

Anatidae

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藤井薫、2017、日本におけるコクガンの個体数と分布（2014-2017年）、*Bird Research Vol. 13*, pp. A69-A77.

Fujii, K., 2017, Population size and distribution of Brent Geese in Japan (2014 to 2017), *Bird Research Vol. 13*, pp. A69-A77.

(Abstract)

日本国内に渡来するコクガン *Brantabernicla* の個体数と分布を明らかにするために、道東コクガンネットワークが中心となって2014~2017年までの3年間、秋期、冬期、春期全国一斉調査を実施した。全国32か所の調査地の中で、コクガンが記録されたのは27か所であった。その中でアジア太平洋地区のコクガンの重要渡来地となる1%基準値の65羽を超えていた地域は、国後島、野付湾、風連湖、浜中・琵琶瀬、厚岸湾、浦河、伊達周辺、渡島半島東部、函館湾周辺、青森県下北半島周辺、青森県陸奥湾周辺、青森県太平洋側、岩手県、宮城県南三陸①、宮城県南三陸②、宮城県蒲生海岸の16か所であった。本調査で記録された最高羽数は2015/2016秋期の8,602羽で、野付湾ではその84%にあたる7,233羽が記録された。日本全国のコクガンの渡来数は、秋期は8,600羽、冬期は2,500羽、春期は3,100羽と推定された。秋期と春期には国内の80~90%のコクガンが野付湾と国後島南部に集中し、春期は国後島南部の比率が高くなった。秋期に北海道東部で8,600羽以上のコクガンが記録されるのに対して、国内の越冬数が2,500羽、春期の北海道東部の記録羽数が3,100羽と異なっており、60%以上の個体がどこで越冬し、どこを通過しているのかは不明だった。

Wood, K. A., Nuijten, R. J.M., Newth, J. L., Haitjema, T., Vangeluwe, D., Ioannidis, P., Harrison, A. L., Mackenzie, C., Hilton, G. M., Nolet, B. A. and Rees, E. C., Apparent survival of an Arctic-breeding migratory bird over 44 years of fluctuating population size. *Ibis*. Accepted Author Manuscript. doi:10.1111/ibi.12521

(Abstract)

Following increases in numbers during the second half of the 20th century, several Arctic-breeding migrant bird species are now undergoing sustained population declines. These include the northwest European population of Bewick's Swan *Cygnus columbianus bewickii*, which declined from c. 29 000 birds on the wintering grounds in 1995 to 18 000 in 2010. It is unclear whether this decrease reflects reduced survival, emigration to a different area, or a combination of both. Furthermore, the environmental drivers of any demographic changes are also unknown. We therefore used an information-theoretic approach in RMark to analyse a data set of 3929 individually marked and resighted Bewick's Swans to assess temporal trends and drivers of survival between winters 1970/71 and 2014/2015, while accounting for effects of age, sex and different marker types.

The temporal trend in apparent survival rates over our study period was best explained by different survival rates for each decade, with geometric mean survival rates highest in the 1980s (leg ring marked birds = 0.853, 95% confidence interval (CI) = 0.830–0.873) and lowest in the 2010s (leg ring = 0.773, CI = 0.738–0.805; neck-collar = 0.725, CI = 0.681–0.764). Mean (\pm 95% CI) resighting probabilities over the study period were higher for birds marked with neck-collars (0.91 ± 0.01) than for those marked with leg-rings (0.70 ± 0.02). Weather conditions in different areas across the flyway, food resources on the winter grounds, density-dependence and the growth of numbers at a relatively new wintering site (the Evros Delta in Greece) all performed poorly as explanatory variables of apparent survival. None of our 18 covariates accounted for more than 7.2% of the deviance associated with our survival models, with a mean of only 2.2% of deviance explained. Our results provide long-term demographic information needed to help conservationists understand the population dynamics of Bewick's Swans in northwest Europe.

*Mingqin Shao, Bin Chen, Peng Cui, Binbin Zeng and Jianhong Jiang, Home Range and Group Characteristics of Wintering Scaly-Sided Merganser *Mergus squamatus* in the Watershed of Poyang Lake, China.*

(Abstract)

Time budgets provide important information for the study of animal behavior. The present study analyzed the daily travel distance, home range and group characteristics of scaly-sided merganser *Mergus squamatus* in Yihuang and Wuyuan counties, Jiangxi Province, China, from December 2012 to March 2013 and December 2015 to March 2016. Results showed that the daily travel distance of scaly-sided merganser was 3100 ± 1313 m; the daily home range was $122,460 \pm 42,019$ m²; and the overall home range was 202,350 m² during the wintering period. No significant difference was detected in the daily travel distance between different months ($F = 0.658, P > 0.05$). Significant differences were detected in the daily home range between January and February, and between February and March. No significant correlation was observed between daily travel distance and home range ($R = 0.256, n = 12, P > 0.05$). The significant correlation between daily home range and daily minimum temperature may be related to energy requirements or prey activities. The average group size of the scaly-sided merganser was 3.91 ± 2.94 individuals, and extremely significant differences existed at different time of day ($F = 25.540, df = 11, P < 0.01$). The largest group size (5.22 ± 5 individuals) appeared at 16:00–17:00, and the smallest at 08:00–09:00 (2.6 ± 1.12 individuals), similar results obtained between December 2015 and March 2016, which was related to the daily habits of this species, such as dispersed foraging, collective maintenance and rest. Group size peaked in February (5.07 ± 4.166 individuals) and was smallest (2.91 ± 1.354 individuals) in December with significantly different group sizes in all months ($F = 35.351, df = 3, P < 0.01$). A total of 57.98% of all groups had a majority of females. A large difference in sex ratios was observed among different months. The actual ratio of [(adult + sub-adult male): (adult + sub-adult female)] was 1:1.44 ($n = 22$) in February. Future studies are necessary, and the main goal should be focused on sex ratio, mortality and sex ratio at birth.

Anatidae 2016

Kim, M. K., S.-i. Lee, and S. D. Lee. 2016. Habitat Use and its Implications for the Conservation of the Overwintering Populations of Bean Goose *Anser fabalis* and Greater White-Fronted Goose *A. albifrons* in South Korea. *Ornithological Science* **15**:141-149

(Abstract)

The Korean peninsula is geographically important for the migration of geese. Several thousand geese visit South Korea every winter, but currently it is unclear which habitats are preferred by the geese. Understanding patterns of habitat usage is important for establishing conservation strategies, as some habitats may be disappearing more rapidly than others making it critical to know whether or not a disappearing habitat is crucial to certain birds. In this study, we investigated the habitat use of the wintering populations of Bean Goose *Anser fabalis* and Greater White-fronted Goose *A. albifrons*. We found that the wintering populations of these two geese species in South Korea have stabilized after sudden increases during the mid and late 2000s. Both species formed larger wintering populations at coastal lakes, on reclaimed lands, and at estuaries than on freshwater habitats, which may be related to the availability and/or diversity of food items. Considering that environmental changes resulting from development and climate change are reducing the inshore areas and estuaries, the role of artificial wetlands, such as reclaimed areas that are used as rice fields, is important for conservation of geese that overwinter in Korea.

Ottenburghs, J., P. van Hooft, S. E. van Wieren, R. C. Ydenberg, and H. H. T. Prins. 2016. Hybridization in geese: a review. *Frontiers in Zoology* **13**:20.

(Abstract)

The high incidence of hybridization in waterfowl (ducks, geese and swans) makes this bird group an excellent study system to answer questions related to the evolution and maintenance of species boundaries. However, knowledge on waterfowl hybridization is biased towards ducks, with a large knowledge gap in geese. In this review, we assemble the available information on hybrid geese by focusing on three main themes: (1) incidence and frequency, (2) behavioural mechanisms leading to hybridization, and (3) hybrid fertility. Hybridization in geese is common on a species-level, but rare on a per-individual level. An overview of the different behavioural mechanisms indicates that forced extra-pair copulations and interspecific nest parasitism can both lead to hybridization. Other sources of hybrids include hybridization in captivity and vagrant geese, which may both lead to a scarcity of conspecifics. The different mechanisms are not mutually exclusive and it is currently not possible to discriminate between the different mechanisms without quantitative data. Most hybrid geese are fertile; only in crosses between distantly related species do female hybrids become sterile. This fertility pattern, which is in line with Haldane's Rule, may facilitate interspecific gene flow between closely related species. The knowledge on hybrid geese should be used, in combination with the information available on hybridization in ducks, to study the process of avian speciation.

Ottenburghs, J., H.-J. Megens, R. H. S. Kraus, O. Madsen, P. van Hooft, S. E. van Wieren, R. P. M. A. Crooijmans, R. C. Ydenberg, M. A. M. Groenen, and H. H. T. Prins. 2016. A tree of geese: A phylogenomic perspective on the evolutionary history of True Geese. *Molecular Phylogenetics and Evolution* **101**:303–313.

(Abstract)

Phylogenetic incongruence can be caused by analytical shortcomings or can be the result of biological processes, such as hybridization, incomplete lineage sorting and gene duplication. Differentiation between these causes of incongruence is essential to unravel complex speciation and diversification events. The phylogeny of the True Geese (tribe *Anserini*, *Anatidae*, *Anseriformes*) was, until now, contentious, i.e., the phylogenetic relationships and the timing of divergence between the different goose species could not be fully resolved. We sequenced nineteen goose genomes (representing seventeen species of which three subspecies of the Brent Goose, *Branta bernicla*) and used an exon-based phylogenomic approach (41,736 exons, representing 5887 genes) to unravel the evolutionary history of this bird group. We thereby provide general guidance on the combination of whole genome evolutionary analyses and analytical tools for such cases where previous attempts to resolve the phylogenetic history of several taxa could not be unravelled. Identical topologies were obtained using either a concatenation (based upon an alignment of 6,630,626 base pairs) or a coalescent-based consensus method. Two major lineages, corresponding to the genera *Anser* and *Branta*, were strongly supported. Within the *Branta* lineage, the White-cheeked Geese form a well-supported sub-lineage that is sister to the Red-breasted Goose (*Branta ruficollis*). In addition, two main clades of *Anser* species could be identified, the White Geese and the Grey Geese. The results from the consensus method suggest that the diversification of the genus *Anser* is heavily influenced by rapid speciation and by hybridization, which may explain the failure of previous studies to resolve the phylogenetic relationships within this genus. The majority of speciation events took place in the late Pliocene and early Pleistocene (between 4 and 2 million years ago), conceivably driven by a global cooling trend that led to the establishment of a circumpolar tundra belt and the emergence of temperate grasslands. Our approach will be a fruitful strategy for resolving many other complex evolutionary histories at the level of genera, species, and subspecies.

Cherkaoui, S. I., Magri, N. and Hanane, S. 2016. Factors predicting Ramsar site occupancy by threatened waterfowl: The case of the Marbled Teal *Marmaronetta angustirostris* and Ferruginous Duck *Aythya nyroca* in Morocco. *Ardeola* **63**:295-309.

(Abstract)

Since 2005, Morocco has designated many Ramsar wetlands, yet little is known about factors determining their occupation by waterbird communities. In this study, we assessed the relationship between the occupation of Moroccan Ramsar wetlands during the breeding season by two globally threatened waterbirds, the marbled teal *Marmaronetta angustirostris* and the ferruginous duck *Aythya*

nyroca, and geographical, topographical and macrohabitat factors. Habitat-based statistical models showed that the presence of these two threatened waterfowl species at Moroccan wetlands was positively correlated with the number of emergent vegetation species, and negatively correlated with altitude and the distance to the nearest coastline. These results highlighted previous findings regarding the significant and positive relationship between the number of plant taxa and the number of threatened waterbird species at Moroccan wetlands. Further investigations should be conducted at regional (Maghreb region) and international (Mediterranean area) levels (i) to allow a global analysis and benchmarking between regions, (ii) to improve the provision of information to support sound management interventions, and (iii) to contribute to conservation management planning for these threatened waterfowl species.

Latty, C. J., T. E. Hollmén, M. R. Petersen, A. N. Powell, and R. D. Andrews. 2016. Biochemical and clinical responses of Common Eiders to implanted satellite transmitters. *The Auk* **118**:489–501.

(Abstract)

Implanted biologging devices, such as satellite-linked platform transmitter terminals (PTTs), have been used widely to delineate populations and identify movement patterns of sea ducks. Although in some cases these ecological studies could reveal transmitter effects on behavior and mortality, experiments conducted under controlled conditions can provide valuable information to understand the influence of implanted tags on health and physiology. We report the clinical, mass, biochemical, and histological responses of captive Common Eiders (*Somateria mollissima*) implanted with PTTs with percutaneous antennas. We trained 6 individuals to dive 4.9 m for their food, allowed them to acclimate to this dive depth, and implanted them with PTTs. We collected data before surgery to establish baselines, and for 3.5 mo after surgery. The first feeding dive took place 22 hr after surgery, with 5 of 6 birds diving to the bottom within 35 hr of surgery. Plumage waterproofing around surgical sites was reduced \leq 21 days after surgery. Mass; albumin; albumin:globulin ratio; aspartate aminotransferase; b1-, b2-, and g-globulins; creatine kinase; fecal glucocorticoid metabolites; heterophil:lymphocyte ratio; and packed cell volume changed from baseline on one or more of the postsurgery sampling dates, and some changes were still evident 3.5 mo after surgery. Our findings show that Common Eiders physiologically responded for up to 3.5 mo after surgical implantation of a PTT, with the greatest response occurring within the first few weeks of implantation. These responses support the need for postsurgery censor periods for satellite telemetry data and should be considered when designing studies and analyzing information from PTTs in sea ducks.

Kraus, R. H. S., J. Figuerola, and K. Klug. 2016. No genetic structure in a mixed flock of migratory and non-migratory Mallards. *Journal of Ornithology* **157**:919–922.

(Abstract)

Mallards do not show genetic differentiation into migratory populations across typical flyways. It is

also known that some Mallard populations are non-migratory. The aim of this study was to test if genetic structure exists between migratory and non-migratory Mallards in an area where they occur sympatrically, in Donana, Spain. After quality filtering we analysed 350 single nucleotide polymorphism markers (SNPs) from 104 migratory and nonmigratory Mallards. No genetic structure was evident from our data. We conclude that the lack of large-scale genetic structure of the global Mallard population remains valid when specifically testing potential differentiation between migratory and non-migratory Mallards.

Simonsen, C. E., J. Madsen, I. M. Tombre, and J. Nabe-Nielsen. 2016. Is it worthwhile scaring geese to alleviate damage to crops? – An experimental study. *Journal of Applied Ecology* **53**:916–924.

(Abstract)

1. Increasing population sizes of geese are the cause of numerous agricultural conflicts in many regions of the Northern Hemisphere. Scaring is often used as a tool to chase geese away from fields, either as a means to protect vulnerable crops or as part of goose management schemes to drive geese to accommodation areas. Geese are quick to habituate to stationary scaring devices; hence, active scaring by humans is often employed. However, it remains undocumented how much effort is required for active scaring to be effective.

2. We explored the relationship between intensity of active human scaring on field use and behaviour by geese. Using an experimental framework, we applied four different scaring doses per day (geese were scared either 2, 5, 7 or 10 times per day), to random pastures in a pink-footed goose spring staging area in mid-Norway, and recorded goose flock sizes, fleeing response distances, and average weekly goose densities assessed by dropping densities. In addition, we counted droppings in fields without scaring. We used mixed models to test for changes in the effects of different scaring doses over time and compared observed with predicted dropping levels.

3. Cumulative dropping densities increased at different rates depending on the scaring dose. Scaring dosage did not affect flock size and fleeing response distance during the study period, but both flock sizes and fleeing response distances changed with time.

4. Scaring dose 2 did not show any decrease in relative goose use compared to the fields without scaring, whereas doses 5, 7 and 10 all showed 74–78% fewer droppings by the end of the spring staging period, indicating a possible threshold between dose 2 and 5. The largest effect of scaring appeared during the first week of scaring.

5. Synthesis and applications. This study is the first to show a dose–response relationship between active scaring and field use of flocking geese. For individual farmers, the study provides guidance on the level of scaring effort needed to be cost-effective. If implemented as part of a management scheme with subsidy/accommodation areas in combination with systematic and persistent scaring, it can be used as a tool to keep geese away from areas where they are not wanted, thereby assisting in the alleviation of goose–agriculture conflicts. The approach in this study can be adapted and used in a wider range of wildlife interactions with human economic interests.

Roberts, B. E. I., W. E. Harris, G. M. Hilton, and S. J. Marsden. 2016. Taxonomic and Geographic Bias in Conservation Biology Research: A Systematic Review of Wildfowl Demography Studies. *PLoS ONE* **11**:e0153908.

(Abstract)

Demographic data are important to wildlife managers to gauge population health, to allow populations to be utilised sustainably, and to inform conservation efforts. We analysed published demographic data on the world's wildfowl to examine taxonomic and geographic biases in study, and to identify gaps in knowledge. Wildfowl (order: Anseriformes) are a comparatively well studied bird group which includes 169 species of duck, goose and swan. In all, 1,586 wildfowl research papers published between 1911 and 2010 were found using Web of Knowledge (WoK) and Google Scholar. Over half of the research output involved just 15 species from seven genera. Research output was strongly biased towards 'high income' countries, common wildfowl species, and measures of productivity, rather than survival and movement patterns. There were significantly fewer demographic data for the world's 31 threatened wildfowl species than for non-threatened species. Since 1994, the volume of demographic work on threatened species has increased more than for nonthreatened species, but still makes up only 2.7% of total research output. As an aid to research prioritization, a metric was created to reflect demographic knowledge gaps for each species related to research output for the species, its threat status, and availability of potentially useful surrogate data from congeneric species. According to the metric, the 25 highest priority species include thirteen threatened taxa and nine species each from Asia and South America, and six from Africa.

Adam, M., M. Podhrázský, and P. Musil. 2016. Effect of start of hunting season on behaviour of Greylag Geese *Anser anser*. *Ardea* **104**:63-68.

(Abstract)

Hunting is a key source of disturbance which affects geese populations directly through killing and indirectly through shooting disturbance. Movements of individuals in response to hunting disturbance may expose geese to reduced feeding opportunities and higher predation risks, which can have consequences on the population level. Thus, geese should use habitats that provide access to food and minimize encounters with hunters. Our study focused on differences in the proportion of hunting-free area used and in the total area used by individuals, size of water bodies used by birds, and flight distance between roosting and feeding areas, during two periods – before and after the start of the hunting season. In south Bohemia (Czech Republic), in 2012, 2014 and 2015, we attached seventeen GPS/GSM-transmitters to moulting Greylag Geese *Anser anser*. We analysed data from nine transmitters, recording two or twelve logs per day, using minimum convex polygons home range estimates and Wilcoxon matched pairs test. We showed that shortly after the opening of the hunting season, individual Greylag Geese used a significantly larger area and increased their roosting-feeding flight distances. These changes in local movements are likely linked with the start of hunting activity

which relates to increased human disturbance in the study area. In the post-breeding season, this may broadly affect the birds' energetic costs and ability to accumulate sufficient reserves for the upcoming autumn migration. However, we did not find a significant difference in the proportion of hunting-free (protected) areas used during our study periods. This result, together with the observed decrease in numbers of Greylag Geese in south Bohemia in the second half of August, may be evidence of a lack of larger disturbance-free refuges in the study area.

Shao, M., B. Chen, P. Cui, N. Dai, and H. Chen. 2016. Sex Ratios and Age Structure of Several Waterfowl Species Wintering at Poyang Lake, China. *Pakistan Journal of Zoology* **48**:839-844.

(Abstract)

The sex ratios of four dabbling duck species were investigated by point count method during the wintering period between October and the following April from 2012 to 2014 at 45 survey sites of Poyang Lake. From October 2013 to April 2014, the age structure of the Tundra Swan was surveyed by point count method at 45 survey sites of Poyang Lake. In middle wintering stage (from December to February), the sex ratio of common teal *Anas crecca* (60.66% male, n=361) was male-biased while falcated duck *Anas falcata* (52.10%, n=286), mallard *Anas platyrhynchos* (50.00%, n=90) and Eurasian wigeon *Anas Penelope* (49.18%, n=183) were near parity. The male ratio of common teal, falcated duck and Eurasian wigeon all showed a tendency of initially increasing and later decreasing throughout the wintering period while mallard showed a continuous growth trend. The male-biased sex ratios in the common teal may be owing to increased female mortality on both breeding and wintering grounds. The intra-seasonal differences in sex ratios for all the ducks can be partly attributed to earlier arrival of males to wintering areas closer to breeding areas, while females and juveniles head further south. There were greater numbers of females for all the ducks in the early wintering stage (from October to November) and the male ratio increased again in the middle wintering stage, which shows that females arrive at winter areas before males in Poyang Lake. Tundra Swan *Cygnus columbianus* had relative high juvenile percentage (28.27%, n=3130). In the early wintering and spring migration stages (from March to April), the proportions of juveniles were significantly higher than in the middle wintering stage. This may indicate that family groups with young ones arrived at Poyang Lake to winter before those who did not participate or failed to breed, but returned later to breeding grounds, knowledge about this can provide guidance to management task.

Ely, C. R., and B. W. Meixell. 2016. Demographic outcomes of diverse migration strategies assessed in a metapopulation of tundra swans. *Movement Ecology* **4**:10.

(Abstract)

Background: Migration is a prominent aspect of the life history of many avian species, but the demographic consequences of variable migration strategies have only infrequently been investigated, and rarely when using modern technological and analytical methods for assessing

survival, movement patterns, and long-term productivity in the context of life history theory. We monitored the fates of 50 satellite-implanted tundra swans (*Cygnus columbianus*) over 4 years from five disparate breeding areas in Alaska, and used known-fate analyses to estimate monthly survival probability relative to migration distance, breeding area, migratory flyway, breeding status, and age. We specifically tested whether migratory birds face a trade-off, whereby long-distance migrants realize higher survival rates at the cost of lower productivity because of reduced time on breeding areas relative to birds that migrate shorter distances and spend more time on breeding areas.

Results: Annual migration distances varied significantly among breeding areas (1020 to 12720 km), and were strongly negatively correlated with time spent on breeding areas ($r = -0.986$). Estimates of annual survival probability varied by wintering area (Pacific coast, Alaska Peninsula, and Eastern seaboard) and ranged from 0.79 (95%CI: 0.70–0.88) to 1.0, depending on criteria used to discern mortalities from radio failures. We did not find evidence for a linear relationship between migration distance and survival as swans from the breeding areas with the shortest and longest migration distances had the highest survival probabilities. Survival was lower in the first year post-marking than in subsequent years, but there was not support for seasonal differences in survival. Productivity varied among breeding populations and was generally inversely correlated to survival, but not migration distance or time spent on breeding areas.

Conclusions: Tundra swans conformed to a major tenet of life history theory, as populations with the highest survival generally had the lowest productivity. The lack of a uniform relationship between time spent on breeding areas and productivity, or time spent on wintering areas and survival, indicates that factors other than temporal investment dictate demographic outcomes in this species. The tremendous diversity of migration strategies we identify in Alaskan tundra swans, without clear impacts on survival, underscores the ability of this species to adapt to different environments and climatic regimes.

Buhnerkempe, M. G., C. T. Webb, A. A. Merton, J. E. Buhnerkempe, G. H. Givens, R. S. Miller, and J. A. Hoeting. 2016. Identification of migratory bird flyways in North America using community detection on biological networks. *Ecological Applications* **26**:740–751.

(Abstract)

Migratory behavior of waterfowl populations in North America has traditionally been broadly characterized by four north–south flyways, and these flyways have been central to the management of waterfowl populations for more than 80 yr. However, previous flyway characterizations are not easily updated with current bird movement data and fail to provide assessments of the importance of specific geographical regions to the identification of flyways. Here, we developed a network model of migratory movement for four waterfowl species, Mallard (*Anas platyrhynchos*), Northern Pintail (*A. acuta*), American Green-winged Teal (*A. carolinensis*), and Canada Goose (*Branta Canadensis*), in North America, using bird band and recovery data. We then identified migratory flyways using a community detection algorithm and characterized the importance of smaller geographic regions in identifying flyways using a novel metric, the consolidation factor. We identified four main flyways for Mallards, Northern Pintails, and American Green-winged Teal, with the flyway identification in Canada Geese exhibiting higher complexity. For Mallards, flyways were relatively consistent through time.

However, consolidation factors revealed that for Mallards and Green-winged Teal, the presumptive Mississippi flyway was potentially a zone of high mixing between other flyways. Our results demonstrate that the network approach provides a robust method for flyway identification that is widely applicable given the relatively minimal data requirements and is easily updated with future movement data to reflect changes in flyway definitions and management goals.

Włodarczyk, R., and P. Minias. 2016. Non-adaptive territory selection by a bird with exceptionally long parental care. *PeerJ* 4:e1852.

(Abstract)

High-quality territories are expected to provide greater fitness return for breeding individuals and, thus, are likely to have higher long-term occupation rate in comparison to low-quality territories. However, if environmental and ecological cues used for territory selection cannot reliably predict true territory quality, a mismatch between preferences and fitness may occur. We suggest that this kind of non-adaptive territory selection is more likely in species with long reproductive cycles, as a long time interval between territory establishment and young fledgling should reduce predictability of conditions during the critical stages of brood care. In this study, we investigated adaptiveness of territory selection in a migratory bird with exceptionally long parental care, the mute swan *Cygnus olor*, which requires over four months to complete the entire reproductive cycle from egg laying to young fledging. For this purpose, we collected information on the long-term (10–19 years) occupancy of 222 swan breeding territories and correlated it with reproductive performance ($n = 1,345$ breeding attempts) and body condition of breeding adults. We found that long-term occupancy positively correlated with the timing of breeding, suggesting that individuals settled earlier in the attractive, frequently occupied territories. By contrast, we found no relationship between territory occupancy and reproductive output (hatching and fledging success) or adult body condition. The results indicate that at the time of territory selection swans might not be able to reliably assess territory quality, likely due to: (1) exceptionally long period of parental care, which reduces temporal correlation between the conditions at the time of territory selection and conditions during chick rearing; and (2) unpredictability of human-related activities that had a major impact on reproductive output of swan pairs in our population.

