

Abstracts of presentations from the First Pan-European Duck Symposium, part of the Nordic Game Biology Conference, Denmark, March 2006.

Oral presentations

Exploring the density-dependent structure of waterfowl populations: new methods and evidence

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The use of long time-series of counts for detecting density-dependence in waterfowl populations has been an elusive and largely fruitless strategy. The explanations for this has been operational (failure of models to integrate the huge spatio-temporal complexity of waterfowl habitats) and natural (density-dependence is simply weak in wild populations). This has left the general belief among researchers that sustainability might not be possible in waterfowl, due to the large uncertainty associated to their population dynamics. Here we challenge this view through the analysis of time-series of population counts from several duck, geese and shelduck species wintering in Marismas de Doñana (SW Spain), one of the most important waterfowl areas throughout the Palearctic. Building on recent advances in nonlinear time-series analysis, we find density-dependence as a generalized process irrespective of waterfowl life history. Moreover, previously unreported nonlinearities and time lags in the density-dependent structure were found in several species. Using the proposed mathematical and statistical methodology, we reanalyse existing datasets of world duck populations obtained from the Global Population Dynamics Database. We find that the intricate density-dependent patterns uncovered in Marismas de Doñana are also a previously neglected but nevertheless quite general source of variability in duck populations worldwide. Overall, we show that with the correct statistical tools density-dependence can be unravelled as a relevant process in waterfowl population dynamics. Furthermore, our results suggest that adaptive management arising from optimal control theory might gain insight by incorporating nonlinearities and time lags as a major source of variability for harvested populations.

Using radio telemetry to investigate length of stay of Teal *Anas crecca* at a Danish autumn staging site

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For optimal design of reserves we need knowledge about how and for how long individual waterbirds exploit the sites they use outside of the breeding season and how to potentially increase this period. This is especially important at staging stopover sites, where length of stay of transient birds has such a dramatic effect on numbers counted at any particular time. We also need information about the influence of intrinsic and extrinsic various factors on the lengths of stay of individuals. To learn more about how Teal exploit one coastal Danish wetland during autumn migration, we radio-marked 252 individuals in an important staging area during 1995-2001. In most seasons individuals were tracked daily during August-December. The length of stay was explored for 142 individuals, each located on more than nine occasions. Based on a total of 3239 positions we found: a) a mean staging time of 20 days, b) large individual variation in length of stay and the effects of various parameters likely to influence these patterns will be presented.

Long-term changes in the structure of the wintering population of Tufted Duck *Aythya fuligula* in Camargue (France)

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Range expansions/contractions are usually well documented, especially in birds. In contrast changes in population dynamics (survival, reproductive output) and physical structure (biometrics, physiology) accompanying these changes in range size have been rarely monitored so far. Here we report changes of population structure of Tufted Ducks wintering in the Camargue monitored from the winter 1954-1955 to the winter 1973-1974, which occurred during the dramatic range expansion and increase in density of the breeding population of western Europe. Because long term changes of weather conditions may have affected population structure, all analyses were performed by including the average minimum daily temperatures recorded during winter. Survival tended to increase linearly with time over the study period. Moreover, average wing length tended to decrease in all classes of individuals whereas body weight tended to increase. Possible explanations for these changes in population processes and structure as a result of the range expansion of the breeding population are discussed.

Mitigation of population declines in the Common Eider *Somateria mollissima* in Denmark by introduced sex-differentiated hunting

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The Baltic-Wadden Sea population of Common Eider has declined markedly (by 35-50%) in number since the mid-1990s based on mid-winter counts in Denmark, Sweden, Germany and The Netherlands. As eiders are legal quarry in Finland and in Denmark, this flyway population qualifies as a huntable population of unfavourable conservation status, as acknowledged in the 'Roosta Resolution' by the Wetlands International Seaduck Specialist Group in 2002. The Danish Wing Survey of huntable bird species showed the ratio of adult Common Eider males and females in this population was stable during the 1980s at around 1.6 (i.e. c. 60% males to 40% females) and probably reflected the general male-biased ratio amongst species where females suffer from higher mortality rates due to investment in breeding efforts compared to males. However, the male/female ratio in the Danish Common Eider bag has dramatically increased since 1996, with 2.7 adult males bagged per adult female during the hunting seasons 2001/02-2003/04. If this reflects the adult sex ratio among Common Eiders in the Baltic-Wadden Sea flyway, the population presently consists of 73% males and 27% females. Combined with overall population estimates, the change in the sex ratio indicates that females have suffered proportionally more than males during the population decline. Given a decline in population from 1.2 million to the present 780,000, the change in sex ratio suggests that the male population has declined c.22% while the female population has declined c.50%. To mitigate the unfavourable status of this population, the Danish Council for Wildlife Management recommended that the open season on Common Eiders in Denmark was reduced from 1 October to 29 February to only allow hunting on male Common Eiders from 1 October to 15 February, and on females from 1 October to 15 January. This recommendation was agreed by the Minister of Environment, and took effect from 2004/05. Based on data from just one season, the effect of the change in law resulted in a marked change in the sex distribution in the bag, as hunters bagged 4.8 males per female during the 2004/05 season. The change in the sex ratio of bagged Common Eiders corresponded to a reduction in the total number of shot females from c.16,000 to c.11,000, assuming no change in the overall bag (estimated at 80,000, but data not yet available). Thus, the objective of protecting females relative to males was apparently fulfilled by the change in legislation, reducing the kill of females by approximately 5,000 compared to previous seasons.

The interplay between reserve management, water levels, eutrophication effects on food resources, staging dabbling duck numbers and hunting bags

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During 1994-2001 the Danish shooting-free area reserve area was doubled. Quarry species of dabbling ducks and geese responded positively by increasing numbers staging and extended staging periods, whereas several non-quarry species and some quarry species did not respond to the reserve network. Despite the doubled area of protected areas, bags of geese increased over the 8 years, and bags of dabbling ducks remained stable. This overall national picture of waterbird numbers in reserves does, however, hide several regional differences, both in numbers of birds staging and bags taken by hunters, which can be attributed to site-specific variations in water level fluctuations and instability of food resources due to eutrophication. In this presentation we explore the interplay between reserve management, water levels, eutrophication effects on food resources and staging dabbling duck numbers in four Danish wetlands, i.e. Ringkøbing Fjord, Nissum Fjord, Nibe-Gjøl Bredninger & Ulvedybet, and Ulvshale-Nyord. The Tipperne-reserve in Ringkøbing Fjord was established before effective waterbird monitoring programmes had been initiated, so there is no evidence of the significance of reserve management from that area. In the three other areas quarry species responded promptly to new reserves. The combination of a reserve with a rich source of submerged vegetation in all four study sites give them the potential to support high and internationally important numbers of waterbirds, and they are all ranked among the six most important Danish wetlands for staging dabbling ducks in Denmark. Unfortunately Ringkøbing Fjord, Nissum Fjord, and Nibe-Gjøl Bredninger & Ulvedybet have suffered from serious eutrophication problems during the last 30 years, and all sites at present support less than 10% of the food resource for herbivorous waterbirds known from the past. We demonstrate how these developments affect waterbird numbers, and explore how it may have repercussions on hunting bags taken from these areas. Food resources at Ulvshale-Nyord are less affected by eutrophication. In this site dabbling duck numbers increased tremendously in response to new reserves, and have since fluctuated in response to variable water levels.

