



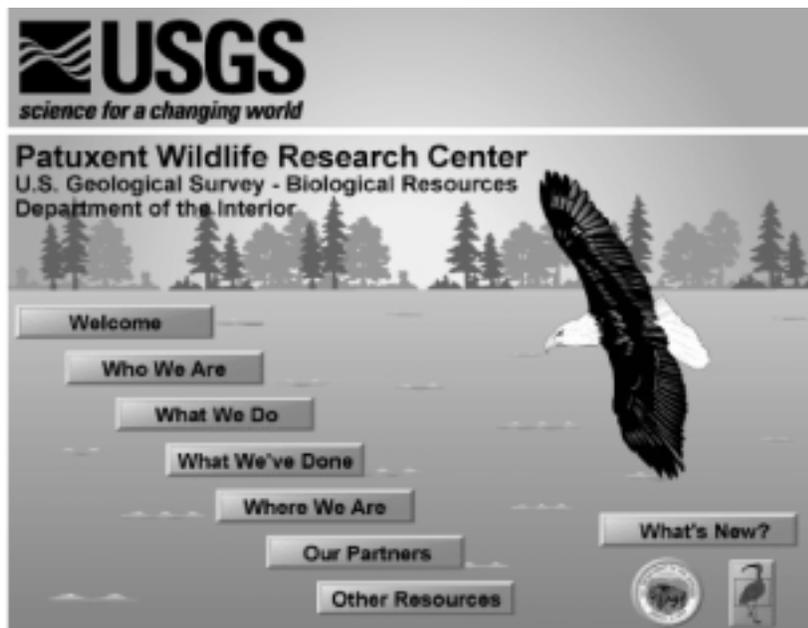
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**USGS Patuxent Wildlife Research Center**

February 2000 — January 2001

Albers, P. H., G. H. Heinz, and R. J. Hall. 2000. Approaches for assessment of terrestrial vertebrate response to contaminants: moving beyond individual organisms. Pages 109-148 in P. H. Albers, G. H. Heinz, and H. M. Ohlendorf, editors. Environmental contaminants and terrestrial vertebrates : effects on populations, communities, and ecosystems. SETAC special publications series. Environmental Toxicology and Chemistry, Pensacola, FL. 344 pp.

Albers, P. H., G. H. Heinz, and H. M. Ohlendorf. 2000. Environmental contaminants and terrestrial vertebrates : effects on populations, communities, and ecosystems. SETAC special publications series. Environmental Toxicology and Chemistry, Pensacola, FL. 344 pp.

The desire of resource managers, risk assessors, and the general public to better understand the consequences of environmental contamination has produced a strong and growing need for information on the effects of contaminants on populations and groups of species, and over moderate to large areas of land or water. However, the problems associated with research involving populations and groups of species or large and complex geographic areas, especially in terrestrial environments, are well known within the scientific community. With the previous thought in mind, an interactive symposium was held at the University of Maryland in October 1998. The purpose of the symposium was to review and critically evaluate our understanding of the effects of contaminants on terrestrial vertebrates at levels of organization above that of the individual. Invited background and technical presentations provided a common baseline of information for symposium participants. Discussion groups were then asked to critically evaluate the topics of two technical sessions. Several presentations of recent or ongoing research provided participants with examples of current approaches to assessments of the effects of contaminants on terrestrial vertebrates at the population or higher level of organization. The book consists of 10 chapters written by presenters at the symposium and three chapters conveying the reports of discussion groups.

Allen, J. R., C. L. LaBash, and J. H. List. 1999. Space and time scales of shoreline change at Cape Cod National Seashore, MA, USA. Pages 1244-1255 in Nichol C. Kraus and William G. McDougal, editors. Coastal sediments '99 : proceedings of the 4th International Symposium on Coastal Engineering and Science of Coastal Sediment Processes : conference theme : scales of coastal sediment motion and geomorphic change, Hauppauge, Long Island, New York, June 21-23, 1999. American Society of Civil Engineers, Reston, VA. 3 v.: xviii, 2620 p. pp.

Different processes cause patterns of shoreline change which are exhibited at different magnitudes and nested into different spatial and time scale hierarchies. The 77-km outer beach at Cape Cod National Seashore offers one of the few U.S. federally owned portions of beach to study shoreline change within the full range of sediment source and sink relationships, and barely affected by human intervention. "Mean trends" of shoreline changes are best observed at long time scales but contain much spatial variation thus many sites are not equal in response. Long-term, earlier-noted trends are confirmed but the added quantification and resolution improves greatly the understanding of appropriate spatial and time scales of those processes driving blue retreat and barrier island changes in both north and south depocenters. Shorter timescales allow for comparison of trends and uncertainty in shoreline change at local scales but are dependent upon some measure of storm intensity and seasonal frequency. Single-event shoreline survey results for one storm at daily intervals after the erosional phase suggest a recovery time for the system of six days, identifies three sites with abnormally large change, and that responses at these sites are spatially coherent for now unknown reasons. Areas near inlets are the most variable at all time scales. Hierarchies in both process and form are suggested.

Bank, M. S. and A. F. O'Connell, Jr. 2000. Stalking salamanders in Acadia National Park. Natural Ne England October/November, Issue 4:8-9.

Banks, R. C. 2000. The Cuban Martin in Florida. Florida Field Naturalist 28(2):50-52.

Banks, R. C. and M. R. Browning. 1999. Questions about Thayer's Gull. *Ontario Birds* 17(3):124-130.

In response to recently published articles about the taxonomic status of Thayer's Gull, *Larus thayeri*, we pose several questions that should be answered before a taxonomic decision can be made.

Beardmore, C. J. and J. S. Hatfield. 2000. Population and habitat viability assessments for Golden-cheeked Warblers and Black-capped Vireos: Usefulness to Partners in Flight Conservation Planning. Pages 60-62 in Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

Golden-cheeked Warblers and Black-capped Vireos are Neotropical migratory birds that are federally listed as endangered. Recovery plans for both species advise the use of viability modeling as a tool for setting specific recovery and management targets. Population and Habitat Viability Assessment workshops were conducted to develop population targets and conservation recommendations for these species. Results of the workshops were based on modeling demographic and environmental factors, as well as discussions of management issues, management options, and public outreach strategies. The approach is intended to be iterative, and to be tracked by research and monitoring efforts. This paper discusses the consensus-building workshop process and how the approach could be useful to Partners in Flight.

Population and Habitat Viability Assessments (PHVA) were used to develop population targets and conservation recommendations for Golden-cheeked Warblers (*Dendroica chrysoparia*) and Black-capped Vireo (*Vireo atricapillus*). This paper explains what PHVAs are, discusses how they are conducted, describes the general results that are produced, and suggests how Partners in Flight (PIF) might use a similar process for bird conservation planning. Detailed results of the assessments are not discussed here; however they can be found elsewhere (U. S. Fish and Wildlife Service 1996a, U. S. Fish and Wildlife Service 1996b).

PHVAs were considered for Golden-cheeked Warblers and Black-capped Vireos because they are controversial, endangered species, and the species' recovery plans list PHVAs as tools to develop recovery recommendations. The U. S. Fish and Wildlife Service (USFWS) realized that the data needed to perform PHVAs for these species is limited, but that various conservation efforts, such as the Balcones Canyonlands Conservation Plan and other endeavors, were proceeding without benefit of the biological summarization and guidance that a PHVA could provide.

Berlin, K. E., T. K. Pratt, J. C. Simon, J. R. Kowalsky, and J. S. Hatfield. 2000. Plant phenology in a cloud forest on the island of Maui, Hawaii. *Biotropica* 32(1):90-99.

We recorded the times of flowering, fruiting, and leafing of ten native canopy and subcanopy trees and shrubs (monthly from December 1994 through December 1997) in a montane cloud forest with relatively aseasonal rainfall on the island of Maui, Hawaii. These species represented the great majority of individual woody plants at the site. Flowers and fruits were available in the community year-round; however, all species exhibited annual patterns of flowering, and four species showed annual patterns of fruiting while the rest fruited in supra-annual patterns. Many species had protracted flowering or fruiting peaks, and some bore small numbers of flowers or fruit year-round. Most species flowered in a monthly peak mainly between May and August, corresponding to the period of greatest solar irradiance and marginally higher temperatures. Fruit ripening followed at varying intervals. In contrast, the heaviest flowering occurred between November and March, resulting from bloom of the dominant tree, *Metrosideros polymorpha*. At the highest elevations, *Metrosideros* flowering was heaviest during September, but peak flowering of lower elevation trees occurred in late fall and winter. Two varieties of this species differed in their temporal and spatial patterns of flowering. For *M. polymorpha* var. *polymorpha* and var. *incana*, bloom peaked annually between November and January; however, for *M. polymorpha* var. *glaberrima*, flowering peaked from April through July, with a possible earlier secondary peak in January.

Berlin, K. E., J. C. Simon, T. K. Pratt, J. R. Kowalsky, and J. S. Hatfield. 2001. `Akohekohe response to flower availability: seasonal abundance, foraging, breeding, and molt. Pages 202-212 in J. M.

Scott, S. Conant, and C. van Riper, III, editors. Ecology, conservation, and management of Hawaiian birds: a vanishing avifauna. Studies in Avian Biology 22.

We studied the relationship of flower availability to the seasonality of life history events of the 'Akohekohe (*Palmeria dolei*), a primarily nectarivorous and endangered Hawaiian honeycreeper from montane rain forests on Maui, Hawai'i. For comparison, we also investigated temporal bird density and foraging behavior of three other competing Hawaiian honeycreepers: 'Apapane (*Himatione sanguinea*), 'I'iwi (*Vestiaria coccinea*), and Hawai'i 'Amakihi (*Hemignathus virens*). All species except 'Amakihi fed primarily on nectar of 'Ohi'a-lehua (*Metrosideros polymorpha*), which produced flowers year-round but had an annual flowering peak in January. Flowers of several subcanopy shrubs and trees were important components of the diet for all nectarivores, and these were available seasonally depending upon the species. 'Akohekohe densities did not change temporally, suggesting a relatively stable population residing above 1,700 m. Monthly densities of 'Apapane, 'I'iwi, and Hawai'i 'Amakihi were positively correlated with monthly 'Ohi'a-lehua flower abundance, and 50-80% of these populations departed temporarily from our high-elevation site in July. There was a positive correlation with the timing of Akohekohe breeding and high abundance of 'Ohi'a-lehua bloom. Molt followed breeding. From a conservation perspective, these results show that 'Akohekohe maintain a relatively stable population above the mid-elevation zone of disease transmission, particularly during the fall when 'Ohi'a-lehua bloom decreases and mosquitoes increase. 'Akohekohe remain on their territories partly by switching their foraging to subcanopy trees and shrubs, most of which require protection from feral pigs (*Sus scrofa*).

Beyer, W. N. 2000. Hazards to wildlife from soil-borne cadmium reconsidered. Journal of Environmental Quality 29(5):1380-1384.

Cadmium is a toxic element that should be included in environmental risk assessments of contaminated soils. This paper argues, however, that hazards to wildlife from cadmium have often been overstated. The literature contains only meager evidence that wild animals have been seriously harmed by cadmium, even at severely contaminated sites. Although some researchers have reported that wildlife have accumulated concentrations of cadmium in their kidneys that were above suggested injury thresholds, the thresholds may be disputed, since they were well below the World Health Organization criterion of 200 mg/kg (wet weight) of cadmium in the renal cortex for protecting human health. Recent risk assessments have concluded that soil cadmium concentrations less than 1 mg/kg are toxic to soil organisms and wildlife, which implies that background concentrations of cadmium naturally found in soils are hazardous. An examination of the databases used to support these assessments suggested that the toxicity of cadmium has been exaggerated.

Beyer, W. N., D. J. Audet, G. H. Heinz, D. J. Hoffman, and D. Day. 2000. Relation of waterfowl poisoning to sediment lead concentrations in the Coeur d'Alene River Basin. Ecotoxicology 9:207-218.

For many years, waterfowl have been poisoned by lead after ingesting contaminated sediment in the Coeur d'Alene River Basin, in Idaho. Results of studies on waterfowl experimentally fed this sediment were combined with results from field studies conducted in the Basin to relate sediment lead concentration to injury to waterfowl. The first step in the model estimated exposure as the relation of sediment lead concentration to blood lead concentration in mute swans (*Cygnus olor*), ingesting 22% sediment in a rice diet. That rate corresponded to the 90th percentile of sediment ingestion estimated from analyses of feces of tundra swans (*Olor columbianus*) in the Basin. Then, with additional laboratory studies on Canada geese (*Branta canadensis*) and mallards (*Anas platyrhynchos*) fed the sediment, we developed the general relation of blood lead to injury in waterfowl. Injury was quantified by blood lead concentrations, ALAD (-aminolevulinic acid dehydratase) activity, protoporphyrin concentrations, hemoglobin concentrations, hepatic lead concentrations, and the prevalence of renal nuclear inclusion bodies. Putting the exposure and injury relations together provided a powerful tool for assessing hazards to wildlife in the Basin. The no effect concentration of sediment lead was estimated as 24 mg/kg and the lowest effect level as 530 mg/kg. By combining our exposure equation with data on blood lead concentrations measured in moribund tundra swans in the Basin, we estimated that some mortality would occur at a sediment lead concentration as low as 1800 mg/kg.

Beyer, W. N., D. Day, M. J. Melancon, and L. Sileo. 2000. Toxicity of Anacostia River sediment fed to mute swans (*Cygnus olor*). *Environmental Toxicology and Chemistry* 19:731-735.

Sediment ingestion is sometimes the principal route by which waterfowl are exposed to environmental contaminants, and at severely contaminated sites waterfowl have been killed by ingesting sediment. Mute swan (*Cygnus olor*) were fed a diet for six weeks with a high but environmentally realistic concentration (24%) of sediment from the moderately polluted Anacostia River in the District of Columbia, to estimate the sediment's toxicity. Control swans were fed the same diet without the sediment. Five organochlorine compounds were detected in the treated diets but none of 22 organochlorine compounds included in the analyses were detected in livers of the treated swans. The concentrations of 24 polynuclear aromatic hydrocarbons measured in the treated diet were as high as 0.80 mg/kg and they were thought to have been responsible for the observed induction of hepatic microsomal monooxygenase activity in livers. A concentration of 85 mg/kg of lead in the diet was enough to decrease red blood cell ALAD activity but was not high enough to cause more serious effects of lead poisoning. The dietary concentrations of Al, Fe, V, and Ba were high compared to the concentrations of these elements known to be toxic in laboratory feeding studies, but these elements did not accumulate in the livers of the treated swans and probably were not readily available in the sediment. Although ingestion of the Anacostia River sediment caused subtle toxicological effects in swans, we concluded from pathological examinations and weight data that the treated swans remained basically healthy.

Beyer, W. N. and G. H. Heinz. 2000. Implications of regulating environmental contaminants on the basis of wildlife populations and communities [letter to the editor]. *Environmental Toxicology and Chemistry* 19(7):1703-1704.

Blanco, J. M., G. Gee, D. E. Wildt, and A. M. Donoghue. 2000. Species variation in osmotic, cryoprotectant, and cooling rate tolerance in poultry, eagle, and Peregrine Falcon spermatozoa. *Biology of Reproduction* 63(4):1164-1171.

Potential factors influencing spermatozoa survival to cryopreservation and thawing were analyzed across a range of the following avian species: domestic chicken (*Gallus domesticus*), domestic turkey (*Meleagris gallopavo*), golden eagle (*Aquila chrysaetos*), Bonelli's eagle (*Hieraaetus fasciatus*), imperial eagle (*Aquila adalberti*), and peregrine falcon (*Falco peregrinus*). Studies focused on spermatozoa tolerance to the following: 1) osmotic stress, 2) different extracellular concentrations of the cryoprotectant dimethylacetamide (DMA), 3) equilibration times of 1 versus 4 h, 4) equilibration temperature of 4 versus 21 degrees C, and 5) rapid versus slow cooling before cryopreservation and standard thawing. Sperm viability was assessed with the live/dead stain (SYBR14/propidium iodine). Sperm viability at osmolalities  $\geq 800$  mOsm was higher ( $P < 0.05$ ) in raptor than poultry semen. Return to isotonicity after exposure to hypertonicity (3000 mOsm) decreased ( $P < 0.05$ ) number of viable spermatozoa in chicken, turkey, and golden and Bonelli's eagle spermatozoa but not in imperial eagle or peregrine falcon spermatozoa. Differences were found in spermatozoa resistance to hypotonic conditions, with eagle species demonstrating the most tolerance. Semen, equilibrated for 1 h (4 degrees C) in diluent containing DMA ( $\geq 2.06$  M), experienced decreased ( $P < 0.05$ ) spermatozoa survival in all species, except the golden eagle and peregrine falcon. Number of surviving spermatozoa diminished progressively with increasing DMA concentrations in all species. Increased equilibration temperature (from 4 to 21 degrees C) markedly reduced ( $P < 0.05$ ) spermatozoa survival in all species except the Bonelli's eagle and turkey. Rapid cooling was detrimental ( $P < 0.05$ ) to spermatozoa from all species except the imperial eagle and the chicken. These results demonstrate that avian spermatozoa differ remarkably in response to osmotic changes, DMA concentrations, equilibration time, temperature, and survival after fast or slow freezing. These differences emphasize the need for species-specific studies in the development and enhancement of assisted breeding for poultry and endangered species.

Brawn, J. D., J. R. Karr, J. D. Nichols, and W. D. Robinson. 1999. Demography of forest birds in Panama: How do transients affect estimates of survival rates? Pages 297-305 (symposium S06.2) in N. J. Adams and R. H. Slotow, editors. *Proceedings 22nd International Ornithological Congress, 16-22 August 1998, Durban*. Bird Life South Africa, Johannesburg, South Africa. on CD-ROM: lxxxi, 3229 pp.

Estimates of annual survival rates of neotropical birds have proven controversial. Traditionally, tropical birds were thought to have high survival rates for their size, but analyses of a multispecies assemblage from Panama by Karr et al. (1990) provided a counterexample to that view. One criticism of that study has been that the estimates were biased by transient birds captured only once as they passed through the area being sampled. New models that formally adjust for transient individuals have been developed since 1990. Preliminary analyses indicate that these models are indeed useful in modelling the data from Panama. Nonetheless, there is considerable interspecific variation and overall estimates of annual survival rates for understory birds in Panama remain lower than those from other studies in the Neotropics and well below the rates long assumed for tropical birds (i.e. > 0.80). Therefore, tropical birds may not have systematically higher survival rates than temperate-zone species. Variation in survival rates among tropical species suggests that theory based on a simple tradeoff between clutch size and longevity is inadequate. The demographic traits of birds in the tropics (and elsewhere) vary within and among species according to some combination of historical and ongoing ecological factors. Understanding these processes is the challenge for future work.

- Buckley, P. A. and F. G. Buckley. 2000. Breeding Common Terns in the Greater West Indies: status and conservation priorities. Pages 96-102 in E. A. Schreiber and David S. Lee, editors. Status and conservation of West Indian seabirds. Special Publication No. 1. Society of Caribbean Ornithology, Ruston, LA. v, 225 pp.
- Buckley, P. A. and F. G. Buckley. 2000. Patterns of colony-site use and disuse in saltmarsh-nesting Common and Roseate Terns. *Journal of Field Ornithology* 71(2):356-369.

Nearly all previous studies of saltmarsh-nesting Common Terns on the east coast of the United States have concluded that tidal saltmarshes were suboptimal or marginal breeding habitats. Questioning that conclusion, we analyzed patterns of both saltmarsh and nonmarsh colony use (stability, movement, establishment, abandonment, and size) obtained during 5 yr of annual helicopter censuses of all Common and Roseate Terns breeding on Long Island, New York. We found 1900-3600 pairs at 10-33 saltmarsh and 22-30 nonmarsh sites; there were few biologically important differences between Common Terns nesting at marsh and at nonmarsh sites. We did find that (1) marsh sites and colony sizes increased through the study period; (2) both marsh and nonmarsh colonies grew with duration of occupancy; (3) smaller marsh and nonmarsh colonies (<50 pairs) usually lasted only 12 yr, while larger colonies were equally likely to persist for 1, 2, 3, 4, or 5 yr; (4) numbers of marsh and nonmarsh sites used each year were generally unrelated to population sizes; (5) 5yr sites composed only 10.6% of total marsh and 17.6% of total nonmarsh sites; (6) the mean sizes of both newly established and about-to-be-abandoned colonies were smaller than the mean sizes of all others when averaged between but not within years; (7) most previously occupied sites, once abandoned, remained so for only 1 yr, and most new sites were occupied for only a single year; (8) annual turnover rates were 32%-49% for both marsh and nonmarsh sites; (9) marsh and nonmarsh breeding populations were correlated each year, allowing estimation of the total Long Island population to within +4% by censusing only the 20-25% in saltmarshes. Roseate Tern data were few, especially in marshes, obviating marsh-nonmarsh comparisons, except that Roseates failed to persist in saltmarshes, and their overall mean colony sizes across the same numbers of years' occupancy were usually smaller than Commons', although their turnover rates were roughly the same. We conclude that saltmarsh-nesting Common Terns are well adapted to marsh nesting and that they have probably been doing so for perhaps hundreds of generations. We hypothesize that it may have been a relict population of saltmarsh-nesters that saved the species from extirpation in the late 1800s. In contrast, Roseate Tern's failure to exploit extensive saltmarsh habitat seems yet another factor abetting its precarious status in northeastern North America.

- Buckley, P. A. and F. G. Buckley. 2000. The role of helicopters in seabird censusing. Pages 134-147 in E. A. Schreiber and David S. Lee, editors. Status and conservation of West Indian seabirds. Special Publication No. 1. Society of Caribbean Ornithology, Ruston, LA. v, 225 pp.

The advantages and disadvantages of fixed-wing, helicopter, photographic, videographic, and ground-count methods of surveying and censusing seabirds are described and compared. Critical terminology is distinguished, and use of small helicopters with multiple, trained observers is firmly recommended for work with diurnal, non-burrow-nesting seabirds in the West Indies and

elsewhere. Details of how to use helicopters effectively are provided, along with recommendations for aerial photography, and for data recording, analysis, and presentation.

- Buckley, P. A. and G. Schairer. 2000. Yellow-nosed Albatross on Fire Island, LI, NY. *Kingbird* 50:223-231.
- Butler, R. W., J. A. Kushlan, and I. J. Davidson. 2000. Herons in North America, Central America and the West Indies. Pages 151-175 *in* James A. Kushlan and Heinz Hafner. Heron conservation. Academic Press, San Diego, CA. xvi, 480 pp.
- Caithamer, D. F., M. Otto, P. I. Padding, J. R. Sauer, and G. H. Haas. 2000. Sea ducks in the Atlantic Flyway: population status and a review of special hunting seasons. U. S. Fish and Wildlife Service, Office of Migratory Bird Management, Laurel, Maryland. 40 +30 unnumbered pp.
- Cam, E. and J. Y. Monnat. 2000. Stratification based on reproductive state reveals contrasting patterns of age-related variation in demographic parameters in the kittiwake. *Oikos* 90:560-574.

