

ABSTRACTS OF PAPERS ON SHOREBIRDS GIVEN AT THE AOU MEETING, NEW YORK, 26 - 30 SEPTEMBER 1983

Genetic variation in some shorebird populations: implications for studies of migratory species

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Levels of genetic variation in 9 species of *Calidris* were determined using starch gel electrophoresis. There are considerable differences in the amount of variation expressed within various species, but the general conclusion emerges that these sandpipers possess comparable genetic variation to that found within other vertebrate species. Two samples of migratory White-rumped Sandpipers, collected at James Bay in Canada and the other near Camarones in Patagonia, can be distinguished on the presence or absence of 9 unique alleles, suggesting that they are from different breeding populations. Further sampling is required to substantiate these findings, but it appears that different populations of migrants can be characterised broadly with specific genetic markers. Biochemical genetic techniques will likely find increasing application in the recognition, management and conservation of populations of migratory shorebirds.

Sex roles during daylight incubation in Wilson's Phalarope (*Charadrius wilsonia*)

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Sex roles during daylight incubation were documented by 900 hr of observations at a total of 16 nests of Wilson's Plover on the coast of Texas. A marked diurnal pattern in sex roles was found: most of the incubation was done by the female until the late afternoon, and by the male from then until dark. Sex roles also varied between stages of incubation, with males doing more during clutch completion and hatching and less incubation during the middle stage. Using data for whole days from the middle stage, males did an average of 25% of the incubation done by the pair, and the male did more than 50% in only 1 of 14 pairs. This indicates that males did significantly less incubation than females (binomial test). Sex roles in incubation were consistent in the same pair on different days, but roles differed significantly between pairs. Possible reasons for the greater female share of incubation, and the variability in male share of incubation, are discussed in relation to the monogamous mating system of this species.

Vegetative interference: a factor affecting Long-billed Curlew (*Numenius americanus*) foraging success

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I monitored curlew foraging activity and sampled the invertebrate prey base on the Black Canyon Planning Unit in Southwestern Idaho during the incubation period 1982. Results from the different methods used to sample the prey base were very dissimilar in kinds, size and numbers of items captured. Numbers of items captured by sweep netting was correlated with grass height, ($r=0.74$, $P=0.01$), however numbers of items captured by pit traps or on sticky boards did not vary with height. Density of potential prey is greatest in areas with tall grass. Curlews captured all prey items and spent most of their foraging time in short grass relative to the height availability continuum ($X^2=291.7$, $P=0.001$, and $X^2=157.9$, $P=0.001$). Curlews realize a greater capture rate in areas characterized by short grass even though prey density was greater in areas with tall grass. Apparently curlews have adapted to seasonal succession of grass height in rangelands and adjust timing of breeding phenology, ontogeny of the juvenile bill, as well as habitat selection and foraging behaviour to assure high capture rates.

Are shorebirds marine birds?

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Shorebirds nest on all continents, in many habitats from dry deserts to wet marshes, and in temperate, tropical and tundra biomes. There are differences among families in breeding and wintering habitats, and in the degree they are migratory. Some families are entirely coastal (Dromadidae, Chionididae, and Haematopodidae), others are entirely inland nesters (Pluvianellidae, Pedionomidae, Ibidorhynchidae). The two largest families have most species nesting inland: Charadriidae (53%) and Scolopciidae (66%). Similar differences exist in winter habitat selection: all species of Dramadidae, Chionididae, Pluvianellidae, and Haematopodidae always or sometimes winter along the coast, while all species of Pedionomidae and Ibidorhynchidae always occur inland. In general more species of Scolopacids are migratory (85%) compared to the Charadriomorphs (41%).

How incubating White-rumped Sandpipers respond to weather

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In the arctic-nesting White-rumped Sandpiper only females incubate. They make many off-nest feeding trips, whose frequency follows a daily cycle peaking around mid-day. White-rumps adjust their daily attendance schedule to take advantage of thermally optimal conditions (with respect to metabolic costs and foraging). Here, I contrast birds' responses (measured as inattendance/h) to immediate weather conditions with their responses to weather at past and future times. In multiple regression models, lags and leads in weather of 12 and 24 hours explain behavior as well as current conditions. This pattern cannot be attributed solely to day-to-day similarities in weather. Behavior is most closely correlated with solar radiation. Birds seem to respond to solar radiation, using it as a "rule of thumb" to schedule foraging trips, because it most accurately predicts, over the long term, the time of day at which temperature is a maximum.