Variation in waterfowl survival rates and population management

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The efficient management of exploited waterfowl populations should be based on an adequate knowledge of their dynamics. However, in many cases, estimates of demographic parameters are not easily obtainable. Then the comparative method, by providing predictions based on comprehensive data over several populations and species, may be particularly useful to predict the value of demographic parameters for a particular species. The values obtained in that fashion can be helpful for designing management practices. Since the work of Kremetz *et al.* (1997) investigating by such a comparative approach the sources of variation in waterfowl survival, several reliable survival estimates became available. In parallel, refined phylogenies of Anseriformes and new techniques to account for phylogenetic relationships in comparative analyses became available. On this basis, we propose a refined comparative analysis of survival patterns in Anseriformes, with a specific attention to hunting mortality.

Density-dependent nest predation in Mallards *Anas platyrhynchos*: patterns and implications

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Breeding success is a key element in population dynamics, and density-dependent processes are a prerequisite for hunting mortality to be compensatory rather than additive. Nest success, the proportion of laid clutches that actually hatch, is an important component of breeding success in birds. In waterfowl, nest success is mainly determined by predation. Previous research gives an inconsistent picture of the prevalence of density-dependent nest predation, as well as of its potential impact on natality and hence on population change. Using semi-natural Mallard nests and a crossover design for 32 lakes in the nemoral-boreal transition zone, we studied nest predation in relation to nest density, landscape type, and density of adult birds. There was a negative effect of nest density on nest survival. Further, survival rate was higher at forest lakes than at lakes in open agricultural landscapes, irrespective of nest density. The study implies that density-dependent nest predation has the potential of affecting habitat choice and population dynamics over large parts of the Mallard's vast range.

Migration of Teal *Anas crecca* wintering in central Portugal

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Teal occur in central Portugal from August to April, reaching maximum numbers in December of most studied years. This means that prenuptial migration starts in that month and that the end of the shooting period for this species should be anticipated, if ORNIS committee recommendations are to be followed. A Portuguese recovery from France confirmed northward migration is already underway in December. Birds wintering in this area mostly originate from Northern Europe and central Russia, reaching central Portugal mainly through the Atlantic flyway, including a proportion that passes through the United Kingdom. Young birds tend to stay further north during following years but there are several cases of Teal returning in subsequent winters. Since 1993, 1,898 have been ringed, although the recovery rate was low (4.8%). Some of the captured females were in the process of moulting primaries, meaning that the study area is also used as a moulting area and should be managed in a manner that takes this into account. The use of nasal saddles since 1999 (1,239 birds marked) produced more than 1,400 resightings and increased the amount of international movement information by 75%. Codes on the saddles can be read at distances up to 300 m using 90x magnification telescopes. There was a regular occurrence of Green-winged Teal *Anas carolinensis* during January, and one of them, as well as a probable hybrid with *A. crecca*, both juvenile males, was captured during the study. First estimates of turnover and returning rates will be presented.

Modelling turnover of Teal *Anas crecca* at a Danish autumn staging site in relation to hunting disturbance

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Patterns of abundance amongst migrating Teal were studied at a major autumn staging area in SE Denmark prior to and following the implementation of major hunting free areas at the site. Numbers of autumn Teal increased by several orders of magnitude following protection, but there was little sign of changes in counts of numbers of birds arriving at the site. Since the length of stay and overlap in arrivals and departures of individual birds are two parameters which have a very great influence on the daily numbers of birds present, it was speculated as to whether the dramatic increase in the number of bird days in autumn was due to an unchanged total volume of birds using the site increasing their length of stay. The presentation will demonstrate through modelling that, assuming exactly the same total number of individuals use the site, an increase in mean length of stay of

individuals from 1-3 days to 2-3 weeks was adequate to explain the increase in teal use of the site. The current length of stay (post refuge designation) as shown by radio telemetry (presented elsewhere in this congress) is compatible with a 2-3 week estimated mean duration of stay, strongly suggesting the role of unregulated hunting in hastening onward migration of individuals prior to declaration of hunting free areas. This further suggests local management of disturbance may enhance length of stay of individuals and hence the numbers of birds present over extended periods. This effect can be dramatic where turnover times are rapid and overlap of arriving and departing birds extended.

Wintering duck populations in Donana: a review of status, trends and spatial patterns

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The huge importance of the Marismas del Guadalquivir or Doñana marshes for wintering waterfowl in the Western Palaearctic is well known, yet until recently there have been no analyses of the huge amount of census data collected there over the past 30 years. Based on monthly aerial count data, we present a summary of the importance of the area for different wintering duck species, their relative abundance during different parts of the wintering period (from October to February), and population trends. We compare these trends with those previously identified at a regional level by Wetlands International. We identify the major changes to habitat in the area over the past 30 years, and consider how these have affected the duck populations.

Automated information extraction on sea birds from digital image data

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The increasing demands of nature conservation agencies to designate protected areas and to undertake environmental impact assessment (EIA) create ever greater challenges to our abilities to collect data relating to wildlife populations and their habitats. In particular, there is an increasing demand for information on the numbers and distribution of birds at high geographical resolution in offshore environments. Duck and other sea birds present special challenges for direct collection of spatially-explicit data on bird numbers that have been gathered by airborne human observers for many decades. In order to meet the data collection demands for EIAs at a fine geographical scale (e.g. in connection with offshore windfarms) improved methods are needed. Aircraft mounted digital cameras provide the possibilities for collecting very high spatial resolution (10 cm and less) image data and recent advances in object-based image information extraction tools offer significant developments over previously available techniques. The work presented in this paper has assessed the representation of Common Eider *Somateria mollissima* and Common Scoter *Melanitta nigra* in very high spatial resolution image data and the success of pixel-based and object-based extraction of information from these image data relevant to the counting and mapping of individual birds. The results demonstrate the capacity of these image data and the object-based methods; however, certain pixel-based methods can also enable useful information extraction in some cases. The paper discusses the potential benefits and problems of these technologies.

