

**THE PATTERN OF PARASITE LOAD IN LESSER SNOW GEESE
(CHEN CAERULESCENS CAERULESCENS) USING SALT- AND FRESHWATER
HABITAT.**

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Abstract: As populations of many bird species increase in number, various factors may become important in limiting further growth. These include limitations of space and food as well as increases in disease agents (Newton, 1998). Gomis et al. (1996) examined the potential involvement of disease agents in the dynamics at the West Hudson Bay colony by comparing the parasite load of pre-fledgling snow geese collected in a degraded coastal portion of the region to that of pre-fledglings collected 15 miles inland in less degraded, freshwater habitat. They found that birds from the degraded, coastal region were smaller, in poorer condition and had higher loads of trichostrongylids, a caecal nematode. In this paper, we further those studies by comparing the load of two different caecal nematodes in pre-fledgling lesser snow geese sampled in salt- and freshwater habitat in the La Pérouse Bay and Cape Churchill region. We conclude that several factors, operating at different spatial scales and modified to differing extents by weather and the landscape, are responsible for the pattern. The notion that smaller birds are necessarily more susceptible is not supported without qualification nor is the conclusion that more heavily parasitized birds are smaller.

MIGRATION AND THE PRENESTING INTERVAL OF EMPEROR GEESE

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Abstract: We deployed abdominally-implanted satellite or VHF radio transmitters in 136 adult female emperor geese (*Chen canagica*) on the Yukon-Kuskokwim Delta (YKD) in western Alaska from 1999-2003. Our objectives were to measure the interval between arrival of females on their nesting area and the onset of egg laying, and to determine relationships between timing of spring arrival and distance females migrated from their wintering sites. We recorded spring arrival dates of 92 radiomarked females on the YKD nesting area and located nests of 32 of those individuals. Distance between the YKD and wintering sites of marked females ranged from 950-3,500 km. However, there was little evidence that migration distance affected arrival date or clutch size. The interval between arrival and nest initiation ranged from 5-17 days. Assuming rapid follicle growth required approximately 12 days, emperor geese exhibited plasticity in timing of RFG. Most females apparently delayed RFG until after arrival on the YKD in a year when timing of breakup was normal, but many females entered RFG prior to arrival in years of early breakup. The proximity of Alaska Peninsula staging areas to the YKD may enable female emperor geese to adjust timing of RFG relative to annual conditions.

HABITAT EFFECTS ON NEST PREDATION RISKS: THE CASE OF THE GREATER SNOW GOOSE

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Abstract: Nest predation and its avoidance are critical components of an individual's fitness. Predators should affect nesting habitat selection and prey should avoid habitat patches associated with high predation risks. We tested the hypothesis that predation affects nesting habitat selection in a Greater Snow Goose (*Chen caerulescens atlantica*) colony characterized by two nesting habitats: mesic tundra and wetlands. Goose eggs are most vulnerable to predation by foxes and avian predators when incubating females leave their nest to drink. Our observations revealed that females nesting in mesic tundra had to travel a greater distance to find water during incubation recesses in mesic tundra (mean = 32 m, SE=10; n =34) than in wetlands (mean = 10 m, SE=1; n=14). Females nesting in mesic tundra were more likely to surpass the distance threshold (10 m) where predator's attacks lead to efficient egg predation. An artificial nest experiment mimicking snow goose nests suggested that differences in predation risk between habitats were not solely due to the behavioral response of females. Predation on artificial nests was higher in the mesic tundra compare to wetlands, and foxes ate eggs more efficiently in the mesic tundra than in wetlands. Females are apparently sensitive to these differences in predation risks because a higher proportion of marked individuals nested in wetlands compared to their availability in the colony. Further studies need to examine how the difference in predation risk between the two habitats affects nesting success and how this varies in function of predator density.

THE NEW ROSS'S GOOSE COLONY AT LA PÉROUSE BAY, MANITOBA.

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Abstract: Ross's geese (*Chen rossii*) were rarely found at La Pérouse Bay through the mid-1990's. When they were, it was as males mated to female lesser snow geese (*Chen caerulescens*). In 1996, a pure Ross's goose pair was found nesting approximately 1 km from our base camp. Beginning in 1998, several families of Ross's geese were observed foraging on the central salt marsh. In 2003, the source of these families was found to be an isolated colony of nearly 1000 pairs of Ross's geese located in fresh water habitat 2 km inland from the east coast of La Pérouse Bay and 8.5 km from our base camp. The colony is surrounded by nesting lesser snow geese and is located in an area previously used (and degraded) by lesser snow geese. The colony persisted as an isolated unit and in 2004 contained approximately 1500-2000 pairs of nesting Ross's geese. We present details on the 2004 season including estimates of colony size, nesting density, reproductive success and the frequencies of mixed pairs and hybrids within and adjacent to the Ross's goose colony. We discuss the findings in light of the late 2004 season and the expansion of the Mid-continent population of Ross's geese.

HISTORICAL TRENDS IN LEMMING ABUNDANCE AND NEST SUCCESS OF CANADA GEESE: EVIDENCE IN SUPPORT OF THE “BIRD-LEMMING” HYPOTHESIS AT CAPE CHURCHILL, MANITOBA

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Poster, Keywords: “bird-lemming” hypothesis, EPP Canada geese, nest success

The dynamic interaction of predator, prey, and alternative prey in determining reproductive success in arctic-nesting birds (the “bird-lemming” hypothesis) has been documented. Data collected during annual Eastern Prairie Population (EPP) Canada goose (*Branta canadensis interior*) breeding ground surveys over the last 15 years at Cape Churchill, Manitoba provide adequate estimates of two of three parameters typically used in the analysis of this cyclic pattern, nest success and the proportion of locally active arctic fox (*Alopex lagopus*) dens. A detailed assessment of the third parameter, the annual abundance of lemmings, is lacking. In 2004, we collected and aged 794 willow (*Salix* spp.) stem scars, caused by the gnawing of collared lemmings (*Dicrostonyx richardsoni*), over 300 random points throughout a 48km² study area. Scar ages ranged from 0 to 13 years. Correlation in scar age frequency was the strongest in 3-year time lags, $\rho = 0.867$, suggesting 3-year population cycles. Time lag correlation analyses of goose nest data suggest 4-year cycles in nest success. However, a negative correlation between lemming abundance and goose nest success at 1-year time lags ($\rho = -0.285$) provides evidence that lemming cycles influence annual EPP Canada goose nesting success.