Zhang, Y., H. H. T. Prins, L. Cao, M. Zhao, and W. F. de Boer. 2016. Variation in Elevation and Sward Height Facilitate Coexistence of Goose Species through Allometric Responses in Wetlands. *Waterbirds* 39:34-44.

(Abstract)

Allometric scaling law predicts that herbivores respond differently to the availability of resources, mediated by body size. However, studies of allometric responses have often focused on animals with a relatively large difference in body size. Here, using a correlative field study, habitat use by two herbivorous species, the Bean Goose (*Anser fabalis*) and the Greater White-fronted Goose (*A.*

albifrons), with a relatively small difference in body size was investigated during the wintering period. Both a generalized linear mixed model and a mixed logistic regression model showed that both species selected lower lying areas that were recently exposed, and, as expected, the smaller Greater White-fronted Goose showed a stronger selection of foraging habitat than the larger Bean Goose. Sward height also influenced habitat selection by both species, and the smaller species selected shorter swards than the larger species. In terms of forage quality, both models failed to detect a significant effect of nitrogen content on goose habitat selection. A logistic regression model showed that structural heterogeneity of the sward negatively correlated with the patch selection of the smaller species, but for the larger species such a correlation was not found. In agreement with our hypotheses, our results provide some preliminary indication that coexistence of the two goose species studied here might be mediated by an allometric response even if the difference in body size is relatively small.

Tang, X., H. Li, X. Xu, G. Yang, G. Liu, X. Li, and D. Chen. 2016. Changing land use and its impact on the habitat suitability for wintering Anseriformes in China's Poyang Lake region. *Science of the Total Environment* **557-558**:296–306.

(Abstract)

As an internationally important wetland for migratory waterbirds, China's Poyang Lake region has experienced substantial changes in land use during the past two decades owing to climate change and anthropogenic disturbances. Recent dam constructions on the Yangtze River and its tributaries for agriculture and hydroelectric power exert strong effects on the hydrological regimes of this lake. However, few studies have investigated how the land-use changes through time affect the habitat suitability for wintering Anseriformes—the largest community in this region. Thus, it is necessary to timely monitor changes in the habitat quality and understand the potential factors that alter it. In this study, three periods (1995, 2005 and 2014) of typical environmental indicators that have direct impacts on foraging and resting for the Anseriformes, including proximity to water (density of lakes, rivers and ponds), human disturbances (density of residences and various road networks), preferred land cover types and food availability (NDVI), are integrated to develop a habitat suitability index model for habitat mapping. The results indicate that long-term lake shrinkage in low-water periods led to greatly expanded wetlands in these years, which provided more suitable habitat for migratory waterfowl. The amount of highly suitable habitat in 2014 was nearly twice as much as in 1995. Recent survey data from 1997 to 2013 also revealed an increase in the population size, and confirmed the improvement of habitat suitability in the Poyang Lake region. Spatial analysis revealed that land use changes contributed most to the improved habitat coverage between 1995 and 2014. However, the relative significances of these transformations for highly suitable and moderately suitable habitats are strikingly different. Increases in wetland and paddy field area are the main reasons for explaining these improvements, respectively. The framework model proposed in this study will help governments to evaluate habitat conservation and restoration for protecting waterbirds in a spatially explicit way.

Shimada T, Hijikata N, Tokita K-i, Uchida K, Kurechi M, Suginome H, Yamada Y, Higuchi H. 2016. Satellite-tracking of the spring migration and habitat use of the Brent Goose *Branta bernicla* in Japan. *Ornithological Science* **15**:37-45.

(Abstract)

Japan hosts more than 40% population of Brent Goose *Branta bernicla* wintering in East Asia. We used satellite-tracking technology to monitor the seasonal movements and habitat usage of Brent Goose wintering in northern Japan. We marked five geese on the Oya sandy beach, Miyagi Prefecture, northeast Honshu, on 21 January 2014. The geese utilized areas along the seacoast, especially concentrating at a small bay, close to the capture site. Most of the geese offshore were found at fishery rafts. No geese were found more than 2 km offshore or more than 6 km from the capture site along the seacoast. In early April, the geese left the southern Sanriku coast and moved up to eastern Hokkaido, crossing the sea directly or via the coastal areas of Iwate and Aomori Prefectures. The geese predominantly remained in the vicinity of the Veslovskiy Peninsula, Kunashiri (Kunashir) Island, while some were distributed along the northern coast of the Nemuro Peninsula. We identified eastern Hokkaido and Kunashiri Island as important stopover sites for Brent Goose wintering in Japan.

Chen W, Doko T, Fujita G, Hijikata N, Tokita K-i, Uchida K, Konishi K, Hiraoka E, Higuchi H. 2016. Migration of Tundra Swans (*Cygnus columbianus*) Wintering in Japan Using Satellite Tracking: Identification of the Eastern Palearctic Flyway. *Zoological Science* **33**:63–72.

(Abstract)

Migration through the Eastern Palearctic (EP) flyway by tundra swans (*Cygnus columbianus*) has not been thoroughly documented. We satellite-tracked the migration of 16 tundra swans that winter in Japan. The objectives of this study were 1) to show the migration pattern of the EP flyway of tundra swans; 2) to compare this pattern with the migration pattern of whooper swans; and 3) to identify stopover sites that are important for these swans' conservation. Tundra swans were captured at Kutcharo Lake, Hokkaido, in 2009–2012 and satellite-tracked. A new method called the “MATCHED (Migratory Analytical Time Change Easy Detection) method” was developed. Based on median, the spring migration began on 18 April and ended on 27 May. Autumn migration began on 9 September and ended on 2 November. The median duration of the spring and autumn migrations were 48 and 50 days, respectively. The mean duration at one stopover site was 5.5 days and 6.8 days for the spring and autumn migrations, respectively. The number of stopover sites was 3.0 and 2.5 for the spring and autumn migrations, respectively. The mean travel distances for the spring and autumn migrations were 6471 and 6331 km, respectively. Seven migration routes passing Sakhalin, the Amur River, and/or Kamchatka were identified. There were 15, 32, and eight wintering, stopover, and breeding sites, respectively. The migration routes and staging areas of tundra swans partially overlap with those of whooper swans, whose migration patterns have been previously documented. The migration patterns of these two swan species that winter in Japan confirm the importance of the Amur River, Udyl' Lake, Shchastya Bay, Aniva Bay, zaliv Chayvo Lake, zaliv Piltun Lake, zaliv Baykal Lake, Kolyma River, Buyunda River, Sen-kyuyel' Lake, and northern coastal areas of the Sea of Okhotsk.

Guan, L., J. Lei, A. Zuo, H. Zhang, G. Lei, and L. Wen. 2016. Optimizing the timing of water level recession for conservation of wintering geese in Dongting Lake, China. *Ecological Engineering* **88**:90–98.

(Abstract)

Habitat suitability and selection are key concepts in wildlife management, especially in protection of critical habitat and conservation of sensitive and endangered populations. In recent years, many approaches have been developed to link habitat suitability with animal occurrence and abundance. These approaches typically involve identifying existing habitats, defining habitat quality metrics, and estimating the association between animal occurrence/abundance and measured habitat metrics. In this study, we first tested whether we could measure habitat quality at Dongting Lake, China, one of the most important migratory waterbird wintering sites in the East Asian Flyway, for a group of Anatidae using metrics derived from the freely available multi-temporal MODIS vegetation index. The results showed that goose counts could be sufficiently modelled using mean winter season EVI (enhanced vegetation index) and habitat size computed from EVI time series and topographic wetness index (TWI). We then quantified the relationships between hydrological regimes and the habitat quality metrics. Our findings suggested that the timing of optimal water draw down should be early to mid-October to ensure quality food sources for the wintering geese in Dongting Lake. The results have direct conservation implications as water recession timing is highly manageable through water flow regulation.

Anatidae 2015

Bocharnikov, V. N., Y. N. Gluschenko, D. V. Korobov, and I. N. Korobova. 2015. Materials for the Study of the Spring Migration of Waterfowl (*Anseriformes, Aves*) on the Lake Khanka. *Achievements in the Life Sciences* **9**:87–94.

(Abstract)

The results of 11 years (2003–2013) monitoring activities, including estimation of number and gender structure of waterfowl on the Lake Khanka, are presented. The accounting work (50 days) took place in the first decade of April, in the period of mass spring migration of migratory birds. About 682,270 birds are registered. The comparison of the species composition and the ratio of the major groups of waterfowl of the two periods — 2003–2009 and 2010–2013 are given. The most minority group of migratory birds is *Cygnus* — less than 0.1% of all registered birds. More than 10,000 specimens of geese were accounted (17.7% of registered birds). The maximum number of birds was registered in 2008, the minimum number was registered in 2011. In all years of monitoring the part of *Anas formosa* was the largest among migratory birds — from 42 to 80% of all registered birds. The *Anser albifrons* dominates among all *Anser*s— about 50–80% of all identified species of *Anser*s. For the first time of all years of the ornithological investigations of the Prikhankayskaya lowland the gender structure of *Anas* was identified by visual estimates and photo data. The sample was 28.9 thousand birds. The average proportion of males for all years (2003–2013) was 58.9%, the maximum was recorded for *Aythya farina* (70.2%) and *Aythya fuligula* (70.3%).

Weegman, M. D., A. D. Fox, S. Bearhop, G. M. Hilton, A. J. Walsh, I. R. Cleasby, and D. J. Hodgson. 2015. No evidence for sex bias in winter inter-site movements in an Arctic-nesting goose population. *Ibis* **157**:401–405.

(Abstract)

Understanding movement of individuals between sites is necessary to quantify emigration and immigration, yet previous analyses exploring sex biases in site fidelity among birds have not evaluated remigration (the return of marked birds that moved to alternative areas from the site at which they were marked). Using novel Bayesian multistate models, we tested whether between-winter emigration, remigration and survival rates were sex-biased among 851 Greenland White-fronted Geese *Anser albifrons flavirostris* marked at Wexford, Ireland. We found no evidence for sex biases in emigration, remigration or survival. Thus, sex biases in winter site fidelity do not occur in any form in this population; these techniques for modelling sex-biased movement will be useful for a better understanding of site fidelity and connectivity in other marked animal populations.

Meissner, W., P. Rowiński, M. Polakowski, P. Wilniewczyc, and D. Marchowski. 2015. Impact of temperature on the number of mallards, *Anas platyrhynchos*, wintering in cities. *North-Western Journal of Zoology* **11**:213-218.

(Abstract)

The mallard, *Anas platyrhynchos*, is a widespread waterfowl species that commonly winters in urban areas. The abundance of mallards wintering in four Polish cities: Warsaw, Białystok, Kielce and Szczecin was analyzed for a 10-year period, between 2003 and 2012. The highest mean number of mallards was recorded in Warsaw (> 18,000) and the lowest in Kielce (approximately 600). In Warsaw, Białystok and Szczecin, where wintering of this species was documented over the period of 1950-1960, the number of birds fluctuated considerably during 2003 – 2012 but showed no significant trend. In Kielce, where mallards only began wintering in the 1990's, there was an increase in their numbers over time. Moreover, the number of mallards wintering in Szczecin was not correlated with mean temperature. In much more severe winter conditions, such as Warsaw and Białystok, the number of mallards increased when the water bodies outside the urbanized areas were frozen. Thus, as cities offered suitable conditions for wintering, part of the mallard population moved to urbanized areas instead of moving towards regions of milder weather.

Chudzinska, M. E., F. M. van Beest, J. Madsen, and J. Nabe-Nielsen. 2015. Using habitat selection theories to predict the spatiotemporal distribution of migratory birds during stopover – a case study of

pink-footed geese *Anser brachyrhynchus*. *Oikos* **124**:851–860.

(Abstract)

Understanding how animals select for habitat and foraging resources therein is a crucial component of basic and applied ecology. The selection process is typically influenced by a variety of environmental conditions including the spatial and temporal variation in the quantity and quality of food resources, predation or disturbance risks, and inter- and intraspecific competition. Indeed, some of the most commonly employed ecological theories used to describe how animals choose foraging sites are: nutrient intake maximisation, density-dependent habitat selection, central-place foraging, and predation risk effects. Even though these theories are not mutually exclusive, rarely are multiple theoretical models considered concomitantly to assess which theory, or combination thereof, best predicts observed changes in habitat selection over space and time. Here, we tested which of the above theories best-predicted habitat selection of Svalbard-breeding pink-footed geese at their main spring migration stopover site in mid-Norway by computing a series of resource selection functions (RSFs) and their predictive ability (k -fold cross validation scores). At this stopover site geese fuel intensively as a preparation for breeding and further migration. We found that the predation risk model and a combination of the density-dependent and central-place foraging models best-predicted habitat selection during stopover as geese selected for larger fields where predation risk is typically lower and selection for foraging sites changed as a function of both distance to the roost site (i.e. central-place) and changes in local density. In contrast to many other studies, the nutritional value of the available food resources did not appear to be a major limiting factor as geese used different food resources proportional to their availability. Our study shows that in an agricultural landscape where nutritional value of food resources is homogeneously high and resource availability changes rapidly; foraging behaviour of geese is largely a tradeoff between fast refuelling and disturbance/predator avoidance.

Si, Y., Q. Xin, H. H. T. Prins, W. F. de Boer, and P. Gong. 2015. Improving the quantification of waterfowl migration with remote sensing and bird tracking. *Science Bulletin* **60**:1984–1993.

(Abstract)

Accurately quantifying waterfowl migration patterns is pertinent to monitor ecosystem health and control bird-borne infectious diseases. In this review, we summarize the current understanding of the environmental mechanisms that drive waterfowl migration and then investigate the effect of intra- and inter-annual change in food supply and temperature (e.g., climate change) on their migration patterns. Recent advances in remote sensing and animal tracking techniques make it possible to monitor these environmental factors over a wide range of scales and record bird movements in detail. The synergy of these techniques will facilitate substantial progress in our understanding of the environmental drivers of bird migration. We identify prospects for future studies to test existing hypotheses and develop models integrating up-to-date knowledge, high-resolution remote sensing data and high-accuracy bird tracking data. This will allow us to predict when waterfowl will be where, in response to short and long-term global environmental change.

Guillemain, M., F. Cavallo, G. Massez, T. George, J.-P. Baudet, P. Gonzalez, V. Ducasse, E. Caillot, B. Lecaplain, L. Tison, N. Piffeteau, J.-P. Artel, and J. Champagnon. 2015. Ringing does not appear to have an adverse effect on body mass immediately following capture in Eurasian Teal *Anas crecca*. *Wildfowl* **65**:64–74.

(Abstract)

Studies of waterbirds rely to a large extent on ringing and resighting or recapture data, whilst assuming that ringed birds are broadly representative of the population as a whole. This may not be the case if the capture process may in itself have an influence on the birds. The analyses presented here showed that the body mass of ringed ducks often decreases between capture and recapture if the latter occurs within a few days or weeks. This could possibly reflect stress caused by handling, which would be problematic if it causes ringed birds to behave in a way that differs from the population as a whole. Alternatively, body mass measurements could also be biased by the general use of bait to attract birds to the trap. Initial and subsequent body mass data recorded for Eurasian Teal *Anas crecca* caught then recaptured within three weeks were compared between sites where the birds were attracted to traps with bait or with live decoys. When bait was used individuals had a greater body mass at ringing but were lighter at recapture at all but one site, where only a marginal difference was found. Conversely, when using live decoys, body mass remained constant at the next capture event. This suggests that mass loss commonly observed between capture and recapture is not caused by handling, but is potentially an artefact linked to duck hyperphagia in the presence of abundant food at ringing. It also implies that most available duck body mass data, which are usually obtained from birds ringed at baited traps, may be artificially inflated. The present results are based on one single unbaited site, however, and experimental manipulative studies (alternating the use of bait and live decoys to trap birds) are needed to confirm the findings.

Aagaard, K., S. M. Crimmins, W. E. Thogmartin, B. G. Tavernia, and J. E. Lyons. 2015. Evaluating predictors of local dabbling duck abundance during migration: managing the spectrum of conditions faced by migrants. *Wildfowl* **65**:100–120.

(Abstract)

The development of robust modelling techniques to derive inferences from large-scale migratory bird monitoring data at appropriate scales has direct relevance to their management. The Integrated Waterbird Management and Monitoring programme (IWMM) represents one of the few attempts to monitor migrating waterbirds across entire flyways using targeted local surveys. This dataset included 13,208,785 waterfowl (eight *Anas* species) counted during 28,000 surveys at nearly 1,000 locations across the eastern United States between autumn 2010 and spring 2013 and was used to evaluate potential predictors of waterfowl abundance at the wetland scale. Mixed-effects, loglinear models of local abundance were built for the Atlantic and Mississippi flyways during spring and autumn migration to identify factors relating to habitat structure, forage availability, and migration timing that influence target dabbling duck species abundance. Results indicated that migrating dabbling ducks responded differently to environmental factors. While the factors identified demonstrated a high degree of importance, they were inconsistent across species, flyways and seasons. Furthermore, the direction

and magnitude of the importance of each covariate group considered here varied across species. Given our results, actionable policy recommendations are likely to be most effective if they consider species-level variation within targeted taxonomic units and across management areas. The methods implemented here can easily be applied to other contexts, and serve as a novel investigation into local-level population patterns using data from broad-scale monitoring programs.

Shao, M., H. Guo, P. Cui, J. Jiang, and B. Chen. 2015. Habitat Selection of Wintering Chinese Merganser, *Mergus squamatus*. *Pakistan Journal of Zoology* **47**:1421-1426.

(Abstract)

Habitat selection of wintering Chinese merganser *Mergus squamatus* was studied using field surveys that documented merganser occurrence in the Poyang Lake Watershed in eastern China, and GIS analysis. Merganser used the widest reaches of rivers, and islands and shoals habitats that accounted for only a small proportion of overall habitat. Percentage of woodland and farmland along the river bank was large. Chinese merganser apparently adapted to large-scale width variation of the river using vegetation cover to mitigate effects of human activity. Distance between the river, where merganser resided, and artificial land (residence, industrial land and bridge) was relatively far, while the distance between river and motorways was relative short. Chinese merganser preferred habitat which had larger percentage of island and was far away from artificial land. In winter, the Chinese merganser was able to tolerate small degree of disturbance such as small population or traffic flow, but avoided higher levels of disturbance. Effective winter habitat protection for the Chinese merganser should include protecting watersheds from flooding and avoiding excessive human activity particularly on more narrow reaches of rivers that are devoid of vegetation.

Enstipp, M. R., J. Frost, T. E. Hollmén, R. D. Andrews, and C. Frost. 2015. Two methods of radio transmitter attachment and their effects on the behavior and energetics of captive long-tailed ducks (*Clangula hyemalis*) during winter. *Animal Biotelemetry* **3**:36.

(Abstract)

Background: Attachment of external devices can have negative consequences for the health and fitness of subjects, but these effects are often overlooked. In preparation for a field study with small sea ducks, we investigated the effects of two types of external radio transmitter attachments on activity budgets and energetics of captive long-tailed ducks (*Clangula hyemalis*) during winter.

Methods: We conducted behavioral observations on 15 ducks over 3 months and measured oxygen consumption rates while resting on water and during preening. Ducks were either sham handled ('Control') or had transmitters attached with subcutaneous anchors ('Prongs') or Tesa tape/sutures ('Tesa').

Results: Following transmitter attachment, the activity budgets of Prong and Tesa birds changed

significantly, while Controls remained largely unchanged. Prong and Tesa birds reduced locomotor activity (−58 and −54%, respectively) and the proportion of time spent in water (−48 and −35%, respectively), while they concomitantly increased time allocated to maintenance behavior (+98 and +151%, respectively). Tesa birds recovered from these changes over time, at least partially, but Prong birds did not. Also, two of the five Prong birds developed a bacterial infection that spread from the attachment site. Retention time of transmitters was significantly greater for the Prong attachments (4 of 5 tags were retained for the entire 59-day study) than the Tesa technique (26.0 ± 3.2 days). Energy metabolism of ducks resting on water did not change significantly after transmitter attachment. Preening, the primary maintenance behavior, increased oxygen consumption rates by ~70% over resting. The greater allocation of time to maintenance behavior after transmitter attachment most likely increased daily energy expenditure in these ducks, although the concurrent reduction in locomotor activity might have mitigated this effect. Ducks in our study had food ad libitum and were able to reduce locomotion after transmitter attachment without compromising food intake and, hence, energy balance. In the wild, this strategy might not be viable.

Conclusions: Given the short retention time, the tape-based attachment technique we applied is not suitable if monitoring periods greater than ~2 to 3 weeks are desired. Both methods resulted in significant behavioral changes with energetic consequences that should be considered when planning to attach external transmitters to small sea ducks in the wild.

Degtyarev, V. G. 2015. Range expansion of the Mandarin Duck *Aix galericulata* (Aves: Anseriformes: Anatidae) to the Lena River catchment, Siberia. *Journal of Threatened Taxa* **7**:7937–7939.

(Abstract)

The range of the Mandarin Duck has enlarged significantly in recent years, reaching at least 60°N. The extension was dramatic because: (1) the species moved nearly 10 degrees northward during 20 years; (2) it crossed the Amur basin boundaries penetrating to the Lena River basin; (3) it reached the middle taiga.

Pernollet, C. A., D. Simpson, M. Gauthier-Clerc, and M. Guillemain. 2015. Rice and duck, a good combination? Identifying the incentives and triggers for joint rice farming and wild duck conservation. *Agriculture, Ecosystems and Environment* **214**:118–132.

(Abstract)

Rice is cultivated in 114 countries worldwide, with nearly half of the world's waterfowl species being directly or indirectly relying on this production during at least one stage of their life cycle. The literature on wild ducks in rice fields is disproportionately represented by studies in North America (although less than 1% of the world's rice fields), while studies in Asia (90% of the worldwide rice production) are mainly focused on the agronomic benefits of breeding farm ducks in Integrated Rice–Duck Farming Systems. In the present literature review we compile knowledge on the interactions between

rice farming and ducks, considering positive and negative interactions between the two entities, strategies to alleviate the problems as well as triggers and management options to promote the beneficial relationships. In particular, we focus on (1) the way rice-production areas could be managed in a waterfowl-friendly way, and (2) the agronomic consequences that rice farmers could in return receive from attracting wild ducks or rearing farm ducks in rice fields. For the farmers, the main constraints seem to be associated with duck damages to rice as well as flooding costs. For the ducks, the major issues are habitat loss, homogenization, disturbance and potential disease transmission. However, the present literature review suggests that duck–rice farming is a mutually beneficial association and demonstrates that relatively simple management such as winter flooding can be taken to improve the usability of these habitats to waterfowl, the farmers in turn benefitting from waterfowl ecosystem services.

Jankowiak, Ł., P. Skorka, Ł. Ławicki, P. Wylegała, M. Polakowski, A. Wuczynski, and P. Tryjanowski. 2015. Patterns of occurrence and abundance of roosting geese: the role of spatial scale for site selection and consequences for conservation. *Ecological Research* **30**:833-842.

(Abstract)

Roosting site selection by geese is a key factor for survival during migration and wintering. Birds should select sites that minimize thermoregulation demands and predation risk, and maximize foraging efficiency. We used data on the spatial location of geese roosting sites in Poland to compare landscape features and the conservation status of roosting and non-roosting sites at different scales ranging from 5 to 50 km. Logistic regression revealed that the sites selected by geese had larger waterbody size than non-selected sites, and surrounded by a smaller coverage of woodland at the scale of 50 km. They also were more often Natura 2000 sites. The most important factors positively affecting the abundance of geese were the size of waterbody and low coverage of artificial area (mostly urban) within a 50 km radius. Several further factors also influenced the roosting site selection. Regardless to the scale a large coverage of farmland (mostly rapeseed) positively affected roosting geese whereas forest coverage had a negative effect. Spatial hierarchical clustering analysis showed that the roosting sites were densely located in regions characterized by the most intensive agriculture. Farming intensity therefore seems to increase the abundance of geese, and consequently, to increase a possible conflict between goose conservation and food production. To alleviate the conflicts we delineated areas that may be most affected and where the conservation measures should be implemented first. As geese respond to environmental factors at different spatial scales this scale-dependency should be included in the conservation and management of goose populations.

Hupp, J. W., S. Kharitonov, N. M. Yamaguchi, K. Ozaki, P. L. Flint, J. M. Pearce, K.-i. Tokita, T. Shimada, and H. Higuchi. 2015. Evidence that dorsally mounted satellite transmitters affect migration chronology of Northern Pintails. *Journal of Ornithology* **156**:977–989.