Disturbance caused by visitors to wildfowl at three wintering day-roosts

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Studies on the effect of human disturbance often adopt an a posteriori approach, and lack proper tests of the effect of disturbance. In this study, we combined the analysis of historical data, present set of behavioural observations and experimental tests to study the potential impact of visitors' disturbance to wildfowl at three different day-roosts of the same protected area. We first compared

average counts of ducks and geese over the last 15 years between a heavily visited, a sometimes visited and a never visited waterbody. Focal and scan samples of birds behaviour were then performed one day per week per waterbody across a winter. Finally, the same tape recording of the noise made by a group of visitors was played regularly at each of the sites. Broadly speaking, long term average use of waterbodies, distribution of birds over these, average behaviour and vigilance while sleeping did not differ, suggesting that birds broadly habituated to occasional disturbance by visitors. However, the presence of a group of visitors or of a simulated group of visitors through the playing of a tape, even if it may not have long term consequences, profoundly affected the behaviour and distribution of the birds in the short term at all sites, suggesting that birds kept on reacting to humans, whatever their frequency of appearance.

Teal *Anas crecca* flyway delineation in western Europe, and its implications for conservation
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Teal in western Europe are generally thought to belong to two distinct sub-populations, a North-Western European and a Black Sea/Mediterranean one. However, the limits of those potential sub-populations are poorly defined, and the rate of exchanges of birds between them has never been quantified. We used the dead recovery place of close to 9,000 Teal initially ringed in the Camargue, southern France in the Black Sea / Mediterranean flyway to measure abmigration rate, i.e. the rate at which individuals switch flyways. Approximately 20% of individuals appeared to do so, which has important consequences in terms of conservation: trends in population size may be different when the two sub-populations are merged, and some sites may lose their international importance, since this is based on the proportion of the total population hosted.

Effects of water level management on autumn staging waterbird and macrophyte diversity in three Danish coastal lagoons

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Many Danish wetlands frequently experience algae blooms and oxygen deficiencies because of eutrophication caused by enhanced nitrogen and phosphorous levels. As a consequence, wetland managers over the past 15 years have been very concerned about improving water quality, but usually without considering wetland suitability for waterbirds. We studied the response of autumn staging waterbirds and submerged vegetation in two Danish lagoons, where managers improved water quality by opening a floodgate to the sea, resulting in enhanced water replacement rates and higher water levels. A third lagoon with no change in management was studied for comparisons. Lagoons with changes in management, e.g. rise in water levels, experienced declines in bird species diversity, a decline in benthivore species and an increase in herbivore species. An increase in macrophyte biomass was found but seagrass diversity was low due to high salinity. Instead of having a shallow watered reserve for waders, the change in management with its associated rise in water level regime created a reserve for herbivorous wildfowl. The lagoon with no changes in management had a high and stable waterbird diversity and the number of bird-days increased. The major explanations for this were found to be diverse topography and low water levels. Furthermore, the macrophyte community was more diverse due to a low salinity. In order to improve both water quality and to increase waterbird diversity and carrying capacity for a wider range of trophic guilds in the managed lagoons, it is suggested to manage water levels actively during peak migration in autumn. This could secure larger shallow-watered areas to non-diving species and create a better synchronicity between water level and bird migration in autumn. The rest of the year the floodgate should be open in order to maintain high water quality.

Large-scale changes in secondary sex ratio in a declining population of Common Eider *Somateria mollissima*

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The breeding potential of a monogamous animal population should theoretically be at its highest when operational sex ratio is unity. If mortality of the other sex exceeds the other one, biased sex ratio will produce a concomitant decrease in the breeding potential of the population. We studied the sex ratio of migrating adult Common Eiders into the Gulf of Finland, the Baltic Sea in 1979-2005 (9 years). The results show that the sex ratio of adult birds has shifted from slight female bias (53.7 % in 1979-1983) to clear male bias (56.1 % in 2001-2005) during two decades. This shift is paralleled by a dramatic decrease of the Baltic Common Eider population since the early 1990s. The male bias among juvenile birds has also showed a nearly significant increase (Danish hunting bag data 1986-2004), which indicates that either the primary production of Common Eider ducklings is exceedingly biased towards males, or that the mortality of female ducklings has increased. The proportion of juveniles in the Danish hunting bag, which reflects breeding success of the Baltic populations wintering in Denmark, also decreased over the study period. The sex ratio changed repeatedly over the migration season. The proportion of females at the end of the migration period experienced a particularly dramatic decrease from the early 1980s. This indicates that the number of late-migrating sub-adult females has collapsed. Both the increased male bias and the decreased breeding success are likely to be linked with the population decline of Baltic Common Eiders. The Baltic population of breeding females may also be negatively affected by an increase in predation due to increasing populations of White-tailed Eagles *Haliaeetus albicilla*.

Use of ring recoveries for study of Pintail *Anas acuta* migratory links in the northern hemisphere

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By the end of 2005, the Bird Ringing Centre of Russia database contained 6,906 ringing recoveries of Pintail ringed in many countries throughout America, Africa, Europe and Asia. Ringing recoveries can be used to study migratory routes and population structure. The average distance for direct recoveries in Pintail was 2,120 km (n=1,876), less than for Wigeon *Anas penelope* (2,918 km, n=595), similar to Teal *Anas crecca* (2,142 km, n= 1,925), but considerably greater than in Mallard *Anas platyrhynchos* (849 km, n=2,878), Garganey *Anas querquedula* (1,731 km, n=593), Gadwall *Anas strepera* (990 km, n=258) and Shoveler *Anas clypeata* (1,855 km, n=595). Pintail can be characterised as an "intercontinental duck" because migratory routes of this species extend not only through Europe, Asia and Africa, but over the Pacific Ocean, as well, linking Eastern Eurasia and North America. In the Northern Hemisphere ringing recovery patterns reveal two meta-populations of the Pintail: African/European/Indian/West Siberian and Far-eastern/Japanese/North American ones. These meta-populations are separated from each other with the gap of the whole Central Siberia, where very few Pintail recoveries were detected. The exchange between these meta-populations is not common. Central Siberia might be an area of Chinese-central Siberia population, which might overlap with both of the mentioned meta-populations. Ring recoveries can show that meta-populations consist of closely related and highly overlapped populations.