ACCURACY IN DETERMINING LAYING SEQUENCE DURING INCUBATION IN BLACK BRANT.

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Abstract: Previous studies have described effects of position in the laying (PILS) sequence on many measures of life history traits and demographics, while other studies fail to detect differences due to PILS. In most waterfowl nesting studies, researchers are unable to visit nests every day during laying to mark eggs in nests as they are laid and therefore, assign PILS by comparing stain color on eggs and assume the darkest stained eggs were laid first. We designed an experiment to test if this method was accurate in determining true laying order in Black Brant. We monitored a sample of 70 Black Brant (*Branta bernicla nigricans*) nests throughout the laying period so that we knew true laying order of eggs within a clutch and had multiple field technicians assign laying order to these clutches during three time periods during incubation. We also allowed observers to assign ties to eggs that were difficult to assign to PILS. Our results indicate that this method is inaccurate in assigning eggs to specific positions within the laying sequence and also when allowed to assign ties. Furthermore, accuracy declined with days of incubation and an increase in clutch size.

POPULATION DYNAMICS OF ARCTIC FOXES IN RELATION TO ANNUAL AND SEASONAL FLUCTUATION IN FOODS: THE RELATIVE IMPORTANCE OF SMALL MAMMALS AND GEESE

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ABSTRACT: Seasonal and annual fluctuations in food availability are common in many northern environments. Fluctuations in food abundance, in turn, affect both the abundance and distribution of animals that feed on them. However, the relative importance of seasonal versus annual fluctuations in food availability is poorly understood. Arctic foxes are opportunistic predators and scavengers that rely heavily on small mammals throughout most of their range. However, other foods such as birds and their eggs can be important in arctic fox diets in some years and parts of the arctic. We examined how large concentrations of geese (i.e. seasonally superabundant foods) and small mammal abundance (i.e. foods that fluctuate over 3-5 years) affected arctic fox abundance, density of breeding foxes, and litter size. Line-transects and den inventories inside and outside the large goose colony at Karrak Lake, Nunavut, showed that (1) the abundance of arctic foxes was predominantly affected by abundance of geese (i.e. foxes were more than twice as abundant in the goose colony than outside the colony) whereas (2) the density of breeding foxes and litter size was predominantly affected by small mammal abundance.

EFFECT OF LOCOMOTION ON GROWTH IN GREATER SNOW GOOSE GOSLINGS (*CHEN CAERULESCENS ATLANTICA*)

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Abstract: Goose families often move to specific brood-rearing areas after hatching. On Bylot Island, Nunavut, Greater Snow Goose goslings can walk over impressive distances soon after hatching (> 30 km) to reach good brood-rearing areas. Despite the potentially high energetic costs associated with walking and the exposure to cold temperatures prevailing in the Arctic, chicks grow very fast. We measured the impact of locomotion and ambient temperature on the growth of young snow geese. We raised 28 goslings hatched from eggs collected on Bylot Island in two controlled temperature chambers (8 and 20°C) in the laboratory. At each temperature, half of the goslings were imposed 6-h periods of walking on a treadmill daily (0.3 m/sec) whereas the other half was used as a control (no walking). At 40 d of age, chicks raised at 8°C were heavier than those raised at 20°C (2072 g vs 1968 g, $p = 0.054$) but goslings who walked 6-h per day had a lower mass than control individuals (1986 g vs 2046 g, $p = 0.057$). However, the difference was less marked for young raised at 8°C. This could be explained by the use of heat produced in muscles during locomotion for thermoregulation.

DO GEESE MANIPULATE THE SEX RATIO OF THEIR OFFSPRING?

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Abstract: Sex ratio manipulation in birds is highly controversial. One example of this debate occurred in studies of geese. Two factors that may have influenced conclusions of whether sex ratio manipulation occurred within geese were comparisons of primary and secondary sex ratios as well as comparisons within and across individuals. Combining these factors may have lead to confusion when addressing hypotheses associated with sex ratio manipulation. In order to address this debate we examined whether primary sex ratio manipulation occurred within individual black brant (*Branta bernicla nigricans*). Microsatellite analysis was used to determine primary sex ratio within clutches of black brant from 1996-1997 and 2002-2004. The Trivers-Willard hypothesis states that high quality parents will manipulate the sex ratio of their offspring to favor the sex with the greatest variation in reproductive output. Within black brant, juvenile males appear to have lower survival and recruitment than females and consequently are the more variable sex. Therefore we expected that high quality mothers would produce more males than low quality mothers.

FITNESS CONSEQUENCES OF CONSPECIFIC BROOD PARASITISM IN BLACK BRANT.

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Abstract: Conspecific brood parasitism (hereafter CBP) is an alternative reproductive strategy that may influence fitness of host individuals. Fitness consequences associated with CBP occur on an individual level, however no study to date has directly measured host fitness consequences associated with CBP while controlling for individual quality. We examined direct fitness consequences of CBP by determining changes in reproductive output within individuals as well as potential impacts on host survival. Microsatellite analysis was used to determine occurrence of CBP within nests from 1996-1999 and 2002-2003 within a black brant colony (*Branta bernicla nigricans*). Following, we developed a predictive function based on egg morphology and laying order that enabled us to identify when a parasitic event had taken place across a 20-year data set on the nesting ecology of black brant. By comparing breeding propensity and reproductive success within individuals before and after a parasitic event we determined direct fitness consequences of CBP. We also determined current impacts of CBP on host reproductive success by comparing clutch size, hatching success, brood rearing success, and breeding propensity of young within host's nests. Finally we compared survival of parasitized individuals to that of non-parasitized individuals to determine impacts of CBP on host survival.