(Abstract)

We compared migration movements and chronology between Northern Pintails (*Anas acuta*) marked

with dorsally mounted satellite transmitters and pintails marked only with tarsus rings. During weekly intervals of spring and autumn migration between their wintering area in Japan and nesting areas in Russia, the mean distance that ringed pintails had migrated was up to 1000 km farther than the mean distance radiomarked pintails migrated. Radiomarked pintails were detected at spring migration sites on average 9.9 days (90 % CI 8.0, 11.8) later than ringed pintails that were recovered within 50 km. Although ringed and radiomarked pintails departed from Japan on similar dates, the disparity in detection of radiomarked versus ringed pintails at shared sites increased 7.7 days (90 % CI 5.2, 10.2) for each 1000 km increase in distance from Japan. Thus, pintails marked with satellite transmitters arrived at nesting areas that were 2500 km from Japan on average 19 days later than ringed birds. Radiomarked pintails were detected at autumn migration stopovers on average 13.1 days (90 % CI 9.8, 16.4) later than ringed birds that were recovered within 50 km. We hypothesize that dorsal attachment of 12–20 g satellite transmitters to Northern Pintails increased the energetic cost of flight, which resulted in more rapid depletion of energetic reserves and shortened the distance pintails could fly without refueling. Radiomarked pintails may have used more stopovers or spent longer periods at stopovers, causing their migration schedule to diverge from ringed pintails. We urge further evaluation of the effects of dorsally mounted transmitters on migration chronology of waterfowl.

Madsen, J., T. K. Christensen, T. J. S. Balsby, and I. M. Tombre. 2015. Could Have Gone Wrong: Effects of Abrupt Changes in Migratory Behaviour on Harvest in a Waterbird Population. *PLoS ONE* **10**:e0135100.

(Abstract)

To sustainably exploit a population, it is crucial to understand and reduce uncertainties about population processes and effects of harvest. In migratory species, management is challenged by geographically separated changing environmental conditions, which may cause unexpected changes in species distribution and harvest. We describe the development in the harvest of Svalbard-breeding pink-footed geese (*Anser brachyrhynchus*) in relation to the observed trajectory and migratory behaviour of the population. In autumn, geese migrate via stopover sites in Norway and Denmark (where they are hunted) to wintering grounds in the Netherlands and Belgium (where they are protected). In Denmark and Norway harvesting increased stepwise during the 2000s. The increase in the population size only partly explained the change. The change corresponded to a simultaneous stepwise increase in numbers of geese staging in Denmark throughout autumn and winter; geese also moved further inland to feed which collectively increased their exposure to hunting. In Norway the increase in harvest reflected greater utilization of lowland farmland areas by geese, increasing their hunting exposure. The study demonstrates how changes in migratory behaviour can abruptly affect exposure to hunting, which showed a functional response to increased temporal and spatial availability of geese. The harvest has now reached a level likely to cause a population decline. It highlights the need for flexible, internationally coordinated hunting regulations and reliable up-to-date population estimates and hunting bag statistics, which are rare in European management of migratory waterbirds. Without such information decisions are left with judgments based on population estimates, which often have time lags of several years between recording and reporting, hampering possibilities for the timely adjustment of management actions.

Tajiri, H., Y. Sakurai, K. Tagome, Y. Nakano, Y. Yamamoto, T. Ikeda, Y. Yamamura, and K. Ohkawara. 2015. Satellite Telemetry of the Annual Migration of Baikal Teal *Anas formosa* Wintering at Katano-Kamoike, Ishikawa, Japan. *Ornithological Science* **14**:69-77.

(Abstract)

Baikal Teal were tracked, by satellite telemetry, in order to identify their migration route between their wintering grounds at Katano-kamoike, Ishikawa, Japan and their breeding range in Russia, and to identify the staging sites they use during migration. In the winter of 2012, four Baikal Teal were captured and satellite transmitters were attached to each individual. From 2012 to 2013, we tracked two of the four teal throughout their annual migration. In the spring, they crossed the Sea of Japan in late March and used stopovers in the Khanka Plain and the Three Rivers Plain for about one month. In early June, they reached their Arctic summer sites in the estuaries of the Indigirka and Khroma rivers of the Sakha Republic, Russia. They remained there for about three months and commenced their autumn migration in early September. The autumn migration route as far as the Three Rivers Plain was similar to that in spring, but after leaving the Three Rivers Plain, they moved to the western part of South Korea and stayed at Seomjin River and other rivers for several weeks. Finally, one of them returned to Katano-kamoike in January and spent more than two months of the winter there. In this study, we identified a total of 19 wetlands as important sites for Baikal Teal; three wintering sites, 13 stopover sites, one stopover/wintering site and two summer sites.

Somura, H., T. Masunaga, Y. Mori, I. Takeda, J. i. Ide, and H. Sato. 2015. Estimation of nutrient input by a migratory bird, the Tundra Swan (*Cygnus columbianus*), to winter-flooded paddy fields. *Agriculture, Ecosystems and Environment* **199**:1–9.

(Abstract)

Thousands of Tundra Swans visit winter-flooded paddy fields in the study area, Yasugi city, Shimane Prefecture, Japan every year for overwintering from November to March. Since 2004, they have roosted in the paddy fields during the night and foraged in the paddy and surrounding fields during the day, coinciding with the time when farmers began using winter-flooded paddy fields. Before 2004, the swans visited the area for foraging during the day and roosted at nearby lakes, wetlands, and sandbars along rivers during the night. When the swans visited our target paddy fields, the water gradually became green and began to emit an ammonia-like odor. In this study, we investigated the changes in the water qualities of winter-flooded paddy fields and the influence of bird excrement on water quality in the paddy fields during winter, and then estimated the amounts of nitrogen (N) and phosphorus (P) provided by bird droppings to the paddy fields. The mean concentrations of N, P, suspended sediment, and total organic carbon were higher in the overwintering season than during the irrigation season. This trend was observed in both the first and second seasons of the study. The spatial distribution of electric conductivity (EC) measured using a GEM-2 broad-band electromagnetic sensor coincided with that of the matted sites of Tundra Swans in the paddy field, which indicated that the excrement of the swans affected the EC distribution. The total input amounts of N and P from the birds' excrement to the flooded paddy fields were estimated using a simple model that considered

bird counts and probable nutrient content of feces, and the amounts were found to be equivalent to approximately 30% of those present in the standard fertilizers used for rice during the irrigation period. These results suggested that the excrement from the swans markedly influences the water qualities of winter-flooded paddy fields.

Nourani, E., M. Kaboli, and B. Collen. 2015. An assessment of threats to Anatidae in Iran. *Bird Conservation International* **25**:242–257.

(Abstract)

The network of wetland systems in Iran provides valuable staging and wintering areas for waterbirds in the African-Western Eurasian flyways. The West Siberian/Caspian/Nile populations of Anatidae (ducks, geese and swans) regularly overwinter and stop over in Iran, and are considered an economically and culturally important group of birds in the country. Conservation of such migratory birds requires the identification of key threat factors impacting them throughout the flyway. Since documented data on the status and threats facing Anatidae in Iran are very scarce, in this paper, we attempted to determine the general population trends for the 26 Anatidae species in Iran, using annual waterbird census data, and to identify and score the most important threat factors affecting each species, by consulting the top ornithologists and professional birdwatchers in the country by means of a survey. Our results indicate that the most prevalent threats affecting all 26 species are dam construction, water management practices, and hunting. Our results provide the necessary material for Red List assessment of these species at the national level, an important tool for conservation priority setting within Iran and in the flyway.

Janke, A. K., M. J. Anteau, N. Markl, and J. D. Stafford. 2015. Is income breeding an appropriate construct for waterfowl? *Journal of Ornithology* **156**:755–762.

(Abstract)

Breeding birds use a range of nutrient accumulation and allocation strategies to meet the nutritional demands of clutch formation and incubation. On one end of the spectrum, capital breeders use stored nutrients acquired prior to clutch formation and incubation to sustain metabolism during reproduction, while on the opposite end, income breeders derive nutrients solely from exogenous sources on the breeding grounds. Blue-winged Teal (*Anas discors*) are an ideal candidate to test for adoption of an income strategy among migratory waterfowl because of their small body size, temperate breeding range, and timing of reproduction relative to pulses in nutrient availability within breeding habitats. We collected migrating and prebreeding Blue-winged Teal (n = 110) during the warmest spring in over a century in the southern edge of the species' breeding range, which produced ideal conditions to test for adoption of an income breeding strategy among migratory waterfowl. Regression analyses revealed that females accumulated protein and fat reserves early in follicle development and appeared to mobilize at least some reserves coincident with the onset of clutch formation. Accumulation and subsequent mobilization of nutrient reserves was inconsistent with adherence to an income breeding strategy and suggested breeding Blue-winged Teal used capital (albeit locally

acquired) for reproduction. Our results add to existing knowledge on the ubiquity of endogenous nutrient reserve accumulation prior to and during reproduction by waterfowl, perhaps suggesting endogenous nutrient reserves are universally used for clutch formation or incubation to some degree. If indeed Blue-winged Teal and other waterfowl universally use capital for breeding, research and conservation efforts should shift from evaluating whether an income breeding strategy is used and focus on when and where necessary capital is acquired prior to clutch formation.

García-Álvarez, A., C. H. A. Leeuwen, C. J. Luque, A. Hussner, A. Vélez-Martín, A. Pérez-Vázquez, A. J. Green, and E. M. Castellanos. 2015. Internal transport of alien and native plants by geese and ducks: an experimental study. *Freshwater Biology* **60**:1316–1329.

(Abstract)

1. Alien plant species are rapidly spreading in aquatic ecosystems around the world, causing major ecological effects. They are typically introduced by humans, after which natural vectors facilitate their further spread. Migratory waterbirds have long been recognised as important dispersal vectors for native and aquatic plants, yet little is known about their role in the spread of alien species.

2. We determined experimentally the potential for long-distance dispersal of native and alien wetland plants in Europe by two abundant waterfowl: mallards *Anas platyrhynchos* and greylag geese *Anser anser*. We fed seeds from two plants alien to Europe and two native plants to 10 individuals of each bird species, testing for the effects of bird and plant species on the potential for dispersal.

3. Intact seeds were retrieved from faeces for up to 4 days after ingestion. The proportion of seeds retrieved intact varied significantly between plant, but not bird, species. Retrieval was highest for the invasive water primrose *Ludwigia grandiflora* (>35% of ingested seeds), lowest for the invasive cordgrass *Spartina densiflora* (<3%) and intermediate for the native glasswort *Arthrocnemum macrostachyum* and seablite *Suaeda vera* (5–10%).

4. Seed retrieval patterns over time varied between both plant and bird species. Contrary to expectations, seeds were retained in the gut for longer in the smaller mallards. No *Spartina* seeds germinated after retention for over 8 h, whereas some seeds of the other species germinated even after retention for 72h. Germinability was reduced by gut passage for *Ludwigia* and *Arthrocnemum* seeds. *Ludwigia* seeds recovered from geese were more likely to germinate than those recovered from mallards. Time to germination was reduced by gut passage for *Spartina* and *Ludwigia*, but increased with retention time.

5. Ducks and geese evidently have the potential for long-distance transport of alien and native plant seeds, with maximal dispersal distances of well over 1000 km. The much greater potential of *Ludwigia* than *Spartina* for dispersal by waterfowl is consistent with its faster expansion across Europe. Maximum retention times of wetland seeds have been underestimated in previous experimental studies that lasted only 1–2 days. Contrary to previous studies, wetland plants with large seeds, such as *Ludwigia*, can still show high potential for long-distance dispersal. More attention

should be paid to the role of waterbirds as vectors of alien plants and to the role of migratory geese as vectors of plants in general.

Zhang, Y., Q. Jia, H. H. T. Prins, L. Cao, and W. F. de Boer. 2015. Individual-Area Relationship Best Explains Goose Species Density in Wetlands. *PLoS ONE* **10**:e0124972.

Explaining and predicting animal distributions is one of the fundamental objectives in ecology and conservation biology. Animal habitat selection can be regulated by top-down and bottom-up processes, and is mediated by species interactions. Species varying in body size respond differently to top-down and bottom-up determinants, and hence understanding these allometric responses to those determinants is important for conservation. In this study, using two differently sized goose species wintering in the Yangtze floodplain, we tested the predictions derived from three different hypotheses (individual-area relationship, food resource and disturbance hypothesis) to explain the spatial and temporal variation in densities of two goose species. Using Generalized Linear Mixed Models with a Markov Chain Monte Carlo technique, we demonstrated that goose density was positive correlated with patch area size, suggesting that the individual area-relationship best predicts differences in goose densities. Moreover, the other predictions, related to food availability and disturbance, were not significant. Buffalo grazing probably facilitated greater white-fronted geese, as the number of buffalos was positively correlated to the density of this species. We concluded that patch area size is the most important factor determining the density of goose species in our study area. Patch area size is directly determined by water levels in the Yangtze floodplain, and hence modifying the hydrological regimes can enlarge the capacity of these wetlands for migratory birds.

Zeng, Q., L. Shi, L. Wen, J. Chen, H. Duo, and G. Lei. 2015. Gravel Bars Can Be Critical for Biodiversity Conservation: A Case Study on Scaly-Sided Merganser in South China. *PLoS ONE* **10**:e0127387.

(Abstract)

Gravel bars are characteristic components of river landscapes and are increasingly recognized as key sites for many waterbirds, though detailed studies on the ecological function of gravel bars for waterbirds are rare. In this study, we surveyed the endangered Scaly-sided Merganser *Mergus squamatus* along a 40 km river section of Yuan River, in Central China, for three consecutive winters. We derived the landscape metrics of river gravel bars from geo-rectified fine resolution (0.6 m) aerial image data. We then built habitat suitability models (Generalized Linear Models—GLMs) to study the effects of landscape metrics and human disturbance on Scaly-sided Merganser presence probability. We found that 1) the Scaly-sided Merganser tended to congregate at river segments with more gravel patches; 2) the Scaly-sided Merganser preferred areas with larger and more contiguous gravel patches; and 3) the number of houses along the river bank (a proxy for anthropogenic disturbance) had significantly negative impacts on the occurrence of the Scaly-sided Merganser. Our results

suggest that gravel bars are vital to the Scaly-sided Merganser as shelters from disturbance, as well as sites for feeding and roosting. Therefore, maintaining the exposure of gravel bars in regulated rivers during the low water period in winter might be the key for the conservation of the endangered species. These findings have important implications for understanding behavioral evolution and distribution of the species and for delineating between habitats of different quality for conservation and management.

Takekawa, J. Y., S. R. Heath, S. A. Iverson, N. Gaidet, J. Cappelle, T. Dodman, W. Hagemeyer, W. D. Eldridge, S. A. Petrie, G. S. Yarris, S. Manu, G. H. Olsen, D. J. Prosser, K. A. Spragens, D. C. Douglas, and S. H. Newman. 2015. Movement ecology of five Afrotropical waterfowl species from Malawi, Mali and Nigeria. *Ostrich* **86**:155-168.

(Abstract)

Habitat availability for Afrotropical waterbirds is highly dynamic with unpredictable rainfall patterns and ephemeral wetlands resulting in diverse movement strategies among different species. Movement strategies among waterfowl encompass resident, regional and intercontinental migrants, but little quantitative information exists on their specific movement patterns. We studied the movement ecology of five Afrotropical waterfowl species marked with satellite transmitters in Malawi, Mali and Nigeria. Resident species, including White-faced Whistling Ducks *Dendrocygna viduata*, Fulvous Whistling Ducks *Dendrocygna bicolor* and Spur-winged Geese *Plectropterus gambensis*, remained sedentary during the rainy season and only flew limited distances during other months. In contrast, Knob-billed Ducks *Sarkidiornis melanotos* made short regional movements >50 km in all months and showed little site fidelity to previously used habitats in subsequent years. Garganey *Anas quequedula* followed an intercontinental strategy and made long-distance jumps across the Sahara and Mediterranean to their Eurasian breeding grounds. Most species flew farthest during the dry season, as mean daily movements varied from 1.5 to 14.2 km and was greatest in the winter months (January–March). Total distance moved varied from 9.5 km for White-faced Whistling Ducks (October–December) to 45.6 km for Knob-billed Ducks (April–June). Nomadic behaviour by Knob-billed Ducks was evidenced by long exploratory flights, but small mean daily movements suggested that they were relying on previous experience. Improving our understanding of these movement strategies increases our ability to assess connectivity of wetland resources that support waterfowl throughout their annual cycle and focuses conservation efforts on their most important habitats.

Souchay, G., G. Gauthier, J. Lefebvre, and R. Pradel. 2015. Absence of Difference in Survival between Two Distant Breeding Sites of Greater Snow Geese. *The Journal of Wildlife Management* **79**:570–578.

(Abstract)

Adaptive management of harvested waterfowl requires accurate estimations of demographic

parameters. These must also be representative of the targeted population. In the greater snow goose, all demographic parameters so far have been estimated from long-term banding conducted at a single nesting colony in the Arctic, Bylot Island, where 15% of the population breeds. We used data from a second banding program conducted on Ellesmere Island, 800 km north of Bylot Island and near the northern limit of the breeding range, to compare adult survival between these 2 breeding sites over the period 2007–2011. This allowed us to determine the representativeness of demographic parameters estimated from the Bylot colony. We used a multi-event capture-recapture model combining recaptures, resightings of neckbanded birds, and recoveries on a seasonal basis, which allowed us to test specifically for differences in survival during the migration periods. Despite differences in migration distance (20% longer for Ellesmere Island) and environmental conditions, survival rate of birds from these 2 breeding sites were similar in all seasons. Annual survival ranged from 0.72 to 0.79. This apparent absence of a cost of migration on survival may be explained by the canalization hypothesis: variance in adult survival of the greater snow goose, a long-lived species, caused by environmental factors may have been reduced because of selection pressure on this trait, which is closely linked to fitness. The absence of spatial variation in adult survival suggests that the extrapolation of survival parameters estimated from the Bylot Island colony to the entire population may be valid.

Holopainen, S., C. Arzel, L. Dessborn, J. Elmberg, G. Gunnarsson, P. Nummi, H. Pöysä, and K. Sjöberg. 2015. Habitat use in ducks breeding in boreal freshwater wetlands: a review. *European Journal of Wildlife Research* **61**:339–363.

(Abstract)

Breeding habitats strongly influence duck reproduction and survival. The boreal biome harbours a large share of the world's wetlands, which are important breeding sites for several duck species. Based on 98 studies in the peer-reviewed literature, we here synthesize and evaluate which habitat characteristics affect habitat use and reproduction of ducks breeding in boreal freshwater wetlands with respect to (1) species and guild (dabbling, diving and piscivorous ducks) and (2) breeding cycle stage (settling by pairs, nesting and brood rearing). We consider the following aspects related to habitat: wetland morphology and spatial aggregation, water characteristics, habitat structure and vegetation, and biotic interactions. Most of the peer-reviewed studies of duck habitat use in boreal wetlands are from North America and Fennoscandia, while nearly half of the boreal area lacks such studies. Few species dominate research thus far while several others have not been studied at all. Nest site use and success are mainly related to predator avoidance. Food resources and habitat structure are the key characteristics affecting habitat use by duck pairs and broods as well as breeding success, although there are differences between duck guilds. Among the commonly studied variables, there is little evidence that water characteristics affect duck habitat use or survival. The most notable knowledge gaps are found in the effects of anthropogenic activities on habitat use and breeding success of ducks. Because boreal breeding environments are increasingly affected by human activities, we underline the need for future studies combining climate variation with natural and anthropogenic disturbances.

Fox, A. D., K. Kuhlmann Clausen, L. Dalby, T. K. Christensen, and P. Sunde. 2015. Age-ratio bias among hunter-based surveys of Eurasian Wigeon *Anas Penelope* based on wing vs. field samples. *Ibis* **157**:391–395.

(Abstract)

We compared age and sex ratios among Eurasian Wigeon *Anas penelope* derived from Danish field observations and hunter-based shot samples throughout an entire winter. Sex ratios did not differ significantly between the two samples. Overall, first-year males were more than three times more likely to be represented than adult males in the hunter sample compared with field samples and were 7–20 times overrepresented in the hunting sample at the beginning of the season. These results confirm the need to account for such bias and its temporal variation when using the results of hunting surveys to model population parameters. Hunter-shot age ratios may provide a long-term measure of reproductive success of dabbling duck flyway populations given an understanding of such bias.

Arzel, C., and J. Elmberg. 2015. Time use and foraging behaviour in pre-breeding dabbling ducks *Anas* spp. in sub-arctic Norway. *Journal of Ornithology* **156**:499–513.

(Abstract)

We studied time budgets and foraging methods in pre-breeding Mallard *Anas platyrhynchos*, (Eurasian) Teal *Anas crecca*, Wigeon *Anas penelope*, Pintail *Anas acuta*, Shoveler *Anas clypeata* and Gadwall *Anas strepera* in subarctic Norway in May. Among all six species studied, foraging accounted for the most common use of time, ranging from 19 % in male Pintail to 40–60 % in female Mallard, Teal, Pintail and Gadwall. Comfort behaviours amounted to 20–34 % of the time budget, and interaction and disturbance were marginal. Vigilance time ranged from 8 % in female Mallard to 20 % in male Pintail. Movement amounted to some 20 % of the time in most species and sexes. In Wigeon, sexes did not differ in time use, whereas in Mallard, Pintail and, in particular, Teal, females foraged more and engaged less in vigilance and interactions than did males. In addition, Teal and Mallard males engaged in the riskier foraging methods less than females, but more in those permitting vigilance. Although overlap in feeding methods was large among these species, Mallard and Teal were generalists, feeding at all depths, Wigeon foraged mainly in shallow water and Pintail foraged essentially in deep water. Our results support the income/capital breeder hypothesis with respect to males only; compared to lighter species, heavier species allocated less time to foraging but more to vigilance. We found no support for the hypothesis that long-distance migrants forage more to compensate for energy loss due to migratory flight. Foraging time in females was related to breeding phenology; early nesters spent more time feeding than later nesters.

Si, Y., Q. Xin, W. F. de Boer, P. Gong, R. C. Ydenberg, and H. H. T. Prins. 2015. Do Arctic breeding geese track or overtake a green wave during spring migration? *Scientific Reports* **5**:1-6.

(Abstract)

Geese breeding in the Arctic have to do so in a short time-window while having sufficient body reserves. Hence, arrival time and body condition upon arrival largely influence breeding success. The green wave hypothesis posits that geese track a successively delayed spring flush of plant development on the way to their breeding sites. The green wave has been interpreted as representing either the onset of spring or the peak in nutrient biomass. However, geese tend to adopt a partial capital breeding strategy and might overtake the green wave to accomplish a timely arrival on the breeding site. To test the green wave hypothesis, we link the satellite-derived onset of spring and peak in nutrient biomass with the stopover schedule of individual Barnacle Geese. We find that geese track neither the onset of spring nor the peak in nutrient biomass. Rather, they arrive at the southernmost stopover site around the peak in nutrient biomass, and gradually overtake the green wave to match their arrival at the breeding site with the local onset of spring, thereby ensuring gosling benefit from the peak in nutrient biomass. Our approach for estimating plant development stages is critical in testing the migration strategies of migratory herbivores.

Dinges, A. J., E. B. Webb, and M. P. Vrtiska. 2015. Effects of the Light Goose Conservation Order on non-target waterfowl distribution during spring migration. *Wildlife Biology* **21**:88-97.

(Abstract)

The Light Goose Conservation Order (LGCO) was initiated in 1999 to reduce mid-continent populations of light geese (lesser snow geese *Chen caerulescens* and Ross's geese *C. rossii*). However, concern about potential for LGCO activities (i.e. hunting activities) to negatively impact non-target waterfowl species during spring migration in the Rainwater Basin (RWB) of Nebraska prompted agency personnel to limit the number of hunt days each week and close multiple public wetlands to LGCO activities entirely. To evaluate the effects of the LGCO in the RWB, we quantified waterfowl density at wetlands open and closed to LGCO hunting and recorded all hunter encounters during springs 2011 and 2012. We encountered a total of 70 hunting parties on 22 study wetlands, with over 90% of these encounters occurring during early season when the majority of waterfowl used the RWB region. We detected greater overall densities of dabbling ducks *Anas* spp., as well as for mallards *A. platyrhynchos* and northern pintails *A. acuta* on wetlands closed to the LGCO. We detected no effects of hunt day in the analyses of dabbling duck densities. We detected no differences in mean weekly dabbling duck densities among wetlands open to hunting, regardless of weekly or cumulative hunting encounter frequency throughout early season. Additionally, hunting category was not a predictor for the presence of greater white-fronted geese *Anser albifrons* in a logistic regression model. Given that dabbling duck densities were greater on wetlands closed to hunting, providing wetlands free from hunting disturbance as refugia during the LGCO remains an important management strategy at migration stopover sites. However, given that we did not detect an effect of hunt day or hunting frequency on dabbling duck density, our results suggest increased hunting frequency at sites already open to hunting would likely have minimal impacts on the distribution of non-target waterfowl species using the region for spring staging.

Doherty, K. E., J. S. Evans, J. Walker, J. H. Devries, and D. W. Howerter. 2015. Building the Foundation for International Conservation Planning for Breeding Ducks across the U.S. and Canadian Border. *PLoS ONE* **10**:e0116735.