Distribution and number of seaducks in the northern European tundras of Russia

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The distribution and abundance of diving ducks in the Nenets Autonomous District of Achangelskaya region was studied during 1973-2005. Long-tailed Duck *Clangula hyemalis* (40%) and Scaup *Aythya marina* (20%) dominated in tundra habitats, with lesser number of Goosander *Mergus merganser* (10%), Common Scoter *Melanitta nigra* (9%) and King Eider *Somateria spectabilis* (8%) and Common Eider *S. mollissima*, Spectacled Eider *S. fischeri* and Steller's Eider *Polysticta stelleri*. Pochard *Aythya ferina* are vagrants. Highest breeding and moulting densities occur between the Tchizcha and Perepusk and Perepusk and Oma rivers, with 70,000-100,000 birds aggregating in autumn in the mouths of the Peshha and Orm rivers. Exceptional densities of breeding and moulting Tufted Duck *Aythya fuligula*, Scaup, Long-tailed Duck, Common and Velvet Scoter *Melanitta fusca* breed and moult on Malozemelskaya tundra and (with Goldeneye *Bucephala clangula*) in the Pechora Delta. Coastal areas of the Bolshezemelskaya tundra also support high densities. Huge numbers of Common and Velvet Scoter (with lesser numbers of King Eider and Scaup) gather and migrate towards the Murmansk coast. Large feeding and resting aggregations occur in many of the bays along the Barents Sea coasts. Numbers of all diving ducks declined from 3.5-4.8 million in the 1980s and 1990s to 2.5 to 3 million now, although the reasons for this decline are unknown.

Measures of annual breeding success amongst Eurasian Wigeon *Anas penelope*

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We tested the hypotheses that hunting selectively harvests (i) juvenile Wigeon over adults and (ii) males over females. Specifically, we tested the prediction that the first-winter age and male sex ratios in hunting bags in Denmark would exceed those further down the autumn migratory corridor in Britain/Ireland, and both measures would exceed the ratios in wild flocks in UK. Age and sex ratios amongst shot birds in Denmark and Britain/Ireland with those amongst samples of birds caught for ringing purposes and field observations in Britain/Ireland were highly correlated. Proportions of young were consistently and significantly higher amongst the sample shot in Denmark (average 0.65), than those shot (0.56), and than those birds caught for ringing (0.38) and sample from field observations (0.27) in Britain/Ireland (the latter 2 measures were not significantly different from each other). The ratio of adult males to adult females showed no significant difference between any of the measures, but was lowest amongst field observations. The ratio of first winter males to first winter females was even in the ringing and shot samples, suggesting differential survival of the sexes after the first winter affects the global sex ratio. In the ringed sample, the proportion of first winter birds was similar from November to March, suggesting winter migrants to Britain/Ireland contained a similar proportion of adults to first-winter birds. Over the same period, the proportion of 1st winter birds determined by field observations increased, suggesting the timing of body moult in winter males may overestimate numbers of females in autumn flocks. Annual variation in productivity from samples of duck wings collected in Denmark and Britain/Ireland were correlated, and, on average, 9% higher in Denmark. There was a significant long term decline in production of young in Britain/Ireland. There was support for the prediction that selective hunting affects age (but apparently not sex) ratios in Wigeon in winter. It was concluded that hunting bags and ringing samples could provide useful indices of annual production of young over extended periods and that production of young was correlated with temperatures on the breeding grounds.

A study of the hybridization of White-headed Ducks *Oxyura leucocephala* and Ruddy Ducks *O. jamaicensis* in Spain

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The White-headed Duck is Europe's most endangered duck species, and the threat caused by the spread of the introduced Ruddy Duck is well known. Using molecular techniques, we have recently completed a study on the hybridization of the two species in Spain, as well as an assessment of the

population genetics of both parental species. There are no significant differences between White-headed Ducks between flyways or eastern and western populations. The Spanish population has extremely low genetic diversity owing to the bottleneck suffered in the 1970s and 80s. European Ruddy Ducks have much lower diversity than those in their native North America, and all appear to be derived from seven founders imported to Slimbridge (WWT, UK) in the 1950s. However, European Ruddy Ducks still have greater genetic diversity than Spanish White-headed Ducks. In this study, hybrids of various types could be identified in Spain, confirming the high risk of genetic introgression. However, no birds identified morphologically as pure White-headed Ducks have been found to have Ruddy Duck genes, showing that introgression has been limited to date.

Effect of nasal saddles on breeding performance of diving ducks

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In total, 133 females of European Pochard *Aythya ferina* and 85 females of Tufted Duck *Aythya fuligula* were marked during 1998 - 2005 in southern Bohemia (in the Třeboň Biosphere Reserve and adjacent areas, 49°00'N, 14°46'E) in the Czech Republic. The project is based on catching, measuring, weighting and colour marking (nasal saddles or nasal discs) of females diving ducks. Advantages and disadvantages of various types of nasal saddles will be discussed in presentation. Females were caught on the nest using drop-door trap or flushed into mist nets exposed close to the nest. Both catching methods are used only during the late phase of incubation to prevent nest abandonment. Evaluation of possible effects of colour marking on patterns in individual behaviour and reproductive performance (nest success, duckling survival) will be included in presentation.

Long-term trends and variation in numbers among autumn staging waterbirds in south Sweden, 1973 – 2004

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Regular counts of staging waterbirds were started in south Sweden in 1973 to complement the International Midwinter Counts started in 1967. Although the main aim was to generate trends and demonstrate fluctuations among species that are largely absent from Sweden in winter, the counts covered all common staging waterbirds in southern Sweden. Between 170 and 200 count units have been counted annually in a standardized network covering southern Sweden north to the river Dalälven. Twelve species were counted in sufficient numbers to calculate annual indices over the entire series. Marked fluctuations between years were found for several species. Decreasing trends over the years were found for the Great Crested Grebe *Podiceps cristatus*, Mallard *Anas platyrhynchos*, Red-breasted Merganser *Mergus serrator*, whereas the Wigeon *Anas penelope* showed a marked increase. Goldeneye *Bucephala clangula* showed a decrease followed by a stable level, which is opposite to the trends in winter indices, whereas Common Eider *Somateria mollissima* on the west coast have shown a marked decrease in recent years. Finally, Coot *Fulica atra* numbers reduced dramatically after the cold winter in 1979, although September indices less so, with numbers only slowly recovering after the crash.

Keystone effects of Beavers *Castor fiber* on wildlife, especially ducks

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As a result of the construction of their ponds, Beavers have a profound effect on a variety of organisms, including invertebrates, fish, amphibians, birds and mammals. The base of the food web in Beaver ponds is the inundated, decomposing shore plants which are exploited by detritus-feeding invertebrates. Amongst the birds, the response of ducks to Beavers is perhaps best known. In boreal waters, the first ducks to colonize a Beaver pond are typically breeding Teal *Anas crecca* pairs. In our

study of 13 Beaver ponds and controls, we found a significant increase in numbers of Teal pairs in Beaver ponds. Interestingly, the number of Teal pairs did not decrease in nearby ponds (within 1 km), implying that the Teal pairs colonising Beaver ponds did not originate from the immediate vicinity. Similarly, in all eight ponds dammed for one or two summers, duck brood numbers increased during inundation, but in the controls there was no consistent change. Broods of all common ducks in the area – Mallard *Anas platyrhynchos*, Teal and Goldeneye *Bucephala clangula* – used flooded areas more than expected. Again, Teal broods were especially prone to remain in Beaver ponds. And downy ducklings even more so: about 60% of downy Teal broods were detected on shores flooded by Beaver although they comprised only 6% of the total shore line of the area. We have also found that Teal ducklings survive better in Beaver ponds than in other waters.

