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6 – 10 September 2004

Abstracts Book

Edited by
Pablo Yorio
Flavio Quintana
Adrián Schiavini
Vth International Penguin Conference

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ORAL PRESENTATIONS

HUMBOLDT PENGUIN SPHENICUS HUMBOLDTI POPULATION IN CHILE: COUNTS OF MOULTING BIRDS, 1999-2004

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Regular counts of moulting Humboldt penguins Spheniscus humboldti have been made along the Chilean coast from Iquique (20°07'S) to Algarrobo (33°21'S), roughly 1800 km of coast, covering the main range and colonies of this species of penguin. The counts were conducted during February, when most penguins were ashore moulting, as recommended by the Population and Habitat Viability Assessment Workshop held in Oimue, Chile in 1998. From 1999 to 2004 counts were made at 29 to 31 localities, including colonies and roosting sites, and the estimated number of adult birds fluctuated from 25,490 to 34,321. Greatest numbers of moulting Humboldt penguin are concentrated on Chafaral (48%), Pan de Azucar, Grande, Pájaros, Choros and Cachagua Islands and the former Pájaros Chicken (Algarrobo). This research was done with the financial assistance of the Milwaukee County Zoo, the Zoological Society of Milwaukee, the Penguin TAG, the Humboldt Penguin SSP and Penguin Conference Japan for which we are grateful.

ENERGETIC COST OF CHICK PROVISIONING FOR ADÉLIE PENGUINS ON ROSS ISLAND, ANTARCTICA: FURTHER EVIDENCE FOR INTRASPECIFIC COMPETITION AND TOP-DOWN FORCING

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We studied the energetic cost of foraging trips for 40 Adélie Penguins (Pygoscelis adeliae) at Cape Crozier on Ross Island, Ross Sea, Antarctica, during the breeding seasons of 2000 and 2002. We used doubly labeled water to measure CO2 production and radio transmitters to precisely measure foraging trip duration. Foraging trips ranged from 0.8 to 6.7 days, with a mean of 2.71 ± 0.22 days. All but 6 birds gained mass during these trips, with a mean mass change of +424 ± 70.4 g per trip. Metabolic rate during these trips ranged from 2129 to 8581 kJ/day, with a mean of 5306 ± 201 kJ/day, and was significantly dependent on mass gain during the trip, the greater the mass gain, the higher the metabolic rate. Diet, colony, and trip duration did not significantly affect metabolic rate. Total energy expended during a trip ranged from 2195 to 38,063 kJ, with a mean of 14,774 ± 1392 kJ, and was significantly affected by diet, colony, and trip duration, but not by mass change during the trip. Several decades of research confirm that penguins at Cape Crozier may experience intraspecific competition as the breeding season progresses. Specifically, they switch prey from krill to silverfish, foraging distance and time away from the colony and depth of foraging dives increase, food loads decrease, and penguins from smaller colonies are excluded from foraging areas used by Crozier birds. Our results here, that total energy expended during a trip is dependent upon trip duration, imply that penguins breeding at Cape Crozier expend more energy to provision their chicks than penguins at other colonies on Ross Island. We believe this adds to the increasing evidence that intraspecific competition is a significant factor at large colonies, and that top-down forcing by predators causes changes in this ecosystem.

THREE-DIMENSIONAL FORAGING EFFORT OF BREEDING ADÉLIE PENGUINS IN RELATION TO SEX, COLONY, SEASON, AND TIME WITHIN SEASON

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Foraging locations and diving behavior of Adélie penguins (Pygoscelis adeliae) provisioning chicks were recorded at three Ross Island colonies ranging in population size by three orders of magnitude, 2000-2001 to 2003-2004. Foraging locations, determined using satellite transmitters, varied between and within season, and among colonies, but no consistent differences were apparent between males and females. Maximum distances to foraging locations of 11 individuals ranged from 1-156 km, with a mean of 44 km. Foraging trip distance was greatest and tended to increase as the season progressed at Cape Crozier, the largest colony, but not at the smaller colonies, Cape Bird and Cape Royds. Depths of foraging dives ranged from 6-138 m and durations ranged from 30-235 s. Diving behavior varied significantly with colony, breeding season, time within season, sex, individual, and light level, though colony differences were the most important. Dive duration and depth increased within seasons, especially at Cape Crozier. Results suggest that competition for food in some colony-seasons decreases food availability near colonies.

COPEPHYLOCENETIC RELATIONSHIPS OF PENGUINS AND THEIR CHEWING LICE

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Fahrenheit’s rule suggests that parasites with few means of transferring between hosts should speculate in response to their hosts speciating and thus the phylogeography of the parasites should mirror the phylogeography of the hosts. Chewing lice are small, obligate ecto-parasites of birds and mammals living in the plumage or fur of their hosts. Lice are thought to have few means of transferring between host species as lice rely on close contacts that occur during mating or the brooding of chicks to transfer between hosts. Thus lice and their hosts should show high degree of cospeciation, i.e. the speciation of the hosts causes speciation of the parasites, because of the close links between lice and their hosts. The chewing lice of gophers are a “textbook” example of almost perfect host-parasite cospeciation. We reconciled a phylogeography derived from the third domain of the mitochondrial 12S rDNA and the mitochondrial cytochrome oxidase subunit 1 gene regions for 14 of the 15 species of chewing lice parasitising penguins to a penguin phylogeography estimated from four gene regions. We did not find perfect cospeciation. Genetic distances were used to evaluate support for the various cophylogenetic scenarios postulated from the analysis and suggested the most likely scenario is that there have been five cospeciation events, eight duplication events, 18 sorting events and four incomplete host switches in the lineage. The analysis was complicated by some louse species parasitising several species penguins and the distribution of some of the multi-host louse species is possibly due to failure to speciate (parasites not speciating in response to their hosts speciating).
AN UNEXPECTED PATTERN OF MOLECULAR DIVERGENCE WITHIN THE LITTLE BLUE PENGUIN (EUPYPTULA MINOR) COMPLEX

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The taxonomy of Eudyptula penguins has been subjected to extensive revision. In 1976 the blue penguin, E. minor and the white-flippered penguin, E. alboagrypis were reclassified as a single species with six subspecies based on a morphometric analysis. Despite the later deletion of the Eudyptula subspecies, following allozyme analysis of some populations, the subspecies classification has persisted in some popular and scientific literature. Many also still believe the white-flippered penguin to be a distinct species. The taxonomy of Eudyptula penguins is not just of academic interest as numbers of the white-flippered form of Eudyptula breeding around Banks Peninsula, New Zealand have declined dramatically, likely due to human impacts. We used the sequences of three mitochondrial gene regions (small ribosomal subunit, cytochrome b and the control region) from the six hypothesised subspecies to examine relationships within Eudyptula. We found evidence of two unexpected clades: the first consisting of Otago, New Zealand and Australian populations, the second consisting of Northern, Cook Strait, Chatham Island and Banks Peninsula, New Zealand populations. We found little evidence that the white-flippered penguin was genetically distinct and we also found little support for the subspecies classification of E. minor.

IMPACT OF THE TREASURE SPILL ON SURVIVAL AND BREEDING OF AFRICAN PENGUINS AT ROBBEN ISLAND

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Following the “Treasure” oil spill in 2000 around 18,000 adult African penguins (Spheniscus demersus) were oiled, caught, transported to rehabilitation centres, rehabilitated, cleaned, and released back into the wild. Since that time we have invested a lot of effort into resightings of these birds. Most of this effort has been concentrated on Robben Island and much of the work carried out by Earthwatch volunteers. Overall about 50,000 resightings of Treasure birds have been reported. Over 11,000 individual birds have been seen at least once since their release on one of the offshore islands. We are still continuing to see “new” birds, in 2003 over 800 birds were seen for the first time and in the first few months of 2004 a further 150 were found. We can use these data to estimate survival rates for these birds. For example, the survival rate for the banded, oiled adults on Robben Island is estimated to be 91% which compares well with previous estimates. 88-96% at St Croix Is from 1976/77-1981/82; 89 % at Dyer Is during 1979-85 (during a period of rapid colony decrease); 82-89 % at Robben Is in 1993/94, (but only 75 % in 1994/95, when ca 1000 birds died after being oiled in the Apollo Sea spill). Over 1,000 birds involved in the spill were juveniles, by following relative resightings of these birds we are able to look at the survival rate of birds of a known age. We present data that indicate that oiled birds breeding on Robben Island have poorer breeding success than un-oiled birds. At the time of the spill it was predicted that reduced breeding success might result from the extensive disruption of breeding pairs that was caused by the spill. If experience with breeding partners (rather than some long-term physiological impairment) is the reason for the reduced breeding success, we would expect breeding success of the oiled birds to improve year on year. This is being monitored.

DIFFERENCES IN BREEDING SUCCESS OF AFRICAN PENGUINS DEPENDING ON TYPES OF FLIPPER BANDS USED

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We have over the last four years been testing a range of designs of flipper bands made from silicon rubbers on African Penguins (Spheniscus demersus) on Robben Island. Each season we have studied three groups each of about 20 nests: one group had pairs of birds with no bands, the second group had birds with conventional steel bands and the third group pairs of birds with the new rubber bands. In each year we found that there was little significant difference in the breeding success of the three groups. In the first two years, we found that pairs with no bands had significantly lower breeding success. It may be that these birds were younger and less experienced breeders than those banded with metal bands. However, a large proportion of the birds on Robben Island in 2001 and 2002 had been banded in 2000 following the Treasure oil spill. We conclude that, if breeding success is used as a measure of the damage caused to African penguins by the wearing of flipper bands, then neither the currently used steel bands, nor any of the new rubber designs have been harmful during the 2001 to 2003 seasons.

THE MATING CONCERTO IN E.MINOR: SOCIAL AND GENETIC PATERNITY IN LITTLE PENGUINS

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The Little Penguin Eudyptula minor is a socially monogamous marine animal which breeds in loose colonies. Males dig, furnish and defend a nesting burrow in order to attract females for mating and breeding. Although Little Penguins form long-term pair bonds and co-operate in parental care, mate-switching occurs and extra pair copulations have been observed. Extra-pair fertilizations are common in other socially monogamous birds but have not been reported among Little Penguins. This study is designed to investigate the genetic reproductive success of male and female Little Penguins at a colony on Phillip island in south-eastern Australia. Using a combination of microsatellite molecular markers, electronic and audio-visual monitoring and field experiments we are investigating the breeding ecology of over 100 pairs of Little Penguins. We describe paternity and reproductive success and report on several aspects of mating behaviour including mate-choice, copulation frequency and male attendance from the 2003-04 breeding season.
FORAGING RANGES AND MIGRATION ROUTES IN SOUTHERN HEMISPHERE ALBATROSSES; TOWARDS MPA'S FOR PELAGIC SEABIRDS

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Albatrosses are the bird family most threatened with extinction, with 19 of the 21 species now globally threatened and the remaining near-threatened. Their extensive foraging and migration in the marine environment places them at risk from fisheries interactions, particularly the longline fishing industry which kills many thousands of birds annually. A network of Marine Protected Areas, particularly in the High Seas where many albatross species congregate, has been urgently identified by the IUCN. Until now, attempts to identify the at-sea distribution of threatened seabird species have been derived from distribution maps in field guides and regional handbooks. However, in terms of remote-tracking to reveal their at-sea distributions albatrosses are the most studied of all marine species. With this in mind, BirdLife International invited all holders of remote-tracking data for albatrosses and petrels to a Global Procellariiform Tracking Workshop, with the aim of identifying important foraging and migration areas for albatrosses and petrels. Although scientists have been tracking seabirds since 1990, to a large extent these studies have been taxonomically and geographically restricted. The development of a central database to integrate these studies will allow for the identification of key foraging areas and migration routes on regional, global and seasonal scales. Here we describe the interim results of the workshop. These illustrate how at-sea distribution data from remote-tracking studies of seabirds can contribute to the development of criteria for defining important Bird Areas in the marine environment and current initiatives for the establishment of high seas Marine Protected Areas.

FLIPPER BANDING MAGELLANIC PENGUINS: Do BANDS REDUCE SURVIVAL?

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Researchers remain concerned over damage caused by bands. Many Antarctic penguins have died because of improper bands. We double banded 150 pairs of breeding Magellanic Penguins in October and November 1993 (during egg laying or early incubation) using one of three types of individually numbered identification. Individuals were double marked with either a band on each flipper or two mouse ear tags in the outer web of the left foot. Fifty pairs were double banded with both bands made by Gey Band and Tag Company (Webtag). Nests of banded birds were individually and permanently marked, and were within a 50 square meter area to facilitate thorough searching. Two to six people searched in and around the area for marked birds four to five times each year between October 1993 and February 2004. By January 1994, several of the Antarctic bands were 1mm open, or turned around on the flipper. In October 1995, we removed all Antarctic bands found: more bands were open or turned around on the flipper, and we found eight Antarctic banded penguins dead, some in their nests. In one case the Antarctic band had pierced the flipper. We found no penguins with Antarctic bands after 1995. In contrast, Stainless bands had not opened, turned around, or been lost. One penguin lost an improperly attached Webtag during the study. Clearly, all bands are not equal. In the 2003-2004 season we checked the area 4 times between October and February and found 13 penguins with two Stainless bands (5 males and 4 females), and 18 double Webtagged penguins (9 males and 9 females). After ten years, double Stainless banded breeding penguins had a 13% survival rate and double Webbagged breeding penguins 18%, which was not significantly different (chi-square = 0.49, P = 0.49).

THE AFRICAN PENGUIN: A RECIPE FOR PRODUCING FLEDGLINGS?

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One prevalent idea in avian ecology is that parental energy expenditure is substantially elevated during the breeding season so that reproductive success may be limited by the maximal daily energy that parents are able to expend whilst finding food for both themselves and their young. For seabirds this may especially be true because breeding and foraging areas are spatially separated and food abundance in pelagic habitats is low compared to most terrestrial habitats. The globally vulnerable African penguin (Spheniscus demersus) inhabits inshore marine waters and feeds mainly on pelagic fish such as Sardines (Sardinops sagax) and Anchovy (Engraulis japonicus capensis). These stocks are distributed over a narrow zone along the southern African coastline characterised by an intensive upwelling of deep nutrient-rich cold water. The Benguela ecosystem. The location and intensity of upwelling vary locally within and between years, which is likely to affect the birds' foraging costs and success and thereby breeding productivity. In this study we quantitatively establish such a link between the Benguela productivity and penguin reproductive success. The breeding colony of African penguins at Robben Island (33°49'S, 18°22'E) was studied between March and August 2004. Because parental budgets are intimately bound up with the energetic requirements of their growing young, chicks were followed from hatching to fledging at 5-day intervals to construct growth curves. Simultaneously satellite imagery measured sea surface temperature and phytoplankton density as a proxy for food availability and therefore parental feeding conditions. These data were then used to understand daily patterns in chick instantaneous growth rate and the number of fledglings produced. For a subset of chicks, daily energy expenditure (DIE) was measured using the doubly labelled water method and resting metabolic rate (RMR) was determined using a flow respiratory. Comparisons of DIE and RMR give insight in the energy chicks spend on thermoregulation and activity and can be used to calculate their metabolic scope. The obtained values are compared with those of other penguin species at other locations to study latitudinal gradients.

CAN PENGUINS WALK A STRAIGHT LINE?

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We followed 105 Magellanic penguins (Spheniscus magellanicus) at Punta Tombo, Argentina as they returned to their nests recording their GPS positions along the route, distance walked, total walking time, sex, and nest contents. Penguin routes are highly directional. We measured straightness by plotting the 4 or more GPS coordinates in decimal degrees on an XY graph for each penguin and used the r value to determine straightness (average r for all areas is 0.980, n= 82, routes with more than 4 coordinates used). Routes with more obstacles such as large bushes or rough topography had a smaller r values than routes without obstacles, though not statistically significant (Door 2 = 0.977, Door r = 0.975, ANOVA: F = 1.39, df = 2 and 74, Fa = 0.05 crit = 3.12). In areas with obstacles (e.g. large, dense bushes) penguins take longer to arrive at their nest than in unobstructed areas. Penguins passing through areas with the most obstacles, had a significantly slower average speed of 0.247 m/s, and than penguin that walked through two areas that had small bushes (average speed of
population declines, particularly of penguins and albatrosses. Populations are declining.
Maintaining ecological viability requires moving beyond single-species or taxon efforts towards
an ecosystem approach to management that includes multiple jurisdictions, including
international waters. A zoning strategy is urgently required, with priority-use zones and sectors
under particularly precautionary management. Science must be at the foundation of this
process. We report on an international cooperation effort to attempt to integrate data on top
predators with oceanographic, jurisdictional and human-use information for the entire system.
A Geographic Information System was created, containing over 170 data sets on the distribution
and status of the regions habitats, resources and biodiversity. This has been used to develop a
seascape species approach as a conceptual model for conservation planning. The vision is to
use the data and approaches to define, in space and time, critical habitats, states and processes
as a basis for the development of a comprehensive system of environmental protection and
sustainable management (e.g. including Marine Protected Areas, environmentally sensitive
areas/special management zones etc), of the region’s resources.