(Abstract)

We used publicly available data on duck breeding distribution and recently compiled geospatial data on upland habitat and environmental conditions to develop a spatially explicit model of breeding duck populations across the entire Prairie Pothole Region (PPR). Our spatial population models were able to identify key areas for duck conservation across the PPR and predict between 62.1 – 79.1% (68.4% avg.) of the variation in duck counts by year from 2002 – 2010. The median difference in observed vs. predicted duck counts at a transect segment level was 4.6 ducks. Our models are the first seamless spatially explicit models of waterfowl abundance across the entire PPR and represent an initial step toward joint conservation planning between Prairie Pothole and Prairie Habitat Joint Ventures. Our work demonstrates that when spatial and temporal variation for highly mobile birds is incorporated into conservation planning it will likely increase the habitat area required to support defined population goals. A major goal of the current North American Waterfowl Management Plan and subsequent action plan is the linking of harvest and habitat management. We contend incorporation of spatial aspects will increase the likelihood of coherent joint harvest and habitat management decisions. Our results show at a minimum, it is possible to produce spatially explicit waterfowl abundance models that when summed across survey strata will produce similar strata level population estimates as the design-based Waterfowl Breeding Pair and Habitat Survey ($r^2 = 0.977$). This is important because these design-based population estimates are currently used to set duck harvest regulations and to set duck population and habitat goals for the North American Waterfowl Management Plan. We hope this effort generates discussion on the important linkages between spatial and temporal variation in population size, and distribution relative to habitat quantity and quality when linking habitat and population goals across this important region.

O'Neal, B. J., J. D. Stafford, and R. P. Larkin. 2015. Migrating ducks in inland North America ignore major rivers as leading lines. *Ibis* **157**:154–161.

(Abstract)

A recently developed radar-based technique permitted empirical re-evaluation of the established but poorly supported theory that migrating North American waterfowl (Anatidae) use landscape features such as rivers as leading lines. Ducks departing the Illinois River Valley in the autumn of each of 15 years travelled SSE with a mean track that was 68° different from the 220° course of the Illinois River ($P \leq 0.001$). We conclude that leading lines were unimportant navigation aids for ducks leaving this major stopover site in autumn and suggest that rivers have less effect on the spatial course of duck migration than previously thought. Timing of departures was examined in a representative subset of 8 years and found to be consistent, with a mean start time of 44 min after civil sunset.

Anderson, H. B., J. Madsen, E. Fuglei, G. H. Jensen, S. J. Woodin, and R. van der Wal. 2015. The dilemma of where to nest: influence of spring snow cover, food proximity and predator abundance on reproductive success of an arctic-breeding migratory herbivore is dependent on nesting habitat choice. *Polar Biology* **38**:153–162.

(Abstract)

Pink-footed geese *Anser brachyrhynchus* nest in two contrasting but commonly found habitats: steep cliffs and open tundra slopes. In Svalbard, we compared nest densities and nesting success in these two environments over ten breeding seasons to assess the impact of spring snow cover, food availability to nesting adults and arctic fox *Vulpes lagopus* (main terrestrial predator) abundance. In years with extensive spring snow cover, fewer geese at both colonies attempted to breed, possibly because snow cover limited pre-nesting feeding opportunities, leaving adults in poor breeding condition. Nesting success at the steep cliff colony was lower with extensive spring snow cover; such conditions force birds to commit to repeated and prolonged recess periods at far distant feeding areas, leaving nests open to predation. By contrast, nesting success at the open tundra slope was not affected by spring snow cover; even if birds were apparently in poor condition they could feed immediately adjacent to their nests and defend them from predators. Foxes were the main nest predator in the open tundra slopes but avian predators likely had a larger impact at the steep cliffs colony. Thus, the relative inaccessibility of the cliffs habitat may bring protection from foxes but also deprives geese from readily accessing feeding areas, with the best prospects for successful nesting in low spring snow cover years. Our findings indicate that spring snow cover, predator abundance and food proximity did not uniformly influence nesting success of this herbivore, and their effects were dependent on nesting habitat choice.

Liang, J., S. Hua, G. Zeng, Y. Yuan, X. Lai, X. Li, F. Li, H. Wu, L. Huang, and X. Yu. 2015. Application of weight method based on canonical correspondence analysis for assessment of Anatidae habitat suitability: A case study in East Dongting Lake, Middle China. *Ecological Engineering* **77**:119–126.

(Abstract)

Habitat suitability assessment is one of the essential steps in habitat conservation and restoration. A weight method, which used the length of arrow in the result of canonical correspondence analysis (CCA) to determine the weight of the environmental variables, was developed to evaluate the Anatidae habitat suitability in East Dongting Lake. Based on descriptive waterfowl statistics from field observation data, Anatidae were selected as the representative waterfowl by the dominance. And then five environmental variables were identified by the correlation analysis as having important effects on the presence/absence of Anatidae habitat suitability. The Anatidae habitat suitability was evaluated by the new weight method. The results showed that the area of highly suitable habitat and moderately suitable habitat were 21.8% and 48.5%, respectively. Only small area was unsuitable habitat (9.3%). The survey data of Anatidae from 2006 to 2011 in East Dongting Lake were used to test the validity of the assessment results. It was concluded that the five environmental variables could well explain the results of Anatidae habitat suitability. The weight method based on CCA was feasible in assessment of Anatidae habitat suitability.

Zeng Q, Zhang Y, Sun G, Duo H, Wen L, *et al.* 2015. Using Species Distribution Model to Estimate the Wintering Population Size of the Endangered Scaly-Sided Merganser in China. *PLoS ONE* **10(2)**: e0117307.

(Abstract)

Scaly-sided Merganser is a globally endangered species restricted to eastern Asia. Estimating its population is difficult and considerable gap exists between populations at its breeding grounds and wintering sites. In this study, we built a species distribution model (SDM) using Maxent with presence-only data to predict the potential wintering habitat for Scaly-sided Merganser in China. Area under the receiver operating characteristic curve (AUC) method suggests high predictive power of the model (training and testing AUC were 0.97 and 0.96 respectively). The most significant environmental variables included annual mean temperature, mean temperature of coldest quarter, minimum temperature of coldest month and precipitation of driest quarter. Suitable conditions for Scaly-sided Merganser are predicted in the middle and lower reaches of the Yangtze River, especially in Jiangxi, Hunan and Hubei Provinces. The predicted suitable habitat embraces 6,984 km of river. Based on survey results from three consecutive winters (2010–2012) and previous studies, we estimated that the entire wintering population of Scaly-sided Merganser in China to be $3,561 \pm 478$ individuals, which is consistent with estimate in its breeding ground.

Anatidae 2014

Shokhrin, V. P., and D. V. Solovyeva. 2014. Broods of the Scaly-sided Merganser (*Mergus squamatus*) in the river basin of Kievka and adjacent territories (Primorskii Krai). *Amurian zoological journal* **VI**:214-220

(Abstract)

Data on the abundance, distribution, and survival of broods of the Scaly-sided Merganser (*Mergus squamatus* Gould, 1864) in the basin of Kievka River were obtained within 2000-2012. The Scaly-sided Merganser is a threatened species, whose populations are decreasing in the last three years. In addition, the data on the number of broods registered at 12 more rivers of the southern Sikhote Alin mountains are presented. (article in Russian)

Stafford, J. D., A. K. Janke, M. J. Anteau, A. T. Pearse, A. D. Fox, J. Elmberg, J. N. Straub, M. W. Eichholz, and C. Arzel. 2014. Spring migration of waterfowl in the northern hemisphere: a conservation perspective. *Wildfowl Special Issue* **4**:70–85.

(Abstract)

Spring migration is a key part of the annual cycle for waterfowl populations in the northern hemisphere, due to its temporal proximity to the breeding season and because resources may be limited at one or more staging sites. Research based on field observations during spring lags behind other periods of the year, despite the potential for fitness consequences through diminished survival or cross-seasonal effects of conditions experienced during migration. Consequently, conservation strategies for waterfowl on spring migration are often only refined versions of practices used during autumn and winter. Here we discuss the current state of knowledge of habitat requirements for waterfowl at their spring migratory sites and the intrinsic and extrinsic factors that lead to variability in those requirements. The provision of plant foods has become the main conservation strategy during spring because of the birds' energy requirements at this time, not only to fuel migration but to facilitate early clutch formation on arrival at the breeding grounds. Although energy sources are important to migrants, there is little evidence on the extent to which the availability of carbohydrate-based food is limiting for many migratory waterfowl populations. Such limitation is relatively unlikely among populations that exploit agricultural grain during migration (e.g. arctic-nesting geese), suggesting that conservation strategies for these populations may be misplaced. In general, however, we found few cases in which an ecological understanding of spring-migrating waterfowl was sufficient to indicate true resource limitation during migration, and still fewer cases where conservation efforts ameliorated these limitations. We propose a framework that aims to address knowledge gaps and apply empirical research results to conservation strategies based on documented limitations and associated fitness impacts on migrating waterfowl. Such a strategy would improve allocation of scarce conservation resources during spring migration and greatly improve ecological understanding of migratory waterfowl and their habitats in the northern hemisphere.

Eichholz, M. W., and J. Elmberg. 2014. Nest site selection by Holarctic waterfowl: a multi-level review. *Wildfowl Special Issue* 4:86–130.

(Abstract)

Because of birds' mobility, behaviour and many species' migratory nature, they select repeatedly and spatially among habitats and have been central figures in studies of avian breeding habitat selection during the 20th and 21st centuries. The scientific literature on habitat use by breeding waterfowl has origins dating back to the writings of Charles Darwin in *The Voyage of the Beagle*, wherein he described the distribution and habitat differences of two species of geese on the Falkland Islands. Since that time, waterfowl ecologists have gone from descriptive studies of nest site characteristics used for planning waterfowl conservation and management to comparing nest site use in relation to potential habitat availability and determining selection for a wide array of ecological correlates. Waterfowl ecologists most recently have been investigating the adaptive significance of nest site selection by associating the latter with individual fitness and demographic measurements to assess the birds' adaptability under environmental conditions at multiple scales of selection. While little direct assessment of 1st and 2nd order nest site selection has occurred (*sensu* Johnson 1980), available information is most consistent with the hypothesis that selection at these scales is driven by food availability. At the 3rd and 4th order of selection, data are consistent with hypotheses that both food availability and predator avoidance drive nest site selection, depending on the species and type of

nesting aggregation. We also identify understudied areas of nest site selection important for the conservation and management of waterfowl and suggest that the large-scale influence of current anthropogenic and natural effects on the environment indicates that greater emphasis should be directed toward understanding waterfowl nest site selection at the 1st and 2nd orders of selection and how nesting habitat selection interfaces with community ecology of sympatric breeding waterfowl. Moreover, because habitat selection of pre fledging waterfowl is inherently linked to breeding habitat selection, we suggest an updated review of brood habitat selection should ensue from our synthesis here.

Fox, A. D., P. L. Flint, W. L. Hohman, and J.-P. L. Savard. 2014. Waterfowl habitat use and selection during the remigial moult period in the northern hemisphere. *Wildfowl Special Issue 4*:131–168.

(Abstract)

This paper reviews factors affecting site selection amongst waterfowl (Anatidae) during the flightless remigial moult, emphasizing the roles of predation and food supply (especially protein and energy). The current literature suggests survival during flightless moult is at least as high as at other times of the annual cycle, but documented cases of predation of flightless waterfowl under particular conditions lead us to infer that habitat selection is generally highly effective in mitigating or avoiding predation. High energetic costs of feather replacement and specific amino-acid requirements for their construction imply adoption of special energetic and nutritional strategies at a time when flightlessness limits movements. Some waterfowl meet their energy needs from endogenous stores accumulated prior to remigial moult, others rely on exogenous supply, but this varies with species, age, reproductive status and site. Limited evidence suggests feather proteins are derived from endogenous and exogenous sources which may affect site selection. Remigial moult does not occur independently of other annual cycle events and is affected by reproductive investment and success. Hence, moult strategies are affected by age, sex and reproductive history, and may be influenced by the need to attain a certain internal state for the next stage in the annual cycle (e.g. autumn migration). We know little about habitat selection during moult and urge more research of this poorly known part of the annual cycle, with particular emphasis on identifying key concentrations and habitats for specific flyway populations and the effects of disturbance upon these. This knowledge will better inform conservation actions and management actions concerning waterfowl during moult and the habitats that they exploit.

Koons, D. N., G. Gunnarsson, J. A. Schmutz, and J. J. Rotella. 2014. Drivers of waterfowl population dynamics: from teal to swans. *Wildfowl Special Issue 4*:169–191.

(Abstract)

Waterfowl are among the best studied and most extensively monitored species in the world. Given their global importance for sport and subsistence hunting, viewing and ecosystem functioning, great

effort has been devoted since the middle part of the 20th century to understanding both the environmental and demographic mechanisms that influence waterfowl population and community dynamics. Here we use comparative approaches to summarize and contrast our understanding of waterfowl population dynamics across species as short-lived as the teal *Anas discors* and *A. crecca* to those such as the swans *Cygnus* sp. which have long life-spans. Specifically, we focus on population responses to vital rate perturbations across life history strategies, discuss bottom-up and top-down responses of waterfowl populations to global change, and summarize our current understanding of density dependence across waterfowl species. We close by identifying research needs and highlight ways to overcome the challenges of sustainably managing waterfowl populations in the 21st century.

Sedinger, J. S., and R. T. Alisauskas. 2014. Cross-seasonal effects and the dynamics of waterfowl populations. *Wildfowl Special Issue* 4:277–304.

(Abstract)

Cross-seasonal effects (CSEs) on waterfowl populations link together events and habitats that individuals experience as carry-over effects (COEs) throughout the annual cycle. The importance of CSEs has been recognized since at least the 1950s. Studies of nutrient dynamics beginning in the 1970s, followed by regression analyses that linked production of young to winter habitat conditions, confirmed the importance of CSEs. CSEs have been most apparent in large-bodied waterfowl, but evidence for CSEs in much smaller passerines suggests the potential for CSEs in all waterfowl. Numerous studies have established effects of winter weather on body condition and reproduction in both ducks and geese. Additionally, the ubiquitous use (during laying and incubation) of nutrients stored previously during spring migration suggests that such nutrients commonly influence reproductive success in waterfowl. Carry-over effects from the breeding season to autumn and winter are less well understood, although nutrition during the growth period in geese has been widely demonstrated to influence subsequent survival and reproduction. Only a few studies have examined effects of breeding on reproduction in later years. Because pathogens and parasites can be carried between seasonal habitats, disease represents an important potential mechanism underlying CSEs; so far, however, this role for diseases and parasitism remains poorly understood. CSEs were originally of interest because of their implications for management of seasonal habitats and CSEs represent a fundamental rationale for the habitat joint ventures in North America. Substantial research examining the role of COEs in individual fitness and of CSEs on population dynamics has now been conducted. New techniques (e.g. stable isotopes, geolocators) developed over the last decade, combined with more traditional marking programs have created opportunities to understand CSEs more fully and to inform the management of seasonal habitats for waterfowl.

Zhao, X., and R. Maming. 2014. The status of Ferruginous Duck *Aythya nyroca* breeding and wintering in China. *Wildfowl* 64:116–125.

(Abstract)

Analysis of data published in the China Bird Report (CBR) and other literature between 1979 and 2013, along with our own field observations, found that the Ferruginous Duck *Aythya nyroca* now occurs throughout most of China. This contrasts with the situation in 1979, when the species was restricted to a few areas in the west of the country. Ferruginous Duck is predominately a winter visitor to China; up to 850 birds have been counted in Yunnan Province, 4,000 in Sichuan Province, and the wintering population is estimated at 6,000–8,000 individuals. In summer, the breeding population is estimated at 3,000–4,000 individuals (1,500–2,000 pairs), with highest concentrations in Xinjiang (c. 900–1,700 individuals) and Inner Mongolia (750–1,400 individuals). In China, females lay 6–11 eggs, which hatch in early June. The present population in China is likely to have spread from neighbouring central Asia (Kazakhstan, Kyrgyzstan or Mongolia). Since 1980, the climate had gradually changed from warm-dry conditions to a wetter climate in northwest China, making it a more suitable breeding area for this species and providing corridors for their expansion to the east. If the present trend continues, southern China could in the near future become an important wintering area for a duck species that is now increasingly common elsewhere in China.

Schummer, M. L., J. Cohen, R. M. Kaminski, M. E. Brown, and C. L. Wax. 2014. Atmospheric teleconnections and Eurasian snow cover as predictors of a weather severity index in relation to Mallard *Anas platyrhynchos* autumn–winter migration. *Wildfowl Special Issue* 4:451–469.

(Abstract)

Research on long-term trends in annual weather severity known to influence migration and winter distributions of Mallard *Anas platyrhynchos* and other migratory birds is needed to predict effects of changing climate on: 1) annual distributions and vital rates of these birds, 2) timing of habitat use by migratory birds, and 3) demographics of the hunters of these species. Weather severity thresholds developed previously for Mallard were used to calculate weather severity and spatially-depicted Weather Severity Index Anomalies (\pm km², WSIA), in comparison with normal conditions, for Mallard in eastern North America from November–January 1950–2008. We determined whether WSIA differed among decades and analysed the effects of atmospheric teleconnections and Eurasian snow cover on annual variation in WSIA. Weather severity was mildest (+ WSIA) during the 2000s compared to other decades and differed substantially from the 1960s and 1970s (– WSIA). The Arctic Oscillation Index explained substantial variation in WSIA during El Niño and La Niña episodes, but not when the Oceanic Niño Index was neutral. Eurasian snow cover models accurately predicted if the WSIA would be greater or less than normal for 75% of the years studied. Our results may provide a partial explanation for recent observations of interrupted or reduced migration to southern latitudes by Mallard and other migratory birds during autumn–winter. Our models also provide ecologists with teleconnection models to help predict future distributions of Mallard and potentially other migratory birds in eastern North America. Future investigations could include testing the influence of WSIA on Mallard survival and on annual movements and distributions for other migratory birds, to provide a better understanding of the influences of climate and changes in climate on population dynamics and the need to conserve particular habitats.

Guan, L., L. Wen, D. Feng, H. Zhang, and G. Lei. 2014. Delayed Flood Recession in Central Yangtze Floodplains Can Cause Significant Food Shortages for Wintering Geese: Results of Inundation Experiment. *Environmental Management* **54**:1331–1341.

(Abstract)

Carex meadows are critical habitat for wintering geese in the floodplains of the middle and lower reaches of Yangtze River, China. These meadows follow a growth cycle closely tied to the seasonal hydrological fluctuation: as water levels recede in the fall, exposed mudflats provide habitat for *Carex* spp. growth. The seasonal growth of *Carex* overlaps the arrival of wintering geese and provides an important food source for the migrants. Recent alterations to the Yangtze's hydrology, however, have disrupted the synchronous relationship between water levels, *Carex* growth and wintering geese at Dongting Lake. In October 2012, we carried out an outdoor mesocosm experiment to investigate potential impacts of delayed water recession on the germination and growth of *Carex heterolepis*, the dominant *Carex* species at Dongting Lake, to understand how changes in hydrology might impact wintering goose habitat. Results showed that the delayed flood recession exerted significant impact on the first growth cycle of *Carex* growth. Prolonged inundation significantly lowered the intrinsic growth rate ($P = 0.03$) and maximum growth rates ($P = 0.02$). It also took significantly longer time to reach the peak growth rate ($P = 0.04$ and 0.05 for number of shoot and biomass, respectively). As a result, biomass accumulation was reduced by 45, 62 and 90 % for 10-day, 20-day and 30-day inundation treatments, respectively. These results indicate a severe risk of food shortage for wintering geese when water recession delayed. This potential risk should be taken into consideration when operating any hydrological control structures that alter the flood regimes in Dongting Lake.

Clausen, K. K., and J. Madsen. 2014. Effects of neckbands on body condition of migratory geese. *Journal of Ornithology* **155**:951–958.

(Abstract)

Ringling and marking are widely used techniques in avian ecology to assist studies of migration, survival and behaviour, and often used to estimate population sizes. Only rarely, however, have the effects of these markings on bird viability been thoroughly tested. Using an abdominal profile index of marked geese and body mass of recaptured birds previously marked, this study investigated the effect of neckbands on body condition of Pink-footed Geese *Anser brachyrhynchus* at different temporal scales, and evaluated to what extent capture, handling and banding affected these birds on short, medium and longer terms. Our results indicated that body condition of geese were negatively affected in the days immediately succeeding capture, but that only a minor effect persisted on a seasonal scale. We found no support for a long-term effect of neckbands on the body mass of individual birds, indicating that the capture and handling event might be the main contributory cause to the transitory decline in body condition. Pink-footed Geese thus seemed to habituate almost completely to the presence of neckbands, and the effects on long-term body condition can be expected to be minor. However, neckbands might still influence important life-history traits such as reproduction and survival

by means of, e.g., altering social interactions, increasing predation or interfering with mate acquisition.

D.V. Solovyeva, S.L. Vartanayan. 2014 Aspects of the breeding biology of Bewick's Swans *Cygnus columbianus bewickii* nesting in high densities in the Chaun River delta, Chukotka, east Russia *Wildfowl* **64**: 148–166

(Abstract)

The breeding biology of Bewick's Swans *Cygnus columbianus bewickii* nesting on Ayopechan Island in the Chaun River delta, Chukotka, northeast Russia was monitored from 2002–2013 inclusive, which coincided with a marked increase in the number of swans in the Eastern Population. A total of 535 nests were located during the study, and nest density, clutch size, egg dimensions, earliest hatch dates and nest success (i.e. whether at least one egg hatched) were recorded. Average nest density was 2.07 ± 0.25 nests/km² (range = 0.98–3.33 nests/km²) and nest density appeared to increase over the study period, although the trend was not statistically significant. The minimum distance between two swan nests was 82 m, and average clutch size was 3.60 eggs (s.d. = 1.05; range = 1–7 eggs, n = 410 clutches). Nest success, recorded in 2009–2013, ranged from 32.2–72.2% and averaged 46.5%. Weather variables, such as the date on which temperatures rose above zero, the timing of snow melt, late May and early June temperatures, and a general (integrated) measure of spring weather conditions, were not significantly associated with nest density. Mean clutch size decreased during the study, through there being a decreasing proportion of large clutches of 5 and 6 eggs. Results are discussed in relation to a separate study of the breeding biology of Bewick's Swans in the Northwest European Population, which increased in numbers between the mid 1970s and the mid 1990s but is currently in decline.

D.V. Solovyeva, P. Liu, A. I. Antonov, A. A. Averin, V. V. Pronkevich, V. P. Shokhrin, S. L. Vartanyan, and P. A. Cranswick. 2014. The population size and breeding range of the Scaly-sided Merganser *Mergus squamatus*. *Bird Conservation International* **24**:393 – 405.

(Abstract)

Based on surveys during 2000–2012 and best available knowledge, we estimate the global population size of the Endangered Scaly-sided Merganser *Mergus squamatus* to be c.1,940 pairs (or c.4,660 birds prior to reproduction). In Russia, surveys identified the breeding range in the Sikhote-Alin mountain range and the area adjoining the lower Amur River. Particular effort was made to define the edge of the range. Breeding densities in the Sikhote-Alin were applied to un-surveyed rivers within the range to estimate overall numbers. The breeding range comprises c.7,800 km of 120 rivers: 6,800 km in Russia, 600 in China and 400 in DPR Korea. In Russia it comprises 88 rivers of both the western and eastern slopes of the Sikhote-Alin Range, and two small isolated areas, one in central Khabarovsk and the other in the Jewish Autonomous Oblast. All known and potential breeding areas were surveyed in China, where the breeding range comprises the western slope of the Changbai

Mountains, and one isolated river system in the Lesser Xingan Mountains. Scaly-sided Mergansers are also assumed to breed on the eastern slope of the Changbai Mountains in DPR Korea. No recent surveys have been made there but numbers were estimated by applying densities from China to rivers with apparently suitable habitat. Detailed examination of past records suggests that an earlier claim of breeding Scaly-sided Mergansers on the Dep River was erroneous and we conclude that the breeding range never extended as far west as has been portrayed in most literature. The lack of comparable surveys previously precludes an assessment of change in population range or size, though it seems inevitable that habitat loss in China is likely to have resulted in some loss of range and numbers, particularly in Heilongjiang Province, in recent decades.

Shimada, T., N. M. Yamaguchi, N. Hijikata, E. Hiraoka, J. W. Hupp, P. L. Flint, K.-I. Tokita, G. Fujita, K. Uchida, F. Sato, M. Kurechi, J. M. Pearce, A. M. Ramey, and H. Higuchi. 2014. Satellite Tracking of Migrating Whooper Swans *Cygnus cygnus* Wintering in Japan. *Ornithological Science* **13**:67-75.

(Abstract)

We satellite-tracked Whooper Swans *Cygnus cygnus* wintering in northern Japan to document their migration routes and timing, and to identify breeding areas. From 47 swans that we marked at Lake Izunuma-Uchinuma, Miyagi Prefecture, northeast Honshu, and at Lake Kussharo, east Hokkaido, we observed 57 spring and 33 autumn migrations from 2009-2012. In spring, swans migrated north along Sakhalin Island from eastern Hokkaido using stopovers in Sakhalin, at the mouth of the Amur River and in northern coastal areas of the Sea of Okhotsk. They ultimately reached molting/breeding areas along the Indigirka River and the lower Kolyma River in northern Russia. In autumn, the swans basically reversed the spring migration routes. We identified northern Honshu, eastern Hokkaido, coastal areas in Sakhalin, the lower Amur River and northern coastal areas of the Sea of Okhotsk as the most frequent stopover sites, and the middle reaches of the Indigirka and the lower Kolyma River as presumed breeding sites. Our results are helpful in understanding the distribution of the breeding and stopover sites of Whooper Swans wintering in Japan and in identifying their major migration habitats. Our findings contribute to understanding the potential transmission process of avian influenza viruses potentially carried by swans, and provide information necessary to conserve Whooper Swans in East Asia.

