus brevirostris*) have declined dramatically over the past few decades throughout many core population centers in Alaska. Prince William Sound, one of these core areas, showed an estimated decline in Kittlitz’s of ~18% per year during the 1990s. With little empirical evidence of the direct causes behind these widespread population declines, monitoring populations in core areas and answering basic questions about Kittlitz’s ecology are crucial steps in any conservation effort. During summer of 2009, we (1) repeated surveys of transects originally surveyed by Kuletz et al. in 2001 to update the current population estimate for Prince William Sound and (2) collected blood and feather samples from 39 Kittlitz’s for stable isotope analysis of diet. A comparison of abundance estimates between the two years suggests a continuing decline in the Prince William Sound Kittlitz’s population since 2001, though the decline may not be as severe as that documented during the 1990s. Further, for both years, we modeled Kittlitz’s presence/absence among fjords as well as their distribution within fjords with respect to a suite of environmental and physical covariates. Finally, stable isotope



analysis of blood and feather samples from captured birds revealed that birds are likely feeding on a combination of plankton and fish in Prince William Sound prior to the breeding season. These results enhance our understanding of Kittlitz's ecology and may facilitate development and implementation of effective management strategies in Prince William Sound."

**Aly McKnight; Katherine Kuletz; Kevin McGarigal; Curtice Griffin; David Irons**

## **WITHDRAWN**

### **P1-104 Caitlin Robinson-Nilsen**

#### **California Gulls in San Francisco Bay: Landfill use and impacts on locally breeding waterbirds**

"Breeding populations of California Gulls (*Larus californicus*) have increased over the past three decades in San Francisco Bay, from less than 30 breeding birds in 1980 to over 43,000 in 2009. The increase in the San Francisco Bay may be closely related to their use of landfills and other anthropogenic sources of food, and this increase may have negative effects on other ground-nesting waterbirds through harassment, encroachment on nesting sites, and predation on eggs and chicks. In response, the local landfill started a gull abatement program in 2008 to reduce the numbers of gulls feeding at the landfill. From 2007 – 2010, we conducted surveys to determine the extent of landfill use by California Gulls, and in 2008, we continued our banding program to document the movement of gulls and the potential interactions of gulls. In 2009 and 2010, we used nest cameras to determine if California Gulls depredate eggs and chicks of the federally threatened Western Snowy Plover (*Charadrius alexandrinus nivosus*). Our results indicate that California Gulls heavily use local landfills, however the abatement program significantly reduced the numbers of California Gulls using the landfill when compared to pre-abatement numbers ( $F_{2,79} = 13.292$ ,  $P < 0.001$ ). The majority of the banded birds we re-sighted were at the largest colony in the South Bay. We documented California Gulls depredating Snowy Plover nests as two of the seven depredation events we recorded with our nests cameras were California Gulls. The South Bay Salt Pond Restoration Project plans to restore 16,000 acres of salt ponds into tidal marsh or other habitats, and may cause a portion of the breeding gulls to move to new nesting sites, displacing other breeding waterbirds and potentially increasing predation rates."

**Jill Bluso Demers; Cheryl Strong**

## **Marine Conservation and Hotspots**

### **P1-105 Carina Gjerdrum**

#### **Trends in abundance and distribution of seabirds at sea in Atlantic Canada over a 44-year period**

"Marine birds play an important role in marine ecosystems and their responses to oceanographic variability can be used to monitor changes in the marine environment. At sea, birds are highly mobile and shifts in their distribution will reflect changes in the ocean that colony monitoring will not necessarily identify. Although abundance may best be assessed at breeding colonies where birds concentrate at predictable times of year, pelagic monitoring will be the primary and often only information source to determine trends in abundance for non-colonial species and for species that breed in disperse and remote locations. In Atlantic Canada, marine bird data were collected from ships-of-opportunity between 1966 and 1992 under PIROP (Programme Intègré de Recherches sur les Oiseaux Pèlagiques). During this time period, 72,052 km were surveyed and over 350,000 birds counted. In 2005, the Canadian Wildlife Service of Environment Canada re-initiated the pelagic seabird monitoring program in eastern Canada (Eastern Canada Seabirds at Sea; ECSAS). This current effort amounts to 52,896 km surveyed and over 125,000 sightings. We analyzed trends in abundance and distribution of the most common marine bird species in Atlantic Canada over a 44-year period, and examined whether the observed changes can be linked to oceanographic variability at multiple scales."

**David Fifield**

### **P1-106 Nils Guse**

#### **Spatial patterns in the distribution of seabirds in the Gulf of St. Lawrence, Canada**

"Our study focuses on the analysis of current distribution patterns of seabirds in the Gulf of St. Lawrence, eastern Canada. Being characterised by unique hydrographic features which combine traits of an estuary as well as a miniature ocean the gulf is a hotspot both for seabirds and marine mammals. The patterns we describe and analyze are based on ship-based seabird surveys which were carried out in the breeding seasons of 2007, 2008 and 2009. During these surveys that were mostly conducted on research vessels, seabird data were collected simultaneously with data on the distribution of marine mammals, hydrography, fish abundance and fishing activity. We present the distribution patterns of different seabird species as well as results of the analysis on the impact of presumed major factors such as hydrography, prey abundance, distance to land, marine mammal distribution and human activity for the patterns observed. In the case of



Northern Gannets (*Sula bassana*), the study site offers the unique possibility to compare the distribution patterns derived from ship-based surveys with those of birds breeding on Bonaventure Island that were equipped with GPS data loggers.”

**François Bolduc; Jean-François Rail; William Montevecchi; Stefan Garthe**

### **P1-107 Holly Goyert**

#### **At-sea distribution and associations of Common (*Sterna hirundo*) and Roseate Terns (*S. Dougallii*)**

“Despite numerous studies of Common (*Sterna hirundo*) and Roseate Terns (*S. dougallii*) at their breeding grounds, relatively little is known about their at-sea distribution. To address this, I participated in seabird surveys aboard National Oceanic and Atmospheric Administration vessels in the Northwest Atlantic, during the pre- and post-breeding seasons. Survey tracks were randomly stratified over the continental shelf from Cape Hatteras to the Gulf of Maine, including George’s Bank. Using 0.3 km<sup>2</sup> bins, I analyzed data from 2006-2009 with a Generalized Additive Model and nonparametric statistics, to test for associations between tern density and environmental factors. At sea, higher densities of Common and Roseate Terns were likely to be found in marine habitats with higher sea surface temperature and lower salinity, and in shallower water closer to shore. Roseates were sighted over areas of significantly lower relative fluorescence that Commons, suggesting that they use different habitats. The most interesting finding was that, when milling and feeding at sea, Common and Roseate Terns were found over significantly higher densities of tuna than when flying. This suggests that terns may be relying on local enhancement or commensal relationships with tuna to locate and access prey. While observers commonly record seabird distributions at-sea in the Pacific Ocean, my research introduces the first and only set of long-term data for at-sea distribution of terns in the Northwest Atlantic. Furthermore, this is the first documentation, to my knowledge, of a statistical association between Common or Roseate Terns and tuna at sea.”

### **P1-108 Gail Davoren**

#### **The importance of biological hotspots to chick-rearing seabirds in northeastern Newfoundland**

“Forage species lie at the core of marine food webs, providing essential linkages for energy transfer among trophic levels. Capelin is the focal forage fish in the Northwest Atlantic on which top predators rely for prey. Our vessel-based research during July-August 2000-09 first discovered deep-water (17-40 m) spawning sites of capelin on the northeast Newfoundland coast, where capelin were thought to primarily spawn on beaches. Deep-water spawning sites were spatially and temporally persistent among years, resulting in

predictably high abundances of capelin and predators, or biological hotspots. Combining vessel-based capelin and predator density and distributional patterns (2000-09) with colony-based measures of seabird diets and bio-physical monitoring of temperature and spawning (2003-09), we explored the importance of hotspot formation on chick-rearing seabirds. The timing of capelin spawning was significantly earlier in years when temperature during gonad development (February-June) was warmer ( $r^2=0.650$ ,  $p=0.053$ ). When spawning was early, hotspots were absent during chick-rearing. This resulted in a significant decrease in the percentage of capelin delivered to chicks of Northern Gannets (*Sula bassana*;  $r^2=0.780$ ,  $p=0.020$ ). This also led to a significant decrease in the percentage of gravid capelin delivered to chicks of Common Murres (*Uria aalge*;  $r^2=0.790$ ,  $p=0.017$ ), which resulted in lower fledging condition. Overall, warming ocean climate leading to a temporal mismatch of hotspots and seabird chick-rearing periods will result in prey switching, alternate foraging strategies and negative energetic consequences.”

**Paulette Penton; Joseph Allen; Chantelle Burke; William Montevecchi**

### **P1-109 Marie Martin**

#### **Greater Shearwaters in the gulf of Maine and Georges Bank (Northwest Atlantic): Can we identify seabird foraging hotspots using at-sea and bycatch data?**

“Greater shearwaters (*Puffinus gravis*) have been little studied due to their remote nesting locations and pelagic distribution at sea. They complete extensive annual migrations between their southern nesting grounds at Tristan da Cunha and the North Atlantic’s productive waters. During these migrations, birds may interact with fisheries of approximately 30 countries; However, the degree of interaction and incidental mortality is largely unknown in most waters. In the United States, greater shearwaters have been regularly documented as incidental bycatch in its Northeast gillnet fisheries since 1991. Utilizing 19 years of bycatch data and 7 years of at-sea distribution data, we investigate some of the species foraging hotspots and important use areas in the Gulf of Maine and Georges Bank. Additionally, we present some of the first data on condition, sex and age bias in bycaught greater shearwaters through necropsy examination of 135 specimens from the Northwest Atlantic between 2008 and 2009.”

**Gina Shield**



### P1-110 Timothy White

#### A hotspot for diving ducks and amphipods: Winter distribution of diving birds and invertebrate prey patches on Nantucket shoals

“Sharp physical and biological gradients have been shown to enhance predator-prey associations. In this paper, we demonstrate how strong fronts influence predator prey dynamics on Nantucket Shoals, MA, during winter. We identify this area as a foraging hotspot for hundreds of thousands of wintering Long-tailed Ducks, as well as for alcids and other seabird species. A dense concentration of pelagic gammarid amphipods (*Gammarus annulatus*) is spatially constrained to Nantucket Shoals, and this concentration is associated with high primary production induced by tidal mixing, currents, and localized upwelling. A persistent and predictable patch of gammarids, located on the western edge of Nantucket Shoals, is seasonally exploited by a substantial wintering group of Long-tailed Ducks, perhaps 30 percent of the North American population. Conspicuous aggregations of foraging Long-tailed Ducks orient in a north/south direction and spatially match the western amphipod patch and frontal gradients in this region. It is possible that Long-tailed Ducks serve as visual cues to other predators as to the quality of the patch, and as a source of local enhancement. Industrial offshore energy development along the East Coast of the United States is imminent, and it is crucial to identify foraging hotspots for marine avifauna, such as Nantucket Shoals, in order to better guide management decisions.”

Richard R Veit

### **WITHDRAWN** P1-111 Robin Hunnewell

#### Stopover distribution and abundance of Red and Red-necked Phalaropes during migration in the Bay of Fundy, Canada

“The Bay of Fundy functions as an important migratory stopover for two species of phalarope, Red-necked (*Phalaropus lobatus*) and Red Phalarope (*P. fulicarius*), that spend a majority of their annual cycles at sea. Despite this, relatively little is known about the time phalaropes spend at sea and the factors affecting their marine distribution. In the outer Bay of Fundy, flocks of both species utilize tidal mixing fronts that concentrate zooplankton prey within reach at the surface. Aerial line transect surveys were conducted between 30 July and 15 September in 2009 to investigate the stopover distribution and abundance of phalaropes in this region. To assess variation in flock size and spatial occurrence over the course of the stopover period, surveys were conducted at a weekly time scale coinciding with the periodicity of lunar-phase events (spring-neap tides). Distance sampling methods were used to analyze line transect data, quantify detectability, and assess the proportion of phalaropes missed from the air. The effect of covariates (altitude, survey date, tidal stage, and

cluster size) on detection functions was evaluated. For one-sided transects covered by a single observer, 31 to 61% of phalarope flocks were detected across transects, depending on width, survey date, and altitude. Survey date had a significant effect on encounter rate for phalaropes, illustrating the need for multiple surveys at fine temporal scales. These data are consistent with evidence indicating that a high proportion of phalaropes remain undetected during aerial surveys and that densities returned by strip transect methods may be routinely underestimated.”

### P1-112 Elizabeth Bell

#### At-sea distribution of Black Petrel, *Procellaria parkinsoni*, on Great Barrier Island, Hauraki Gulf, New Zealand

“The black petrel, *Procellaria parkinsoni*, a medium-sized endemic seabird, breeds on Little and Great Barrier Islands, New Zealand. The main breeding area on Great Barrier Island is around the summit of Mount Hobson. This population is part of an ongoing long-term monitoring study which began in the 1995/96 breeding season. Black petrels feed in areas where there are a number of fisheries for many months of the year, and migrate to South America where bycatch of unknown cause has occurred. In New Zealand waters black petrels have been caught in both commercial and recreational fisheries. Observer coverage of fisheries that potentially interact with this species has been poor, and it is suspected that more are taken incidental to fishing than are reported. LotekÆ light and SIRTrackÆ and iGuilfordi GPS loggers were deployed on breeding black petrels between the 2005/06 and 2009/10 breeding seasons. The resulting tracks showed that the foraging range was highly variable, with no apparent preferences separating males and females. Most birds foraged around the North Island of New Zealand, particularly along the continental shelf edges or seamounts. Birds also traveled near the Chatham Rise, north towards Fiji, towards the eastern Australian coast and around the bottom of the South Island of New Zealand. The at-sea distribution within New Zealand waters was related to environmental variables and fisheries to determine overlap, interaction and risk to the petrels.”

Joanna Sim; Chris Francis; Leigh Torres; Tim Guilford; Scott Schaffer

### **WITHDRAWN** P1-113 Chris Gaskin

#### Will the creation of large oceanic sanctuaries benefit seabirds?

“The proposed creation of a large Kermadec ocean sanctuary out to northern New Zealand’s Exclusive Economic Zone 200nm (370 km) boundary will create a 630,000 km<sup>2</sup> no-take reserve. We investigate the potential benefits for seabirds breeding on the Kermadec Islands and further afield. Seabirds were mostly extirpated from Raoul Island by the end of the



twentieth century, a major population and diversity decline of 10 native seabird taxa correlated to predator introduction associated with human visitation and settlement from the 1400s onward. We analyse recent recovery indicators of seabirds following eradication of all predators and pests by 2003. We also examine 'at sea' observations of seabirds in the Kermadec Region to determine those species which would benefit from the establishment of a large ocean sanctuary. This would include those breeding on the Kermadec Islands including white-necked petrel (*Pterodroma cervicalis*), Kermadec petrel (*Pterodroma neglecta neglecta*), New Zealand sooty tern (*Onychoprion fuscata kermadeci*), Kermadec little shearwater (*Puffinus assimilis kermadecensis*), Kermadec storm petrel (*Pelagodroma marina albiclunis*) and black winged petrel (*Pterodroma nigripennis*) as well as seabirds breeding outside the region which migrate through or forage there, such as Parkinson's petrel (*Procellaria parkinsoni*). We discuss anthropogenic threats to seabirds and benefits of protecting whole ecosystems for seabirds."