Heterogeneity in individual quality can be a major obstacle when interpreting age-specific variation in life-history traits. Heterogeneity is likely to lead to within-generation selection, and patterns observed at the population level may result from the combination of hidden patterns specific to subpopulations. Population-level patterns are not relevant to hypotheses concerning the evolution of age-specific reproductive strategies if they differ from patterns at the individual level. We addressed the influence of age and a variable used as a surrogate of quality (yearly reproductive state) on survival and breeding probability in the kittiwake. We found evidence of an effect of age and quality on both demographic parameters. Patterns observed in breeders are consistent with the selection hypothesis, which predicts age-related increases in survival and traits positively correlated with survival. Our results also reveal unexpected age effects specific to subgroups: the influence of age on survival and future breeding probability is not the same in nonbreeders and breeders. These patterns are observed in higher-quality breeding habitats, where the influence of extrinsic factors on breeding state is the weakest. Moreover, there is slight evidence of an influence of sex on breeding probability (not on survival), but the same overall pattern is observed in both sexes. Our results support the hypothesis that age-related variation in demographic parameters observed at the population level is partly shaped by heterogeneity among individuals. They also suggest processes specific to subpopulations. Recent theoretical developments lay emphasis on integration of sources of heterogeneity in optimization models to account for apparently "sub-optimal" empirical patterns. Incorporation of sources of heterogeneity is also the key to investigation of age-related reproductive strategies in heterogeneous populations. Thwarting "heterogeneity's ruses" has become a major challenge: for detecting and understanding natural processes, and a constructive confrontation between empirical and theoretical studies.

- Cam, E., J. D. Nichols, J. R. Sauer, J. E. Hines, and C. H. Flather. 2000. Relative species richness and community completeness: avian communities and urbanization in the mid-Atlantic states. *Ecological Applications* 10:1196-1210.

The idea that local factors govern local richness has been dominant for years, but recent theoretical and empirical studies have stressed the influence of regional factors on local richness. Fewer species at a site could reflect not only the influence of local factors, but also a smaller regional pool. The possible dependency of local richness on the regional pool should be taken into account when addressing the influence of local factors on local richness. It is possible to account for this potential dependency by comparing relative species richness among sites, rather than species richness per se. We consider estimation of a metric permitting assessment of relative species richness in a typical situation in which not all species are detected during sampling sessions. In this situation, estimates of absolute or relative species richness need to account for variation in species detection probability if they are to be unbiased. We present a method to estimate relative species richness based on capture-recapture models. This approach involves definition of a species list from regional data, and estimation of the number of species in that list that are present at a site-year of interest. We use this approach to address the influence of urbanization on relative richness of avian communities in the Mid-Atlantic region of the United States. There is a negative relationship between relative richness and landscape variables describing the level of urban development. We believe that this metric should prove very useful

for conservation and management purposes because it is based on an estimator of species richness that both accounts for potential variation in species detection probability and allows flexibility in the specification of a "reference community." This metric can be used to assess ecological integrity, the richness of the community of interest relative to that of the "original" community, or to assess change since some previous time in a community.

Cam, E., J. R. Sauer, J. D. Nichols, J. E. Hines, and C. H. Flather. 2000. Geographic analysis of species richness and community attributes of forest birds from survey data in the mid-Atlantic integrated assessment region. *Environmental Monitoring and Assessment* 63:81-94.

Species richness of local communities is a state variable commonly used in community ecology and conservation biology. Investigation of spatial and temporal variations in richness and identification of factors associated with these variations form a basis for specifying management plans, evaluating these plans, and for testing hypotheses of theoretical interest. However, estimation of species richness is not trivial: species can be missed by investigators during sampling sessions. Sampling artifacts can lead to erroneous conclusions on spatial and temporal variation in species richness. Here we use data from the North American Breeding Bird Survey to estimate parameters describing the state of bird communities in the Mid-Atlantic Assessment (MAIA) region: species richness, extinction probability, turnover and relative species richness. We use a recently developed approach to estimation of species richness and related parameters that does not require the assumption that all the species are detected during sampling efforts. The information presented here is intended to visualize the state of bird communities in the MAIA region. We provide information on 1975 and 1990. We also quantified the changes between these years. We summarized and mapped the community attributes at a scale of management interest (watershed units).

Custer, C. M., T. W. Custer, P. D. Allen, K. L. Stromborg, and M. J. Melancon. 1999. Organochlorine contaminants and Tree Swallows along the Fox River and Green Bay, Wisconsin, USA. J021 (abstract of poster) in N. J. Adams and R. H. Slotow, editors. *Proceedings 22nd International Ornithological Congress, 16-22 August 1998, Durban*. Bird Life South Africa, Johannesburg, South Africa. on CD-ROM: lxxxi, 3229 pp.

Green Bay, Wisconsin is contaminated with polychlorinated biphenyls (PCBs) however, whether these contaminants affect reproduction in insectivorous birds is unknown. Tree Swallows, *Tachycineta bicolor*, are secondary cavity nesters that will nest in boxes and tolerate handling. Because Tree Swallows are aquatic insectivores, residues in their tissues are primarily indicative of contaminants in sediments. We studied swallows at two contaminated and two reference colonies in 1993, 1994, and 1995 in the Green Bay area. Swallows at the two contaminated sites had significantly higher PCB levels in eggs when compared to two reference sites. Eggs from clutches that contained dead embryos had higher PCB concentrations than eggs from clutches where all eggs hatched; there were no contaminant effects overall on reproduction, however. Twelve-day-old nestlings at the two contaminated sites accumulated significantly more PCBs than did nestlings at the reference sites demonstrating that PCB contamination came from the local area. The PCB congener profile in 12-day-old nestlings mirrored the congener profile in their food.

Custer, T. W., C. M. Custer, R. K. Hines, D. W. Sparks, M. J. Melancon, D. J. Hoffman, J. W. Bickham, and J. K. Wickliffe. 2000. Mixed-function oxygenases, oxidative stress, and chromosomal damage measured in lesser scaup wintering on the Indiana Harbor Canal. *Archives of Environmental Contamination and Toxicology* 38:522-529.

During the winter of 1993-1994, male lesser scaup (*Aythya affinis*) were collected on the heavily polluted Indiana Harbor Canal, East Chicago, Indiana, and examined for several bioindicators of chemical exposure. Livers were analyzed for activities of three cytochrome P450-associated monooxygenases and four measures of oxidative stress. Blood and spleen were analyzed by flow cytometry for chromosomal damage. In a concurrent study, scaup tissues were analyzed for organic and inorganic contaminants. Ethoxyresorufin-O-dealkylase (EROD) activity in livers of scaup collected in January 1994 was significantly higher than in livers of scaup collected in March 1994 or in livers of reference birds. Three hepatic monooxygenase activities were each significantly correlated with polycyclic aromatic hydrocarbon (PAH) concentrations in scaup carcasses. Thiobarbituric acid (TBA) activity in scaup livers was positively correlated with iron,

boron, and lead concentrations in livers and polychlorinated biphenyl concentrations in carcasses. TBA activity was negatively correlated with protein-bound thiol activity and mercury concentrations in livers. The coefficient of variation of DNA content in scaup blood cells was correlated with PAH concentrations in scaup carcasses. This is the first field study with birds to demonstrate a correlation between liver monooxygenase activity and carcass PAH concentrations and to show a direct correlation between PAH concentrations in tissues and somatic chromosomal damage in blood.

Custer, T. W., C. M. Custer, K. L. Stromborg, and M. J. Melancon. 1999. Effects of contaminants on Double-crested Cormorant reproduction in Green Bay, Wisconsin, USA. J022 (abstract of poster) in N. J. Adams and R. H. Slotow, editors. Proceedings 22nd International Ornithological Congress, 16-22 August 1998, Durban. Bird Life South Africa, Johannesburg, South Africa. on CD-ROM: lxxxi, 3229 pp.

In 1994 and 1995, Double-crested Cormorants *Phalacrocorax auritus* were monitored from egg-laying through 12 days of age at Cat Island, Green Bay, Wisconsin, USA. Sample eggs at hatching were analyzed for organochlorines (including total PCBs, PCB congeners, and DDE), hepatic microsomal ethoxyresorufin-O-dealkylase (EROD) activity in livers of embryos, and eggshell thickness. The number of eggs per nest that hatched and survived to 2 days of age was estimated to be 2.2 in 1994 and 2.0 in 1995. Hatching success of eggs was not correlated with PCBs, the toxicity of PCBs based on congeners, or EROD activity. Hatching success was correlated with eggshell thickness and negatively correlated with DDE concentrations. Even though the insecticide DDT was banned in the early 1970s, we suggest that DDE concentrations in cormorant eggs in Green Bay are still having an effect on reproduction in this species.

Dowell B. A., J. E. Fallon, C. S. Robbins, D. K. Dawson, and F. W. Fallon. 2000. Impacts of cowbird parasitism on wood thrushes and other neotropical migrants in suburban Maryland forests. Pages 244-254 in J. N. M. Smith, T. Cook, S. Rothstein, S. Robinson, and S. Sealy. Ecology and management of cowbirds and their hosts: studies in the conservation of North American passerine birds. University of Texas Press, Austin, TX. ix, 388 pp.

During 1988-1993, we monitored nests of neotropical migrant birds in seven suburban Maryland forests to compare parasitism and predation rates in forests of different areas. Of 1,122 nest monitored, 672 were of Wood Thrush, the most commonly found nesting species. Study sites were forests that ranged in size from 21 ha to more than 1,300 ha in the Piedmont and Coastal Plain regions of Maryland within 50 km of Washington, D.C. Parasitism rates of Wood Thrush nest varied greatly among sites, ranging from 0% (29 nests in 1990-1992) in a site in extensive forest to 68% (31 nests 1992-1993) in a 21-ha, selectively logged old-growth forest. A sudden increase in parasitism from 9% (102 nests 1990-1991) to 35% (125 nests 1992-1993) in a 23-ha old-growth forest was noteworthy. The surrounding environment at this site is changing from rural to residential. Wood Thrush parasitism rates dropped as the breeding season progressed, but peak of parasitism coincided with peaks of nesting activity. Parasitism rates for Hooded Warblers (88% of 17 nests-all sites) were most alarming. High predation rates were a much greater factor in low productivity for Wood Thrushes than parasitism.

Drake, B. M., R. M. Goto, M. M. Miller, G. F. Gee, and W. E. Briles. 1999. Molecular and immunologic analysis of major histocompatibility haplotypes in Northern Bobwhite enable direct identification of corresponding haplotypes in an endangered subspecies, the Masked Bobwhite. Zoo Biology 18(4):279-294.

The major histocompatibility complex (MHC) is a group of genetic loci coding for haplotypes that have been associated with fitness traits in mammals and birds. Such associations suggest that MHC diversity may be an indicator of overall genetic fitness of endangered or threatened species. The MHC haplotypes of a captive population of 12 families of northern bobwhites (*Colinus virginianus*) were identified using a combination of immunogenetic and molecular techniques. Alloantisera were produced within families of northern bobwhites and were then tested for differential agglutination of erythrocytes of all members of each family. The pattern of reactions determined from testing these alloantisera identified a single genetic system of alloantigens in the northern bobwhites, resulting in the assignment of a tentative genotype to each individual within the quail families. Restriction fragment patterns of the DNA of each bird were determined using

the chicken MHC *B-G* cDNA probe *bg11*. The concordance between the restriction fragment pattern and the alloantisera reactions showed that the alloantisera had identified the MHC of the northern bobwhite and supported the tentative genotype assignments, identifying at least 12 northern bobwhite MHC haplotypes.

Eisler, R. 2000. Contaminant Hazard Reviews 1-35. Biological report ; Biological Science Report ; Contaminant Hazards Reviews Report. U.S. Department of the Interior, U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD. 1 CD-ROM pp.

This compact disc (CD) contains the 35 reports in the Contaminant Hazard Reviews (CHR) that were published originally between 1985 and 1999 in the U.S. Department of the Interior Biological Report series. The CD was produced because printed supplies of these reviews--a total of 105,000--became exhausted and demand remained high. Each review was prepared at the request of environmental specialists of the U.S. Fish and Wildlife Service and each contained specific information on the following: mirex, cadmium, carbofuran, toxaphene, selenium, chromium, polychlorinated biphenyls, dioxins, diazinon, mercury, polycyclic aromatic hydrocarbons, arsenic, chlorpyrifos, lead, tin, index issue, pentachlorophenol, atrazine, molybdenum, boron, chlordane, paraquat, cyanide, fenvalerate, diflubenzuron, zinc, famphur, acrolein, radiation, sodium monofluoroacetate, planar PCBs, silver, copper, nickel, and a cumulative index to chemicals and species. Each report reviewed and synthesized the technical literature on a single contaminant and its effects on terrestrial plants and invertebrates, aquatic plant and animals, avian and mammalian wildlife, and other natural resources. The subtopics include contaminant sources and uses; physical, chemical, and metabolic properties; concentrations in field collections of abiotic materials and living organisms; deficiency effects, where appropriate; lethal and sublethal effects, including effects on survival, growth, reproduction, metabolism, mutagenicity, teratogenicity, and carcinogenicity; proposed criteria for the protection of human health and sensitive natural resources; and recommendations for additional research.

Eisler, R. 2000. Handbook of Chemical Risk Assessment. Lewis Publishers, Boca Raton, FL. 3 vols., 1903 pp.

Contents: v. 1, Health hazards to humans, plants, and animals ; v. 2, Organics ; v. 3, Metalloids, radiation, cumulative index to chemicals and species. Update of the Contaminant Hazard Reviews report series.

Elias, S. P., J. D. Fraser, and P. A. Buckley. 2000. Piping Plover brood foraging ecology on New York barrier islands. *Journal of Wildlife Management* 64(2):346-354.

Effective management of piping plover (*Charadrius melodus*) populations requires knowledge of the habitats that foster successful reproduction. We studied piping plover chick foraging ecology and survival on the central barrier islands of Long Island, New York, 1992 and 1993. Within the 90-km study area, all 1-km beach segments with ephemeral pools or bay tidal flats were used for nesting and brood rearing, whereas <50% of beach segments without these habitats were used. On beach segments with ephemeral pools, broods preferred ephemeral pools to ocean intertidal zone, wrack, backshore, open vegetation, and interdune habitat. Indices of terrestrial arthropod abundance and foraging rates were greater in ephemeral pools than in other habitats. In 1992, chick survival was higher on beach segments with ephemeral pools than on segments without ephemeral pools. On beach segments with bay tidal flats, broods preferred bay tidal flats and wrack to ocean intertidal zone, backshore, and open vegetation habitats. Foraging rates in bay tidal flats were similar to those in ephemeral pools and greater than in open vegetation, wrack, and backshore habitats. On beach segments without ephemeral pools and bay tidal flats, broods preferred wrack to all other habitats, and open vegetation was second most preferred. To assist in the recovery of the piping plover, land-use planners should avoid beach management practices (e.g., beach filling, dune building, renourishment) that typically inhibit natural renewal of ephemeral pools, bay tidal flats, and open vegetation habitats.

Ellis, D. H., G. F. Gee, S. G. Hereford, G. H. Olsen, T. D. Chisolm, J. M. Nicolich, K. A. Sullivan, N. J. Thomas, M. Nagendran, and J. S. Hatfield. 2000. Post-release survival of hand-reared and parent-reared Mississippi Sandhill Cranes. *Condor* 102(1):104-112.

The Mississippi Sandhill Crane (*Grus canadensis pulla*) reintroduction program is the largest crane reintroduction effort in the world. Here we report on a 4-year experiment in which we compared post-release survival rates of 56 hand-reared and 76 parent-reared Mississippi Sandhill Cranes. First-year survival was 80%. Surprisingly, hand-reared cranes survived better than parent-reared birds, and the highest survival rates were for hand-reared juveniles released in mixed cohorts with parent-reared birds. Mixing improved survival most for parent-reared birds released with hand-reared birds. These results demonstrate that hand-rearing can produce birds which survive at least as well as parent-reared birds and that improved survival results from mixing hand-reared and parent-reared birds.

Ellis, D. H., P. Tsengeg, P. Whitlock, and M. H. Ellis. 2000. Predators as prey at a Golden Eagle *Aquila chrysaetos* eyrie in Mongolia. *Ibis* 142:139-158.

Although golden eagles (*Aquila chrysaetos*) have for decades been known to occasionally take large or dangerous quarry, the capturing of such was generally believed to be rare and/or the act of starved birds. This report provides details of an exceptional diet at a golden eagle eyrie in eastern Mongolia with unquantified notes on the occurrence of foxes at other eyries in Mongolia. Most of the prey we recorded were unusual, including 1 raven (*Corvus corax*), 3 demoiselle cranes (*Anthropoides virgo*), 1 upland buzzard (*Buteo hemilasius*), 3 owls, 27 foxes, and 11 Mongolian gazelles.

Some numerical comparisons are of interest. Our value for gazelle calves (10 minimum count, 1997) represents 13% of 78 prey items and at least one adult was also present. Our total of only 15 hares (*Lepus tolai*) and 4 marmots (*Marmota sibirica*) compared to 27 foxes suggests not so much a preference for foxes, but rather that populations of more normal prey were probably depressed at this site. Unusual prey represented 65% of the diet at this eyrie.

Ellis, D. H., N. Woffinden, P. L. Whitlock, and P. Tsengeg. 1999. Pronounced variation in tarsal and foot feathering in the upland buzzard (*Buteo hemilasius*) in Mongolia. *Journal of Raptor Research* 33(4):323-326.

During 1994, 1995, 1997, and 1998 expeditions across Mongolia, we located over 250 upland buzzard (*Buteo hemilasius*) nests. At these, we noted considerable morphological variation in plumage coloration and in leg pterylosis. In 1997 and 1998, we examined 131 nests scattered across eastern and central Mongolia and report here the tarsal condition of 119 nestlings from 59 brood where young were at least 2 weeks of age. Of 119 birds carefully examined, 50 (42%) had less than fully feathered tarsi and 4 of the 69 with fully feathered tarsi had scattered feathers on their toes. Thus, 54 of 119 birds (45%) in some way deviated from the feathered tarsibare toes condition. This extraordinary degree of variability in feather patterns may be best explained as the result of extensive and relatively recent hybridization between the longlegged (*Buteo rufinus*) and roughlegged (*B. lagopus*) buzzards and/or between long-legged and upland buzzards.

Erwin, R. M. and T. W. Custer. 2000. Herons as indicators. Pages 311-330 in James A. Kushlan and Heinz Hafner. *Heron conservation*. Academic Press, San Diego, CA. xvi, 480 pp.

Erwin, R. M., M. K. Laubhan, J. E. Cornely, and D. M. Bradshaw. 2000. Managing wetlands for waterbirds: How managers can make a difference in improving habitat to support a North American Bird Conservation Plan. Pages 82-87 in Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process* Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

Wetland are the most productive ecosystems in the world, yet they have suffered more loss and degradation than any other ecosystem. Not surprisingly, 50% (29 of 58) of all the bird species in the U. S. (excluding Hawaii and territories) that are listed either as federally threatened or endangered, or are on the U. S. Fish & Wildlife Service 1995 List of Migratory Nongame Birds of Management Concern, occupy wetland or aquatic habitats even though many remaining wetlands across the North American landscape already are managed primarily for waterbirds. Some of these wetlands are administered by federal and state entities (e.g., national wildlife refuges,

national and state parks, state wetland management areas) or are maintained on private lands through federally supported restoration and enhancement programs (e.g., Conservation Reserve Program, Wetland Reserve Program, Waterfowl Production Areas, and Partners for Wildlife). Private organizations, such as the National Audubon Society, The Nature Conservancy, and private hunting clubs, also own wetland areas that are managed specifically to benefit wildlife. I management philosophies are altered to consider the entire complex of wetlands, many wetlands can provide benefits to a broad array of waterbirds, as opposed to just one or a few species. However, challenges for natural resource managers are in forming partnerships with owners-manager of wetlands where the objectives are not primarily wildlife oriented. These owners or manager need to be included in wetland training workshops in an attempt to educate them about wetland values and secondary wildlife benefits that may be derived in flooded agricultural lands, aquaculture ponds, altered coastal marshes (mosquito control), and salt evaporation ponds. In some cases, compensation for crop damages by wildlife may be a necessary part of any cooperative agreements. In the development of a North American Bird Conservation Plan we propose a four-step approach and recommend that emphasis be placed on working with Joint Venture of the North American Waterfowl Management Plan to ensure that a diverse array of waterbird species will benefit. Efforts also should be devoted to developing similar partnerships in areas where important wetland resources exist but no Joint Ventures are planned.

Flint, P. L., M. R. Petersen, C. P. Dau, J. E. Hines, and J. D. Nichols. 2000. Annual survival and site fidelity of Steller's Eiders molting along the Alaska Peninsula. *Journal of Wildlife Management* 64:261-268.

Populations of Steller's eiders (*Polysticta stelleri*) molting and wintering along the Alaska Peninsula have declined since the 1960's. We captured and marked a large sample of Steller's eiders molting in 2 lagoons along the Alaska Peninsula between 1975-97. We used mark-recapture analysis techniques to estimate annual survival and movement probabilities within and among lagoon for male and female eiders. Estimates of annual survival ( $\pm$ SE) were  $0.899 \pm 0.032$  for females and  $0.765 \pm 0.044$  for males. Both sexes showed high rates of fidelity to specific molting location (>95%) within lagoons; yet we found no evidence that annual probability of survival differed among groups molting in different locations either within or among lagoons. We found weak evidence that annual survival decreased between the periods 1975-81 and 1991-97. The lower survival of males compared to females is unusual for waterfowl and may result in a female-biased sex ratio. We conclude that a decrease in adult survival may have initiated the long-term population decline. Further, a shortage of males may be limiting reproductive potential.

Foster, M. 1999. Ecology and behaviour of the Alder Flycatcher *Empidonax alnorum*, Tyrannidae in winter. B030 (abstract of poster) in N. J. Adams and R. H. Slotow, editors. *Proceedings 22nd International Ornithological Congress, 16-22 August 1998, Durban.* Bird Life South Africa, Johannesburg, South Africa. on CD-ROM: lxxxii, 3229 pp.

The Alder Flycatcher *Empidonax alnorum* (Tyrannidae) winters from Colombia and Venezuela, south to northern Argentina. We studied the species in Manu National Park, Madre de Dios, Peru. In this area the species occupies riparian zones along lowland meander rivers as well as adjacent transition zone forest in the floodplain. These habitats have a number of age-related longitudinal zone (parallel to the river margin) that are short term (1-2 year) transitory stages in the succession to floodplain forest. The fast growing plant species that make up these habitats are suitable for commercial harvest for paper pulp. We examined habitat use of the species in an attempt to identify the effects of such harvest and resulting habitat loss on these birds. The Alder Flycatcher favour two longitudinal zones where it establishes territories. The territories may be long-term or transitory, and are often occupied and defended by two individuals, generally of different age. One bird tends to be more active in territory defence than the other. Defence involves patrolling, vocal duels, and chases. Birds sally for insects but also eat large quantities of fruit.