Liu, D.-P., C.-Q. Li, G.-G. Zhang, J. Lu, and G. Chen. 2014. Satellite Tracking of Scaly-Sided Merganser (*Mergus squamatus*) Breeding in Lesser Xingan Mountains, China. *Waterbirds* **37**:432-438.

(Abstract)

This study provides the first detailed information on the migration routes and stopover sites for the endangered Scaly-sided Merganser (*Mergus squamatus*) breeding in Northeast China. Scaly-sided Mergansers (n = 4) were tagged with Platform Transmitter Terminals at Dailing in the southeastern

Lesser Xingan Mountains of China during the late breeding seasons of 2010 and 2011. Two Scaly-sided Mergansers completed their autumn migration across the Yellow Sea, lasting 58 and 26 days, respectively, arriving on their wintering grounds at Yuanjiang River in Hunan Province and Xiushui River in Jiangxi Province of China. Both of the Scaly-sided Mergansers stopped at four sites and travelled 2,600 km from their breeding to wintering grounds. After a stay of 120 days, one of the marked individuals departed its wintering ground and returned to Dailing on 19 April 2012 and used a similar route as that in autumn migration and stopped at two sites. Wetlands at Ryonghung Gang estuary in North Korea, Yunshui River and Chidong Lake in Hubei Province of China, and Songjiang River in Jilin Province of China were used as major stopover sites. The determination of previously unknown wintering grounds and stopover sites in China and North Korea provides opportunity to discover more populations of the Scaly-sided Merganser outside its breeding areas.

Holopainen, S., P. Nummi, and H. Poysä. 2014. Breeding in the stable boreal landscape: lake habitat variability drives brood production in the teal (*Anas crecca*). *Freshwater Biology* **59**:2621–2631.

(Abstract)

1. Boreal forest lakes are normally considered stable environments, but from a duck's point of view, both resource abundance and habitat quality in the lakes may differ from 1 year to another. Duck species differ in their flexibility to respond to variation in environmental factors, such as habitat quality, habitat variability and weather. *Anas crecca*, the common teal, has been suggested to be a species that can readily colonize newly formed habitat.

2. We studied the effect of habitat quality (invertebrate food resources, amount of spring flood, beaver flood abundance, predation pressure), weather (temperature, precipitation, timing of ice breakup) and pair abundance on breeding success of teal at the landscape scale in Southern Finland. We used 20 years of data (1989–2008) from a study area consisting of 50 lakes. This is typical boreal breeding area for the teal, whose population size is markedly variable. We express breeding success as number of broods in two different age classes.

3. The number of broods in both age classes was explained well by habitat quality, but different variables seem to operate during different phases of the breeding season. Increases in abundance of breeding pairs and of food led to increased production of younger broods. Habitat factors including food and flood abundance were the most important predictors for older broods, which are the more influential in terms of recruitment. These factors manifested in an age-specific manner, highlighting the importance of comprehensive breeding time surveys of boreal breeding ducks to understand variation in their recruitment.

4. Our research underlines the importance of high-quality habitats for breeding teal populations in the boreal forest landscape. The existence of these habitats depends substantially on human actions, such as managing beaver populations and preserving seasonal pond habitats.

Shariatinajabadi, M., T. Wang, A. K. Skidmore, A. G. Toxopeus, A. Kölzsch, B. A. Nolet, K.-M. Exo,

L. Griffin, J. Stahl, and D. Cabot. 2014. Migratory Herbivorous Waterfowl Track Satellite-Derived Green Wave Index. *PLoS ONE* **9**:e108331 .

(Abstract)

Many migrating herbivores rely on plant biomass to fuel their life cycles and have adapted to following changes in plant quality through time. The green wave hypothesis predicts that herbivorous waterfowl will follow the wave of food availability and quality during their spring migration. However, testing this hypothesis is hampered by the large geographical range these birds cover. The satellite-derived normalized difference vegetation index (NDVI) time series is an ideal proxy indicator for the development of plant biomass and quality across a broad spatial area. A derived index, the green wave index (GWI), has been successfully used to link altitudinal and latitudinal migration of mammals to spatiotemporal variations in food quality and quantity. To date, this index has not been used to test the green wave hypothesis for individual avian herbivores. Here, we use the satellite-derived GWI to examine the green wave hypothesis with respect to GPS-tracked individual barnacle geese from three flyway populations (Russian $n = 12$, Svalbard $n = 8$, and Greenland $n = 7$). Data were collected over three years (2008–2010). Our results showed that the Russian and Svalbard barnacle geese followed the middle stage of the green wave (GWI 40–60%), while the Greenland geese followed an earlier stage (GWI 20–40%). Despite these differences among geese populations, the phase of vegetation greenness encountered by the GPS-tracked geese was close to the 50% GWI (i.e. the assumed date of peak nitrogen concentration), thereby implying that barnacle geese track high quality food during their spring migration. To our knowledge, this is the first time that the migration of individual avian herbivores has been successfully studied with respect to vegetation phenology using the satellite-derived GWI. Our results offer further support for the green wave hypothesis applying to long-distance migrants on a larger scale.

Cooch, E. v. G., M. Guillemain, S. Boomer, J.-D. Lebreton, and J. D. Nichols. 2014. The effects of harvest on waterfowl populations. *Wildfowl* **4**:220–276.

(Abstract)

Change in the size of populations over space and time is, arguably, the motivation for much of pure and applied ecological research. The fundamental model for the dynamics of any population is straightforward: the net change in the abundance is the simple difference between the number of individuals entering the population and the number leaving the population, either or both of which may change in response to factors intrinsic and extrinsic to the population. While harvest of individuals from a population constitutes a clear extrinsic source of removal of individuals, the response of populations to harvest is frequently complex, reflecting an interaction of harvest with one or more population processes. Here we consider the role of these interactions, and factors influencing them, on the effective harvest management of waterfowl populations. We review historical ideas concerning harvest and discuss the relationship(s) between waterfowl life histories and the development and application of population models to inform harvest management. The influence of population structure (age, spatial) on derivation of optimal harvest strategies (with and without explicit consideration of various sources of uncertainty) is considered. In addition to population structure, we discuss how the optimal harvest strategy may be influenced by: 1) patterns of density-dependence in one or more vital rates, and 2) heterogeneity in vital rates among individuals within an age-sex-size class. Although

derivation of the optimal harvest strategy for simple population models (with or without structure) is generally straightforward, there are several potential difficulties in application. In particular, uncertainty concerning the population structure at the time of harvest, and the ability to regulate the structure of the harvest itself, are significant complications. We therefore review the evidence of effects of harvest on waterfowl populations. Some of this evidence has focused on correspondence of data with more phenomenological models and other evidence relates to specific mechanisms, including density dependence and heterogeneity. An important part of this evidence is found in the evolution of model weights under various adaptive harvest management programs of the U.S. Fish and Wildlife Service for North American waterfowl. Overall, there is substantial uncertainty about system dynamics, about the impacts of potential management and conservation decisions on those dynamics, and how to optimise management decisions in the presence of such uncertainties. Such relationships are unlikely to be stationary over space or time, and selective harvest of some individuals can potentially alter life history allocation of resources over time – both of which will potentially influence optimal harvest strategies. These sources of variation and uncertainty argue for the use of adaptive approaches to waterfowl harvest management.

Haugen, M. T., L. A. Powell, and M. P. Vrtiska. 2014. Assessment of spatial changes in the duck harvest within the Central Flyway, 1997–2011. *Wildfowl* **64**:75–90.

(Abstract)

Knowledge of the factors which influence the spatial distribution of duck harvest would be useful to managers when setting dates for the duck hunting seasons. Here we used changes in mean latitude of harvest to represent changes in distribution of duck harvest during the hunting season within the Central Flyway from 1997–2011, derived from harvest data from the U.S. Fish and Wildlife Service Parts Collection Survey. A candidate set of models was developed to represent competing hypotheses of corn availability, weather, water on the landscape, competition via population density, hunting pressure, and regulatory change to explain the variation in harvest distribution of Mallard *Anas platyrhynchos*, dabbling ducks *Anas* sp., and diving ducks *Aythya* sp. The model selection process revealed that hunting pressure, the amount of water on the landscape, and Mallard density best explained the distribution of Mallard harvest. Mallard harvest distributions tended to be further north during wet years of high Mallard densities and low hunting pressure, relative to dry years with high Mallard densities and low hunting pressure. High hunting pressure shifted the spatial distribution of Mallard harvest further south. Regulations had the largest influence on both dabbling (non-Mallard) and diving duck harvest distribution. Dabbling duck harvest distribution was further north under the 2002–2011 frameworks, relative to the 1997–2001 frameworks. During the 2002–2011 frameworks, diving ducks were more likely to be harvested further south early in the season and further north later in the season, relative to 1997–2001 frameworks. Trends in the distribution of harvest should be informative for future harvest management decisions.

Austin, J., S. Slattery, and R. G. Clark. 2014. Waterfowl populations of conservation concern: learning from diverse challenges, models and conservation strategies. *Wildfowl* 4:470–497.

(Abstract)

There are 30 threatened or endangered species of waterfowl worldwide, and several sub-populations are also threatened. Some of these species occur in North America, and others there are also of conservation concern due to declining population trends and their importance to hunters. Here we review conservation initiatives being undertaken for several of these latter species, along with conservation measures in place in Europe, to seek common themes and approaches that could be useful in developing broad conservation guidelines. While focal species may vary in their life histories, population threats and geopolitical context, most conservation efforts have used a systematic approach to understand factors limiting populations and to identify possible management or policy actions. This approach generally includes a priori identification of plausible hypotheses about population declines or status, incorporation of hypotheses into conceptual or quantitative planning models, and the use of some form of structured decision making and adaptive management to develop and implement conservation actions in the face of many uncertainties. A climate of collaboration among jurisdictions sharing these birds is important to the success of a conservation or management program. The structured conservation approach exemplified herein provides an opportunity to involve stakeholders at all planning stages, allows for all views to be examined and incorporated into model structures, and yields a format for improved communication, cooperation and learning, which may ultimately be one of the greatest benefits of this strategy.

Hagy, H. M., S. C. Yaich, J. W. Simpson, E. Carrera, D. A. Haukos, W. C. Johnson, C. R. Loesch, F. A. Reid, S. E. Stephens, R. W. Tiner, B. A. Werner, and G. S. Yarris. 2014. Wetland issues affecting waterfowl conservation in North America. *Wildfowl* 4:343–367.

(Abstract)

This paper summarizes discussions by invited speakers during a special session at the 6th North American Duck Symposium on wetland issues that affect waterfowl, highlighting current ecosystem challenges and opportunities for the conservation of waterfowl in North America. Climate change, invasive species, U.S. agricultural policy (which can encourage wetland drainage and the expansion of row-crop agriculture into grasslands), cost and competition for water rights, and wetland management for non-waterfowl species were all considered to pose significant threats to waterfowl populations in the near future. Waterfowl populations were found to be faced with significant threats in several regions, including: the Central Valley of California, the Playa Lakes Region of the south-central U.S., the Prairie Pothole Region of the northern U.S. and western and central Canada, the boreal forest of northern Canada, the Great Lakes region and Latin America. Apart from direct and indirect threats to habitat, presenters identified that accurate and current data on the location, distribution and diversity of wetlands are needed by waterfowl managers, environmental planners and regulatory agencies to ensure focused, targeted and cost-effective wetland conservation. Although populations of many waterfowl species are currently at or above long-term average numbers, these populations are thought to be at risk of decline in the near future because of ongoing and predicted nesting habitat loss and wetland destruction in many areas of North America.

Davis, J. B., M. Guillemain, R. M. Kaminski, C. Arzel, J. M. Eadie, and E. C. Rees. 2014. Habitat and resource use by waterfowl in the northern hemisphere in autumn and winter. *Wildfowl* 4:17–69.

(Abstract)

A particular aim of avian ecologists, especially those studying waterfowl Anatidae, in the 20th and early 21st centuries has been to elucidate how organisms use habitats and intrinsic resources to survive, reproduce and ultimately affect fitness. For much of the 20th century, research was mainly on studying species during the breeding season; however, by the 1970s, the focus had changed to understanding migratory waterfowl throughout their annual cycle and range in Europe and North America. Autumn and winter are considered the non-breeding seasons, but habitat and resource use through these seasons is crucial for completing spring migration and subsequent breeding. Here we review the literature on autumnal and winter habitat use by Nearctic and Palearctic waterfowl to determine characteristics of important landscapes and habitats for the birds during autumn migration and in winter. Selection of habitats and resources is discussed (when literature permits) in relation to Johnson's (1980) model of hierarchical habitat selection. Habitat use by selected species or groups of waterfowl is also reviewed, and important areas for future research into habitat ecology are identified. We suggest that the greatest lack of understanding of waterfowl habitat selection is an ongoing inability to determine what habitats and intrinsic resources, at multiple scales, are truly available to birds, an essential metric in quantifying "selection" accurately. Other significant challenges that impede gaining knowledge of waterfowl ecology in the northern hemisphere are also described. Nonetheless, continued technological improvements and engagement of diverse interdisciplinary professional expertise will further refine understanding of waterfowl ecology and conservation at continental scales.

Ely, C. R., W. J. L. Sladen, H. M. Wilson, S. E. Savage, K. M. Sowl, B. Henry, M. Schwitters, and J. Snowden. 2014. Delineation of Tundra Swan *Cygnus c. columbianus* populations in North America: geographic boundaries and interchange. *Wildfowl* 64:132–147.

North American Tundra Swans *Cygnus c. columbianus* are composed of two well-recognized populations: an Eastern Population (EP) that breeds across northern Canada and north of the Brooks Range in Alaska, which migrates to the eastern seaboard of the United States, and a Western Population (WP) that breeds in coastal regions of Alaska south of the Brooks Range and migrates to western North America. We present results of a recent major ringing effort from across the breeding range in Alaska to provide a better definition of the geographic extent of the migratory divide in Alaska. We also reassess the staging and winter distributions of these populations based on locations of birds tracked using satellite transmitters, and recent recoveries and sightings of neck-collared birds. Summer sympatry of EP and WP Tundra Swans is very limited, and largely confined to a small area in northwest Alaska. Autumn migration pathways of EP and WP Tundra swans abut in southwest Saskatchewan, a region where migrating WP birds turn west, and EP birds deviate abruptly eastward.

Overall, from 1989 to 2013 inclusive, 2.6% of recoveries or resightings reported to the USGS Bird Banding Laboratory were of birds that moved from the domain of the population in which they were initially captured to within the range of the other population; a proportion roughly comparable to the results of Limpert et al. (1991) for years before 1990. Of the 70 cross-boundary movements reported since 1989, 39% were of birds marked on breeding areas and 61% were of birds marked on wintering areas. Dispersing swans (i.e. those that made crossboundary movements) did not differ with respect to age or sex from those that did not move between populations. The Brooks Range in northern Alaska effectively separates the two populations within Alaska, but climate-induced changes in tundra breeding habitats and losses of wetlands on staging areas may alter the distribution for both of these populations

Barter, M., X. Zhuang, X. Wang, L. Cao, J. Y. Lei, D. V. Solovyeva, and A. D. Fox. 2014. Abundance and distribution of wintering Scaly-sided Mergansers *Mergus squamatus* in China: where are the missing birds? *Bird Conservation International* **24**:406-415.

(Abstract)

The Endangered Scaly-sided Merganser *Mergus squamatus* is amongst the most threatened of sea ducks (Mergini), with an estimated population of c.4,600 individuals based on a recent population estimate on the breeding areas in Primorye, Far East Russia, China and DPR Korea. For the first time, we present published and unpublished data on the wintering distribution in China and smaller numbers in Korea. We report 156 sightings during 2000–2011, together with 11 records of wintering sites using geolocation devices, from 16 provinces in China, with greatest concentrations in Jiangxi Province (97 reports from 18 sites). Both sources of data suggest some degree of winter site fidelity to fast-flowing clear water rivers 50–350 m wide, with riffles, islands or sand banks in hilly/mountainous areas with low levels of human disturbance. Surveys located a maximum of 370–770 birds, 8–17% of the estimated total population, confirming our poor knowledge of the species' wintering distribution. There is an urgent need to define the wintering range of this species which is widely dispersed and nowhere abundant, but is threatened everywhere by dam construction, sand and gravel extraction, industrial and domestic pollution and fishing that threaten the integrity of the winter habitat. This also raises important conservation questions about how to protect such a species that is not highly concentrated and may require catchment scale nature conservation actions to effectively safeguard its current distribution.

Namgail, T., J. Y. Takekawa, S. Balachandran, P. Sathiyaselvam, T. Mundkur, and S. H. Newman. 2014. Space use of wintering waterbirds in India: Influence of trophic ecology on home-range size. *Current Zoology* **60**:616–621.

(Abstract)

Relationship between species' home range and their other biological traits remains poorly understood,

especially in migratory birds due to the difficulty associated with tracking them. Advances in satellite telemetry and remote sensing techniques have proved instrumental in overcoming such challenges. We studied the space use of migratory ducks through satellite telemetry with an objective of understanding the influence of body mass and feeding habits on their home-range sizes. We marked 26 individuals, representing five species of migratory ducks, with satellite transmitters during two consecutive winters in three Indian states. We used kernel methods to estimate home ranges and core use areas of these waterfowl, and assessed the influence of body mass and feeding habits on home-range size. Feeding habits influenced the home-range size of the migratory ducks. Carnivorous ducks had the largest home ranges, herbivorous ducks the smallest, while omnivorous species had intermediate home-ranges. Body mass did not explain variation in home-range size. To our knowledge, this is the first study of its kind on migratory ducks, and it has important implications for their conservation and management.

Batbayar, N., J. Y. Takekawa, T. Natsagdorj, K. A. Spragens, and X. Xiao. 2014. Site Selection and Nest Survival of the Bar-Headed Goose (*Anser indicus*) on the Mongolian Plateau. *Waterbirds* **37**:381-393.

(Abstract)

Waterbirds breeding on the Mongolian Plateau in Central Asia must find suitable wetland areas for nesting in a semiarid region characterized by highly variable water conditions. The first systematic nesting study of a waterbird dependent on this region for breeding was conducted on the Bar-headed Goose (*Anser indicus*). The purpose of this study was to document Bar-headed Goose nesting locations, characterize nests and nesting strategies, and estimate daily nest survival ($n = 235$ nests) from eight areas of west-central Mongolia across three summers (2009-2011) using a modified Mayfield estimator. Bar-headed Goose daily nest survival ranged from 0.94 to 0.98, with a 3-year average nest success of 42.6% during incubation. Bar-headed Geese were found to primarily nest on isolated pond and lake islands as previously reported, but were also documented regularly, though less frequently, along rocky cliffs in several regions of west-central Mongolia. Daily nest survival was higher for cliff nests than for island nests. Information-theoretic models indicated that nest survival decreased with nest age and varied annually with changing environmental conditions. Results of this study suggest that while Bar-headed Geese primarily rely on nesting island sites these sites may be more susceptible to anthropogenic disturbance and predation events influenced by seasonal variation in environmental conditions, and that higher daily nest survival values documented for the less frequent cliff nest strategy may provide an important alternative strategy during poor island nest success years. Thus, conservation efforts for this and other waterbird species in the semiarid region should be focused on conserving nesting islands and protecting them from disturbance in areas of high livestock densities experiencing a rapidly warming climate.

Kuhlmann Clausen, K., and J. Madsen. 2014. Effects of neckbands on body condition of migratory

geese. *Journal of Ornithology* **155**:951–958.

(Abstract)

Ringling and marking are widely used techniques in avian ecology to assist studies of migration, survival and behaviour, and often used to estimate population sizes. Only rarely, however, have the effects of these markings on bird viability been thoroughly tested. Using an abdominal profile index of marked geese and body mass of recaptured birds previously marked, this study investigated the effect of neckbands on body condition of Pink-footed Geese *Anser brachyrhynchus* at different temporal scales, and evaluated to what extent capture, handling and banding affected these birds on short, medium and longer terms. Our results indicated that body condition of geese were negatively affected in the days immediately succeeding capture, but that only a minor effect persisted on a seasonal scale. We found no support for a long-term effect of neckbands on the body mass of individual birds, indicating that the capture and handling event might be the main contributory cause to the transitory decline in body condition. Pink-footed Geese thus seemed to habituate almost completely to the presence of neckbands, and the effects on long-term body condition can be expected to be minor. However, neckbands might still influence important life history traits such as reproduction and survival by means of, e.g., altering social interactions, increasing predation or interfering with mate acquisition.

Gehrold, A. 2014. Species-specific habitat use of wing-moulting waterbirds in response to temporary flightlessness. *Ibis* **156**:850–863.

(Abstract)

The choice of the moulting habitat is of paramount importance for wing-moulting waterbirds that have to cope with a flightless period of several weeks. However, some species might have more restricted habitat requirements during moult than others, for example due to a highly specialized feeding ecology. The moult-related habitat use of five species (Gadwall *Anas strepera*, Red-crested Pochard *Netta rufina*, Common Pochard *Aythya ferina*, Tufted Duck *Aythya fuligula*, Coot *Fulica atra*) was compared at a European inland moulting site that offered a variety of water bodies characterized by different levels of nutrient concentration, water depth, shoreline vegetation density and disturbance. To determine location- and species-specific densities, birds were regularly counted throughout the moulting seasons of 2010 and 2011. In 2011, additional data on Gadwalls were used to assess differences in requirements between the flightless phase of moult and the periods before and after. Furthermore, habitat choice of 38 tagged Gadwalls was compared among two to four successive years. During the moulting season, all species showed clear preferences for specific levels of nutrient content, suggesting an active choice of suitable food sources in both food specialists and generalists. Species showing the strongest attachment to shallow water (Gadwall and Coot) were most sensitive to human disturbance and increasing water depths, and species averse to diving (Gadwall) used ponds with dense shore vegetation while flightless. For Gadwalls, habitat conditions rather than nutrient supply became increasingly important during the flightless phase. Average return rates of 59 and 54% were recorded for male and female Gadwalls, respectively, and the repeated use of familiar locations could be demonstrated in the majority of returning birds (65%). Familiarity with the habitat apparently plays an important role and may enable individuals to compensate for suboptimal conditions at the moulting site.

Pöysä H, Väänänen V-M. 2014. Drivers of breeding numbers in a long-distance migrant, the Garganey (*Anas querquedula*): effects of climate and hunting pressure. *Journal of Ornithology* **155**:679–687.

(Abstract)

A multitude of anthropogenic factors are threatening bird populations but their roles as drivers of population changes are generally poorly understood. Several duck species, for instance, have unfavorable conservation status at the Pan-European level but in most cases we do not know why the species have been declining, nor do we know actual drivers of their population dynamics. We studied population dynamics of the Garganey (*Anas querquedula*), a quarry species with unfavorable conservation status at the Pan-European level. As a trans-Saharan migrant, Garganey is potentially highly vulnerable to climate change impacts. We used long-term (1989–2012) data of breeding numbers from a study area in central Finland and assessed the relative importance of three climatic variables (representing conditions in wintering areas and during spring migration) and local hunting pressure in explaining the interannual variation in breeding numbers. Population size of Garganey showed a decreasing trend over the study period but also considerable interannual variation. Spring temperature in southern Finland was the most important factor in explaining interannual variation in breeding numbers. Rainfall in the wintering areas was also of importance, whereas the NAO (North Atlantic Oscillation) and local hunting pressure appeared not to be important. Our results suggest that weather conditions during spring migration largely drive interannual variation in Garganey breeding numbers at the NW edge of the species' range. However, positive effects of warm springs may be counteracted by negative effects of drought in the wintering areas.

Wang X, Fox AD, Zhuang X, Cao L, Meng F, Cong PH. 2014. Shifting to an energy-poor diet for nitrogen? Not the case for wintering herbivorous Lesser White-fronted Geese in China. *Journal of Ornithology*.

(Abstract)

Geese often forage on mid-winter foods that fail to satisfy daily energy needs, but they may do so to acquire other nutrients, such as nitrogen. We tested this hypothesis by evaluating nitrogen budgets, namely the balance of nitrogen income against expenditure, of wintering Lesser White-fronted Geese *Anser erythropus* feeding at two sites within East Dongting Lake, China, where they could and could not balance daily energy budgets. Geese could balance nitrogen budgets in energy-rich habitats but were less able to do so in habitats where they failed to balance energy budgets. This study presents the first full nitrogen budget for a wintering goose species, and suggests that, rather than acting as a source of nitrogen, use of energy-poor but undisturbed habitats may represent a refuge from human disturbance at other habitats.

Bengtsson D, Avril A, Gunnarsson G, Elmberg J, Soderquist P, Norevik G, Tolf C, Safi K, Fiedler W, Wikelski M, Olsen B, Waldenstrom J. 2014. Movements, Home-Range Size and Habitat Selection of Mallards during Autumn Migration. PLoS ONE **9**, e100764.

(Abstract)

The mallard (*Anas platyrhynchos*) is a focal species in game management, epidemiology and ornithology, but comparably little research has focused on the ecology of the migration seasons. We studied habitat use, time-budgets, home-range sizes, habitat selection, and movements based on spatial data collected with GPS devices attached to wild mallards trapped at an autumn stopover site in the Northwest European flyway. Sixteen individuals (13 males, 3 females) were followed for 15–38 days in October to December 2010. Forty-nine percent (SD = 8.4%) of the ducks' total time, and 85% of the day-time (SD = 28.3%), was spent at sheltered reefs and bays on the coast. Two ducks used ponds, rather than coast, as day-roosts instead. Mallards spent most of the night (76% of total time, SD = 15.8%) on wetlands, mainly on alvar steppe, or in various flooded areas (e.g. coastal meadows). Crop fields with maize were also selectively utilized. Movements between roosting and foraging areas mainly took place at dawn and dusk, and the home-ranges observed in our study are among the largest ever documented for mallards (mean = 6,859 ha; SD = 5,872 ha). This study provides insights into relatively unknown aspects of mallard ecology. The fact that autumn-staging migratory mallards have a well-developed diel activity pattern tightly linked to the use of specific habitats has implications for wetland management, hunting and conservation, as well as for the epidemiology of diseases shared between wildlife and domestic animals.