LITTLE PENGUINS AND LARGE BOATS: A STORY OF COEXISTENCE

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Within the last twenty years, a small colony of Little Penguins has established amongst a
limestone retaining wall on Garden Island, Western Australia. This island is a base for the Royal
Australian Navy and the colony is bordered on one edge by a wharf where large naval vessels
dock. Cockburn Sound, a large embayment adjacent to the colony and through which the
penguins must travel, is the busiest in Western Australia and one of the busiest in Australia.
Apart from the naval vessels, it is extensively used by large ships associated with the eight
major industries that have developed on the eastern shore such as an oil refinery, alumina
refinery and fertilizer plant. Five commercial fishing industries operate within the Sound and it is
also an important area for recreational use such as skiing, PWCs, recreational fishing and
boating. From May 2001 - Feb 2003 nest sites within the colony were studied weekly and night
counts were conducted once a month. Various population parameters of the colony were
assessed. Comparisons in annual cycle and breeding success were made between this colony
and a representative group of the colony on Penguin Island, the largest in Western
Australia and less than 10 km south of Garden Island. The success of single clutches in
Garden Island colony averaged 78% over the three years, this was greater than that for
Penguin Island. A higher proportion of penguins on Penguin Island only laid a single clutch.
In 2003 41% of pairs successfully raised two clutches on Garden Island compared to less than 1%
of the nestbox population on Penguin Island. At least two-thirds of the penguins arriving back at
the Garden Island colony did so within 40 minutes after sunset. As Little Penguins are visual
hunters, it is presumed that the sunset arrival back at sunset indicated they were
foraging close by. The ramifications of this will be discussed. Problems associated with studying
such a cryptic colony as well as various management issues and recommendations for this
colony will be discussed.

STABLE ISOTOPEs OF CARBON AND NITROGEN AND THE TROPIC ECOCeLOGY OF
PENGUINS

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Stable isotope measurements of carbon (13C/12C, δ13C) and nitrogen (15N/14N, δ15N) in
proteins have been used as dietary tracers in seabirds, and recent investigations also show that
they have the potential for locating moulting areas of migratory species. δ13C indicates inshore
or benthic versus offshore or pelagic feeding preferences of predators, while δ15N is an
CALL DISCRIMINATION IN MAGELLANIC PENGUINS (SPHENISCUS MAGELLANICUS)

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Vocalizations in Magellanic penguins (Spheniscus magellanicus) are a key component of mate selection, pair bonding, and parent-chick and agonistic interactions. Call discrimination is important in colonial nesting birds, and I predicted that Magellanic penguins should exhibit call discrimination. However, few studies have addressed the roles of vocalizations in the genus Spheniscus and on Magellanic penguins in particular, and the literature contains almost no experimental research on call discrimination in these species. To test for the presence of call discrimination, I played previously recorded male display calls – used primarily by males for mate attraction – to incubating females using a computer running Syrinx software and a pre-amplified speaker placed approximately two meters from the subject's nest matched by ear to the loudness of the display calls under natural conditions. These tests included randomized calls of a neighbor, a stranger, and the female's mate. All calls in each playback set were matched for length, clarity, and volume. After males relieved the females at the nest and assumed incubation duties, I played the same playback sequence to the males. To further explore call discrimination, I used a different call: the duet performed by breeding pairs. The pair duet is a bonding call, usually performed on reunion at the nest. I played randomized calls of a pair's own duet and that of a stranger pair to incubating males. I ranked individual responses to each playback using an ordinal scale of 0-7. Response categories included head orientation toward call source, response calls, movement toward call source, etc. I found that females discriminated between the display calls of mates versus strangers and mates versus neighbors, but not between calls of strangers and neighbors. Male discrimination response to display calls was weaker, but still significant. Male response to pair duets was strong, showing highly significant differences in response to their own duet versus a stranger pair's duet. The results of these playback experiments suggest that Magellanic penguins can discriminate between intraspecific individual calls.

CLIMATE, OILING AND TRENDS OF PENGUIN POPULATIONS IN SOUTH AFRICA AND AT THE PRINCE EDWARD ISLANDS

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Off western South Africa, numbers of African Penguins Spheniscus demersus increased from 1998 to 2002 (after a decrease that had persisted for about 70 years) and then decreased in 2003. The increase resulted from a high availability of food caused by exceptional recruitment of forage fish species after the ENSO event of 1997/98. The decrease in 2003 was most apparent at stands where large numbers of birds were oiled and breeding was severely disrupted in 2000, after the sinking of the Treasure. It is likely to have arisen from poor recruitment of first-time breeders to these penguin colonies in 2003. Four species of penguin breed at South Africa’s subantarctic Prince Edward Islands: King Penguin Aptenodytes patagonicus, Gentoo Penguin Pygoscelis papua, Macaroni Penguin Eudyptes chrysolophus and Rockhopper Penguin E. chrysocephalum. There were large decreases in numbers of Gentoo and Rockhopper Penguins after 1995. Numbers of Macaroni Penguins probably also decreased. Reproductive success of these birds is thought to have been inadequate to maintain populations and was probably influenced by a reduced availability of food to the island where sea surface temperatures have increased. Other seabirds foraging closer to the islands also decreased. Numbers of King Penguins, which forage far from the island, may have increased, perhaps as a result of an increased availability of mysids.
FORAGING DECISIONS OF MACARONI PENGUINS AT SOUTH GEORGIA

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Macaroni penguins (Eudyptes chrysocome) are an abundant predator around South Georgia; major colonies, such as the Bird Island colony, can contain up to 2.5 million pairs breeding each summer. Parents remain within the vicinity of the colony during the breeding season because of the pressure to protect and feed their growing chick. This is particularly the case during the guard stage, when the father guards the chick whilst the mother has the sole responsibility of providing it with regular meals. Antarctic krill (Euphausia superba) are the preferred prey-items during chick rearing and studies have shown that success at this stage is strongly dependent on the mother’s ability to find them. A state dependent programming (SDP) model was created to examine the foraging decisions of the mother during the 23 days of the guard stage. The model was parameterised using available data on energetics and behaviour of macaroni penguins. Optimal foraging decisions were predicted under different scenarios of krill availability, reflecting their observed variability in space and time. Female macaroni penguins were predicted to travel to areas where the availability of krill was more reliable, even considering a relative increase in the energetic costs of travelling there. Within the context of South Georgia, this means that more females head out to the shelf-break, where the krill are distributed in extensive, dispersed swarms that are easy to find, rather than remain in continental shelf waters, where krill swarms are relatively tight and hard to locate. These predictions agree with observations made with satellite tags and time depth recorders. The modelling approach has enabled predictions of how foraging in macaroni penguins may change under various scenarios of climate change, through impacts on krill abundance, the length of the productive season, and temperature. The approach has also highlighted areas where further targeted fieldwork may improve our understanding of penguin behaviour, such as the better parameterisation of chick growth rate.

POPULATION REGULATION IN LITTLE PENGUINS EUDYPTULA MINOR

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Although studies of seabirds have had a fundamental influence on development of theories of population regulation, the role and importance of potential factors regulating seabird populations remain unresolved. Here we examine the potential effects of the abundance and availability of breeding sites and food availability in the breeding season on populations of Little Penguins Eudyptula minor in south-eastern Australia. Correlations between population size on islands and available breeding area suggest that Little Penguins may be limited on smaller islands by area. On larger islands, nesting sites do not seem to be a limiting factor. Food supply is commonly thought to be a significant limiting factor regulating seabird populations but difficulty in measuring prey availability has meant that direct evidence is lacking. Little Penguins have very short foraging ranges and thus may be particularly likely to experience density-dependent food shortages when breeding. We found support for Ashmole’s “halo effect” in that there was 1. an inverse relationship between colony size and mean mass of chicks near fledging, and 2. apparent depletion of prey within the daily foraging range of breeding penguins. However, more recent variations of this model (e.g. the "hungry hordé", or "hinterland") do not explain the observed distribution and numbers of penguins breeding in Victoria. We conclude that intraspecific competition for both nesting sites and food during chick rearing may be involved in the regulation of Little Penguin populations, and propose an elaboration of Ashmole’s model in which the area available for nesting is combined with intraspecific competition for food during breeding as determinants of population size.

THE COURTSHIP AND INCUBATION BEHAVIOUR OF ERECT-CRESTED PENGUINS

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Erect-crested penguins (Eudyptes sclateri) are the least-studied of all penguins. Here we present the first detailed analysis of the breeding behaviour of these enigmatic penguins. All occurrence sampling was used to record fighting, copulatory behaviour, egg-laying and egg loss in a study colony of 139 nests during the day/night hours from 29 September to 22 October. In addition, the behavioural states of birds in 19 nests in a sub-section of the colony were sampled using instantaneous scan sampling every 15 minutes over the same period. Measurements of adult penguins and their eggs confirmed a marked sexual dimorphism and an extreme egg-size dimorphism: characteristics that have been hypothesized as being associated with high levels of competition and fighting. However, contrary to the prevailing view of many crested penguins, erect-crested penguins do not exhibit high levels of fighting or competitive behaviours. While the behavioural repertoire of erect-crested penguins is similar to that of other penguins, frequencies of occurrence and activity budgets can be quite different. In part this probably reflects phylogenetic differences in breeding schedules but it is less likely to reflect the differences that ecological factors play in determining life history strategies and, ultimately, behaviour.

HEART RATE RESPONSES OF INCUBATING AFRICAN PENGUINS TO PEDESTRIAN APPROACHES

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The behavioural responses of African Penguins (Spheniscus demersus) to humans have been variously described. Physiological responses to disturbance may, however, be unobservable in the absence of overt behavioural indicators, providing valuable information regarding the sensitivity of wildlife to disturbance stimuli. Physiological changes in parameters such as heart rate have not yet been reported for African Penguins. As part of a broader study investigating the effects of ecotourism on this species, we measured heart rates of incubating birds in response to controlled pedestrian approaches. The study was restricted to incubating penguins with sheltered nest sites under Tetragonia shrubs on Dassen Island, Western Cape Province, South Africa. Real eggs were removed from nests and kept in an incubator for the duration of experiments. Artificial eggs containing FM transmitters were introduced into nests, and heart rates were recorded at a distance using FM receivers and dictaphones. Each nest was then approached twice by a single person on foot. An approach was terminated either when the approacher was first within sight of the breeding bird, or at five meters from the nest. Heart rates were monitored immediately following egg deployment, and before, during and after each approach. Nineteen penguins were approached. Heart rate increased significantly in response to being approached, with stronger responses recorded upon approach to 5 m than to the position in first sight of a bird. Heart rate increases were transitory, and heart rates dropped once the approacher retreated to a position out of sight of the birds. The heart rate responses of individual African Penguins were highly variable, suggesting that management of tourist visitation to breeding birds at Dassen Island should be precautionary.
EFFECT OF FLIPPER-BANDS ON THE FORAGING BEHAVIOR AND SURVIVAL OF ADÉLIE PENGUINS ON ROSS ISLAND

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It has been proposed that penguins, banded on the flipper, exhibit significantly lower annual survivorship or incur higher energetic costs during at-sea travel than do unbanded individuals. We investigated these issues over a four-year period, austral summers 2000-2001 to 2003-04, as part of a study of the ecology and breeding/foraging effort of Adélie Penguins (Pygoscelis adeliae) on Ross Island, Antarctica. We compared results between one group in which penguins were identified by a flipper band and an RFID tag and another group in which individuals were identified only by an RFID tag. The flipper bands were of the 'Boersma design,' which are more rounded than those used on Ross Island in studies during the 1960-70s. The RFID tags, approximately 1 x 14 mm in size, were injected under the skin of each penguin and were recorded remotely using a scanner. The latter was part of a system that also weighed each penguin whenever it arrived at or exited the study subcolony. In addition to comparing annual survivorship of these two groups, we also report on body mass changes, food load mass, and foraging trip duration of banded and unbanded penguins during the chick-provisioning period. If energetic costs of foraging are being affected by the bands, we would expect to see differences in the latter factors.

LAID-BACK OR DISTRESSED? PENGUIN RESPONSES TO HUMAN DISTURBANCE

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Penguins face ever increasing interest from humans, in the forms of tourism, research, and conservation management. Over the last two decades, there has been growing concern that human activity in the proximity of breeding sites may adversely affect penguin populations. But unlike the more overt human-induced impacts, such as habitat destruction and oil spills, the effects of human disturbance are less obvious and not easily assessed. Reviewing the literature, we consider the evidence for human disturbance induced impacts on penguins.

Recent data obtained for Humboldt and Snares penguins will highlight two extremes in apparent stress response to human proximity. During 2001-2003 we studied the responses to human activity of Humboldt penguins in the Humboldt Penguin National Reserve (Chile), where the rapid development of wildlife-tourism has been largely uncontrolled. We found that variation in breeding success reflects the different disturbance regimes on the reserve’s three islands. Heart rate telemetry experiments indicate that Humboldt penguins are extremely sensitive to the presence of humans, the average heart rate increase provoked by a person passing a nesting Humboldt penguin at a distance of 50m, is comparable to the maximum heart rate response observed in Gentoo, Adélie and Magellanic penguins when approached to 2.3m. In contrast, Snares penguins (Snares Islands, sub-Antarctic New Zealand) barely respond to human presence. Six weeks of intensive research during the 2003 breeding season, including handling of penguins and logging deployment, had no measurable impact on the penguins’ breeding performance. Close proximity of humans caused no heart rate reaction in Snares penguins as long as the person stayed outside the colony. Even when researchers entered a colony during a direct experimental approach to within 2m, some penguins showed no significant heart rate change.

A 9000-YEAR RECORD OF ADÉLIE PENGUIN OCCUPATION AND DIET IN THE WINDMILL ISLANDS, EAST ANTARCTICA

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We investigated 17 abandoned penguin colonies in the Windmill Island, East Antarctica, in summer 2002-2003. Forty radiocarbon dates on penguin bone and eggshell from 13 of these sites indicate a continuous occupation by breeding penguins in this region for over 9000 years. Dietary remains from these sites include at least 23 taxa of cephalopods and teleost fish. Quantification of these remains indicates significant fluctuations in the relative abundance of two of the more common major prey taxa. The Antarctic silverfish (Pleuragramma antarcticum) was the most common teleost prey during all time periods represented by the ages of the sites, but preservational factors may explain a gradual decline in this species in increasingly older sites. The most common cephalopod in the sediments was the squid, Psychroteuthis glaciale, which occurred in low numbers in most sites except one (Site 76). An unusually large number of squid beaks preserved in this site, dating to approximately 5677-6089 B.P. (calibrated to calendar years before present), does not correlate with a decline in fish prey or to any known climactic events. The large number of abandoned colonies (>200) in the Windmill Islands may be due to population cycles in the past as well as low nest-site fidelity and movement by breeding penguins to new sites within this region.

MANAGEMENT PLAN FOR PUNTA TOMBO: A PARTICIPATORY EXPERIENCE TOWARDS THE CONSERVATION OF THE MAGELLANIC PENGUIN

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Punta Tombo (Chubut, Argentina) is home to the largest known Magellanic Penguin colony in the world, with approximately 150,000 pairs breeding over 310 ha. Currently, only half of the area of the colony is under legal protection. Since 1979, when the colony was declared a Protected Area, tourist activity has increased annually from 5,000 to 60,000 visitors in 2003, with up to 1,400 visitors on peak days. Despite this strong increase in tourist visitation, the Managemen Plan has been installed to regulate activities and uses for Punta Tombo. In order to design a Management Plan for this area, a joint agreement was signed between the Chubut Tourm Secretary and the Project "Consolidation and Implementation of the Patagonian Coastal Zone Management Plan" (ARG02/G31), developed by Fundación Patagonia Austral, UNDP and the Global Environmental Facility. There are 90 stakeholders involved in designing the Management Plan, representing more than 20 governmental, academic and private institutions, NGOs, international and national research associations and the landowner, who is a
crucial stakeholder. The process is organized in working groups (legal, environmental, socio-economic and cultural), with periodic meetings and general workshops. The first phase focused on finding background information and characterizing the area. Based on this, advantages and disadvantages for the effective management of the area were identified. The vision for Punta Tombo defined by consensus stated: "Punta Tombo is a protected area for the conservation of its natural and cultural resources, particularly its important Magellanic penguin population, aiming at ensuring benefits for present and future generations". According to IUCN management categories, category II has been proposed: Protected area managed mainly for ecosystem protection and recreation. The initial diagnosis highlighted the need to redesign the protected present area boundaries in order to incorporate a marine component and to enlarge the land sector. Zoning plans were prepared according to the provincial legal framework, considering untouchable, restricted, sustainable, buffer and rehabilitation zones. At present the management programs are under design. The strength of this Management Plan lies in its participatory approach, involving a great number of stakeholders, and the existence of more than 20 years of scientific research on Magellanic penguins. It should become the fundamental tool for the management and use of this area, assuring the conservation of this natural resource of global importance.