French, J. B., Jr., S. P. Bradbury, H. Krueger, E. McGee, and B. E. Sample. 2000. Group A discussions of endpoint selection, study design, and extrapolation. Pages 189-201 in P. H. Albers, G. H. Heinz, and H. M. Ohlendorf, editors. *Environmental contaminants and terrestrial vertebrates: effects on populations, communities, and ecosystems.* SETAC special publications series. Environmental Toxicology and Chemistry, Pensacola, FL. 344 pp.

Gall, S. A., W. P. Kuvlesky, Jr., G. Gee, J. C. Lewis, and D. Steinbach. 2000. Releasing captive-reared masked bobwhite: A new strategy. Pages 147-152 in L. A. Brennan, W. E. Palmer, L. W. Burger, Jr., and T. L. Pruden, editors. Quail IV: proceedings of the Fourth National Quail Symposium, May 6-9, 1997. Tall Timbers Research Station, Tallahassee, FL. 254 pp.

Efforts to re-establish the endangered masked bobwhite (*Colinus virginianus ridgwayi*) to its former southern Arizona range have been ongoing since establishment of the Buenos Aires National Wildlife Refuge in 1986. Pre-release conditioning techniques developed prior to Refuge establishment continued to be utilized in an effort to improve post-release survival of captive-reared masked bobwhite chicks. Foremost among these techniques was the use of wild Texas bobwhite (*C. v. texanus*) males as foster parents which were paired with all broods released on the Refuge. The efficacy of this technique was evaluated using radio telemetry in 1994, and the results indicated that the use of foster Texas males was not as effective as had been presumed because post-release chick survival was poor. Therefore, in 1995 pre-release conditioning protocol were modified in an effort to improve post-release survival. The primary intent of these modifications was to emphasize wild behavior among chicks prior to release. Modifications to established protocol included imprinting chicks to adult bobwhites immediately after eggs hatched and exposing 1-to-2 day old chicks to natural foods (insects and seeds) while they were in brooder units. Foster parents and their respective broods were then placed in flight pens that mimicked the natural conditions that would confront broods upon release. Family groups were held in flight pens for several weeks for acclimatization purposes and then transported to temporary enclosures erected at release sites where they were held for a week and then released. Finally all releases were conducted during fall after covey formation was apparent to ensure that foster parents and released chicks remained with a group of birds. Preliminary results indicated that post-release chick survival was higher than what was observed in 1994. Pre-conditioning research will continue in an effort to further quantify post-release survival of masked bobwhite chicks. Although the results of this research project are preliminary, it is possible that pre-release conditioning techniques developed for masked bobwhites will prove useful to quail reestablishment efforts throughout North America.

Gardner, A. L. 1999. Order Dedelphidae. Pages 1-5 in Don E. Wilson and Sue Ruff. Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington, DC. 750 pp.

Ginsberg, H. S. 1999. Unwanted invaders: introduced species and vector-borne disease. Maritimes Winter:13-15.

Ginsberg, H. S. 2000. Integrated pest management and allocation of control efforts for vector-borne diseases. Journal of Vector Ecology 25(2):

Applications of various control methods were evaluated to determine how to integrate methods so as to minimize the number of human cases of vector-borne diseases. These diseases can be controlled by lowering the number of vector-human contacts (e.g., by pesticide applications or use of repellents), or by lowering the proportion of vectors infected with pathogens (e.g., by lowering or vaccinating reservoir host populations). Control methods should be combined in such a way as to most efficiently lower the probability of human encounter with an infected vector. Simulations using a simple probabilistic model of pathogen transmission suggest that the most efficient way to integrate different control methods is to combine methods that have the same effect (e.g., combine treatments that lower the vector population; or combine treatments that lower pathogen prevalence in vectors). Combining techniques that have different effects (e.g., a technique that lowers vector populations with a technique that lowers pathogen prevalence in vectors) will be less efficient than combining two techniques that both lower vector populations or combining two techniques that both lower pathogen prevalence, costs being the same. Costs of alternative control methods generally differ, so the efficiency of various combinations at lowering human contact with infected vectors should be estimated at available funding levels. Data should be collected from initial trials to improve the effects of subsequent interventions on the number of human cases.

Ginsberg, H. S. and J. M. Steinback. 2000. The biotic community of sandy beaches. RINHewS 7(2):2-3.

- Ginsberg, H. S. and V. J. Tepedino. 1999. Pollinator declines and changing pollination patterns. *ESA Newsletter (Entomological Society of America)* 22(12):1, 9.
- Grace, J. B. and G. R. Guntenspergen. 1999. The effects of landscape position on plant species density: Evidence of past environmental effects in a coastal wetland. *Ecoscience* 6(3):381-391.

Here we propose that an important cause of variation in species density may be prior environmental conditions that continue to influence current patterns. In this paper we investigated the degree to which species density varies with location within the landscape, independent of contemporaneous environmental conditions. The area studied was a coastal marsh landscape subject to periodic storm events. To evaluate the impact of historical effects, it was assumed that the landscape position of a plot relative to the river's mouth ("distance from sea") and to the edge of a stream channel ("distance from shore") would correlate with the impact of prior storm events, an assumption supported by previous studies. To evaluate the importance of spatial location on species density, data were collected from five sites located at increasing distances from the river's mouth along the Middle Pearl River in Louisiana. At each site, plots were established systematically along transects perpendicular to the shoreline. For each of the 175 Plots, we measured elevation, soil salinity, percent of plot recently disturbed, percent of sunlight captured by the plant canopy (as a measure of plant abundance), and plant species density. Structural equation analysis ascertained the degree to which landscape position variables explained variation in species density that could not be explained by current environmental indicators. Without considering landscape variables, 54% of the variation in species density could be explained by the effects of salinity, flooding, and plant abundance. When landscape variables were included, distance from shore was unimportant but distance from sea explained an additional 12% of the variance in species density ( $R^2$  of final model = 66%). Based on these results it appears that at least some of the otherwise unexplained variation in species density can be attributed to landscape position, and presumably previous storm events. We suggest that future studies may gain additional insight into the factors controlling current patterns of species density by examining the effects of position within the landscape.

- Hafner, H., R. V. Lansdown, J. A. Kushlan, R. W. Butler, T. W. Custer, I. J. Davidson, R. M. Erwin, J. A. Hancock, A. M. Lyles, M. Maddock, L. Marion, G. Morales, T. Mundkur, C. Perennou, O. Pineau, D. Turner, P. Ulenaers, J. van Vesse, and L. Young. 2000. Conservation of herons. Pages 343-375 in James A. Kushlan and Heinz Hafner. *Heron conservation*. Academic Press, San Diego, CA. xvi, 480 pp.
- Hahn, D. C. and J. S. Hatfield. 2000. Host selection in the forest interior: cowbirds target ground-nesting species. Pages 120-127 in J. N. M. Smith, T. Cook, S. Rothstein, S. Robinson, and S. Sealy. *Ecology and management of cowbirds and their hosts: studies in the conservation of North American passerine birds*. University of Texas Press, Austin, TX. ix, 388 pp.

We investigated patterns of cowbird host selection in a large (1300 ha), unfragmented forest in eastern New York in 1992-3 to determine whether cowbird parasitism rates can be attributed to species-specific traits or to other features associated with nest sites. Nest height was significantly associated with parasitism ( $P = 0.003$ ) in this community of 23 species ( $n = 430$  nests, 23% parasitized). Further analysis revealed that the difference in mean nest heights between parasitized and unparasitized nests was due to species identity, and within each species there was no difference in mean nest heights between parasitized and unparasitized nests. These results imply that during 1992-3 cowbirds in this forest specialized on species that have low nests and did not necessarily select low nests regardless of species. This was further supported by a negative association across all 23 species between mean nest height and parasitism rate ( $P = 0.03$ ). Thus, although most of the forest-nesting species in this community experienced cowbird parasitism, there was a tendency for higher parasitism rates on low-nesting species such as the Ovenbird, Black-and-white Warbler, Louisiana Waterthrush, Veery, and Hermit Thrush. The Wood Thrush, a mid-range nester which is heavily parasitized in southern Illinois, experienced only 10% parasitism in our site and ranked 9th in parasitism rate, although it was the most abundant species in this forest in terms of the number of nests found. A long-term study is necessary to determine whether this cowbird population consistently parasitizes the ground-nesting species of this forest.

community more often than those nesting at higher levels or whether they periodically shift among hosts at different heights and in different habitats across the local landscape.

Hahn, D. C., R. D. Price, and P. C. Osenton. 2000. Use of lice to identify cowbird hosts. *Auk* 117(4):943-951.

The host specificity of avian lice (Phthiraptera) may be utilized by biologists to investigate the brood parasitism patterns of Brown-headed Cowbirds (*Molothrus ater*). As nestlings, brood parasites have a unique opportunity to encounter lice that are typically host specific. Lice are permanent hemimetabolic ectoparasites, a group found strictly on the body of the host, and they are transferred almost exclusively by bodily contact between hosts during care of young and at copulation. We investigated whether cowbird nestlings become infested with avian lice from their host parents and carry these lice away when they fledge, in effect bearing ectoparasite indicators of the species that raised them. The technique of examining the lice on cowbird fledglings to identify their foster parents would be much less costly than hiring a team of experts to determine parasitism patterns in the conventional way by finding hundreds of songbird nests. We examined 244 cowbird fledglings and found that they carried a rich fauna of lice representing 11 species and six genera, almost the entire spectrum of louse genera known to occur on passerines. We also examined 320 songbirds from 30 species, all known hosts of the Brown-headed Cowbird. As a group the host birds bore a diversity of louse species comparable to that on the fledgling cowbirds: 13 species of lice from seven genera. In contrast, most individual passerine host species yielded only 1 or 2 louse species, significantly fewer than the cowbird fledglings ( $p < 0.0001$ ). Of 44 fledgling cowbirds carrying lice, 11 were linked to their probable avian foster parents via louse indicators, and these are the Wood Thrush and Red-winged Blackbird. Eighteen additional fledglings were linked to one of two possible foster parents. We concluded that cowbird fledglings do carry away host lice and this survey technique provides a partial assessment of local community parasitism patterns. The incomplete state of passerine louse taxonomy requires anyone using this technique to de-lice both cowbird fledglings and local host species in order to have a reference collection of lice. Lice from cowbird fledglings can be identified by a skilled taxonomist and linked to particular host species, and the principal difficulty is the scarcity of skilled avian louse taxonomists. We also found an unusually rich louse fauna on 219 adult cowbirds, which supports the interpretation that lack of opportunity due to physical isolation has been the fundamental factor in the host specificity of lice observed in certain avian orders.

Hammerschlag, R. 2000. Spring brings hope for native plants. *People, Land & Water* 7(5):29.

Haramis, G. M. and G. D. Kearns. 2000. A radio transmitter attachment technique for soras. *Journal of Field Ornithology* 71(1):135-139.

We modified a figure-8 leg-loop harness designed for small passerines to attach successfully 1.8-g radio transmitters over the synsacrum of migrant Soras (*Porzana carolina*). Because of the short caudal region of Soras, addition of a waist loop was critical to securing the transmitter while leg loops were maintained to center the package. Thin gauge (0.6-mm diameter) elastic thread proved ideal for transmitter attachment and allowed for freedom of movement and girth expansion associated with fattening during a 6-10 week stopover. Of 110 Soras radio tagged during three field seasons, only a single mortality was observed and only a single bird lost its transmitter. Migration from the study area was confirmed for 76 (69%) and suspected for another 25 birds (total 92%).

Harrison, M. K., Sr., G. M. Haramis, D. G. Jorde, and D. B. Stotts. 2000. Capturing American black ducks in tidal waters. *Journal of Field Ornithology* 71(1):153-158.

We modified conventional, funnel-entrance dabbling duck bait traps to increase captures for banding of American Black Ducks (*Anas rubripes*) in tidal saltmarsh habitats of Smith Island, Maryland, one of the few remaining strongholds for breeding Black Ducks in the Chesapeake Bay. Trap and trapping techniques were adapted to tidal creeks and refined to improve capture rate, reduce mortality, and minimize interference by gulls. Best results were achieved by synchronizing trapping with predawn, low-tide foraging patterns of Black Ducks. Trap entrances were critical to retaining ducks, and use of loafing platforms reduced overall mortality to 3% of captures per year. We captured 3071 Black Ducks during the 14-year period, 1984-1999.

- Harthill, M., D. W. Sparling, J. P. Sullivan, and H. M. Ohlendorf. 2000. Group C discussions of endpoint selection, study design, and extrapolation. Pages 217-223 in P. H. Albers, G. H. Heinz, and H. M. Ohlendorf, editors. Environmental contaminants and terrestrial vertebrates: effects on populations, communities, and ecosystems. SETAC special publications series. Environmental Toxicology and Chemistry, Pensacola, FL. 344 pp.
- Hatfield, J. S. 2000. [Book review] Conservation Biology with RAMAS® EcoLab by Susan M. Shultz, Amy E. Dunham, Karen V. Root, Sheryl L. Soucy, Steven D. Carroll, and Lev R. Ginzburg. Sunderland (Massachusetts): Sinauer Associates... 1999. Quarterly Review of Biology 74(4):480.
- Henry, P. F. P. 2000. Aspects of amphibian anatomy and physiology. Pages 71-110 in Donald W. Sparling, Greg Linder, and Christine A. Bishop, editors. Ecotoxicology of Amphibians and Reptiles. SETAC technical publications series. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 876 pp.
- Heusmann, H. W. and J. R. Sauer. 2000. The northeastern states' waterfowl breeding population survey. Wildlife Society Bulletin 28:355-364.

Efforts to tailor waterfowl hunting regulations to conditions in the Atlantic Flyway have been hampered by lack of information on local breeding populations. The Atlantic Flyway Council's technical section voted at its 1987 winter meeting (Atlantic Flyway Council Technical Section, Toronto, Canada) to establish a regional waterfowl breeding survey. Consequently, an annual survey was started in 1989 and further refined in 1993 using results from 1989 to 1992. During 1993-1997, annual spring surveys of more than 1,450 randomly selected 1-k<sup>2</sup> plots, stratified by physiographic strata, were conducted in the Atlantic Flyway from New Hampshire to Virginia to estimate breeding populations of mallards (*Anas platyrhynchos*), American black ducks (*A. rubripes*), wood duck (*Aix sponsa*), and Canada geese (*Branta canadensis*). Ground crews systematically surveyed all potential waterfowl habitat for these species in each plot. The adjusted mean mallard pair estimate over the 5-year period was 375,962 (range 310,299-415,182, mean SE 25,761) for the region surveyed. The estimate for black duck pairs was 31,154 (range 27,164-37,521, mean SE 4,978), and for wood duck pairs it was 240,473 (range 218,959-281,916, mean SE 25,408). Total number of Canada geese increased from 526,663 in 1993 to 892,278 in 1997. Population estimates for other species had unacceptably large standard errors.

- Hoffman, D. J., G. H. Heinz, L. Sileo, D. J. Audet, J. K. Campbell, and L. J. LeCaptain. 2000. Developmental toxicity of lead-contaminated sediment to mallard ducklings. Archives of Environmental Contamination and Toxicology 39:221-232.

Sediment ingestion has been identified as an important exposure route for toxicants in waterfowl. The toxicity of lead-contaminated sediment from the Coeur d'Alene River Basin (CDARB) in Idaho was examined on posthatching development of mallard (*Anas platyrhynchos*) duckling for 6 weeks. Day-old ducklings received either untreated control diet, clean sediment (24%) supplemented control diet, CDARB sediment (3,449 ug/g lead) supplemented diets at 12% or 24%, or a positive control diet containing lead acetate equivalent to that found in 24% CDARB. The 12% CDARB diet resulted in a geometric mean blood lead concentration of 1.41 ppm (WW) with over 90% depression of red blood cell ALAD activity and over threefold elevation of free erythrocyte protoporphyrin concentration. The 24% CDARB diet resulted in blood lead of 2.56 ppm with over sixfold elevation of protoporphyrin and lower brain weight. In this group the liver lead concentration was 7.92 ppm (WW), and there was a 40% increase in hepatic reduced glutathione concentration. The kidney lead concentration in this group was 7.97 ppm, and acid-fast inclusion bodies were present in the kidneys of four of nine ducklings. The lead acetate positive control group was more adversely affected in most respects than the 24% CDARB group. With a less optimal diet (mixture of two thirds corn and one third standard diet), CDARB sediment was more toxic; blood lead levels were higher, body growth and liver biochemistry (TBARS) were more affected, and prevalence of acid-fast inclusion bodies increased. Lead from CDARB sediment accumulated more readily in duckling blood and liver than reported in goslings, but at given concentrations was generally less toxic to ducklings. Many of these effects are similar to ones reported in wild mallards and geese within the CDARB.

Hoffman, D. J., G. H. Heinz, L. Sileo, D. J. Audet, J. K. Campbell, L. J. LeCaptain, and H. H. Obrecht, III. 2000. Developmental toxicity of lead-contaminated sediment in Canada Geese (*Branta canadensis*). *Journal of Toxicology and Environmental Health, Part A*. 59:235-252.

Sediment ingestion has recently been identified as an important exposure route for toxicants in waterfowl. The effects of lead-contaminated sediment from the Coeur d'Alene River Basin (CDARB) in Idaho on posthatching development of Canada geese (*Branta canadensis*) were examined for 6 weeks. Day-old goslings received either untreated control diet, clean sediment (48%) supplemented control diet, or CDARB sediment (3449 µg/g lead) supplemented diets at 12%, 24%, or 48%. The 12% CDARB diet resulted in a geometric mean blood lead concentration of 0.68 ppm (ww) with over 90% depression of red blood cell ALAD activity and over fourfold elevation of free erythrocyte protoporphyrin concentration. The 24% CDARB diet resulted in blood lead of 1.61 ppm with decreased hematocrit, hemoglobin, and plasma protein in addition to the above effects. The 48% CDARB diet resulted in blood lead of 2.52 ppm with 22% mortality, decreased growth and elevated plasma LDHL activity. In this group the liver lead concentration was 6.57 ppm (ww) with twofold increases in hepatic lipid peroxidation (TBARS) and in reduced glutathione concentration; associated effects included elevated glutathione reductase activity but lower proteinbound thiols concentration and G6PDH activity. The kidney lead concentration in this group was 14.93 ppm with subacute renal tubular nephrosis in one of the surviving goslings. Three other geese in this treatment group exhibited calcified areas of marrow, and one of these displayed severe chronic fibrosing pancreatitis. Lead from CDARB sediment accumulated less readily in gosling blood and tissues than reported in ducklings but at given concentrations was generally more toxic to goslings. Many of these effects were similar to those reported in wild geese and mallards within the Coeur d'Alene River Basin.

Howe, M. A. and B. G. Peterjohn. 2000. A different kind of census: A field guide to nongame bird monitoring programs. *Bird Conservation No.* 13:8-9.

Jung, R. E., S. Droege, J. R. Sauer, and R. B. Landy. 2000. Evaluation of terrestrial and streamside salamander monitoring techniques at Shenandoah National Park. *Environmental Monitoring and Assessment* 63(1):65-79.

In response to concerns about amphibian declines, a study evaluating and validating amphibian monitoring techniques was initiated in Shenandoah and Big Bend National Parks in the spring of 1998. We evaluate precision, bias, and efficiency of several sampling methods for terrestrial and streamside salamanders in Shenandoah National Park and assess salamander abundance in relation to environmental variables, notably soil and water pH. Terrestrial salamanders, primarily redback salamanders (*Plethodon cinereus*), were sampled by searching under cover objects during the day in square plots (10 to 35 m<sup>2</sup>). We compared population indices (mean daily and total counts) with adjusted population estimates from capture-recapture. Analyses suggested that the proportion of salamanders detected ( $p$ ) during sampling varied among plots, necessitating the use of adjusted population estimates. However, adjusted population estimates were less precise than population indices, and may not be efficient in relating salamander populations to environmental variables. In future sampling, strategic use of capture-recapture to verify consistency of  $p$ 's among sites may be a reasonable compromise between the possibility of bias in estimation of population size and deficiencies due to inefficiency associated with the estimation of  $p$ . The streamside two-lined salamander (*Eurycea bislineata*) was surveyed using four methods: leaf litter refugia bags, 1 m<sup>2</sup> quadrats, 50 x 1 m visual encounter transects, and electric shocking. Comparison of survey method at nine streams revealed congruent patterns of abundance among sites, suggesting that relative bias among the methods is similar, and that choice of survey method should be based on precision and logistical efficiency. Redback and two-lined salamander abundance were not significantly related to soil or water pH, respectively.

Jung, R. E., W. L. Ward, C. O. Kings, and L. A. Weir. 2000. *Plethodon cinereus* (Redback Salamander) predation. *Herpetological Review* 31(2):98-99.

Keough, J. R. 2000. Uncovering death and decay at the bottom of the marsh. A review. *Jug Bay Wetlands Sanctuary News* 15(1):6.

Keough, J. R., T. A. Thompson, G. R. Guntenspergen, and D. A. Wilcox. 1999. Hydrogeomorphic factors and ecosystem responses in coastal wetlands of the Great Lakes. *Wetlands* 19(4):821-834.

Gauging the impact of manipulative activities, such as rehabilitation or management, on wetlands require having a notion of the unmanipulated condition as a reference. An understanding of the reference condition requires knowledge of dominant factors influencing ecosystem processes and biological communities. In this paper, we focus on natural physical factors (conditions and processes) that drive coastal wetland ecosystems of the Laurentian Great Lakes. Great Lakes coastal wetlands develop under conditions of large-lake hydrology and disturbance imposed at a hierarchy of spatial and temporal scales and contain biotic communities adapted to unstable and unpredictable conditions. Coastal wetlands are configured along a continuum of hydrogeomorphic types: open coastal wetlands, drowned river mouth and flooded delta wetlands, and protected wetlands, each developing distinct ecosystem properties and biotic communities. Hydrogeomorphic factors associated with the lake and watershed operate at a hierarchy of scales: a) local and short-term (seiches and ice action), b) watershed / lakewide / annual (seasonal water-level change), and c) larger or year-to-year and longer ( regional and/or greater than one-year). Other physical factors include the unique water quality features of each lake. The aim of this paper is to provide scientists and managers with a framework for considering regional and site-specific geomorphometry and a hierarchy of physical processes in planning management and conservation projects.

Kirby, R. E., A. Reed, P. Dupuis, H. H. Obrecht, III, and W. J. Quist. 2000. Description and identification of American Black Duck, Mallard, and hybrid wing plumage. Biological Science Report USGS/BRD/BSR-2000-0002. iv, 26 pp.