Karen Baird

#### **P1-114 Ana Paula Carneiro**

##### **Abundance and spatial distribution of sympatrically breeding *Catharacta* spp. (skuas) in Admiralty Bay, King George Island, Antarctica**

"We examined the abundance and spatial distribution of sympatrically breeding skuas (*Catharacta* spp.) within Admiralty Bay, King George Island, Antarctica during the austral summer of 2004/2005 in relation to spatial variables, which correspond to access to resources and nesting site safety and quality. We also compared the distribution and abundance of skua pairs observed in 2004/2005 to published skua census data from 1978/1979. Similar to previous studies, we found that brown skua (*C. Antarctica lonnbergi*) pairs often nested in close proximity to penguin colonies and actively excluded other pair types from having direct access to penguin resources. In areas directly around penguin colonies, brown skua displace south polar skua (*C. maccormicki*) and other pair types, indirectly forcing them to nest in possibly lower quality territories, which are farther away from the coastline and in areas with lower incident solar radiation. When examining skua population trends, we discovered that the total number of breeding skuas in Admiralty Bay had increased by 293%, from 128 to 468 pairs, since 1978/1979. This dramatic increase was driven primarily by a tenfold increase in south polar skua pairs, as well as smaller increases in mixed and hybrid pairs. In contrast, there has been an overall decline (by 40%) in brown skua pairs during this same time, driven primarily by a large decrease in the breeding density of brown skua pairs in areas without penguin colonies."

Michael Polito; Martin Sander; Wayne Trivelpiece

#### **P1-115 Michael Force**

##### **Investigations into mid-summer seabird distribution in the Drake Passage (1994-2010)**

"Investigations into mid-summer seabird distribution in the Drake Passage (1994-2010) Information on at sea distribution and abundance of seabirds in the SW Atlantic is lacking a long-term perspective. The Drake Passage is a dynamic oceanographic region with at least two to three well-defined habitats delineated by the Polar Front and the Antarctic Circumpolar Current. Our study identifies important regions for threatened species of large albatrosses and mollymawks. Our objective is to investigate the probability of increasing or decreasing trends in seabird abundance. Systematic counts on seabird distribution and abundance were conducted across the Drake Passage between January and March during annual surveys to the South Shetland Islands from Punta Arenas Chile by the US Antarctic Marine Living Resources (AMLR) program. Data on species identity and number, as well as age where possible, were obtained using a standardized 300 meter strip transect on more than 60 crossings along a 900 km trackline. We use a combination of geo-spatial and regression models to reveal insights into population dynamics, relative abundance and inter-annual variability of habitat use. Additional data such as sea surface temperature, sea surface salinity and other environmental factors were collected to further elucidate seabird distribution in the Drake Passage."

Jarrod Santora; Christian Reiss

#### **P1-116 Juan Jose Alava**

##### **At sea distribution and abundance of seabirds around the Galapagos Islands-Ecuador: Conservation implications**

"Field surveys to determine the species, relative abundance and spatial distribution of seabirds in the Galapagos Marine Reserve (GMR) were conducted during the oceanographic cruise aboard the BAE Orion around the Galapagos Islands on April 27-23, 2009. A total of sixteen species from 460 sightings (1,490 birds) were identified, including two IUCN-critically endangered (CR) species: the Galapagos albatross (*Phoebastria irrorata*), and the Galapagos Petrel (*Pterodroma phaeopygia*). The major species with their relative abundances (number of birds) at sea throughout the cruise track were, Galapagos albatross, *P. irrorata* (15); Galapagos Petrel, *P. phaeopygia* (24); Galapagos Shearwater, *Puffinus subalaris* (123); Cape Petrel, *Daption capense* (1); Parkinson's Petrel, *Procellaria parkinsoni* (5); Pink-footed Shearwater, *Puffinus creatopus* (1); Wedge-rumped Storm Petrel, *Oceanodroma tethys tethys* (144); Swallow-tailed Gull, *Larus furcatus* (119); Blue-footed Booby, *Sula nebouxii excisa* (46); Nazca bobby, *Sula granti* (797); Red-footed Booby, *Sula sula websteri* (200). The Nazca bobby was the most abundant seabird accounting for 51% of the total abundance of species. Most of the sightings were aggregated in places southwestern



Galapagos (0°?2°S; 94°?91°W), where generally nutrient-enriched, upwelling areas are found. A high abundance of sea birds was also observed in areas exhibiting the highest values of primary production (0.46-0.50 mg/m<sup>2</sup>), southeast of the Galapagos (2°?3°S; 88°W). These observations underline the use of seabirds as eco-markers of primary productivity in a highly stochastic marine environment. Several seabirds, including threatened species, were recorded in foraging areas off the GMR boundaries, implying the risk of bycatch in these unprotected areas.”

**Pedro Jimenez; Santiago Torres**

### **P1-117 Pilar Velasquez Jofre**

#### **First study of seabirds in the Guatemalan Pacific**

“In Guatemala, seabirds (*Procellariidae*, *Hydrobatidae*, *Phaethontidae*, *Sulidae* and *Stercorariidae*) have been poorly studied. Until 2006 there was insufficient information to assess their status. With the objective of determining pelagic seabirds richness as a knowledge baseline for this group, from March 2007 to June 2008 open sea trips between the coastline and 60 nautical miles (nm) were undertaken. The observed species were registered using non systematic and modified systematic survey methods according to Hyrenbach (2006), and physical-chemical surface water parameters were measured to relate those variables with the birds’ presence and distribution. 17 species reported by Murphy (1958), Jehl (1974), Dickerman (1975) and 07 with potential distribution were identified. Four of these seven reports represent new records for the study region and three new records for Guatemala. The distance between the 30-45 nm away from the coastline houses the highest species richness and the species abundance fluctuate along the 60 nm. Most sightings of jaegers are concentrated among the 05-15 nm and the boobies’ sightings at the 10-20. Shearwaters and petrels sightings are concentrated between the 30-40 and the storm-petrels sightings at the 40-50. Such concentrations can be explained by the different levels of productivity associated to coastal and open waters as well as for the cost of flight of these birds. The temperature appears to be another factor that influences their distribution”

### **P1-118 James Grecian**

#### **A novel technique to highlight important at-sea areas for seabird conservation**

“Seabirds are well monitored and protected at the breeding grounds but spend most of their life at sea. Addressing this dichotomy, recent attention has been directed on establishing a network of pelagic marine reserves for seabirds. Previous identification of marine Important Bird Areas has relied largely on information from at-sea surveys or bio-logging technology. Nevertheless, these approaches are costly and not suitable for species that have poor at-sea detectability or are

unable to carry tracking devices. Here we develop a novel technique, synthesising data from seabird colony surveys with detailed information on population dynamics, foraging ecology and near-colony behaviour to project colony-specific foraging distributions of the Northern gannet (*Morus bassanus*) when attending colonies in the UK, Ireland and France. We test the ability of our models to identify at-sea hotspots through comparison with existing data from tracking studies and at-sea surveys. Our models provide qualitatively similar findings to GPS tracking data and show a positive spatial correlation with one of the most intensive at-sea survey datasets. While there are limitations to projecting at-sea distributions of seabirds, implemented appropriately, we propose they could prove useful when designing protected areas for seabirds. Moreover, these models could be developed to suit a range of species or whole communities and could also provide a theoretical framework for the study of colony demographics.”

**Matthew Witt; Martin Attrill; Stuart Bearhop; Brendan Godley; David Gremillet; Keith Hamer; Kerstin Kober; Stephen Votier**

### **P1-119 Iv'n Ramirez**

#### **Identifying marine IBAs in Portugal, setting a methodology universally applicable**

“The identification of Important Bird Areas (IBAs) carried out by BirdLife International since the mid eighties is one of the most successful conservation programmes in the world. It seeks to identify and document sites that are critical for the long-term sustainability of bird populations and is constituted by more than 11000 IBAs (2009 database). The identification of Marine IBAs is a much more recent process, that had to overcome various methodological and scientific challenges, namely the inherent difficulties of data-gathering at offshore marine areas, the patchy amount of information available and the absence of regular seabird aggregations that could allow a better application of the numerical thresholds set by the IBA Criteria. In 2004, SPEA (BirdLife in Portugal) launched a pioneering project that aimed to identify the Marine IBAs in Portugal, a country with the eleventh largest Economic Exclusive Zone of the World and home to some of the largest seabird colonies in the North Atlantic. The project finished in 2008 and identified 17 Marine IBAs. This Poster details the methodology identified by SPEA & BirdLife International for the identification of Marine IBAs, that is now being applied elsewhere in the world. Two examples are given: Berlengas archipelago and Norte do Corvo oceanic Marine IBA. Tracking, Boat-based, Coastal census & Environmental modelling data are combined and shown as different data-layers so as to explain the criteria followed.”

**Pedro Geraldes; Ana Meirinho; Vitor Paiva; Patricia Amorim**



### **P1-120 Mohammad Islam**

#### **Seabird diversity and distribution in the Bay of Bengal Bangladesh marine territory**

“Bangladesh is a subtropical country having a coastline of 710 kms from the world largest mangrove forest at the west and St. Martin island at the southeast end near Myanmar, the vast area provides more than 12,000,000 hectares rich marine biodiversity habitat, attracted a large number of seabirds and stay their winter at sea and along the coast in tidal marshes and beaches. We have documented seabirds’ species during 2004 to date with a total 5 long-term and short term survey covering 15 days. The coverage extension ranged from 20°59’6.47”N 89°39’38.24”E at the north west and 20°11’39.08”N 91°49’48.70”E at the south east. We counted more than 22 species having direct sea habiting preference. There are some species has never been recorded in Bangladesh bird list. Among them Skua, Frigate birds, Common and lesser Noddy are mentionable. All birds have been recorded during winter survey during Dec-Feb, but we recorded noddy only in June–July in St. Martin Island, only coral bearing offshore Island in Bangladesh located at south eastern end. We have recorded 8940 birds during 2007 the heist record during the 5 surveys. Birds were recorded in close interaction in some areas with the fishing activity specially with gill netters and also with marine set bag net (MSBN) fleets located 50-90 kms offshore. It is assumed that Skua and frigate birds and some gulls never come to shoreline and stay pelagic although there entire winter time and return to breeding area at post winter.”

### **P1-121 Peter Kappes**

#### **Seaward extensions of terrestrial Important Bird Areas in the French Administered Territories in the Western Indian Ocean**

“BirdLife International’s Important Bird Areas (IBA) program has identified terrestrial IBAs on several of the French administered Iles Éparses in the western Indian Ocean, including the islands of Europa, Juan de Nova, and Tromelin. Collectively, these IBAs protect over 10 different seabird species, including both globally significant and regionally important breeding populations that in total number over a million breeding pairs. In an effort to extend protection from terrestrial IBAs to the marine environment, we are in the process of compiling a definitive list of candidate marine IBAs for the Iles Éparses and the western Indian Ocean. Phase I of this project entailed following protocols and criteria developed by BirdLife International’s Global Seabird Program to identify boundaries for candidate marine IBAs based on seaward extensions from breeding colonies for coastal foraging ‘trigger’ species including the Masked Booby (*Sula dactylatra*), Red-footed Booby (*S. sula*), Caspian Tern (*Sterna caspia*), and Crested Tern (*S. bergii*). We conducted a gap analysis of foraging behaviors for these species adding

appropriate data to BirdLife International’s seabird foraging database. Data ranged from high quality satellite tracking studies conducted in the Iles Éparses to low quality diet studies from congeners. We present candidate marine IBA boundaries for these species, which were determined by applying foraging radii centered on the colonies within an existing terrestrial IBA. Incorporation of these candidate marine IBAs into future conservation and management plans will insure the protection of these critical habitats for the globally important seabird assemblages found in the Iles Éparses.”

**Matthieu Le Corre; Ross Wanless**

### **P1-122 Karine Delord**

#### **Identifying hotspots for albatrosses and petrels in high seas and overlap with fisheries: Seasonal effects and importance of the non-breeding part of the populations in the Indian Ocean**

“Distribution at sea of non-breeding, immature or juvenile seabirds remains largely unexplored for many albatross and petrel species. Nowadays, the miniaturization of technology allowed long term deployments. Incidental mortality of seabirds on fishing vessels is relatively well documented, and there is mounting evidence that longline fishing is a major cause of observed decrease of albatross and petrel populations. We present the seasonal distribution at sea of several species of albatrosses and petrels breeding in the Indian Ocean throughout the year, i.e. during the breeding and outside the breeding season, for juveniles, immatures and adults birds. We show how hotspots of concentration differ between season and between stages of the life cycle of the species. We present an estimate of overlap between seabirds and fisheries, focusing on subtropical waters in the IOTC area with longline fisheries. We explore potential overlap by species, stage and fisheries at a fine scale spatial and temporal. We show that identifying good candidates for Marine Protected Areas is particularly challenging in this context and discuss the possible solutions. “

**Christophe Barbraud; Charly Bost; Alain Fonteneau; Richard Phillips; Henri Weimerskirch**

### **P1-123 Adrian Gall**

#### **Influence of water masses on the distribution and abundance of seabirds in the northeastern Chukchi Sea**

“We examined the seasonal and spatial variation in the distribution and abundance of seabirds in the northeastern Chukchi Sea in 2008 and 2009. We had sufficient detections to generate density estimates for eight species after correcting for species-specific differences in detection probability. Procellariids were the most abundant species-group recorded



during 2008, primarily because of large flocks of Short-tailed Shearwaters (*Puffinus tenuirostris*) that moved through both study areas in early fall. In contrast, alcids were the most abundant species-group recorded during 2009 and were primarily composed of Crested Auklets (*Aethia cristatella*). In both years, total density was highest in early fall, with overall densities in 2009 being six times higher than total densities in 2008. Seasonal and spatial patterns of species abundance and composition were similar between historical data (1975–1981) and the current study, although species richness was higher in 2008 and 2009. The Klondike study area appears to be a pelagically-dominated system affected by oceanic water associated with the Central Channel Current, and the Burger study area appears to be a benthically-dominated system affected by remnant winter water associated with a gyre over Hannah Shoal. Diving alcids that forage on zooplankton dominated in Klondike, whereas surface-feeding larids and procellariids dominated in Burger. We propose that the structure of the seabird community differs substantially between the two study areas and that these differences reflect oceanographic differences between the two areas.”