Spatial modelling of offshore bird densities, a case study using Common Eider *Somateria mollissima*

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Aerial surveys of coastal and marine waterbirds have been carried out in Denmark since the 1960s, providing unique information on waterbird numbers and distributions over extensive areas in relatively short periods and covering areas difficult to survey by other means. Until the late 1990s survey data were gathered almost entirely as 'total counts', where coastal and marine areas were divided into predefined sub-areas within which the total number of all birds was estimated. Since then, the need to accurately map bird densities with much greater geographical precision necessitated changes in data collection methods from total counts to line transect surveys, based on the Distance Sampling principles. In this way, observations were recorded along predefined transect lines, incorporating perpendicular distances of the observed objects from the survey track line to account for declining detectability of objects with distance from observer. In collaboration with the RUWPA group at the University of St. Andrews, Scotland, we initiated the development of tools to perform spatial modelling of bird densities from these transect line survey data, using GAM's (Generalised Additive Models). In the first stage, established Distance Sampling procedures were used to fit detection functions to the data, incorporating meaningful variables to account for the effects of factors such as sea state or individual observer differences on density estimations. In the second phase, the relationship between derived density estimates and environmental variables such as water depth, salinity or distance from coast were investigated using GAMs and standard hierarchical model fitting procedures to predict bird density surfaces in a grid form at high geographical resolution (in this case 500 x 500 m), incorporating meaningful environmental variables. Results from a case study using these approaches will be presented.

Dissecting density dependence of reproductive output in the Common Goldeneye *Bucephala clangula*: implications for harvesting and resource management

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Density dependence of vital population processes is a fundamental ecological principle of sustainable harvesting. Less attention has been given to the idea that density dependence also should be considered in resource management. Density dependence is of particular concern if there are several potentially limiting resources to be managed. When the limitation of one critical resource on a demographic rate is removed, another resource may become most limiting, diluting the outcome of the management action. Nest-site limitation of breeding numbers has been demonstrated in several bird species, including hole-nesting ducks. Nest-box provisioning has often been recommended as a management tool for such species. In this paper I provide an empirical example of how density-dependent processes may dilute the management of hole-nesting ducks using nest-box provisioning. In addition, I will study at which stage of the breeding season density-dependent mechanisms mainly operate. My study has two management implications. First, density dependence of reproductive output enables a demographic response of Common Goldeneye populations to exploitation. Second,

density dependence of reproductive output should be considered in nest-box programmes aimed to increase breeding numbers and production of hole-nesting birds.

Moulting of primaries – a forgotten limiting factor for European dabbling ducks population dynamics?

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Primary moult of female ducks is supposed to occur on their breeding grounds. However, that may not be the case during the hunting period, since more than 50% (n = 418) of female Mallards *Anas platyrhynchos* marked in Portugal have still to finish primary moult or had to do it after the start of hunting, and do so preferentially in refuge areas. A review of data from Teal *Anas crecca* ringed in Camargue (France), between 1952 and 1978, found potential primary moult underway in 23 out of a total of 59,437 marked birds. Recent capture and marking efforts on Teal in France only found one bird moulting primaries, in a total sample of 2,597 birds captured between September 2002 and March 2005. In addition, during regular capture and marking of waterfowl in Portugal, from June 1993 until March 2005, there were seven Teal and eight Wigeon *Anas penelope* caught whilst moulting primaries, between September and early December, from total captures of 1,898 and 222, respectively. The ecological consequences of this situation will be discussed, but it seems that there may be a lack of appropriate moulting places along the Atlantic migratory route and/or some ducks delay the moulting process and migrate further south to moult on the same wintering grounds that they would have used if they moulted prior to migration. As South European wetlands are also moulting grounds for migratory waterfowl, this should be considered for their appropriate management.

Distribution, abundance and trends of Scaly-sided Mergansers *Mergus squamatus* and Mandarin Duck *Aix galericullata* in Russia

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Six years of boat surveys along the rivers of Primorye were undertaken to determine the distribution and abundance of the Scaly-sided Merganser and Mandarin Duck within their optimal breeding ranges in Russia. Density of breeding pairs was estimated during spring surveys. The two cavity-nesting ducks show opposite trends in abundance: the Mandarin Duck is declining in contrast to the increase shown by the Scaly-sided Merganser. Long-term trends in these species are also opposite. Surprisingly, rivers showing similar geographical features (even tributaries of the same river) differ significantly in the number of breeding pairs and subsequent number of broods, especially amongst Scaly-sided Mergansers. No obvious environmental factors have proved responsible for shaping the distribution of mergansers, although trophic factors do seem to play a role.

The impact of indigenous peoples' subsistence hunting on Russian Arctic duck populations

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Arctic areas are relatively much less populated by humans than temperate areas so the impact of duck hunting on their populations was traditionally supposed to be negligible, compared with the impact of millions of hunters in more developed southern areas. However, this assertion has never been verified, at least not in Russia. The main aims of our study were: (1) in the absence of the availability of any bag statistics to develop a method of collection of such data; (2) to assess whether subsistence harvest may influence populations of globally threatened species, with special focus on eiders; and (3) to estimate general levels of bird harvest in selected Russian Arctic areas. This presentation provides a progress report focused on the duck harvest using data collected in the years 1999 & 2002-04. Since 1999, our ongoing survey has run for five years in the NE Russian tundra coastal villages of Yakutia and Chukotka. Fifteen settlements were surveyed and over 500 reliable completed questionnaires were collected. For data collection we had combined the modified method of anonymous questionnaires used by US Fish and Wildlife Service in Alaska and personal interviews. Ducks comprised about 70% of the total bird harvest in the villages. Annual personal duck harvest averaged 18–45 birds/hunter while total numbers of hunted ducks amounted to 1,300–3,600 in most of the surveyed settlements. Total harvest and species composition are dependent on the settlement's human demography and the position of the settlement in relation to key bird migration areas. Local pressure on Steller's Eider *Polysticta stelleri* and Spectacled Eider *Somateria fischeri* could be high and we suppose that it may influence general population trends, especially in the Steller's Eider. More than 50% of eiders of both species were shot in five sampled villages in Yakutia in lower Yana, Kolyma and Indigirka rivers.