We developed a key to identify wings of hybrids between American Black Ducks (*Anas rubripes*) and Mallards (*A. platyrhynchos*). Material for analysis included review of historical descriptions dating from the late 1700's, older museum collections in Europe and North America, wings collected from hunters in North America and Great Britain, birds banded in Canada and the United States, and a flock of propagated hybrids. All first filial generation ( $F_1$ ) American Black Duck x Mallard hybrids were identified correctly with the key. A lower proportion of other hybrid cohorts (i.e., backcrosses of  $F_1$ , to parental forms ( $P_1$ ), and second and third filial generations ( $F_2$ ,  $F_3$ , etc.) were identified. We successfully identified a larger portion of male than female hybrids for all hybrid progeny cohorts examined except  $F_1$ . The new key identified 2.37 times more hybrids in the 1977 U.S. Fish and Wildlife Service Parts Collection Survey (annual determination of the species, age, and sex composition of the waterfowl harvest using detached wings contributed by hunters) than were identified by standard techniques. The proportion of American Black Duck x Mallard hybrids to the American Black Duck parental population (the ratio: hybrids/[hybrids + American Black Ducks]) may therefore be closer to 0.132 than 0.056, the historically reported value. The hybrid key is suggested for use from North Carolina north in the Atlantic Flyway and Arkansas and Tennessee north in the Mississippi Flyway (areas where other members of the Mallard group will not confound assessment). We provide suggestions for further research that would assist identification of wings in parts collection surveys and permit estimation of the proportional representation of Mallard genes in the American Black Duck gene pool.

Knutson, M. G., J. R. Sauer, D. A. Olsen, M. J. Mossman, L. M. Hemesath, and M. J. Lannoo. 2000. Landscape associations of frog and toad species in Iowa and Wisconsin, U.S.A. Pages 134-145 *in* Hinrich Kaiser, Gary S. Casper, and Neil P. Bernstein, editors. Investigating amphibian declines: Proceedings of the 1998 declining amphibians conference. *Journal of the Iowa Academy of Science* 107(3-4, Special Issue).

Landscape habitat associations of frogs and toads in Iowa and Wisconsin were tested to determine whether they support or refute previous general habitat classifications. We examined which Midwestern species shared similar habitats to see if these associations were consistent across large geographic areas (states). *Rana sylvatica* (wood frog), *Hyla versicolor* (eastern gray treefrog), *Pseudacris crucifer* (spring peeper), and *Acris crepitans* (cricket frog) were identified as forest species, *P. triseriata* (chorus frog), *H. chrysoscelis* (Cope' gray treefrog), *R. pipiens* (leopard frog), and *Bufo americanus* (American toad) as grassland species, and *R. catesbeiana* (bullfrog), *R. clamitans* (green frog), *R. palustris* (pickerel frog), and *R. septentrionalis* (mink frog) as lake or stream

species. The best candidates to serve as bioindicators of habitat quality were the forest species *R. sylvatica*, *H. versicolor*, and *P. crucifer*, the grassland species *R. pipiens* and *P. triseriata*, and a cold water wetland species, *R. palustris*. Decline of *P. crucifer*, *R. pipiens*, and *R. palustris* populations in one or both states may reflect changes in habitat quality. Habitat and community associations of some species differed between states, indicating that these relationships may change across the range of a species. *Acris crepitans* may have shifted its habitat affinities from open habitats, recorded historically, to the more forested habitat associations we recorded. We suggest contaminants deserve more investigation regarding the abrupt and widespread declines of this species. Interspersion of different habitat types was positively associated with several species. A larger number of wetland patches may increase breeding opportunities and increase the probability of at least one site being suitable. We noted consistently negative associations between anuran species and urban development. Given the current trend of urban growth and increasing density of the human population, declines of amphibian populations are likely to continue.

Krementz, D. G. and J. S. Christie. 2000. Clearcut stand size and scrub-successional bird assemblages. *Auk* 117(4):913-924.

We investigated the effects of clearcut stand size on species richness, reproductive effort, and relative abundance of scrub-successional birds and the entire bird assemblage at the Savannah River Site in South Carolina. We used standardized mist-net grids to mark and recapture birds in clearcut replanted with longleaf pine (*Pinus palustris*) in stands of 2 to 57 ha that were two to six years old. Species richness for the entire bird assemblage was not explained by stand size ( $P = 0.67$ ), stand age ( $P = 0.95$ ), or the interaction of these two variables ( $P = 0.90$ ). Similarly, species richness of scrub-successional birds was not explained by stand size ( $P = 0.63$ ), stand age ( $P = 0.55$ ), or the interaction of stand size and stand age ( $P = 0.35$ ). Regressing species richness on clearcut stand size, we found a significant negative relationship between these variables for the entire bird assemblage ( $P = 0.01$ ) and for scrub-successional birds ( $P = 0.02$ ). The ratio of juvenile to adults in mist-net samples varied by year ( $P = 0.04$ ), but neither clearcut size ( $P = 0.23$ ) nor the interaction of clearcut size and year ( $P = 0.25$ ) was related to the ratio of juveniles to adults in the sample. We found no relationship between the frequency of capture of any category of birds and stand size (scrub-successional,  $P = 0.52$ ; woodland,  $P = 0.77$ ; combined sample,  $P = 0.55$ ). Neither bird-species richness, reproductive effort, nor relative abundance differed across clearcut stand sizes. Clearcut stand size does not appear to be an important management variable if variation in species richness, reproductive effort, or relative abundance are objectives. We suggest that even-aged forestry is a useful tool for managing birds in the south-eastern United States.

Kushlan, J. A. 2000. Heron feeding habitat conservation. Pages 219-235 in James A. Kushlan and Heinz Hafner. Heron conservation. Academic Press, San Diego, CA. xvi, 480 pp.

Kushlan, J. A. 2000. Research and information needs for heron conservation. Pages 331-342 in James A. Kushlan and Heinz Hafner. Heron conservation. Academic Press, San Diego, CA. xvi, 480 pp.

Kushlan, J. A. and H. Hafner. 2000. Heron conservation. Academic Press, San Diego, CA. xvi, 480 pp.

Kushlan, J. A. and H. Hafner. 2000. Introduction. Pages xi-xii in J. A. Kushlan and H. Hafner. Heron conservation. Academic Press, San Diego, CA. xvi, 480 pp.

Kushlan, J. A. and H. Hafner. 2000. Reflections on heron conservation. Pages 377-379 in James A. Kushlan and Heinz Hafner. Heron conservation. Academic Press, San Diego, CA. xvi, 480 pp.

Kuvlesky, W. P., Jr., S. A. Gall, S. J. Dobrott, S. Tolley, F. S. Guthery, S. A. DeStefano, N. King, K. R. Nolte, N. J. Silvy, J. C. Lewis, G. Gee, G. Camou Luders, and R. Engel-Wilson. 2000. The status of masked bobwhite recovery in the United States and Mexico. Pages 42-57 in Leonard A. Brennan, William E. Palmer, Loren W. Burger, Jr., and Teresa L. Pruden, editors. Quail IV: proceedings of the Fourth National Quail Symposium, May 6-9, 1997. Tall Timbers Research Station, Tallahassee, FL. 254 pp.

The masked bobwhite (*Colinus virginianus ridgwayi*) is an endangered species currently numbering < 1500 individuals and restricted to 2 locales in southeastern Arizona and northcentral Sonora, Mexico. The subspecies' endangered status is attributed to overgrazing of Sonora savanna grassland that began during the late 1880's and continued well into the 20th century. This overgrazing resulted in the conversion of many native grass pastures to the exotic buffleggrass (*Cenchrus ciliaris*). The Arizona masked bobwhite population was extirpated around the turn of the century, and the Sonoran population was thought to have disappeared during the 1940's until a small remnant population was discovered on a ranch near Benjamin Hill, Sonora, in 1964. Masked bobwhite recovery efforts have a dynamic, long history of nearly six decades. Current masked bobwhite recovery efforts focus on reestablishing a self-sustaining population on the Buenos Aires National Wildlife Refuge (BANWR) in the United States, as well as 2 remnant wild populations located on privately owned ranches in northcentral Sonora.

- Larson, L., P. Lehman, P. A. Buckley, J. Burgiel, and M. O'Brien. 2000. New Jersey Bird Records Committee - Annual Report, 2000. Records of New Jersey Birds 26:90-100.
- Lasier, P. J., P. V. Winger, and K. J. Bogenrieder. 2000. Toxicity of manganese to *Ceriodaphnia dubia* and *Hyalella azteca*. Environmental Contamination and Toxicology 38:298-304.

Manganese is a toxic element frequently overlooked when assessing toxicity of effluents, sediment and pore waters. Manganese can be present at toxic levels in anoxic solutions due to its increased solubility under chemically-reducing conditions, and it can remain at those levels for day in aerated test waters due to slow precipitation kinetics. *Ceriodaphnia dubia* and *Hyalella azteca* are freshwater organisms often used for toxicity testing and recommended for assessments of effluent and pore waters. Lethal and reproductive-inhibition concentrations of Mn were determined for *C. dubia* in acute 48h tests and chronic 3-brood tests using animals <24 h old and between 24 and 48 h old. Sensitivity of *H. azteca* was determined with 7d old animals in acute 96h tests. Tests were run at three levels of water hardness to assess the amelioratory effect, which was often significant. Manganese concentrations were measured analytically at test initiation and after 96 h for calculations of toxicity endpoints and determinations of Mn precipitation during the tests. Minimal amounts of Mn (below 3%) precipitated within 96 h. LC<sub>50</sub>s determined for *H. azteca* progressively increased from 3.0 to 8.6 to 13.7 mg Mn/L in soft, moderately-hard and hard waters, respectively. The tolerance of *C. dubia* to Mn was not significantly different between moderately-hard and hard waters, but was significantly lower in soft water. There was no significant difference in Mn sensitivity between the ages of *C. dubia* tested. Acute LC<sub>50</sub> values for *C. dubia* averaged 6.2, 14.5 and 15.2 mg Mn/L and chronic IC<sub>50</sub> values averaged 3.9, 8.5 and 11.5 mg Mn/L for soft, moderately-hard and hard waters, respectively. Manganese toxicity should be considered when assessing solutions with concentrations near these levels.

- Leung, Y. F. and J. L. Marion. 2000. Recreation impacts and management in wilderness: A state-of-knowledge review. Pages in D. N. Cole, S. F. McCool, W. T. Borrie, and J. O'Loughlin (compilers). Proceedings: Wilderness Science in a Time of Change. Vol. 5, May 23-27, 1999, Missoula, MT. Proceedings RMRS-P-15-Vol-5. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT.
- Loesch, C. R., D. J. Twedt, K. Tripp, W. C. Hunter, and M. S. Woodrey. 2000. Development of management objectives for waterfowl and shorebirds within the Mississippi Alluvial Valley. Pages 8-11 in Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. Strategies for Bird Conservation: The Partners in Flight Planning Process. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. PMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

The goal of the Lower Mississippi Valley Joint Venture of the North American Waterfowl Management Plan is to provide sufficient habitat to support 4.3 million wintering ducks and 1.0 million wintering geese annually. Under the assumption that the amount of foraging habitat is the primary limitation to supporting waterfowl population goals in the Mississippi Alluvial Valley (MAV), a habitat objective to make available 285,000 ha of waterfowl foraging habitat is divided among seven states. This habitat objective is further divided between public and private ownership and among three habitat types: Bottomland hardwood forest, moist-soil sites, and agricultural fields. Management objectives for shorebirds within the MAV which provide foraging habitat for 0.5

million shorebirds during their southward migration have been tentatively established. Several as yet unverified assumptions were used in establishing these objectives; consequently, we caution that the objectives are subject to revision as the assumptions are tested. We assumed that 0.5 million shorebirds move through the MAV during late summer and fall, each foraging for an average of 10 days. During this migration period, foraging shorebirds are assumed to require sufficient forage to gain 1 g of biomass per day, in addition to their basal metabolic needs. Given an invertebrate food supply that provides  $17.6 \text{ kJ} \cdot \text{g}^{-1}$ , we calculated that an average 45 g shorebird requires about 8 g of invertebrate forage per day. Further assuming that each ha of managed shorebird habitat can provide 20 kg of invertebrate food resources available to shorebirds, we extrapolated a need for 2000 ha of shorebird foraging habitat. We suggest that the bulk of this foraging habitat be provided on public lands and that it be distributed throughout the MAV.

Longcore, J. R., D. G. McAuley, D. A. Clugston, C. M. Bunck, J.-F. Giroux, C. Ouellet, G. R. Parker, P. Dupuis, D. B. Stotts, and J. R. Goldsberry. 2000. Survival of American Black Ducks radiomarked in Quebec, Nova Scotia and Vermont. *Journal of Wildlife Management* 64(1):238-252.

We monitored survival of 397 radiomarked juvenile American black ducks (*Anas rubripes*) distributed among Les Escoumins (n = 75) and Kamouraska, Quebec (n = 84), Amherst Point, Nova Scotia (n = 89), and a site on the Vermont-Quebec border (n = 149) during autumn 1990 and 1991. Eighty-six percent (215 of 250) of all confirmed mortalities during the study was from hunting; 72% of marked ducks were shot and retrieved and 14% were shot and unretrieved. We tested for differences in survival in relation to sex, body mass, year (1990-91, 1991-92), and among the 4 locations for each of 2 monitoring periods (early, EMP; late, LMP). With data from the EMP for Vermont-Quebec in 1990 and 1991, Les Escoumins in 1990, and Amherst Point in 1991, survival of hatching-year (HY) males and females did not differ (P = 0.357). For sexes combined for the EMP, survival of ducks was greater in 1991 than 1990 (P = 0.086), and differed among locations (P = 0.013). Survival (years combined) was greater at Amherst Point than at Kamouraska (P = 0.003) and Vermont-Quebec (P = 0.002) during the EMP. The highest survival rate at Amherst Point ( $0.545 \pm 0.056$  [SE]) was associated with the latest date (8 Oct) of season opening; the lowest survival rate ( $0.395 \pm 0.043$ ) was at the Vermont-Quebec border, where hunter number and activity were greatest. For the LMP, no interaction between years and locations was detected (P = 0.942), and no differences in survival existed between years (P = 0.102) and among location (P = 0.349). No association was detected between body mass at capture and survival of combined males and females during the EMP (P = 0.572) or during the LMP (P = 0.965). When we censored hunting losses for combined years for each period, EMP or LMP, all survival estimates exceeded 0.800 (0.809-0.965). These data emphasize need for an improved harvest strategy for American black ducks in North America to allow for increases in breeding populations to achieve population goals.

Longcore, J. R., D. G. McAuley, G. R. Hepp, and J. M. Rhymer. 2000. American Black Duck (*Anas rubripes*). A. Poole and F. Gill, editors. *Birds of North America* No. 481. The Birds of North America, Inc., Philadelphia, PA. 36 pp.

This document is a current life history and status account of the American Black Duck (*Anas rubripes*).

Marshall, M. R., R. R. Wilson, and R. J. Cooper. 2000. Estimating survival of neotropical-nearctic migratory birds: Are they dead or just dispersed? Pages 195-199 in Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station Ogden, UT. 281 pp.

The most common method for estimating adult survival in site specific demographic studies of Neotropical-Nearctic migratory bird populations is by measuring the return rate of marked individuals. Return rate historically has been defined as the ratio of resighted birds to the total number banded (i.e., with bands on) the prior year, and has been used as a "minimum number known alive" estimate of survival. Return rates potentially underestimate true survival (the complement of mortality) for two reasons. First, not every bird that returns to the study plot is

actually encountered by the field researcher, and second, not every bird that survives to the next breeding season returns to the study plot. We use a branching-tree diagram to illustrate that the essential problem with return rate methodology is that the fate of birds that are not resighted is unknown. It is widely recognized that Cormack-Jolly-Seber based analyses greatly improve "survival" estimates by incorporating the probability of resighting a bird given that it is alive and present on the study plot. However, these estimates will underestimate true survival if birds disperse beyond the range of the resighting effort. Because long-distance dispersal events are an important component of migratory bird ecology, we cannot estimate true survival from return rate data until better information on dispersal distances and probabilities are collected. We discuss several conservation implications of underestimating survival, and suggest terminology that is potentially less confusing.

- McDiarmid, R. W. and J. C. Mitchell. 2000. Diversity and distribution of amphibians and reptiles. Pages 15-69 *in* Donald W. Sparling, Greg Linder, and Christine A. Bishop, editors. *Ecotoxicology of Amphibians and Reptiles*. SETAC technical publications series. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 876 pp.
- Meyers, J. M. and E. P. Odum. 2000. Early avian research at the Savannah River Site, South Carolina: historical highlights and possibilities for the future. *Studies in Avian Biology* 21:18-31.
- Middendorf, G. and R. Reynolds. 2000. Herpetofauna of the Beni Biological Station Biosphere Reserve, Amazonian Bolivia: Additional information, and current knowledge in context. Pages 151-169 *in* Olga Herrera-MacBryde, Francisco Dallmeier, Bruce MacBryde, James A. Cominsky, and Carmen Miranda, editors. *Biodiversity, Conservation and Management in the Region of the Beni Biological Station Biosphere Reserve, Bolivia*. SI/MAB Series No. 4. Smithsonian Institution, Washington, D.C. v, 423 pp.

Previous collections in the Departamento del Beni in tropical Bolivia only hinted at high levels of herpetological biodiversity (Fugler 1986, 1988; de la Riva 1990a; Fugler and de la Riva 1990). Fieldwork (totaling 48 days) in July-August 1988 and September 1987 (dry seasons) and November-December 1990 (wet season) has resulted in collection and identification of 401 amphibian and reptilian specimens from the general area of the Beni Biological Station's (EBB) headquarters at El Porvenir. These collections represent 33 amphibian and 17 reptilian species in 29 genera (14 amphibian, 15 reptilian). The inventory of herpetofauna scientifically documented to occur in the Departamento del Beni is considered to have been increased by 6 amphibian and 10 reptilian species. Specimens that could not be definitively identified (reflecting taxonomic uncertainty and/or probably species new to science) include 3 amphibian species (anurans) and 2 reptilian species (snakes). The EBB harbors the richest savanna for anuran species known in South America.

- Mitra, S. S. and P. A. Buckley. 2000. Cayenne Tern on Long Island, NY: North America's fourth. *Kingbird* 50:358-367.
- Mueller, A. J., D. J. Twedt, and C. R. Loesch. 2000. Development of management objectives for breeding birds in the Mississippi Alluvial Valley. Pages 12-17 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

We used a six-step process to set habitat objectives and population goals for breeding birds in the Mississippi Alluvial Valley. Specifically, we used existing empirical studies and mathematically derived viable population estimates to define habitat objectives and population goals for bottomland hardwood forest, the most important habitat type in this physiographic area. Although habitat objectives must address both quality and quantity, we concentrate here on the size and number of forest patches in this highly fragmented landscape. To support source populations of all forest breeding birds we recommend the protection/restoration of 52 forest patches that are 4,000-8,000 ha in size, 36 patches of 8,000-40,000 ha, and 13 patches greater than 40,000 ha.

Although every physiographic area is unique, the methodology applied here should be applicable in other situations.

Neckles, H. A. and M. Dionne, editors. 2000. Regional standards to identify and evaluate tidal wetland restoration in the Gulf of Maine. A GPAC Workshop, June 2-3, 1999. Wells National Estuarine Research Reserve, Wells, ME. v, 21 pp.

Nichols, J. D. 2000. Monitoring is not enough: on the need for a model-based approach to migratory bird management. Pages 121-123 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station. 281 pp.

Informed management requires information about system state and about effects of potential management actions on system state. Population monitoring can provide the needed information about system state, as well as information that can be used to investigate effects of management actions. Three methods for investigating effects of management on bird populations are (1) retrospective analysis, (2) formal experimentation and constrained-design studies, and (3) adaptive management. Retrospective analyses provide weak inferences, regardless of the quality of the monitoring data. The active use of monitoring data in experimental or constrained-design studies or in adaptive management is recommended. Under both approaches, learning occurs via the comparison of estimates from the monitoring program with predictions from competing management models.

Nichols, J. D., J. E. Hines, J. R. Sauer, F. W. Fallon, J. E. Fallon, and P. J. Heglund. 2000. A double-observer approach for estimating detection probability and abundance from point counts. *Auk* 117(2):393-408.

Although point counts are frequently used in ornithological studies, basic assumptions about detection probabilities often are untested. We apply a double-observer approach developed to estimate detection probabilities for aerial surveys (Cook and Jacobson 1979) to avian point counts. At each point count, a designated "primary" observer indicates to another ("secondary") observer all birds detected. The secondary observer records all detections of the primary observer as well as any birds not detected by the primary observer. Observers alternate primary and secondary roles during the course of the survey. The approach permits estimation of observer-specific detection probabilities and bird abundance. We developed a set of models that incorporate different assumptions about sources of variation (e.g. observer, bird species) in detection probability. Seventeen field trials were conducted, and models were fit to the resulting data using program SURVIV. Single-observer point counts generally miss varying proportions of the birds actually present, and observer and bird species were found to be relevant sources of variation in detection probabilities. Overall detection probabilities (probability of being detected by at least one of the two observers) estimated using the double-observer approach were very high (>0.95), yielding precise estimates of avian abundance. We consider problems with the approach and recommend possible solutions, including restriction of the approach to fixed-radius counts to reduce the effect of variation in the effective radius of detection among various observers and to provide a basis for using spatial sampling to estimate bird abundance on large areas of interest. We believe that most questions meriting the effort required to carry out point counts also merit serious attempts to estimate detection probabilities associated with the counts. The double-observer approach is a method that can be used for this purpose.

Olsen, G. H. 2000. Embryologic considerations. Pages 189-212 *in* Glenn H. Olsen and Susan E. Orosz. *Manual of Avian Medicine*. Mosby, St. Louis, MO. x, 622 pp.

Olsen, G. H. 2000. Problems of neonates. Pages 213-227 *in* Glenn H. Olsen and Susan E. Orosz. *Manual of Avian Medicine*. Mosby, St. Louis, MO. x, 622 pp.

Olsen, G. H. 2000. Problems of the bill and oropharynx. Pages 359-368 *in* Glenn H. Olsen and Susan E. Orosz. *Manual of Avian Medicine*. Mosby, St. Louis, MO. x, 622 pp.

- Olsen, G. H. 2000. Soft tissue surgery. Pages 527-541 in Glenn H. Olsen and Susan E. Orosz. Manual of Avian Medicine. Mosby, St. Louis, MO. x, 622 pp.
- Olsen, G. H. and S. E. Orosz. 2000. Manual of Avian Medicine. Mosby, St. Louis, MO. x, 622 pp.
- Olsen, G. H., P. T. Redig, and S. E. Orosz. 2000. Limb dysfunction. Pages 493-526 in Glenn H. Olsen and Susan E. Orosz. Manual of Avian Medicine. Mosby, St. Louis, MO. x, 622 pp.
- Perry, M. C., B. Bauman, G. A. Gough, and E. J. R. Lohnes. 2000. Use of contour maps of water depths to predict flora and fauna abundance in moist soil management. Wetland Journal 12(2):10-13.
- Perry, M. C. and A. S. Deller. 2000. Effects of two long-term mowing regimes on vegetation. Pages 249-252 in Proceedings of the Second Eastern Native Grass Symposium held in Baltimore, Maryland, November 17-19, 1999. Agricultural Research Service, Natural Resources Conservation Service, Baltimore, MD. vi, 360 pp.