CHRONIC OIL POLLUTION PROBLEMS WITH MAGELLANIC PENGUINS (SPHENISCUS MAGELLANICUS) ALONG THE ATLANTIC COAST OF SOUTH AMERICA

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In the Atlantic Ocean, Magellanic penguins migrate between Argentina and Brazil on routes that overlap with maritime traffic and petroleum development. We used the location and number of organizations dedicated to rehabilitate or survey oiled seabirds from Brazil to central Argentina to determine if petroleum pollution was a problem along the coast. We reviewed petroleum use in the area and used the concentration of rehabilitation-survey centers to suggest where petroleum pollution may be a problem. The northernmost limit where oiled penguins were found was Salvador (Brazil). From Salvador south to central Argentina there are 30 maritime main harbors (Brazil: 21, Uruguay: 1, Argentina: 8), 49 oil terminals (Brazil: 43, Uruguay: 1, Argentina: 5) and 17 offshore platforms (Brazil), out of 115 for the whole Brazilian coast. In the late 1990s, Brazilian oil production reached 1.6 million barrels per day (bbl/d), importing 600,000 bbl/d, mainly from Argentina and Venezuela. Argentina exported more than 600,000 bbl/d. Uruguay has no oil resources, importing 43,000 bbl/d. We found 25 organizations rehabilitating or surveying oiled seabirds, mainly Magellanic penguins, along 6500 Km of coastline. In Brazil, there are 14 organizations with most centers near the Rio de Janeiro-Santos coastal sector, the area with highest oil-related activities. Uruguay had two rehabilitation centers at Montevideo and nearby Punta del Este, where the Urayuyan terminal is located. In Argentina, there are seven organizations. Few oiling activities are in the area where the rehabilitation centers are located (Buenos Aires Province) suggesting oil is either coming from sources related to other maritime activities or more likely that vegetation occurs as a consequence of petroleum activity. The indicator of interest is the number of colonies each year, which is known for most of the colonies and is in good condition and very close to the colonies in Argentina. Climate factors might be a limiting factor for some of the colonies in Brazil, but they are in good condition and very close to the colonies in Argentina, and the number of cats...
PREYED ON BY THE LITTLE RAVEN CURVUS MELLORI ON THE NESTS OF LITTLE PENGUINS EUDYPTULA MINOR AT PHILLIP ISLAND, VICTORIA, AUSTRALIA

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This study investigated the breeding and feeding behaviour of the Little Raven Curvus mellori on the Summerland Peninsula, Phillip Island, Victoria, Australia, an area where it is the dominant corvid. The peninsula has a Little Penguin Eudyptula minor colony of about 13,000 breeding burrows. Little Ravens were observed destroying Little Penguin burrows and stealing eggs and chicks during the spring of 2000 and 2001. Previously the Little Raven had been thought to only consume eggs ejected from burrows by penguins. Field observations of Little Raven’s were made at three sites from September to December 2003. Little Penguin burrow characteristics were investigated at three breeding sites to determine if they were correlated with predation rates. Little Raven’s use of the Summerland Peninsula changed over the spring and summer period. These changes were related to food availability. Of the three sites studied, one was used mainly for feeding while the other two were used for roosting. The amount of time Little Ravens spent foraging and on other activities such as roosting and preening did not vary throughout the study period. Of 389 Little Penguin burrows studied 79 were predated. The rate of predation varied from 17 to 21%. The shapes of burrows were categorized into five different types depending on their general character. Other characteristics investigated were length to wall, width, entrance height and width, height of the burrow roof above the nest box, inner and outer roof of vegetation and soil type. There were no statistical differences between predated and un-predated burrows for burrow shape or character. The predation of Little Penguin burrows by Little Ravens will continue to be monitored.

BREEDING IN BINS: DO ARTIFICIAL BURROWS IMPROVE BREEDING SUCCESS OF AFRICAN PENGUINS (SPHENISCUS DEMERSUS) ON HALIFAX ISLAND, NAMIBIA?

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African penguins preferentially nest in burrows. After large-scale removal of guano from all of the penguin breeding islands in Namibia, penguins are generally forced to nest on the surface. This makes them vulnerable to disturbance and leaves eggs and small chicks susceptible to predation by Kelp gulls (Larus dominicanus vetula). In addition, nest contents of surface nests are exposed to extreme weather conditions, such as flooding or excessive heat. Apart from a lack of food, the scarcity of quality nesting habitat is thought to be one of the main causes for the continued decline of the African penguin in Namibia. Halifax Island, Namibia, consists of a flat, sandy, central plain surrounded by rocky ridges and hills. Little guans is left on the island and burrowing potential is minimal. Several bushes growing along the ridges, scattered, isolated rocky outcroppings and a few abandoned, disintegrating buildings on the island offer some protection for nesting penguins. Large numbers of Kelp guils are present on the island, particularly during summer, when they breed on the island. During winter, hot, dry east winds from the desert occur frequently, causing temperatures to rise above 30°C. Rainstorms are uncommon. Penguins on Halifax Island breed throughout the year. Of the 655 breeding pairs, more than 85% breed on the surface, with the remainder breeding under bushes, boulders and in buildings. Between September 2001 and August 2002, 62 artificial burrows made from rubbish bin halves were set up on Halifax Island. Breeding success was compared on Halifax Island. Breeding success was compared with a control site with surface-, bush-, and artificial burrow nests by monitoring them at weekly intervals. Preliminary results suggest that breeding success in artificial burrows was the highest and similar to that in bushes. Breeding success on surface colonies was higher than in buildings but lower than in artificial burrows or bushes. The success of artificial burrows appears to be design-dependent and site-specific. At breeding localities with characteristics similar to Halifax Island, these burrows could limit further decline of the species.

ANALYSIS OF SEQUENCE VARIATIONS OF THE MHC CLASSII GENE IN PENGUINS

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The MHC (the major histocompatibility complex) is known to have an important role in the immunity system of vertebrates and to display a highest degree of genetic polymorphism. By present, the human MHC was determined for the entire genomic sequence of 3.6 Mb. Furthermore, the MHCs in birds have been extensively studied, but the ocean birds including penguins have never been reported for MHC polymorphisms. We have determined analysis of sequence variations of the penguins MHC is most important to clarify the evolutionary process of penguins so that the penguins may have evolved very uniquely from other birds. We have previously reported that several penguin species have a high degree of polymorphism on exon 2 of the MHC class II gene. In this study, we determined the complete sequences of exon 2 for application of MHC genetic polymorphism to molecular classification of species in this field. Here, we have focused on Humboldt penguins for which we could get enough sample number. We could determined the nucleotide sequences of 1 kb PCR products containing the exon 2, intron 2 and exon 3 segments of the DRB1 like gene. Two sets of primers were designed for amplification of each of complete exon 2 and 3 sequences from thus obtained 1 kb sequence. These nucleotide sequences in exon 2 had at least 6 different alleles. Homology search showed 85% and 88% identity with DRB1 of Gallus gallus in exons 2 and 3. However, the intron 2 sequences appeared to be specific for penguin because low nucleotide identity could be observed when compared among other birds. Interestingly, unique nucleotide sequences specific for Humboldt penguins could be found, suggesting a possibility that each genera or species of penguins has acquired each specific sequence in the process of their evolution. These findings can be expected to be applied to other areas, such as subspecies discernment, and parentage test. Furthermore, species on the verge of extinction can be estimated to be kept as moderate polymorphisms. We are now planning to determine the exon 3 complete sequences and to analyze on exons 2 and 3 with different MHC haplotypes.
FISHERIES, LARGE AND SMALL AND THEIR POTENTIAL IMPACT ON HUMBOLDT PENGUINS IN PERU

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Peruvian Humboldt penguin (Spheniscus humboldti) populations in Peru are presently largely restricted south of 13°S, to a few selected sites along the southern coast of Peru. There are also a few hundred individuals in northern Peru but not much is known about these northern colonies. Relating the limited available information on Humboldt penguin (HP) distribution to more detailed information available for the large scale industrial and artisanal fisheries off Peru, here we try to identify potential refuges and conflict areas. Because the largest fishing effort focuses on small pelagic fish (the penguins’ preferred prey) and deploys many very large curtain nets in areas likely to overlap penguin foraging areas, the potential for conflict between penguins and fisheries in Peru is great. Fortunately, the largest industrial fishing fleet and the largest number of artisanal fishermen are found north of 13°S. In Southern Peru, particularly around Punta San Juan where most HPs breed, fishing activities are relatively low. Further south, close to the border with Chile, recent border conflicts have led to an increase in industrial fishing effort and to new legislation allowing industrial scale fishing closer to shore (linked to competition for transboundary distributed resources). Luckily only around 200 HPs are found in this conflict area. However, if El Niño events or global climate changes induce individuals from more northerly locations to move south, they would then become exposed to greater risks than those to which they are now exposed at their present locations. A further cause of concern is the development of a new type of semi-legal fishery targeting small pelagic fish very close to shore areas. This type of fishery is rapidly expanding and invading areas traditionally used by the small scale artisanal fishery and penguins. Presently most of this fleet is still in northern Peru and just beginning to operate towards the south. Future research and conservation efforts should focus on evaluating penguin use of marine areas, changes in these patterns and colony displacements linked to warm events and how all these relate to fisheries use of space and resources.

DIFFERENCES IN EGG SIZE, SHELL THICKNESS, PORE DENSITY, PORE DIAMETER AND WATER VAPOUR CONDUCTANCE BETWEEN FIRST AND SECOND EGGS OF SNARES PENGUINS (EUDYPTES ROBUSTUS) AND THEIR INFLUENCE ON HATCHING ASYNCHRONY

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Brood reduction in birds is frequently induced by hatching asynchrony. Crested penguins (genus Eudyptes) are obligate brood reducers, but in contrast to most other birds, first-laid eggs are considerably smaller in size than second-laid eggs and, additionally, first-laid eggs hatch after their siblings. The mechanisms underlying this reversal in size and hatching order remain unclear. In this study, we tested whether second-laid eggs in Snares Penguins (Eudyptes robustus) have a higher eggshell porosity allowing them to maintain a higher metabolism throughout incubation and to hatch before their first-laid siblings. We investigated differences in egg size, shell thickness, pore density, pore diameter and water vapour conductance between first and second eggs within clutches and examined the influence of these shell characteristics on hatching asynchrony. First-laid eggs of Snares Penguins were approximately 78% of the size of the larger second eggs. Second-laid eggs had considerably thicker eggshells and more pores per cm² than first eggs, whereas pore diameter did not differ between eggs. Water vapour conductance was greater in second- (16.8 mg day⁻¹ torr⁻¹) than in first-laid eggs (14.9 mg day⁻¹ torr⁻¹). The difference in water vapour conductance between first- and second-laid eggs within clutches was related to hatching patterns. In nests where second eggs hatched before first-laid
eggs, second eggs had a considerably greater water conductance than their sibling, whereas in nests where both eggs hatched on the same day, the difference in water conductance between eggs was very small and in a few nests where small first eggs hatched before their larger sibling, they had a greater water conductance than their larger second-laid nestmate. Surprisingly few studies have investigated differences in shell characteristics between eggs within clutches and associated effects on hatching asynchrony. This study has demonstrated that such differences exist between eggs within clutches and that they can influence hatching patterns.

EFFECTS OF ARTIFICIAL EGGS ON PROLACTIN SECRETION, STEROID LEVELS, BROOD PATCH DEVELOPMENT, INCUBATION ONSET AND CLUTCH SIZE IN THE YELLOW-EYED PENGUIN

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Several studies have shown that the transition from egg laying to incubation behavior in birds is associated with changes in plasma levels of prolactin and steroid hormones. However, any effect of the tactile and visual input provided by eggs at initiating these hormonal changes has not been fully investigated in wild birds. A few days before yellow-eyed penguins, Megadyptes antipodes, started egg laying, we placed an artificial egg into their nests or under cages next to their nest. We then investigated the effect of the tactile and/or visual stimulus of such an artificial egg on prolactin secretion, steroid hormone levels (testosterone and progesterone), brood patch development, incubation onset and clutch size in these penguins. Prolactin levels rose in females in response to having an artificial egg in the nest, while they declined in males. Testosterone concentrations in males decreased to less than 10% of the levels prior to egg placement and were significantly lower than in control males. Brood patch width increased in both males and females. Additionally, an egg in the nest caused yellow-eyed penguin pairs to attend and sit more frequently. Females that initiated egg laying one or two days after placement of the artificial egg in the nest, laid a full clutch of two eggs, while most other females that were exposed to an artificial egg in their nest, laid only a single egg. In contrast, the visual stimulus of an artificial egg alone (that was placed under a cage) did not influence hormone levels, brood patch development, incubation behavior or clutch size. We have demonstrated that the tactile stimulation of an egg in the nest influences immediately prolactin and steroid hormone levels in yellow-eyed penguins. These hormonal changes initiated brood patch development and incubation onset and also terminated egg laying. We encourage further studies on other bird species taking such an experimental approach to investigate the influence of the nest and eggs in initiating this positive feed-back reaction between hormonal secretion, brood patch development and incubation onset simultaneously. Moreover, such experimental studies will widen our understanding of the endocrine mechanisms that regulate clutch size.

FORAGING BEHAVIOUR OF SNARES CRESTED PENGUINS – A MATTER OF ROLE ALLOCATION DURING BREEDING

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The offshore feeding Snares Crested penguin Eudyptes robustus is endemic to the subantarctic Snares Islands some 200km south of New Zealand’s South Island. During breeding, Snares penguins exhibit distinct gender-dependent roles. After laying, both males stay at the nest for two weeks before the male leaves on a two week foraging trip, after which the female leaves to forage for four to nine days. The return of the female coincides with chick hatching. Until creching, the female performs short-term trips and feeds the chicks while the male guards the nest and offspring. During the breeding seasons of 2002 and 2003 we examined foraging behaviour of male and female Snares Crested penguins using time-depth recorders (TDRs) to record dive depths and GPS-dive loggers that recorded depth and a bird’s position. During the 3-day battery life of the GPS devices, three equipped males swam due east of the islands, moved up to 216km away from the islands and dived on average 320 times per day (max depth: 101m). On two other males, TDRs recorded dive foraging trips (10-14d, 294 dives day-1, max depth: 120.5m); data indicate increased dive activities during the second half of the trips. No GPS data was recovered for females on long-term trips, but trip lengths suggest shorter ranges than those determined for males. TDR data of two females on long-term trips (duration: 5d) indicate higher foraging effort (612 dives day-1, max depth: 107m) during chick guard, females performed short-term trips during which they foraged 40 to 60km north and north-west of the islands, feeding in the productive waters of the Subtropical Front. These trips were either overnight (1086 dives trip-1, max depth: 99m) or daylight trips only (640 dives trip-1, max depth: 82m). Reflecting their different incubation routines, male and female Snares penguins exhibit different foraging strategies. While foraging in males is primarily a matter of self-sustenance, females additionally must assume the primary responsibility of finding food for the offspring.

THUGS AND BULLIES – PATTERNS OF AGGRESSION IN SNARES CRESTED PENGUINS

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Snares crested penguins are aggressive birds. While aggression during the early breeding season is often a result of competition for nest sites and mates (e.g. male-male fights) other forms of aggression observed during later stages of breeding are not as easy to comprehend (e.g. attacks on incubating females). Although the majority of agonistic behaviour occurs in the colonies (intra-colony aggression) there are also regular cases of extra-colonial aggression that can be described as "beach bullying" or "forest ambushing". After clutch completion, the number of aggressive events is low as long as the majority of male penguins are still present at their nests. After most of the males have left their incubating partners to forage, the number of attacks directed towards single females increases markedly. During such attacks, single males or pairs attack an incubating female with at times severe pecks and flipper beating — often for no obvious reasons. The incubating females generally do not fight back but assume a defensive position to protect their clutch. Although attacks often have no severe consequences some assaults result in egg loss or nest abandonment. With the return of the males, the rate of aggression recedes in the colonies. Instead single aggressive birds are now increasingly observable at the penguin landing and along the forest paths to the colonies randomly attacking returning females. During the breeding season, 2003 we recorded aggressive behaviour in a Snares large penguin colony of approximately 1200 nest. The data show, that an equal number of attacks were staged by breeding and non-breeding birds. However, the severity and duration of the attacks were higher if the aggressor was a non-breeder. Furthermore, breeders often conducted short attacks to steal nest material, whereas attacks by non-breeders had generally no visible outcome. In most cases, the attacked females often got off lightly with loss of nest material at the worst. Nevertheless we found that assaults contribute significantly to egg loss. The lack of obvious gain for the aggressor makes it hard to explain attacks from an evolutionary viewpoint. In any case, such patterns of aggression have consequences for the Snares penguins' general breeding behaviour.
GROWTH OF LITTLE PENGUIN Eudyptula minor chicks in relation to hatching date, parental age, parental quality and mate change

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We studied growth of little Penguin chicks at Phillip Island, Australia, in five breeding seasons (1999-2000 to 2003-04). Among years, breeding dates varied by two months and clutch survival varied from 15% to 90%. Chicks were weighed every 1-2 days from the end of the guard stage. Body mass data were used to calculate five growth parameters for each of 228 chicks that survived to fledging: (linear) growth rate (days 13-30), peak mass, age at peak mass, mass and age at fledging (departure for the sea). Relative hatching date (hatching date relative to the mean for all chicks in the same year) advanced with increasing parental age. Most of the growth parameters were independently related to hatching date and parental age, being better (more rapid growth, higher peak and fledging masses) among chicks hatched earlier and chicks with older parents. Both relationships were curvilinear: chick growth parameters improved with parental age in the early years of breeding (ages 3-7 yr), levelled off around the median age of breeding (ages 8-10 yr), and declined significantly among older birds (ages 11-16 yr). Hatching date, linear growth rate, peak mass and age at peak mass were more closely related to the age of the female than the male parent, but mass at fledging was most closely associated with the age of the male. In 12 cases where parents are known to have changed mates between successive years, breeding was slightly later and growth parameters were better in the year after the change. All growth parameters varied markedly among years after controlling for other factors. Growth parameters of chicks raised by pairs that remained together for two or more years were less variable than those of other pairs breeding in the same years and more related to laying date. These findings suggest that reproductive performance in little Penguins is most strongly influenced by year-to-year variations in food availability, although factors intrinsic to the parents (age and 'quality') are important sources of variability within years.

SURVIVAL OF LITTLE PENGUIN Eudyptula minor CHICKS FROM FLEDGING TO BREEDING AGE IN RELATION TO HATCHING DATE AND PEAK MASS

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In the 33 years 1968-2001, 23,015 Little Penguins Eudyptula minor were banded at Phillip Island, Victoria, Australia, at about the time of peak mass, one or two weeks before fledging. By the end of the 2003 season, 770 had been found dead within two years of banding (mostly on beaches away from the breeding colony), and 2,237 had been found alive more than two years after banding (mostly as breeders in the colony). We used logistic analysis of covariance to analyse the dependence of recovery rates on hatching date and mass at banding (provides for hatching date and peak mass, respectively). The probability of being recovered dead before breeding age increased with increasing hatching date and decreased with peak mass; the probability of being found alive after breeding age showed the opposite trends. Using independently-derived estimates of demographic parameters, we estimate the dependence of survival to age 2 (first breeding) on hatching date and peak mass. The results also show variability in recovery rates from year to year, although it is not possible to distinguish fully between changes in survival rates and changes in encounter and reporting rates.