**Robert Day; Caryn Rea**

#### **P1-124 Richard Veit**

##### **Spatial persistence of seabird-krill hotspots in the California**

“The persistence time of seabird prey patches is an important yet poorly understood factor for the conservation of marine birds. We contrast data from the Antarctic and the California Current to address the generality of persistence time and the importance of this persistence to seabirds. In the Southern Ocean and California Current, krill are integral to ecosystem organization and food web dynamics. Seabirds comprise key predator communities on which comparative analysis of marine ecosystem functions can be based. We quantified the persistence of krill patches and the influence of this persistence on the abundance and behavior of foraging seabirds. We synthesized data from 2 studies where at-sea bird and krill distributions were collected simultaneously over 2002-2010, and compared krill-seabird spatial dynamics in two hemispheres and across multiple coastal marine habitats (from the Antarctic Peninsula to the Gulf of the Farallones). We quantify persistence and test the hypothesis that seabirds preferentially forage in regions where krill patches are persistent. Questions we addressed were: 1) Where are the persistent krill- seabird ‘hotspots’ in representative study regions? 2) Do seabirds with similar foraging techniques (e.g. auks and penguins) respond in similar ways to patch persistence? 4) What habitat features (bathymetric and hydrographic) appear to be associated with krill-seabird hotspots in these different ecosystems? “

**Jarrod Santora**

#### **P1-125 John Bower**

##### **Inshore North American Pacific northwest marine bird abundance changes: Comparing studies and determining causes**

“The 1978-79 Marine Ecosystems Analysis Puget Sound Project provided baseline data for wintering marine bird abundance for the southern Strait of Georgia and adjacent waters. Since that time, census work has been mainly limited to the Puget Sound Ambient Monitoring Program’s aerial surveys (PSAMP; 1990-present), the Western Washington University (WWU) survey of marine bird abundance in NW Washington (2003-present), and Christmas bird counts (CBC; 1970’s-present). All three studies show widespread declines for many species. For instance, my study (WWU) shows significant declines over the last 30 years in 14 of the 37 most common over-wintering Salish Sea species, including 10 species which declined >50%, while seven species showed significant increases over that time period. These results largely corroborate the findings of the PSAMP study and my analysis of CBC data. The order of species, from those showing the most declines to those showing the greatest increases showed a significant correlation between the PSAMP and WWU studies. Western Grebe *Aechmophorus occidentalis*, scaup (primarily Greater Scaup *Aythya marila*), and Marbled Murrelet *Brachyramphus marmoratus*, showed significant declines in all three studies. The Common Murre *Uria aalge*, not included in the PSAMP study, showed significant declines of over 80% in the WWU and CBC studies. Significant declines occurred in species of four of the five feeding guilds, including piscivores, benthivores, omnivores, and planktivores, while significant increases were seen in species of three feeding guilds, demonstrating that the factors affecting species abundance are complex and may be unique to each species.”

#### **P1-126 Ken Morgan**

##### **At-sea seabird surveys and predicted seabird aggregations in support of establishing a marine protected area around the Scott Islands, British Columbia, Canada**

“The Canadian Wildlife Service (CWS) is leading an initiative to establish a Marine Wildlife Area (MWA) in the marine waters surrounding the Scott Islands, British Columbia (BC). MWAs are legally designated marine areas under the Canada Wildlife Act. Although the Scott Islands and the immediate surrounding waters are protected as a BC Ecological Reserve, there is currently no protection for the more distant waters that support the more than two million birds (of 13 species) that nest on the Scott Islands, nor the tens of millions of migrants that utilize those same waters for varying lengths of time throughout the year. Here we present graphical ‘evidence’, derived from two related ‘programs’ that demonstrate the scale of the importance of the waters



surrounding the Scott Islands to the resident and migrant seabirds of Canada's west coast. The first of the two programs referred to above is the opportunistic at-sea pelagic seabird program led by the CWS. The other program is the investigation of the relationships between seabird aggregations and habitat features led by PRBO Conservation Science, and the single- and cumulative species predictive models that this effort has developed. The predictive models were developed as a way to identify areas of high seabird concentrations, in order to help guide the identification and design of marine protected areas throughout the California Current System. The identification of marine areas that support high concentrations of birds, by way of at-sea surveys and predictive hotspot modeling, provides valuable tools to Scott Islands MWA planning."

**Nadav Nur; Jaime Jahncke; Julie Howar;  
Andreas Pettersson**

### **P1-127 Nacho Vilchis**

#### **Seabirds of the Salish Sea: A retrospective analysis of factors driving marine bird status and trends**

"Over 170 bird species use the Salish Sea, a 17,000 square kilometer inland sea shared by British Columbia and Washington State. While some marine bird populations have increased, multiple data sets compiled over different time periods have shown significant population declines in many species. Traditional efforts have focused on the recovery of declining populations on a species-by-species basis but there is a need to investigate ecosystem-level drivers that could be responsible for causing declines in multiple bird species to inform restoration efforts. An international collaborative effort is underway to identify ecosystem-wide status and trends and to ultimately identify the risk factors for species in decline and commonalities for species whose populations are stable. Epidemiologic and population modeling are being used to evaluate the relationship between marine bird trends and demographic factors, behavioral traits, environmental stressors and other processes known to drive population dynamics. The goal of the project is to identify management strategies in Canada and the United States that will positively impact multiple species and encourage ecosystem-level recovery."

**John Bower; Rob Butler; Peter Davidson; Joseph Evenson;  
Alan Fritzberg; Kirsten Gilardi; Martin Haulena; Grant Kirby; David Nysewander; Scott Pearson; Martin Raphael;  
Joanna Smith; Joseph Gaydos**

### **P1-128 Barbara Blackie**

#### **A sanctuary and its seabirds - Is it a match?**

"The rugged Olympic Coast was designated as a National Marine Sanctuary in 1994 in part because its boundaries delineate a highly productive upwelling area that attracts a high abundance and high diversity of marine organisms including fish, birds and mammals. How significant is this marine protected area to migratory and resident marine birds? What are the patterns of use by the most abundant species using the sanctuary area? Olympic Coast National Marine Sanctuary (OCNMS) has monitored seabird activity in sanctuary waters from 1995 to 2008 with bi-annual/annual at-sea surveys from the RV McArthur and McArthur II. It has also conducted annual seasonal surveys throughout the breeding seasons 2006 through 2009 from the RV Tatoosh. Using GIS tools to examine these data, we characterize the preliminary patterns of use we have observed within the sanctuary over the past decade and a half. We correlate the use patterns of two foraging guilds, piscivores and planktivores, to the bathymetry and some oceanographic conditions of the area. Seasonal variation in species type and abundance is characterized. These data aid in the identification of sensitive resource locations within the sanctuary and provide useful correlates when trying to understand massive seabird wrecks. Seasonal fluctuations in species composition and distribution inform our understanding of the role of the sanctuary as part of the California Current System. As OCNMS proceeds in the process of updating their management plan, these data will inform conservation efforts regarding seabirds."

**Nancy Wright; Peter Hodum**

### **P1-129 James Grecian**

#### **A novel technique to highlight important at-sea areas for seabird conservation**

"Seabirds are well monitored and protected at the breeding grounds but spend most of their life at sea. Addressing this dichotomy, recent attention has been directed on establishing a network of pelagic marine reserves for seabirds. Previous identification of marine Important Bird Areas has relied largely on information from at-sea surveys or bio-logging technology. Nevertheless, these approaches are costly and not suitable for species that have poor at-sea detectability or are unable to carry tracking devices. Here we develop a novel technique, synthesising data from seabird colony surveys with detailed information on population dynamics, foraging ecology and near-colony behaviour to project colony-specific foraging distributions of the Northern gannet (*Morus bassanus*) when attending colonies in the UK, Ireland and France. We test the ability of our models to identify at-sea hotspots through comparison with existing data from tracking studies and at-sea surveys. Our models provide qualitatively similar findings to GPS tracking data and show a positive



spatial correlation with one of the most intensive at-sea survey datasets. While there are limitations to projecting at-sea distributions of seabirds, implemented appropriately, we propose they could prove useful when designing protected areas for seabirds. Moreover, these models could be developed to suit a range of species or whole communities and could also provide a theoretical framework for the study of colony demographics. “

**Matthew J Witt; Martin J Attrill; Stuart Bearhop; Brendan J Godley; David Gremillet; Keith C Hamer; Kerstin Kober; Stephen C Votier**

**WITHDRAWN P1-130 Alexander Remeslo**  
**Ornithological observations during the round-the-world-voyage of the Four-masted Bark Kruzenshtern in 2005-2006**

“Dr. Alexander Remeslo Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, Russia During the 408 days’ round-the-world-voyage the Russian sail training ship ‘Kruzenshtern’ covered more than 46,000 miles in the Atlantic, Pacific and Indian ocean, even some rarely visited regions. The ship sailed from the Baltic round Cape Horn, along the west coast of the Americas, crossing the North Pacific to Vladivostok and back via the Cape of Good Hope. Complex hydro-meteorological and biological observations were carried out during all the voyage. One component of this research was visual observation of species diversity, quantitative distribution and behavior of sea birds. Representatives of practically all bird families inhabiting marine environments were seen. The greatest diversities of species have been observed in the northern Atlantic, near the Latin American Coast, near the coast of South Africa, and around the oceanic island and groups of islands (Mauritius, Hawaii, Canary et.al.). The areas of the oceanic fronts were found to be particularly interesting. There, as a rule, a raised abundance of sea birds could be seen. For some species of sea birds a close correlation between their distribution and the oceanic currents and water masses was observed. Also natural borders like straits were found to influence the specific structure of the avifauna.”

## Monitoring

### P1-131 Sue Trivelpiece

#### **Population dynamics and breeding biology of the Southern Giant Petrel (*Macronectes giganteus*) along the western shores of Admiralty Bay (ASP A 128), King George Island, Antarctica, 1980-2000**

“We have been following and banding a population of southern giant petrels (*Macronectes giganteus*) nesting in nine small colonies at our research site on King George Island, South Shetland Islands, Antarctica since 1980/81. Reproductive success varied, but the overall mean was 0.72 ( $\pm 0.16$ ) chicks fledged per nest, which is consistent with other studies. Southern giant petrels will often take sabbatical leaves of one to two years between breeding efforts, which we found to affect nest-site fidelity versus birds that breed annually. We also examined demographic variables such as breeding success in relation to age & experience, cohort return rates, age at first breeding, & natal philopatry, and compared these with other studies. Our long term population data show that the population in our region increased by 69% over this period, although it was stable throughout most of the 1980s. Several studies have also seen population increases for the same time period in other regions (e.g., Frazier Islands, Bird Island, Falkland Islands), although a recent analysis of the entire Southern Ocean population reported a marked decrease. We examine these opposing trends and how they may possibly be linked to such factors as climate change and human disturbance.”

**Michael Polito; Wayne Trivelpiece**

### P1-132 Aevor Petersen

#### **Atlantic Puffin in Iceland: Population changes and main threats**

“The Atlantic Puffin *Fratercula arctica* is believed to be the most common breeding bird species in Iceland. Most recent estimate is 3-4 million pairs, or about half the world population. The population is distributed mostly on islands, in roughly 800 colonies, the largest about 200 thousand pairs. We review available unpublished and published information on population changes. Colony sizes were estimated mainly from burrow counts. Population development, ranging from 5 to 33 years, is reviewed for 18 colonies in S-, SW- and N-Iceland during the period 1975-2009. Mean increase of 4.3%/year was recorded in 10 colonies, including the largest ones under study (>30000 pairs). The greatest increase was 15%/year. We conclude a general increase in the study regions during the last part of the 20th century, including formation of new colonies, but there appears to have been some regional differences. Historical data show threats e.g. hunting and introduced predators, have impacted individual colonies.



More recently 8 colonies showed a mean decline of 4.9%/year. Decline has also been observed in *Sandeel Ammodytes* spp., a preferred Puffin food, possibly related to climate change. Although other factors may also affect individual Puffin colonies, climate change is currently the greatest potential threat to Icelandic Puffins. More focused data collecting from a monitoring program is urgently needed to follow trends in the Icelandic population.”

**Thorkell Thorarinsson**

### **P1-133 Nora Lisnizer**

#### **Kelp gull population trends in northern Patagonia, Argentina: A regional perspective considering artificial food sources”**

“Food availability is a key factor influencing seabird population dynamics. The Kelp gull *Larus dominicanus* is widely distributed in the Southern Hemisphere, including the Atlantic coast of Argentina. It is a generalist species that feeds on a wide variety of food from natural and artificial sources. We analyzed Kelp gull population trends at 71 colonies in northern Patagonia, Argentina (1800 km of coastline, from 40°47’ to 46°00’S), considering the relationship of colonies with artificial food sources (fisheries discards and landfills). We used recent census of breeding pairs (2006-2008) integrated with unpublished and published information, extending over a 15-year period (1994-2008). We analyzed the population trend for the whole study area and then for the same set of colonies divided into four coastal sectors characterized by differences in the characteristics of artificial food sources. We tested for differences in population growth rates among sectors by fitting linear regression models and comparing regression slopes. The Kelp gull population in the study area increased 52%, from 47500 to 72000 breeding pairs ( $\beta=1.027$ ). Population growth rates showed significant differences ( $p<0.05$ ) among sectors, and trends mirrored the differential availability of artificial food sources. The northern and southernmost sectors, where availability of fish waste was greatest, showed higher rates of increase ( $\beta=1.049$  and  $\beta=1.046$ , respectively) than central sectors ( $\beta=0.989$  and  $\beta=0.999$ ) where available artificial food was lower. Our results show the marked increase in the breeding population and suggest the importance of artificial food sources, specially fisheries discards, on Kelp gull demography in Patagonia, Argentina.”