Sexual dimorphism and differential niche utilization in Wilson's Phalarope in fall migration

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After breeding, Wilson's Phalaropes concentrate at several major staging areas in the western United States, where they molt and feed prior to making a non-stop migration of 3000 miles to South America. From mid-June to mid-August approximately 120,000 adult Wilson's Phalaropes stage at Mono Lake, California. Individual birds remain for about 6 weeks, during which time they undergo a nearly complete molt and lay on huge fat deposits. Overlapping these activities requires large amounts of energy. At Mono Lake, only two types of prey are available, and male and female phalaropes show strong differences in foods taken and in foraging behavior. The larger females feed largely, though not exclusively, on brine shrimp, while the smaller males feed mainly on brine flies. According to current ecological theory, sexual differences in foraging behavior have evolved to alleviate intra-specific competition for food, and the phalaropes would seem to offer an outstanding example of differential niche utilization. Things are rarely so simple.

Sexual size dimorphism in shorebirds

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Size dimorphism in birds has generally been discussed in terms of species with polygamous mating habits and of raptors, in which reversed size dimorphism (RSD) is usual regardless of mating system. The RSD of raptors has been thought to have a different origin from that in other groups of birds. We studied size dimorphism in shorebirds, which exhibit great diversity in dimorphism with M/F ratios as great as those found in other birds, a complete range of mating systems, including polyandrous and lekking species, and a diverse array of foraging behavior. Dimorphism in monogamous and polygynous species may be normal, reversed, or lacking. Dimorphism in polyandrous species is always reversed. Dimorphism is uncorrelated with the foraging ecology of the species. Our main hypothesis is that RSD in shorebirds is associated with acrobatic aerial display in intermale aggression and perhaps in courtship and with polyandry. Our hypothesis seems applicable to birds in general.

Comparisons of Whimbrel Foraging and Food Resources at Different Phases of Their Migratory Cycle

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Foraging rates, success and effort in handling are compared in Whimbrels on their breeding, fall migratory and wintering grounds. Since food resources differ in the various sites (berries, insects and crabs), they are analyzed on the bases of energy, protein, carbohydrate and lipid content to allow direct comparison. Also, special characteristics of the food resources, like CaCO₃ content and prey defenses, are considered. These data are then used to adjust the interpretation of Whimbrel foraging behavior and the relative difficulty of foraging at the various phases of the migratory cycle. Ramifications of this study on our understanding of shorebird migratory life history are discussed.

Constraints on Shorebird Morphology: Phylogenetic Allometry in the Tringinae

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Seven hundred and ninety-five study skins of 30 species (43 races) in the subfamily Tringinae, from the American, National, and Field Museums of Natural History were analyzed for Phylogenetic allometry. Highly significant regressions show proportional allometric scaling in culmen, wing, and tarsus measurements in the Tringinae. Each genus represented by two or more species (*Numenius*, *Limosa*, *Tringa*, *Actitis*) is consistent with the trend. These data suggest that evolutionary design of Tringinae gross morphology has been restrained either by a successful adaptive design or by "engineering" constraints. Thus the evolution of species and races in this group has resulted in differential scaling of body size, and this is discussed in the context of shorebird foraging ecology. Species and race classification and sexual dimorphism in the Tringinae are also evaluated in the context of morphology.

Seasonal changes in activity patterns, prey capture rates, and weights of wintering Sanderling (*Calidris alba*)

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Seasonal changes in Sanderling prey capture rates, time budgets and weights were examined throughout the non-breeding season at Bodega Bay, Ca.. Sanderlings spent more time roosting in fall than in winter. In fall, adults spent more time roosting than juveniles. Sanderling prey capture rates were higher in fall and spring than in winter. When feeding on tidal flats, prey capture rates varied inversely with tidal height. In mid-winter, prey capture rates were higher on tidal flats than on exposed beaches. Sanderling weights paralleled seasonal changes in feeding rates and activity patterns; birds were heaviest in fall and spring and were lightest in winter. These results indicate lowered food availability in winter and imply birds may have difficulty balancing their energy budgets during part of the non-breeding season.

Going to extremes: why do Sanderlings (*Calidris alba*) migrate to the Neotropics

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Sanderlings breed within a small latitudinal range in the arctic while spreading in winter virtually throughout temperate and tropical marine beaches of the world. Hemispheric-wide censuses in the New World indicate that densities on the Atlantic coast in winter are consistently lower than those at the same latitude on the Pacific Coast. The largest wintering populations occur along the coast of the Humboldt Current in Peru and Chile. Comparisons of weights and time-activity budgets near the northern and southern ends of Sanderling winter distribution on the Pacific Coast indicate that resource conditions are more favorable for individuals in the south.