Wildlife managers have for many years been interested in the role of mowing as a management technique to benefit wildlife. Two long-term mowing regimes (60 years of similar management) were evaluated at Patuxent Research Refuge during the summer of 1997 to better understand the influence of mowing on vegetation communities. Mowing ceased in 1997 due to reduction in maintenance funds, which facilitated the identification of mature grasses. The previous mowing regime included (1) lawn areas that had been mowed with rotary mowers approximately every 24 weeks and (2) meadow areas that had been mowed approximately once a year with a brushhog. Each regime had two replications. Vegetation was sampled in 20, 1<sup>2</sup> plots per area (n=80) and percent cover visually estimated by species. The percent ground cover of the dominant vegetation on the lawn area was 40.0% red fescue (*Festuca rubra*), 26.5% white clover (*Trifolium repens*), and 18.0% Kentucky blue grass (*Poa pratensis*). The percent ground cover of the dominant vegetation in the meadow area was 33.2% meadow fescue (*Festuca elatior*), 9.9% sweet vernal grass (*Anthoxanthum odoratum*), 9.2% orchard grass (*Dactylis glomerata*), 6.3% Japanese honeysuckle (*Lonicera japonica*), and 5.2% red fescue. The sites were sampled again in 1999 with the major difference being the absence of white clover in the lawn areas, believed to be a result of the drought conditions in recent years. All percent ground covers for the dominant vegetation were significantly different ( $P < 0.01$ ) between the two mowing regimes. Species richness was higher in both years in the meadow regime (74, 62) versus the lawn regime (33, 23). Frequently mowed lawn areas may provide better grazing forage for herbivores, such as geese, rabbits, and deer, however, meadow areas may provide greater plant biomass (232 vs. 63 g/1<sup>2</sup>) and greater diversity of plant species. The meadow regime also appeared to have greater seed production and cover, which is favored by a wider variety of wildlife species, especially passerine birds and small mammals.

- Perry, M. C., P. Kangas, and H. H. Obrecht, III. 2000. Creating and managing wetland impoundments to provide habitat for aquatic birds. Pages 261-279 in Francisco A. Comin, Jorge A. Herrera-Silveira, and Javier Ramirez-Ramirez, editors. Limnology and aquatic birds, monitoring, modelling and management : Second International Symposium on Limnology and Aquatic Birds, Monitoring, Modelling and Management, Merida, Yucatan, Mexico, November 24-27, 1997. Universidad Autonoma de Yucatan, Merida, Mexico. xi, 305 pp.

Patuxent Research Refuge, located in Central Maryland (USA), has approximately 140 ha of impoundments that were constructed for recreational and wildlife conservation purposes. Impoundments are of three major designs: dammed ravines, excavated basins, and diked ponds. Over 50 species of wetland plants were transplanted to impoundments of Patuxent from many parts of the United States between 1945 and 1963 to determine the species best suited for establishment in tannin-stained infertile waters. The wood duck was the only waterfowl species commonly observed on the Refuge when the area was established, but Canada geese, mallards, and black ducks, were introduced and numerous techniques developed to improve nesting and brood habitat. Twenty-six waterfowl species and 80 species of other water birds have used the impoundments for resting, feeding, or nesting. Management is now conducted to optimize avian biodiversity. Management techniques include drawdowns of water every 3-5 years in most impoundments to provide maximum plant and invertebrate food resources for wildlife. Research on the impounded wetlands at Patuxent has included evaluation of vegetation in regard to water

level management, improving nest box design to reduce use of boxes by starlings, imprinting o waterfowl to elevated nesting structures to reduce predation on nests, and drawdown techniques to increase macroinvertebrates. Data on waterfowl abundance are evaluated relative to management activities and a preliminary computer model for management of the impoundments ha been developed. Past, present, and future management and research projects are reviewed in this paper.

- Perry, M. C., P. C. Osenton, G. A. Gough, and E. J. R. Lohnes. 2000. Establishment of warm season grasses with and without the use of compost soil amendments. Pages 244-248 *in* Proceedings of the Second Eastern Native Grass Symposium held in Baltimore, Maryland, November 17-19. Agricultural Research Service, Natural Resources Conservation Service, Beltsville, Md. vi, 360 pp.

Two compost materials (COMPRO and LEAFGRO) were evaluated as soil amendments to enhance wildlife habitats, while maintaining optimal floral and faunal biodiversity. Special emphasis was placed on the role of compost in the establishment and retention of native warm season grasses (*Andropogon gerardi*, *Schizachyrium scoparium*, and *Sorghastrum nutans*). This study was conducted at two sites that were degraded by previous military and farming operations. Sites were plowed twice in 1996 and then a one inch layer of COMPRO or LEAFGRO was applied with a modified manure spreader and disked into the soil to a depth of 3 inches. Vegetation sampling was conducted in 1996, 1997, 1998, and 1999. Initially the greatest vegetation cover occurred in plots treated with LEAFGRO. Plots treated with COMPRO had less vegetation cover than both type of controls plots (with and without warmseason grasses). The reduced plant growth in the plots treated with COMPRO may have been related to the much higher soil pH of these plots on both sites. In subsequent years, amounts of warm season grasses increased, however, in general there was more cover of warm season grasses in plots that did not receive compost than those that did receive compost. *Sorghastrum nutans* was more abundant on the sites than either of the other two species of warm season grasses. Invertebrate and mammal data collected for three year indicated that there was not more faunal activity in the plots treated with LEAFGRO or COMPRO compost soil amendments. Results indicate that compost amendments did not improve establishment of warm season grasses and the resultant faunal diversity or abundance.

- Peterjohn, B. G., J. R. Sauer, and S. Schwarz. 2000. Temporal and geographic patterns in population trend of brown-headed cowbirds. Pages 21-34 *in* J. N. M. Smith, T. Cook, S. Rothstein, S. Robinson, and S. Sealy. Ecology and management of cowbirds and their hosts: studies in the conservation of North American passerine birds. University of Texas Press, Austin, TX. ix, 388 pp.

The temporal and geographic patterns in the population trends of Brown-headed Cowbirds are summarized from the North American Breeding Bird Survey. During 1966-1992, the survey-wide population declined significantly, a result of declining populations in the Eastern BBS Region, southern Great Plains, and the Pacific coast states. Increasing populations were most evident in the northern Great Plains. Cowbird populations were generally stable or increasing during 1966-1976, but their trends became more negative after 1976. The trends in cowbird populations were generally directly correlated with the trends of both host and nonhost species, suggesting that large-scale factors such as changing weather patterns, land use practices, or habitat availability were responsible for the observed temporal and geographic patterns in the trends of cowbirds and their hosts.

- Pinkney, A. E., J. C. Harshbarger, E. B. May, and M. J. Melancon. 2000. Tumor prevalence and biomarkers of exposure and response in brown bullheads (*Ameiurus nebulosus*) from the tidal Potomac River watershed. CBFO-C99-04. U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD. various pp.

Four groups of thirty brown bullheads (*Ameiurus nebulosus*) were collected from the tidal Potomac River watershed to survey tumor prevalence in relation to contaminant exposure. Fish were obtained from the Quantico embayment, near a Superfund site that released polychlorinated biphenyl (PCBs) and DDT compounds; Neabsco Creek, a tributary with petroleum inputs from upstream areas and marinas; and the Anacostia River (both in spring and fall), where sediment is contaminated with polynuclear aromatic hydrocarbons (PAHs), PCBs, and organochlorine

pesticides. Fish were also collected from the Tuckahoe River, on the Eastern Shore of Maryland, as a reference. Fish were necropsied and examined grossly and histopathologically for skin and liver neoplasms. Cytochrome P450 activity, bile PAH metabolites, and muscle organochlorine pesticide/PCB concentrations were determined in randomly selected individuals. There were significant differences among sites in liver tumor prevalence: Anacostia (spring)-50%, Anacostia (fall)-60%, Neabsco-17%, Quantico-7%, Tuckahoe-10%. Skin tumor prevalences were also significantly different: Anacostia (spring)-37%, Anacostia (fall)-10%, Neabsco-3%, Quantico-3%, Tuckahoe-0%. Tumor prevalences in Anacostia fish were comparable to those at contaminated sites in the Great Lakes. PAH concentrations were higher in Anacostia sediments than at the other sites and there were significantly higher concentrations of PAH metabolites in bile of the Anacostia fish. At present, there are insufficient data, however, to establish a cause-effect linkage with a particular class of contaminants. Tumor surveys in selected species are recommended for monitoring the status and remediation of Regions of Concern and other areas in the Chesapeake Bay watershed.

Pinkney, A. E., P. C. McGowan, D. R. Murphy, T. P. Lowe, D. W. Sparling, and L. C. Ferrington. 2000. Effects of the mosquito larvicides temephos and methoprene on insect populations in experimental ponds. *Environmental Toxicology and Chemistry* 19(3):678-684.

The nontarget effects of Abate 4E® (44.6% temephos) at 0.054 kg of active ingredient (a.i.) per 1 ha and of Altosid Liquid Larvicide® (5% methoprene) at 0.011 kg a.i./ha were investigated in 18 experimental ponds (average area, 202 m<sup>2</sup>; maximum depth, 0.7 m) at Patuxent Wildlife Research Center, Laurel, Maryland, USA. Ponds were sprayed three times at 3-week intervals. Six ponds were sprayed with Abate, six with Altosid, and six with distilled water. Two insect-emergence traps per pond collected for 7 d and were then harvested 1 d before each spray and 13 to 14 days afterward. A repeated measures analysis of variance (ANOVA) revealed significant reductions in Shannon diversity, equitability, and numbers of individuals, species, and families in the Abate ponds relative to controls. Significant reductions also occurred in Ephemeroptera, Odonata, Diptera, Chironomidae, and *Chaoborus* sp. Hester-Dendy samplers were installed before spray one and harvested 16 d after spray three. Based on one-way ANOVA, Shannon diversity, equitability, and number of Ephemeroptera and Chironomidae were significantly reduced in the Abate ponds. Emergence data indicate only isolated cases with significant reductions in the Altosid ponds relative to controls, and the Hester-Dendy data indicate no significant differences between the Altosid and control ponds.

Pinkney, A. E., P. C. McGowan, D. R. Murphy, T. P. Lowe, D. W. Sparling, and W. H. Meredith. 1999. Effects of temephos (Abate 4E) on fiddler crabs (*Uca pugnax* and *Uca minax*) on a Delaware salt marsh. *Journal American Mosquito Control Association* 15:321-329.

The non-target effects of temephos (as Abate 4E, 44.6% active ingredient) on fiddler crabs were examined on the salt marsh at Bombay Hook National Wildlife Refuge (NWR), near Dover, DE. Six 170 x 170 m plots were established; 3 were sprayed on 4 occasions at a rate of 1.5 fl oz/acre (0.054 kg active ingredient/ha) and 3 were controls. On each plot, marsh fiddler crab (*Uca pugnax*) populations were monitored by repeatedly counting the number of burrow holes in 2 counting areas marked out along tidal guts. One half of each counting area was covered with bird netting to evaluate sublethal toxic effects, which, if present, could result in increased susceptibility to bird predation. A statistically significant linear association was established between the number of hole and the number of crabs. No significant differences were found in the numbers of holes (or crabs) in the sprayed vs. control plots and in the covered vs. uncovered sections. However, survival of juvenile crabs in *in situ* bioassays was significantly reduced (16% lower) by the spraying. Median acetylcholinesterase activity in claw muscle of red-jointed fiddler crabs (*U. minax*) collected 2 days after an operational spray with Abate 4E was significantly reduced (28% lower) compared to unsprayed crabs. In view of the toxicity to juvenile crabs and the cholinesterase inhibition, we recommend continued monitoring and research for non-target impacts of Abate 4E on fiddler crabs to establish whether the reported level of cholinesterase inhibition results in acute or chronic toxicity.

Powell, L. A., M. J. Conroy, J. E. Hines, J. D. Nichols, and D. G. Kremetz. 2000. Simultaneous use of mark-recapture and radiotelemetry to estimate survival, movement, and capture rates. *Journal of Wildlife Management* 64(1):302-313.

Biologists often estimate separate survival and movement rates from radio-telemetry and mark-recapture data from the same study population. We describe a method for combining these data type in a single model to obtain joint, potentially less biased estimates of survival and movement that use all available data. We furnish an example using wood thrushes (*Hylocichla mustelina*) captured at the Piedmont National Wildlife Refuge in central Georgia in 1996. The model structure allows estimation of survival and capture probabilities, as well as estimation o movements away from and into the study area. In addition, the model structure provides many possibilities for hypothesis testing. Using the combined model structure, we estimated that wood thrush weekly survival was  $0.989 \pm 0.007$  ( $\pm$ SE). Survival rates of banded and radio-marked individuals were not different ( $\alpha \text{ hat } [S_{\text{radioed}}, S_{\text{banded}}] = \log [S \text{ hat }_{\text{radioed}} / S \text{ hat }_{\text{banded}}] = 0.0239 \pm 0.0435$ ). Fidelity rates (weekly probability of remaining in a stratum) did not differ between geographic strata ( $\psi \text{ hat} = 0.911 \pm 0.020$ ;  $\alpha \text{ hat } [\psi^{11}, \psi^{22}] = 0.0161 \pm 0.047$ ), and recapture rates ( $\rho = 0.097 \pm 0.016$ ) banded and radio-marked individuals were not different ( $\alpha \text{ hat } [\rho_{\text{radioed}}, \rho_{\text{banded}}] = 0.145 \pm 0.655$ ). Combining these data types in a common model resulted in more precise estimates of movement and recapture rates than separate estimation, but ability to detect stratum or mark-specific differences in parameters was weak. We conducted simulation trials to investigate the effects of varying study designs on parameter accuracy and statistical power to detect important differences. Parameter accuracy was high (relative bias [RBIAS] <2 %) and confidence interval coverage close to nominal, except for survival estimates of banded birds for the "off study area" stratum, which were negatively biased (RBIAS -7 to -15%) when sample sizes were small (5-10 banded or radioed animals "released" per time interval). To provide adequate data for useful inference from this model, study designs should seek a minimum of 25 animals of each marking type observed (marked or observed via telemetry) in each time period and geographic stratum.

Powell, L. A., J. D. Lang, M. J. Conroy, and D. G. Krementz. 2000. Effects of forest management on density, survival, and population growth of wood thrushes. *Journal of Wildlife Management* 64(1):11-23.

Loss and alteration of breeding habitat have been proposed as causes of declines in several Neotropical migrant bird populations. We conducted a 4-year study to determine the effects of winter prescribed burning and forest thinning on breeding wood thrush (*Hylocichla mustelina*) populations at the Piedmont National Wildlife Refuge (PNWR) in Georgia. We estimated density, adult and juvenile survival rates, and apparent annual survival using transect surveys, radiotelemetry, and mist netting. Burning and thinning did not cause lower densities ( $P = 0.25$ ); wood thrush density ranged from 0.15 to 1.30 pairs/10 ha. No radiomarked male wood thrushes ( $n = 68$ ) died during the 4 years, but female ( $n = 63$ ) weekly survival was  $0.981 \pm 0.014$  (SE) for females ( $n = 63$ ) and  $0.976 \pm 0.010$  for juveniles ( $n = 38$ ). Apparent annual adult survival was 0.579 (SE = 0.173). Thinning and prescribed burning did not reduce adult or juvenile survival during the breeding season or apparent annual adult survival. Annual population growth ( $\lambda$ ) at PNWR was 1.00 (95% confidence interval = 0.32--1.63), and the considerable uncertainty in this prediction underscores the need for long term monitoring to effectively manage Neotropical migrants. Population growth increased on experimental compartments after the burn and thin (95% CI before = 0.91--0.97, after = 0.98--1.05), while control compartment declined (before = 0.98--1.05, after = 0.87--0.92). We found no evidence that the current management regime at PNWR, designed to improve red-cockaded woodpecker (*Picoides borealis*) habitat, negatively affected wood thrushes.

Pringle, C. M., M. C. Freeman, and B. J. Freeman. 2000. Regional effects of hydrologic alterations on riverine macrobiota in the New World: Tropical-temperate comparisons. *BioScience* 50(9):807-823.

This article has two main objectives: to examine what is known about regional effects of hydrologic modifications in temperate and tropical areas of the New World (i.e., North and South America and the Caribbean), with an emphasis on fishes and molluscs; and to discuss research need regarding regional effects of hydrologic alterations in temperate and tropical regions. A better understanding of regional effects of cumulative hydrologic alterations could help inform decisions on the nature and location of future hydrologic modifications.

- Rattner, B. A., J. B. Cohen, and N. H. Golden. 2000. Contaminant effect endpoints in terrestrial vertebrates at and above the individual level. Pages 61-93 in P. H. Albers, G. H. Heinz, and H. M. Ohlendorf, editors. Environmental contaminants and terrestrial vertebrates: effects on populations, communities, and ecosystems. SETAC special publications series. Environmental Toxicology and Chemistry, Pensacola, FL. 344 pp.
- Rattner, B. A., D. J. Hoffman, M. J. Melancon, G. H. Olsen, S. R. Schmidt, and K. C. Parsons. 2000. Organochlorine and metal contaminant exposure and effects in hatching Black-Crowned Night Heron (*Nycticorax nycticorax*) in Delaware Bay. Archives of Environmental Contamination and Toxicology 39(1):38-45.

Pea Patch Island in Delaware Bay is the site of the largest heronry north of Florida. From 1989-93, the population of nine species of wading birds numbered approximately 12,000 pairs, but has recently declined to about 7,000 pairs. Because Delaware Bay is a major shipping channel and receives anthropogenic releases of toxic substances from agricultural, industrial, and municipal point and non-point sources, contaminant exposure and effects to the heronry have been an ongoing concern. In 1997, pipping (early hatching stage) black-crowned night herons (*Nycticorax nycticorax*) were collected from separate nests at Pea Patch Island and from a coastal reference site, Middle Island in Rehoboth Bay, Delaware. There was no evidence of malformations or hepatic histopathological lesions in embryos, and their body and liver weights did not differ between sites. Biomarkers of petroleum hydrocarbons, polyhalogenated contaminant, and metal exposure (cytochrome P450 induction and oxidative stress responses) did not differ ( $p > 0.05$ ) between sites, although activities of benzyloxy-O-dealkylase and ethoxyresorufin-O-dealkylase were somewhat elevated in 3 of the 15 embryos collected from Pea Patch Island. Concentrations of 21 organochlorine pesticides and metabolites were relatively low at both sites, with *p,p'*-DDE value well below the threshold associated with eggshell thinning. Although total PCB concentration was modestly elevated ( $p < 0.05$ ) in Pea Patch Island heron embryos, levels of arylhydrocarbon receptor-active PCB congeners, polychlorinated dibenzodioxins and dibenzofurans, and toxic equivalents were low and did not differ between sites. Concentrations of Cd and Mn in pipping embryos from Pea Patch Island were slightly greater ( $p < 0.05$ ) than value observed in Middle Island embryos, but levels of these and the other metals and metalloids (e.g., Hg and Se) were below values associated with toxicity. In conclusion, it seems unlikely that chlorinated hydrocarbon and metal contaminant exposure constitutes a direct threat to the reproductive success of black-crowned night herons at Pea Patch Island. However, low-level exposure to these contaminants may constitute one of many stressors that in combination could adversely affect the stability of the wading bird population at this large heronry.

- Rattner, B. A., J. L. Pearson, N. H. Golden, J. B. Cohen, R. M. Erwin, and M. A. Ottinger. 2000. Contaminant exposure and effects--terrestrial vertebrates database: Trends and data gaps for Atlantic Coast estuaries. Environmental Monitoring and Assessment 63:131-142.

In order to examine the condition of biota in Atlantic coast estuaries, a "Contaminant Exposure and Effects--Terrestrial Vertebrates" database (CEE-TV) has been compiled through computerized search of published literature, review of existing databases, and solicitation of unpublished reports from conservation agencies, private groups, and universities. Summary information has been entered into the database, including species, collection date (1965-present), site coordinates, estuary name, hydrologic unit catalogue code, sample matrix, contaminant concentrations, biomarker and bioindicator responses, and reference source, utilizing a 98-field character and numeric format. Currently, the CEE-TV database contains 3699 georeferenced records representing 190 vertebrate species and >145,000 individuals residing in estuaries from Maine through Florida. This relational database can be directly queried, imported into a Geographic Information System to examine spatial patterns, identify data gaps and areas of concern, generate hypotheses, and focus ecotoxicological field assessments. Information on birds made up the vast majority (83%) of the database, with only a modicum of data on amphibians (<0.1%). Of the >75,000 chemical compounds in commerce, only 118 commonly measured environmental contaminants were quantified in tissues of terrestrial vertebrates. There were no CEE-TV data records in 15 of the 67 estuaries located along the Atlantic coast and Florida Gulf coast. The CEE-TV database has a number of potential applications including focusing biomonitoring efforts to generate critically needed ecotoxicological data in the numerous "gaps" along the coast, reducing

uncertainty about contaminant risk, identifying areas for mitigation, restoration or special management, and ranking ecological conditions of estuaries.

- Robbins, C. S. 1999. Foreword. Page xi *in* Willia H. Turcotte and David L. Watts. Birds of Mississippi. University Press of Mississippi, Jackson. xi, 636 pp.
- Robbins, C. S. 2000. Monitoring in North America: A brief history. Bird Conservation No. 13:2-3.
- Robbin , C. S. and D. K. Dawson. 2000. Atlantic Flyway Review: Piedmont--Coastal Plain, Region IV, Fall 1999. North American Bird Bander 25(2):60-67.
- Roman, C. T., N. Jaworski, F. T. Short, S. Findlay, and R. S. Warren. 2000. Estuaries of the northeastern United States: Habitat and land use signatures. Estuaries 23:743-764.
- Rosenberg, D. K., D. F. DeSante, and J. E. Hines. 2000. Monitoring survival rates of landbirds at varying spatial scales: An application of the MAPS Program. Pages 178-184 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. Strategies for Bird Conservation: The Partners in Flight Planning Process. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

Survivorship is a primary demographic parameter affecting population dynamics, and thus trends in species abundance. The Monitoring Avian Productivity and Survivorship (MAPS) program is a cooperative effort designed to monitor landbird demographic parameters. A principle goal of MAPS is to estimate annual survivorship and identify spatial patterns and temporal trends in these rates. We evaluated hypotheses of spatial patterns in survival rates among a collection of neighboring sampling sites, such as within national forests, among biogeographic provinces, and between breeding populations that winter in either Central or South America, and compared these geographic-specific models to a model of a common survival rate among all sampling sites. We used data collected during 1992-1995 from Swainson's Thrush (*Cathorus ustulatus*) populations in the western region of the United States. We evaluated the ability to detect spatial and temporal pattern of survivorship with simulated data. We found weak evidence of spatial differences in survival rates at the local scale of "location," which typically contained 3 mist-netting stations. There was little evidence of differences in survival rates among biogeographic provinces or between populations that winter in either Central or South America. When data were pooled for a regional estimate of survivorship, the percent relative bias due to pooling "locations" was <1%. With the pooled data, we estimated a 44% annual regional survival rate; this low estimated survival rate was likely due to the presence of transients in the population (Rosenberg and others 1999). Using simulated data, we found that power to detect spatial differences increased considerably with number of years and spatial scale, the latter reflecting larger sample size. Detection of trends at smaller spatial scales required > 12 years of monitoring. Detection of spatial pattern and temporal trends in survival rates from local to regional scales will provide important information for management and future research directed toward conservation of landbirds.