PENGUINS USE A NOVEL CLASS OF PLUMAGE PIGMENTS TO COLOR THEIR FEATHERS YELLOW

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Yellow plumage colors in birds are usually thought to be due to the presence of carotenoid pigments. However, there are several other groups of pigments in animals that confer these same colors, including melanins, pterins, and flavins. We conducted the first tests of the biochemical nature of yellow plumage coloration in penguins. Using traditional methods for extracting and analyzing carotenoids from bird feathers, we detected no carotenoid pigments in the yellow feathers of wild-caught king, macaroni, and emperor penguins. Instead, these yellow pigments exhibited chemical properties distinct from any pigments previously described from birds. They were soluble in mild acids and bases, fluoresced blue under ultraviolet (UV) light, and absorbed light maximally in the UV. These pigments appear to be most similar to the pterin pigments described from the wings of butterflies and the eyes of several birds (e.g., owls, pigeons, starlings, blackbirds). We discuss the implications of these findings in light of the recent evidence that penguins use these yellow color patches as sexual signals.

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THE MOST FREQUENTLY REGISTERED DISEASES IN MAGELLANIC PENGUIN (SPHENISCUS MAGELLANICUS) IN A REHABILITATION CENTER IN THE PROVINCE OF BUENOS AIRES, ARGENTINA

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The Rehabilitation Center of the Mundo Marino Foundation (FMM) has been operating since 1987 as a pioneer Institution in rehabilitation and reinsertion into the natural environment of different bird species in Argentine. This retrospective study is based on data obtained from 1,616 Magellanic penguins (Spheniscus magellanicus) attended between 1987 and 2003. The FMM, San Clemente del Tuyú, Buenos Aires, Argentina, receives birds that are rescued in an area of approximately 160 kilometers from the north Buenos Aires coast (from 36°22'S/56°44'W to 37°15'S/56°58'W). On receiving each penguin in the quarantine area, an evaluation of its general condition and identification are made, a clinical history is prepared, and corresponding treatment is given according to the disease diagnosed. If the medical discharge coincides with the migration period, the bird is released within the study area. In reverse conditions the birds go to a maintenance area until the next migration period. If the bird die in rehabilitation or during the waiting time, the appropriate necropsy is performed. The primary disease first diagnosed have been represented by 79.6% of distinct degrees of oiling, 13.33% of paramyxovirus, 1,33% of hepatitis, 1,33% of enteritis, 2.68% of parasites, and 1,33% of diverse problems. Of the 79.6% affected by petroleum contamination, 5% died of that cause. Having survived the removing of oil, during their stay, the birds present other diseases, of which the following are the most important: Paramyxovirus 32,65%, hepatitis 6,12%, trauma 5,11%, parasites 5,10%, enteritis 4,08%, aspergillosis 5,11%, septicemia 2,04%, air sacculitis 1,02%, spleen problems 1,02%, various causes 6,12% and diseases not diagnosed 31,63%. There is a close relationship between the decrease in immunological responses in these birds produced by oiling and the outbreak of various illnesses. The results of the annual serological tests in the birds’s natural habitat coincide with illnesses that appear under stressful conditions such as oiling. The test in the breeding colony and the results obtained from the birds that reach the FMM shows an indication of the sanitary conditions of the penguin population, been necessary the constant improving of the diagnostic techniques.

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MICROSATELLITE ANALYSIS OF GENETIC STRUCTURE BETWEEN LITTLE PENGUIN (EUDYPTULA MINOR) COLONIES IN SOUTH-EASTERN AUSTRALIA

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The Little Penguin (Eudyptula minor) is mainland Australia’s only breeding species of penguin, with a patchy distribution along the southern coastline. The majority of breeding colonies are located in the Bass Strait region, the shallow (55 to 90 metres) water body that separates Tasmania from the Australian mainland. It is currently assumed that colonies within the area exist in a meta-population structure, i.e. a set of local populations connected by migrating individuals. The local populations usually inhabit isolated patches of resources, and the degree of isolation may vary depending on the distance between patches. Within this region, two colonies are known to have been recently established; Middle Island (south-western Victoria) and St Kilda (metropolitan Melbourne) colonies were first recorded in the 1950s and 1980s respectively. The Middle Island site (292 active burrows) and St Kilda (112 breeding sites) have both been recorded as exhibiting differences in morphometric traits and breeding success.
Island (ca 21 000 pairs) (33 km, 575 min). The mean foraging range also differed significantly between mainland (20 km) and island colonies (8 km). The foraging area available to a central place foraging seabirds breeding on the mainland typically is less than that for seabirds breeding on islands, but the area per pair is greater for the Boulders mainland colony. We thus conclude that the greater foraging effort of Boulders birds reflects reduced prey availability in False Bay, and that recent slowing in growth at the colony probably is not a direct result of management actions to limit the spatial growth of the colony.

CORTICOSTERONE RESPONSES IN RELATION TO FASTING IN BREEDING ADELIE PENGUINS (PYGOSCELIS ADELIAE)

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Penguins naturally fast each year during breeding and again whilst moulting, and may lose more than 40% of body mass during a fast. Fasting in king (Aptenodytes patagonicus) and emperor (Aptenodytes forsteri) penguins has been divided into three phases, with a prolonged period of low daily body mass loss in phase II then an increased rate of body mass loss in phase III. Corticosterone, a metabolic hormone that promotes adjustments to fasting, increases during phase III in king and emperor penguins. The breeding of Adelie penguins (Pygoscelis adeliae) on Ross Island was disrupted in 2001 by a large iceberg (B15A) which stopped the normal movement of sea ice in the Ross Sea. Female penguins either returned late to relieve their mates at the end of the first incubation spell or did not return at all. We compared plasma corticosterone concentrations and corticosterone responses to handling between male Adelie penguins that were departing from the colony, females returning to the colony and incubating females to determine the effects of prolonged fasting on corticosterone in this species. Departing birds were lighter than returning or incubating birds (3.39 ± 0.09 cf. 4.16 ± 0.09 and 4.07 ± 0.08 kg). Plasma corticosterone concentrations were higher in departing than in returning or incubating penguins (6.89 ± 1.69 cf. 2.36 ± 0.42 and 1.08 ± 0.20 ng/ml). Corticosterone responses to handling were also greater in the departing penguins. Corticosterone concentrations were inversely correlated with body mass in departing penguins when birds were first picked up and after 30 min of confinement (r= 0.46 and 0.56), but there were no relationships between these variables in the other penguins. Previous studies did not find a relationship between body mass and corticosterone in Adelie penguins, and the present results may reflect the unusual ice conditions when incubating birds fasted for longer than normal. This is the first report of corticosterone responses to handling during fasting in any species of penguin. In addition, the results indicate that corticosterone may be involved in the increased rate of body mass loss in phase III of fasting in the Adelie penguin.

MAGELLANIC PENGUINS (SPHENISCUS MAGELLANICUS) ON THE BEACHES AT PUNTA TOMBO, CHUBUT, ARGENTINA

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Magellanic penguins (Spheniscus magellanicus) stand on the beaches during the breeding season but little is known about the age composition and breeding status of these birds. At Punta Tombo, (44° 02’ S 65° 11’ W), the largest breeding colony of Magellanic penguins in the world, over 55,000 penguins have been banded since 1983, most of them as chicks so their a
environmental temperature (the onset of summer season in the Southern Hemisphere) some penguins ran down, started with anorexia, decrease of body weight (in some cases up to 50%), dehydration and hemolytic anemia. The blood cytology studies showed refracting particles in the cytoplasm of the red cells. The necropsy revealed splenomegaly (up to 7cm in length), hepatomegaly, hydropericardium and subcutaneous edemas, among other lesions. The samples imprint from spleen, liver and kidney showed an intracellular parasite located in the cytoplasm of the erythrocytes displacing the nucleus. Histopathology studies revealed congestion of the haematopoietic organs, macrophages with hemosiderin and small round particles in the cytoplasm of erythrocytes. Bearing in mind the summer season and the hematological, cytological and histopathological results we were able to diagnose that the penguins were affected by Avian Malaria produced by a Protozoa hemoparasite belonging to the genus Plasmodium. In addition, there were important erythematous skin lesions around the eyes of the penguins —due to mosquito bites— which confirm the previous diagnosis. Finally, for regions with humid and hot climate that hold penguins in captivity we recommend periodical fumigations in the areas in order to decrease the mosquito population, considering that these insects are vectors of Plasmodium. It would also be useful to perform annual hematology test in order to identify the parasites and— if necessary— the instauration of antimalarial treatment.

MOVEMENTS OF SOUTHERN ROCKHOPPER PENGUIN (EUDYPTES CHRYSOCOME CHRYSOCOME) FROM STATEN ISLAND DURING THE WINTER DISPERSION IN RELATION TO OCEANOGRAPHIC FEATURES

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Seabirds show a strong association with oceanographic features expressed as fronts, sea surface height anomalies and water mass boundaries during their foraging movements while at sea. We characterized the movements and oceanographic habitats of southern rockhopper penguins from Staten Island during the winter dispersion. Ten birds were fitted with platform terminal transmitters in March 2002 and 15 in March 2003. Analyses of satellite telemetry data in conjunction with remotely sensed sea surface temperature (SST) and bathymetry revealed two main foraging areas: one situated to the north of Staten Island off the coast of Tierra del Fuego and the other one to the south of Staten Island in the vicinity of the Antarctic Polar Front. Sixteen out of 25 birds commuted between the two zones. In the area to the north of Staten Island birds used shallow coastal waters characterized by tidal fronts, which are well-known highly productive features. Moreover, penguins spent 47% of their time at sea in those areas. By contrast, the area to the south included pelagic waters (> 3000m) and penguins spent 43% of their time in those waters. This area, in the region of the Drake Passage, included the Polar Frontal Zone (PFZ), an important water mass with high phytoplankton concentration, especially in its southern and northern limits (polar front PF and sub-Antarctic front SAF, respectively). During March and April birds preferred water masses warmer than 8°C SST (along the Atlantic coast of Tierra del Fuego), although during April some birds also foraged in Antarctic waters (-2°C). From May to July penguins spent more than 50% of time in water masses between 4-6°C (PFZ based on the published and widely used locations of water masses and fronts). The individual movements were analysed together with SST, sea surface height anomalies and chlorophyll a images to identify the oceanographic features that penguins follow during their movements. Implications for the status and present conservation of this species in the southwest Atlantic Ocean are also discussed.
FORAGING LOCATIONS OF MAGELLANIC PENGUINS BREEDING AT PUNTA TOMBO, ARGENTINA

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We tracked breeding Magellanic Penguins (Spheniscus magellanicus) at Punta Tombo, Argentina (44°33' S, 56°13' W) using platform transmitter terminals (PTTs) from the 1996-1997 breeding season through 2000-2004. We followed adult penguins during three stages of the breeding season: 1) incubation, when mates alternate making long foraging trips; 2) early-chick rearing, when mates alternate making short foraging trips, and 3) late-chick rearing, when mates forage simultaneously. We deployed PTTs on 101 males and 57 females for a total of 155 deployments, and calculated the maximum distance traveled from Punta Tombo using Vincenty's inverse method. The maximum distance traveled by males and females were similar (F = 0.95, p = 0.32). Distance differed by stage of the breeding season (F = 172.61, p < 0.001) and year (F = 4.36, p = 0.007). Penguins traveled farthest during incubation, with averages by year from 321 km to 536 km. They stayed closest to the colony during the early chick period, with averages from 81 km to 128 km. During the late chick period, distances were intermediate, averaging 126 to 335 km. There was an increasing trend in maximum distance traveled among years during incubation (F = 9.16, p = 0.03). Using sea-surface temperature (SST) and chlorophyll-a data from NOAA/NASA satellites, we found that during incubation, foraging locations are determined by the distribution of relatively warm (11-15°C SST) coastal water inshore of the shelf-break front and the cold Malvinas (Falkland) Current. The primary prey of Magellanic penguins in this area, the Argentine anchoveta (Engraulis anchoita), is migratory, arriving in the region in October-November from waters off Brazil. The foraging locations of penguins during the early-chick and late-chick stages are associated with tidal-mixing fronts, which are well developed along the coast of Chubut by December. Anchorea aggregate near these fronts to spawn in areas of high productivity. During December when penguins are constrained to short trips to feed their chicks every 1-2 days, the fronts are generally well developed near the coast at Punta Tombo. By January, the frontal areas usually move farther offshore to the northeast, but by this time the chicks are left alone and penguins can reach the frontal areas and return before the chicks starve.

POPLATIONS FLUCTUATIONS OF PYGOSCELID PENGUINS DURING 1994-2004, IN ARDLEY ISLAND, SOUTH SHETLAND ISLANDS

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This study is the result of field work done on Ardley Island (62°13' S, 58°55' W) – Fildes Peninsula, King George Island, South Shetland Islands. This island is home to colonies of three species of penguins: species of genus Pygoscelis: P. antarctica, P. adeliae and P. papua. The importance of these seabirds, components of the Antarctic ecosystem, is that they are among 80% of the total biomass of birds present in the continent. Ardley Island also has one of the largest reproductive colonies of Gentoo penguins censused on the South Shetland. Penguins are the main predators of the Antarctic ecosystem food chain and such as they have been considered good indicators of the conservation status of the environment. Then, monitoring programs and reproductive ecology studies become of great importance. This is reinforced because the reproductive colonies are found in areas of increasing human activities including oil spills. The case of Ardley Island shows the potentiality of the system to censuse the status of colonies and help in the management of the species. In this case, monitoring programs of the three species of penguins during the period of the last ten years. The annual census statistics reveal yearly fluctuations of reproductive populations, reproductive success is shown as number of chicks per nestling couple. The most abundant population is Pygoscelis papua (around 4,000 nests) followed by P. adeliae (around 1,000) and P. antarctica (less than 40). The reproductive success of the three species has the same sequence of magnitude. During the period of study, the population of P. papua and P. antarctica showed a tendency to stability. Meanwhile P. adeliae during the last few years has shown a tendency to decrease its nesting population size. This is probably associated to fluctuations of sea ice yearly cycles as it has been found in other areas of the range of this species.

IFAW PENGUIN REHABILITATION AND RESEARCH NETWORK

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South America has seven species of penguins distributed along the Atlantic and Pacific coasts. The Magellanic penguin (Spheniscus magellanicus) breed in large colonies in Argentina and Chile and migrate north as far as Southwest Brazil between March and September. Gandini et al. (1994) estimate that 42,000 Magellanic penguins die each year due to chronic oil pollution along the coast of Chubut Province, in Argentina. Every year, different species of oiled and/or debilitated penguins show up on beaches along their migration range and between 350 to 500 animals are rescued by different rehabilitation organizations in Argentina. Due to limiting factors such as funding for gasoline, fish for larger numbers of birds and other expenses related to the rehabilitation process, the search for beached penguins is still insufficient, leaving many animals in remote areas to die, therefore the IFAW Penguin Network was developed. Its main purpose is to bring together rehabilitation organizations working with penguins in South America and help them to increase the number of rescued animals, standardize rehabilitation protocols and data collection. The goal is to understand the effects of oiling on penguins and to mitigate these effects through rehabilitation, research and prevention. The IFAW Emergency Relief Team – Oiled Wildlife Division, co-managed by the International Bird Rescue and Research Center (IBRRC), is a world-class team of experts in rehabilitating animals injured in oil spills, best known for the rescue and rehabilitation of more than 21,000 oiled African penguins in South Africa in 2000. Between 2001 and 2004 the IFAW ER Team was directly involved in emergency responses for the recovery of penguins in Argentina, Uruguay, Brazil and Chile where 1,090 oiled birds were rescued, with 85% (928/1,090) been successfully rehabilitated by five different institutions. The need for this Network, its operations and increased capabilities are evident, as past rehabilitation efforts managed by SANCCOB, IBRRC and IFAW have been extremely successful to the point that Cape Nature Conservation, in South Africa, considers rehabilitation of oiled penguins to be a valuable, cost effective and essential species conservation and management tool.

DIVING PHYSIOLOGY OF THE KING PENGUIN (APTENODYTES PATAGONICUS): TEMPERATURE ADJUSTMENTS, ENERGY SAVINGS AND SWIMMING EFFORT

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Recent studies showed reductions of different body temperatures while foraging at sea in several species of diving birds. In diving endotherms, a reflex peripheral vasconstriction is the mechanism involved to limit heat exchange and preserve a high and stable core temperature.

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However, in king penguins even deep organs and tissues have been found to undergo temperature drops during prolonged diving activity. These latest results pointed up the potential role of temperature reduction in diving energetic and could partly explain the large discrepancy between theoretical and observed aerobic dive autonomy. To determine how temperature variations are related to diving behavior and environmental characteristics, we measured both the temperature of the ambient and of the main propulsive muscles, the pectoral, together with the associated movements, revealed by the down stroke of the flippers. In this study, we examined the possible interrelations between changes in pectoral muscle temperature and amplitude of the flippers strokes as an index of locomotor work. Our results showed temperature drops of several degrees of the dive, the pectoral muscle temperature increased when progressing to depth (±3°C), while water temperature decreased and stroke frequency was averaging 1.0 Hz. This high level of activity continued during the bottom part of the dive, with very complex and irregular patterns, in frequency and amplitude, of the flipper strokes. However, during this period the pectoral muscle temperature stayed constant. Finally, during the ascent part of the dive, the pectoral muscle temperature decreased (6°C), while flippers stopped stroking at a mean depth of 60 m. In this presentation, thermoregulation of the pectoral muscle in the king penguin is discussed in terms of production and dissipation of heat and its implication in diving physiology and energetic. Our results suggest that even during hard muscular work, penguins rely on physiological and behavioral adjustments to minimize the energetic cost of diving.