LONG-TERM VARIATION IN NEST SURVIVAL OF LESSER SNOW AND ROSS'S GEESE BREEDING SYMPATRICALLY AT KARRAK LAKE, NT.

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Abstract: Lesser snow (LSGO) and Ross's (ROGO) geese nest sympatrically at Karrak Lake, Nunavut. Historically, LSGO populations at Karrak Lake grew at an annual rate double that of ROGO. Recently, ROGO have grown at a rate twice that of LSGO, offering a unique opportunity to examine why population growth (λ) differs between two closely-related yet different sized-species. Here, we focus on variation in nest survival. Nest survival is a critical component of productivity and can be affected by numerous biotic and abiotic factors, although the importance of each factor varies annually. Additionally, ROGO are of smaller body size than LSGO and so are confronted with different constraints. For example, body size influences the amount of exogenous reserves an organism can store. In this study, we model long-term (1991-2004) variation in nest survival and influential factors such as spring female condition and body size, weather, nesting densities, and nest initiation date between ROGO and LSGO. By using a comparative approach, we hope to learn how differences in nest survival in these arctic-nesting geese may differentially influence their respective rates of local λ and if life history variation dictates how each responds to annual ambient conditions on arctic breeding grounds.

THE CASE OF THE BLOODY EGG: INSIGHT INTO THE ROLE OF ECTOPARASITES IN POPULATION REGULATION

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Abstract: Density-dependent factors regulate many wildlife populations. Overpopulation of arctic-nesting goose species is of interest to biologists because of its impact on sensitive habitat. Lesser snow goose (*Chen caerulescens caerulescens*) and Ross' goose (*Chen rossii*) populations have increased at high annual rates. Food is a regulating factor for goslings on the brooding grounds; however, neither food nor predation in the arctic appears to regulate adult geese. Most parasite-host interactions result in a reduction of host densities, particularly impacting reproductive success and offspring body condition and immunity. Our study focuses on the recent discovery of blood in high prevalence on lesser snow and Ross' goose eggs at Karrak Lake, Nunavut, Canada. Evidence suggests that the blood is a product of flea parasites inhabiting goose nests. Data collected from 2000 to 2004 suggest an increase in frequency of bloody eggs; in addition, blood is linked to decreased nest success. We propose that ectoparasites may be a regulating factor that has arisen in response to increased light goose populations.

EGG DAMPING AND FAMILY STRUCTURE IN THE WESTERN TUNDRA BEAN GOOSE (*ANSER FABALIS ROSSICUS*) IN VAIGACH ISLAND, RUSSIA.

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Egg damping is very common in many species of Arctic Geese. This phenomenon has been most comprehensively described for the Lesser Snow Goose (*Anser caerulescens caerulescens*) (Syroechkovsky, 1979, Gurtovaja, 1985, Lank et al 1989). The main reason for the egg damping in Arctic colonial geese is believed to be shortage of nesting territories in years with late and cold spring. It seemed logical to think that in non-colonial species of geese that didn't suffer from such a shortage of nesting territories even in the years with late spring the egg damping wouldn't be so widely occurring as in the colonial geese. However our investigations of nesting ecology of the Tundra Bean Goose performed in Vaigach Island (70°15 N 58°47E) in 1986 – 1988 and 1995 – 1997 showed that the egg damping was very common in this species. We used the quantitative method of recognizing of the damped eggs in the geese clutches that we had devised (Syroechkovsky, Baranyuk, 2003) based on differences of egg shape and size in different geese clutches. In total 515 clutches of Bean Geese were investigated. The frequency of nests containing the damped eggs occurred to be unexpectedly high in every year of our investigation - from 17% in 1997 to 33% in 1988 and 1997. So the frequency of egg damping in the non-colonial Bean Goose appeared to be quite comparable with that in the colonial Lesser Snow Goose. However the egg damping in the two species differed in many features. First of all the frequency of egg damping in Bean Goose was not correlated with the type of spring of a given year. It was especially high both in very favorable for geese nesting 1988 and in unfavorable 1997 (33% in both years). Secondly, we did not observe in Vaigach Island any heaps of eggs or solitary eggs lying on the ground even in the years of mass egg damping. It could mean that damping eggs in other bird's nests proceeded there peacefully whereas in a colony of Snow Goose there were usually fights between birds damping eggs and hosts of the nests. Thirdly we never met more than 9 eggs in one nest of Bean Goose. It means that no more than two females damped their eggs in one nest. Finally there were substantial interspecific differences in the form of frequency distribution of clutches of different size in years of mass egg damping. While the distribution curve in Snow Goose was with the upper limit of 15 – 17 eggs thus indicating that eggs had been dumped in all the nests without choice, the curves of distribution in Bean Goose sometimes was bimodal with modes at 3 and 5 or 6 eggs. The modeling of the process of egg dumping showed that such distribution size could emerge only if eggs had been damped predominantly into nests with rather big «own» clutch size. The most logical explanation of this phenomenon is that eggs were damped into the nests of old geese whose clutch size usually is bigger than that of the young birds. Considering the above mentioned differences in egg damping between Snow – and Bean Geese and taking into consideration the fact that pairs of non-nesting geese were observed very often in nesting territories of some geese in Vaigach Island encountering no aggression from the hosts of nests (the Bean Geese are strictly territorial birds) I came to the conclusion that the egg damping in Bean Geese is regulated mostly by family relationships. I suggest that daughters making their first attempt to breed damp their eggs into nests of their mothers.