Restoration of the Ramsar site Tautra-Svaet in central Norway

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Due to its great importance for waterbirds the Tautra-Svaet Nature Reserve was designated as a Ramsar site in 1985. Regrettably, at that time this wetland already suffered a major encroachment as a 2.5 km long compact causeway had been built across the Svaet during 1976-78. The strong tidal current crossing the shallow water of Svaet was stopped and foxes, martens and badgers used the new road connection to invade the island Tautra. The consequences were swiftly manifest. The rich bivalve fauna of Svaet almost collapsed, and the diving duck populations, especially the key species Common Eider *Somateria mollissima* and Velvet Scoter *Melanitta fusca* which declined dramatically as their main food resource was drastically reduced. In addition, the new mammalian predators at Tautra caused considerable decreases in the ground-nesting species, with the Common Eider again most affected. As a result, the Tautra-Svaet was considered as a candidate for the Montreux Record of mismanaged Ramsar sites. However, after a long process, a 350 m long bridge, with a gateway to safeguard against predator access, was built in the central part of the causeway during the winter 2002/03. Thus, the current across central part of the Svaet was re-established. In total, this represents the most expensive nature restoration project in a protected area in Norway. So far this effort has given rise to a significant increase in the wintering and moulting, but not breeding, population of the Common Eider. At present, two seasons after the bridge construction, the impacts on the other species involved are not so evident.

Poster presentations

Factors determining Pochard *Aythya ferina* nest predation along a wetland gradient in the Czech Republic

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Waterfowl management on the breeding grounds focuses on improving nest success. Yet few studies have compared waterfowl nest success and factors affecting nest survival along a wetland gradient and simultaneously identified nest predators. We monitored nests ($n = 195$) of Common Pochards

(*Aythya ferina*) in Trebon Basin Biosphere Reserve, Czech Republic, during 1999-2002. Daily nest survival rates (DSRs, logistic-exposure) declined from island to over-water and terrestrial nests. Nest survival was improved by reduced nest visibility, increased water depth and increased distance from the nest to wetland edge in littoral habitats, and by increased distance to open water on islands. A model of constant nest survival best explained data for terrestrial nests. There were no observer effects on DSRs in any habitat. In 2003, artificial nests (n = 180; 120 contained a wax-filled egg) were deployed on study plots. The model that best explained variation in DSRs for artificial nests included only 1 variable: habitat class (DSRs: island \geq over-water > terrestrial). Mammalian predation of artificial nests prevailed in terrestrial habitats. By contrast, birds prevailed among predators of over-water and island nests. Our data indicate that artificial islands and wide strips of littoral vegetation may represent secure breeding habitats for waterfowl because those habitats allow nests to be placed in areas that are not accessible to, or that are avoided by, mammalian predators. Future research should focus on nest placement relative to agricultural edges and nesting habitat class, and on its effects on basic demographic parameters.

Transient climatic teleconnections translate to recruitment regime shifts in the Spanish population of White-headed Duck *Oxyura leucocephala*

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Intermittent teleconnections within the global climate system represents a challenge to the prediction reliability of climate change models, even though these sorts of transients are a spatial and temporal ubiquitous source of non-linear climatic behaviour. To date, their ecological effects remain unexplored. An increase in the teleconnection strength between the Southern Oscillation and Western Mediterranean climate during the last 50 years, which was likely related to recent climate change, became punctuated by several transient decoupling. For the first time, we show that this temporal transient behaviour of the global climate system left a clear fingerprint in the increasing Spanish population of the endangered White-headed Duck, encompassing 30% of its world population. At least three regime shifts, induced by a dramatic increase in brood recruitment during teleconnected phases were detected through a 20-year period, punctuated by largely stochastic dynamics with very low recruitment during non-teleconnected phases. Implementing this information in a model simulating transient climatic teleconnections reproduce in detail the ecological regime shifts observed in the population, and suggest that the persistent summer droughts predicted by several climate change models for the Western Mediterranean would disrupt this dynamic shifts and increase population instability and extinction probability. While transient climatic teleconnections arise as a real source of prediction uncertainty in the science of climate change, the challenge now is to assess whether this non-linear behaviour of the global climate system is of a deterministic or random nature.

Common numeric trends of waterfowl populations in response to external and internal factors: the case of Delta De L'Ebre (SW Spain)

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Waterfowl populations vary in space and time due to internal (i.e. density-dependent) factors and external variables (water availability, hunting pressure, climate, etc.). The relative extent to which these factors impact waterfowl populations will determine the success of conservation strategies and management actions. However, studies exploring the joint population effects of human-induced and natural changes in the environment within European waterfowl communities are scarce. Here we present 33-year time series of abundance of waterfowl populations wintering in Delta de L'Ebre (SW Spain), one of the most important sites for wintering waterfowl in the Mediterranean basin. Using Dynamic Factor Analysis, we show that different groups of environmental factors (multi-scale climate, rice culture extension, management of water availability) affect long-term trends of different groups of waterfowl species depending on its natural history and the strength of density-dependence. These

local and regional scale environmental factors sometimes override the internal effects of density-dependence and the populations trends observed for the species outside the study area. Our study highlights the importance of acknowledging the open nature of waterfowl communities at the regional level, but at the same time it strengthens the need for a wise exploration of the environmental drivers of local trends superimposed on regional trajectories.

Counting methods for seaducks and divers at sea: aerial versus ship-based surveys

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We compare results from standardized aerial and ship-based seabird counts conducted over three winters in two important staging sites in the German Baltic Sea focusing on differences between

- the densities obtained from different survey platforms at the same time and;
- the results of spatial modelling based on data from the different survey platforms.

Densities differed substantially between simultaneous aerial and ship-based counts with higher densities recorded from ship for seaducks (especially Long-tailed Ducks *Clangula hyemalis*) and from aircrafts for divers *Gavia* spp.. Spatial modelling, however, revealed similar distributional patterns in the Long-tailed Duck. In order to obtain reliable density estimates for seaducks from aerial surveys we recommend to pay more attention to detection probability by estimating $g(0)$ and effective strip width and to take into account individual differences between observers.