- Sauer, J. R. 2000. Combining information from monitoring programs: Complications associated with indice and geographic scale. Pages 124-126 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. Strategies for Bird Conservation: The Partners in Flight Planning Process Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station.

To adequately monitor Neotropical migratory birds, information must be collected to assess population change at local, regional, and continent-wide scales. I suggest that large-scale survey results (such as those derived from the North American Breeding Bird Survey) should not be used to predict population attributes on parks, refuges, and other protected areas. These areas are often managed, and generally contain habitats that can be poorly sampled in large scale surveys, hence local bird populations might be quite different from those sampled in the large-scale surveys. Furthermore, we are limited in our capabilities to combine information from local surveys with large-scale survey data. Most surveys of bird populations collect indices of abundance which are often not comparable among surveys due to habitat and region specific differences in probabilities of detecting birds. In assessing the effects of management, it is important to

understand the limitations of monitoring at different geographic scales and to design programs to monitor at the scale at which management is conducted.

Sauer, J. R. 2000. Why monitoring matters. *Bird Conservation* No. 13:6-7, 16.

Sauer, J. R. and R. J. Cooper. 2000. Population and habitat assessment: Monitoring bird populations over large areas: Introduction. Pages 113-114 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process* Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

Monitoring provides essential information about status and change in bird populations. For Neotropical Migrant Birds (NTMBs), the North American Breeding Bird Survey (BBS) has been particularly influential in documenting regional population change and often is cited as justification for management actions. However, as with most bird surveys, the design of the BBS, and the geographic scale of the information, often limits its use either in evaluating the response of bird populations to management, or in identifying causes of population change.

Sauer, J. R., J. Hadidian, C. Swarth, S. Droege, P. Handy, G. Diddan, and J. Huff. 2000. DC birdscape: a program for monitoring neotropical migrant birds in Washington, DC. Pages 140-142 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT.

Urban and suburban habitats often contain a variety of Neotropical migratory birds, but are poorly sampled by programs such as the North American Breeding Bird Survey. DC Birdscape was developed to inventory and monitor birds in Washington, D.C. Birds were surveyed using a systematic sample of point counts during 1993-1995. Results indicate that species richness of Neotropical migratory birds varied among land-use categories, and that maximum species richness occurred in parkland habitats. Although DC Birdscape has provided relevant information on bird distribution and species richness, it is unclear whether the information is of sufficient management interest to support its continuation as a long-term monitoring program.

Schwab, W. C., E. R. Thieler, J. R. Allen, D. S. Foster, B. A. Swift, and J. F. Denny. 2000. Influence of inner-continental shelf geologic framework on the evolution and behavior of the barrier-island system between Fire Island Inlet and Shinnecock Inlet, Long Island, New York. *Journal of Coastal Research* 16(2):408-422.

High-resolution, sea-floor mapping techniques, including sidescan-sonar and subbottom profiling, were used to investigate how the geologic framework of the inner-continental shelf influenced the Holocene evolution and modern behavior of the Fire Island barrier-island system, Long Island, New York. The inner-continental shelf off Long Island is divided into two physiographic provinces by a broad outcrop of Cretaceous coastal-plain strata offshore of Watch Hill; this outcrop was part of a subaerial headland during the Holocene marine transgression. Erosion of the headland during transgression furnished sediment to the inner-continental shelf down-drift to the west. The sediment was, in turn, reworked by oceanographic processes into a series of shoreface-attached sand ridges. The oldest (~1200 yr BP) and most stable part of the barrier-island system is immediately landward of the outcropping coastal-plain strata and thickest sand ridges. East of Watch Hill, Pleistocene sediment either is exposed on the inner-continental shelf or is buried by a veneer of modern reworked sediment. Here the barrier-island system has migrated landward at a faster rate than the segment west of Watch Hill and has been breached by numerous historic inlets. Because the Pleistocene sedimentary deposit is generally of uniform thickness throughout the study area and unconformably overlies the Cretaceous coastal-plain strata, both the Holocene and historical evolution of the Fire Island barrier-island system are controlled by the physiography of this regional unconformity. In particular, the shoreface-connected sand ridges appear to be a significant source of sediment to the western portion of Fire Island. Previous attempts to develop a sediment budget for this coastal system have failed to explain volumetric discrepancies, primarily

because poor assumptions were made about the nature of sediment transport in the system. A more realistic sediment budget must include a significantly larger spatial scale, including sediment input from the inner-continental shelf.

Sewalk, C. J., G. L. Brewer, and D. J. Hoffman. 2001. The effects of diquat, an aquatic herbicide, on the development of mallard embryos. *Journal of Toxicology and Environmental Health, Part A* 62:101-113.

Bipyridyliu herbicides produce embryotoxic and teratogenic effects in dipteran, amphibian, avian, and mammalian organisms. Diquat dibromide, a bipyridylum compound, is commonly used as an aquatic herbicide. Mallard (*Anas platyrhynchos*) eggs were exposed to diquat by immersing the eggs for 10s in solutions of 0.88, 3.5, 7, 14, or 56 g/L on either the fourth or twenty-first day of incubation. Application of diquat on day 4 yielded an estimated LC<sub>50</sub> of 19.5 g/L through 18 day of incubation, and 9.6 g/L through hatching. Body and organ weights, and bone lengths o hatchlings did not differ between control and treatment groups with the exception of a slight increase in brain weight in the 14 g/L group. Malformations in diquat-treated embryos included defect of the brain, eye, bill, limb, and pelvis; skeletal scoliosis; and incomplete ossification. Subcutaneous edema was also present. Significant manifestations of oxidative stress were apparent in hatchlings and included increased hepatic thiobarbituric acid reactive substances (TBARS) (lipid peroxidation) and decreased brain reduced glutathione (GSH). Brain protein-bound sulfhydryls (PBSH) increased. Diquat applied on day 21 of incubation yielded an estimated LC<sub>50</sub> of 12.6 g/L through hatching. Exposure at this late stage of development did not produce deformities. Body and organ weights, and, bone lengths of hatchlings did not differ between control and treatment groups. Significant manifestations of oxidative stress in hatchlings included decreased brain GSH, increased oxidized glutathione (GSSG) and ratio of GSSG:GSH. This study suggests that concentrations of diquat commonly used for aquatic weed control, when based upon the expected dilution effect of average water depth of the application area, would probably have little impact on mallard embryos. However, concentrations applied above ground to weeds and cattails along the edge of waters and ditches could adversely affect the survival and development of mallard embryos, and presumably other avian species nesting in such habitats.

Sparling, D. W. 2000. Effects of Altosid and Abate-4E on deformities and survival in southern leopard frogs under semi-natural conditions. Pages 90-91 *in* Hinrich Kaiser, Gary S. Casper, and Neil P. Bernstein, editors. Investigating amphibian declines: Proceedings of the 1998 declining amphibians confereence. *Journal of the Iowa Academy of Science* 107(3-4, Special Issue).

Experimental wetlands were sprayed with Abate-4E (a.i. temephos) and Altosid (a.i. methoprene) through the summer following label directions. In late August and early Septemeber metamorphing tadpoles were captured and examined for deformities. Tadpoles captured fro pond sprayed with Altosid had a 15% deformity rate mostly involving total or partially missing hind limbs. Tadpoles from control ponds had a 5% rate of deformities. The difference was statistically signiicant. The relative abundance of tadpoles from ponds sprayed with Abate-4E was significantly lower than those from Altosid-sprayed or control wetlands.

Sparling, D. W., C. A. Bishop, and G. Linder. 2000. The current status of amphibian and reptile ecotoxicological research. Pages 1-14 *in* Donald W. Sparling, Greg Linder, and Christine A. Bishop, editors. *Ecotoxicology of Amphibians and Reptiles*. SETAC technical publications series. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 876 pp.

The extent of research conducted on the effects of contaminants on reptiles and amphibians has been scant compared to that of other vertebrate classes including fishes, birds and mammals. In a review of literature from 1972 until 1998 we found that only about 2.7% of the papers published on ecotoxicology in vertebrates concerned amphibians and 1.4% for reptiles. Most studies on amphibian ecotoxicology were on metals, pesticides, and acid deposition. For reptiles the greatest frequency of papers included metals, organochlorines, and others. In proportion to the taxonomic importance, far more papers were written on turtles than on other reptile orders. Most of the papers dealt with residues and very few dealt with effects of contaminant exposure.

Sparling, D. W., C. A. Bishop, and G. Linder. 2000. Ecotoxicology of organic contaminants to amphibians. Pages 461-494 *in* Donald W. Sparling, Greg Linder, and Christine A. Bishop, editors.

Ecotoxicology of Amphibians and Reptiles. SETAC technical publications series. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 876 pp.

The effects of organic contaminants on amphibians are poorly known but of considerable interest. These contaminants include the highly toxic dioxins and furans as well as PCBs, PAHs and organochlorine pesticides. Although these compounds may have lower acute toxicity than dioxins and furans, they have been implicated in several problems associated with genotoxicity, endocrine disruption, malformations and reduced growth. There is evidence that amphibian tadpoles bioaccumulate these organic compounds and may have biological concentrating factors ranging in the hundreds. This chapter reviews what is known about the effects and concentrations of organic contaminants in amphibians and provides recommendations for further research.

Sparling, D. W., C. A. Bishop, B. Pauli, and S. Money. 2000. Epilogue: Lessons yet to be learned. Page 811-822 in Donald W. Sparling, Greg Linder, and Christine A. Bishop, editors. Ecotoxicology of Amphibians and Reptiles. SETAC technical publications series. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 876 pp.

This chapter provides a summary of the book Ecotoxicology of Amphibians and Reptiles edited by Sparling, Linder and Bishop. In addition to the comparative lack of information on effects and residue burdens of known contaminants in amphibians and reptiles, there is a plethora of new chemicals being produced and released into the environment on which no data exist at all. According to the Environmental Defense Fund, there are some 75,000 chemicals produced each year, not including pesticides. Of these, 3,000 are produced in high volumes. Of the high volume chemicals, only 29% have been examined for effects of human health and only 5% have been examined for effects on the environment and wildlife. Even of these 150 chemicals, only a small handful have been examined in amphibians or reptiles. Thus there is a tremendous lack of information on the effects of environmental contaminants on these vertebrates. This chapter outlines the major research needs in the area of ecotoxicology of amphibians and reptiles and lists several reasons why these animals would make excellent subjects for monitoring the effects of contaminants.

Sparling, D. W., G. Linder, and C. A. Bishop, editors. 2000. Ecotoxicology of Amphibians and Reptiles. SETAC technical publications series. Society of Environmental Toxicology and Chemistry, Pensacola, FL. 876 pp.

For many years, ecological research on amphibians and reptiles has lagged behind that of other vertebrates such as fishes, birds, and mammals, despite the known importance of these animals in their environments. The lack of study has been particularly acute in the area of ecotoxicology where the number of published scientific papers is a fraction of that found for the other vertebrate classes. Recently, scientists have become aware of severe crises among amphibian populations, including unexplained and sudden extinctions, worldwide declines, and hideous malformations. In many of these instances, contaminants have been listed as probable contributors. Data on the effects of contaminants on reptiles are so depauperate that even the most elementary interpretations are difficult.

This state-of-the-science review and synthesis of amphibian and reptile ecotoxicology demonstrates the inter-relationships among distribution, ecology, physiology, and contaminant exposure, and interprets these topics as they pertain to comparative toxicity, population declines, malformations, and risk assessment. In this way, the book identifies and serves as a basis for the most pressing research needs in the coming years.

The editors have invited 27 other internationally respected experts to examine the state of existing data in specific areas, interpret it in light of current problems, and identify research gaps and needs. Through its emphasis on recent research, extensive reviews and synthesis, Ecotoxicology of Amphibians and Reptiles will remain a definitive reference work well into the next century.

Spina, F. and J. Tautin. 1999. Present and future of scientific bird ringing. Page 3190 (RT15) in N. J. Adams and R. H. Slotow, editors. Proceedings 22nd International Ornithological Congress, 16-22 August 1998, Durban. Bird Life South Africa, Johannesburg, South Africa. on CD-ROM: lxxxii, 3229 pp.

In 1999 scientific bird ringing will celebrate its first century of existence. Started mainly to investigate bird movements, bird ringing has become a much more flexible method to study different aspects of bird biology. Bird ringing can only be properly organised if an effective international co-operation exists. In Europe, this co-ordination is ensured by EURING, made of 35 national ringing centres; sister organisations exist in other parts of the world (like Africa, Australia, U.S. and Canada), sharing the same aims and problems. This RTD is mainly targeted to ornithologists involved with the co-ordination of bird ringing stations and national centres world-wide. Common aspects of the organisation of ringing activities, as well as of the potential ringing has and will have in the future in addressing major scientific questions in Ornithology will be taken into account. The advisability of setting up a standing committee on bird ringing within the IOC will be discussed, and the project of creating a world-wide organisation of ringing schemes in order to further improve communication and exchange of experiences will also be addressed. This new organisation would be formally founded in 1999, when an international conference organised by EURING to celebrate the first 100 years of bird ringing will be held in Denmark.

Sykes, P. W., Jr., A. K. Kepler, C. B. Kepler, and J. M. Scott. 2000. Kaua'i 'O'o; O'ahu 'O'o; Hawai'i 'O'o; Bishop's 'O'o; Kioea. *Birds of North America* 535. 32 pp.

The Hawai'i 'O'o was the first Hawaiian honeyeater discovered by westerners, described from a specimen obtained in 1779 during Captain James Cook's third voyage; the other 4 species were not known to the scientific community until the mid- to late 1800's. The O'ahu and Hawai'i 'o'o and the Kioea are now definitely extinct, and the Kaua'i and Bishop's 'o'o are probably extinct.

Tepedino, V. J. and H. S. Ginsberg. 2000. Report of the U.S. Department of Agriculture and U.S. Department of the Interior Joint Workshop on declining pollinators, 27-28 May 1999, Logan, Utah. Information and Technology Report USGS/BRD/ITR - 2000-0007.

Pollinators such as bees, birds, and bats are important components of agricultural and natural ecosystems. Current evidence suggests that populations of some pollinators are declining because of habitat loss and fragmentation, pesticide use, and the effects of invasive species. The U.S. Department of Agriculture and the U.S. Department of the Interior held a joint workshop on declining pollinators to assess the current status of pollinator populations and to recommend research directions for their agencies. The two-day workshop on 27-28 May 1999 in Logan, Utah, included presentations by federal scientists and university and museum researchers on the evidence and causes of pollinator declines and on resulting problems for agriculture, changing pattern in pollination of wild plants, and implications for natural communities. The participants discussed research needs and joint research strategies for both agencies. Important recommendations included establishing monitoring programs to assess trends in pollinator populations, conducting biological surveys of pollinators, fostering study of bee systematics, assessing the roles of pollinators in natural and agricultural systems, and restoring pollinator habitat.

Twedt, D. J., P. B. Hamel, R. J. Cooper, and M. S. Woodrey. 2000. An evaluation strategy for conservation goals of the Mississippi Alluvial Valley. Pages 18-22 *in* Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

The population goals and habitat objectives established by the Mississippi Alluvial Valley Migratory Bird Initiative are based on several unverified assumptions. We have developed an evaluation strategy that identifies research needed to verify these assumptions. We also have outlined a monitoring strategy designed to track progress toward achieving habitat objectives and population goals.

Twedt, D. J. and C. R. Loesch. 1999. Forest area and distribution in the Mississippi alluvial valley: Implications for breeding bird conservation. *Journal of Biogeography* 26:1215-1224.

Knowing the current forest distribution and patch size characteristics is integral to the development of geographically defined, habitat-based conservation objectives for breeding birds. Towards this

end, we classified 2.6 million ha of forest cover within the Mississippi Alluvial Valley using 1992 thematic mapper satellite imagery. Although historically this area, from southern Illinois to southern Louisiana, was dominated by forested wetlands, forest cover remains on less than 25% of the floodplain. Remaining forest cover is comprised of > 38,000 discrete forest patches > 2 ha. Mean patch area ( $64.1 \pm 5.2$  ha;  $\bar{x} \pm SE$ ) was highly skewed towards small fragment size. Larger patches had a higher proportion of more hydric forest cover classes than did smaller patches which had a higher proportion of less hydric forest cover classes. Public lands accounted for 16% of remaining forested wetlands. Fewer than 100 forest patches exceeded our hypothesized habitat objective (4000 ha minimum contiguous forest area) intended to support self-sustaining populations of forest breeding birds. To increase the number of forest patches exceeding 4000 ha contiguous area, and thereby increase the likelihood of successful forest bird conservation, we recommend afforestation adjoining existing forest fragments  $\approx 1012$  ha and focused within designated Forest Bird Conservation Regions.

Twedt, D. J. and C. R. Loesch. 2000. Conservation planning and monitoring avian habitat. Pages 131-134 in Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. *Strategies for Bird Conservation: The Partners in Flight Planning Process*. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

Migratory bird conservation plans should not only develop population goals, they also should establish attainable objectives for optimizing avian habitats. Meeting population goals is of paramount importance, but progress toward established habitat objectives can generally be monitored more easily than can progress toward population goals. Additionally, local or regional habitat objectives can be attained regardless of perturbations to avian populations that occur outside the geographic area covered by conservation plans. Assessments of current avian habitats, obtained from remotely sensed data, and the historical distribution of habitats should be used in establishing habitat objectives. Habitat planning and monitoring are best conducted using a geographic information system. Habitat objectives are assigned to three categories: maintaining existing habitat, restoring habitat, and creating new or alternative habitat. Progress toward meeting habitat objectives can be monitored through geographic information systems by incorporating georeferenced information on public lands, private lands under conservation easements, corporate lands under prescribed management, habitat restoration areas, and private land under alternative management to enhance wildlife values. We recommend that the area and distribution of habitats within the area covered by conservation plans be reassessed from remotely sensed imagery at intervals appropriate to detect predicted habitat changes.

Twedt, D. J. and C. O. Nelms. 1999. Waterfowl density on agricultural fields managed to retain water in winter. *Wildlife Society Bulletin* 27(4):924-930.

Managed water on private and public land provides habitat for wintering waterfowl in the Mississippi Valley, where flood control projects have reduced the area of natural flooding. We compared waterfowl densities on rice, soybean, and moist-soil fields under cooperative agreements to retain water from 1 November through 28 February in Arkansas and Mississippi and assessed temporal changes in waterfowl density during winter in 1991-1992 and 1992-1993. Fields flooded earlier in Arkansas, but retained water later in Mississippi. Over winter, waterfowl densities decreased in Arkansas and increased in Mississippi. Densities of waterfowl, including mallard (*Anas platyrhynchos*), the most abundant species observed, were greatest on moist-soil fields. However, soybean fields had the greatest densities of northern shoveler (*Spatula clypeata*).

Uhart, M., M. E. Zaccagnini, editors, and N. Vyas, et al., contributors. 2000. *Manual de procedimientos operativos estandarizados de campo para documentar incidentes de mortandad de fauna silvestre en argoecosistemas*. Comision Interinstitucional para la Conservacion de la Vida Silvestre en Agroecosistemas, Buenos Aires, Argentina. 151 pp.

Vann, S. I., D. W. Sparling, and M. A. Ottinger. 2000. Effects of white phosphorus on mallard reproduction. *Environmental Toxicology and Chemistry* 19:2525-2531.

Extensive waterfowl mortality involving thousands of ducks, geese, and swans has occurred annually at Eagle River Flats, Alaska since at least 1982. The primary agent for this mortality has

been identified as white phosphorus. Although acute and subacute lethality have been described, sublethal effects are less well known. This study reports on the effects of white phosphorus on reproductive function in the mallard (*Anas platyrhynchos*) in captivity. Fertility, hatching success, teratogenicity, and egg laying frequency were examined in 70 adult female mallards who received up to 7 daily doses of 0, 0.5, 1.0, and 2.0 mg/kg of white phosphorus. Measurements of fertility and hatchability were reduced by the white phosphorus. Teratogenic effects were observed in embryos from hens dosed at all treatment levels. Egg laying frequency was reduced even at the lowest treatment level; treated hens required a greater number of days to lay a clutch of 12 eggs than control hens. After two doses at 2.0 mg/kg, all females stopped laying completely for a minimum of 10 days and laying frequency was depressed for at least 45 days. Fertility of 10 adult male mallards dosed with 1.0 mg/kg of white phosphorus did not differ from 10 controls, but plasma testosterone levels were significantly ( $p < 0.05$ ) reduced in the treated males 1 day after dosing ended. These results provide evidence that productivity of free-ranging mallards may be impaired if they are exposed to white phosphorus at typical field levels.

Vickery, P. D., J. R. Herkert, F. L. Knopf, J. Ruth, and C. E. Keller. 2000. Grassland birds: An overview of threats and recommended management strategies. Pages 74-77 in Rick Bonney, David N. Pashley, Robert Cooper, and Larry Niles, editors. Strategies for Bird Conservation: The Partners in Flight Planning Process. Proceedings of the 3rd Partners in Flight Workshop, Cape May, New Jersey, October 1-5, 1995. RMRS-P-16 U.S. Forest Service, Rocky Mountain Research Station, Ogden, UT. 281 pp.

Grassland ecosystems are dependent on periodic disturbance for habitat maintenance. Historically, grazing by native herbivores and prairie fires were the agents principally responsible for maintaining grassland areas. However, elimination of native herbivores, wide-spread fire suppression, and conversion for agriculture have greatly altered grasslands in the United States and Canada. Because of these landscape changes, many grassland birds are increasingly dependent on land managers for habitat creation, maintenance, and health. Grazing, prescribed burning, and mowing/haying are the most frequently used, and versatile, grassland management techniques. Grassland birds prefer a wide range of grass heights and densities, with some species preferring short sparse vegetation, and others preferring taller, more dense vegetation. Due to differences in species habitat preferences and regional differences in soils and floristics, the responses of individual grassland species to specific grassland management practices can be variable and often are regionally dependent. As a result, management of grassland areas is best directed toward the creation of a mosaic of grassland habitat types. This habitat mosaic is probably best maintained through some type of rotational management system in which sections of large grassland areas receive management on a regular schedule. Such a rotational system would provide a variety of habitat types in every year, would ensure the availability of suitable habitat for birds at either end of the grassland management spectrum, and also would provide habitat for birds whose preferences lie between these extremes.

Vyas, N. B., J. W. Spann, and G. H. Heinz. 2001. Lead shot toxicity to passerines. Environmental Pollution 111(1):135-138.

Vyas, N. B., J. W. Spann, G. H. Heinz, W. N. Beyer, J. A. Jaquette, and J. M. Mengelkoch. 2000. Lead poisoning of passerines at a trap and skeet range. Environmental Pollution 107(1):159-166.