Guillemain M, Pradel R, Devineau O, Simon G, Gauthier-Clerc M. 2014. Demographic heterogeneity among individuals can explain the discrepancy between capture–mark–recapture and waterfowl count results. The Condor **116**:293-302.

(Abstract)

Demographic heterogeneity has long been considered within wildlife populations, but only the modern development of capture–mark–recapture methods allows this to be easily tested and quantified. It is now possible to rapidly assess whether the modeling of heterogeneous populations, in which categories of individuals differ in survival rate, performs better than traditional approaches, in which all individuals are considered equivalent within a sex and age class. Using long-term banding data for 4,703 adult female Green-winged Teal (*Anas crecca*) from the Camargue, southern France, we show that a heterogeneous model outperformed a homogeneous model. Individuals from the high survival category had a ~60% annual survival rate, whereas birds in the second category had a survival rate reduced by a factor of 0.76–0.80, depending on the model (i.e. <50%). We could not demonstrate that individuals within the high survival category were larger or heavier. The link between survival rate and potential differences in individual morphometrics or individual behavioral strategies thus remains to be established. Previous studies in which a Green-winged Teal population was modeled as homogeneous suggested it should decline (population growth rate <1), which we also found when using demographic parameters obtained from a homogeneous model. This finding contradicts waterfowl surveys that show a long-term population increase in this flyway. Modeling the population

as heterogeneous led to growth rates of 1.03–1.05 (a 3–5% annual increase), numbers consistent with the growth rate inferred from duck counts and that also partly explain how species such as Green-winged Teal can increase in numbers despite large hunting harvest, sustaining harvest to some extent.

Nuijten RJM, Kölzsch A, van Gils JA, Hoyer BJ, Oosterbeek K, de Vries PP, Klaassen M, Nolet BA. 2014. The exception to the rule: retreating ice front makes Bewick's swans *Cygnus columbianus bewickii* migrate slower in spring than in autumn. *Journal of Avian Biology* **45**:113–122.

(Abstract)

In the vast majority of migratory bird species studied so far, spring migration has been found to proceed faster than autumn migration. In spring, selection pressures for rapid migration are purportedly higher, and migratory conditions such as food supply, daylength, and/or wind support may be better than in autumn. In swans, however, spring migration appears to be slower than autumn migration. Based on a comparison of tundra swan *Cygnus columbianus* tracking data with long-term temperature data from weather stations, it has previously been suggested that this was due to a capital breeding strategy (gathering resources for breeding during spring migration) and/or to ice cover constraining spring but not autumn migration. Here we directly test the hypothesis that Bewick's swans *Cygnus columbianus bewickii* follow the ice front in spring, but not in autumn, by comparing three years of GPS tracking data from individual swans with concurrent ice cover data at five important migratory stop-over sites. In general, ice constrained the swans in the middle part of spring migration, but not in the first (no ice cover was present in the first part) nor in the last part. In autumn, the swans migrated far ahead of ice formation, possibly in order to prevent being trapped by an early onset of winter. We conclude that spring migration in swans is slower than autumn migration because spring migration speed is constrained by ice cover. This restriction to spring migration speed may be more common in northerly migrating birds that rely on freshwater resources.

Madsen J, Tjørnløv RS, Frederiksen M, Mitchell C, Sigfusson AT. 2014. Connectivity between flyway populations of waterbirds: assessment of rates of exchange, their causes and consequences. *Journal of Applied Ecology* **51**:183–193.

(Abstract)

1. Conservation and management of migratory waterbirds use flyway populations as the basic unit, and knowledge of the delineation, rate of exchange and gene flow between populations is fundamental. However, for the majority of global flyway populations, information is too fragmentary to address connectivity between populations and, hence, insufficient to inform management.

2. We investigated the demographic connectivity between the eastern (breeding in Svalbard and wintering in Denmark, the Netherlands and Belgium) and western (breeding in Greenland or Iceland and wintering in Britain) flyway populations of pink-footed geese *Anser brachyrhynchus* based on

resightings of marked geese from both populations. Previous genetic analyses suggested a modest gene flow between the two populations.

3. Capture–recapture analysis conservatively estimated that mean annual movement probabilities were low (eastern to western population: 0.071%, 95% CI = 0.033–0.15%; western to eastern: 0.076%, 95% CI = 0.031–0.18%). Movement probability from eastern to western flyway populations increased in years with high snow cover in the southernmost winter range in Belgium. Life histories of exchanged individuals from eastern to western (32 different individuals during 1988–2010) revealed that the majority entered Britain via Belgium and the Netherlands during winter; some returned to the eastern population via Belgium and/or the Netherlands, others moved northwards in Britain during the spring and appear to have migrated directly from Britain (western population) to Norway (eastern population). None of the birds from the eastern population emigrated permanently, but some individuals turned up in Britain in consecutive years. Out of nine individuals switching from western to eastern flyway populations, three returned to Britain; the others were not subsequently resighted. An alternative winter strategy and spring flyway over Britain to Norway is suggested, used by hundreds to thousands of eastern birds, particularly following severe winters. Thus, the two populations currently appear to be demographically closed; low genetic connectivity probably reflects dispersal over longer time.

4. Synthesis and applications. Current initiatives to internationally manage the eastern population of pink-footed geese do not need to consider net immigration in predictive harvest models. For waterbirds in general, a targeted approach to evaluate connectivity, using classic marking studies in combination with molecular methods and focused sampling on breeding grounds, is recommended to better underpin management decisions at population levels.

Anatidae 2013

Håland, A. 2013. Increase in numbers of wintering Wigeon *Anas penelope*, Eurasian Teal *A. crecca* and Pintail *A. acuta* on the Bergen Peninsula, Western Norway, during the last 25 years, in perspective of milder autumns and winters. *Ornithology Studies* 3:1-10.

(Abstract)

During the 1970s and 1980s the Mallard *Anas platyrhynchos* was the only regular wintering dabbling duck at the Bergen Peninsula, Western Norway, i.e. wintering of other dabbling ducks were sporadic and even rare. This pattern has gradually changed during the last 25 years, corresponding to a milder winter climate. Wigeon was the first species to respond, gradually building up a mainly urban wintering population. Although varying, their numbers have peaked between 60 and 80 birds, mostly located in two suburban lakes, but they also use wetlands less affected by humans. In the urban areas Wigeons explore bread feed by park visitors, but they also frequently grazed in lawns close to the lake shores. The habit of taking bread was also seen during the 1970s and 1980s when mainly single birds wintered in the city. The increase in Wigeon number have been followed by an increase in the Eurasian Teals, first wintering as single/a few birds, later also in smaller flocks. Teals deviate from Wigeons using mainly natural wetlands, although single birds also approach the feeding sites in the

more urban sites. During the latest years the total numbers have passed 20 birds, but still the Eurasian Teal is less common than the Wigeon. The third Anas-species to show up is the Pintail, but only 1- 3 birds so far in a single winter. During two periods male Pintails did return to the same wintering site for 3 and 4 successive years, respectively, one bird being ringed showing high winter site tenacity. Recent cold winters (2009/10 and later years) only slightly affected numbers of wintering birds, indicating that overall site tenacity is high despite harsh conditions. Although their numbers still are low, e.g. compared to wintering Mallards in the area (about 1600 birds the last winter), the three Anas-species adds significantly to the wintering duck community on the central west coast of Western Norway.

Heim, W., K. Wolanska, A. Siegmund, and U. Schuster. 2013. Possible breeding of Baer's Pochard *Aythya baeri* at Muraviovka Park, Far East Russia. *Birding ASIA* **20**:64–66.

(No abstract available)

Shimada T, Kurechi M, Suzuki Y, Miyabayashi Y, Higuchi H. 2013. Effects of the Great East Japan Earthquake on the wintering distribution of Brent Geese. *Japanese Journal of Ornithology* **62**, 9-15.

(Abstract)

To assess the effects of the Great East Japan Earthquake (2011) on the life of Brent Geese *Branta bernicla*, the wintering distribution of the geese was investigated along the southern Sanriku Coast from Hirota Bay (38°59'N, 141°38'E) through Rikuzentakata to the estuary of Kitakami River (38°34'N, 141°27'E), Ishinomaki in the winter of 2011–2012. Geese were counted in the study area in late November to early December 2011 (291), early January 2012 (380), and late February 2012 (403). The number of observed Brent Geese was not substantially different from population data prior to the earthquake. In late November to early December 2011 and in early January 2012, larger numbers of the geese were observed in the fishery harbors (59%) than on the sea (35–41%). It is suggested that the geese began using fishery harbors (where they had only rarely been observed prior to the earthquake) due to: (1) wharfs in harbors that had subsided during the earthquake being subsequently washed by sea water and covered with seaweed, providing a new food resource to the geese, (2) reduced fishery activity in the damaged harbors and hence reduced human disturbance, and (3) farming facilities in coastal waters for Wakame (seaweed) *Undaria pinnatifida* and Oysters *Crassostrea gigas*, which had previously provided the geese with seaweed, having been lost during the tsunami. In late February, more geese were observed on the sea (63%) and on the sandy beaches (21%), presumably resulting from the growth of seaweed on the farming facilities resettled after the earthquake, and newly available seaweeds on sandy beaches. It seems likely that the geese adapted to large-scale environmental changes caused by the earthquake through shifting their foraging habitat and overwintering areas.

Zhang Z-Q, Qin C-J, Fang D-A, Wang A-P, Luo C-H, Liu K. 2013. Genetic diversity of the endangered scaly-sided merganser (*Mergus squamatus*) in the wintering habitat of central-southern China. *Genetics and Molecular Research* **12**, 3103-3109.

(Abstract)

The scaly-sided merganser (*Mergus squamatus*), found in temperate East Asia, has been reduced to a very small population. Central and southern China are its main wintering habitat. However, populations have declined greatly since the 1980s due to habitat loss and degradation, and poaching. To meet the urgent need for up-to-date conservation information, we examined RAPD DNA markers from 156 specimens in 6 populations in Jiangxi Province. We found that genetic diversity (based on individual similarities) is in fact low; molecular variance between populations ranged from 0.137 to 0.347. Genetic similarity ranged from 0.683 to 0.866. In conclusion, the geographical pattern of genetic diversity supports the long-term refugial status of the scaly-sided merganser in central-southern China; strong conservation measures should be taken to maintain the merganser in this region.

Tajiri H, Sakurai Y, Kumigashira I, Oonishi I, Suzukawa F, Tagome K, Yamamoto Y. 2013. Relationship between flight route selection of wintering White-fronted Geese and weather conditions, and foraging sites in the vicinity of Awara Wind Farm, Fukui Prefecture, central Japan. *Strix* **29**, 1–16.

(Abstract)

In the winters of 2010–2011 and 2011–2012, we studied the flight routes of wintering White-fronted Geese *Anser albifrons* in the vicinity of Awara Wind Farm with 10 wind turbines that was constructed on the western bank of Lake Kitagata in 2010 in Fukui Prefecture, western Japan in order to assess the effects of the local weather conditions on the flight route selection of the species. During the wintering season, White-fronted Geese go back and forth every day between Katano-Kamoike, the resting site and the Sakai plain, the foraging ground. Since Lake Kitagata and Awara Wind Farm are located between the two places, geese fly over the lake and its neighboring area twice a day. We also studied the distribution of foraging sites in the Sakai plain to analyze the relationship between flight route and foraging site selections. The studies were aimed at contributing toward the reduction of the goose collision risk with wind turbines. We chose the probability that geese fly over the area including the wind farm (Area A) as an objective variable, and the depth of snow cover, snowfall, an index of northern and western wind speed, study years and the number of geese which passed around the study area as explanatory variables. We constructed 64 generalized linear models (GLM) and selected the best model using AIC. Snow depth and the number of geese were selected in the top five models and snow depth was also selected in the top 32 models. So we decided that snow depth was the highest influential variable on the flight route selection of geese. We decided the model was acceptable because the rate of prediction success was 84.62% and the value of Cohen's kappa was 0.54. The model shows that the probability that geese fly over the wind farm becomes higher as the snow cover on the foraging ground gets deeper. We observed that geese moved their foraging site to the western part of the Sakai plain when snow cover was deep. It is assumed that the flight route of geese was affected by the depth of snow cover because they changed their foraging site according

to the depth of snow cover. The collision risk of geese with wind turbines can be reduced by stopping the turbines when the geese fly over the wind farm.

Tajiri H, Ohkawara K. 2013. The effects of flooding and plowing on foraging site selection by wintering dabbling ducks in rice fields. *Ornithological Science* **12**, 127-136.

(Abstract)

In Japan, Rice *Oryza sativa* fields are regarded as important sites for wintering waterbirds. Rice fields harbor considerable amounts of post-harvest waste rice, which is an important food resource for dabbling ducks in winter. The availability of rice fields as duck foraging sites is affected by agricultural management methods, harvest methods or post-harvest treatment of residues. In the present study, we examined the effects of two agricultural practices after harvesting, flooding with shallow water and plowing the surface of fields, on foraging site selection by ducks in rice fields near Katano-kamoike, Ishikawa Prefecture, Japan. To investigate the distribution of duck flocks in rice fields, night censuses were conducted during winters 2004–2005 to 2006–2007. Field conditions (flooded or plowed) in the census area were also recorded. By GLMM model selection, it was shown that water cover had a positive effect on the number of ducks, but post-harvest plowing had a negative effect. Furthermore, the effect of plowing was tested by a field experiment. The initial grain density on the ground was higher at unplowed plots. Unplowed rice fields are considered to be more suitable for ducks as foraging sites, with plowing reducing the attractiveness of rice fields as foraging sites by burying residual rice grains.

Moriguchi S, Amano T, Ushiyama K. 2013. Creating a potential distribution map for Greater White-fronted Geese wintering in Japan. *Ornithological Science* **12**, 117 – 125.

(Abstract)

For species conservation, identifying factors that affect the distribution of the target species is essential. To provide basic information for the conservation of Greater White-fronted Geese in Japan, this study investigated factors associated with the distribution of the species by using data from the nationwide waterfowl survey. The geese were observed in 88 grid cells (about 10 km×10 km) in 2008–2012. The maximum entropy approach was adopted to model the distribution using presence only data. Explanatory variables were the proportion of rice field area, urban area, and lake area; distance to lakes; and maximum snow depth. Spatial filters were also included in the model to account for spatial autocorrelation. Habitat suitability for the geese was high in areas with a high proportion of rice fields, having a certain proportion of urban area and lake area and less snow. Consequently, the suitable habitats tended to be distributed on the plains along the Sea of Japan and Pacific coasts. This study represents the first step towards habitat management and restoration of Greater White-fronted Geese in Japan.

Koyama K, Kasahara S, Abe S. 2013. Effects of the climatic conditions at breeding, stopover and wintering sites on the number of juvenile Whooper Swans *Cygnus cygnus* wintering in Japan. *Ornithological Science* **12**, 107-115.

(Abstract)

We studied the effects of climatic conditions on the number of juvenile Whooper Swans wintering in Aomori Prefecture, northern Japan, from 1983 to 2009. We analyzed the relationship between the abundance of wintering juveniles and eight climatic variables using generalized linear models; (May and June temperatures recorded in Cokurdah, Yakutia, Russia within their breeding range, the temperature in Nikolayevsk-na-Amure within their migratory stopover range, snowfall in Obihiro, Hokkaido, a stopover site, and temperature and snowfall of the previous and present years in Nobechi, Aomori Prefecture, where they winter. The models with good fit showed that the mean highest daily temperatures in May on the breeding grounds had a positive effect on the abundance of wintering juveniles, while the total snowfall of both previous and present years in the wintering range had a negative effect on juvenile abundance.

Luo Z-K, Zhang W-H, Hou Y, Li X-Y, Liu W, Li Z-J. 2013. Seasonal Dynamics and Habitat Selection of Ruddy Shelduck (*Tadorna ferruginea*) (*Anseriformes: Anatidae*) in Alpine Wetland Ecosystem of Southwest China. *Acta Zoologica Bulgarica* **65**, 469-478.

(Abstract)

For a variety of reasons, the global abundance of Ruddy Shelduck (*Tadorna ferruginea*) has declined dramatically in recent decades. Information on its overwintering ecology, particularly regarding the habitat selection in its overwintering area, is scant. In order to gain a better understanding of the Ruddy Shelduck overwintering ecology, two alpine freshwater lakes and adjacent habitats were surveyed in the Yungui Plateau of Southwest China; the habitats were classified as croplands, vegetable plots, marshlands, aquatic habitats and forests. The abundance of the Ruddy Shelduck in the marshland was significantly higher in winter than in spring ($P = 0.039$), while the opposite was true in the forest ($P = 0.024$). No significant seasonal differences were detected in the croplands, vegetable plots and aquatic habitats, respectively ($P = 0.302-0.817$). The Ruddy Shelduck numbers differed significantly among the five habitat types both in winter ($P = 0.000$) and in spring ($P = 0.005$). The aquatic habitats and the vegetable plots showed not only the largest abundances of this species but also the lowest coefficients of variation. The abundance of the Ruddy Shelduck did not vary among different months ($\chi^2_3 = 1.984$, $P = 0.576$); the observed daily mean numbers, however, revealed a slight decline from December to March. When we explored the relationships between the numbers of the Ruddy Shelduck and the vegetable coverage in the vegetable plots, a multiple regression model (stepwise) indicated that the Ruddy Shelduck abundance was significantly and positively correlated with the radish (*Raphanus sativus* L.) coverage ($R^2 = 0.619$, $P = 0.000$) in winter, and significantly and positively correlated with both the cabbage (*Brassica pekinensis* (Lour.) Rupr.) coverage and the radish coverage ($R^2 = 0.555$, $P = 0.002$) in spring. The aquatic habitats and the vegetable plots were preferred habitats and the radish was the favorite diet to the Ruddy Shelduck in its overwintering area

in Southwest China. Various factors, such as agricultural activities, pollution, boat fishing, human population expansion and urbanization, are all likely to threaten birds and their habitats in Southwest China.

Boyd WS, Ward DH, Kraege DK, Gerick AA. 2013. Migration patterns of Western High Arctic (Grey-belly) Brant *Branta bernicla*. *Wildfowl* **3**, 3–25.

(Abstract)

This study describes the seasonal migration patterns of Western High Arctic Brant (WHA, or Grey-belly Brent Geese), *Branta bernicla*, an admixed population that breeds in the Canadian High Arctic and winters along the Pacific coast of North America. Adult WHA Brant were captured in family groups on Melville Island (75°23'N, 110°50'W) in 2002 and 2005 and marked with satellite platform transmitting terminal (PTT) transmitters or very high frequency (VHF) transmitters. During autumn migration, all PTT-tagged Brant followed a coastal route around Alaska and staged for variable lengths of time at the following sites on the north and west coasts of Alaska: Kasegaluk Lagoon (69°56'N, 162°40'W), Ikpek Lagoon (65°55'N, 167°03'W), and Izembek Lagoon (55°19'N, 162°50'W). Izembek Lagoon was the most important staging area in terms of length of stay (two months on average) and the majority (67–93%) of PTT and VHF detections occurred in Moffet Bay (55°24'N, 162°34'W). After departing Izembek Lagoon, the PTT-tagged geese followed a c. 2,900 km trans-oceanic route to overwinter in the southern part of the Salish Sea (i.e. from north Puget Sound, Washington to south Strait of Georgia, British Columbia; centred at c. 48°45'N, 122°40'W). Most (c. 45%) PTT detections in the southern Salish Sea occurred in Samish Bay (48°36'N, 122°30'W) followed by Padilla Bay (48°30'N, 122°31'W; c. 26%). Brant migrated north from the Salish Sea along the coast to southeast Alaska and then followed either an interior route across the Yukon or a coastal route around Alaska. The “interior” birds staged for c. four days at Liverpool Bay (69°20'N, 133°55'W) in the Northwest Territories before flying on to Melville Island. They also departed the Salish Sea two weeks later than the coastal migrants and arrived at Melville Island two weeks earlier. This study and previous research suggest that WHA Brant use similar migration routes each year and are faithful to their breeding, staging, and wintering grounds. Because WHA Brant constitute one of the smallest breeding stocks in the world (8,000–11,000 individuals), concentrate in only a few areas, and are likely highly site-faithful, they are susceptible to a range of threats such as excessive harvesting, habitat loss and/or degradation, and petroleum spills.

Ikawa H, Ikawa M-J. 2013. Autumn and spring migration of the Taiga Bean Goose *Anser fabalis middendorffii* in northern Japan from 2002 to 2012, with implications for site conservation. *Wildfowl* **63**, 40–55.

(Abstract)

The Taiga Bean Goose *Anser fabalis middendorffii* is classified as “near threatened” (NT) on Japan’s

Red List with c. 9,000 birds wintering in the country. The Sarobetsu Plain, northern Hokkaido, is an important staging area for the geese migrating between northeast Russia and Honshu, Japan. Over the period 2002–2011, peak numbers staging at Sarobetsu each autumn ranged from 6,178–9,230 birds (mean±s.e. = 7,272 ± 267), suggesting that most Taiga Bean Geese wintering in Japan migrate through Sarobetsu. The duration of autumn staging ranged from 51–87 days (mean = 74 ± 3) across the years. Lakes Kabuto and Penke and the Teshio Oxbow Lakes were the main autumn roost sites. In spring, peak numbers at the site varied from 1,486–2,776 individuals (mean = 2,048 ± 140; 2002–2012), and the geese were present for 23–50 days (mean = 35 ± 2). Peak numbers were significantly greater and staging periods were always longer in autumn than in spring. The main spring roost sites were the Furaoi Oxbow Lake and Lakes Penke and Kabuto, confirming the latter two sites as the most important roosts in both autumn and in spring, whereas Furaoi Oxbow Lake was used only in spring. Farmland surrounding these roosts is also important to the birds, as the geese feed mostly in fields close to the roost sites. Two core roosts, Lake Penke and the Furaoi Oxbow Lake, are suffering siltation and adverse effects of fishery activities, which could adversely affect Taiga Bean Geese wintering in Japan.

D.V. Solovyeva, S.L. Vartanayan, N. I-F. Vartanayan. 2013. Artificial Nest-Sites for Scaly-sided Merganser *Mergus squamatus* (GOULD, 1864) – a way to breeding Habitat Restoration

(Abstract)

Habitat degradation due to deforestation of riverine forest could be compensated with artificial nest-sites for cavity-nesting ducks. Occupation of artificial sites by Scaly-sided Merganser differed significantly between logged and un-logged river banks. This paper details construction of nest tube for Scaly-sided Merganser, rate of destruction for nestboxes and nest-tubes and recommendations for artificial nest maintenance. Two types of artificial nests (tubes and boxes) are of equal attractiveness to Scaly-sided Mergansers: occupation of tubes (13%) did not differ from boxes (12,5%). Significant difference in occupation by Scaly-sided Merganser was found for the first versus following years site existence with lower occupation rate the first year. Pest species used artificial nest in Primorye, Far East Russia, are listed.

Eda M, Shimada T, Amano T, Ushiyama K, Mizota C, Koike H. 2013. Phylogenetic relationship of the Greater White-fronted Goose *Anser albifrons* subspecies wintering in the Palaearctic region. *Ornithological Science* **12**, 35-42.

(Abstract)

Greater White-fronted Goose *Anser albifrons* has a holarctic breeding distribution and is polymorphic. Three subspecies winter in the Palaearctic region, one of which also winters in the Nearctic region: European White-fronted Goose *A. a. albifrons* breeds in the far north of Europe and Asia and winters in the south and west of Europe; Pacific White-fronted Goose *A. a. frontalis* breeds in east Siberia

and Arctic Canada and winters in East Asia and United States; and Greenland White-fronted Goose *A. a. flavirostris* breeds in Greenland and winters in Ireland and western Scotland. The phylogenetic relationships among these three subspecies are unclear. We determined the mitochondrial DNA control region sequences of Pacific White-fronted Goose, using 66 shed feathers collected from wintering sites in Japan, and compared the sequences with those previously published for Greater White-fronted Goose subspecies. Phylogenetic trees and networks revealed that there are three clades within the species. The sequence divergence among the clades corresponds to divergence long before the last glacial maximum (15-25 thousand years ago), which suggests the existence of at least three ancient refugia for the species. However, all three subspecies consist of haplotypes from two of the three clades. This suggests that they originated from individuals that survived in two refugia during the last glacial period.

Marais M, Maloney SK, Gray DA. 2013. Sickness behaviours in ducks include anorexia but not lethargy. *Applied Animal Behaviour Science* **145**, 102– 108.