Effect of age and number of ducklings on behaviour of rearing female in Pochard *Aythya ferina* in condition of south Bohemian fishponds

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Survival of ducklings reared by female ducks is generally affected by many factors, such as weather conditions and food availability. Knowledge about the effects of the behaviour of rearing females on behaviour and survival of ducklings are poorly known. Daily activity patterns of rearing females of Common Pochard change during the breeding season and we suppose there are differences in these patterns according to the age and numbers of ducklings. These aspects together with the environmental factors such as weather condition, water transparency (i.e. indicator of feeding condition), total waterbird numbers and other characteristics were investigated in South Bohemian (Czech Republic) fishponds in 2003-2005. From mid-June to the beginning of August the behaviour of certain females (marked or/and non-marked) and their broods was recorded throughout daylight hours at 30-second intervals during 5-minute periods. A few hundred hours of observations including the observation data from the field season 2005 will be included in the poster. Female behaviour was classified into six categories (feeding, swimming, alert behaviour, sleeping, 'no activity' and comfort behaviour). Broods were divided into four age groups and four size groups. The preliminary results show that some categories of females' behaviour (like alert behaviour, swimming or feeding) are affected by the number of ducklings and their age. The highest frequency of alert behaviour was recorded in female rearing mid-age broods. Alert and feeding behaviour of females is also positively correlated for example with water transparency. Alert behaviour and swimming of the observed female correlated negatively with presence of other females of Common Pochard and their broods.

Doubling the reserve areas does not mean halving the hunters' bags: waterbirds responses to the establishment of a countrywide hunting free reserves network in Denmark, and effects on hunting bags

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Denmark has a strong tradition for waterbird hunting in coastal areas. More than one million waterbirds are harvested annually, of which c.33% are Mallards released for shooting, but the remainder are wild. Experimental reserves studied in the early 1990s demonstrated that the hunting activity constrained waterbird numbers, especially those of quarry species, below the carrying capacity of the study sites. In 1993, the Danish Parliament revised the Hunting and Wildlife Management Act and established a planned national network of new shooting-free reserves to be created in NATURA2000 sites in subsequent years. Under this plan, during 1993-2001, the Danish Forest and Nature Agency established 33 new shooting-free reserves, enlarged seven existing reserves, and established three additional areas where shooting from motorised boats are prohibited. In combination with the phasing out of hunting in the Wadden Sea (under a trilateral agreement with Germany and the Netherlands), this increased the hunting-free area from 803 to 1,534 km²; 701 km² have been designated where hunting is only allowed from anchored punts (i.e. hunting from kayak-punts and motorboats are prohibited); and the area where hunting from motorised boats are prohibited increased from 2,613 to 2,782 km². We present results of a monitoring programme to investigate the response of staging waterbirds to these protection instruments – as well as their consequences for hunting-bags, 1994-2001. Quarry dabbling ducks and geese increased in new reserve areas, and some species extended their staging periods, although several non-quarry species and some quarry species did not respond to the reserve network. Several new sites of international importance for dabbling ducks emerged following the establishment of reserves. Despite doubling the extent of protected areas, bags of geese increased over the eight years, bags of dabbling ducks remained stable, whereas bags of diving ducks declined.

Non-invasive molecular analysis of reproductive strategies in Mallards *Anas platyrhynchos*

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Phenomena related to reproductive history of particular individuals (e.g. fidelity, re-nesting) and secondary reproductive strategies (nest parasitism, EPC) of birds are one of the hot topics in the past decades. Individual marking or genetic sampling of caught individuals have been traditionally used for such kind of research. However, these methods often do not allow accumulation of a sufficient sample size for robust analysis. Hopefully, newly emerging non-invasive alternatives may overcome some of these methodical drawbacks. Waterfowl seem to be one of the best candidates for non-invasive approaches since their nests often contain both egg remnants as well as feathers of incubating females which can be used a valuable source of individual DNA. Since such studies are still surprisingly scarce in waterfowl we tested the appropriateness of non-invasive methods in Mallard. Nests were intensively searched during the whole breeding season around selected fishponds in the Southern Czech Republic in 2004 and 2005. Female feathers, egg membranes and dead embryos were collected and subsequently used for DNA extraction. The fragment analysis of polymorphic microsatellite loci revealed unequivocally conspecific nest parasitism, extra-pair fertilizations and female fidelity in our dataset. As the evidence of DNA contamination was surprisingly low and practically every nest and breeding female in a subpopulation can be tested, we proved that non-invasive methods can yield data that can be hardly obtained using traditional methods.

Nest predation in Mallards *Anas platyrhynchos*: the role of crypsis and parental behaviour

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Crypsis is a mechanism that decreases nest predation of many bird species. However, little effort has been invested in assessing the role of crypsis in the context of other anti-predation strategies. Our intention was to analyze the impact of parental activity (nest defence versus nest disclosure), vegetation structure around nest site, and crypsis (coloration of the female body and concealment of the clutch by nest material during incubation recess) on the nest success of Mallard in conditions with visually oriented predators. To filter out the effect of parental activity from crypsis two artificial nests (Art) (not affected by parental behaviour) were ascribed to each experimental active Mallard nest (Ac)

(n = 58). The clutch of the first Art was covered by nest material taken from the active nest whereas the second one was left uncovered. Controls of nest groups were performed, after six and 12 days. Covered Art survived better than uncovered Art but worse than Ac. However, the effectiveness of crypsis (time required to identify the place of nests randomly located on photographs by volunteers) didn't differ between clutches covered by incubating female and nest material, but was much lower for uncovered clutches. The difference in the success of Ac and covered Art indicate effective nest defence. Negative role of nest disclosure due to parental activity has not been confirmed. Concealment of the clutch by female body or nest material reduces the risk of nest predation and compensates efficiently the absence of the cryptic eggshell painting among waterfowl.

Long-term trends in the breeding populations of ducks in the Czech Republic (1981-2005)

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The remarkable changes in numbers of water and wetland bird species on the territory of Czech Republic have attracted the attention of ornithologists over the last 100 years. Increases in numbers and establishment of new breeding populations have been recorded in many duck species (e.g. Gadwall *Anas strepera*, Red-crested Pochard *Netta rufina*, Common Pochard *Aythya ferina*, Tufted Duck *A. fuligula*, and Goldeneye *Bucephala clangula*). Population sizes of these newly breeding species initially increased, but these trends for many water and wetland species were interrupted in the beginning of the 1980s. Numbers of waterbird species (grebes, ducks, Coot *Fulica atra*, Black-headed Gull *Larus ridibundus*) increasing for many decades started to decline. In the mid 1980s, population size of several duck species fell to only 30% of the population size recorded at the beginning of the 1980s. Moreover, the gradual decline in the breeding population size of meadow species (e.g. Teal *Anas crecca*, Garganey *A. querquedula*, Shoveler *A. clypeata*, Snipe *Gallinago gallinago*) since the 1950s continued as the result of changes in landscape use (especially draining of wetlands). These population declines are documented by the Czech programme of Monitoring of Water Bird Breeding populations. Many possible causes of this rapid decrease in waterfowl population will be discussed in the poster (e.g. direct effect of fishpond management, esp. negative effect of increasing fish stocks in fishponds).