Our objective was to determine if ground foraging passerines in a woodland surrounding a trap and skeet range were subject to lead poisoning. Lead availability to birds was determined by shot count and soil and earthworm analysis. Avian exposure to lead was identified by measuring free-erythrocyte protoporphyrin levels in blood and lead in tissues of three passerine species. Results showed that most shot were found in the top 3 cm of soil. Lead measurements ranged from 110 to 27,000 ppm (dry wt) in soil and were 660 and 840 ppm in earthworms. Sparrows held in an aviary at the range ( $p = 0.02$ ) and free-flying juncos ( $p = 0.0005$ ) mistnetted at the range displayed significantly higher protoporphyrin levels than those at an uncontaminated site. Sparrow and cowbird carcasses from the aviary carried 37 and 39 ppm lead (dry wt), respectively, whereas a junco liver contained 9.3 ppm lead.

Walters, J. R., S. R. Beissenger, J. W. Fitzpatrick, R. Greenberg, J. D. Nichols, H. R. Pulliam, and D. W. Winkler. 2000. The AOU Conservation Committee Review of the biology, status, and management of Cape Sable Seaside Sparrows: Final Report. *Auk* 117(4):1093-1115.

White, D. H. and J. T. Seginak. 2000. Nest box use and productivity of great crested flycatchers in prescribed-burned longleaf pine forests. *Journal of Field Ornithology* 71(1):147-152.

Managing for the endangered Red-cockaded Woodpecker (*Picoides borealis*) on federal lands require burning large tracts of mature pine forests every 3-5 yr. Many cavity trees that serve as potential nest sites for primary and secondary hole-nesting birds are destroyed by fire. We assessed the efficacy of a nest box program for the Great Crested Flycatcher (*Myiarchus crinitus*) at Carolina Sandhills National Wildlife Refuge, an area intensively managed for Red-cockaded Woodpeckers. During 1996-1998, we installed and monitored 330 (30 in each of 11 sites) nest boxes in mature (>60 yr) longleaf pine (*Pinus palustris*) tracts that were burned either in April-June (warm season) or December-March (cool season). Prescribed-burned sites were nearly devoid of snags; we estimated only 0.8/ha in cool-season burns and 1.7/ha in warm-season burns. Great Crested Flycatchers built nests in 20% of the boxes available to them. Clutch sizes were larger in warm-season burns than in cool-season burns, but fledging success (fledglings/nest hatching -1 egg) was lower. Twenty-two of 59 Great Crested Flycatcher nests were depredated and the proportions in each burn class were similar. We recommend the installation of nest boxes for Great Crested Flycatchers in prescribed-burned pine forests, but additional research is needed in these habitats on nest depredation rates and causes.

Wilson, R. R., D. J. Twedt, and A. B. Elliott. 2000. Comparison of line transects and point counts for monitoring spring migration in forested wetlands. *Journal of Field Ornithology* 71(2):345-355.

We compared the efficacy of 400-m line transects and sets of three point counts at detecting avian richness and abundance in bottomland hardwood forests and intensively managed cottonwood (*Populus deltoides*) plantations within the Mississippi Alluvial Valley. We detected more species and more individuals on line transects than on three point counts during 218 paired surveys conducted between 24 March and 3 June, 1996 and 1997. Line transects also yielded more birds per unit of time, even though point counts yielded higher estimates of relative bird density. In structurally more-complex bottomland hardwood forests, we detected more species and individuals on line transects, but in more-open cottonwood plantations, transects surpassed point counts only at detecting species within 50 m of the observer. Species richness and total abundance of Nearctic-Neotropical migrants and temperate migrants were greater on line transect within bottomland hardwood forests. Within cottonwood plantations, however, only species richness of Nearctic-Neotropical migrants and total abundance of temperate migrants were greater on line transects. Because we compared survey techniques using the same observer, within the same forest stand on a given day, we assumed that the technique yielding greater estimates of avian species richness and total abundance per unit of effort is superior. Thus, for monitoring migration within hardwood forests of the Mississippi Alluvial Valley, we recommend using line transects instead of point counts.

Zhioua, E., K. Heyer, M. Browning, H. S. Ginsberg, and R. A. LeBrun. 1999. Pathogenicity of *Bacillus thuringiensis* variety *kurstaki* to *Ixodes scapularis* (Acari: Ixodidae). *Journal of Medical Entomology* 36:900-902.

Pathogenicity of the entomopathogenic bacterium *Bacillus thuringiensis* var. *kurstaki* de Barjac & Lemille was tested against the black-legged tick, *Ixodes scapularis* Say. Engorged larvae dipped in a solution of  $10^8$  spore per ml showed 96% mortality, 3 wk post-infection. The  $LC_{50}$  value for engorged larvae (concentration required to kill 50% of ticks) was  $10^7$  spores/ml. *Bacillus thuringiensis* shows considerable potential as a microbial control agent for the management of *Ixodes scapularis*.

Presentations and Unpublished Reports of the  
**USGS Patuxent Wildlife Research Center**

February 2000 — January 2001

Adamowicz, S. C. and C. T. Roman. 2000. Physical attributes of New England salt marsh pools. Ne England Estuarine Research Society, Block Island, RI., November 2-4.

Albers, P. H. 2000. Sources, fate, and effects of PAHs in shallow water environments. A workshop on "Impacts of motorized boats on shallow water systems," Douglas College Center, Rutgers, the State University of New Jersey, November 8.

Polycyclic aromatic hydrocarbons (PAHs) are aromatic hydrocarbons with two to seven fused carbon (benzene) rings that can have substituted groups attached to the carbons. Shallow coastal, estuarine, lake, and river environments receive PAHs from treated wastewater, stormwater runoff, petroleum spills and natural seeps, recreational and commercial boats, natural fires, volcanoes, and atmospheric deposition of combustion products. Abiotic degradation of PAHs is caused by photooxidation, photolysis in water, and chemical oxidation. Many aquatic microbes, plants, and animals can metabolize and excrete ingested PAHs; accumulation is associated with poor metabolic capabilities, high lipid content, and an organism distribution that coincides with high concentrations of PAHs. Resistance to biological transformation increases with increasing number of carbon rings; four- to seven-ring PAHs are the most difficult to metabolize and the most likely to accumulate in sediments. Disturbance by boating activity of sediments, shorelines, and the surface microlayer of water causes water column re-entry of recently deposited or concentrated PAHs. Residence time for PAHs in undisturbed sediment exceed several decades. Toxicity of PAHs causes lethal and sublethal effects in plants and animals, whereas some substituted PAHs and metabolites of some PAHs cause mutations, developmental malformations, tumors, and cancer. Environmental concentrations of PAHs in water are usually several orders of magnitude below levels that are acutely toxic, but concentrations can be much higher in sediment. The best evidence for a link between environmental PAHs and induction of cancerous neoplasms is for demersal fish in areas with high concentrations of PAHs in the sediment.

Albers, P. H., D. J. Hoffman, D. M. Buscemi, and M. J. Melancon. 2000. Effects of the mosquito larvicide GB-1111 on Red-winged Blackbird embryos. Wildlife Society's 7th Annual Meeting, Nashville, TN, September 12-16.

Golden Bear Oil or GB-1111 is a petroleum distillate that is used throughout the United States as a larvicide for mosquito pupae. The oil forms a barrier at the air-water interface, which suffocates air-breathing insects. Classified as a hydrotreated (processing removes polycyclic aromatic hydrocarbons), light naphthenic (closed-chain alkane) petroleum distillate, GB-1111 is insoluble in water, has a specific gravity of 0.8-0.92, and has a low rate of evaporation. The toxicity of GB-1111 is low for fish and water-column invertebrates, but reduced abundance has been observed for air-breathing larvae and adult insects, and crustaceans near the water surface. The eggs of birds breeding in wetlands can be exposed to the larvicide during application. Eggs of red-winged blackbirds (*Agelaius phoeniceus*) were collected from several sites in Maryland and Delaware, artificially incubated, and treated on days 3-5 of incubation with external applications of GB-1111 equivalent to either 0, 1/3, 1, 3, or 10 times the maximum rate of recommended field application (X). Hatching success was significantly reduced only by the highest level of treatment. Neither duration of incubation for hatchlings and age at death for unhatched eggs, nor body weight, yolk weight, liver weight, liver weight/body weight ratio, and four of five skeletal measurements for hatchlings were different among groups. Crown-rump distance was less for the 1/3 X group than

for the controls, X, and 3 X groups, but not less than the 10 X group. Hepatic microsomal, P450-associated, monooxygenase activity (EROD) of day-old hatchlings was not different among groups. Recommended rates of field applications of GB- 1111 are unlikely to threaten the survival or development of embryos of wetland passerines.

Alpizar-Jara, J., J. Nichols, J. Hines, J. Sauer, K. Pollock, and C. Rosenberry. 2000. The relationship between species detection probability and local extinction probability. [poster]. EURING 2000 Conference, Point Reyes, California, October 1-7.

In community-level ecological studies, it is common that not all species present in sampled areas are detected. Recently proposed estimation methods allow detection probabilities to be less than 1 and to be heterogeneous among species. These methods can also be used to estimate species local extinction probability and turnover rates. However, they were not developed to deal with simultaneous heterogeneity of detection probabilities and community-level vital rates. We present reasons for suspecting that heterogeneous detection probabilities should covary with heterogeneous vital rates. We present an ad hoc approach to estimating community-level vital rates in the presence of joint heterogeneity of detection probabilities and vital rates. The method consists of partitioning the number of species in two groups using the detection frequencies and then estimating vital rates (e.g., local extinction probabilities) for each group. Estimators from each group are combined in a weighted estimator of vital rates that accounts for heterogeneity. We used data from the North American Breeding Bird Survey to test our hypotheses and to illustrate estimation methods. Our data analyses support the hypothesis that species detection probability covaries negatively with local probability of extinction and turnover rates. A simulation study shows that weighted and unweighted estimators perform similarly.

Brawn, J., J. D. Nichols, J. E. Hines, and J. Nesbitt. 2000. Estimated rates of change in selected species of tropical birds using mark-recapture. *Living on the edge: Birds 2000*. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

The population biology of tropical birds is known for a only small sample of species; especially in the Neotropics. Robust estimates of parameters such as survival rate and finite rate of population change ( $\lambda$ ) are crucial for conservation purposes and useful for studies of avian life histories. We used methods developed by Pradel (1996, *Biometrics* 52:703-709) to estimate  $\lambda$  for 10 species of tropical forest lowland birds using data from a long-term (> 20 yr) banding study in Panama. The species constitute an ecologically and phylogenetically diverse sample. We present these estimates and explore if they are consistent with what we know from selected studies of banded birds and from 5 yr of estimating nesting success (i.e., an important component of  $\lambda$ ). A major goal of these analyses is to assess if the mark-recapture methods generate reliable and reasonably precise estimates of population change than traditional methods that require more sampling effort.

Brawn, J., J. Nichols, J. Hines, J. Nesbitt, and J. Karr. 2000. Estimating for tropical forest species with mark-recapture data: Is this approach sufficient? [poster]. EURING 2000 Conference, Point Reyes, California, October 1-7.

The population biology of tropical birds is known for only a small sample of species; especially in the Neotropics. Robust estimates of parameters such as survival rate and finite rate of population change ( $\lambda$ ) are crucial for conservation purposes and useful for studies of avian life histories. We used methods developed by Pradel (*Biometrics* 1996, 52:703-709) to estimate  $\lambda$  for 10 species of tropical forest lowland birds using data from a long-term (> 20 yrs.) banding study in Panama. These species constitute an ecologically and phylogenetically diverse sample. We present and evaluate these estimates to see if they are consistent with what we know from selected studies of banded birds and from 5 years of estimating nesting success. A major goal of these analyses is to assess if the mark-recapture methods generate reliable and reasonably precise estimates than more traditional methods that require far more sampling effort.

Cam, E., B. Cadiou, J. E. Hines, and J. Y. Monnat. 2000. Squatting as a behavioral strategy associated with recruitment in the kittiwake: influence of age and behavior on survival and transition probability to first reproduction. EURING 2000 Conference, Point Reyes, California, October 1-7.

In many species of seabirds, individuals start attending colonies several years before first reproduction. Prebreeders may visit several colonies; they may establish on a specific site and form a pair, exhibit territorial behavior and be involved in social interactions. The low recapture probability of prebreeders usually makes investigations of the multiple functions of their activities difficult. In colonial species, recruitment involves integration into a complex web of social relationships. Behavioral tactics may influence recruitment probability, age of first reproduction, and the probability of success in the first breeding attempt. Age of first reproduction is a component of reproductive strategies that may influence the overall fitness of individuals. Here we used capture-recapture data to address the influence of behavioral tactics and age on survival in prebreeders, and on the probability of recruiting, in a long-lived colonial seabird, the Kittiwake (*Rissa tridactyla*). We also addressed the influence of behavior and age on breeding performance in the first attempt. Each year, prebreeders were categorized according to behavior. Behavioral studies in this species led to specification of a particular category of prebreeders: "squatters", which are considered as "more involved" in the recruitment process. We used multistate capture-recapture models to address the fitness consequences of squatting.

Cooch, E. G., E. Cam, and W. A. Link. 2000. Occam's Revenge: levels of analysis in evolutionary ecology - where to next? EURING 2000 Conference, Point Reyes, California, October 1-7.

In the most literal sense, evolutionary ecology is the study of evolutionary processes, and the ecological conditions which influence them. The overarching paradigm underlying the study of evolution is natural selection. Although there is a variety of operational definitions for natural selection in the literature, perhaps the most general one is that which characterizes selection as the process whereby heritable variation in fitness associated with variation in one or more phenotypic traits leads to intergenerational change in the frequency distribution of those traits. The past 20 years has witnessed a marked increase in the precision and reliability of our ability to estimate one or more components of fitness and characterize natural selection in wild populations, owing particularly to significant advances in methods for analysis of data from marked individuals. However, there is some risk that focus on parameter estimation in and of itself, and the standard methodologies that are applied, may have distracted attention from some of the larger contexts under which estimation of vital rates is relevant. First, estimation should be motivated a priori by strong theoretical analysis. Doing so provides clear guidance, both in terms of (i) the practical necessity (or not) of estimating one or more parameters, and (ii) assisting in the identification of realistic and meaningful models to include in the candidate model set. Second, our traditional approach to estimation often rests upon analysis of aggregates of individuals, which in the wild may reflect increasingly non-random (selected) samples with respect to the trait(s) of interest. In some cases, analysis at the aggregate level, rather than the individual level, may obscure important patterns. While there are a growing number of analytical tools available to estimate parameters at the individual level, and which can cope (to varying degrees) with progressive selection of the sample, many of these methods implicitly assume independence among individuals. However, while it is true that selection (as defined) operates at the level of the individual, the selection gradient is often (if not generally) conditional on the abundance of the population. This dependence on abundance can reflect either (i) the relative frequency of the phenotype in the population (frequency-dependence), or (ii) the direct interaction of abundance on the transition rate itself (density-dependence). As such, it may be important to consider estimating individual transition rates conditional on both the parameter values of the other individuals in the population (or at least their distribution), and population abundance. This will undoubtedly pose a considerable challenge, for both single- and multi-strata applications. It will also require renewed consideration of the estimation of abundance, especially for open populations. Third, selection typically operates on dynamic, individually varying traits. Such estimation will require characterizing fitness in terms of individual plasticity in one or more state variable constitutes analysis of the norms of reaction of individuals to variable environments. This can be quite complex, especially for traits that are under facultative control. Recent work has

indicated that the pattern of selection on such traits is conditional on the relative rates of movement among and frequency of spatially heterogeneous habitats, suggesting analyses of evolution of life histories in open populations can be misleading in some cases.

Demarest, D. W., M. P. Vrtiska, K. J. Reinecke, B. A. Lercel, and R. M. Kaminski. 2000. Age-assortative pairing in Wood Ducks and Mallards. 2nd North American Duck Conference, Saskatoon Saskatchewan, Canada, October 11-15.

Pairing with individuals of the same age may occur actively, presumably for adaptive reasons, or passively as a consequence of mate availability. This phenomenon has not been unequivocally addressed in waterfowl, due in part to disagreement over validity of designs and analytical techniques employed. We investigated age-assortative pair formation in wood ducks (*Aix sponsa*) and mallards (*Anas platyrhynchos*) using winter pairing data from captive flocks of freely associating, wild-strain birds of two ages (adult =17-19 months; immature=5-7 months). We compared the observed frequency of pairs having members of the same age against an expected distribution established through repeated simulation that assumed random pairing of each flock's mate pool. Construction of appropriate mate pools is critical to deriving expected frequency distributions, but often relies on untestable assumptions. For completeness, available mate pools in randomization procedures modeled age-sex distributions of a) paired individuals within flocks; and b) all individuals within flocks. Regardless of mate pool used, results for both species strongly indicated nonrandom pair formation, with individuals disproportionately selecting mates of the same age in 4 of 4 years ( $P < 0.005$ ). Results support the argument that like-aged assortative pair formation in waterfowl may result from active, homotypic selection, while challenging hypotheses that predict waterfowl should preferentially select older, more experienced mates. Alternative explanations describing the pattern as a passively occurring phenomenon are explored and refuted.

Doherty, P., J. Nichols, G. Smith, J. Tautin, J. Voelzer, D. Benning, J. Bidwell, A. Brazda, E. Buelna, C. Ferguson, J. Goldsberry, E. Martin, F. Roetker, J. Solberg, P. Thorp, and J. Wortham. 2000. The effects of age, sex and wetland conditions on breeding ground philopatry in Mallards: an application of Burnham's (1993) joint recovery-recapture model [poster]. EURING 2000 Conference, Point Reyes, California, October 1-7.

Breeding ground philopatry in waterfowl is usually considered with regard to behavior or evolutionary ecology, but it also has practical relevance to waterfowl management. For example, an assumed high degree of philopatry underlies breeding population referenced hunting regulations, and for many habitat conservation measures to be successful, birds must return to the areas conserved. Understanding philopatry and the factors that influence it are important to drawing inferences from estimates of population size, survival rates, harvest rates, and for determining the effectiveness of harvest management. Common hypotheses about breeding ground philopatry in waterfowl are that (1) females are more philopatric to breeding grounds than males, (2) adults are more philopatric than young, and (3) philopatry is affected by wetland conditions. In this poster we test these hypotheses for mid-continent Mallards (*Anas platyrhynchos*) utilizing Burnham's (1993) model for the combined analysis of band recovery (birds dead) and recapture (birds alive) data. This model and its extensions have seen few applications, but hold promise for investigating philopatry in cases where both recovery and recapture data are available for a species.

Dreitz, V. J., R. E. Bennetts, J. D. Nichols, D. L. Deangelis, and W. M. Kitchens. 2000. Estimating the rate of population change of the snail kite population in Florida. EURING 2000 Conference, Point Reyes, California, October 1-7.

The Snail Kite (*Rostrhamus sociabilis*) is a tropical species whose range in the United States reaches its northern limit in the wetlands of peninsular Florida. During the past century over half the wetlands in Florida have been virtually eliminated, while others have been severely altered as a result of water management practices. With the loss and degradation of these wetlands, decline in wildlife populations occurred. In particular, 1950s and 1960s the snail kite population

was reported to be fewer than 40 individuals. From 1969 to 1994, the Snail Kite population was monitored by an annual quasi-systematic count survey. Numerous biological interpretations have been derived from these counts, including the rate of population change. Often the interpretations had little or no regard for the inherent sources of variation in these data that could influence the validity of resulting inferences. In this paper, we estimate annual rates of population change from capture-mark-resighting data collected since 1992 and discuss both advantages and problems associated with this approach.

- Droege, S. 2000. Collecting raptor migration count data for long-term monitoring [interactive workshop]. Celebrating hawk migration study: past, present and future. Hawk Migration Association of North America 25th Anniversary Conference, June 8-11, Split Rock Resort, Lake Harmony, PA.
- Eisler, R., R. E. Munro, L. M. Loges, K. Boone, M. M. Paul, and L. J. Garrett. 2000. Contaminant Hazard Reviews now available on compact disc [poster]. 6th International Symposium on Metal Ions in Biology and Medicine, San Juan, Puerto Rico, May 7-10.
- Eisler, R., R. E. Munro, L. M. Loges, K. Boone, M. M. Paul, and L. J. Garrett. 2000. Contaminant Hazard Reviews now available on compact disc [poster]. Third World Fisheries Congress: Feeding the world with fish in the next millennium: The balance between production and environment, Beijing, China, October 31 - November 3.
- Elias, S. P., J. D. Fraser, and P. A. Buckley. 2000. Piping Plover beach selection in New York. Birds and Aquatic Environments: Science for Management and Conservation, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.

We tested the hypothesis that foraging habitat and disturbance influenced Piping Plover (*Charadrius melodus*) nesting beach selection on three New York barrier islands, 1992 and 1993. We measured physiognomic characteristics, habitat availability, and human and predator disturbance levels on nesting and non-nesting beaches, and incorporated the variables into a logistic regression model. The model predicted that average open vegetation width of 12 m over a 1-km beach segment was necessary for a probability of plover nesting equal to or greater than 50%. There was evidence that human pedestrian and ORV disturbance precluded nesting on some beaches. Open vegetation fields are an example of early successional-stage barrier island habitat maintained by storm overwash and the scouring action of waves. Coastal management activities such as beach renourishment, dune-building, grass-planting, and construction of roads, jetties, groins, and seawalls, are designed to stabilize islands and prevent overwash and scouring. Open vegetation will be naturally renewed on low-lying sections of barrier islands where stabilization practices are limited.

- Erwin, R. M. 2000. Wetland management beyond typical integration. Birds and Aquatic Environments: Science for Management and Conservation, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.
- Erwin, R. M., D. Prosser, and G. Sanders. 2000. Rising seas and sinking coastal marshes: Implications to Atlantic waterbirds. Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

Along the mid-Atlantic US coast, relative sea level rise is higher than the global average of 1.5-2.0 mm/yr, ranging from about 2.5 in parts of Virginia and Delaware to about 4.0 in New Jersey (Atlantic City and Sandy Hook) and near the mouth of Chesapeake Bay, Virginia. Very few data exist on marsh elevation changes, but information from some areas in Virginia, New Jersey and New York suggest that marsh islands are not "keeping pace" with this RSLR. We began a study in 1999 that addresses changes in sea level and marsh elevation at sites from Cape Cod to southern Virginia known to be important areas for migratory waterbirds, including waterfowl, shorebirds, wading birds, and seabirds. Marsh monitoring sites have been established and data on microhabitat use by birds during all four seasons is being collected at these sites. Species

expected to be most vulnerable to RSLR in these marshes are breeding species such as Laughing Gulls, Common, Gull-billed and Forster's terns, Clapper Rails, and American Black Ducks. Most of these species are of special concern at state, regional, or national levels. We show how important this region is to these species from a flyway perspective, with more than 70% of all Atlantic coast Laughing Gulls and Forster's Terns nesting from New Jersey to Virginia.