(Abstract)

The characteristics of mammalian sickness behaviour are often conferred on the avian phyla despite there being little scientific evidence that birds change their behaviour when the innate immune system is activated during disease or infection. We used bio-logging techniques to measure activity and feed intake in birds exposed to different pathogen associated molecular patterns (PAMPs). Even though the PAMPs of Gram-negative and Gram-positive bacteria, as well as double-stranded RNA viruses, evoked innate immune responses, none of them induced lethargy in free-roaming Pekin ducks (n = 12). But each of the PAMPs induced anorexia in the ducks. The degree of anorexia was strongly correlated with the fever response that each PAMP evoked. It is well known that when birds have an increase in their core body temperature, they become anorectic. Therefore, it is possible that the fever response, which is mediated by the pro-inflammatory cytokines that are released from immune cells post immune activation, may be responsible for the anorexia that our birds developed, rather than the pro-inflammatory cytokines directly modulating the motivation for feeding. From our results it is clear that sickness-induced lethargy cannot be considered a clinical sign or a diagnostic criterion for the onset of pathogenic infection in certain lines of poultry.

Fondell TF, Flint PL, Schmutz JA, Schamber JL, Nicolai CA. 2013. Variation in body mass dynamics among sites in Black Brant *Branta bernicla nigricans* supports adaptivity of mass loss during moult. *Ibis* **155**, 593–604.

(Abstract)

Birds employ varying strategies to accommodate the energetic demands of moult, one important example being changes in body mass. To understand better their physiological and ecological significance, we tested three hypotheses concerning body mass dynamics during moult. We studied

Black Brant in 2006 and 2007 moulting at three sites in Alaska which varied in food availability, breeding status and whether geese undertook a moult migration. First, we predicted that if mass loss during moult were simply the result of inadequate food resources then mass loss would be highest where food was least available. Secondly, we predicted that if mass loss during moult were adaptive, allowing birds to reduce activity during moult, then birds would gain mass prior to moult where feeding conditions allowed and mass loss would be positively related to mass at moult initiation. Thirdly, we predicted that if mass loss during moult were adaptive, allowing birds to regain flight sooner, then across sites and groups, mass at the end of the flightless period would converge on a theoretical optimum, i.e. the mass that permits the earliest possible return to flight. Mass loss was greatest where food was most available and thus our results did not support the prediction that mass loss resulted from inadequate food availability. Mass at moult initiation was positively related to both food availability and mass loss. In addition, among sites and years, variation in mass was high at moult initiation but greatly reduced at the end of the flightless period, appearing to converge. Thus, our results supported multiple predictions that mass loss during moult was adaptive and that the optimal moulting strategy was to gain mass prior to the flightless period, then through behavioural modifications use these body reserves to reduce activity and in so doing also reduce wing loading. Geese that undertook a moult migration initiated moult at the highest mass, indicating that they were more than able to compensate for the energetic cost of the migration. Because Brant frequently change moult sites between years in relation to breeding success, the site-specific variation in body mass dynamics we observed suggests individual plasticity in moult body mass dynamics.

Wang X, Fox AD, Cong PH, Cao L. 2013. Food constraints explain the restricted distribution of wintering Lesser White-fronted Geese *Anser erythropus* in China. *Ibis* **155**, 576–592.

(Abstract)

More than 90% of the Lesser White-fronted Geese *Anser erythropus* in the Eastern Palearctic flyway population winter at East Dongting Lake, China. To explain this restricted distribution and to understand better the winter feeding ecology and habitat requirements of this poorly known species, we assessed their food availability, diet and energy budgets at this site through two winters. Lesser White-fronted Geese maintained a positive energy budget when feeding on above-ground green production of *Eleocharis* and *Alopecurus* in recessional grasslands in autumn and spring to accumulate fat stores. Such food was severely depleted by late November and showed no growth in mid-winter. Geese fed on more extensive old-growth *Carex* sedge meadows in mid-winter where they were in energy deficit and depleted endogenous fat stores. Geese failed to accumulate autumn fat stores in one year when high water levels prevented the Geese from using recessional grassland feeding areas. Fat stores remained lower throughout that winter and Geese left for breeding areas later in spring than in the previous year, perhaps reflecting the need to gain threshold fat stores for migration. Sedge meadows are widespread at other Yangtze River floodplain wetlands, but recessional grasslands are rare and perhaps restricted to parts of East Dongting Lake, which would explain the highly localized distribution of Lesser White-fronted Geese in China and their heavy use of these habitats at this site. Sympathetic management of water tables is essential to maintain the recessional grasslands in the best condition for Geese. Regular depletion of fat stores whilst grazing sedge meadows in mid-winter also underlines the need to protect the species from unnecessary

anthropogenic disturbances that enhance energy expenditure. The specialized diet of the Lesser White-fronted Goose may explain its highly restricted winter distribution and global rarity.

Ouellet J-F, Vanpe C, Guillemette M. The Body Size-Dependent Diet Composition of North American Sea Ducks in Winter. *PLoS ONE* **8**, e65667.

(Abstract)

Daily food requirements scale with body mass and activity in animals. While small species of birds have higher mass-specific field metabolic rates than larger species, larger species have higher absolute energy costs. Under energy balance, we thus expect the small species to have a higher energy value diet. Also the weight and time constraints for flighted and diurnal foragers should set a maximum to the amount of prey items taken in one meal and to the daily number of meals, respectively. Further, avoidance of competition causes the species to reduce the amount of shared prey in their diet. Some diet segregation is therefore to be expected between species. We tested these hypotheses and investigated the role of body mass in the diet composition of 12 sea duck species (*Somateria mollissima*, *Somateria spectabilis*, *Somateria fischeri*, *Polysticta stelleri*, *Bucephala clangula*, *Bucephala islandica*, *Bucephala albeola*, *Melanitta nigra*, *Melanitta perspicillata*, *Melanitta deglandi*, *Histrionicus histrionicus* and *Clangula hyemalis*) wintering in North America. This study was based on a literature survey with special emphasis given to the diet data from the former US Bureau of Biological Survey. The data supported our hypothesis that the energy value of winter diet of sea ducks scales negatively with body mass. Diet diversity also scaled negatively with body mass. Our results suggest the existence of a minimum for the energy value of avian diets.

Nolet BA, Gyimesi A. 2013. Underuse of stopover site by migratory swans. *Journal of Ornithology* **154**, 695-703.

(Abstract)

Many migratory birds use a chain of stopover sites to fuel their migration. Under time-minimizing migration, fuelling time and giving-up density at stopovers are predicted to depend on fuelling conditions. Fluctuations in food accessibility likely lead to changes in fuelling conditions, which should in turn be reflected in fuelling time and giving-up density. During their migration, Bewick's Swans *Cygnus columbianus bewickii* refuel on below-ground tubers of Fennel Pondweed *Potamogeton pectinatus* in shallow lakes. We studied giving-up density and stopover use (expressed in bird-days) of Bewick's Swans at an autumn stopover site (Lauwersmeer, The Netherlands) during 1995–2008, as dependent on local environmental conditions. High water levels were hypothesized to restrict access to tuber stocks. High water levels at the stopover site were predicted to lead to higher giving-up densities and less bird-days spent at the stopover. Annual variation in giving up densities and number of bird-days was strongly associated with year-to-year differences in initial tuber biomass density and number of days with high water levels. As predicted,

giving-up density increased and bird-days decreased with the number of days with high water level. We conclude that, in line with time-minimizing migration, changes in fuelling conditions may lead to underuse of a stopover site. Underuse of stopovers by migratory birds has been reported before but only in the sense that more food was left at stopover sites than at wintering sites. In contrast, in our case, dealing with a given stopover site, more food is left behind in some years than in other years.

Lehikoinen A, Jaatinen K, Vähätalo AV, Clausen P, Crowe O, Deceuninck B, Hearn RD, Holt CA, Hornman M, Keller V, Nilsson L, Langendoen T, Tománková I, Wahl J, Fox AD. 2013. Rapid climate driven shifts in wintering distributions of three common waterbird species. *Global Change Biology* **19**, 2071-2081.

(Abstract)

Climate change is predicted to cause changes in species distributions and several studies report margin range shifts in some species. However, the reported changes rarely concern a species' entire distribution and are not always linked to climate change. Here, we demonstrate strong north-eastwards shifts in the centres of gravity of the entire wintering range of three common waterbird species along the North-West Europe flyway during the past three decades. These shifts correlate with an increase of 3.8 °C in early winter temperature in the north-eastern part of the wintering areas, where bird abundance increased exponentially, corresponding with decreases in abundance at the south-western margin of the wintering ranges. This confirms the need to re-evaluate conservation site safeguard networks and associated biodiversity monitoring along the flyway, as new important wintering areas are established further north and east, and highlights the general urgency of conservation planning in a changing world. Range shifts in wintering waterbirds may also affect hunting pressure, which may alter bag sizes and lead to population-level consequences.

Gehrold A, Kohler P. 2013. Wing-moulting waterbirds maintain body condition under good environmental conditions: a case study of Gadwalls (*Anas strepera*). *Journal of Ornithology* **154**, 783–793.

(Abstract)

Wing moult is a critical period within the annual cycle of birds, particularly in waterbirds which become completely flightless. The inherent vulnerability to anthropogenic disturbance, predation and decreasing habitat quality often results in remarkable body weight loss. However, moult-related changes in body weight can be explained by two hypotheses: The 'adaptive weight loss' hypothesis suggests that the reduction of body weight is a special adaptation to flightlessness, whereas the 'environmental constraint' hypothesis suggests that weight dynamics mainly depend on local environmental conditions. To assess these two scenarios, weight changes of moulting Gadwalls (*Anas strepera*) were measured during 9 study years. We also analysed the effect of sex-specific differences in timing of moult and previous reproductive investment. Over all years, flightless males lost on

average 3.9 % and females 10.6 % of body weight, yet both sexes recovered weight towards the end of moult. In single years, male weight significantly decreased during only 1 out of 9 and female weight during 3 out of 8 moulting seasons. Only female weight dynamics changed considerably among and within these seasons. In particular, females were significantly lighter when moulting late, a trait that is characteristic of successful breeders. Lower average weight levels of moulting females following breeding seasons of higher reproductive output further highlight the connectivity of these consecutive life history stages. Overall, our data indicate that moult-related changes in body weight result from environmental circumstances, rather than being an adaptation to the flightless stage per se. Appropriate moulting sites should be created and protected because adverse habitat conditions during moult could have direct as well as long-lasting fitness-relevant effects on waterbirds.

Anatidae 2012

Caswell, J. H., R. T. Alisauskas, and J. O. Leafloor. 2012. Effect of Neckband Color on Survival and Recovery Rates of Ross's Geese. *The Journal of Wildlife Management* **76**:1456–1461.

(Abstract)

Colored neckbands are known to reduce survival rates of geese, but the underlying cause for lower survival is unknown. We tested the hypothesis that hunters cause this lower survival rate by actively targeting neckbanded geese. We evaluated this hypothesis by estimating recovery and survival rates of adult Ross's geese (*Chen rossii*) at both Queen Maud Gulf (QMG) and McConnell River (MCR) Migratory Bird Sanctuaries carrying each of 3 marker combinations: 1) standard legbands (n=11,321) for basic estimates of recovery and survival rates; 2) standard legbands and colored neckbands (n=8,587) as the marked sample most detectable and thus most vulnerable to targeting by hunters; and 3) standard legbands and white neckbands (n=6,501) as the sample exposed to the general risks of carrying neckbands but only minimally detectable by hunters, if at all. Recovery rates ($\pm 95\%$ CL) of Ross's geese were lowest for those marked with legbands (0.024 ± 0.004 at MCR and 0.016 ± 0.003 at QMG) and highest for those marked with neckbands, regardless of neckband color (0.042 ± 0.005 at MCR and 0.035 ± 0.005 at QMG). Survival rates ($\pm 95\%$ CL) were indistinguishable between geese marked with color and white neckbands (0.54 ± 0.08 at MCR and 0.52 ± 0.08 at QMG), but lower than those marked with standard legbands only (0.72 ± 0.17 at MCR and 0.83 ± 0.23 at QMG). Geese marked with white neckbands were recovered at rates similar to those marked with color neckbands, suggesting that hunter selection of color neckbands did not contribute greatly to lower survival rates in neckbanded geese. Rather, results suggest that neckbanded geese, regardless of neckband visibility, are more vulnerable to hunters than are geese marked only with legbands.

Humburg, D. D., and M. G. Anderson. 2014. Implementing the 2012 North American Waterfowl Management Plan: people conserving waterfowl and wetlands. *Wildfowl* **4**:329–342.

(Abstract)

The North American Waterfowl Management Plan (NAWMP) is a continental ecosystems model for wildlife conservation planning with worldwide implications. Since established in 1986, NAWMP has undergone continual evolution as challenges to waterfowl conservation have emerged and information available to support conservation decisions has become available. In the 2012 revision, the waterfowl management community revisited the fundamental basis for the Plan and placed greater emphasis on sustaining the Plan's conservation work and on integration across disciplines of harvest and habitat management. Most notably, traditional and nontraditional users (i.e. hunters and wildlife viewers) of the resource and other conservation supporters are integrated into waterfowl conservation planning. Challenges ahead for the waterfowl management enterprise include addressing tradeoffs that emerge when habitat for waterfowl populations versus habitat for humans are explicitly considered, how these objectives and decision problems can be linked at various spatial and temporal scales, and most fundamentally how to sustain NAWMP conservation work in the face of multi-faceted ecological and social change.

D.V. Solovyeva, Afanasiev V, Fox JW, Shrokhin V, Fox AD. 2012. Use of geolocators reveals previously unknown Chinese and Korean scaly-sided merganser wintering sites. *Endangered Species Research* **17**, 217-225.

(Abstract)

We determined, for the first time, individual linkages between breeding areas of nesting female scaly-sided mergansers *Mergus squamatus* in the Russian Far East and their previously unknown wintering grounds in coastal Korea and inland China. Geolocators were deployed on nesting females caught and recaptured on nests along a 40-km stretch of the Kievka River. Mean positions for brood-rearing females during the summer were on average within 61.9 km of the nest site, suggesting reasonable device accuracy for subsequent location of winter quarters. Geolocation data showed that most birds wintered on freshwater habitats throughout mainland China, straddling an area 830 km E-W and 1100 km N-S. Most wintered in discrete mountainous areas with extensive timber cover, large rivers and low human population density. Three birds tracked in more than one season returned to within 25-150 km of previous wintering areas in successive years, suggesting winter fidelity to catchments if not specific sites. A single female from the adjacent Avvakumovka catchment wintered on saltwater in Korea, at least 1300 km east of Chinese wintering birds. Most sea duck species (Tribe Mergini) form pairs away from breeding areas, suggesting that this high level of winter dispersal amongst close-nesting females is a potential mechanism to maintain gene flow in this threatened species that has specialist habitat requirements. Hence, female scaly-sided mergansers disperse widely from breeding areas, but show fidelity to nesting areas and winter quarters.

Kim TJ, Park HC. 2012. The Analysis of Wintering Baikal Teal (*Anas formosa*) at Junam Wetlands and Its Interference Factors. *Journal of Korean Nature* **5**, 227-231.

(Abstract)

The investigation of annual changes of the number of *Anas formosa* during the wintering season from 2004 to 2008 showed that there was the largest number of individuals (78,000) in 2008. The monthly changes of the number of individuals at Junam Wetlands from October to March demonstrated that there was the largest number of individuals in December. On the other hand, the size of wintering population decreased in January. In order to analyze the factors affecting the decreasing population of *A. formosa*, daily investigations of wintering *A. formosa* were conducted in 2008. The results indicated the decreasing population and migration of *A. formosa* were mainly caused by interference factors such as fishing from motorboats and ice punching on the ice.

Fox AD, Walsh A. 2012. Warming winter effects, fat store accumulation and timing of spring departure of Greenland White-fronted Geese *Anser albifrons flavirostris* from their winter quarters. *Hydrobiologia* **697**, 95-102.

(Abstract)

Migratory geese accumulate energy and nutrient stores in winter to fly to refuelling spring staging areas before onward migration to breeding areas. Mean ground temperatures at two important Greenland White-fronted Geese wintering sites rose in winter and spring by 1.0–1.3°C during 1973–2007. Greenland White-fronted Geese departed the Wexford winter quarters on 3rd April 2007 for Icelandic spring staging areas, the earliest on record, representing a mean advancement of 15 days since 1973, mirrored amongst mean dates of departure amongst Scottish wintering birds that have advanced by 12 days during 1973–2007. Icelandic temperatures at critical midway staging areas en route to Greenland showed no significant change since 1973, suggesting that it is warming on the winter quarters that enable geese to depart earlier, rather than elevated temperatures at ultimate spring staging areas. However, Wexford departure date did not correlate with spring temperature. Data presented here show that Greenland White-fronted Geese have accumulated threshold body stores progressively earlier in spring migration, especially during 1995–2007. Although this did not correlate with ambient temperature, the mean degree of accumulated fat stored by 1st April in each year was a statistically significant predictor of departure date for the wintering population at Wexford. These data support the hypothesis that it is intrinsic factors (i.e. improvements in internal body state resulting from better feeding conditions) that has permitted progressively earlier departure of these geese from Wexford on spring migration, rather than amelioration of spring conditions in Iceland or solely the result of warming of the winter quarters.

Hoye BJ, Hahn S, Nolet BA, Klaassen M. 2012. Habitat use throughout migration: linking individual consistency, prior breeding success and future breeding potential. *Journal of Animal Ecology* **81**, 657–666.

(Abstract)

1. Habitat use can influence individual performance in a wide range of animals, either immediately or through carry-over effects in subsequent seasons. Given that many animal species also show consistent individual differences in reproductive success, it seems plausible that individuals may have consistent patterns of habitat use representing individual specializations, with concomitant fitness consequences.
2. Stable-carbon isotope ratios from a range of tissues were used to discern individual consistency in habitat use along a terrestrial–aquatic gradient in a long-distance migrant, the Bewick’s swan (*Cygnus columbianus bewickii*). These individual specialisations represented <15% of the isotopic breadth of the population for the majority of individuals and were seen to persist throughout autumn migration and overwintering until aquatic habitats were no longer available.
3. Individual foraging specialisations were then used to demonstrate two consecutive carry-over effects associated with macroscale habitat segregation: consequences of breeding season processes for autumn habitat use; and consequences of autumn habitat use for future reproductive success. Adults that were successful breeders in the year of capture used terrestrial habitats significantly more than adults that were not successful, revealing a substantial cost of reproduction and extended parental care. Use of aquatic habitats during autumn was, however, associated with increased body condition prior to spring migration; and increased subsequent breeding success in adults that had been unsuccessful the year before. Yet adults that were successful breeders in the year of capture remained the most likely to be successful the following year, despite their use of terrestrial habitats.
4. Our results uniquely demonstrate not only individual foraging specializations throughout the migration period, but also that processes during breeding and autumn migration, mediated by individual consistency, may play a fundamental role in the population dynamics of long-distance migrants. These findings, therefore, highlight the importance of long-term consistency to our understanding of habitat function, interindividual differences in fitness, population dynamics and the evolution of migratory strategies.

Wang X, Barter MA, Cao L, Lei JY, Fox AD. 2012. Serious contractions in wintering distribution and decline in abundance of Baer’s Pochard *Aythya baeri*. *Bird Conservation International* **22**,121-127.

(Abstract)

Observed maximum numbers of Baer’s Pochard *Aythya baeri* in China, the traditional core wintering range, declined from 16,792 during 1987–1993 to 2,131 during 2003–2011, accompanied by a dramatic contraction in range. Coordinated coverage of the most important sites in the middle and lower Yangtze River floodplain in January 2011 found only 194 Baer’s Pochard. The reported wintering population outside China declined from 719 in 2000–2005 to 48 in 2006–2010. The world population in 2011 apparently did not exceed 1,000 individuals, and the true number was most likely many fewer. The species seems to have ceased wintering regularly outside mainland China, where none had been found by mid-February 2012 despite coverage of favoured sites. Urgent, coordinated actions are needed to protect this species which may soon be on the verge of extinction in the wild.

Wang X, Fox AD, Cong PH, Barter MA, Cao L. 2012. Changes in the distribution and abundance of wintering Lesser White-fronted Geese *Anser erythropus* in eastern China. *Bird Conservation International* **22**, 128-134.

(Abstract)

The Lesser White-fronted Goose *Anser erythropus* is globally threatened with an estimated world population of 25,000–28,000, of which c 20,000 winter at East Dongting Lake, China. We present here the first collation of published and unpublished data on the distribution and abundance of the species in eastern China in recent decades. Lesser White-fronted Goose numbers have declined greatly in Anhui, Jiangxi and Jiangsu Provinces between the late-1980s/early-1990s and recent years: the species' range has now mainly contracted to East Dongting Lake in Hunan. The relatively stable numbers at East Dongting Lake suggest that the population is not currently threatened, but the extreme concentration at one lake makes the species vulnerable. Lesser White-fronted Geese rely on very specific meadow vegetation exposed after water recession, so changes in water levels or recession timing, due to hydrological changes following the commissioning of the Three Gorges Dam, may affect biomass, palatability and plant species composition of the meadows. Thus, it is critically important to understand the wintering ecology and habitat needs of this threatened species at East Dongting Lake. It is also essential to conduct further synchronous Yangtze River floodplain surveys to assess the current status, distribution and habitat use of Lesser White-fronted Geese throughout the region.

Zhao D, Cong PH, Barter MA, Fox AD, Cao L. 2012. The changing abundance and distribution of Greater White-fronted Geese *Anser albifrons* in the Yangtze River floodplain: impacts of recent hydrological changes. *Bird Conservation International* **22**, 135-143.

(Abstract)

Count data show that wintering Greater White-fronted Goose *Anser albifrons* numbers in their Chinese stronghold (the Yangtze River catchment) have fallen from about 140,000 in the late 1980s and early 1990s to c.18,000 now, despite increases in the overall flyway population (mostly wintering in South Korea and Japan). Declines have occurred in Jiangxi, but most markedly in Hunan (predominantly at East Dongting Lake) where the decline has been steady since 2003/2004, with few left from 2008/2009 onwards. Numbers have increased substantially in Anhui (predominantly at Shengjin Lake), which now supports more Greater White-fronted Geese than Jiangxi and Hunan combined. The species appears a habitat specialist in China, confined to grazing short sward recessional *Carex* sedge meadows. At East Dongting Lake, reductions in Greater White-fronted Geese numbers correlated with declines in availability of suitable sedge swards, caused by earlier water table recession, which in recent years has meant swards were too tall for geese to utilize from their arrival in autumn. The hydrological changes are most probably due to the commissioning of the Three Gorges Dam in mid-2003. At Shengjin Lake, the increases may be due to recent stable first exposure dates and slow water recession rates which favour short *Carex* swards attractive to geese; high buffalo grazing density at this lake may also assist in maintaining suitable sward heights. These

hypotheses require investigation.

Cong PH, Wang X, Cao L, Fox AD. 2012. Within-winter shifts in Lesser White-fronted Goose *Anser erythropus* distribution at East Dongting Lake, China. *Ardea* **100**, 5-11.

(Abstract)

At the important wintering site, East Dongting Lake in the Yangtze River floodplain, Lesser White-fronted Geese *Anser erythropus* showed within-season shifts in distribution and abundance between local areas. On arrival in November, over 4,000 geese grazed high-biomass stands of new growth spikerush *Eleocharis migoana* on exposed mud flats at Caisang Lake. High feeding densities depleted *Eleocharis* by early December, when the geese departed to feed on old-growth above-ground *Carex heterolepis* at nearby lakes. Cool, arid conditions inhibited plant growth until January, when the grass *Alopecurus aequalis* and *C. heterolepis* restarted growing, attracting geese back to Caisang Lake. Greater numbers returned in late February when *E. migoana* began to grow, rapidly building to peak at 4,500 in late March when geese began spring migration. Habitat management that maintains these patterns of plant growth and availability may be critical to keeping present Lesser White-fronted Goose numbers at this site.

Anatidae 2011

Solovieva D, Vartanyan S. 2011. Lesser White-Fronted Goose *Anser erythropus*: good news about the breeding population in west Chukotka, Russia *Wildfowl* **61**: 110–120

(Abstract)

A total of 243 Lesser White-fronted Geese *Anser erythropus* were counted along the Rauchua River and its main tributaries, the Konevaam and Ngagleyngyvaam Rivers, in July–August 2010. Average size of flocks that included broods was 27.5 individuals (s.d. = 10.7, range = 10–40, n = 8). Mean brood size was 3.57 goslings (s.d. = 1.22, range = 2–6, n = 14). Gosling age varied from 4 to 6.5 weeks. Of the Lesser White-fronted Geese seen on the Rauchua River, 65% were young birds and 32.5% were brood-rearing (breeding) adults, whilst just 2.5% were non-breeders. We estimated that 500–600 pairs of Lesser White-fronted Geese bred in the Rauchua Basin in spring 2010, a dramatic increase from none present in 1983. This could indicate a local increase in response to human emigration from the catchment or a more general increase in the Eastern Population of the Lesser White-fronted Goose.

D.V. Solovyeva & J. M. Pearce. 2011. Comparative mitochondrial genetics of North American and Eurasian mergansers with an emphasis on the endangered scaly-sided merganser (*Mergus squamatus*). *Conserv Genet* **12**: 839–844

(Abstract)

The scaly-sided merganser, *Mergus squamatus*, is considered one of the most threatened sea duck species in the Palearctic with limited breeding and wintering distribution in China and Russia. To provide information for future conservation efforts, we sequenced a portion of the mitochondrial (mt) DNA control region in four species of mergansers and three additional sea duck taxa to characterize the evolutionary history of the scaly-sided merganser, infer population trends that may have led to its limited geographic distribution, and to compare indices of genetic diversity among species of mergansers. Scaly-sided mergansers exhibit substantially lower levels of mtDNA genetic diversity ($h = 0.292$, $p = 0.0007$) than other closely related sea ducks and many other avian taxa. The four haplotypes observed differed by a single base pair suggesting that the species has not experienced a recent population decline but has instead been at a low population level for some time. A phylogenetic analysis placed the scaly-sided merganser basal to North American and European forms of the common merganser, *M. merganser*. Our inclusion of a small number of male samples doubled the number of mtDNA haplotypes observed, suggesting that additional genetic variation likely exists within the global population if there is immigration of males from unsampled breeding areas.