Timing and size of mixed broods of sympatric duck species in south Bohemia

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Brood censuses was carried on 40 – 200 fishponds in the Trebon Biosphere Reserve and adjacent area (South Bohemia, Czech Republic) in 1991- 2005. Each investigated fishpond was visited at least four times during each breeding season, when a census of all adult birds as well as females rearing ducklings was carried out for all ducks species. In total about 150 – 450 broods of six duck species (Mallard *Anas platyrhynchos*, Gadwall *A. strepera*, Red-crested Pochard *Netta rufina*, Common Pochard *Aythya ferina*, Tufted Duck *A. fuligula*, and Goldeneye *Bucephala clangula*) were recorded annually. Data on mixed broods (i.e. broods composed by at least particularly by ducklings which differ from female rearing broods) will be analysed in our contribution. We find all five open nesting duck species (e.g. Mallard, Gadwall, Red-crested Pochard, Common Pochard, Tufted Duck) as rearing female of mixed brood) as well as 'parasite' ducklings (i.e. ducklings of other species). The frequency of the phenomenon was higher in diving ducks than in dabbling ducks. The total frequency of mixed brood was only about 2% in contrast to the frequency of inter-specific parasite clutches which represented about 10 % of c.1400 nest controlled in the study area. The comparison of timing and size of mixed versus non-mixed broods will be included in the poster. Moreover, the potential origin of mixed brooding, e.g. the effect of nest parasitism vs. post-hatching mixture of duckling will be discussed. This study is pilot study of project of Grant Agency of the Czech Republic (No. A 6093403) entitled "Evolutionary determinants of brood parasitism in ducks".

Trends in numbers and distribution of wintering ducks in the Czech Republic (1967–2005)

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The International Waterfowl Census (IWC) was initiated in the former Czechoslovakia in winter of 1967/68 and has been carried out annually up to now. The current project of "Complete wintering waterbird census" is aimed at assessment of recent distribution of wintering waterbirds in January 2004 - 2006. In total, 478 wetland sites were covered in January 2004 and 561 in 2005. These results will be used for optimization of coverage of the IWC in the Czech Republic (see www.iwccz.wz.cz). Among recorded waterbirds, Mallard *Anas platyrhynchos* was the most abundant species and that most frequently recorded during whole census period. Long-term increases in numbers were recorded in Mallard, Tufted Duck *Aythya fuligula* and Common Pochard *Aythya ferina*, while numbers of wintering Teal *Anas crecca* declined. Numbers of diving ducks and Wigeon *Anas penelope* were greatly affected by winter conditions. In colder winter numbers of those birds increased, probably due to immigration of birds from the Baltic region. Interesting regional patterns were found in winter distribution of several duck species in the Czech Republic. Common Pochard, Tufted Duck and Goosander *Mergus merganser* were most abundant in North and Central Bohemia. Goldeneye *Bucephala clangula* was recorded mainly in Central Bohemia and South Moravia. Teal and Smew *Mergus albellus* were recorded mainly in South Moravia.

Effect of movements on survival of individually marked broods of diving ducks in condition of south Bohemian fishponds

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Survival and movements of diving duck broods was investigated in relation to the conditions prevalent at South Bohemian fishponds in 2001-2005. Females of Common Pochard *Aythya ferina* and Tufted Duck *A. fuligula* were caught on the nest using drop-door traps or flushed into mist nets set close to the nest. Both catching methods are used only during the late phase of incubation to avoid nest abandonment. Duck females were measured, weighed and colour-marked by both nasal saddles and colour rings (see <http://www.mujweb.cz/veda/aythya/>). Movements of about 45 female Pochards and 35 female Tufted Ducks will be presented, including data from the 2005 field season. Movements of up to 2.8 km occurred in Pochard and up to 4.6 km in Tufted Duck. Effect of female condition, clutch investment, timing of breeding, weather condition, feeding condition and movement distance was analysed in both species. The preliminary results show that daily mortality rate was higher in smaller broods and it was not affected by length of brood movements and female condition. Older ducklings survive better during movements. The highest duckling mortality was recorded in the week after hatching. Females of diving ducks move their broods to fishponds with higher water transparency and younger fish stocks, which offer rich invertebrate food supply.

Common Scoter *Melanitta nigra* at the southern coast of Norway

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Measurements of Common Scoter *Melanitta nigra* were obtained from the southern coast of Norway (58°27'N, 08°50'E) in October-November in the years 1989-1994 and 1998. The material consists of a total of 1,522 Common Scoters, but for most of the birds we only have wing length. Wing length, weight and bill length is measured. Wing length averaged 222 for all birds. Male and female juveniles differed in size. Males averaged 951 g in weight compared to 822 g in females. Wing length showed a mean of 216.1 and 226.5 mm in females and males, respectively, and bill length had a mean of 45.1 mm in females and 48.1 mm in males. Relatively low overlap in wing length and bill length was found between sexes in young Common Scoter. Juvenile males and adult females had similar weight and wing length, but bill was longer with 48.1 and 45.4 mm, respectively. Juvenile and adult females had similar bill length, but juveniles were not so heavy and had shorter wings compared to adult females with 822 and 925 g, and 216 and 225 mm, respectively. Mainly juveniles were found at the southern

coast of Norway. Of all the 1,522 birds a little more than 98% were juveniles, with males dominating. Only five adult males were found. A significant correlation between wing and bill length was found. Using a combination of wing length and bill length juvenile Common Scoters can be sexed with relatively low percentage of error.

Management of coastal bird populations: effects of nesting-islands with restricted public access

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Conservation agencies have long used sanctuaries (where access is prohibited during the breeding season) to neutralize effects of steadily increasing recreational activities in coastal zones. Although the use of such sanctuaries is well established, their effects on the size and distribution of populations have seldom been assessed. I used a data set from the archipelago off the Swedish west coast to study such effects on waterbird populations at a regional level. I compared population changes in 30 sanctuaries with restricted access (350 islands) with those on unprotected islands (3,000 islands) from establishment in 1966-1968 to 1993-1995. The proportion of the population breeding on protected islands increased amongst Common Eider *Somateria mollissima*, Greylag Goose *Anser anser*, Canada Goose *Branta canadensis*, Ringed Plover *Charadrius hiaticula* and Black Guillemot *Cepphus grylle*, whereas it decreased amongst Mute Swan *Cygnus olor*, Arctic Skua *Stercorarius parasiticus* and Lesser Black-backed Gull *Larus fuscus*. In total, populations of all species, except Common Gull *Larus canus* and Arctic Skua, were larger in the 1990s than in the 1960s. Most protected islands were chosen for their high density of nesting waterbirds. This may complicate the evaluation of the true effects of protection, as there may be less room for population growth on the protected islands with high bird densities than on unprotected islands with fewer birds.