COMPARATIVE ANALYSIS OF GOSLING DIETS ON AKIMISKI ISLAND, NUNAVUT: EARLY POST-HATCH OVERLAP AND LATER POST-HATCH SEGREGATION

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Abstract: Brood-rearing geese should select habitats and plants within habitats in some optimal fashion given morphological and behavioral adaptations. Morphological and behavioral adaptations limit potential for interspecific competition among geese. On Akimiski Island, Nunavut, researchers have argued that competition with an increasing breeding colony of Lesser Snow Geese (hereafter LSGO), may be the cause of poor growth and first-year survival of Canada Goose (hereafter CAGO) goslings. Our objectives were to compare spatial and temporal variation in CAGO gosling food habits and variation in food habits related to goose species in an area where CAGO and LSGO broods were synoptic. We collected 180 goslings ($n_{\text{CAGO}} = 120$, $n_{\text{LSGO}} = 60$) distributed among three sample periods (age classes) and two areas. Preference by CAGO goslings for certain plant foods (i.e., *Festuca rubra*, *Carex subspathacea*, *Puccinellia phryganodes*, and *Triglochin maritima*) was similar between areas, but differed with gosling age. Though differences in diets due to goose species were detected, the relative ranks of plant foods were generally similar between species. Our results are suggestive of competition and we offer that present foraging conditions are insufficient to meet energetic demands of CAGO goslings particularly in the area of syntopy.

FEEDING ECOLOGY OF GREATER SNOW GOOSE (*CHEN CAERULESCENS ATLANTICA*) GOSLINGS IN UPLAND TUNDRA ON BYLOT ISLAND, NUNAVUT

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Abstract: Although geese prefer wetland habitats during brood-rearing, a significant amount of feeding also occurs in uplands where their feeding ecology has been little studied. We assessed the diet of Greater Snow Goose goslings in upland tundra using two techniques: oesophagi contents of wild goslings (N = 67) and behavioural observations of 16 human-imprinted goslings on Bylot Island. Human-imprinted goslings allowed us to use a rigorous factorial sampling design to assess the impact of plant communities and date of the season on goslings' diet whereas wild goslings were used to validate the diet obtained with captive ones. A total of 35 vascular plant species were found in the diet with about 75% of the items being leaves and the rest mostly flowers. Gramineae were the main food item (48% for captive and 53% for wild goslings). Captive goslings also consumed many Leguminosae in communities where those plants were abundant (39%). Juncaceae (captive 18%, wild 8%), Polygonaceae (captive 4%, wild 16%), Caryophyllaceae and Crucifereae (<5% each) were also eaten. The diet varied seasonally as goslings consumed 5 times more Gramineae in late summer than earlier in the season and the number of plant taxa eaten decreased over time, presumably because goslings gained experience.

USING STABLE ISOTOPES TO TRACK LESSER SNOW GOOSE DISPERSAL AND HABITAT USE AT LA PEROUSE BAY, MANITOBA

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Although geese are keystone species in arctic ecosystems, habitat selection by geese during brood-rearing is poorly understood. Overpopulation of lesser snow geese (*Chen caerulescens*) in the Hudson Bay region has degraded most preferred salt marsh habitat and this may force geese to use less preferred freshwater marsh habitat during brood-rearing which likely affects their fitness. We used naturally occurring stable isotopes in forage plants and goose tissues to test this hypothesis. During summer 2004, a total of 27 plant species and 130 goslings were collected from salt marsh and freshwater marsh habitat at La Pérouse Bay, Canada. These plant and animal samples were dried, finely ground, and their carbon and nitrogen signatures were measured. Nitrogen but not carbon signatures of freshwater and salt marsh plant species collected at a given site were significantly different, and isotope signatures of two plant species were significantly different between sites. Carbon signatures of liver and leg muscle from goslings collected in freshwater marsh were significantly more enriched than tissues from goslings collected in salt marsh. The difference in carbon signatures of liver and leg muscle from goslings collected in freshwater and salt marsh sites was greater in older goslings compared to younger goslings. Nitrogen signatures of liver and leg muscle from goslings collected in freshwater marsh were similar to those from goslings collected in salt marsh. Nitrogen signatures of liver and leg muscle became significantly more enriched with age of gosling while carbon signatures of these tissues became significantly more depleted. Our results suggest that environmental inputs other than salinity must be important in determining carbon and nitrogen signatures in sub-arctic plants of Hudson Bay, and carbon but not nitrogen signatures of food plants must be different between the two habitats where goslings were collected. Thus, stable isotope signatures of gosling tissues may indicate patterns of habitat use during gosling growth although our understanding of the causes of spatial and temporal variation in isotope signatures in forage plants currently limits our ability to interpret these patterns in gosling tissues.

EELGRASS RESPONSE TO SIMULATED GRAZING BY BLACK BRANT

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Abstract: Black brant geese (*Branta bernicla nigricans*) forage almost exclusively on eelgrass (*Zostera marina*) along the Pacific flyway during their spring migration. The abundance and vitality of this resource has an important role in the success of the population. The grazing optimization model predicts an increase in net primary production of leaf biomass with moderate levels of grazing, exceeding that of ungrazed plants. A pilot study in 2003 confirmed that clipped eelgrass in Humboldt Bay, California did overcompensate. I will present results of our current study including above and below ground biomass, shoot primary production, and nitrogen content of leaves from manipulated plots. Plot treatments include simulated grazing, simulated grazing + feces, control, and feces fertilizer. If brant manipulate eelgrass quality and quantity, then grazing will have a positive effect on eelgrass and brant will benefit from foraging on previously grazed eelgrass when regrowth is optimal.

FOOD AND FEEDING ECOLOGY OF FOUR SYMPATRIC GEESE SPECIES ON THE COASTAL PLAINS OF SOUTH CHUKOTKA

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Key words: Geese, Feeding ecology, Food resources

Four geese species inhabit coastal plains of South Chukotka with extensive overlap in their main feeding areas. Data on geese feeding ecology have been collected in 3 different sites in 1991-1994 and in 2001. The data were collected separately for the pre-nesting, nesting, brood-rearing and molting periods, droppings were analyzed following the method of Owen (1976).