**Pablo García Borboroglu; Pablo Yorio**

### **P1-134 Louise Blight**

#### **Using historical ecology to acquire long-term perspectives in seabird research**

“Anthropogenic changes to marine ecosystems have occurred for millennia, but are progressing at an ever-increasing rate. The shifting baseline syndrome means each generation of ecologists tends to see as ‘normal’ the conditions existing at

the beginning of their careers, but interpretation of changes in marine systems should instead be underpinned by a strong understanding of historical states. Long-term baselines improve our estimates of cumulative change and our ability to evaluate multiple scenarios of future conditions. My dual objective is to describe how the emerging field of marine historical ecology is relevant to seabird studies, and to use examples from my research on a common coastal species to do so. I am investigating drivers of dramatic population changes in the glaucous-winged gull (*Larus glaucescens*) over the last century. For historical studies a diversity of sources is often required: I combine contemporary field data with such varied sources as museum specimens (1860 – present), naturalist accounts, and published data. To assess long-term dietary change in gulls I use stable isotope analysis of archived feathers, while to ask whether changes in diet have affected reproductive parameters I conduct meta-analysis of egg size data collected from the literature and measurements of museum egg sets from around North America. Study results will help identify historical baseline conditions, and the degree to which current changes in gull populations are attributable to anthropogenic versus oceanographic influences. Using historical ecology helps develop techniques for monitoring seabirds over ecologically meaningful timelines, a requisite for improved scientific understanding and management practices.”

### **P1-135 Linda Welch**

#### **Recent Changes in the Distribution and Abundance of Gulls and Cormorants**

“Coastwide surveys of breeding gulls and cormorants were completed in Maine, New Hampshire, and Massachusetts between 2005-08. We compared data from these surveys to data collected on the same islands between 1994-96. While the methods varied among the three states, the methods utilized within each state remained constant between the survey periods. Ground and boat surveys were completed on 95 islands in Massachusetts and nine islands in New Hampshire. Aerial and ground-based surveys were completed on 225 islands in Maine. The 2005-08 surveys were completed on 329 islands and documented 20,017 pairs of Great Black-backed Gulls (*Larus marinus*) on 256 islands, 35,846 pairs of Herring Gulls (*L. argentatus*) on 244 islands, and 16,291 pairs of Double-crested Cormorants (*Phalacrocorax auritus*) on 113 islands. A comparison of sites surveyed in 1994-96 and 2006-08 indicates large declines in all three species. Great Black-backed Gulls declined 36%, Herring Gulls declined 32%, and Double-crested Cormorants declined 36%. While the number of active Double-crested Cormorant colonies has remained stable in Massachusetts and New Hampshire, the number of active colonies in Maine decreased by 35%. Contrary to the other two gull species, Laughing Gulls (*L. atricilla*) have increased from 1,823 to 7,524 pairs (+312%) during the 1994-2008 time period. Within



this region, Laughing Gulls nest on five islands and one mainland site where predators are actively managed to enhance tern nesting efforts. Recommended management actions include research into the cause of the rapid declines, more frequent regional surveys, and standardization of survey methods.”

**Scott Melvin; Rick Schauffler; Julie Ellis**

### **P1-136 Cameron Eckert**

#### **Monitoring Black Guillemot population and nesting success at Herschel Island, Yukon, Canada**

“The Black Guillemot (*Cephus grylle*) is a seabird with a circumpolar breeding distribution. One of the largest colonies in the Western Arctic is located on Herschel Island, a Yukon Territorial Park off the Yukon’s North Coast. This colony has been monitored for population and nesting success since the mid-1980s. Concerns about the species’ and ecosystem health have arisen due to population declines at Herschel Island, as well as a colony near Barrow, Alaska. Alaskan researchers have found that sea ice conditions affect nesting productivity, and have made the link between climate change and guillemot population health. Black Guillemot monitoring at Herschel Island provides valuable information for understanding changes across the Beaufort Sea region. Currently there are about 60 adult Black Guillemots at Herschel Island. This number has been stable for the past five years, but is down from over 100 in the 1980s. Nesting productivity declined between 1994 and 2004 when no eggs hatched. It has since recovered somewhat with 2009 having highest nesting productivity recorded since the late 1990s. All chicks are now being colour-banded to provide information on survival, dispersal, and population recruitment. In 2009, the first returns of adults banded as chicks at Herschel were recorded. In 2005, an investigation was initiated to determine dominant prey species of nesting guillemots; these have been found to include Arctic cod (*Arctogadus glacialis*) and sculpin (*Myoxocephalus* spp.), along with smaller numbers of slender eelblenny (*Lumpenus fabricii*), Arctic lamprey (*Lethenteron japonicum*), capelin (*Mallotus villosus*), and eelpout (*Gymnelus* sp.).”

**Dorothy Cooley; Richard Gordon**

### **P1-137 Scott Pearson**

#### **Nine years of seabird trends in Puget Sound and the Washington State Coast, USA**

“There is growing concern about the health of Puget Sound, Washington USA including the decline of some over-wintering seabirds, yet published trends for local breeders are lacking. While conducting near-shore marbled murrelet line-transect or DISTANCE monitoring for the Northwest Forest Plan effectiveness monitoring program, we recorded all

species detections. Using these data, we assessed trends for local breeding alcids (n = 7 species) and cormorants (n = 3 species) from 2001-2009, May-July in Puget Sound/Strait of Juan de Fuca (Sound-Strait) and the Washington coast. For species common to both the coast and Sound-Strait, densities were similar for the marbled murrelet and pigeon guillemot but were considerably higher on the coast for all other species. Some species were found almost exclusively on the coast (e.g., tufted puffin and Cassin’s auklet) and no species were found exclusively in the Sound. In the Sound-Strait, only the marbled murrelet exhibited a trend, a 7% decline per year. On the coast, only the ancient murrelet and pelagic cormorant exhibited trends, both positive ( $r^2 = 0.7$ ,  $p = 0.03$ ,  $r^2 = 0.67$ ,  $p = 0.05$ ). The only abundance correlation between the coast and Sound-Strait was for the common murre and pelagic cormorant (murre = 0.86, cormorant = -0.79). These patterns suggest fairly nuanced relationships between the upwelling system of the coast and the non-upwelling system of the Sound. In addition, only one locally breeding species is exhibiting a breeding population decline in the Sound unlike the broader declining trends for over-wintering species.”

**Martin Raphael**

### **P1-138 Jennifer Rock**

#### **Spatio-temporal patterns of seabirds in Laskeek Bay, Haida Gwaii, Canada: 20 years of monitoring with volunteers**

“Laskeek Bay Conservation Society (LBCS) has monitored nearshore abundance and distribution of seabirds in Laskeek Bay, Haida Gwaii, Canada since 1989. These data were collected with the help of volunteers and represent the longest continuous time series for any seabird program in the region. We conducted small-craft surveys from April to July and each survey followed 100m wide transects for 55 nautical miles. Ancient Murrelet, (*Synthliboramphus antiquus*), Marbled Murrelet (*Brachyramphus marmoratus*) and Pigeon Guillemot (*Cephus columba*) were the most common species, representing 77% of birds counted. Most species were concentrated within 1 km from shore except Ancient Murrelet and Rhinoceros Auklet (*Cerorhinca monocerata*) which were most common 2 to 4 km away. Cassin’s Auklet (*Ptychoramphus aleuticus*), a local breeder, was not regularly detected; likely a function of the species’ preferred offshore foraging habitat located beyond our survey area limit. Peak abundance (birds / km) of Ancient Murrelet occurred in May, Marbled Murrelet in June, Pigeon Guillemot in April, and Rhinoceros Auklet in July. Numbers of Ancient and Marbled Murrelet decreased across years. For Ancient Murrelet this trend was consistent with a decline in the number of breeding birds at a nearby colony (Limestone I.) suggesting that similarly, drops in at-sea counts of Marbled Murrelet may reflect a decline in the local breeding population. Understanding spatial and temporal patterns of seabird abundance and distribution is key to effective marine



conservation planning aimed at protecting birds at sea, especially in the vicinity colonies where birds may congregate during the breeding season.”

**Jake Pattison; Anthony Gaston**

### **P1-139 Michael Rodway**

#### **Use of permanent plots to monitor trends in burrow-nesting seabird populations**

“We describe the use of permanent plots for monitoring population trends of burrow-nesting seabirds in British Columbia and provide a test of the assumption that trends in plot counts mirror trends in overall population size. A total of 97 plots for Ancient Murrelets (*Synthliboramphus antiquus*), Cassin’s Auklets (*Ptychoramphus aleuticus*), Rhinoceros Auklets (*Cerorhinca monocerata*), and Tufted Puffins (*Fratercula cirrhata*) were established in the 1980s. Plots were subjectively distributed through higher-density nesting areas of major colonies to ensure that plots contained adequate numbers of burrows and were numerous enough to allow modest changes to be detected. Since then, numbers of Ancient Murrelet, Rhinoceros Auklet, and Tufted Puffin burrows increased or remained stable at monitored colonies, except on Pine Island where a discrepant negative trend was found for Rhinoceros Auklets. In contrast, declines were apparent for Cassin’s Auklets, especially on Triangle Island where numbers of burrows in plots declined at 2.5% per year, resulting in a 40% decline in 20 years. If representative of breeding populations in the region, a decline of this magnitude represents a loss of about 0.8 million birds comprising over 20% of estimated world breeding populations. We had four cases where counts of burrows in permanent monitoring plots and full-colony transect surveys were replicated concurrently. Close agreement was found in the trend information provided by these two methods. Both methods revealed significant differences when changes were in the order of 3-4% annually. Results suggests that 6-8, subjectively-placed permanent plots reveal accurate trends in burrow numbers within a colony.”

**Moira Lemon**

### **P1-140 Emily Runnells**

#### **Changes in seabird community composition and feeding activity at a historically important foraging location in the Salish Sea**

“The biologically rich waters around the San Juan Archipelago (Washington, USA) have experienced decreased abundances of many marine bird species. Surveys undertaken in the fall, winter and spring indicate regional declines during the past 30 years, which have been most severe (80-95%) in diving birds that specialize on schooling pelagic fish. Anecdotal reports suggest decreases in feeding activity of seabirds at historically important foraging locations. Causes

of these declines are unknown in most instances, but possible explanations include natural or anthropogenic variability in food supply. This study will test the hypothesis that seabird feeding activity is decreasing at a historically important foraging location and describe changes in the species composition at this location. Starting in summer 2010, land based seabird surveys will record species, abundance, and behavior of seabirds in Cattle Pass. Surveys will target detection of multi-species foraging aggregations as an indicator of feeding success, recording frequency of formation, size, and duration of foraging flocks. This information will be compared to research conducted at the same location in 1996-97 to detect temporal changes in seabird abundance and activity and shifts in the distribution of feeding guilds observed. Presented results will particularly focus on Rhinoceros Auklets (*Cerorhinca monocerata*), a species that was not included in the larger surveys during the non-breeding season and which falls into the piscivorous diver category. Observed decreases in feeding activity and abundances of diving piscivores would lend credence to the possibility that seabird declines are related to changes in local forage fish abundance and/or distribution.”



## Outreach and Education

### P1-141 Lora Leschner

#### The role of Pacific Coast Joint Venture in seabird colony habitat protection and restoration

“The Pacific Coast Joint Venture develops partnerships to protect and restore habitat for birds and other wildlife. There are 18 habitat joint ventures in North America, implementing conservation initiatives for waterfowl, shorebirds, waterbirds, and land birds. The PCJV Conservation Strategies include acquisition, agreements, restoration, enhancement, monitoring and research, communication and education. Our partners’ projects help carry out the goals of four major bird conservation initiatives: North American Waterfowl Management Plan, North American Waterbird Conservation Plan, U.S. Shorebird Conservation Plan and Partners in Flight (landbirds). Seabird habitat conservation and restoration is included in the North American Waterbird Conservation Plan. Many of the projects focus on wetland and estuary restoration which benefits both seabirds and their prey. The PCJV coordinators can help seabird colony managers with grants for habitat acquisition or habitat restoration. Education projects may be funded and the Joint Venture Partner Network may be used to distribute information about conservation priorities.”

Carey Smith

### P1-142 Stephen Insley

#### Establishing long-term trends of winter seaducks and gulls on the Pribilof Islands, Alaska, via community-based monitoring

“Reliable long-term data on abundance and reproductive success of well chosen species can be one of the best indications of what is happening in the broader ecosystem as well as providing important information for questions of anthropogenic impact. In remote areas such as the Bering Sea, biological data collection programs are focused primarily on species occurring during the summer, resulting in substantial seasonal information gaps. A well designed community based ecological monitoring program can address this problem. Using the existing capabilities and infrastructure of the Aleut Community of St. Paul Island-Tribal Government-Ecosystem Conservation Office, our project set out to conduct trend surveys of winter seaducks and gulls during winter; species that are important for subsistence (seaducks), negative impact on important species (gulls), or as broader indicators of general ecosystem health and change. Seaduck counts focused primarily on eiders (*Somateria* spp.), harlequin ducks (*Histrionicus histrionicus*), long-tailed ducks (*Clangula hyemalis*), and white-winged scoters (*Melanitta fusca*). Gull counts focused on glaucous-winged gulls (*Larus glaucescens*), the most prevalent of the three locally occurring gull species. From September to April of each year on St.

Paul Island, weekly counts were made at a total of 26 observation sites representing nine island regions. Previous USFWS survey methodology was adhered to as much as possible. Temporal and spatial frequency data for the primary species observed are reported herein and contrasted with previous data. Our ultimate goal is a long-term high quality monitoring program that is cost effective and locally based.”

Dustin Jones; Phillip Zavadil; Bruce Robson;  
Paul Melovidov

### P1-143 Kayoko Kameda

#### The plant succession of the Great Cormorants’ colony and forest restoration by local people who utilized the cormorant guano

“In order to investigate the influences on vegetation in the colonies of the great cormorant *Phalacrocorax carbo* and forest restoration by local people, we analyzed, using GIS, the plant succession and the effects of tree planting. We examined aerial photographs from 1947 to 1995 and distinguished the breeding areas of the cormorant, areas of open, low vegetation, and forested areas in the ‘Unoyama’ colony in Aichi Prefecture, Japan. The data of the cormorant’s population and breeding areas were collected from previous papers and the present vegetation was examined from field surveys. The data of people’s utilization and management of the forest were obtained by interviewing residents who had collected cormorant guano until the 1960’s, and from regional documents and the official documents in Aichi Prefectural Archives. From the interpretation of the aerial photographs in comparison with previous research, the movement of the cormorant’s breeding area caused retrogressive succession from forests to open areas or grasslands. The memories of the residents and the regional and official documents showed that the Japanese black pine *Pinus thunbergii* was planted in the open areas to attract the cormorants to re-colonize. The areas of tree planting were closely correlated with the areas of rapid forestation in the aerial photographs. As a result, the cormorants re-colonized the recovered forest in 1990 after their disappearance in 1970. In conclusion, vegetation of the ‘Unoyama’ forest has drastically changed within several decades, and anthropogenic influences on forest recovery facilitated the plant succession and the re-colonization by the cormorants.”