Wintering behavior of Lesser Golden Plovers (*Pluvialis dominica fulva*) in Hawaii

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A population of plovers (many color-banded) wintering on Oahu was about evenly divided between territorial and non-territorial birds over four consecutive seasons. This behavioral duality appears to be established in juveniles during their first wintering season. Thereafter, the mode of behavior selected probably remains fixed for life. Empty territories often were vacant for one or two seasons with no indications of non-territorial birds switching to territorialism. Survival rates were similar between the two groups. The species may be in a period of genetic transition associated with habitat modification. Land-clearing, generally favorable for the plover, began with the coming of the ancient Hawaiians about 400 AD and continues to the present. Perhaps territoriality is more apt to be expressed amidst an abundance of open environments. Alternatively, territoriality may have had greatest survival value when resources were restricted, and non-territoriality may be a recent response to lessened competition as suitable habitats expanded.

Interactions between Western and Semipalmated Sandpipers on breeding grounds

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At Cape Krusenstern, Alaska, both Western Sandpipers, *Calidris mauri*, and Semipalmated Sandpipers, *C. pusilla*, nest at approximately equal, high densities. Foraging habitat types, foraging microhabitats, and breeding season prey were virtually identical for the two species. Nesting dates were similar, although post-breeding migration movements at arctic sites differed consistently in timing. Territories of the two species overlapped broadly, encompassing the same habitat mosaic within each, although nest site microhabitats differed. This broad ecological overlap was accompanied by high levels of aggression between the species. Interspecific interactions occurred at rates equalling 45% of rates of intraspecific interactions, an unusually high frequency not approached by other pairs of sympatric *Calidris* species studied elsewhere.

Does the tidal clock or the diel clock rule the roost? - A study of pre-migratory Dunlin

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During late summer Dunlin (*Calidris alpina*) stage in large numbers along the coast of western Alaska, where they molt and put on fat before migrating south. In fall 1980 we studied the complex array of factors governing the formation of roosts by this species on the Yukon-Kuskokwin Delta, a major staging area. Compact roosting flocks of up to 30,000 birds were formed along the supratidal or exposed intertidal not only during diurnal high tides but also at dawn and dusk, irrespective of the stage of the tide. Duration at the roost was strongly influenced by the time of day in relation to stage of tide. Birds spent most time at the roost resting, but time spent at the roost feeding, running, preening, and bathing varied with the stage of tide, the time of day, and the time of season. Sightings of color-marked birds indicated interchange of individuals among the three major roosts within the area. The importance of the occupation of roosts and the behavior typical of roosting flocks are discussed in relation to needs of Dunlin before their extensive migration.

South migration strategies of five shorebirds in eastern North America

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Assessments of survey data contributed to the International Shorebird Surveys between 1974 and 1981 are used to compare routes and stopover strategies of Black-bellied Plovers, Red Knots, Pectoral Sandpipers, Stilt Sandpipers and Sanderlings during south migration in the United States. Migration strategies of these species will be compared with respect to the breadth of migration corridors, the degree of concentration of migrants at stopover areas, and the relative dependence upon using marine versus inland stopover places. The discussion will include the conservation implications of various migration strategies.

Influence of prey density and biomass on migration timing of Semipalmated Sandpipers in the Bay of Fundy

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The southward migration of Semipalmated Sandpipers (*Calidris pusilla*) in the upper Bay of Fundy peaks around the end of July, with local concentrations exceeding 100,000 birds, and departures follow soon afterwards. At departure, most birds have nearly doubled their weights, by feeding on the burrowing amphipod *Corophium volutator*. Despite heavy predation pressure, *Corophium* densities increase markedly through August as a result of recruitment, but biomass decreases because of size-selective predation on the older and larger individuals. Consequently, ingestion rates and rates of fat deposition of Semipalmated Sandpipers decline after the peak of migration numbers. This indicates that the earlier migrants deposit fat more quickly and thus gain an advantage over later arrivals, which must remain longer in the area to accumulate the fat reserves needed for overseas migration to South America.

Fidelity to feeding and roosting sites by Semipalmated Plovers and Sandpipers at a migratory stopover

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Cobscook Bay, Maine, is a major stopover for Semipalmated Sandpipers and Semipalmated Plovers during southbound migration. The objective of the present study was to determine if individual migrants show distinct patterns of fidelity to feeding and roosting sites. Sixty-two plovers and 828 sandpipers were individually color-marked. Dedicated efforts were made over a 4-week period to resight marked birds on intertidal feeding flats and in high tide roosts. Individuals of both species exhibited clear site specificity patterns; these were more pronounced in plovers than sandpipers and more pronounced for feeding sites than roosting sites in both species. The significance of these findings are discussed from ecological and conservation perspectives.