HUMBOLDT PENGUINS AFTER THE “GUANO RUSH”: ARE THEY STILL NESTING ACCORDING TO “MURPHY’S LAW”? 
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In his “Oceanic Birds of South America” (1936), R. C. Murphy stated that the removal of guano in the second half of the nineteenth century, to be sold as fertilizer mainly in North America and Europe, greatly reduced the number of Humboldt penguins (Spheniscus humboldti) and other seabirds along the coasts of Peru and northern Chile. The ancient guano layers were the main substrate in which the penguins dug their burrows, which led Murphy to suggest that without this layer, the birds were forced to breed in sub-optimal habitats. At present, deep guano layers are still absent from most seabird islands which raises the question of how Humboldt penguins cope with this nest-substrate scarcity. In an attempt to answer this, we surveyed eleven islands where Humboldt penguins nest along the Chilean coast, ranging from Punta de Arica (26°39’S) to Punta Huilul (41°55’S). Nests were categorized by nest-type according to being rock-crowned (e.g. Punta de Arica, Choros, Concón, Pájaros and Isla) and vegetation-covered (Chupaya). Only two colonies we found nestling in guano (Pájaros and Concón). Each colony presented a dominant type of nest (50-70% at each colony), which indicates that penguins use the sites available at each island and thus are flexible in their behavior of habitat selection. Data from the literature indicate that burrow-like nests are more successful than other nest-types, which suggests that despite this behavioral flexibility, Humboldt penguins may still be using precarious nesting sites, and thus still breeding according to “Murphy’s law.”
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PROTECTING PENGUINS WITH CREATIVE OCEAN ZONING IN THE SW ATLANTIC
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Marine protected areas number over 4000 worldwide and cover over 1.6 million square km. Less than 0.5% of the oceans are protected (compared to 11.5% of the Earth’s land surface), and the status of many marine species continues to deteriorate. Strong political and economic forces oppose the creation of protected areas that would restrict exploitation of marine resources. In the SW Atlantic, human activities such as fishing, shipping, oil exploration and transport, and pollution are putting increasing pressure on marine ecosystems. The Magellanic penguin, a top predator, has the charisma to galvanize political support. When thousands of penguins were killed each year in the 1980s along the Chubut coast, the government and oil companies changed oil discharge practices and moved tanker lanes farther offshore. These penguins are a useful focal species for marine conservation. Most Magellanic penguins migrate north from their colonies along the Atlantic coast during the austral winter, following a “highway” along the coast from May to July. Most appear to remain in Argentine waters, but some move as far north as the Brazilian coast before returning to their breeding colonies in August and September. We document that few marine areas around Magellanic penguin breeding colonies are currently protected, and that the penguin migration route has no protection. Because the birds remain for the most part inside the exclusive economic zone (EEZ) of coastal nations, protection can be implemented at a national level. We show that a core area and moving corridor could be designated a national park or marine sanctuary within Argentina where activities that specifically threaten penguins (e.g., fishing and oil transport) would be restricted during the months penguins use the area. Argentina could protect much of the population on the wintering grounds, but a corridor in the winter months (July to early September) extended into the EEZ of Uruguay and Brazil would further benefit the species. This novel approach of having a spatial and temporal protected area for a few months of the year could minimize conflicts between people and penguins, with little impact on human economic activities.

ECTO- AND ENDOPARASITES OF AFRICAN PENGUIN SPHENISCUS DEMERSUS
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This study of penguin-parasites showed two species of ecto- and four different endoparasites. The number of setae at the segment V of mid- and hindtarsae of the males were the most important detail to identify the sea Parocephalus longirostris humboldti JORDAN, 1942. The tick Ommithodoros capensis NEUMANN showed a capitulum, which cannot be seen in a dorsal view and a dorsal plate length:breadth ratio of 1:0.7. Intestinal cestodes Tetrabothrius lutzi PARONA, 1901 and Tetrabothrius eurypidis LOENN-BERG, 1896 could be identified by their scolices and the different ways of male atrial canal and vaginal canal into the atrium ventralis. A nematode called Caulliaeia variata KRAMER and RUDOLPH, 1809 was identified through a bifurcated interlabium. Samples of liver and lung were searched for Plasmodium sp. All studies were made with a scanning electronic microscope (SEM) and details of interior tissues were proved by histological methods. Samples were collected alongside the Southamerican Coast from different Pengun colonies.
LONG-TERM TRENDS IN DIET OF ROCKHOPPER PENGUINS, AND IN MARINE PRODUCTIVITY, AS REVEALED THROUGH STABLE ISOTOPE ANALYSES

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Rockhopper penguins Eudyptes chrysocome have undergone marked population declines at some of their main breeding sites. For example, at Campbell Island in New Zealand, the number is generally thought that this particular population decrease was due to changes in sea temperature, which brought about either a shift in penguin diets or a decrease in food availability. Lack of dietary data from the period when the population was large. Stable isotope analyses of a collection of feather samples from contemporary birds and from birds held in museum collections, not only providing data on penguins' diet but also on the relative level of productivity of the marine ecosystem in which birds foraged. We present isotopic data for rockhopper penguins from throughout their breeding range (New Zealand sub-Antarctic islands, South Atlantic Ocean) covering 150 years. We use these data to determine long-term trends in rockhopper penguin diet and to explore spatial patterns of marine productivity over similarly long time scales.

GENTOO PENGUINS: INDICATORS OF PHYSICAL FORCING IN THE SOUTHWEST ATLANTIC

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In the southwest Atlantic sector of the Southern Ocean, temporal variability in the physical environment has been recorded since the early part of the last century. For example, ocean analyses of sea surface temperatures at South Georgia show the presence of high levels of autocorrelation, with periodicity evident in temperature anomalies at lag periods of approximately 4 years in the Pacific show that variability at South Georgia also reflects temperature fluctuations in the Pacific, with the leading South Georgia by approximately 3 years. Biological variability is also apparent at South Georgia, being evident in data from a suite of top predators as well as in data from fish and Antarctic krill. Increased biomass appears to performance in predator breeding months. Some predators the most critical periods appear to be prior to the breeding season. Thus, gentoo penguins (Pygoscelis papua) show a strong negative relationship between the number of chicks fledged and sea temperatures in the preceding February some 12 months earlier. Other top predators the preceding season. Such relationships most likely reflect prey availability. The explained variation not only a detailed understanding of environmental variability, but also predator demography and foraging dynamics, and prey biomass and recruitment.


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We present satellite-tracking data for Rockhopper Penguins at New Island South, Falkland Islands, and compare these data to previous satellite tracking results and to an index of ocean productivity. In 2000-01, we tracked four breeding males and three breeding females during the late chick-rearing period. Males travelled greater total (1421 ± 86 km) and maximum distances (279 ± 144 km), and had trips of longer duration (longest trip: 11.8 ± 7.8 days) than females (total: 978 ± 228 km; maximum: 111 ± 85 km; longest trip: 6.3 ± 2.9 days). In 2001-02, we tracked four breeding males during the late chick-rearing period. The males travelled a total distance of 1143 ± 508 km, a maximum distance of 285 ± 224 km, and were away on their longest trip for 17.5 ± 13.5 days. In February-March 2002, we tracked two recently molting juveniles. This is the first attempt to track immature penguins, giving us important insight into where this critical age class goes at sea. Both birds remained within 100 km of New Island. In 2003-04, we tracked three breeding males during the late chick-rearing period. On average, these males travelled greater total (2143 ± 55 km) and maximum distances (388 ± 151 km), and had trips of longer duration (longest trip: 26.3 ± 10.5 days) than in any previous year, 1997-2002. As in 1997-98 and 1998-99, males made long foraging trips hundreds of km W or WSW toward the coast of Tierra del Fuego during the late chick-rearing period. Some individuals foraged between 100 km of New Island in all years. Unlike in 1997-98 and 1998-99, none foraged due south of New Island. When we compared satellite locations to chlorophyll a estimates, tracks of males on long foraging trips corresponded well to areas or edges with higher chlorophyll a values than the surrounding water. In all years, 1997-2004, penguins used an area designated for oil and gas development. Detailed knowledge of when and how penguins use the ocean is essential if tools like ocean zoning are to be effective in reducing conflicts between penguins and humans.

PENGUINS AND PEOPLE IN PATAGONIA: HOW TOURIST VISITATION AFFECTS BEHAVIOR AND PHYSIOLOGY IN MAGELLANIC PENGUIN (Spheniscus magellanicus) ADULTS AND CHICKS

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Human population growth and consumption is radically modifying the environment. Even practices with a conservational mandate such as ecotourism have the potential to negatively affect animals. It is therefore increasing important to know what impact humans have on the behavior and physiology of wildlife. This is particularly relevant for penguins, as these charismatic birds are very popular for tourist visitation worldwide. We measured behavioral (head turns or approach distance) and physiological (stress hormone corticosterone) responses to human visitation in Magellanic penguins (Spheniscus magellanicus) adults and chicks at Punta Tombo, Argentina. Adult penguins rapidly habituate to human presence in the breeding colony (within 5 days of repeated contact), and tourist visitation is perceived as less stressful than capture and restraint. These data, coupled with yearly reproductive success information, suggest that Magellanic penguins have little negative consequences due to tourist visitation. However, we also show that adult penguins in tourist areas are a decrease in the physiological capability to express the stress hormone corticosterone. It is unknown whether this physiological change in tourist penguins could have long-term negative impact on breeding adult penguins. We further found that Magellanic penguin chicks raised in tourist areas show a rapid expression of the corticosterone stress response, much earlier than chicks in areas not visited by humans.
While this rapid expression of a stress response may not be detrimental to Magellanic penguin chicks, such patterns of early exposure to high corticosterone have been known to have negative consequences much later in life in other species. Finally, chicks in the distance do not yet show the decreased physiological stress response as in adults. This suggests that the pattern of behavioral and physiological habituation in Magellanic penguins is uncoupled, occurring at different rates as penguins adapt to human visitation.

IS HAND RAISING ORPHANED AFRICAN PENGUIN CHICKS WORTH THE EFFORT? AN ASSESSMENT FROM THE APOLLO SEA OIL SPILL.

Philip Whittington
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The African Penguin Spheniscus demersus is endemic to southern Africa, breeding at 29 colonies in South Africa and Namibia. The population declined by 90% during the 20th century. In response, the Apollo Sea oil spill occurred north of Dassen Island, causing 10,000 African penguins to be killed. Large numbers of nests at Dassen and Robben islands were effectively abandoned because the oil spills were ongoing. New colonies were started on Dassen Island, but there was no evidence available to estimate the success of this attempt.

The timing and duration of molt of banded Humboldt Penguins was determined over three years (1994-96) at Punta San Juan, Peru. In order to examine possible effects on the timing of the molt and the annual breeding cycle, different bands were used. Molting took place from the beginning of January to the end of March, but 90% of the population molted within a period of 3 weeks, with a peak between the second and third weeks of January. The molt was not skipped or repeated in a year. The molt of juveniles was asynchronous than adults, extending from January to June. Before coming ashore, penguins continuously foraged for a mean period of 3 weeks, when they gained between 32% and 34% of the pre-molt body mass. Penguins for 15 to 32 days, loosing between 8% and 9% of the pre-molt body mass. After replacing their old feathers, they remained at sea for a mean period of 2 weeks to replenish their fat reserves. The timing and duration was similar between sex, but changing year to year perhaps as a result of food conditions. There was a positive correlation between the timing of molt and the onset of the first breeding season and breeding frequency. Adults that molted earlier started breeding earlier and showed a higher breeding success than those individuals that molted later. Molt rather than breeding, occurred when food availability was the highest. Anchovies are closer to the coast and in shallower waters during the austral summer than in other seasons. A seasonal and synchronized molt during the period of high food supply is Adaptive by increasing not only adult survival but also to maximize the annual reproductive success. The onset and pattern of breeding Humboldt Penguins at Punta San Juan does not necessarily match the periods of high food supply, but it is the result of a synchronized molt period.

FORAGING AREAS OF KING PENGUINS AND PHYSICAL FEATURES: IS THERE A LINK?

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In 1999 and 2004, we tracked King penguins during incubation at Macquarie Island and Heard Island, respectively. Total foraging distances, maximal distances from the colony, and foraging trip durations were compared for both locations and related to oceanographic features, such as currents and bathymetry. At Macquarie Island, the behaviours among individual penguins were more similar to those tracked at Heard Island. Also, foraging distances were greater at Macquarie than at Heard Island. Frontal structures appeared more important at Macquarie than at Heard Island.

HOW DOES THE TIMING OF MOLT AFFECT THE ONSET OF BREEDING AND REPRODUCTIVE PERFORMANCE OF HUMBOLDT PENGUINS AT PUNTA SAN JUAN, PERU

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The timing and duration of molt of banded Humboldt Penguins was determined during three years (1994-96) at Punta San Juan, Peru. In order to examine possible effects on the timing of the molt and the annual breeding cycle, different bands were used. Molting took place from the beginning of January to the end of March, but 90% of the population molted within a period of 3 weeks, with a peak between the second and third weeks of January. The molt was not skipped or repeated in a year. The molt of juveniles was asynchronous than adults, extending from January to June. Before coming ashore, penguins continuously foraged for a mean period of 3 weeks, when they gained between 32% and 34% of the pre-molt body mass. Penguins for 15 to 32 days, loosing between 8% and 9% of the pre-molt body mass. After replacing their old feathers, they remained at sea for a mean period of 2 weeks to replenish their fat reserves. The timing and duration was similar between sex, but changing year to year perhaps as a result of food conditions. There was a positive correlation between the timing of molt and the onset of the first breeding season and breeding frequency. Adults that molted earlier started breeding earlier and showed a higher breeding success than those individuals that molted later. Molt rather than breeding, occurred when food availability was the highest. Anchovies are closer to the coast and in shallower waters during the austral summer than in other seasons. A seasonal and synchronized molt during the period of high food supply is Adaptive by increasing not only adult survival but also to maximize the annual reproductive success. The onset and pattern of breeding Humboldt Penguins at Punta San Juan does not necessarily match the periods of high food supply, but it is the result of a synchronized molt period.
POSTER PRESENTATIONS

FOSSIL PENGUINS FROM SOUTH AMERICA

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Penguins have an exclusive austral habitat that extends back 55 My (Late Paleocene, Antarctic) and constitute the most frequently birds in marine Cenozoic assemblages. Fossil Antarctica, Africa, Australia, New Zealand, and South America. Focused in the last area, the remains belong to the Spheniscidae (except one exhumed in the Upper Eocene of Tierra del Fuego considered as a Parnpapheosiformes). From the Upper Eocene-Lower Oligocene of Formation plus a Peruvian penguin (Otunru Formation). A gap exists between these Paleocene and the better known Pleistocene assemblages. In the lower Miocene of Patagonia have been found Erebales uncinus, Palaeocephalus gigantic, P. patachonicus, and P. biculcata (Gaiman Lower Pliocene of Chile (Bulla Inglesia Formation), were recognized a Spheniscidae. From the Middle Miocene of Peru (Pisco Formation) come Spheniscus megalephus and S. Miocone of Patagonia appear Parnapheosiformes and a new taxa currently under study. South America. Through the study of these fossils, it can be pointed out: (1) All these taxa are exclusive of specific level (Parnapheosiformes antarcticus, P. robustus and Palaeocephalus patachonicus), (2) osteological similarities with the recent taxa; (3) longivity showed by recent penguin is Spheniscus antarcticus, at least 11 My), there are no records of giant forms in the South penguin fauna because the beginning of the Neogene, by this time, living genus like Pygoscelis, currently known in Antarctica and subantarctic islands, have been recognized in China.

WITHIN-SEASON MASS CHANGE OF ADELIE PENGUINS RELATED TO ADULT CONDITION AND CHICK PROVISIONING RATES

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Using an automated weighbridge, we measured individual mass change and food load delivered to chicks in >100 pairs of Adelie Penguins (Pygoscelis adeliae) at Cape Crozier, Ross Island, over the course of six breeding seasons, 1997-2002 (average of >30 pairs per season). Individuals from a subsample of approximately 200 pairs; this information we calculated trip delivery. Most birds lost mass during the guard and creche stages.

GEOPHYSICAL VARIATION IN SEXUAL DIMORPHISM IN LITTLE PENGUINS (Eudyptula minor)

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We examined the geographic variation in mean bill depth and bill depth sexual dimorphism among 8 colonies of Little penguins (Eudyptula minor) in southeastern Australia. There was a positive correlation between mean male and mean female bill depths (r2 = 0.78, P < 0.01). Adult bill depth was also positively correlated to clutching mass (r2 = 0.93, P < 0.05) and negatively related to number of birds (r2 = 0.96, P = 0.02) at some colonies suggesting bill depth is influenced by local food availability during breeding period. The degree of sexual dimorphism (Mean Difference index, MDI), however, was not correlated to colony size. Nevertheless, there was a strong positive correlation (r2 = 0.83, P = 0.01) between MDI and the overall density of birds at the colonies. These findings suggest sexual dimorphism in bill depth in Little penguins is primarily influenced by sexual selection (either through intra-sexual competition or mate choice) rather than niche-separation to avoid inter-sexual competition for food.

ENERGY COSTS OF STEEL FLIPPER BANDS CAUSED BY FEATHER WEAR

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It has been widely reported that Antarctic penguin species are greatly affected by the use of steel flipper bands. The reason is usually argued to be that the bands cause significant hydrodynamic drag, forcing the penguins to expend significantly more energy while swimming and catching prey. It appears that penguins from warmer climates wearing similar flipper bands experience significantly fewer problems. There are reports of some problems with Little penguins (Eudyptula minor) with birds carrying bands having reduced breeding success. However, it is hard to find any evidence of widespread detrimental effects of bands on African penguins (Spheniscus demersus), although we recognised that there have not yet been completed studies investigating the effects of bands on these penguins and that poorly-fitted or manufactured bands have on occasion caused mortality, e.g. through swelling of penguins during moult or causing penguins to become snared in fishing line or bushes. We have
however, noted that nearly all African penguins wearing steel flipper bands suffer from wear of the feathers on their bodies under the flippers. In many cases this can result in a large area (ca. Africa), the loss of insulation caused by such feather wear is not significant. However, if similar heat loss will be significant. For example, we calculate that an Adélie penguin (Pygoscelis between 5 and 10% simply to maintain its body temperature while swimming.