Yuri Maesako; Akira Ishida; Atsushi Makino; Hiroaki Fujii

### P1-144 Keith Moore

#### Citizen science and seabird conservation on Haida Gwaii, British Columbia

“Laskeek Bay Conservation Society (LBCS) has been undertaking environmental monitoring in Haida Gwaii (formerly Queen Charlotte Islands), British Columbia for 20 years. At a remote field camp, biologists monitor seabird and



shorebird populations, and the impact of introduced species, as well as marine mammals and forest birds annually. Volunteer “citizen scientists” contribute extensively to these programs. Since 1992, about 550 volunteers have participated - half of them residents of Haida Gwaii; others from other provinces and countries. Local students are also active participants and gain hands-on field-work experience. Over 550 students have participated since 1992. These volunteer citizen scientists assist in monitoring Ancient Murrelets (*Synthliboramphus antiquus*), Marbled Murrelets (*Brachyramphus marmoratus*), Pigeon Guillemots (*Cephus columba*) and other seabirds as well as Glaucous-winged Gulls (*Larus glaucescens*) and Black Oystercatchers (*Haematopus bachmani*). LBCS has the most extensive continuous long-term monitoring data sets for seabirds anywhere on the coast of British Columbia. This long-term data is invaluable for monitoring climate change and the effects of oil drilling, forestry and wind energy projects. Long-term monitoring also provides life history information necessary for management planning and effective conservation decision-making. At a time when government funding is very limited and public interest is growing, the role of citizen science non-government organizations is increasingly important. The 20 years of work by LBCS provides an exciting case study.”

**Christine Pansino; Jen Rock**

### **P1-145 Sage Tezak**

#### **Using Marine Protected Areas to achieve restoration of seabird colonies: A case study on the Central California coast**

“This presentation will discuss ways to successfully promote change in human behavior by focusing on a comprehensive approach to protect seabirds. High levels of human disturbance, including frequent interruptions of natural behaviors or a single severe event, can impact breeding and roosting seabird species. This case study will explore the successes of the Seabird Protection Network (Network), a multi-organization collaborative, developed to address human disturbance to seabird colonies, in a region with the largest concentration of seabirds in the contiguous United States, central California. The three primary components of the Network are: 1) Outreach; 2) Enforcement and Coordinated Management; and 3) Monitoring. The most frequent human-caused disturbances to seabirds in California fall into three categories: close approaches by motorized and non-motorized boats; low-flying aircraft; and hikers accessing near-shore colonies from land. A network of protected areas has been established near key seabird colonies, including no-access zones in the water surrounding colonies, the protection of off-shore sea stacks making up colony sites, and the airspace above colonies. Establishing no-access marine protected areas to protect seabirds at breeding colonies can be controversial, affecting both consumptive and non-consumptive ocean users.

An important aspect of building constituency includes fostering and maintaining support through a comprehensive outreach program that: 1) effectively targets individuals and/or groups impacting the resource; 2) builds awareness; and 3) promotes stewardship. However, outreach and education cannot prevent all sources of human disturbances, which is why marine protected areas that can be enforced, is critical.”

**Karen Reyna; Mai Maheigan; Gerard McChesney; Jennifer Boyce**

### **P1-146 Kathleen Blanchard**

#### **Improving performance of education and stewardship programs for seabird conservation**

“Conservation practitioners are calling for evidence-based evaluation of conservation programs in order to improve the performance of conservation initiatives and to demonstrate that the approaches being applied are successful and cost-effective. One approach that practitioners often utilize, and which public and private sector funding programs support with millions of dollars each year in North America, is the engagement of target audiences through stewardship and education. But does it work? How do we know? How can conservation programs that use these approaches improve their tracking of conservation outcomes? An evaluation conducted between 1981 and 1988 of a seabird conservation initiative that occurred over many years along the North Shore of the Gulf of St. Lawrence, Quebec, Canada, remains one of the best documented examples of how education and the engagement of target audiences can contribute substantially to conservation and recovery. This presentation will re-visit that case study for lessons learned and present findings from an evaluation of endangered species recovery projects in eastern Canada.”

### **WITHDRAWN P1-147 Patricia Nash**

#### **Preventing conflict and engaging citizens in conserving seabirds in the Brador Bay Federal Migratory Bird Sanctuary, Blanc-Sablon, Quebec, Canada**

“The Brador Bay Federal Migratory Bird Sanctuary is located in a remote area of eastern Canada. It is an important nesting area for seabirds which includes the largest atlantic puffin nesting colony in Quebec. The seabird population in the sanctuary experienced a dramatic decline from 1955-1978 due to illegal harvesting of birds and eggs. Seabirds and their eggs comprised an important food source for residents. The Quebec-Labrador Foundation (QLF), a non-profit charitable organization implemented a community-based conservation education program in the 1980’s to improve local knowledge about seabird biology and hunting regulations. This program along with an increased enforcement presence changed attitudes and behaviours of residents about the harvesting of



seabirds. This resulted in a significant increase in the alcid population. Twenty years later, the sanctuary is now impacted by human disturbance, fishing practices and illegal spring hunting. Residents do not acknowledge the sanctuary and do not comply with regulations. There is no enforcement by the government. QLF is now working with a new generation of residents to engage them in the management and stewardship of the sanctuary. A unique webcam system has been designed to 1) allow biologists to assess the alcid population; 2) provide real time video of atlantic puffins for a new website and at the local visitor centre; and 3) monitor compliance. The local community was also a partner in the development of a Ecotourism Feasibility Study for the sanctuary - the first of its kind in Canada.”

### **P1-148 Patricia Serafini**

#### **Establishment and reinforcement of a seabird rescue network within a coastal protected area in southern Brazil**

“The Right Whale Environmental Protection Area ñ EPA (28° 14’ 25” S ; 48° 40’ 13” W), a 156.100 hectares natural protected area created in 2000, is managed by the Brazilian Government and comprises thousands of inhabitants living within its territory. These people have an important role as the sentinels of the area, but are not always aware of that. For instance, every year, hundreds of sick, injured or dead seabirds are found on the beach by inhabitants, but a very small percentage of this information were actually shared. In order to improve the communication between the inhabitants and the scientific community, the Brazilian government and the EPA Council established the first seabird rescue network within the EPA in 2007. A total of eleven workshops were attended by over 400 members of the community (e.g. fishermen, surfers, teachers, police officers, etc.). Here we present data gathered from seabirds found dead or sick at the EPA coast, important information for scientific studies on home range, stomach contents, diseases or parasites and toxins. In 2008 and 2009, 462 *Spheniscus magellanicus*, 3 *Larus dominicanus*, 3 *Macronectes halli*, 1 *Fregetta sp.* and 1 *Puffinus griseus* were rescued after communication by locals and sent to a Rehabilitation Center. Most animals were rehabilitated, banded and released back into the wild after disease screening. The creation of the SRN was effective in increasing public awareness on seabirds monitoring and communicating downed seabirds, which will ultimately provide essential information for seabird conservation.”

**Luciana Moreira; Audrey Correa; Karina Groch; Sandro Sandri; Sandra Severo; Maria Rocha; Vanessa Kanaan; Ariana Fernandes; Cristiane Kolesnikovas**

## **Physiology & Health**

### **P1-149 Franziska G. J. Perner**

#### **Hints for critical health status of sea- and shorebirds in the German North Sea**

“Many bird species in the German North Sea showed negative population trends during the last years. This holds true for coastal birds as well as for seabirds living offshore. The reasons for these declines are largely unknown. The present pilot study investigated the health status of a variety of sea- and shorebird species. Here, we present the results for the offshore species Northern Fulmar (*Fulmarus glacialis*), the inshore species Common Scoter (*Melanitta nigra*) and the Wadden Sea species Common Shelduck (*Tadorna tadorna*). Dead individuals of the three species were collected at the North Sea coastline to assess the health status by autopsy. So far we studied 49 individuals of the three species by assessing the body condition following the classification by van Franeker (2004). In 15 individuals we conducted further detailed, histological, microbiological and parasitological investigations. Most individuals of all three species were emaciated. Body mass in most individuals was significantly lower than values taken from literature. In most Common Scoters and Common Shelducks severe bacterial inflammation of several organs and sepsis were responsible for bad body condition. In Common Shelduck severe peritonitis was found in all individuals investigated. Particularly in Northern Fulmars no lesions caused by diseases were found that could have explained their bad nutritional status. Our results show that all individuals investigated were in a critical state of health. Representativeness of the samples needs further investigation to allow conclusions at a population or Wadden Sea area level. Possible relationships with shortages in food supply should be studied.”

**Philipp Schwemmer; Nils Guse; Stefan Garthe; Reinhard Weiss; Ellen Prenger-Berninghoff; Peter Wohlsein; Ursula Siebert**

### **P1-150 Michelle Wille**

#### **The possible role of gulls in intercontinental avian influenza virus exchange across the North Atlantic Ocean**

“The primary hosts for influenza A viruses are waterfowl, but other bird groups such as gulls and shorebirds also contribute to global influenza dynamics. Avian influenza virus genes separate phylogenetically into two geographic clades, American and Eurasian, because of the geographic separation of host species between these two regions. The roles of waterfowl and shorebirds in the movement and evolution of influenza viruses are relatively well characterized, however little emphasis has been placed on gulls, particularly in



context of intercontinental virus exchange. We surveyed a gregarious and cosmopolitan species, the Great Black-backed Gull (*Larus marinus*), in Newfoundland, Canada for infection by influenza viruses. We have isolated and determined the complete genome sequence of an H13N2 virus from one of these birds. Phylogenetic analyses revealed that this virus contained segments with a mosaic pattern of relationships to previously characterized viruses from various avian influenza groups and geographic regions. We have also analyzed all gull influenza sequences to investigate the phylogeographic characteristics of all genes from this host group. Movement patterns of host species were analyzed in relation to virus movement, with particular emphasis on long distance intercontinental movements. These analyses demonstrated that increased surveillance effort for influenza in gulls is required to determine the importance of this group in intercontinental virus movements. However, preliminary analyses suggest gulls are important for movement of influenza viruses across the Atlantic Ocean and also within continental regions.”

**Gregory Roberston; Hugh Whitney; Davor Ojkic; Andrew Lang**

#### **P1-151 Curt Clumpner**

##### **A survey of seabird rehabilitation at four wildlife rehabilitation centers on the Northeastern Pacific Ocean 2005-2009**

“The interface of the northeastern Pacific Ocean and the coast of North America is home to millions of seabirds and millions of people. Each year thousands of seabirds are brought to wildlife rehabilitation facilities in this region. International Bird Rescue Research Center’s rehabilitation programs in the San Francisco Bay and the Southern California Bight areas, the Wildlife Center of the North Coast at the mouth of the Columbia River and the PAWS Wildlife Center on Puget Sound collectively care for several thousand seabirds each year. Little has been published about these seabirds and the reasons they are brought to the rehabilitation centers. This paper will survey the annual reports of these four centers for seabird species cared for, presenting problems, ancillary health issues and any trends or anomalous events that have impacted the annual caseloads in these species. Rehabilitation records from the centers will be analyzed to identify and document significant threats to these seabird species. It will also survey population data collection within the four rehabilitation programs and suggest opportunities for collaboration with other seabird researchers.”

**Sharnelle Fee; Jennifer Convy; Michelle Bellizzi; Julie Skoglund**

#### **P1-152 Pierre-Yves Daoust**

##### **Encephalitis associated with *Sarcocystis neurona* in Northern Gannets (*Morus bassanus*) from the Gulf of St. Lawrence, Canada**

“In the northwestern Atlantic, Northern Gannets breed in large colonies in the Gulf of St. Lawrence and off the province of Newfoundland and overwinter along the coast of southeastern United States. Between 1990 and 2009, a full necropsy was performed on carcasses of 150 free-living Northern Gannets found sick, injured or dead. Sarcocysts were identified microscopically in skeletal muscle of 23 (15.3%) and in heart muscle of 16 (10.6%) of these birds. Thirteen birds (nine adult, four immature) (8.66%) had microscopic evidence of encephalitis severe enough to be considered clinically significant; 11 of these 13 birds also had muscular sarcocystosis (47.8% of the 23 birds with muscular sarcocystosis). *Sarcocystis neurona* and at least one other *Sarcocystis* sp. were identified by polymerase chain reaction infecting the brain, heart, and/or skeletal muscle in 7 of 9 birds tested. *Sarcocystis neurona* has been diagnosed as a cause of encephalitis in horses in the United States and in harbour seals and sea otters along the western seaboard of North America, but is not known to be indigenous to the Atlantic provinces of Canada. The source and transmission of *S. neurona* among Northern Gannets are enigmatic and this protozoan may represent an emerging threat among coastal seabirds in eastern North America that is capable of causing significant morbidity and mortality.”

**Erick James; Michael Grigg**

#### **P1-153 Meagan Dewar**

##### **Changes in the gastrointestinal microbiota during fasting in penguins**

“Fasting is common in many seabird species including penguins and Procellariiforme seabirds, due to food availability, moult, migration and reproduction. In this study we focused our attention on penguins fasting during moult. In the past many studies have focused their attention on understanding the physiology of fasting and re-feeding. However, little attention has been paid to the affects of fasting on the gastrointestinal microbiota. Recent studies on the affects of fasting in mammalian species, has shown that long-term fasting not only alters the diversity and species richness of the gut microbiota, but also affects the host’s immune systems response and ability to prevent infection and disease. Therefore the aims of this study were to examine: 1) the affect that fasting has on the gastrointestinal microbiota of penguins; 2) the presence of mucin-degrading bacteria; and 3) The changes in the number of pathogens increase during moult, increasing the risk of infection and disease. Utilising group specific 16S rRNA DNA primers changes in diversity, species richness and quantity of the major bacterial phyla were analysed in moulting and non moulting King, Gentoo



and Little penguins using PCR- Denaturing Gradient Gel Electrophoresis (DGGE) and quantitative Real Time PCR. Results have indicated that fasting during moult alters the diversity and species richness in the gastrointestinal microbiota of penguins, with major differences between the DGGE profiles of moulting and non-moulting king penguins, resulting in changes in the pre-dominant bacterial species, indicating a shift in dominance.”