White-fronted Geese (WFG) showed clear shift from extensively used non-renewable to intensively used renewable food resources in upland habitats from May-June to July-August. But this shift was not so prominent in their coastal populations and in all populations of Emperor Geese (EG). The main feeding habitats of WFG during brood rearing were *A.fulva*, *C.subspathacea* and *E.arvense*, while for the moulting WFG and for EG the important food sources were *C.cryptocarpa* and *P.phryganodes*. In general the diet of EG were wider in compare to WFG, while they were more limited in distribution.

Black Brant showed marked differences in the food composition and the important part of the diet were aquatic plants *C. aquatilis*, *A.fulva*, *R.pallasii* and *P. filiformis*.

The diet of Bean Geese is marked by clear dominance of *E.arvense*, *A.fulva*, and Carex heads, and that was quite close to WFG diet in the upland habitats.

HABITAT USE AND FORAGE QUALITY BY A NEOTROPICAL GRAZER: THE ORINOCO GOOSE (*NEOCHEN JUBATA*) IN VENEZUELA

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Abstract: Most geese utilize Arctic habitats with nutrient-rich vegetation (25+% protein) for breeding. In contrast, nutrient-poor soils and plants characterize tropical savannas, suggesting that waterfowl with a goose-like ecology could not inhabit the tropics. Orinoco Geese (*Neochen jubata*), one of eight sheldgeese (*Tadorini*), however, occur in the Neotropics and breed during the dry season, when nutrient levels in most plants are at their lowest. It remains unclear how they have adapted as grazers in a nutrient-poor environment. Using arctic geese for comparison, this project describes habitats utilized by Orinoco Geese in southern Venezuela, assesses forage quality during breeding, and evaluates the impact of grazing on forage quality and availability. Orinoco Geese were observed 90.9% of the time in a short-grass habitat (cespitoso) near open water that comprised only 1.2% of the habitat at my study site. Forage availability declined throughout the study area as the dry season progressed. In contrast, protein content of the three grass species that dominated the habitats where Orinoco Geese were observed grazing was higher (16.6-19.3%) than in similar habitats where geese were absent (8.0-10.5%), suggesting that Orinoco Geese were selecting grazing sites based on forage quality. Grazing by Orinoco Geese and capybara (*Hydrochaeris hydrochaeris*) reduced plant availability but had no effect on plant protein concentrations. Plants that were grazed, however, had lower concentrations of acid-detergent fiber than plants that were not grazed. Conservation efforts to protect populations of Orinoco Geese, therefore, should protect existing cespitoso habitat and establish flooded savannas and permanent water sources that promote the growth of higher-quality forage during the dry season.

FIELD CHOICE OF ALEUTIAN CANADA GEESE IN RELATION TO FOOD QUALITY AND HABITAT MANAGEMENT AT HUMBOLDT BAY NATIONAL WILDLIFE REFUGE.

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Abstract: Since the late 1990's Aleutian Canada geese (*Branta canadensis leucopareia*) spring staging in northern California have become agricultural pests by grazing livestock pastures. The most satisfactory solution appears to be the creation of highly managed refuge areas or alternative feeding areas. The Humboldt Bay National Wildlife Refuge is attempting to increase the quality of habitat for goose foraging on the refuge. The work described here was a field experiment to investigate the interaction between food quantity and quality of grass swards, and how this influences their use by Aleutian Canada geese. During February through April 2003-2004 goose grazing intensity was quantified using dropping counts in two treatment areas. One Treatment area was livestock grazed and the other was mechanically hayed. Sward surface height and grass crude protein levels were quantified for each field. Overall use of the cattle grazed areas was much higher than in the mowed areas. Crude protein levels in grass were higher in cattle grazed areas than in mowed areas. Once the sward grew >12 cm geese were no longer seen feeding in those areas. Applications of this research for the management of Aleutian Canada goose refuges are discussed.

THE ALEUTIAN CANADA GOOSE STORY FROM ENDANGERED TO EXPLODING

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Abstract :The Aleutian Canada goose (*Branta canadensis leucopareia*) is a subspecies of the Canada goose that migrates from summer breeding areas in Alaska to major winter foraging areas in California. In 1967 the Aleutian Canada goose population was estimated at only a few hundred individuals. It was one of the first species to be put on the endangered species list and also one of the greatest success stories of the ESA. The U. S. Fish and Wildlife service has been intensively monitoring this goose population since 1975 when the Aleutian Canada goose recovery program began. Throughout the 1990's the Aleutian Canada goose population increased rapidly at an average rate of 20% per year. In 2001 the species was considered recovered and removed from the endangered species list. The spring 2004 population was estimated at more than 70,000 geese. Coastal pastures in Northern California and Southern Oregon serve as feeding grounds for spring staging geese as they prepare for their return to the breeding grounds. The majority of these pastures are in private ownership. Increasing populations of geese using these pastures is currently causing conflicts between local private landowners and geese.

THE GREATER SNOW GOOSE: A NEW SUSTAINABLE AND INTEGRATED MANAGEMENT PLAN.

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Abstract: The Greater Snow Goose (GSG) spring population has increased from less than 50,000 birds in late 1960's to about 800,000 in 1998, representing at that time, a population growth rate of about 9% per year, due to change in land use on the wintering and staging grounds, and climate warming . It was then predicted that the population would reach more than 1 million birds by 2002 if no management actions were taken. Consequently, on the basis of the recommendations of the AGJV-GSG Habitat Working Group, the Canadian Wildlife Service (Québec region) launched in spring 1999 an Action plan aiming at stopping the growth of the population. A stabilization of the population was observed, the Plan implementation was a success, both in terms of results achieved and of partnerships formed, but overabundance conditions are still present.