RESIGHTING RATES OF AFRICAN PENGUINS RELOCATED OR OILED FOLLOWING THE TREASURE OIL SPILL IN 2000

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Following the "Treasure" oil spill in 2000, oil surrounded Dassen and Robben Islands and at Robben Island and many from Dassen Island venturing into the sea were almost certain to be washed ashore at several landing beaches, so that all African Penguins (Spheniscus demersus) were killed. The number of oiled penguins was estimated to rise into the thousands (and eventually remove clean birds from these two islands. Around 19,500 African penguins (mostly birds in transported some 700 km to Port Elizabeth and released to swim back to the Western Cape carrying out intensive monitoring, especially on Robben Island. The proportion of the trans-located penguins were banded. We have since then seen that located "swimmers" subsequently seen is lower than the proportion of oiled and rehabilitated Robben Island, whereas about 75% of the oiled birds were taken off Robben Island. The (about 7% of all the resightings). If we assume that all the oiled birds from Robben the right proportion of the swimmers and the survival rates of the swimmers are similar to those of the oiled birds. The estimate of the number of penguins in adult plumage at Robben Island at locality, including those in immaturity plumage. This suggests that most oiled birds collected from Cape. The three "swimmers" that were tracked each returned rapidly to the islands from which they were taken.

PYGOSCELIS PAPUA OF PETERMANN ISLAND: SPATIAL STRUCTURE OF POPULATION AND MORPHOLOGICAL VARIATION

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The Petermann Island (65°10’ S, 64°08’ W) is the place of localization of the most southern large population of Pygoscelis papua and the edge of gentoo population area. The 2210 nests of gentoo were registered during summer of 2002-2003. In total the 132 nesting groups were identified. Along the island they were distributed non-uniformly. Some of them were situated close to others and some were settled very aside of other nests. Nestlings differed also with the altitude and with the place were penguins used to go to the water for feeding ("beach"). The nestlings (and nests) were classified as "anchoreto-soal", "high-mountain", and according to their usual beach. The following three groups of adult birds were investigated for morphological variability. First group - EP (n = 124) - from the rookery at the low place of eastern part of Petermann Island, near the refuge. Second group - WP (n = 113) - from the rookery situated high on the hill at the small peninsula of western part of the island. Third group - BP (n = 73) - adults of different rookeries that had the common beach near the refuge. Analysis of variability of 16 morphological traits revealed statistically significant differences among groups for some of the traits. Relations between groups were different, for instance: Body mass, kg: BP < EP = WP.
of 2002-2003 (Petermann Isl.). The samples of blood of Catharacta macrorrhachis were collected in austral summer 2001-2002 (Gallinéz Isl.). Blood smears were fixed in 95% methanol and stained with 2% Giemsa stain. The mature erythrocytes (10,000 cells minimum for each bird) were scored under the light microscope for micronuclei and nuclear anomalies. To characterize genome instability of birds we had studied level of MN and more frequent NA. More frequently registered NA were classified as "budding nucleus" (bn), "two-lobe nucleus" (tn), "tiled nucleus" (ln) and "nucleus with cavity" (nc). The average rate of micronuclei of P. antarctica was 0.0250 ± 0.02%, bn - 0.175 ± 0.04%, ln - 0.186 ± 0.06%, nc - 0.38 ± 0.08%. The middle value of micronuclei frequency of P. adeliae was 0.0170 ± 0.02%, bn - 0.130 ± 0.05%, ln - 0.26 ± 0.07%, ln - 0.08 ± 0.04%. The average rate of micronuclei of P. papua was 0.05 ± 0.02%, bn - 0.10 ± 0.03%, ln - 0.09 ± 0.03%, ln - 0.12 ± 0.06%, bn - 0.03 ± 0.02%, a rate of magnitude of C. macrorrhachis was 0.0440 ± 0.02%, bn - 0.0250 ± 0.02%, ln - 0.09 ± 0.03%, ln - 0.1250 ± 0.04%, bn - 0.10 ± 0.01%. The average rate of MN of Ph. ariosus was 0.20 ± 0.14%, bn - 0.10 ± 0.10% and ln - 0.10 ± 0.10%. The application of studied parameters to characterize the species and populations' features of genome instability of Antarctic birds will be discussed. This work was supported in part by grant INTAS-2001-0517.

INTER-ANNUAL CHANGE IN THE FORAGING SUCCESS OF KING PENGUINS IN RELATION TO OCEANOGRAPHIC CONDITIONS AT Kerguelen Islands, South Indian Ocean

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Detraining and understanding the consequences of long-term changes in southern marine ecosystems is of prime importance. Top predators such as penguins are the only components of these ecosystems that can be easily monitored. They are directly influenced by the availability of their prey which are themselves influenced by abiotic components. King Penguin Aptenodytes patagonicus is one of the largest consumers of myctophid fish, a key resource and temperature-sensitive, of the southern ocean. As part of a long-term study on the foraging ecology of King penguin, we investigated variations in foraging success at Kerguelen (South Indian ocean) in relation to climatic variability. Data were available for 5 years (1995, 1996, 1997, 1998, 2004). The foraging movements (determined by satellite tracking) and the diving behaviour of penguins breeding at the Ratmoff colony (>60 000 pairs) were recorded together with the sea water temperature on the same individuals each austral summer from 1998 to 2004 (n=41 birds). Temperature and pressure were sampled with resolutions of 0.18 °C and 2 m respectively. Data about myctophid availability was available from pelagic trawls conducted over 3 summers (1998-2000).

Results indicated that many parameters related to foraging behaviour such as dive distribution, dive rate, dive depth and bottom time show high flexibility both within the population and from year to year. The foraging parameters varied concurrently with changing oceanographic conditions (temperature of the upper water column) and food availability. In all years the birds foraged eastward along a transect following the Kerguelen shelf break south of the Polar Front. The penguins foraged between 110 and 840 km from the colony and dived mostly between 120 and 250 m. During a year of abnormal warm water and low myctophid availability such as 1998, they dived deeper and increased their dive rate and bottom time by contrast to normal years (50%, 57% and 7% differences, respectively). Also the relative proportion of non-myctophid fish species was higher in the diet. On the other hand, the maximal foraging range, chick provisioning rate and breeding success at the guard stage did not differ significantly. Adjustment of diving parameters by King Penguins probably optimizes their foraging success so as to maximize feeding for themselves and provisioning their chick in response to environmental variability.

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CYTOGENETIC PARAMETERS OF GENOME INSTABILITY OF PYGOSCIELIS SP.

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The comparative analysis of cytogenetic parameters of genome instability of Pygoscies sp. and other birds of Antarctic ecosystem was carried out. The rates of micronucleus (MN) and nuclear anomalies (NA) in mature erythrocytes of peripheral blood were selected as main indicators of genome instability. The blood samples of three species of Pygoscies genus (P. adeliae, P. antarctica, P. papua) and Phalacrocorax ariosus were collected in austral summer

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Abstracts Book. 8th International Penguin Conference. Ushuaia, 6-10 September 2004

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We suggest that the presence of Chinstraps had not only direct adverse effects on the breeding success of Adelie penguins in mixed sites, but also a possible long term effect by negatively impacting on the recruitment of pre-breeding birds.

LITTLE PENGUINS AS INDICATORS OF CLIMATE CHANGE

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Recently there has been renewed interest in the use of natural systems in detecting climate change. Continuous biological datasets, covering a number of decades, are rare in Australia, however, data do exist on the timing of commencement of breeding of Little Penguins on Phillip Island in south-eastern Australia over 30 years. The mean laying date of the penguins on Phillip Island, has become progressively later over time and the question is raised as to whether this can be interpreted as a climate change signal.

ARE KIWIS BETTER DIVERS THAN AUSSIES: AN INTRASPECIFIC COMPARISON OF FORAGING EFFORT IN LITTLE BLUE PENGUINS Eudyptula minor

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Little blue penguins, the world’s smallest penguin, breed in several small colonies in New Zealand and Australia where environmental conditions and breeding success varies dramatically amongst colonies. However, they breed on similar types of prey (Clupeids) and face similar limitations on their foraging range. In this study, we compare the diving performance of little blue penguins at two colonies in New Zealand (Motuara Island and Oamaru) and two colonies at eastern (Phillip Island) and Western Australia (Penguin Island) using unmanned time-depth recorders of similar size. Sampling was focused on the guard stage when parents mostly make one-day trips. In New Zealand, diving little blue penguins showed higher vertical velocities than in Australia, with males gaining depth two times faster and females between 50% and 80% faster than Australian penguins. The pause between dives was longer for penguins in Australia. Penguins dived up to four times deeper in colonies with lower breeding success (Motuara Island and Phillip Island) which resulted in dives up to three times longer for those two locations. As little blue penguins have one of the shortest foraging ranges among seabirds, their diving performance at different locations can help to reveal the constraint conditions under which they evolved their foraging behaviour.
STRUCTURE OF THE HELMINTH COMMUNITY OF THE MAGELLANIC PENGUIN: FIRST RESULTS FROM NORTHERN ARGENTINEAN COAST

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In this we present the first results about the parasites helminth community of Spheniscus magellanicus on the Argentinian coast. From 1996 to 2001, Magellanic penguins (Spheniscus magellanicus) were caught in a massive mortality occurring in 2000, and 4 from Buenos Aires (Berissochole). The birds were prevaences (n=10), mean intensities (MI) and mean abundances (MA) were calculated for each parasitized species. The 100% of the hosts were parasitized. The 20 species from Chubut were (intensities, P = 60%, MI = 42, MA = 34); Cardiocephaloides sp. (G. Stratiotes); (intensities, P = 23%, MI = 5, MA = 1), Cerebratulidae sp. (Nematoda: Acucardiidae) (nematodes, MA = 40); Myctophiformes sp. (adult Corynosoma: Polymorphidae) (nematode, MI = 85, MA = 53, MA = 30). A. Populations of parasitic helminths in the distribution of the Binomial Normal model. The parasitic interactions in the intestines, and the results of the analyses performed, we can conclude that the Helminthes community in corroborating the hypothesis that a narrow trophi spectrum corresponds with few ways of incorporation of parasites, because most helminthes are transmitted by food.

PENGUIN POPULATION MONITORING - HOW MANY PENGUINS SHOULD WE COUNT?

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The use of population size of penguins as a monitoring tool to detect the effects of fisheries is well established. The size of a population as well as a product of the effects of demographic changes (colony census data from penguins as a tool to monitor the effects of fisheries generally depends on detecting demographic changes rather than movement induced changes. However, in very small sub-units (is) is chosen in the assumption that any changes registered will be representative of the population as a whole. However, at small scales, relative to the total population, the effects therefore limit the ability to determine the causes of any observed changes. Data on the long-term monitoring of a number of colonies on Signy Island, South Orkney, are used to identify a range of different scenarios where demographic and movement processes might be implicated in changes in population size. The results of these analyses are discussed in the context of a general approach to determining the appropriate scale at which monitoring of penguin population size should be conducted.

TO FLEE OR NOT TO FLEE: AFRICAN PENGUINS AND PEOPLE

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Ecotourism in the Western Cape Province, South Africa, is a huge and growing industry. African Penguins (Spheniscus demersus) (Vulnerable) are a drawcard in the industry, and the species has a reputation for tolerance of humans at its most visited mainland breeding site (Boulders Penguin Colony). One-third of the global population of the species occurs on Dassen Island, a site that will soon be accessible to tourists. The aim of this study was to describe the behavioural responses of breeding penguins on Dassen Island to approaches by a small group of people, and to investigate the effects of nest type and breeding stage on these responses. Three people, always wearing the same clothes, approached breeding birds on foot at a slow, constant pace. Key responses (vigilance, agonism, shifting position on the nest and nest abandonment) were recorded prior to the approach and after 2 minutes. Three nests were defined: exposed, semi-exposed and rock shelves. Nest contents recorded as eggs, small chicks or large chicks. Most birds became vigilant prior to the onset of the approach and demonstrated agnostic behaviour when approached at 1 m. Pre-approach behaviour was generally resumed as soon as the approachers retreated to their start position. An agnostic response to a 1 m approach was more common for birds with chicks than for birds with eggs. About one-quarter of birds with exposed nests abandoned during approaches. All except one of these birds were incubators. African Penguins breeding on Dassen Island appear tolerant to disturbance by small groups of humans on foot. Tourists on the island will have to be carefully regulated to avoid negatively impacting the breeding success of this important population.

VARIABILITY IN NEST TEMPERATURE BETWEEN DIFFERENT NEST TYPES AND ITS IMPLICATION ON DESERTION FOR THE AFRICAN PENGUIN (SPHENISCUS DEMERUS)

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African penguins Spheniscus demersus come ashore to breed from mid-January/February where they lay a clutch of 1-2 eggs. This is frequently followed by mass abandonment of eggs during periods of extreme heat experienced in February/March. On Robben Island a variety of nest types and habitats are used as nest sites, including scrapes, burrows, nests in metal boxes in open grassland, rock racks thickets and woody forested areas. Mini-biological recording temperature at 15 minute intervals were placed in a sample of active nests of various nest and habitat types. The nests were monitored to determine the causes of any observed changes. Data on the long-term monitoring of a number of colonies on Signy Island, South Orkney, are used to
DO NUMBERS COUNT? GENTOO PENGUIN BEHAVIOUR IN RESPONSE TO SINGLE AND GROUP PEDESTRIAN APPROACHES ON SUBANTARCTIC MACQUARIE ISLAND

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Predator group size is known to be a significant factor influencing anti-predator behaviour in wildlife. Similarly, group sizes of anthropogenic stimuli, e.g., numbers of wildlife tourists, are suggested to play an important role in how wildlife will respond to human activities (Frid & Dill 2002). Developing an understanding of these responses can assist wildlife managers in producing more appropriate minimal impact guidelines for human activity near wildlife. During the 2002 – 2003 austral summer on subantarctic Macquarie Island (54°30’S 158°57’E), we undertook a study to determine if there was a difference in the behavioural responses of guarding Gentoo penguins Pygoscelis papua when exposed to single persons or groups of people visiting the nest. This was achieved using an experimental design, whereby the behavioural responses of guarding Gentoo penguins were collected before, during, and after exposure to a standardised pedestrian approach of either a single person or a group of five people. For both pedestrian treatments, behaviour in the presence of a single person was significantly different to that recorded prior to the pedestrian stimuli, primarily characterised by heightened vigilance activity. However, the frequency and duration of vigilant activity was significantly greater in the presence of groups of people than single persons, suggesting that Gentoo penguins associated a higher level of perceived risk with increased numbers of people during pedestrian visitation. Further, for both pedestrian approach treatments, there was evidence that vigilance levels continued to remain elevated after the pedestrians departed. The relevance of findings for the management of human-Gentoo penguin interactions on Macquarie Island are discussed.
**AN ESTIMATE OF POPULATION SIZES OF ROCKHOPPER AND MACARONI PENGUINS AT ISLAS SAN IDELEFONSO AND DIEGO RAMIREZ, CHILE**

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During the incubation period of 2002, we estimated numbers of breeding pairs of rockhopper and macaroni penguins at Islas de Idefonso and Diego Ramirez, in Southern Chile. Both locations groups. First, we searched the islands to locate breeding areas and used a hand-held GPS to taking slope into account, were determined through plotting the GPS points into a spatial two area-sampling techniques, quadrat sampling and distance sampling. To extend the survey, we conducted aerial photography of all the islands and within the areas of occupation and the densities derived at the ground-surveyed islands, we derived to record the current status of these penguins in southern Chile.

**IS CAROTENOID-BASED PLUMAGE INVOLVED IN MATE CHOICE BY SNARES CRESTED PENGUINS?**

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Carotenoid-based colours such as red, orange, yellow can potentially serve as important sexual signals that function as indicators of the health and quality of prospective mates. Carotenoid-based colours appear to be more common in the penguins species with high-quality sexual display and in species with the Crested Penguins. The crest however, whether this is used for their sexual display is largely unknown. This study will examine mate choice of Snare Crested Penguins by studying the relationship between the mate body characteristics and their plumage colours.

**AVIAN PREDATION AT A SOUTHERN ROCKHOPPER PENGUIN COLONY ON STATERN**

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The association between avian predation on Southern Rockhopper Penguins (Eudyptes chrysocephalus) and colony size was examined during the chick-rearing period in the 1997-1998 season and quantified for the first time. Eight subcolonies ranging from 69 to 1520 nests were observed for 461 hr from 3-31 December 2003. Striated Caracaras (Phalcoboenus australis) were the most common predator/scavenger species in all subcolonies except for two in which Kelp Gulls (Larus dominicanus) and Dolphin Gulls (Larus scoresbii) were dominant. Total activity rates by both gull species were significantly higher during the last week of our study, once creches had formed. Searches, predation and attempted predation rates for all species were generally less than 2% of the subcolony size, but this was not significant. For Striated Caracaras, 50% of the predation and attempted predation events were from central tussocks and on nests that were next to these tussocks. Striated Caracaras probably spend more time in larger subcolonies where central tussocks are generally absent. Predation and attempted predation by gulls were only on central nests and from the air. Neither chick mortality nor probability of predation showed a significant correlation with subcolony size. The largest subcolony had the lowest chick mortality and probability of predation compared to the rest of the subcolonies.