**John Arnould; Peter Dann; Phil Trathan; Rene Grocolas; Stuart Smith**

### **P1-154 Nola Parsons**

#### **Occurrence and prevalence of blood parasites in seabirds (excluding the African Penguin) admitted to a rehabilitation centre, Western Cape, South Africa, 2001-2009**

“There were 1,895 seabirds (excluding African penguins *Spheniscus demersus*) admitted to a rehabilitation centre from 2001 to 2009. A total of 3 088 bloodsmears were evaluated from 1 157 individuals during the birds’ stay at the centre. This gave us the opportunity to examine infrequently sampled species of birds for haemoparasites and to provide basic information on host/parasite relationships. Each bird was bled peripherally (feet or legs) and a smear evaluated. The majority of birds bled were Cape cormorants *Phalacrocorax capensis* (546 individuals) and Cape gannets *Morus capensis* (362 individuals) but at least one blood smear was examined from a total of 27 species. There was a prevalence of 4% for *Plasmodium* spp. in the Cape gannet, Cape cormorant, white-breasted cormorant *Phalacrocorax carbo*, 30% in the rockhopper penguin *Eudyptes chrysocome* and also seen in five other species. For *Babesia* spp., there was a prevalence of 4% in the Cape gannet, 30% in the bank cormorant *Phalacrocorax neglectus*, white-breasted cormorant and rockhopper penguin, 52% in the Cape cormorant and also seen in two other species. *Borrelia* spp. were seen in two birds: a Cape gannet and a Southern giant petrel *Macronectes giganteus*. *Leucocytozoon* sp. (new species described) was seen in two Cape cormorants, *Hepatozoon albatrossi* was seen in one black-browed albatross *Diomedea melanophris* and *Haemoproteus* sp. (new species described) was seen in one Subantarctic skua *Catharacta Antarctica*. Mortality was only associated with *Plasmodium* spp. in the rockhopper penguin and *Babesia* spp. in the king penguin *Aptenodytes patagonicus*. Although haemoparasites may cause little mortality in normal conditions, they may aggravate other disease conditions, especially if the host is stressed or immune-compromised.”

**Michael Peirce; Venessa Strauss; Michael Yabsley**

### **P1-155 Hannah Munro**

#### **The relationship between ticks (*Ixodes uriae*) and host age, ornamentation and condition in Least (*Aethia pusilla*) and Crested Auklets (*A. cristatella*) during the breeding season”**

“*Ixodes* ticks are terrestrial, obligate, non-permanent ectoparasites that are known to impact seabird nestling growth rates and adult health. Populations with high levels of ticks tend to have reduced breeding success and may even show significant declines. The direct feeding by *I. uriae*, the most common seabird tick on adults and nestlings can result in excessive blood loss, bacterial infections and paralysis. Nevertheless, little work has focused on the prevalence and effects of ticks on adult auklets. We looked at the relationship between parasitism and individual body condition and expression of feather ornaments in Least (*Aethia pusilla*) and Crested Auklets (*A. cristatella*) at Buldir Island in the Western Aleutians during 2009 and 2010. Condition was indexed from standard body measurements and ornament size by measurement of plumage characteristics that vary between individuals and are known to play a role in mate choice. Adult auklets were caught throughout the breeding season and number and age category of ticks found on the entire body recorded. Tick presence was related to body condition but not ornamentation in 2009. A negative relationship between ticks and condition or size of ornaments would indicate either a cost of parasitism, or an increased likelihood of parasitism in poor condition birds. It is important to first establish a natural relationship between ectoparasites and their hosts condition in order to understand the effect that ectoparasites can have at the hosts population level.”

**Ian Jones**

### **P1-156 Maggie Watson**

#### **Quantifying the effects of parasites: A medication experiment in Crested Terns (*Thalasseus bergii*)**

“Parasites are often assumed to be detrimental to their hosts, but by definition, their effects must be sub-lethal. Quantifying these sub-lethal effects can be difficult in the field, but are best achieved by experimentally manipulating natural parasite loads. Here, the numbers of ectoparasites (lice and ticks) of wild crested tern chicks were experimentally reduced, through medication. Medicated individuals were monitored until fledging and showed increased growth and condition, as well as increased ability to grow feathers faster. These effects indicate the cost that parasites incur to their hosts. However, non-medicated individuals varied greatly in the number of naturally occurring parasites they possessed, indicating natural variations in quality and/or immune function. These factors may play a large role in chick survival and future recruitment. This work, one of the few medication experiments on a non-passerine bird, indicates the potential importance of parasites to seabird population regulation.”



### **P1-157 Michelle Kissling**

#### **Effects of capture, handling, and transmitters on a pursuit-diving seabird, the Kittlitz's Murrelet**

“Telemetry is a useful technique for studying the mechanics of wildlife, particularly for species that are otherwise difficult to study. However, a fundamental assumption of the use of telemetry data is that capture and radio-tagging do not alter the animal's behavior or affect vital rates. The Kittlitz's Murrelet (*Brachyramphus brevirostris*) is a solitary nesting seabird of conservation concern. We captured 340 Kittlitz's Murrelets and radio-marked 122 adults and four juveniles in Icy Bay, Alaska, 2005-2009, as part of a study to estimate demographic parameters of this species. As an index of stress response to capture and handling, we recorded lactate levels (mmol/L) and summarized these relative to capture attempts (1-3), transport and processing times, sex, age, and breeding status. To assess transmitter effects, we compared at-sea activity budgets (e.g., resting, rate of diving) between radio-marked (n=47) and randomly selected unmarked (n=114) Kittlitz's Murrelets. Capture time averaged 43 min total, including 10 min of handling and processing; these times were not correlated with lactate level. We did not detect differences in lactate between males ( $\bar{x}=1.94$ ) and females ( $\bar{x}=2.08$ ), but hatch-year birds ( $\bar{x}=3.60$ ) had much higher lactate levels. Brood patch scores were positively correlated with lactate levels of females, but not males, captured in May. We did not observe differences in dive or surface times, or activity of marked and unmarked Kittlitz's Murrelets. We conclude that there is an immediate stress response to capture, particularly for breeding females, but there is no evidence of transmitter effects on at-sea behavior of Kittlitz's Murrelets.”

**Stephen Lewis; Paul Lukacs; Scott Gende; Nicholas Hatch; Sarah Schoen**

### **P1-158 Amy-Lee Kouwenberg**

#### **Using enzyme immunoassay to measure corticosterone in alcid feathers: A tool for assessing long-term stress**

“Developing an accurate and reliable method for measuring corticosterone (CORT) in feathers would greatly improve our ability to quantify stressful challenges faced by birds during parts of the life-cycle when they are inaccessible for blood sampling (e.g., during the non-breeding season). Bortolotti et al. (2008, 2009) have showed that CORT measured in a given feather mirrors the amount of stress experienced by a bird during the growth of that feather. We adapted their methods to measure CORT levels in feathers of Atlantic Puffins (*Fratercula arctica*), Dovekies (*Alle alle*) and barnyard hens (*Gallus gallus domesticus*). To our knowledge, this is the first study to explore feather CORT in alcid species. We extracted CORT by incubating minced feathers in vials containing methanol (n = 3 birds per species, 2 primary feathers per bird) and then filtering samples under vacuum. We found high

amounts of lipid residue in sample tubes after evaporation, which led us to develop an acetonitrile-hexane extraction to remove unwanted lipids before re-evaporating samples and reconstituting them in buffer. Furthermore, we measured CORT using a highly sensitive enzyme immunoassay (Cayman Chemical Company), which allowed us to detect very low concentrations of CORT. We found that feathers from all species had measurable levels of CORT and that lipid-extracted alcid samples showed more consistent CORT measurements than non-lipid-extracted samples. Therefore, we conclude that our enzyme immunoassay method combined with the acetonitrile-hexane extraction provides an effective method for measuring CORT in alcid feathers and lays the groundwork for informative future studies.”

**Donald McKay; Anne Storey**

### **P1-159 Cecilia Villanueva**

#### **Physiological responses of incubating Magellanic Penguins exposed to tourism**

“In the last decade, there has been increasing tourist activity in Argentine Patagonia focusing on wildlife visitation. Seabird colonies (penguins, cormorants, gulls, etc.) are particularly popular for visitation. As a consequence of this growth, there is a concern about the effects that ecotourism may have on these populations. We investigated the physiological responses of incubating Magellanic penguins (*Spheniscus magellanicus*) exposed to human visitation in San Lorenzo colony, located in Peninsula Valdés, Chubut, Argentina. We measured the heart rate response of Magellanic penguin when small (<5 people) and big (up to 60 people) groups of tourists walked around the target nest. We used an egg dummy device connected to a digital recorder. Heart rate was measured before, during and after pedestrian tourists were crossing by the nests. There was no relationship between heart rate and group size, however there was a great variation among individuals, so further analysis must be done. We also measured the levels of the circulating stress hormone corticosterone in penguins nesting in tourist visited areas and undisturbed areas. Baseline corticosterone levels were similar between areas and sexes. Integrated corticosterone was similar between areas, but different for sexes, with females having higher levels than males. We have not seen obvious adverse effects on the penguin in short term studies. However, the continue monitoring of the activity is important, due to concerns of potential long-term effects which are not detectable in short term studies.”

**Marcelo Bertelotti; Brian Walker**



### P1-160 Vincent Viblanc

#### Comfort behavior incurs substantial energy cost in breeding-fasting King Penguins

“Birds spend significant time in comfort behavior (e.g. preening, stretching, etc.) maintaining plumage waterproofing, eliminating parasites, and preventing ankylosis. Understanding the adaptive value of comfort behavior may benefit from knowledge on its energetic costs, especially in situations of food shortage. We determined time and energy spent in comfort activities in freely breeding king penguins (*Aptenodytes patagonicus*), seabirds known to fast for up to one month during incubation shifts ashore. Time-budgets were derived from focal observations and energetic cost of comfort activities calculated from the associated increase in heart rate (HR), related to energy expenditure (EE). Incubating penguins spent 23% of the 24 hrs day in comfort, mainly devoted to preening (75 %) and body shaking (16 %). Average cost of comfort activities, i.e. energy expended in excess of resting metabolism, was 58 kJ/hr. Costs varied greatly among comfort activities, e.g. from 18 kJ/hr for preening to 180 kJ/hr for stretches and flipper beats. Comfort behavior represented 7% of daily EE (half for preening and half for comfort with high muscular activity). Long-term fasting king penguins thus devote substantial energy to comfort, suggesting that plumage waterproofing and maintenance of a functional musculature are required and must be paid ashore, for the penguins to be efficient foragers as soon as they return at sea to restore their energy reserves.”

**Adeline Mathien; Vanessa Viera; Renè Groscolas**

### P1-161 Chris Thaxter

#### Influence of wing loading on the trade-off between pursuit-diving and flight in Common Guillemots and Razorbills

“Species of bird that use their wings for underwater propulsion are thought to face evolutionary trade-offs between flight and diving, leading to the prediction that species with different wing areas relative to body mass (i.e. different wing loadings) also differ in the relative importance of flight and diving activity during foraging trips. We tested this hypothesis for two similarly sized species of *Alcidae* (common guillemots and razorbills) by using bird-borne devices to examine three-dimensional foraging behaviour at a single colony. Guillemots have 30% higher wing loading than razorbills and, in keeping with this difference, razorbills spent twice as long in flight as a proportion of trip duration whereas guillemots spent twice as long in diving activity. Razorbills made a large number of short, relatively shallow dives and spent little time in the bottom phase of the dive whereas guillemots made fewer dives but frequently attained depths suggesting that they were near the seabed (ca. 35–70m). The bottom phase of dives by guillemots was relatively long, indicating that they spent considerable time searching for and

pursuing prey. Guillemots also spent a greater proportion of each dive bout underwater and had faster rates of descent, indicating that they were more adept at maximising time for pursuit and capture of prey. These differences in foraging behaviour may partly reflect guillemots feeding their chicks single large prey obtained near the bottom and razorbills feeding their chicks multiple prey from the water column. Nonetheless, our data support the notion that interspecific differences in wing loadings of auks reflect an evolutionary trade-off between aerial and underwater locomotion.”

**Sarah Wanless; Francis Dault; Mike Harris; Silvano Benvenuti; Yutaka Watanuki; David Grèmillet; Keith Hamer**

### P1-162 Amélie Lescroë

#### Working less to gain more: When breeding quality relates to foraging efficiency

“In animal populations, a minority of individuals consistently achieves the highest breeding success and therefore contributes the most recruits to future generations. On average, foraging performance importantly determines breeding success at the population level, but evidence is scarce to show that more successful breeders (better breeders) forage differently than less successful ones (poorer breeders). To test this hypothesis, we used a 10-yr, 3-colony, individual-based longitudinal data set on breeding success, foraging parameters of a long-lived bird, the Adèlie penguin *Pygoscelis adeliae*. Better breeders foraged more efficiently than poorer breeders under harsh environmental conditions and when offspring needs were higher, therefore gaining higher net energy profit to be allocated to reproduction and survival. Additionally, we tested the hypothesis that better breeders are parents that can afford to lose the most mass during the chick-rearing season. Our results imply that adverse extrinsic conditions might select breeding individuals on the basis of their foraging ability. Adèlie penguins show sufficient phenotypic plasticity that at least a portion of the population is capable of surviving and successfully reproducing despite extreme variability in their physical and biological environment, variability that is likely to be associated with climate change and ultimately with the species’ evolution.”

**Grant Ballard; Viola Toniolo; Kerry Barton; Peter Wilson; Philip Lyver; David Ainley**

### P1-163 Agustina Gómez Laich

#### Use of Overall Dynamic Body Acceleration for estimating energy expenditure in free-living animals: Do locomotory types affect the relationships?

“The way in which animals use and acquire energy is fundamental to their fitness. To date, two methods have been widely used for the determination of energy expenditure in free-ranging animals: the doubly-labeled water and the heart



rate methods. A recently-developed method uses overall dynamic body acceleration (ODBA) as a proxy for energy expenditure. Although this relationship has been calibrated using gas-respirometry in several species, it has only been validated for animals moving in one medium. In this work we examined whether the relationship between ODBA and energy expenditure varies between activity types and in particular, how locomotion in different media affects the regressions using the Imperial Cormorant *Phalacrocorax atriceps* as a model species. We determined ODBA values for this species during resting, diving, walking and flying and approximated the likely energetic costs of these behaviors using published data from congeners. Regressing mean ODBA values for resting, diving and walking periods on a single graph against mean power values of the mass-specific power ( $W\ kg^{-1}$ ) was related to ODBA via;  $Power = 12.09 + 41.31\ ODBA$  ( $r^2 = 0.93, P < 0.01$ ). Although values for resting, walking and swimming all fell close to a single linear fit, values for flight deviated substantially from this. Using just values for resting and flight the relationship was;  $Power = 8.229 + 92.39\ ODBA$ ;  $r^2 = 0.95, P < 0.01$ ). The different relationships found between locomotory types are discussed in terms of the muscle groups involved in each kind of behaviour.”