Sex roles in the American Oystercatcher

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Two problems inherent in sex role studies may be alleviated by multivariate statistics. First, multidimensional scaling provided an objective method to define categories of behavior of breeding American Oystercatchers. For example, looking up while standing was distant from standing with head back in multidimensional space and hence were not combined into 'resting'. Twelve categories of behavior were derived from an original 30. Discriminant analysis, using these categories as variables, resulted in complete discrimination of the sexes at each stage of the breeding cycle. In prelaying and laying birds, piping and feeding were important discriminators. During incubation, incubating and a group of vigilant acts discriminated the sexes. During chick rearing, brooding was an important discriminator. Sex roles are components of parental investment and since p.i. is not realistically expressed as a single factor the multivariate approach may be more appropriate.

Polygamous breeding in Snowy Plovers

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A 6-year study in coastal California has shown Snowy Plovers typically breed polygamously; females desert broods within a few days of hatching and reneest with new mates; males also remate for second broods but usually not until brood rearing duties are completed. Pair bonds are not broken when clutches are destroyed or broods are lost prior to female desertion. Both sexes are needed for successful incubation as clutch desertion almost always occurs if one parent is lost. A sexual imbalance in the breeding population at about 1.4 males per female may be caused by different adult mortality rates. The male surplus combined with female emancipation from brood rearing duties are seen as the key factors promoting polygamous breeding, but the species' inability to evolve uniparental egg care is interpreted as the factor preventing polygamous breeding from advancing to the degree exhibited by the polyandrous Spotted Sandpiper and American Jacana.

Techniques for aging and sexing Upland Sandpipers (*Bartramia longicauda*)

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Study skins of 270 Upland Sandpipers were evaluated on 31 physical characteristics to determine the extent of sex and age dimorphism in (1) body measurements, (2) feather wear, and (3) plumage patterns. Discriminant function analyses of body measurements and feather wear variables were run on reference data sets, and the functions produced were tested on test data sets. Sexing by a discriminant function of tail length and wing chord was 80.0% effective, and comparison of measurements from mated pairs would allow an accuracy of 88.3%. Aging was accomplished by (1) a discriminant function of 5 feather wear variables (89.9% accurate), (2) pattern of the upper median secondary coverts (92.1% accurate), and (3) pattern of the longest proximal secondary (84.2% accurate). Aging by a scheme combining these three methods was 96.1% accurate.

Adaptive aspects of growth and development of Long-billed Curlews (*Numenius americanus*)

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Growth measurements of 4 body size parameters (mass + tarsus, culmen, and wing lengths) were taken every two days on radiomarked Long-billed Curlew chicks during 1977-79. Richards growth curves were fitted to the data by David Bradley. Listed in order of decreasing degree of development at hatching are tarsi, culmen, body mass, and wing length. As expected, a similar ordering of growth rates followed this sequence in reverse except that the culmen grew more slowly and took significantly longer to reach 90% of asymptotic size than did the tarsi. For such a precocial, nidifugous species, the adaptive significance of early development of legs and rapid growth of wings is clear. I hypothesize that the relatively depressed rate of culmen growth is an adaptation which facilitates locomotion and foraging by Long-billed Curlew chicks in tall, thick vegetative cover. Several predictions suggested by this hypothesis are discussed.

Philopatry in the Red-necked Phalarope

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Phalaropes are facultatively polyandrous, non-territorial shorebirds. It has been predicted that in such a mating system natal and adult philopatry should be male-biased (e.g. Greenwood 1980; *Anim. Behav.* 28: 1140-1162) due to greater advantages of site familiarity to males for incubation and brood-rearing, which they do alone. A study from 1981 to 1983 near Churchill, Manitoba demonstrated that natal philopatry was significantly male-biased. Of 60 nestlings banded in 1981, 9 males and only 1 female returned in 1982. There was an equal return rate for males and females which had previously bred on the study area; 46% of females (5/11) and 51% of males (22/43) returned in 1982. Female natal dispersal should be effective in avoiding high rates of potentially harmful inbreeding. However, females, like males, showed considerable fidelity to home ranges. Hence experience with an area may be advantageous to females for competition for foraging efficiently, or avoiding predators.

Habitat factors affecting polyandry in Wattled Jacanas

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Microgeographic and vegetational characteristics of 4 habitats were studied to determine relationships of habitat quality to mating systems. Low-density habitats were characterized by widely dispersed monogamous pairs with poor productivity. In high density habitats, nests were clumped, the population was monogamous and polyandrous, and productivity was higher. Microgeographic and vegetational characteristics at nest sites were similar across habitat type, but low density habitats differed more, seasonally, than did high-density habitats. Results support the conclusion that the temporal and spatial distribution, and availability of nest sites is important in determining social systems.