**THERMOREGULATION IN MAGELLANIC AND HUMBOLDT PENGUINS**

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The Humboldt penguin is endemic to the Humboldt Current with colonies extending from Isla Foca, Peru (5°S), to Punta Ballena, southern Chile (42°S), while the Magellanic penguin breeds from Cape Horn to 45°S on the Atlantic coast, and up to 28°S on the Pacific coast. Although, these species overlap in their distribution by ca. 900 km, it is expected that, species-specific adaptations may have moulded different physiological responses in these two species, setting each be optimally adapted to the environmental conditions in its breeding distributional range. It is expected that seabirds in cooler climates have higher metabolic rates, lower thermal conductance and a lower limit of the thermoneutral zone than seabirds in warmer climates. To test these predictions, we conducted flow respirometry experiments in the congeners Magellanic and Humboldt penguins: we measured oxygen consumption and body temperature in air at ambient temperature ranging from -2 to 40 °C. We found that the thermoneutral zone extended from 2 to 16 °C for the Magellanic and from 4 to 30 °C for the Humboldt penguin. Rearing metabolic rate differed significantly between Magellanic (3.2 W/kg) and Humboldt (3.7 W/kg) penguins. Minimal thermal conductance was also significantly lower in the Magellanic (0.9 W/kg°C) than in Humboldt (0.15 W/kg°C) penguins. Our results show that in the Humboldt penguins higher metabolic rates are not accompanied by an increase in insulation and reduction in the lower limit of the thermoneutral zone. The lower thermal conductance of the Magellanic compared to the Humboldt penguin reflects an adaptation to cooler climates. It appears that the observed physiological responses of the Magellanic and Humboldt penguins reflect the conditions they face in their colonies during the breeding period.

**REHABILITATION OF MAGELLANIC PENGUINS (SPHENISCUS MAGELLANICUS) IN THE ATLANTIC RAINFOREST COAST FROM 1999 THROUGH 2003**

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The populations of Magellanic penguins, as well as other species of South American Spheniscus (S. humboldt) and S. mendiculus), have declined due mainly to oil pollution, interaction with fishing activities and weather changes caused by global warming. The report by
penguin fishers in Southeast Brazil has been taking place through decades, because penguins are migratory birds that cross international borders as part of their life cycle. The ones found alive in the Atlantic Rainforest Coast are taken to the Aquário de Santos for recovery and rehabilitation. The birds are stabilized and get specific treatment, being released or redirected to other institutions that have appropriate facilities according to the law on the maintenance of captive species. The Aquário de Santos has reported successful reproduction of penguins since 2001. Although the Magellanic penguin is not considered a threatened species by IUCN, population monitoring and research may help explain the reasons of the observed fluctuations and help establish actions for reducing human related effects. The most common effects observed in stranded birds were: depletion in juvenile individuals (55.90%), clinical infection by aspergillosis (8.7%), bacterial infections (14.47%), oiling (6.76%) and trauma due to interactions with fisheries and predators (6.9%). The weight of juveniles individuals that arrived at the Institution in the last 5 years appears to reflect the higher or lower food availability, that probably varies due to climatic factors. Wider studies in Brazilian Coasts are necessary to improve Magellanic penguin conservation strategies.

HUMBOLDT PENGUIN CENSUS ON ISLA CHARÁRAL, CHILE: RECENT INCREASE OR PAST UNDERESTIMATES OF PENGUIN NUMBERS?

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While Isla Chañaral (29°02'S) in Chile has long been recognized as one of the most important breeding islands for the Humboldt Penguin, reported numbers of birds there never exceeded 3,500 breeding individuals in the last two decades. However, in 2002, a one-day survey found considerably more penguins present on Isla Chañaral such as to exceed the world population estimate for the species (3,300 - 12,000 birds). Between 9 and 14 February 2003 we conducted a Humboldt Penguin census on Isla Chañaral. Two different survey methods were combined to assess the number of penguins. Terrestrial or surface counts were used to survey penguins on open plains or beaches. Small area surveys of randomly established counting quadrats were conducted to assess the number of penguins in nests as well as total number of nest sites. Results from small area surveys were extrapolated using surface size ratios of counting quadrats vs. entire nesting sectors. We determined that approximately 22,000 adult Humboldt Penguins, 3,600 chicks and 117 juveniles were present on the island during the survey. The results were much higher than any previously published estimate. Natural processes alone cannot account for a population increase, and penguin numbers on Isla Chañaral probably have on past underestimated. The results correspond well with recent publications that suggest that Humboldt Penguin numbers in Chile have been underestimated in the past due to inconsistent census methods. There are concerns about the current protection status of the island in light of its fragility and importance as the premier breeding location of the Humboldt Penguin along its entire distributional range.

FOSSIL PENGUIN REMAINS AT THE SOUTH SHETLAND ISLAND: TAPHONOMICAL INFERENCE

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A vertebrate fossil assemblage was exhumed from the Holocene raised beach deposits on the coast of Potrero Peninsula, King George Island (South Shetland Islands, Antarctica), where the geological composition is dominated by Lower Tertiary volcanic sequences and Quaternary deposits. The vertebrates remains found at Pingüo locality (62°15'20"S, 58°37'08"W), were identified to species where possible, and radiocarbon dating on the penguin bones as well as new taphonomical data were obtained as a contribution to reconstruct the Holocene environmental history of this area. The subfossil assemblage includes remains assigned to Pygoscelis adeliae, P. papua, Catharacta antarctica and unidentified marine mammals. Radiocarbon dating on the penguin bones yielded near 5600 yr BP, corresponding to mid-Holocene epoch. We found nearly 450 penguin bones, which correspond to 8 skulls, 224 appendicular elements, 12 sternum, 131 parts of girdle, 13 symphysis and 50 vertebrae, among others. Similar proportion of bone types was observed in the modern tanatorio near the study area, where remains of penguins (some of them preyed on by skuas and marine mammals) constitute large accumulations. The studied fossil-bearing raised beach deposits reflect the glacio-eustatic emergence of the coastal area, where important uplifts have been identified. Additionally, the avian assemblage is composed of flying bird remains assigned to Brown skua Catharacta antarctica, including three bones of the wing, two of the leg, a synsacrum with the pelvic girdle, and a jaw. The bird bones and a fragmentary appendicular bone of sea elephant Mirounga leonina suggest that the complete fossil assemblage represents biocoenoses, representing organisms inhabiting the coastal area of King George Island. The presence of non-reworked bones accompanied by a partially articulated penguin skeleton indicates that the remains underwent minimal transport. This idea is confirmed by the discovery of several nearly complete skulls and sternums as well as the presence of penguins’ tail feathers, which abound within the studied sandy beds. Besides, this proposal is congruent with the rapid sedimentation produced by the beach dynamics associated to the mid-Holocene episodes of marine transgression reported from this coast.

COLOUR VISION CAPABILITIES OF LITTLE PENGUINS, EUEDYPTULA MINOR

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Many penguin species have coloured markings ranging from yellow to red on their head and neck which may be used in specific displays between individuals. To recognize these markings on other individuals, penguins should have good perception of light at longer wavelengths. However, a study showed that penguins have poor perception at this end of the light spectrum. Although Little Penguins have no coloured markings, they may be useful to determine the perception of colours at long wavelengths due to the similar anatomy of the penguin eye. I examined three anatomical characteristics of the retinas of Little Penguins: (i) the ratio of rods to cones, (ii) the density of visual receptors in different regions of the retina and (iii) the type/colour of oil droplets present in the retina. This study found the retina of the Little Penguin to be cone dominated and the majority of the oil droplets in the cones to be pale green, with much smaller proportions of yellow, clear/clearless and red oil droplets. The low proportion of red oil droplets indicates reduced sensitivity at longer wavelengths (yellow-red). Little Penguins have a higher concentration of receptors in the posterior-temporal region of the retina, which means that their vision is better when looking up and forward. The poor perception of long wavelength light suggests that perception of colour for Little Penguins is not a primary function.
of the eyes. This poor perception may be enough for other penguin species to recognise the coloured markings. The results indicate that the retina is primarily designed for seeing water; the wavelength of light is reduced. In addition, the higher visual acuity in the catch their prey.

CONSERVATION OF HUMBOLDT PENGUINS IN PERU: EXPERIMENTAL APPROACH USING ARTIFICIAL COLONIES, DECOYS AND SOUND RECORDINGS

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This study was a follow up of tests using artificial nest burrows for increasing breeding success of the endangered Humboldt Penguin at Punta San Juan, the largest breeding colony in Peru. Surface nests because they were less affected by heat stress, gull predation, likelihood of penguins using artificial nests were less affected by rainfall and exposure than disturbance of surface. Penguins using artificial colonies with covered nests in order to expand suitable breeding areas. Colonies each holding 50% of the population in Peru. Four to test size of decoy groups (2-15s) and the diversity of vocalizations. The presence/absence of conspecific activity and the diversity of conspecific sounds. Penguins showed higher response to location of the target. Penguins decoys. Likewise, penguins had more interactions with the "standing" and "standing" positions. Although penguins visited all colonies and showed no behavioral changes for the Humboldt penguins can respond to artificial colonies, decoys and sound may help design similar enhancements to higher quality nest sites in other locations for Humboldt penguins.

IMPACT OF AVIAN MALARIA IN CAPTIVE PENGUINS AT EDINBURGH ZOO, AND RELEVANCE TO WILD PENGUINS

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Exposure to Plasmodium spp. has been recorded in wild penguin populations, but only in zoos. Ante-mortem detection of Plasmodium spp. penguins, house indoors molecular and serological tests only demonstrate infection, not clinical disease. Post-mortem in tissue sections. A cause of death could not be found in 39% (n = 1371, 35,857) 68-62% of the Plasmodium schizonts are not demonstrated penguins examined post-mortem at Edinburgh zoo from 1914-2004. It was postulated that malaria may have contributed to these deaths. Hepatic histology samples were evaluated for non-specific pathology that could be caused by infection with Plasmodium. Pathology included peri-vascular mononuclear cell infiltration, erythropagocytosis, and hemosiderin deposition. No significant association (Fishers exact test, p > 0.5, n = 92) between the season (March-September) and proportion of penguins showing pathological changes was found. (0-14.0, 27.65%) of penguins were found. (0.0-0.5, n = 4) and undiagnosed causes in single species. Gentoo penguins (Pygoscelis papua) (p > 2, n = 24). Only a single 12 month old gentoo penguin was confirmed with Plasmodium infection on demonstration of schizonts on post-mortem hepatic histology. No significant difference in pathology was found before and after prophylactic treatment of Gentoo penguin chicks with Clotiap.mosquito breeding sites with Bacillus thuringiensis. Israellensis were introduced in 1999 (p = 0.9-9.9, n = 92). Avian malaria is thus unlikely to be a significant cause of undiagnosed deaths in penguins at Edinburgh zoo. As suitable anthropod vectors and Plasmodium in the local wild bird population are both present, the possibility exists that, in contrast to Spheniscus spp., the species held by Edinburgh zoo (King penguins Aptenodytes patagonicus, Gentoo penguins Pygoscelis papua, Magellanic penguins Eudyptes chrysocome, Rockhopper penguins Eudyptes chrysocome) are not particularly susceptible to clinical disease caused by Plasmodium. Work is needed to elucidate the structure and function of the Plasmodium in wild population exposed to Plasmodium. Further factors and implications for studies of Plasmodium in wild penguins will be discussed.

STATISTICAL CLASSIFICATION OF DIVING BEHAVIOUR IN FEMALE ROCKHOPPER PENGUINS FROM STATION ISLAND, ARGENTINA

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Time and depth recorders are capable of storing information over several weeks, yielding thousands of dives. Dives are usually characterized by variables strongly related. Multivariate methods provide a useful tool to analyse huge amounts of data, and to reduce the number of variables and human subjective bias in interpreting diving behaviour. 1189 dives of eight adult females of southern rockhopper penguins (Eudyptes chrysocome chrysocome) recorded during the chick-rearing period in Tierra del Fuego were classified manually and statistically (principal component analysis, discriminant function analysis and cluster analysis). Using a combination of these methods all dives were classified into nine dive types. Each of them was characterized by a combination of variables used to feed the multivariate analysis (like duration, bottom time, maximum depth, etc.). Visual inspection of the distribution of the dive types over the foraging trip context and time of the day, allowed to assign significant functionality to each diel type. The nine types were then reclassified into three hypothesized function groups: traveling, searching and foraging. The first one was characterized by shallow depths and short duration dives restricted at the beginning and end of a foraging trip. The exploration group was composed by dives of middle to intermediate depths, longer duration than the previous but with similar descent and ascent rates. The foraging group was similar to the second one but characterized by faster ascent rate. This characteristic was observed in other crustaceans' eaters pursuing mobile patches of prey. Most of the dives belong to the foraging group and occurred often immediately after some searching dives type of the classification group could be used to estimate foraging effort and efficiency, by allowing calculation of the proportion of time spent performing dives associated with foraging and the relative number of feeding events recorded. Although such an index remain a coarse estimate of foraging effort and efficiency, it could provide further insight into key aspects of foraging ecology of these animals.
SEX AND BREEDING STAGE DIFFERENCES IN THE DIET OF SOUTHERN ROCKHOPPER PENGUINS (EUPTYES CHRYSOCELE CHRYSOCELE) IN STATEN ISLAND, ARGENTINA

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Southern rockhopper penguins as all the crested species are sexually dimorphic and each sex has specific breeding duties. During the breeding season only females were seen with their chicks while both parents did it during the crèche stage. The stomach contents of 20 females during brooding and 10 from each sex during the crèche stage in 2002/2003 breeding season were analysed and the diet and stages and sex differences studied. Moreover, the foraging trips duration in both periods was assessed by an automated reading system that detected breeding birds, which were injected with transponders in previous seasons. In both stages a mixture of crustaceans, cephalopods and fish larvae and juveniles were found. Nevertheless, not all the prey species remained the same in both stages and also the frequency of occurrence and composition by number varied. We found also differences in prey species and composition by number between sexes during the crèche period. Given the duration of the foraging trips, the foraging areas were almost the same in both stages but, however, almost twice the number of penguins were foraging during the crèche compared with the brooding stage. The diet differences found between stages and sexes and its relation with the habitat, sexual dimorphism and competition are discussed.

UNCOUPLING PROTEIN AND ATP/ADP CARRIER INCREASE MITOCHONDRIAL PROTON CONDUCTANCE AFTER COLD ADAPTATION OF KING PENGUINS

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Juvenile king penguins develop adaptive thermogenesis after repeated immersion in cold water. However, the mechanisms of such metabolic adaptation in birds are unknown, as they lack brown adipose tissue and uncoupling protein-1 (UCP1), which mediate adaptive non-shivering thermogenesis in mammals. We used three different groups of juvenile king penguins to investigate the mitochondrial basis of avian adaptive thermogenesis in vitro. Skeletal muscle mitochondria isolated from penguins that had never been immersed in cold water showed no superoxide-stimulated proton conductance, indicating no functional avian UCP. Skeletal muscle mitochondria from penguins that had been either experimentally immersed or naturally adapted to cold water did possess functional avian UCP, demonstrated by a superoxide-stimulated, GDP-inhibitable proton conductance across their inner membrane. This was associated with a markedly greater abundance of avian UCP mRNA. In the presence (but not the absence) of fatty acids, these mitochondria also showed a greater adenine nucleotide translocase-catalysed proton conductance than those from never-immersed penguins. This was due to an increase in the amount of adenine nucleotide translocase. Therefore, adaptive thermogenesis in juvenile king penguins is linked to two separate mechanisms of uncoupling of oxidative phosphorylation in skeletal muscle mitochondria: increased proton transport activity of avian UCP (dependent on superoxide-stimulated GDP-inhibitable) and increased proton conductance activity of the adenine nucleotide translocase (dependent on fatty acids and inhibited by carbonyl cyanide 4-(trifluoromethoxy)phenylhydrazone).

MONITORING HEMATOCRIT VALUES AND WEIGHT OF MAGELLANIC PENGUINS (SPHENISCU S MAGELLANICUS) DURING THE REHABILITATION PROCESS

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The objective of this work was to verify hematocrit and weight variation in Magellanic penguins (Spheniscus magellanicus) during the rehabilitation process. In 2002 and 2003, upon arrival at the Centro de Recuperación de Animales Marinos - Museu Oceanográfico (CARMAL), a marine animal rehabilitation center located in Southern Brazil, penguins were weighed and blood samples collected for hematocrit determination. Additional sample collection and penguin weighing were weekly performed until the rehabilitation process was released. The penguins (n=90) showed mean values (± SE) of hematocrit of 46.91 ± 0.58%, 41.92 ± 0.56%, 41.58 ± 0.60%, 42.34 ± 0.48%, 44.62 ± 0.31% upon arrival at CARAL, after the second, third and fourth week of recovery and before release, respectively. Hematocrit was significantly higher upon arrival at CARAL (p<0.05). It also was significantly higher at the second, third and fourth weeks of recovery and before release (p<0.05). Hematocrit after the second, third and fourth weeks showed similar values (p>0.05). Mean weight of the penguins (n=76) was 2.725 ± 0.055 kg; 2.985 ± 0.048 kg; 3.005 ± 0.0475 kg; 3.127 ± 0.0521 kg; 3.662 ± 0.048 kg upon arrival, after the second, third and fourth week of recovery and before release, respectively. Weight was significantly lower upon arrival (p<0.05) and significantly higher before release (p<0.05). Weight after the second, third and fourth weeks of recovery showed similar values (p>0.05). Low weight upon arrival suggests the penguins were fasting or starving. Water ingestion occurs through feeding, consequently dehydration occurred as a result of starvation. Dehydration was verified through high hematocrit values upon arrival, which decreased after hydration therapy.