**Rory Wilson; Adrian Gleiss; Emily L. Shepard;  
Flavio Quintana**

### **P1-164 Yasuaki Niizuma**

#### **Field metabolic rate in relation to flight cost of Streaked Shearwaters *Calonectris leucomelas***

“Procellariiformes are known to be well-adapted to long distance flights, by virtue of their high aspect ratios. The flight cost of albatrosses is estimated to be extremely low, as their main flying mode is gliding. Instead, shearwaters use flap-gliding flight, so they are assumed to have a higher flight cost than albatrosses. However, the flight cost of shearwaters is still unknown because their small body size makes it difficult to find a suitable device to monitor their activity in the field. In order to determine activity-specific metabolic rates of streaked shearwaters (*Calonectris leucomelas*), we equipped 10 birds with miniature wet-dry loggers (geolocators) and injected them with doubly-labelled water. We were thus able to measure simultaneously the percentage of time spent on water by the birds and their field metabolic rate (FMR). The study was conducted at Awa-Island (38°28' N, 139°15' E) in 2008-2009 and the birds were monitored for 1-4 days. The FMR of shearwaters averaged  $686 \pm 281$  kJ per day, which is 2.5 times the basal metabolic rate (BMR) predicted by the allometric equation of Procellariiformes. On average, the birds spent  $50.8 \pm 9.5$  % of their time per day on the sea surface; this percentage of time was negatively correlated with FMR. Assuming that their energy expenditure on water corresponds to BMR, the mean flight cost of streaked shearwater can be estimated to be  $4.0 \pm 1.8$  times the

predicted BMR, which is intermediate between that found in gliding flyers ( $2-4 \times$  BMR) and flapping flyers ( $7-11 \times$  BMR).”

**Masaki Shirai; Akemi Ushijima; Emiko Oda; Takashi Yamamoto; Maki Yamamoto; Naoyuki Ebine; Nariko Oka**

### **P1-165 Daisuke Ochi**

#### **Dynamics of nutritional status at fasting and oil-feeding in Streaked Shearwater chicks**

“Parents of Procellariiformes often take long distant foraging trips during chick rearing period. Long trips result in frequent chick fasting and oily chick food (i.e. stomach oil). Previous studies have explained these features by an adaptation for food scarcity in their pelagic habitat. However, long fasting and oily meals likely causes growth stagnation and depletion of nutritional reserve. To verify adverse effects of long trip, a food control experiment was carried out in 19 chicks of streaked shearwater *Calonectris leucomelas*. During the experiment, ten chicks were fed with mashed Sandlance *Ammodytes personatus* everyday (control group) and the other chicks were fed with fish oil (European anchovy *Engraulis encrasicolus*) for four days after six days of fasting (oil-meal group). Their daily growth of body mass and wing length were recorded during the experiment. Blood samples were also collected every two days to analyze plasmatic nutritional components. Compared to control group, chicks of oil-meal group had growth stagnation at fasting phase and then exhibited compensative growth at following oil-feeding phase. They also experienced rise of plasmatic free fatty acid and fall of albumin and total protein concentration only at oil-feeding phase. Those results indicated that streaked shearwater chicks hardly have adverse effects on their growth but have serious protein deficit if they were repeatedly fed with stomach oil by long trips.”

**Koichi Murata; Katsufumi Sato**

### **P1-166 Stephen Oswald**

#### **Morphological adaptations to climate predict differences in thermoregulatory behavior between gulls and terns**

“For high-latitude seabirds, bathing behavior may play an important role in mitigating heat stress resulting from climatic warming. Recent work indicates that, even at moderate temperatures, sub-polar seabirds may trade-off nest attendance for increased bathing opportunity and ultimately experience reduced breeding success. Comparative studies of bathing for temperate-breeding species are lacking. We examined differences in bathing activity between Caspian terns, *Hydroprogne caspia*, and ring-billed gulls, *Larus delawarensis*, at a mixed-species, Canadian breeding colony (44 °N). Ring-billed gulls are restricted to breeding at temperate latitudes between 37 - 60 °N but Caspian terns also breed in the tropics. We hypothesized that gulls would be



evolutionarily adapted to breed under cooler conditions than terns and so would bathe more at this site in the south central portion of their range. Operative temperature recordings from taxonomic mounts of both species indicated that ring-billed gull plumages did retain heat more effectively than those of Caspian terns. Ring-billed gulls also bathed for significantly longer than Caspian terns and bathing activity was strongly correlated with heat stress intensity. Differences in the use of particular bathing behaviors by gulls and terns reflected the limitations imposed by bathing length. Since ecological constraints on activity budgets may determine the time each species can spend bathing, we also explored differences in nest attendance and foraging activities. Our results indicate that, within the bounds of ecological constraints, species accommodate morphological inflexibility through behavioral adjustments. Thus, the ability to make these adjustments will affect species' capacities to cope with climate change."

**Jessica Amenta; Jennifer Arnold**

### **WITHDRAWN P1-167 Craig Hebert**

#### **Aquatic food web change and multiple stressor impacts on seabirds in inland seas**

"Early explorers referred to the Laurentian Great Lakes as Inland Seas. They form the largest freshwater ecosystem in the world and are similar in surface area (244,000 km<sup>2</sup>) to marine systems such as the Baltic Sea. The Great Lakes support diverse biotic communities including seabirds. However, intentional and accidental introductions of exotic species have altered Great Lakes food webs. Fisheries management programs have introduced millions of Pacific salmonids into the Great Lakes. Competition with these non-native predators has resulted in reduced availability of forage fish for seabirds. Using a 30-yr dataset, we link declines in forage fish populations to seabird dietary change. As a result of this change, seabirds are experiencing serious energetic and nutritional constraints that may be heightening physiological stress in individual birds, reducing resources for reproduction, and causing population-level declines. Unfortunately, additional stress on seabird populations has resulted from accidental introductions of other exotic species. By further altering food web structure, these species have changed pathways of disease transfer to seabirds resulting in large-scale seabird mortalities. The Great Lakes present an opportunity to further our understanding of the impacts of multiple stressors, e.g. food stress, disease, contaminants, on seabirds and results from these Inland Seas are relevant to the conservation of seabirds in both freshwater and marine ecosystems."

**Chip Weseloh**

### **P1-168 Louise Soanes**

#### **Relating differences in foraging ranges and breeding success to the metabolic rates of seabirds.**

"This study investigated the links between rates of energy expenditure and performance in natural populations of seabirds. European Shags (*Phalacrocorax aristotelis*) on Puffin Island, Wales were fitted with GPS data loggers and their foraging ranges recorded at different stages of the breeding season. The basal metabolic rates of these birds was then recorded using an open flow respirometry system and their breeding performance monitored by recording breeding success, chick growth rates and fledging dates of chicks. Metabolic rates of individuals will be linked to individual's breeding success and foraging ranges to determine if a link exists between metabolic rates and breeding quality of individuals. The results of this study should allow the conflicting hypothesis concerning energy expenditure to be tested. Do successful animals have a high BMR, indicative of a high capacity to work and gain resources from their environment? Or will successful animals have a low BMR which allows them to consume less food and pass more to their chicks?"

**Jonathan Green**

### **P1-169 Astrid Willener**

#### **The biomechanics and energetics of a common behaviour in poorly-adapted species: Analyses of pedestrian locomotion in penguins**

"The potential deterioration of resources in the Southern Ocean may enhance the sensitivity of long-lived species such as the king penguin *Aptenodytes patagonicus* to energy-dependent factors. As some individuals must walk kilometres to their nest upon returning from the sea, I measured the energy expenditure of this species and how it is related to their pedestrian gait; both these variables vary against a number of factors such as body mass, terrain and the presence of other conspecifics. While experiments of walking penguins on a treadmill have already been conducted, no information existed on the energy expenditure of individuals in their colony. Additionally, penguins represent a valuable new model for interpreting morphological and biomechanical adaptations associated with pedestrian locomotion, for comparison to other, distantly related bird species."

**Lewis Halsey**

### **P1-170 Rian Dickson**

#### **Strategies of remigial moult of White-winged Scoters and Surf Scoters along the Pacific coast of North America**

"Sea ducks, like other waterfowl, moult their remiges simultaneously, rendering them flightless while wing feathers



re-grow. Waterfowl display a wide range of strategies to accommodate potential energetic, nutritional, or demographic constraints during this discrete annual cycle stage, although these are not well-studied in sea ducks. We examined strategies used by White-winged Scoters (*Melanitta fusca*) and Surf Scoters (*M. perspicillata*) to meet demands of the wing moult period at two nearshore marine study sites in Southeast Alaska and the Salish Sea (British Columbia/Washington). Scoters were captured during wing moult (July-September, 2008 and 2009) and VHF transmitters were deployed to allow monitoring of individual behaviour and movements. We found that during wing moult, scoters of both species and sexes, and all age classes, exhibited high body mass relative to other phases of the annual cycle and showed no significant decreases in body mass. Further, overall foraging effort was relatively low and scoters rarely foraged during nocturnal or crepuscular periods. Similar patterns were found at both study sites despite very different habitats and levels of human disturbance. These observations indicate that scoters are not nutritionally/energetically constrained during wing moult and that they do not rely heavily on reserves acquired prior to initiating wing moult. We also documented relatively high survival rates of both species during remigial moult. White-winged and Surf Scoters apparently select highly productive and safe nearshore marine habitats to accomplish post-breeding wing moult.”

**Daniel Esler; Jerry Hupp; Eric Anderson; Joseph Evenson; Jennifer Barrett**

### **P1-171 Olivia Kane**

#### **Feather-loss disorder in African and Magellanic Penguins**

“A new feather-loss disorder, first reported in African penguin (*Spheniscus demersus*) chicks in 2006 and in Magellanic penguin (*Spheniscus magellanicus*) chicks in 2007, reduced growth and, likely, survival. The disorder was more common in an African rehabilitation center than in the wild, suggesting that close contact and/or enclosed spaces facilitated the disorder. The cause is unknown. The disorder disrupted feather growth in both species, resulting in chicks with bare skin for several weeks. Feather loss caused most African penguin chicks to grow adult instead of juvenile plumage; Magellanic penguin chicks grew normal juvenile plumage. The development phase at which feather loss occurs may explain this disparity. African featherless chicks took 16 days longer to reach release weight than feathered chicks. Magellanic featherless chicks grew slower and were smaller than feathered chicks. In the African center, mortality rates were similar for featherless and feathered chicks in 2006 and 2007, but higher for feathered chicks in 2008. In 2008, the center admitted a higher percentage of young chicks that died before they lost their hatching down, which explains the higher mortality rate of feathered chicks. In the center, chicks had unlimited food and could stay until they were in good

condition, which likely contributed to featherless chick survival. Feather loss likely increases mortality in the wild because of the chick’s higher energy needs and longer rearing period.”

### **P1-172 Patrick O’Hara**

#### **Effects of sheens associated with offshore oil and gas development on the feather microstructure of pelagic seabirds**

“Operational discharges of hydrocarbons from maritime commercial activities can have major cumulative impacts on marine ecosystems and fauna. Seabirds are particularly vulnerable to the accumulation of hydrocarbons at the sea surface (i.e., slicks and sheens). Small quantities of oil (i.e., 10 ml) can result in a considerable, if not lethal, reduction in thermoregulation. Thin sheens of oil and drilling fluids form around offshore oil and gas production structures from operational discharges of hydrocarbons (produced water), and many species of seabirds are attracted to these structures increasing their exposure to these thin sheens. In this study, we developed a methodology to measure impacts of thin sheens on feather microstructure (Amalgamation Index or AI). We compared impacts of thin sheens of varying thicknesses of both crude oil and synthetic lubricant on feather microstructure collected from two species commonly found in Atlantic Canada: Common Murres (*Uria lomvia*) and Dovekies (*Alle alle*). We found that feather weight and microstructure changed significantly for both species after exposure to thin sheens of crude oil and synthetic drilling fluids, and that impacts increased with sheen thicknesses, except for dovekie feathers exposed to sheens from synthetic drilling fluids. Our results indicate that seabirds may be impacted by oil sheens that form around oil and gas production facilities in Atlantic Canada from produced water containing currently admissible concentrations of hydrocarbons. Our study did not address linkages between feather damage from thin shins and risk to individuals and populations, future research is needed to determine if current regulations are sufficient to protect marine avifauna and habitats associated with this industry.”

**Lora Morandin**

### **P1-173 Ellie Owen**

#### **Sampling avian adipose tissue: Assessing a non-destructive biopsy technique**

“Adipose tissue samples can provide valuable information about the physiology, foraging ecology, and toxicology of birds. However, despite these varied applications, to date, no procedure for taking adipose samples from live birds has been described in detail, nor assessed for potential adverse effects. We describe a non-lethal method for collecting adipose tissue from adults and chicks of Black-legged Kittiwakes (*Rissa tridactyla*), Common Murres (*Uria aalge*), and Northern



Fulmars (*Fulmarus glacialis*), and assess the short- and longer-term effects of the procedure. Biopsies were carried out in the field using topical anaesthetic and samples were taken from the synsacral region. Only two of 283 birds sampled (0.7%) had too little adipose tissue to be sampled successfully. Thirty-two kittiwakes were recaptured at varying intervals after the procedure (3-50 days) and the biopsy site inspected carefully. No signs of infection were observed and wounds healed completely within six days. Compared to birds captured for routine banding, biopsied kittiwakes showed neither greater weight loss nor reduced breeding success in the year of sampling. Similarly, recapture rates of biopsied birds in subsequent years were similar to those of individuals that had been blood sampled or banded. Our results suggest that collecting samples of adipose tissue by non-destructive biopsy has no more effect on birds than taking blood samples via syringe. Thus, we recommend non-destructive adipose tissue sampling via biopsy as an effective alternative to lethal methods in studies of wild birds.”

**Francis Daunt; Sarah Wanless**

### **P1-174 Elizabeth Phillips**

#### **A comparison of methods for age estimation of seabirds**

“To characterize population-level impacts of seabird mortality from fisheries bycatch, oil spills, and periodic die-offs, an accurate estimate of the demographic composition of birds affected is paramount. Seabird age and sex ratios are useful for summarizing disproportionate mortality in a group of birds (e.g., adults) and can direct further research towards elucidating reasons for the mortality and possible mitigation measures. Several indices are used to estimate approximate age in dead seabirds, including maturity of the gonads (length and width of gonad in both sexes, diameter of largest follicle and oviduct development in females), size and description of the bursa of Fabricius, plumage, molt limits, active molt of primary and body feathers, ossification of the supraorbital ridge and, in rare cases, band returns. We review and compare methods used to estimate age in seabirds examined ( $n > 1000$ ) at California Department of Fish and Game, Marine Wildlife Veterinary Care and Research Center, Santa Cruz, California, USA, and compare results among methods and species. A careful examination of all possible ageing variables will improve estimates of demographic impacts of mortality on seabird populations.”