Therefore, the current issues are 1) to review and refine the management objective, 2) adapt our actions to new circumstances, and 3) implement a new management framework that is not only integrated (ecological integrity of natural marsh habitat, crop damages, economic impact of hunters and bird observations, etc.) but sustainable.

The basics conditions of this new sustainable and integrated management plan is to maintain a healthy GSG population, with an clear objective population that is recognized by all, based on a adaptive population management, with a target population that lean on biological and social carrying capacities, an optimal management of natural habitat and preventive crop damage programs.

EVIDENCE OF SOURCE-SINK DYNAMICS IN A SUBURBAN CANADA GOOSE (*BRANTA CANADENSIS*) POPULATION

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City University of New York Ph.D. Program in Biology

ABSTRACT: To study population structure and dispersal, Canada Goose goslings were banded between 2000 and 2004 with red tarsal bands in Rockland County, New York. A matrix of dispersal probabilities where 95% of dispersal events occurred (subpopulations) was created showing seven subpopulations. There is a high level of movement within subpopulations and low-levels of immigration and emigration. The Hackensack River Population (HRP) is within the Town of Clarkestown, which has an active management program. Lethal takes in the past have eliminated local goose flocks and the egg addling program has been highly successful in reducing gosling production. The HRP has the lowest gosling production, highest immigration and low emigration rates, while subpopulations with high gosling production have higher emigration and low immigration. Despite the management program, the population in the HRP has remained stable since the lethal takes. Management in HRP has created a sink into which birds are dispersing. A metapopulation model is being developed to predict the effects of a source-sink system on the countywide goose population and to determine the feasibility of using these dynamics to manage geese at a regional level.

ESTIMATING IDENTIFICATION ERROR FOR SIMILAR SUBSPECIES: DISTINGUISHING TULE GREATER WHITE-FRONTED GEESE IN THE PACIFIC FLYWAY

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Abstract: Identification error is a source of bias for estimating population sizes of similar subspecies. We estimated identification error for Tule greater white-fronted geese (*Anser albifrons elgasi*) with a double-observer survey. We used a Bayesian approach adapted from medical research to compare results from two observers examining the same geese. We estimated probabilities of an observer correctly classifying a greater white-fronted goose as a Tule or Pacific (*A. a. frontalis*) subspecies. The approach uses a multinomial distribution with cell probabilities corresponding to rates of correct and incorrect identification. We used the WinBUGS program to conduct Markov Chain Monte Carlo simulations to estimate these rates. Bayes' rule was applied to estimate correct identification conditional on the observers' classification. We had observers with limited experience conduct field tests along Tule survey routes in the Central Valley in the early spring of 2004. Among birds classified as Tule geese, the analysis indicated that 87% (SE = 11%) of birds were likely Tule geese. Among birds classified as Pacific geese by both observers, an estimated 8.4% (SE=8.9%) were likely Tule geese. These estimates may be improved by including observer experience levels and another classification level (birds with "intermediate" characteristics) in a multidimensional model.

WASHINGTON BRANT FOUNDATION: PRESERVING BRANT LEGACY ON OUR PACIFIC COAST

Maynard Axelson. Washington Brant Foundation, 15758 Fir Island Road, Mount Vernon, WA 98273

Washington Brant Foundation is a non-profit organization involved in education, research, and habitat enhancement programs for marine waterfowl. Our focus is brant due to their singular dependence on specific dwindling estuarine areas along the Pacific Coast.

In April 2005, we will host our third annual Brant Festival near Blaine, WA to mark spring migration through this important staging area. Presentations at local schools, conservation groups, and the Padilla Bay Estuarine Reserve have been ongoing. Since 2002 WBF's website has received more than five thousand visits. Future goals include specific research, as well as habitat preservation or enhancement projects here in Puget Sound.

The Foundation board believes heightened awareness of brant needs will lead to less degradation, disturbance, and loss of habitat for them and other marine species. Please consider joining our quest to preserve and perhaps enhance this distinctive part of our marine heritage.

RESPONSE OF GREATER WHITE-FRONTED GEESE TO THE CENTRAL VALLEY JOINT VENTURE: CHANGE IN WINTERING ECOLOGY OVER A DECADE

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Abstract: We investigated the response of Greater White-fronted Geese (*Anser albifrons frontalis*) to the Central Valley Joint Venture by comparing goose movements, distribution, and habitat use during the winters of 1987–1990, before major habitat changes occurred, and 1998–2000, after a decade of habitat change. Using radio telemetry, we tracked 192 female geese and recorded 4,516 locations. Geese traveled shorter distances between roosting and feeding sites during 1998–2000 (24.2 ± 2.2 km) than during 1987–1990 (32.5 ± 3.4 km). Population range size was more concentrated during 1998–2000 ($3,367$ km²) than during 1987–1990 ($5,145$ km²), despite a 2.2-fold increase in population size. Distributions of geese differed between decades; geese shifted into basins with the greatest increases in rice production (American Basin) and out of other basins (Delta Basin). Use of rice fields for roosting (1987–1990: 40%, 1998–2000: 54%) and feeding (1987–1990: 57%, 1998–2000: 72%) increased between decades, whereas use of wetlands declined. Within post-harvested rice fields, geese roosted and fed primarily within burned rice fields during 1987–1990 (roost: 43%, feed: 34%) whereas they used flooded rice fields during 1998–2000 (roost: 78%, feed: 64%). Our results indicate that geese have altered their spatial use of California's Central Valley in response to recent habitat changes related to the Central Valley Joint Venture and current agricultural practices.