THE PRESENCE OF THE MAGELLANIC PENGUIN (SPHENISCU S MAGELLANICUS) ON THE NORTHEASTERN COAST OF THE PROVINCE OF BUENOS AIRES, ARGENTINA, AND ITS RELATIONSHIP WITH PETROLEUM CONTAMINATION

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The population of Magellanic penguins of the Southeast Atlantic migrates towards the north arriving approximately at 23° south latitude (Brazil), during the non-breeding season. During this pelagic movement, parts are affected by petroleum spills or by derivative products. Numerous spills have occurred along the Argentine Coast which according to the reports of the Argentine National Navy, happened from 1998 to 2003, principally in ports, the same being controlled by trained personnel. Not having declared the possibility of eventual accidents or illegal discharge might prevail on the high seas. However the constant appearance of affected penguins evidence the chronic presence of petroleum in our waters. La Fundación Mundo Marino (FMM), San Clemente del Tuyu, Buenos Aires, Argentina, receives oiled birds that are rescued in an area of approximately 100 kilometers from the north Buenos Aires coast (from 36°22'S/56'44"W to 37°15'S/56'58"W). From 1987 until 2003, 1,166 Magellanic penguins have been received. Of these, 79.04% were oiled, 0.2% adults and 30.7% juveniles. The major appearance of oiled penguins (75.06%) occurs between the months of may and august, a period that coincides with the pelagic phase of the biological cycle. On the arrival of each penguin its general condition is evaluated, morphometric measurements are taken, and they are identified with metal rings. The rehabilitation consists of: stabilization, feeding, removal of the contaminant, and re-conditioning of the plumage. Once they are discharged from veterinary care and coinciding with the appropriated migration period, the birds are restored to the wild. These techniques have been
perfected throughout these 17 years, allowing the percentage of rehabilitated birds to reach 94% in the last three years. This treatment of 1,616 birds for oil spills is insignificant in relation to the conservation of the penguin species. It has, however, given us proof of constant petroleum spills for over 17 years, using the penguin as a biological indicator of the contamination that exists, and proves the necessity of efficient political control of the contaminant. In this way, it makes proven techniques possible and trained personnel available for eventual oil spills that can affect the stability of the penguin colonies.

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ANALYSIS OF THE SOURCES OF INTERANNUAL VARIABILITY ON THE REPRODUCTIVE PARAMETERS AND DIET OF CHINSTRAP PENGUIN ON LAURIE ISLAND, SOUTH ORKNEY ISLANDS, ANTÁRTICA

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The CCAMLR Ecosystem Monitoring Program (CEMP) included krill predator parameters to detect changes in krill availability that can be attributed to the harvesting of krill. To this end it is necessary to establish baselines of interannual variability and to discriminate between changes due to natural factors other than variability in krill abundance. The results of the analysis of the dietary and reproductive success CEMP parameters at Laurie Island in five breeding seasons (1998-2002) are presented here. Stomach contents weights, general diet components and krill length distribution were obtained using the standard CEMP methodology as Chinstrap penguin (Pygoscelis antarctica). Similar data from Adélie penguins (P. adelae) were used for comparison purposes. Standard meteorological parameters were available, together with glaciological information. Krill was present in all the samples, while the frequency of occurrence of fish and amphipods was variable within and between years; always below 65%. The nested ANOVA of krill lengths in stomach contents indicates that Chinstrap penguins do not feed on the same aggregations and that a set of penguins is required to obtain a sample representative of the length distribution. Significant differences in lengths of krill available to penguins were found between days and years. Analysis of Kolmogorov distances between penguins confirms these results. The weight of the stomach contents along the five years studied presented interannual variability that could not be explained by any particular cause, except in 1998 when the influence of the late breaking of the pack ice was highly significant in the stomach contents weights before and after the breaking of the pack ice. The late breaking of pack ice was identified as the cause of the significantly low reproductive success observed in 1998 (0.67 chicks/nest in 1998 against relative stable values around 1.2 in the other years of early breaking of the pack ice). It should be noted that the causal relationship between the late breaking of the pack ice and the marked descent in reproductive success was based on the comparison of Chinstrap with Adélie penguin data.

ARE NEST-BOXES TOO HOT FOR LITTLE PENGUINS?

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In order to assess the potential impact that artificial nest-boxes may have on the occupation rate or physical condition of adults and chicks of Little Penguins Eudyptula minor, temperature was recorded continuously for 37 days simultaneously inside 7 nest-boxes, and in the

surrounding bush. The temperature inside the boxes was always higher than that in the bush, the difference being greater around noon. Solar radiation was suspected to be the main cause of the high temperatures recorded inside of the boxes. Temperature differences between outside and inside the boxes were smaller on windy and dry days. Our results indicate that the maximum temperatures experienced by Little Penguins in the nest-box may likely reflect the most unfavorable conditions for the birds. In order to avoid hyperthermic conditions, an improvement in the ventilation of nest-box is suggested here.

OCCURRENCE OF MALARIA IN MAGELLANIC PENGUINS (SPHENISCUS MAGELLANICUS) IN A REHABILITATION CENTER IN SOUTHERN BRAZIL

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5 Fundação Parque Zoológico de São Paulo (FPZSP)

Avian malaria is caused by Plasmodium sp. parasites and is a recognized disease problem of penguins during captive circumstances, causing significant mortality. Parasites are transmitted between vertebrate hosts mostly through Culicoid spp. and Anopheles spp. mosquitoes, which inject sporozoite forms into the bloodstream. On a small scale, these mosquitoes are rarely parasitised and most infections are naturally occurring. Malaria is therefore a disease of long-term infections. Cross species may include those caused by anemia, pulmonary edema, hydropneumonia and sphenomegalgy (Gardiner et al., 1998, Grim et al., 2003). Avian malaria is identified as the cause of death in the presence of clinical signs such as anemia, depression, vomiting, dyspnea, gastritis, and post-mortem findings. Gross lesions may include those caused by anemia, pulmonary edema, hydropneumonia and sphenomegaly (Gardiner et al., 1998, Grim et al., 2003). Sudden death is common. In 2001, at Centro de Recuperação de Animais Marinhos (CRAM), a marine animal rehabilitation center located in Brazil, had two Magellanic penguins (Spheniscus magellanicus) dieing unexpectedly. Necropsy was performed and findings included hemorrhagic and edematous lungs, hydropneumonia, sphenomegaly, hepatic necrosis with friable consistency. Microscopically, the main lesions were related to the liver and included moderate periportal granulocytic and mononuclear infiltrates, discrete to moderate multifocal necrotic areas, multifocal areas of extramedullary erythropoiesis, moderate congestion, and the presence of malarial pigment within macrophages and endothelial cells. The goal of this study is not only to document the record of malaria affecting penguins in Brazil, but also to alert other institutions rehabilitating seabirds in the region to consider preventative measures against the vector, to identify and monitor the presence of hemoclasses when considering reintroduction. Acknowledgments: We thank Dr. C H Gardiner (Registry of Veterinary Pathology - Armed Forces Institute of Pathology, Washington D.C., USA) for his assistance.

THE INTRODUCTION OF THE PENGUIN CONFERENCE JAPAN

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PCJ, that in NG0 which consists of a lot of members who belong to zoos and aquariums and people who are interested in penguins, has been being active for all species of penguins since established in 1990. Since that, PCJ is being active to support and cooperate for penguin conservation of the world. For example, we keep to cooperate conservation of Humboldt
penguin in wild and support to SANCCOB, South Africa. In this conference we introduce about our activity on poster.

DECREASE IN A POPULATION OF ADELIE PENGUINS AT KING GEORGE ISLAND, ANTARCTICA

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As part of a monitoring study of an Adélie penguin colony, birds occupying nests with eggs and chicks at fledging were counted annually from 1995 to 2002, at Stranger Point, King George Island and 1995 and 1996, increasing during 1997 and 1998, when the breeding population reached the pairs represented by a continuous decrease from 1996 to 2002, when the number of breeding pairs followed a trend similar to that of the breeding population, the smallest number occurring in Adélie Penguins is discussed in relation to the reduced population area of krill observed in the Antarctic Peninsula region and to the critical death of Adélie penguins from critical wintering habitats.

PRELIMINARY RESULTS ON THE POST-BREEDING DISPERSAL OF MAGELLANIC PENGUINS FROM ISLA MARTILLO, TIERRA DEL FUEGO

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The winter dispersal of Magellanic penguins (Spheniscus magellanicus) breeding on Isla Martillo (54°S 79°W, Beagle Channel, Tierra del Fuego) has been monitored for the first time. Eight birds (4 females and 4 males) were successfully equipped with satellite transmitters in May 2002 and 23 March 2004. The devices lasted for an average period of 38±22 days (min=8, max=56), with 4 devices lasting >50 days. The last device stopped transmitting on 26 May 2004. All birds left Isla Martillo within days after being equipped and travelled eastwards along the coasts of Tierra del Fuego and southern Patagonia. During the initial tracking period birds were monitored northwards along the coast in Patagonia waters not further than 30 miles away from the coast. However, the two female birds only returned to coastal waters in southern Chile where devices finally suggesting that some animals may be detected in the area for at least the initial winter period. Coastal waters of the Strait of Magellan and Tierra del Fuego. Five birds were monitored along the coast in Patagonia waters not further than 30 miles away from the coast. However, the two female birds only returned to coastal waters in southern Chile where devices finally suggesting that some animals may be detected in the area for at least the initial winter period. Coastal waters of the Strait of Magellan and Tierra del Fuego. Two birds were monitored in coastal waters of Tierra del Fuego for >50 days, presumably, during their dispersal period. They were tracked and followed during incubation period. Coastal waters of the Strait of Magellan and Tierra del Fuego. Two birds were monitored in coastal waters of Tierra del Fuego for >50 days, presumably, during their dispersal period. They were tracked and followed during incubation period.

VARIATIONS IN ADELIE PENGUIN HEART RATE AND BEHAVIOUR

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The study investigates impacts of stressors on physiological and behavioural reactions in incubating penguins. This contribution describes equipment and methods, provides data on heartbeats in relation to behaviour during incubation, and compares these parameters in Adélie penguins with Ninn's data on Gentoo penguins (Pygoscelis papua). In a field study based in SSSI no. 13, Porta Fiumicino, King George Island (South Shetland Islands), simultaneous recordings were obtained of variations of heartbeats and behaviour in incubating Adélie penguins. Techniques were applied in recording heartbeats and behaviour in incubating Adélie penguins. Techniques were applied in recording heartbeats and behaviour in incubating Adélie penguins.

through a Provincial Park planned for Tierra del Fuego (Peninsula Mitre), and forest and some of them later traveled by a marine area proposed for the recent National Park Monte Leon, underlying their biological importance.

THE RETURN OF THE KING AND THE GROWTH OF THE GENTOO. NEW DATA ON PENGUINS NESTING IN TIERRA DEL FUEGO.

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King penguins were known to rest at Staten Island (Tierra del Fuego). One of the known breeding localities was Puerto Roca, where hunters reported about 20,000 pairs in 1869. By the early XIX century the colony disappeared due to hunting. We recorded birds in the coast of Staten Island in five occasions from 1992 to 2003. Birds are also known to visit Isla Martillo (Beagle Channel) to moult in numbers from one to three thousand over the summer. On 9th January 2004 we recorded three animals on Puerto Roca. One of them was incubating an egg, in the same exact location reported for the colony during the XIX century. We did not verify the viability of the egg later in the season. If a chick was raised it would have represented the return of king penguins to Staten Island after 94 years. Reports of gentoo penguins from the Tierra del Fuego archipelago are scarce. Despite of some sightings in the Cape Horn area, no breeding record existed for this area. Gentoo penguins were reported to visit and nest on Isla Martillo since the 1880’s. The colony is located within a Magellanic penguin colony, and showed an increase in numbers of active nests from one (November 1962 and December 1993). In five (November 2003) of the previous year, respectively, eight (November 2003) and nine (November 2003). Isla Martillo represents the only known breeding ground for gentoo penguins in South America. We found no evidence of gentoo penguins nesting or visiting Staten Island despite intensive surveys. The growth of the gentoo penguin colony from Isla Martillo may be the result of the recruitment of birds descendant of the first settlers or to movements of animals from the Falkland (Malvinas) Islands (or both factors acting together). Also, we propose that the vast foyuan archipelago may hide unknown breeding locations for gentoo penguins, to be revealed in the future.
and categorisation, using a standard Sony video camera (H8, CCD-TR200E) installed in a tent incubation period. The data present correlating variations in heart rate and behaviour of those obtained from undisturbed birds. This research, based in the Department of Zoology, tourism initiated by the Scott Polar Research Institute, Cambridge, in co-operation with the Department of Antarctic Biology, Polish Academy of Sciences. The current project is a co-operation between Phipps-Universitat Marburg and Imperial Colage, London.

EFFECT OF COLONY SIZE AND ENVIRONMENTAL VARIABILITY ON PREDATION ACTIVITY AT PENGUIN COLONIES IN ANTARCTICA

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The activity of predators and prey dynamics may change with colony size and environmental variability such as weather, phenology, time of day, or availability of alternative food resources. Larger colonies may receive greater attention by predators because of larger prey availability. Earlier studies on predation rates have focussed on colonies with high density of breeding birds, and not on smaller colonies with lower density. The purpose of this study was to evaluate the influence of colony size and environmental factors on predation rates at penguin colonies in Antarctica. Predation activity at Adelie, Stronger Point (King George Island), South Shetland Islands. Samples were taken from late March to early April 1998. Activity rates by Southern Giant petrels, Skuas, Kelp Gulls, and Sheathbills were assessed through the analysis of 132 h of observation. Multiple linear regressions and principal component analyses were carried out to evaluate the influence of environmental variables upon the activity of predators. Activity rates were significantly influenced by colony size at Chiriguan, Adelie, and Gentoo colonies. Activity rates were not significantly changed within colonies. Activity rates were positively correlated with wind intensity; however, predation attempts and predation rates were positively correlated with wind intensity. There was no evidence of reduced colonies, both considering colony size, colony composition and other sources of environmental variability.

IMPACT OF CRUDE OIL ON FEATHERS OF AFRICAN PENGUIN SPHENISCUS DEMERSUS

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Feather samples were taken from an oilied African Penguin Spheniscus demersus on admission, after washing, rinsing and day 1 after cleaning. These were exposed to a controlled environment with a scanning electron microscope (SEM) and showed evidence of the effects of oiling feathers of oiled birds at the SANCORB (Southern African National Foundation for the Conservation of Coastal Birds) Facilities in Capetown, R S A. These pictures are accompanied by washing guidelines to handle a bird during a complete cleaning procedure.

DIVE BEHAVIOUR OF ROCKHOPPER PENGUINS IN NEW ZEALAND

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Rockhopper penguins Eudyptes chrysocome have undergone a marked population decline over the last 70 years at their main breeding sites in New Zealand. At Campbell Island, the number of rockhopper penguins decreased by approximately 94% between the 1940s and 1980s. Stable isotope analyses have revealed that diet has not changed over this period, but the possibility remains that penguin experience relatively low food availability during the breeding season and that they have to devote increased time and effort to acquiring food. Our hypothesis of this idea is that rockhopper penguins breeding at Campbell Island will quantify dive effort, in terms of number and depth of dives, proportion of time spent diving and diving frequencies of rockhopper penguins using time-depth recorders. These are the first such data for rockhopper penguins from New Zealand. We discuss the results in relation to findings from similar work on rockhopper penguins carried out elsewhere in this species breeding range.

PENGUINS IN PERIL? ISOTOPIC INSIGHTS INTO DIET, MARINE PRODUCTIVITY AND SEA TEMPERATURE CHANGES

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Breeding populations of rockhopper penguins Eudyptes chrysocome in New Zealand's sub-Antarctic have declined dramatically over the past 50 years. For example, at Campbell Island, between the period 1940s-1980s, rockhopper penguins suffered a 94% reduction in numbers. The reasons for this marked population crash were not clear but changes in penguin diet, either a switch in prey species taken or a reduction in prey availability, perhaps the result of changes in sea surface temperatures, were a likely explanation. However, hypotheses involving changes in penguin diet have not been tested, and sea temperature data were limited. We present isotopic data to address the following specific questions: 1. Have New Zealand rockhopper penguin switched diet over the period when populations crashed? 2. Is there any evidence to indicate that there has been a shift in the level of productivity within New Zealand's sub-Antarctic marine ecosystem upon which rockhopper penguins depend? Additionally, the issue of sea temperature change is considered by presenting a time series of δ18O signatures from shell carbonate of the benthic foraminifera Neodyina gregaria, and relating these to corresponding trends in the strength of prevailing westerly winds over the sub-Antarctic region. Finally, we
comment on the current stats of rockhopper penguin populations at Campbell Island with respect to their interactions with avian and mammalian predators.

**A NEW SEABIRD REHABILITATION CENTRE FOR THE EASTERN CAPE OF SOUTH AFRICA**

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The Eastern Cape of South Africa is richly endowed with breath-taking scenery, beautiful beaches and is also important for its breeding seabirds. Algoa Bay supports up to 18 000 pairs of the largest gannetries in the world, numbering some 160 000 Cape Gannets and virtually pollution is a major threat to seabirds. Up to now, most major pollution incidents in southern occurrence in Algoa Bay and affects a number of seabirds, particularly African Penguins. The purpose and are inadequate to deal with a large number of oiled birds. No regular monitoring of shipping expected as a result of the building of a new deep-water port at the mouth of the Coega River, the risk of pollution and major disasters will inevitably increase. There is a need therefore for a rehabilitation centre and an active monitoring policy. The South African Marine Rehabilitation and Education Centre Trust (SAMREC) intend to build such a centre on the of oiled, sick and injured seabirds with an education centre, outlining the problems faced by seabird populations and the urgent need for their conservation. Funds for the building of the Authority. However, additional funds need to be found to equip the building and to cover the costs of day to day running and staffing.

**BREEDING PRODUCTIVITY AND ANNUAL CYCLE OF REHABILITATED AFRICAN PENGUINS FOLLOWING OILING**

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The success of rehabilitation efforts is often measured by the number of individuals that survive to return to their breeding colony. However, little is known about the effect of the oiling and the that return to their breeding colony. At Dassen Island in the south-western Cape, a monitoring Apollo Sea oil spill in June 1994. Eight years after the Apollo Sea oil spill at least 75% of the rehabilitated penguins had been recorded breeding. The breeding productivity of the rehabilitated birds was, on average, no different to that of other penguins that were not affected by the oil spill. However, in a couple of the latest cohort comparisons, when both the Apollo Sea conditions, the rehabilitated birds did not do as well as the unaffected birds. These differences highlighted the short-term nature of this impact. Other subtle and short-term impacts of oiling...
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