**Hannahrose Nevins; Diana Humple**

## **Sampling Methods**

### **P1-175 Ken Wright**

#### **Cruise ships as platforms for seabird monitoring in the Southern Ocean**

“We propose that cruise ships employ a simple standardized seabird sampling protocol for monitoring at-sea distribution and abundance. This method consists of five time-constrained intervals (5 minutes). The Southern Ocean is home to a great diversity of Procellariiform (tubenose-bearing) seabirds. Many species of albatrosses and petrels are restricted to this highly productive body of water, several of which are experiencing long-term declines. These declines are especially evident in albatrosses (Diomedidae) and are attributable to fishery-related bycatch mortality. Each year numerous ecotourism-driven cruise ships traverse segments of the Southern Ocean. While the bulk of these ships cross the Drake Passage between Tierra del Fuego & the Antarctic Peninsula, others tour the subantarctic islands around New Zealand, the Falkland Islands, South Georgia and several other remote archipelagos including Tristan da Cunha. Most of these cruises have naturalists on board that are well-versed in seabird identification and natural history. We present data collected on a trans-Atlantic trip from southern Argentina to Cape Town, South Africa. We hope to promote this at-sea survey as a tool for monitoring populations of seabirds with high visibility (albatrosses, shearwaters and petrels) on cruise ships venturing across the Southern Ocean.”

**Craig Harrison**

### **P1-176 Ross Wanless**

#### **Surveys of seabirds at sea: Harnessing platforms of opportunity with a flexible, effort-based count methodology and an open-access, online database**

“There are a number of methods for at-sea surveys of seabirds. Methods such as line and band transects yield high quality distributional and ecological information, but require intense observations by highly skilled, dedicated observers. These methods are however not easy to use by non-dedicated observers. The rising popularity of nature cruises with seabird experts on board as guides, fisheries observer programmes, non-seabird research cruises and other ‘platforms of opportunity’ represent an excellent opportunity to gather data that is at present under-utilised. We present a relatively simple, flexible count methodology that records densities and reduces information to a unit density based on counting effort. Access to GPS data at sea is near-universal. This allows the time and area of sea covered by the count to be combined, regardless of how long, or over what area counts are conducted, including point counts (i.e. distance traveled is zero) at times of high diversity/abundance. Sitting and flying



birds are counted separately to account for flux. Registered contributors submit records to an online database that can accept records from across the globe. The online database refreshes within two hours of data uploads. A vetting committee reviews submissions to verify unusual records. A knowledge commons policy is in place to manage commercial use, but research and private use of Atlas of Seabirds at Sea (AS@S) data are free.”

**Michael Brooks; Phoebe Barnard; Kees Camphuysen; Timothy Dunn; Peter Ryan; Mark Tasker; Les Underhill; Andy Webb**

### **P1-177 Emily Wilson**

#### **Combining vessel surveys and satellite telemetry to assess seabird diversity and habitat associations in the Gulf of Maine**

“As highly mobile, energy-demanding, top predators in marine ecosystems, seabirds exploit predictable and ephemeral productive habitats. They respond rapidly to environmental change, and their conspicuousness and vulnerability to both oceanographic and anthropogenic change and perturbation make them robust bio-indicators of the ocean environment. A wealth of multi-species data on diversity, distribution, seasonal changes and the abundance of seabirds was collected from vessel surveys in the Gulf of Maine during the late 1970s to the early 1980s. This information will be used as baseline data for contemporary comparisons. Since the 1980s, fisheries activities and global climate change have greatly impacted the Gulf of Maine and adjacent waters and decadal comparisons are needed to understand subsequent changes in seabird biodiversity and habitat use. Survey and telemetry data will be used in comparisons to evaluate changes in biodiversity and distribution. We are testing habitat models through spatial analysis of environmental characteristics for different seabird species. We are satellite tracking Greater Shearwaters during summer when they are the most abundant seabird in the Gulf of Maine, historically and currently. Determining the movements and foraging habitat of dominant seabirds will help locate important feeding sites for many species. This information can be used to model high use areas in the Gulf of Maine.”

**William Montevecchi**

### **P1-178 Tracee Geernaert**

#### **Bird counts during fish surveys ñ Does the relative abundance of three albatross species correspond to population trends?**

“Since 2002, the International Pacific Halibut Commission (IPHC) has been observing and recording seabird occurrences during its annual standardized halibut stock assessment survey. The survey takes place from May to August and covers the Pacific coast from southern Oregon through

Canada and into the Bering Sea. The number of stations where bird counts were performed ranged from 1,218 to 1,260 annually, with a total of 9,924 counts over eight years. IPHC samplers recorded abundance and bird species seen within a 50-meter radius of the vessels’ stern. Over 460,000 birds representing over 30 species have been recorded since 2002. Three albatross of concern were regularly sighted; Black-footed (*Phoebastria nigripes*), Laysan (*Phoebastria immutabilis*), and Short-tailed Albatross (*Phoebastria albatrus*). Black-footed Albatross were more commonly observed throughout Washington and Oregon but ranged northward into the Gulf of Alaska. Laysan Albatross were seen in greatest numbers in the central and western Aleutian Islands, and rarely sighted east of Kodiak Island. A total of 153 endangered Short-tailed Albatross were also sighted in the Gulf of Alaska and regions westward. We compared IPHC estimates of relative abundance for these three albatross species against independent estimates of world population trends. None of the three albatross showed significant decreasing or increasing trends over the eight years of IPHC count data but the results were confounded by timing of the surveys and observer experience. With continued, consistent gathering of these data for all species seen, trends in abundance may be determined that will help predict a species decline or recovery.”

### **WITHDRAWN P1-179 Richard Tkachuck**

#### **Density analysis of breeding seabirds**

“A species density analysis was performed to determine which coastal areas and small geographical units (islands, etc) demonstrated the largest number individual species (not the number of individuals within a species.) Using an ArcInfo, areas of the largest species diversity were determined by an overlap analysis. Areas of greatest species densities were determined. The results of this study will be used to determine which areas are most vulnerable to ecological disasters such as oil spills or to environmental changes such as overfishing or sea level rise.”

### **P1-180 David Fifield**

#### **Comparison of detectability of flying birds at sea using point count and line transect distance sampling frameworks**

“Knowledge of the distribution and abundance of seabirds at sea is essential for marine conservation planning, environmental assessment and emergency response. Modern at-sea surveys often employ distance sampling to account for variable bird detectability, thereby furnishing estimates of absolute abundance. A line transect framework is typically employed whereby perpendicular distance is measured to each bird. Flying birds and birds on water that move as the vessel approaches require perpendicular distance to be estimated ahead of the vessel. This can be accomplished by measuring



radial (i.e., direct) observer-bird distance in addition to the angle from the transect line to the bird. Alternatively, a point count distance sampling framework can be used whereby a series of circular plots are surveyed along the transect requiring only radial distance (and no angle) for each bird, simplifying the measurement procedure. Our objective was to compare detectability estimates for flying birds using line transect and point count frameworks. We conducted at-sea surveys using the snapshot method for flying birds under each framework. We employed a small number of distance categories and accounted for covariates including observer, vessel and environmental conditions. Detectability was more variable and often lower using the point count framework compared to line transect methods. We discuss the interactive effects of the choice of inner distance band size and species specific response behaviours on detectability (and hence abundance) estimates under each framework.”

**Carina Gjerdrum**

### **P1-181 Beth Gardner**

#### **Estimating occupancy and detection of multiple species from repeated aerial count data**

“Aerial surveys of seabirds are difficult to conduct and often ignore estimation of detection probabilities and spatial variability, both of which are fundamental components of sound population sampling. Detection probabilities can vary greatly over time, space, and by species, and can be influenced by habitat, environmental, and other covariates. Typical datasets, even those from terrestrial monitoring programs, contain only limited data for a portion of the species occurring in an area, while some species are never detected. This is true of most aerial surveys of seabirds, where many rare, elusive, and hard-to-detect species occur in the survey area. In this study, we describe a hierarchical model where data from individual species are combined to estimate occupancy, detectability, and species richness for surveys conducted on seabirds off of Nantucket Sound, Massachusetts (USA). We developed an extension of current hierarchical community models that accounted for survey effort and spatial correlation. We examined over 20 species including Long-tailed Ducks, Northern Gannet, and Roseate Terns. Our results show that the probability of detection varies by species, with some species having a maximum probability of detection of 0.03 while others were as high as 0.95. For many species, detection probability was found to be a quadratic function of survey date. These results allow us to make inference about survey design (timing and number of replicates needed), as well as which species are best surveyed using aerial methods.”

**Allan O’Connell; Andrew Gilbert**

### **P1-182 Libby Megna**

#### **Mathematical model of habitat occupancy for Pigeon Guillemots**

“Pigeon guillemots (*Cephus columbus*) breed in colonies along the west coast of North America. Adults feed by diving to the seafloor beneath inshore waters. Temporal patterns of habitat occupancy, whether on land or water, however, have been little explored. Guillemots in the water off of the south side of Violet Point, Protection Island, Washington, USA, were counted hourly during the breeding seasons of 2006, 2007, and 2009. Time of day, tide height, current speed, solar elevation, temperature, wind speed, humidity, and barometric pressure were also recorded. Compartmental models were constructed from all combinations of the environmental variables and evaluated using information-theoretic techniques. Before egg-laying, the best model was a function of hour of day ( $R^2 = 0.75$ ) and predicted that numbers of swimming guillemots decrease with hour of day. The best model for summer data was a function of hour of day, solar elevation, and current speed ( $R^2 = 0.5$ ) and predicted that numbers of swimming guillemots increase with increasing current speed and decrease with increasing hour of day. All models failed for 2007, an El Niño year, perhaps due to low guillemot numbers.”

**Shandelle Henson; James Hayward**

### **P1-183 Steffen Opiel**

#### **Comparing four different modelling techniques to predict the spatial distribution of Balearic Shearwaters (*Puffinus mauretanicus*) off the coast of Portugal**

“The distribution of pelagic seabirds at sea is logistically challenging to study, yet knowledge about the spatial distribution is important for management and conservation. Increasingly complex statistical models are now available to relate the occurrence and abundance of pelagic seabirds to environmental variables. Here we compare the spatial distribution of Balearic Shearwaters (*Puffinus mauretanicus*) along the coast of Portugal as predicted by four different modelling techniques: traditional generalized linear models (GLM), RandomForest (RF), boosted regression trees (BRT), and Maximum Entropy (ME). We collected data from 2004–2009 over a total of 63,343 km of ship transect surveys, and noted the presence or absence of Balearic Shearwaters in 4 x 4 km pixels. We then acquired remote sensing information on bathymetry and monthly averages of sea surface temperature and chlorophyll a concentration from online databases, and calculated the distance to the nearest coastline for each pixel. Based on those environmental predictor variables we estimated the probability of occurrence in each pixel with the four different methods and graphically compared the predicted distribution pattern. We used cross-validation to assess the predictive ability of the four models, and found that



GLMs had the lowest predictive ability. The algorithmic techniques RF, ME, and BRT resulted in much more accurate predictions than GLM. These results indicate that the appropriate choice of a model to predict the spatial distribution of seabirds at sea is important if such data form the basis for the establishment of marine protected areas or fisheries exclusion zones. We encourage seabird ecologists to adopt machine learning methods to predict the spatial distribution of seabirds.”

**Ana Meirinho; Ivan Ramirez**

### **P1-184 Grant Humphries**

#### **Forecasting at-sea distributions: A digital seabird observatory?**

“Many seabird species are of serious conservation concern due to a variety of anthropogenic or climate-related forces. Currently, there are a number of efforts being undertaken to understand many of these species on global and local scales. In order to manage species of concern successfully on a global scale, it is imperative that we understand their distribution at-sea so that we may better predict the impacts of future climate change or human influence. Spatial modeling using Geographic Information Systems (GIS) is a technique being used worldwide with great success. One of the major advantages of this type of modeling is that software tools can be programmed to run automatically, and to harvest data from online sources. Currently, global scaled forecasting systems (Integrated Ocean Observing System - IOOS, Global Earth Observation System of Systems - GEOSS) are in place, using open access philosophies to deliver high quality products to the public. Using well established spatial modeling techniques, it is possible to harvest pelagic survey data from a proposed global seabird database to create forecasts of seabird distribution. These statistically rigorous distribution models would be produced online and delivered to the public with full acknowledgements to those who contributed to creating the models by delivering their data. We will discuss the science behind spatial models, their assessments, and data mining as well as the how, and why we should move towards forecasting at-sea distributions of seabirds.”

**Scott Hatch; Falk Huettmann**

### **P1-185 Maite Louzao**

#### **Retrospective modelling of pelagic habitats: Changes in the foraging range of an oceanic predator over the last half century**

“Within the current global change scenario, most spatial modelling studies have been directed to project species distributions in the next decades in order to understand how key habitats might change. However, it is also important to establish historical distribution ranges in order to provide baseline conditions that help understand distribution shifts.

Here, we focused on pelagic ecosystems, undoubtedly the largest ecosystem on Earth. Specifically, we built an integrative modelling approach to sculpt the foraging patterns of an oceanic predator, the Wandering Albatross *Diomedea exulans* in the southern Indian Ocean over the last half century. Thanks to the development of the OPA-PISCES oceanic models, accurate oceanographic data have been produced from 1958 until 2001, when satellite imagery was not available. We first validated modelled oceanographic data for the period 1998-2001 with available concurrent satellite imagery (surface temperature and height, and chlorophyll a), which were highly correlated. Secondly, we developed habitat models based on albatross foraging patterns (via tracking devices) with both oceanographic datasets, which predictions reasonably matched observations. Finally, the development of robust mathematical tools allow us project the most likely historical key pelagic habitats of this oceanic indicator species over the last 50 years and, ultimately, understand the distribution shifts that some predators are experiencing in the changing Southern Ocean.”

**Henri Weimerskirch**

### **P1-186 Daisuke Kawai**

#### **Seasonal distribution and abundance predictions of seabirds in British Columbia using random forests**

“Characterizing spatial distribution and abundance is essential for understanding the ecology of species and assessing risk factors relating to adverse influences from human activities. Accordingly, traditional regression models are often used to predict animal abundance and distribution. Although favoured for development of spatially explicit predictive models, several methodological problems associated with regression models are unresolved. Consequently, new data mining approaches deemed more robust than traditional regression models are now being used in other fields such as economics and medical science. Random Forests is a data mining and ensemble algorithm developed by Breiman (2001), which has shown outstanding performances for its predictive accuracy, modelling efficiency, and stability. We conducted systematic transect surveys for seabirds in the coastal British Columbia from 2005 to 2008. We applied detection function models to estimate densities of animals on transects. Then, abundances and distribution surfaces were constructed by using Random Forests with freely available environmental data as predictors. Finally, distributions and abundances were predicted for each survey season and assessed for accuracy.”

**Patrick O’Hara; Caroline Fox; Paul Paquet; Falk Huettmann**



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