HEART RATES OF TULE GREATER WHITE-FRONTED GEESE IN RESPONSE TO HUMAN DISTURBANCE USING RADIO TELEMTRY

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Abstract: We monitored the heart rates of free-living Tule Greater White-fronted Geese (*Anser albifrons elgasi*) during human disturbances on their wintering range in the Sacramento Valley of California during 1997. We used implanted radio transmitters to record the heart rates of geese as an observer experimentally approached them at a constant walking speed. Change point regression was used to identify the point in time when heart rate abruptly increased prior to flushing and when heart rate began to level off in flight after flushing. Heart rate increased as the observer approached the radio-marked goose, from 114.1 ± 6.6 beats/min during the observer's initial approach to 154.8 ± 7.4 beats/min just prior to flushing at the first change point. On average, goose heart rates began to increase most rapidly 5 sec prior to taking flight, and continued to increase rapidly for 4 sec after flushing until they reached flight speed. Heart rate was 456.2 ± 8.4 beats/min at the second change point, which occurred immediately after flushing, and 448.3 ± 9.5 beats/min a minute later during flight. Although heart rates of geese increased as an observer approached, the largest physiological change occurred during a 9-sec period (range: 1.0–15.7 sec) immediately before and after flushing when heart rates nearly tripled.

GIZZARD CONTENT AS EVIDENCE OF BLACK BRANT STAGING AREAS

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Abstract Black brant (*Branta bernicla nigricans*) migrate every year from their breeding grounds in Alaska, south to the bays of Mexico, and then stage within bays along the coast of California, Oregon, Washington, and British Columbia on their return migration north. At each of these locations brant feed primarily on eelgrass (*Zostera marina*) and use specific sites to ingest grit to aid in digestion. The rate of passage of grit may be frequent, but residual rock and mineral material will yield evidence of previous staging areas visited by a particular Black brant. The objectives of this study are to 1) create a baseline reference of rock and mineral composition for confirmed grit ingestion sites at known Black brant staging bays, 2) analyze gizzard content of Black brant obtained from Humboldt Bay for residual rock and mineral fragments to compare to other bays, and 3) conduct band observations to find how many resightings could be obtained for potential future studies that would involve comparison of gizzard content of brant that have been in Humboldt for a known duration of time.

SPATIAL AND TEMPORAL PATTERNS OF LAKE USE BY MOLTING GEESE IN THE TESHEKPUK LAKE SPECIAL AREA

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The Teshekpuk Lake Special Area (TLSA) in northern Alaska contains approximately 200 lakes used annually during wing molt by up to 100,000 geese representing 4 species. Aerial surveys of these lakes during July were conducted during 1976-1978 and 1982-2004. High annual variability in counts exists as migration to the TLSA for wing molt is dependent on reproductive success in other areas, particularly for Black Brant. Despite such variability, notable patterns emerge in goose use of the TLSA. Black Brant are distributed more in the eastern portion of the TLSA, Greater White-fronted Geese in the western portion, and Canada Geese evenly distributed throughout. Coincident with a large increase in numbers of white-fronted geese (7-fold), the distribution of brant is shifting more easterly. Canada Geese and Black Brant have remained relatively stable throughout the survey, and Snow Geese occur in very small numbers, but have begun an exponential increase. Habitats are changing due to water level fluctuations, coastline erosion, and salt-water intrusion into drained lake basins. In 2004, we initiated studies of how habitats are changing and its correspondence with goose distribution. In particular, we are assessing whether distributional changes in Black Brant are related to competitive exclusion by White-fronted Geese or shifts in optimal foraging habitat.

Brant in Ontario and Western James Bay

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Abstract: A significant proportion of the Atlantic Brant (*Branta bernicla hrota*) population uses western James Bay enroute between the US Atlantic coast and the eastern Canadian Arctic. One-day spring surveys counted up to 24,000 birds, mostly in salt marshes. Peak numbers occur from mid May to mid June. Historically, brant use offshore eel grass habitats in fall. Fall aerial surveys in the 1970s and 1980s, although not designed to count brant offshore, regularly tallied more than 10,000 birds; one-day ground count of migrants yielded an estimate of 40,000. Brant arrive as early as the third week of August and stay until late October. South of James Bay in Ontario, migration is often nocturnal and relatively small numbers are seen regularly in Lake Ontario, Lake Erie, the Ottawa Valley, and Lake Temiskaming, from mid April to late May and from mid October to early November. In exceptional years, brant are more widely dispersed throughout Ontario, possibly related to food or weather events. Brant are not established as a breeder in this region. The objective of this presentation is to provide a synthesis of the information available on the occurrence and status of brant in Ontario and western James Bay since the 1950s.

ABUNDANCE AND DISTRIBUTION OF SPRING-STAGING LESSER SNOW AND ROSS'S GEESE IN NEBRASKA'S RAINWATER BASIN

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The number of lesser snow (*Chen caerulescens*) and Ross's (*Chen rossii*) geese (hereinafter light geese) staging during spring in the Rainwater Basin (RWB) region of southcentral Nebraska has dramatically increased since the late 1980s. However, there has been no documentation as to abundance or distribution of light geese across the RWB and the relationship of distribution to conservation order activities. We used aerial transect surveys and distance sampling methodology to estimate abundance and distribution of light geese in the RWB in springs 2001-2003. In 2001 at peak migration, we estimated approximately 7.3 million light geese to be in the RWB. There were approximately 1.2 and 1.6 million light geese at peak migration in 2002 and 2003, respectively. Distribution did not appear to change in relation to conservation order activities. However, there was an increased use of the Platte River Valley during 2002 and 2003 due to drought. The RWB has become a major spring staging area for light geese. Abundance and distribution appears to be related to water conditions and migration chronology.

OPTIMAL GRIT ACQUISITION BY BLACK BRANT

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Abstract: Brant (*Branta bernicla nigricans*) arriving at spring stopover areas are under energetic demands to build-up endogenous nutrient reserves for migration and breeding efforts. To understand how brant meet these demands, research has focused on questions relating to foraging efficiency, feeding site selection, and disturbance. Little attention has been given to the importance of gritting sites at staging areas. Grit facilitates the mechanical breakdown of ingested plant materials, aiding efficient digestion and potentially playing a significant role in the daily energy budget decisions made by brant. We investigated whether brant obtained grit in an optimal manner at the primary gritting site in Humboldt Bay, CA. We will present comparisons of brant attendance, distribution, and flock behaviors with GIS-interpolated values of sand grain size and percent calcium carbonate of grit at the site.