Effects of number of mates on maternal care in the polyandrous Northern Jacana (*Jacana spinosa*)

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Female Northern Jacanas help their 1 to 4 mates defend their offspring from potential predators such as Purple Gallinules (*Porphyryla martinica*). This study examines how a ♀'s number of mates ('harem size') affects her contribution to the defense of individual families. Three aspects of maternal care decreased with increasing harem size: 1) the percentage of attacks that ♀♀ participated in (monandrous ♀♀ participated in 74% of attacks, biandrous ♀♀ 49%, and triandrous ♀♀ 46%); 2) the percentage of joint ♂/♀ attacks that ♀♀ initiated (monandrous ♀♀ initiated 26%, biandrous ♀♀ 10%, and triandrous ♀♀ 5%); and 3) proximity to offspring (which has a guarding function, in part). The third finding is a consequence of a correlation between harem size and ♀ territory size and partly explains the first two findings: as a result of the long, average distances between ♀♀ with large harems and their offspring, these ♀♀ are less likely than other ♀♀ to be aware of the presence of potential predators near their offspring.

GIVING DETAILS OF AGE FOR OYSTERCATCHERS ON BTO RINGING SCHEDULES

by Chris Mead

The EURING age codes seem ambiguous for some waders, like Oystercatchers *Haematopus ostralegus*, with distinguishable first-year and adult birds, and an amorphous group of birds probably two or three years old. The solution is the use of I (meaning Immature) as a plumage indicator, in the way that J (meaning Juvenile) is used. The proper codes, which should be used on British Trust for Ornithology ringing schedules, for Oystercatchers are given below:

| | To end of December | From 1 January |
|------------------------------------|--------------------|----------------|
| First-year (i.e. up to 1 year old) | 3 | 5 |
| Second year (if certain) | 5 | 7 |
| Fully adult | 6 | 8 |
| Immature | 4 I | 6 I |

Soft part characters may eventually allow the certain separation of all second and third-year birds, so that fully, adult birds would be coded 8 or 10, but, as far as I know, this degree of certainty has not even been claimed by anyone. What is needed to make such determinations stick is good colour photographs of known-age birds caught through their second and third winters - pack your camera with the cannon-nets.

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(WSG ringing data forms do not allocate a space for I or J, as indicated above. This information can be entered in the 'Remarks' column, but will not at present be computerised. Eds.)

BREEDING WADERS IN EAST GERMANY

We have heard recently from Dr. Kurt Lambert of Rostock about breeding waders in East Germany. Ten species of waders breed in East Germany (Table 1). Lapwing, Snipe, Curlew, Black-tailed Godwit and Redshank nest inland as well as on the coast, but the last three species are extremely rare inland. Most waders breed on a small number of specially protected nature reserves which are principally gull and tern colonies. There are no polders or other large marshes, so the waders nest directly among the seabirds. Only a few pairs nest on the coast outside the reserves. Breeding numbers vary greatly from year to year depending on water level and the existence of pools and muddy areas, and also in relation to the gull numbers (many gull colonies are culled to reduce their impact on breeding wader, tern and duck populations). The most important breeding reserves for waders are the islands Oie and Kirr (together 376 ha) which are in Darss Bay. These are flat and chiefly grass-covered, and protected by a warden each summer. Visiting is by permit only and these and the other 13 or so islands-reserves are managed by the Central Office for Seabird Protection. Numbers of birds breeding on all the reserves are recorded each year (Table 1).

Table 1. Numbers of pairs of waders breeding on the island nature reserves in East Germany in recent years.

| Species | Pairs | Numbers in East Germany outside the reserves |
|--|---------|--|
| Lapwing <i>Vanellus vanellus</i> | 200-250 | fair numbers |
| Redshank <i>Tringa totanus</i> | 180-250 | very few |
| Oystercatcher <i>Haematopus ostralegus</i> | 100-150 | very few |
| Avocet <i>Recurvirostra avosetta</i> | 80-120 | none |
| Ringed Plover <i>Charadrius hiaticula</i> | 50-100 | very few |
| Black-tailed Godwit <i>Limosa limosa</i> | 20-60 | very few |
| Ruff <i>Philomachus pugnax</i> | 30-50 | very few |
| Dunlin <i>Calidris alpina</i> | 20-30 | very few |
| Snipe <i>Gallinago gallinago</i> | 2-5 | few |
| Curlew <i>Numenius arquata</i> | 2-5 | very few |

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