Cao L, Barter M, Zhao M, Meng H, Zhang Y. 2011. A systematic scheme for monitoring waterbird populations at Shengjin Lake, China: methodology and preliminary results. *Chinese Birds* **2**, 1-17.

(Abstract)

Changes in the areas and quality of wetland habitat makes it imperative to monitor trends in the number of wintering waterbirds and their distribution in the Yangtze River floodplain, the most important waterbird region in eastern China, so that effective science-based action can be taken to ensure the survival and future recovery of the waterbirds of the region. However, obtaining accurate data on the number of waterbirds and distribution, which can be confidently compared across years and sites, is complicated by a number of factors which can affect count quality. It is essential to employ a survey methodology which maximizes count accuracy and precision and minimizes the bias inherent in counting waterbirds; failure to achieve these goals will lead to incorrect results and analytical problems. Recently we developed a systematic waterbird survey methodology which was tested, with promising results, in the winters of 2008/2009 and 2009/2010 at Shengjin Lake, an important wetland in the Yangtze River floodplain. The methodology involves dividing the lake into discrete survey areas, each containing a number of sub-areas, with clear boundaries, which were surveyed separately. Data, which included information on counts, distributions, the environment and disturbance, were collected in a standardized manner to maximize precision and minimize bias. We use the results from the surveys of the first two winters to provide examples of how the data can be employed to provide detailed information on the number of waterbirds, their distributions and habitat usage. Finally, we discuss the importance of wider application of the methodology throughout the Yangtze River floodplain to underpin a much needed floodplain-wide waterbird monitoring program.

Cong PH, Cao L, Fox AD, Barter M, Rees EC, Jiang Y, Ji W, Zhu W, Song G. 2011. WaChanges in Tundra Swan *Cygnus columbianus bewickii* distribution and abundance in the Yangtze River floodplain. *Bird Conservation International* **21**, 260-265.

(Abstract)

Approximately 75% of the East Asian Flyway Tundra Swan *Cygnus columbianus bewickii* population winters in the Yangtze River floodplain, China. Historically the species was more widely distributed throughout the floodplain but now most of the population is confined to five wetlands in Anhui Province and to Poyang Lake in Jiangxi Province, where the majority (up to 113,000 birds) occur. Within-winter counts suggest that swans congregate at Poyang Lake before dispersing to other sites later in the winter. Counts show large between-year fluctuations, but suggest declines at Shengjin and Fengsha Lakes (both in Anhui) during the last five years. Declines at Shengjin Lake are likely due to decreases in submerged vegetation (particularly tuber-producing *Vallisneria*, a major food item) perhaps linked to eutrophication. Range contractions throughout the floodplain may also be linked to reductions in submerged vegetation coverage elsewhere. Changes in water quality and lake hydrology post-Three Gorges Dam may have adversely affected submerged egeation productivity. Key information needs for the effective implementation of conservation measures for Tundra Swans include: (1) annual surveys of all major wintering sites throughout each winter to establish the importance of different sites during the non-breeding period; (2) more information on swan diets at important sites; and (3) an assessment of adverse effects of water quality and lake water levels post-Three Gorges Dam on submerged vegetation productivity at Poyang Lake and other important sites.

Cong PH, Rees EC, Sun MM, Zhao M, Cao L, Barter MA, Fox AD. 2011. A comparison of behaviour and habitat use by Bewick's Swans *Cygnus columbianus bewickii* at wintering sites in China and Europe: preliminary observations. *Wildfowl* **61**, 52-73.

(Abstract)

The dynamics and behaviour of the Northwest European population of Bewick's Swans *Cygnus columbianus bewickii* has been studied over several decades, yet relatively little is known about the more numerous Eastern population of the species. Comparisons of the two populations could help explain why the Northwest European population is in decline. Here we describe for the first time the swans' use of a wintering site (Shengjin Lake) in China, comparing these findings with studies made of Bewick's Swans wintering at Slimbridge, UK. First birds arrived in late October at both sites, and swans remained at Shengjin Lake until late March, which approximates to the time that Bewick's Swans spend at wintering sites across Europe. Monthly swan counts did not correlate significantly with water level variations at Shengjin Lake (and by implication food accessibility). However, more extensive monitoring, both of water depth and food abundance, is required to understand whether fluctuating water levels affect site use by the birds. There was no significant difference between the two sites in the proportion of birds recorded feeding throughout the day, though this may reflect a high level of variance in the swans' feeding activity. A bimodal pattern in feeding activity recorded for the swans in China is similar to feeding patterns recorded for Bewick's Swans at Slimbridge. Breeding

success recorded for Bewick's Swans in the Eastern population was significantly higher than for those in the Northwest European population every year from 2007 to 2010 inclusive. Further studies should investigate whether this is attributable to the carry-over effects of swans in the Eastern population feeding on aquatic vegetation in traditional wetland habitats during winter, as opposed to the farmland used by swans wintering in Europe.

Chen J, Zhou L, Zhou B, Xu R, Zhu W, Xu W. 2011. Seasonal dynamics of wintering waterbirds in two shallow lakes along Yangtze River in Anhui Province. *Zoological Research* **32**, 540-548.

(Abstract)

The shallow lake wetlands in the middle and lower Yangtze River floodplain are important wintering and stopover habitats for migratory waterbirds on the East Asia-Australia Flyway. With increasing fishery practices in recent years, however, the wetlands have deteriorated significantly and now threaten wintering waterbirds. To gain insight into the influence of deteriorating wetlands on waterbirds, we conducted a survey of wintering waterbird species, population size, and distribution across 11 belt transects in Caizi Lake and Shengjin Lake, two shallow lakes along the Yangtze River in Anhui Province from November 2007-April 2008 and from November 2008-April 2009, respectively. The impacts of different fishery patterns on the distribution of waterbirds were also analyzed. A total of 43 waterbirds species belong to 7 orders of 12 families were counted during the surveys, of which 38 were found in Caizi Lake with a density of 8.2 ind./hm², and 42 in Shengjin Lake with a density of 3.5 ind./hm². Geese (*Anser cygnoides*), bean geese (*Anser fabalis*), tundra swan (*Cygnus columbianus*), and dunlin (*Calidris alpina*) were the dominant species in the two shallow lakes. Species number and individual assemble reached maximum at the end of December and in early January of the following year, without coincidence of the largest flock for different ecological groups. Based on waterbird diversity across the 11 belt transects and the fishery patterns, habitats could be divided into three groups. Gruiformes, Anseriformes and Charadriiformes had relatively higher densities in the natural fishery zones and lower densities in the cage fishery zones; whereas, the density of Ardeidae showed little change across all lake zones. It is important to develop sustainable fishery patterns in shallow lakes along the middle and lower Yangtze River floodplain to better protect resources of wintering waterbirds.

Anatidae 2010

Peiqi LIU, Feng LI, Huidong SONG, Qiang WANG, Yuwen SONG, Yusen LIU, Zhengji PIAO. 2010. A survey to the distribution of the Scaly-sided Merganser (*Mergus squamatus*) in Changbai Mountain range (China side)

(Abstract)

In 2008 and 2009, we made continuous and repeated breeding surveys of the Scaly-sided Merganser (*Mergus squamatus*) in the Changbai Mountain range (China side), using a combination of rubber-boat drifting and walking. Each survey consisted of a census of breeding pairs in the spring and broods in the summer. A total of 1553 km in length of 17 river stretches were surveyed in four different river system of the Yalujiang, Songhuajiang, Tumenjiang and Mudanjiang rivers. A total of 1354 individuals of the Scaly-sided Merganser were recorded during the both surveys. The breeding density for all the stretches surveyed over both years averaged 0.26 ± 0.30 pairs per km; the population density in the spring averaged 0.75 ± 0.88 individuals per km. According to our survey results, we estimated that the breeding population in the Changbai Mountain range was about 170 breeding pairs of the Scaly-sided Merganser. Three major breeding sites of this bird were found in the Changbai Mountain range in these surveys.

Nijman, V., M. Aliabadian, and C. S. Roselaar. 2010. Wild hybrids of Lesser White-fronted Goose (*Anser erythropus*) Greater White-fronted Goose (*A. albifrons*) (*Aves: Anseriformes*) from the European migratory flyway. *Zoologischer Anzeiger* **248**:265–271.

(Abstract)

The Lesser White-fronted Goose [*Anser erythropus* (Linnaeus, 1758)] is one of the most threatened *Palaearctic* goose species, with the *Fennoscandinavian* subpopulation in particular having seen a drastic decline over the last century. In the 1990s, captive-bred Lesser White-fronted Geese were used successfully for reintroduction and restocking in Sweden and Finland. The discovery of Greater White-fronted Goose [*Anser albifrons* (Scopoli, 1769)] mtDNA haplotypes in some of these captive-bred birds (Ruokonen et al. 2000) suggested that hybridisation had occurred during captive propagation and led to the discontinuation of the re lease of captive goslings. Here we report two hybrids of Lesser Greater White-fronted Geese that were collected on their wintering grounds in England in 1936 and Holland in 1966. Birds from western Russia normally do not migrate south to Western Europe. Hence, these birds most likely originated from the *Fennoscandinavian* subpopulation and were collected prior to the commencement of the captive-breeding programs. Both specimens show a heterogeneous set of morphological characters, some of which shared with the putative parent species and others being intermediate between the two White-fronted Goose species. A Canonical Discriminant Function analysis positions both specimens between the two putative parent species, making their hybrid status likely. We show, thus, that hybridisation between Greater and Lesser White-fronted Geese does occur naturally, albeit perhaps infrequently, and argue that the presence of Greater White-fronted Goose mtDNA haplotypes in Lesser White-fronted Goose maybe the result of this naturally occurring hybridisation. Our data provide additional information on the debate whether the restocking programs were halted for the right reasons and whether it is desirable to re-commence with the reintroduction program.

Dou ST, Cao L, Cheng Y, Fox AD. 2010. TFunctional use of Shengjin Hu National Nature Reserve,

China, by three species of dabbling ducks – preliminary observations. *Wildfowl* **60**:124–135.

(Abstract)

Counts made at Shengjin Lake, China, in 2008/09 found internationally important numbers of Falcated Duck *Anas falcata* and nationally important numbers of Baikal Teal *Anas formosawintering* at the site. Activity budgets showed that neither species fed at all during daylight hours in February, but that the large raft of ducks took to the air at dusk and flew to harvested rice fields to feed at night. Baikal Teal had departed the site by early April, whereas Falcated Duck activity budgets at this time showed the species remaining to forage in a series of feeding/loafing cycles on the lake during the day, having abandoned night-time feeding in the fields. In contrast, the more common and widespread Spot-billed Duck *Anas poecilorhyncha*, which also winters in the area, remained to feed on the lake throughout the day, although the possibility remains that they may also feed in fields if they leave the lake after dark. These findings confirm that the globally threatened Falcated Duck and globally vulnerable Baikal Teal derive a major part of their energy and nutrition from agricultural fields at Shengjin Lake National Nature Reserve in mid-winter, potentially putting them at risk of land-use change and pesticides in the vicinity. On the other hand, the gleaning of waste unharvested grain creates no agricultural conflict and offers opportunities for developing management agreements with farmers, which would provide a feeding resource for maintaining and enhancing stocks of these ducks wintering at the site.

Zhao M, Cao L, Fox AD. 2010. Distribution and diet of wintering Tundra Bean Geese *Anser fabalis serrirostris* at Shengjin Lake, Yangtze River floodplain, China. *Wildfowl* **60**:52–63.

(Abstract)

More than half of the estimated global flyway population of Tundra Bean Geese *Anser fabalis serrirostris* was counted at the Shengjin Lake National Nature Reserve, Anhui Province, China, in winter 2008/2009, peaking at 41,500 birds in mid-December 2008. In October–November and March, when fewer geese were recorded, the birds were found on sedge *Carex* meadows, because high water levels restricted access to other food resources at this time. Much larger numbers coincided with lowest water levels in mid-winter, when faecal analysis showed that geese fed on a wide range of additional food items. These included the grass *Alopecurus aequalis*, submerged Water Chestnut *Trapa maximowiczii* fruits exposed by falling water levels, and fields of winter wheat. The extent of floating Water Chestnut in summer has more than doubled from 4.2 to 9.1 km² at Shengjin Lake since 2002 (potentially linked to eutrophication at the site), but more study is required to support the hypothesis that this source of winter food is responsible for dramatic recent increases in Bean Goose numbers at the site.

Anatidae 2009 and earlier

2009

Guay, P.-J., and R. A. Mulder. 2009. Do neck-collars affect the behaviour and condition of Black Swans (*Cygnus atratus*)? *Emu* **109**:248–251.

(Abstract)

Neck-collars are commonly used to identify geese and swans, but possible adverse effects of collars have been investigated in few species. We evaluated the effects of plastic neck-collars on the behaviour and condition of Black Swans (*Cygnus atratus*). We fitted 67 individuals with rigid, plastic neck-collars between July and November 2007, and three months later compared the behaviour of a sample of 16 collared Swans with that of 16 uncollared birds. There were no differences between collared and uncollared Swans in the percentage time spent resting, swimming or preening. Collared Swans tended to spend less time upending and more time dabbling than uncollared Swans, but the overall proportion of time spent foraging was similar, and the difference in preferred foraging mode did not result in differences in body condition. We suggest that neck-collars are suitable for identification of Black Swans.

2008

Fox AD, Hearn RD, Cao L, Cong PH, Wang X, Zhang Y, Dou ST, Shao XF, Barter MA, Rees EC. 2008. Preliminary observations of diurnal feeding patterns of Swan Geese *Anser cygnoides* using two different habitats at Shengjin Lake, Anhui Province, China. *Wildfowl* **58**, 20–30.

(Abstract)

Swan Geese *Anser cygnoides* wintering at two different areas of Shengjin Lake fed either by grubbing below ground rhizomes of *Vallisneria asiatica* or by grazing the above ground primary production of sedges *Carex* sp. and Canary Grass *Phalaris arundinacea* leaves. Activity budgets were compiled from geese using the two different foods and feeding behaviours showed little appreciable difference in time spent feeding (c. 50% of daylight hours) or resting (c. 30%), which were similar to previous observations from Poyang Lake of the species feeding on *Vallisneria*. In the absence of evidence of night feeding, the extended periods spent resting during the day suggests that the species is well able to meet its energetic needs at present foraging rates. However, to understand fully the profitability of the two habitats, detailed studies are required on the energetics of goose exploitation of *Carex* and *Phalaris* leaves and of *Vallisneria* rhizomes, including the effects of food depletion on the profitability of both habitats, and in relation to changes in body stores accumulated by the geese throughout the winter season. This is especially important if availability of these foods is likely to change at Shengjin Lake and at the many other lakes in the Yangtze River basin as a result of the hydrological effects of the Three Gorges Dam project, as these sites are the main winter strongholds for the global Swan Goose population.

Cao L, Wang X, Wang Q, Barter MA. 2008. Wintering Anatidae In China: A Preliminary Analysis. *Casarca* **11**, 161-180.

(Abstract)

In mainland China itself, there are 10% of the land water-bodies of the planet, and some of them are, for the parameters of the world, the most significant. Many wetland and waterfowl that breed in the Russian Far East, in Mongolia and northeast China, migrate to the south-east China – an area with a relatively mild climate. Published information on the number and distribution of species of the Anatidae family in China during the non-breeding period is very limited and fragmentary. The data obtained in recent years in the breeding areas indicate a significant reduction in the size of many populations of waterfowl wintering in China. It is therefore important to have information on the status of these populations on the wintering grounds in China – both now and in the past. Such information were obtained from a large number of different sources, and now, our database contains over 7000 records on different species, mainly in east China. Search for data counts continues. We conducted a preliminary analysis of materials the spread of the 12 major species in the period from November to February. According to the results, the wintering area most of them significantly decreased, and now the main wintering area is the Yangtze floodplain. The number of wintering birds, too decreases. It seems that the province of Jiangsu, the coastal areas Shandong Province and wetlands in the valley. Yellow River some have lost their value for waterfowl compared to previous years. Proliferation of all globally threatened species, especially Swan Goose, Baer's Pochard and Baikal Teal decrease. We will make every effort to ensure that the final version of the database were included most accurate and detailed data from published and unpublished sources, it will need to constantly introduce new information. It should be noted that the more complete the database gets, the more accurate is its interpretation, which in the future may be very different from the one proposed in this paper.

Fox AD, Cao L, Barter MA, Rees EC, Hearn RD, Cong PH, Wang X, Zhang Y, Dou ST, Fang SX. 2008. The functional use of East Dongting Lake, China, by wintering geese. *Wildfowl* **58**, 3–19.

(Abstract)

A survey and study of geese wintering at the East Dongting Lake National Nature Reserve, China, in February 2008 revealed internationally important numbers of Lesser White-fronted Geese *Anser erythropus*, Greater White-fronted Geese *Anser albifrons* and Bean Geese *Anser fabilis* using the site, as well as small numbers of Greylag Geese *Anser anser*. Only five Swan Geese *Anser cygnoides* were recorded, compared with several hundreds in the 1990s. Globally important numbers of Lesser White-fronted Geese spend the majority of daylight hours feeding on short grassland and sedge meadows within the core reserve areas of the National Nature Reserve, and also roost there at night. Greater White-fronted Geese were not studied in detail, but showed similar behaviour. Large numbers of Bean Geese of both *serrirostris* and *middendorffi* races showed differing feeding strategies. The small numbers of *serrirostris* tended to roost and feed in or near the reserve on short grassland, as did small proportions of *middendorffi*. However, the majority of *middendorffi* slept within the confines of the reserve by day and flew out at dusk, to nocturnal feeding areas at least 40 km north on the far side of the Yangtze River, returning 40–80 min after first light. In order to safeguard these goose populations, it is essential to optimise the foraging opportunities for geese within the reserve and to understand the feeding habitats exploited by the geese in adjacent and remote areas

such as those used by the *middendorffi* birds north of the Yangtze.

Cao L, Barter MA, Lei G, Yang Q. 2008. Anatidae in the Yangtze floodplain in winter 2004 and 2005. *Casarca* **11**, 146-160.

(Abstract)

The wetlands in the lower reaches of the river Yangtze are essential for a large number of waterfowl outside the breeding season. In the area large clusters of waterfowl form, including many globally threatened species. In this case, however, there are still no bird surveys conducted in the region during the short periods when there is the maximum number of individuals. This is necessary in order to make the most accurate estimate of abundance and present a picture of their distribution. The paper presents and discusses the most complete count data held WWF-China for two weeks in late January – early February 2004 and the second half of February 2005 the surveyed area land is 72% of the total area in 2005 and 61% in 2004. In 2005, it was considered a total of 427,881 individuals of 29 species of the family Anatidae, and in 2004 – 338 384 individuals of 27 species. Most likely, the increase in the number of birds counted was due to the increase in the area covered by light, but because of the cold weather in winter 2005 in the Yangtze floodplain could move birds from more northern areas. Of waterfowl geese were the most common, followed by ducks and swans. During the six counts were observed globally endangered species (swan goose, red-breasted goose, Baikal Teal, Baer's Pochard and merganser), and one species in a state of near-threatened (Ferruginous Duck). Swan goose was present in the area in internationally significant numbers (classified by BirdLife International as "internationally significant concentrations"). The most common were the following (indicated by the highest number in two years): Bean Goose (104,519 individuals), Bewick's swan (65,114), Swan Goose (61,178), Eurasian teal (43,037), Spot-billed Duck (29,210), Greater white-fronted goose (26,494), Falcated duck (18 364), lesser white-fronted goose (16,937), mallard (13,884), and Northern Pintail (9,281). These surveys conducted indicate that in the region is concentrated a large proportion of individuals from the general (estimated), some species of birds that use the Flyway. Numbers of some species (eg, Swan Goose and Lesser White-fronted Goose) in the floodplain of the Yangtze was higher than existing estimates. As for the ducks, this figure was significantly lower (except Falcated Duck). At the same time, the abundance of some species (eg, Swan Goose and Lesser White-fronted Goose) in the floodplain Yangtze was higher than existing estimates. This Article describes the distribution of the ten species of birds, whose numbers at least one section of the Yangtze River in the floodplain has been internationally significant, ie was at least 1% of the total population in the migration route. To maintain such large concentrations of waterfowl on such a large number of sites in the region requires the creation of a wide network

2007

Guillemain, M., M. Poisbleau, L. Denonfoux, M. Lepley, C. Moreau, G. Massez, G. Leray, A.

Caizergues, C. Arzel, D. Rodrigues, and H. Fritz. 2007. Multiple tests of the effect of nasal saddles on dabbling ducks: combining field and aviary approaches: Capsule Nasal saddles have no negative consequences apart from, under some circumstances, a potential bias in social relationships. *Bird Study* **54**:35-45.

(Abstract)

Capsule: Nasal saddles have no negative consequences apart from, under some circumstances, a potential bias in social relationships.

Aims: To test the effect of nasal saddles on Teal *Anas crecca*, Wigeon *A. penelope*, Mallard *A. platyrhynchos* and Pintail *A. acuta*.

Methods: The following features were compared between saddled and unsaddled individuals: body mass change of wild Teal between ringing and first live recovery, pairing probability of wild Teal through the winter, wild Teal and Wigeon time-budgets, captive Mallard and Pintail body mass fluctuations, testosterone levels and dominance in the aviary.

Results: We generally found no significant difference between values for birds with nasal saddles and control birds. Exceptions were for pairing probability, which was lower for marked Nasal saddles are an appropriate general method for marking dabbling ducks. However, saddles may not be appropriate for the study of social relationships in some conditions.

2005

Duckworth JW, Chol K. 2005. Scaly-sided Mergansers *Mergus squamatus* on the lower Chongchon River, central Korea. *Wildfowl* **55**, 135-144.

(Abstract)

In autumn 2003, the lower Chongchon River in central Korea supported at least 40 Scaly-sided Mergansers *Mergus squamatus*, significantly exceeding previous published estimates of the DPR Korean population. This is a non-breeding concentration of global significance (on currently available information) for this threatened species. Information is presented upon numbers present, sex ratio and behaviour from mid-October (when the birds were found) until late November (when observations ceased). Supplementary observations from March 2004 and autumn 2004, indicating regular use of the site, are also presented. Conservation issues related to the species at the site are reviewed.

Reed, E. T., G. Gauthier, and R. Pradel. 2005. Effects of neck bands on reproduction and survival of female greater snow geese. *Journal of Wildlife Management* **69**:91-100.

(Abstract)

An assumption of mark–recapture studies is that the marker has no effect on the animal. Neck bands have been used extensively for goose research, but there has long been concern that they may have

negative effects on some demographic parameters, and recent studies have yielded contradictory results. We evaluated the effects of neck bands on adult female greater snow geese (*Chen caerulescens atlantica*) by contrasting breeding propensity and apparent survival of geese marked with both a plastic neck band and a metal leg band and those marked solely with metal leg bands over an 11-year period on Bylot Island, Nunavut Territory, Canada. The use of multistate mark–recapture models also allowed us to estimate neck band loss and to obtain survival and capture probabilities that were not biased by such loss. Finally, we tested the effects of neck bands on other reproductive parameters (laying date, clutch size and nest success) over a 3-year period. Neck-banded females had decreased clutch size and capture probabilities, but their apparent survival rate, nest initiation and hatching dates, and nest survival were not affected compared to leg-banded only or unbanded females. Breeding propensity, indexed by capture probabilities of neck-banded females was, on average, 48% lower than that of leg-banded-only females but clutch size was only 10% lower. Neck band loss of females was low in this population (3% per year). We urge researchers to be cautious in the use of neck bands for estimation of population parameters and that the potential negative effects of neck bands be assessed as it is likely to be species-specific.

2002

Alisauskas, R. T., and M. S. Lindberg. 2002. Effects of neckbands on survival and fidelity of white-fronted and Canada geese captured as non-breeding adults. *Journal of Applied Statistics* **29**:521-537.

(Abstract)

We conducted an experiment to examine the effect of neckbands, controlling for differences in sex, species and year of study (1991- 1997), on probabilities of capture, survival, reporting, and fidelity in non-breeding small Canada (*Branta Canadensis hutchinsi*) and white-fronted (*Anser albifrons frontalis*) geese. In Canada's central arctic, we systematically double-marked about half of the individuals from each species with neckbands and legbands, and we marked the other half only with legbands. We considered 48 a priori models that included combinations of sex, species, year, and neckband effects on the four population parameters produced by Burnham's (1993) model, using AIC for model selection. The four best approximating models each included a negative effect of neckbands on survival, and effect size varied among years. True survival probability of neckbanded birds annually ranged from 0.006 to 0.23 and 0.039 to 0.22 (Canada and white-fronted geese, respectively) lower than for conspecifics without neckbands. Changes in estimates of survival probability in neckbanded birds appeared to attenuate more recently, particularly in Canada Geese, a result that we suspect was related to lower retention rates of neckbands. We urge extreme caution in use of neckbands for estimation of certain population parameters, and discourage their use for estimation of unbiased survival probability in these two species.