TITLE: BARNACLE GOOSE MOVEMENTS AND FIDELITY AMONG SITES

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Abstract: Relative fighting ability or social status may influence the distribution of unequal competitors. In goose societies, dominant birds may experience enhanced foraging opportunities, resulting in improved reproductive success. As arctic-breeding geese migrate towards their breeding grounds, spring staging areas provide feeding opportunities that are crucially important to reproductive success. We studied spring staging site fidelity and movement of barnacle geese (*Branta leucopsis*) on three islands of differing habitat quality. Yearlings and young-adults had the highest movement probabilities in every case, with movements being least likely in adults. Site fidelity probabilities varied, with the New (high quality) site having the highest site fidelity probabilities, while Degraded and Control sites had much lower fidelity for all age classes. The probability of changing spring staging site decreased with age, body size, and reproductive success in the previous season. Our results show that young geese are most likely to cause the shift in distribution when habitat quality deteriorates, while older geese tend to remain in traditionally used sites.

MOLT MIGRATION IN RESIDENT CANADA GEESE

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Abstract: Molt migration is thought to provide nonbreeding geese access to safe habitats with less competition for rich resources which enables a successful annual molt. The function of enabling permanent dispersal into new populations has not been emphasized in describing this phenomenon. Canada geese in the lower 48 states, although labeled resident, have been known to move long distances during molt migrations. Eighteen percent of our population of western Canada geese breeding in California has moved as far north as Alberta, Canada (~2000 km north). We present results from an analysis of phenotypic and life history characteristics of individuals involved in these movements compared to residents. Dispersers consisted of young birds less than 2 years (79%) and adults (21%) ranging from 2-15 years of age. In addition to nonbreeders, entire families (adults with fledged young) are involved in these movements. Sixty percent of the migrants originated from dense nesting colonies thought to be at carrying capacity. Birds originating from small families did not move more than those from large families. We will present results regarding site fidelity and movement from an analysis of mark and recapture data. These movements by so called resident Canada geese may act as a source for other migratory populations.

FLOCK SIZE AND FIELD USE OF ALEUTIAN CACKLING GEESE DURING SPRING STAGING

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Abstract: The Aleutian cackling goose (*Branta hutchinsii leucopareia*) (Aleutians from here on) is one of four living races of cackling geese. Aleutians have extended their traditional spring staging area to Loleta, CA and Arcata, CA(40°53'N, 124°07'W). A total of 31 days were spent collecting data between 9 February and the 11 April 2004. Flock size and locations at sunrise, midday, and sunset were recorded every other day while the geese were present at the study site. Average flock size for sunrise, midday, and sunset time periods were 260, 126, and 436 respectively. There was significance difference between sunrise and midday time periods (df = 2, p < 0.01, and F = 7.72), sunset and sunrise time periods (df = 2, p < 0.01, and F = 7.72), and midday and sunset time periods (df = 2, p < 0.01, and F = 7.72). Total number of fields used peaked in the midday time period with 180 fields. Significance was found between the sunrise and midday time periods (df = 2, t = 8.14, and p = 0.015), and sunset and midday time periods (df = 2, t = 8.14, and p < 0.01). This study suggests that with the rapid increase in Aleutian population numbers any available habitat needs to be set aside under a CRP type program for their continued growth.

Priority sites for waterfowl in Mexico

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Abstract: A set of priority sites for waterfowl conservation in Mexico was determined using contemporary count data (1991-2000) from the U.S. Fish & Wildlife Service mid-winter surveys. We used a complimentary approach implemented through linear integer programming that addresses particular conservation concerns for every species included in the analysis and large fluctuations in numbers through time. A set of 31 priority sites was identified, which held more than 69% of the mid-winter count total in Mexico during all surveyed years. Six sites were in the northern highlands, 12 in the central highlands, six on the Gulf of Mexico coast, and seven on the upper Pacific coast. Twenty-two sites from the priority set have previously been identified as qualifying for designation as wetlands of international importance under the Ramsar Convention and 20 sites are classified as Important Areas for Bird Conservation in Mexico. We also present population trends of 24 waterfowl species in Mexico. The information presented here provides an accountable, spatially-explicit, numerical basis for ongoing conservation planning efforts in Mexico, which can be used to improve existing waterfowl conservation networks in the country, and can also be useful for conservation planning exercises elsewhere.

HISTORY AND CURRENT TRENDS OF GRAIN SORGHUM PRODUCTION AND WINTERING GEESE IN TAMAULIPAS, MÉXICO.

Yépez Rincón, Fabiola D. Universidad Autónoma de Tamaulipas

ABSTRACT: Tamaulipas, Mexico contains important North American wintering habitats for a large population of Snow Geese (*Chen caerulescens*) and White-fronted Geese (*Anser albifrons*), and also ranks first in sorghum production within the country. This agricultural activity, coupled with associated irrigation and construction of reservoirs, supports this wintering goose population. This study was held from October 2001 to March 2002 in 3 study areas of 900 Km² each, located in north, central and southern Tamaulipas. [1] It determined seasonal and land tenancy availability of waste sorghum. [2] The study also document and evaluate the agricultural history, goose population density and land-use practices of the state and [3] finally estimated goose numbers in association with sampling of waste sorghum fields. Results indicated that there was a difference in waste sorghum among the study areas. The relationship between goose numbers and the total area of harvested sorghum during the same period was significant, and adding the area of harvested corn was higher significant. There was no difference in waste sorghum based on land tenancy, but there was an interaction of land tenancy and study area. A historical comparison of goose populations in Tamaulipas revealed that the change began in 1970s which is related also to the increasing grain crop area in the state. Overall, policy and management of natural resources in Mexico have affected the future of winter habitats for waterfowl, and especially affected goose wintering habitats in Tamaulipas.

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