- Erwin, R. M., Prosser, D., and G. Sanders. 2000. Sea level rise and changing Atlantic coastal marshes: are waterbirds at risk? *Birds and Aquatic Environments: Science for Management and Conservation*, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.
- Farnsworth, G. L., K. H. Pollock, J. D. Nichols, T. R. Simons, J. E. Hines, and J. R. Sauer. 2000. A removal model for estimating detection probabilities from point count surveys. *Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.*

We adapted a removal model to estimate detection probability during point count surveys. The model assumes one factor influencing detection during point counts is the singing frequency of birds. This may be true for surveys recording forest songbirds when most detections are by sound. The model requires counts to be divided into several time intervals. We used time intervals of 2, 5, and 10 min to develop a maximum likelihood estimator for the detectability of birds during such surveys. We applied this technique to data from bird surveys conducted in Great Smoky Mountains National Park. We used model selection criteria to identify whether detection probabilities varied among species, throughout the morning, throughout the season, and among different observers. The overall detection probability for all birds was 75%. We found differences in detection probability among species. Species that sing frequently such as Winter Wren and Acadian Flycatcher had high detection probabilities (about 90%) and species that call infrequently such as Pileated Woodpecker had low detection probability (36%). We also found detection probabilities varied with the time of day for some species (e.g. thrushes) and between observer for other species. This method of estimating detectability during point count surveys offers a promising new approach to using count data to address questions of bird abundance, density, and population trends.

- Flather, C. H., M. Bevers, E. Cam, J. D. Nichols, and J. R. Sauer. 2000. Evidence for habitat persistence thresholds among forest birds across the eastern U.S. *Society for Conservation Biology*, Missoula, MT, June 9-12.

There is growing theoretical evidence that populations inhabiting fragmented landscapes may exhibit persistence thresholds. Empirical tests of such thresholds are difficult because the process of fragmentation involves a simultaneous loss and shift in configuration of habitat. Results from previous reaction-diffusion modeling predict that species with strong habitat affinities should exhibit detectable shifts in persistence (i.e., a threshold) as habitat amount is reduced, and habitat arrangement should only become important in explaining variation in abundance below threshold. We used the North American Breeding Bird Survey (BBS) and digital land use and land cover data across the eastern United States to test these predictions. For each of 1,625 BBS routes, we estimated total abundance and local persistence rates for a group of birds considered to have strong affinity for forest habitats. The amount of forest habitat and its arrangement were estimated for circular scenes (19.7 km radius) centered on each BBS route. After controlling for the covariation between habitat amount and arrangement variables, ANOVA results provided support for the three hypotheses tested. Thresholds among species did vary along the habitat amount axis suggesting that species-specific criteria may be developed to determine when habitat arrangement considerations are key to species conservation.

- Freeman, M. C. 2000. Ecological aspects of the Flint River system and its fauna. Invited conference paper, *Conservation of riverine habitats of the Flint and other southeastern rivers*. Sponsored by the J. W. Jones Ecological Research Center, National Wildlife Federation and Upper

Chattahoochee Riverkeeper, Newton, GA, February 27-28. Also given as an invited presentation at the Southwest Georgia Water Leadership Summit IV, Albany GA., June 15.

The Flint River system holds exceptional biological and natural resource values. The portion of the Flint River upstream from Lake Blackshear is one of the few remaining southeastern rivers that flows unimpeded by dams from the Piedmont onto the Coastal Plain. River shoals, rocky areas of moderate to high gradient, provide productive habitats for diverse fauna, including fishes and freshwater mussels that occur natively only in the Apalachicola system. Native fishes range from the well-known and appreciated (at least by anglers) shoal bass to lesser-known (but colorful) animal such as the grayfin redhorse, bluestripe shiner and Halloween darter. The Flint River system represents a potential refuge for these fishes along with other native fishes, freshwater mussels (> 20 species) and rare plants such as the spider lily that have diminished through much of their ranges because of impoundments, pollution, and hydrologic alteration. The Flint system has also lost fauna. For example, prior to the construction of Woodruff Dam at the lower end of the system, gulf sturgeon ascended the Flint River to spawn and use spring-fed pools as cool-water refugia. In much the same way, striped bass continue to ascend the lower river from Lake Seminole and depend on the thermal refugia provided by groundwater-fed springs.

Maintaining adequate flow regimes throughout the Flint River system is critical for conserving the system's remaining diverse and abundant native fauna. One can approach the key question of what constitutes "adequate" flows by considering habitat requirements for better-studied species, and by investigating how fauna respond to naturally occurring flow events. Examples include requirements by fishes, such as the Halloween darter, for fast-water shoal habitats where they feed and spawn. Many filter-feeding invertebrates, integral components of river food-webs, can not feed without sufficient water flow. Some native mussels require moderately flowing water through their pool habitats to reproduce successfully; these remarkable animals use fishes as temporary hosts for their juveniles, and so need sufficient current to suspend their reproductive lures and attract host fishes. High flows during spring that flood riparian areas provide productive habitat for fishes to spawn and grow, while helping to shape the stream channel and removing silt from gravel beds. Periods of steady, low flows also provide reproductive opportunities for some fishes, so that a mixture of low- and high-flow years contributes to maintaining species diversity. Our present knowledge of relations among flow, habitats and river fauna, though a long way from a complete, can be used to assess potential effects on riverine communities or management that would alter flow regimes.

Freeman, M. C., E. R. Irwin, and B. J. Freeman. 2000. Native fishes below dams: working with what we have. Invited symposium paper, American Fisheries Society, Midyear Meeting of the Southern Division, Savannah, GA, February.

A century of improvements for efficient barge travel and electricity production has transformed the physical and biological character of southeastern rivers. Remnants of native riverine communities no longer persist in headwaters and tributaries of impounded river systems and, importantly, in unimpounded river fragments flowing between an upstream dam and the next downstream reservoir. Our research in the eastern Mobile River basin has shown large differences in relative diversity and abundance of native fishes among regulated river fragments. For example, regulated segments of the Tallapoosa River support substantial populations of as much as 70% of the native non-anadromous fauna. In contrast, regulated segments of the Etowah River and lower Coosa River support a smaller fraction of their native fish faunas, at low abundances. Differences in integrity among regulated segments partly correspond to differences in dam operations, hydrologic regimes and instream habitat, especially with respect to short-term flow stability and availability of shallow-water riffle habitats. Applying adaptive management to these regulated segments, by integrating management with research designed to test hypothesized mechanisms of species survival, could enhance conservation of native fauna and improve our understanding of relations between river fishes and hydrologic regimes.

Ginsberg, H. 2000. Ticks in New England: occurrence and management. New England Regional Turfgrass Conference and Show, Providence, RI, March.

Golden, N. H., B. A. Rattner, J. B. Cohen, D. J. Hoffman, and M. A. Ottinger. 2000. Effects of lead in nestling black-crowned night-herons (*Nycticorax nycticorax*) experimentally dosed in the field. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 229.

Lead is a known environmental toxicant, and poisoning resulting from the ingestion of lead shot has been well-documented in many species of waterfowl. However, much less is known regarding exposure and effects of free environmental lead in species of birds other than waterfowl. In an attempt to evaluate toxicity of lead to herons and to determine the usefulness of feathers as a non-invasive exposure-monitoring tool, black-crowned night-heron nestlings were dosed with lead to determine its distribution among tissues, and its effects on biochemical biomarkers, growth, and survival. Five-day-old heron nestlings (one per nest) at Chincoteague Bay, Virginia were given a single intra-peritoneal injection of dosing vehicle (control; N=7) or one of three lead solutions (as lead nitrate) (10, 50, or 250 mg/kg body weight of nestling; N=7 per dose) chosen to represent levels below, at, and above those found in moderately-polluted environments. All nestlings treated with lead exhibited dose-dependent inhibition of delta-aminolevulinic acid dehydratase (ALAD) activity compared to controls, and nestlings treated with the highest concentration showed a reduced carcass weight compared to controls. Of several measures of oxidative stress that were analyzed, significant differences were found between low- and high-dosed nestlings in hepatic total thiol and protein-bound sulfhydryl concentrations. No differences in survival were detected between dosed nestlings, controls, or uninjected siblings. Lead concentrations in several matrices, including feathers, are being determined to assess distribution among tissues and will also be examined for relationships with measures of effect.

Grinnell, C. M. and J. A. Spendelov. 2000. Roseate Tern breeding habitat use, nestsites, productivity, and behavior at the Falkner Island Unit of the Stewart B. McKinney National Wildlife Refuge, Connecticut in 1999. Unpublished report to U.S. Geological Survey, Laurel, MD and to U.S. Fish and Wildlife Service, Westbrook, CT. iii, 24 pp.

The Falkner Island Unit of the Stewart B. McKinney National Wildlife Refuge is slated for construction of a Shoreline Protection Project (a rock revetment) to curb erosion on the east side of the island. This site is the only major breeding area in Connecticut for the federally endangered Northwest Atlantic population of Roseate Terns (*Sterna dougallii*). Upon completion, the revetment could modify (if not displace) all current nesting habitat for this species, and much of the nesting habitat for Common Terns (*S. hirundo*) at this site.

In 1998 and 1999, work was conducted to assess baseline habitat conditions and Roseate Tern behavior relating to habitat use prior to revetment construction. This work is being done as part of a USGS Patuxent Wildlife Research Center project entitled "Assessment of Impacts of a Shoreline Protection Project on Endangered Roseate Terns at the Stewart B. McKinney National Wildlife Refuge", and also in conjunction with the Center's cooperative long-term metapopulation dynamic and ecology project on Roseate Terns. Here we report on results of fieldwork completed in 1999 on 1) Common Tern nestsite distribution, 2) Roseate Tern nestsite distribution, 3) adult Roseate Tern behavior and habitat use during the period of nestsite selection, 4) Roseate Tern chick behavior and use of microhabitats, and 5) characterization of potentially available rock crevices and those known to have been used as hiding places by Roseate Tern chicks.

Hahn, D. C. 2000. Endocrine basis of parasite begging behavior and nestling competition. Workshop on Parent-Offspring Communication. Gregynog, Wales, August 13-17.

Hahn, D. C. 2000. Using parasitic cowbirds as natural probes of host specificity of avian lice. 8th International Behavioral Ecology Congress, Zurich, August 8-12.

Hahn, D. C. 2000. Using parasitic species to gain novel access to research problems. A workshop on Innovation in the Biosciences, organized by the Marie Curie Fellowship Association and the Unilever Research Centre at Colworth, Bedford, England, February 21-22.

Parasitic species offer the opportunity to step back from a research problem in ecology, evolution, or behavior and to approach the problem in a novel way. The adaptations or life history strategy of the parasite species may allow the investigator to control variables in a way not possible in a non-parasitic species. For example, parasitic species gave us novel access to the evolutionary question of the relative importance of isolation vs competition in speciation. We traded on the life history strategies of two parasitic species in different taxa to investigate this evolutionary question. We used the brown-headed cowbird as an ecological probe of the host specificity of passerine lice. Specifically we examined whether the cowbird young became infested with host lice and carried these lice after fledging. If isolation rather than competition were primary in the evolution of louse specificity, then cowbird nestlings in different host nests should become infested with different lice species, and this is what we found.

Using a parasitic species as study organism may also allow an investigator to see how broad in evolutionary terms a particular physiological mechanism. We are following up on very recent work on birds in several orders (Passeriformes, Ardeiformes, and Galliformes) that has shown that maternal deposition of testosterone in eggs varies significantly among the eggs in the clutch. The pattern of variation implements the female's strategy to depress or enhance competition among her hatchlings. We are examining the relative levels of maternal testosterone in eggs of the parasitic cowbird vs the eggs of its hosts. If cowbird eggs consistently have a higher level of testosterone, we will know that this endocrine mechanism is used to manipulate nestling competition across species as well as within species.

A parasitic species can also be used as a natural experiment in the evolution of social systems. The brown-headed cowbird, along among passerine species, has no parental behavior such as nest-building, incubation of egg, or territorial defense. We are currently investigating what for of mating system the cowbird has evolved in the absence of parental care. Having collected blood samples from all the females and male cowbirds in a local population, we are using molecular genetics to reveal the maternity and paternity of the anonymous cowbird eggs we found in the host nests at our study site. From this information, we can determine the basic elements of the cowbird's mating system, whether the females are monogamous or polygamous, whether serially or simultaneously polygamous, or if long-term pair bonds exist from year to year.

The advantages of using a parasitic species to address fundamental questions in ecology, evolution, and behavior are only recently being recognized and they should also be available to research in other areas of bioscience.

- Hammerschlag, R. S. 2000. Reconstructed Anacostia wetlands. [poster]. Black Ducks and Chesapeake Bay Habitats, a symposium sponsored by the Wildfowl Trust of North America, Chesapeake College, Wye Mills, MD, October 4.
- Hammerschlag, R. S. 2000. The reconstructed freshwater tidal Anacostia wetland. Quebec 2000: Millennium Wetland Event, jointly organized and conducted by the International Peat Society, the International Association of Ecology, the Society of Wetland Scientists, and the International Mire Conservation Group, Quebec, Canada, August 6-12.
- Hammerschlag, R. S. 2000. Urban ecology as an essential basis for understanding sprawl. [poster]. Urban Sprawl Workshop sponsored by EPA and USGS at Harper's Ferry, WV, December 6-8.
- Haramis, G. M. 2000. Nest site selection and breeding productivity of Smith Island Black Ducks. Black Ducks and Chesapeake Bay Habitats, a symposium sponsored by the Wildfowl Trust of North America, Chesapeake College, Wye Mills, MD, October 4.
- Hatfield, J. S. 2000. Categorical response variables: Logistic regression, loglinear models, and survival analysis. A statistics seminar for biology students at University of Maryland Eastern Shore, May 8.
- Heacker-Skeans, M. and R. C. Banks. 2000. The early role of the AOU in bird conservation. Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

One of the first committees established by the newly founded American Ornithologists' Union in 1883 was the Committee on Bird Protection. This active committee drafted a model law for the protection of nongame birds that was adopted by several states. The AOU was instrumental in the formation in 1885 of what became the U.S. Bureau of Biological Survey. An offshoot of the committee was a National Association of Audubon Societies. The AOU paid part of the salary of the first warden at an Audubon Society refuge. The AOU demonstrated very early that the science of avian biology and activities of bird conservation could work hand in hand.

Henry, P. F. P., E. Russek-Cohen, C. S. Casey, M. A. Abdelnabi, and M. A. Ottinger. 2000. Evaluating endocrine endpoints relative to reproductive success in Japanese quail exposed to estrogenic chemical [poster]. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16, abstract book p. 263.

The standard US EPA guidelines for avian reproductive testing may not be sufficiently sensitive to detect effects of sublethal and chronic exposure to endocrine disrupting toxins. There is a need to evaluate endocrine endpoints as potential markers for contaminant effects, and to determine their effectiveness and sensitivity when applied to wildlife. To this end, a three generational test was conducted using the Japanese quail (*Coturnix japonica*) and a proven estrogenic PCB. Birds were exposed during embryonic development via maternal deposition and/or direct egg injection at day 4. Standard measures of reproductive success and productivity used in toxicological studies, as well as multiple measures of physiological and behavioral responses used in endocrine studies were collected. Long term effects on growth and apparent development were similar between treated and control offspring. Fertility of treated eggs decreased from 75%+ 4.4 (x + se) for P1, to 59% + 12.5 for F1 and 54% + 14.2 for F2. All paired control birds mated to produce viable eggs, whereas 27 % of the F1 and 41 % of the F2 treated pairs failed to produce at least 1 viable egg. Although some decreases in productivity can be related to direct toxic exposure, the response from one generation to the next was not linear with treatment, indicating a potential effect from behavioral or other endocrine alterations.

Hestbeck, J. B., R. M. DeGraaf, and J. R. Sauer. 2000. Conservation of avian diversity across geographic scales: Local management for national change. Science for Avian Conservation: Understanding, Modeling, and Applying Ecological Relationships, USGS Integration & Collaboration for Emerging Biological Issues & Research Goals (ICEBIRG) Workshop, USGS Patuxent Wildlife Research Center, Laurel, MD. Oct 31-Nov 2.

Avian diversity can only be conserved through the collective effect of thousands of local, land management actions. All land management is local. We need to find a way to guide land manager toward specific avian conservation goals. This can be accomplished by developing a system of land management models that can visually predict the consequences of different land-management scenarios. This system of models must be developed in partnership with the public and private land-holding agencies such that their confidence in the models will be higher, increasing the likelihood that prescribed land management actions will actually be implemented. Avian conservation will only occur when prescribed management actions are implemented on the ground.

An Adaptive Resource Management approach can be used to create species-habitat models with sufficient structure to allow testing of a wide variety of management scenarios. Species-habitat models can be used to summarize and test causal relationships between species occurrence and the biotic and abiotic variables that define the different habitat dimensions. Species-habitat models are developed by relating species occurrence data to habitat conditions. Once these models have been developed, they can be used to predict the outcomes of competing management scenarios including impacts on different species, different aspects of habitat, and different profit levels for the industrial forests. Land management scenarios are developed by first selecting the desired avian species and then determining how the environment must be modified to produce the necessary habitat. Optimization can be used to help select the 'best compromise' among the various competing scenarios. The selected management scenario can be implemented to modify habitat. Monitoring must be used to quantify the species and habitat

responses to the management actions to allow further refinement and testing. Model development and testing should occur on DOI and USDA-Forest Service lands to strengthen the partnership increasing the probability of implementation. Lessons learned from these experiments in ecosystem management on the Federal lands can be more confidentially applied to other land owning individuals, companies, and agencies.

Avian diversity is sufficiently rich that large numbers of possible habitats occur within the existing broad landscape cover-types. New types of remotely sensed data are needed, such as the change in vertical, vegetative structure over 50 m, that can provide sufficient local detail to provide a testable relationship between species occurrence and the remotely sensed data and a testable relationship between local habitat modifications and the remotely sensed data. To be useful for local management, the species-habitat models must relate local habitat modifications to species occurrence. To be cost-effective, the rich diversity of avian habitats must be detected remotely.

The USGS needs to manage the science upon which the species-habitat models are developed and the ecosystem management experiments are conducted. But more importantly, the USGS needs to cultivate a partnership among science and land-holding agencies to increase confidence which will ensure that prescribed management actions are implemented. Avian conservation will only occur when prescribed land management actions are implemented on the ground.

Hines, J. E. and J. D. Nichols. 2000. Investigation of potential bias in the estimation of  $\lambda$  using Pradel's (1996) model. EURING 2000 Conference, Point Reyes, California, October 1-7.

Using capture-history data and a model developed by Pradel (1996) and implemented in program MARK, it is possible to directly estimate the rates of population change ( $\lambda$ ) over time as model parameters in addition to survival and capture probability. This type of model is of particular interest to biologists studying threatened or endangered species, however alterations of study design can cause model assumptions to be violated. When captures of animals are difficult or expensive to obtain, there is a natural tendency to try to increase the number of animals captured by slightly altering the design of the experiment after it has started. These types of modifications can cause the assumptions of the model to be violated, which leads to bias in the estimated parameters. We consider three specific kinds of assumption violations: expansion of the study area over time, permanent trap response in capture probability (e.g., resulting from increased effort to capture marked animals), and heterogeneous capture probabilities. We also investigated the combined effects of trap response and heterogeneity. Results of large-sample approximations and computer simulations are discussed and plotted. Possible explanations for the results and cautions about the parameters most severely affected are also provided.

Hoffman, D. J., P. H. Albers, M. J. Melancon, and A. K. Miles. 2000. Effects of the mosquito larvicide GB-1111 on mallard and bobwhite embryos. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 230.

Golden Bear Oil or GB-1111 is a petroleum distillate that is used throughout the United States as a larvicide for mosquito pupae. The oil forms a barrier at the air-water interface, which suffocates air-breathing insects. There are few published studies on non-target effects of GB-1111 but the product label warns that "GB-1111 is toxic to fish and other aquatic organisms." Fertile eggs of mallard (*Anas platyrhynchos*) and bobwhite (*Colinus virginianus*) were incubated in the laboratory, and treated on days 4 or 11 of incubation with external applications equivalent to either 0, 1/3, 1, 3, or 10 times the maximum rate (5 gal/A) of field application of GB-1111. Hatching success was significantly reduced in mallards treated on day 4 or day 11 at 3 and 10 times the maximum field application, with a calculated approximate LD<sub>50</sub> of 1.9 times the maximum field application. Most mortality occurred within a week of treatment. Hatching success of bobwhite was only reduced at the highest level of treatment. Other effects at this level in bobwhite included a significant increase in incidence of abnormal embryos/hatchlings, lower body and liver weights of hatchlings and a two-fold increase in hepatic microsomal P450-associated monooxygenase activity (EROD) in hatchlings. Recommended rates of field application of GB-1111 are potentially toxic to mallard

embryos, especially under conditions of larvicide drift or spray overlap, but unlikely to impair the survival or development of bobwhite embryos.

Hoffman, D. J., C. J. Henny, E. F. Hill, J. O. Keith, and R. A. Grove. 2000. Effects of mercury on plasma and organ biochemistries in heron and egret nestlings along the Carson River, Nevada. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 229.

High concentrations of mercury from past mining activities have accumulated in the food chain of fish-eating birds nesting along the mid to lower Carson River. Activities of nine plasma and tissue enzymes, and concentrations of other plasma and tissue constituents were measured for black-crowned night-heron, *Nycticorax nycticorax*, (BCNH) and snowy egret, *Egretta thula*, (SE) nestlings from two high mercury sites and one low mercury site. Geometric mean blood Hg concentrations for BCNHs at the high mercury sites were 2.6 and 2.8 ppm (ww) and 0.6 ppm at the low mercury site. Blood concentrations for SEs were 3.6 and 1.9 ppm at the high mercury sites and 0.7 ppm at the low mercury site. In BCNHs plasma glutathione peroxidase (GSH peroxidase) activity was lower in both high mercury sites relative to the low mercury site. Butyryl cholinesterase (BuChe), ALT, glutathione reductase (GSSG-reductase) and LDH-L activities were lower in one high mercury site. In SEs significant differences were lower BuChe and LDH-L, but elevated GGT activities. Evidence of renal stress in both species at high mercury sites included increased plasma uric acid, blood urea nitrogen, and creatinine concentrations as well as oxidative stress in the kidney tissue itself where oxidized glutathione increased. A number of the mercury site-related effects, including decreased plasma GSH-peroxidase and hepatic G-6-PDH activities, higher GSSG-reductase activity, and lower hepatic concentrations of reduced thiols have been reported in methylmercury feeding studies with great egrets and mallards. These findings suggest the utility of herons and egrets for monitoring mercury sites.

Jorde, D. 2000. Mid-winter survey of Black Ducks, locally, and regionally. Black Ducks and Chesapeake Bay Habitats, a symposium sponsored by the Wildfowl Trust of North America, Chesapeake College, Wye Mills, MD, October 4.

Jung, R. E. 2000. The Amphibian Research and Monitoring Initiative (ARMI) in the Northeast. Northeast Partner in Amphibian and Reptile Conservation (NE PARC) Meeting, USGS Patuxent Wildlife Research Center, Laurel, MD. October 13-15.

Jung, R. E. 2000. Streamside and terrestrial salamander monitoring at Shenandoah National Park. University of Virginia Shenandoah Watershed Study Seminar Series, University of Virginia, Charlottesville, VA, May 1.

Jung, R. E., K. E. Bonine, M. L. Rosenshield, and S. Droege. 2000. Amphibian surveys by canoe along the Rio Grande in Big Bend National Park, Texas, USA. Joint Meeting of the American Society of Ichthyologists and Herpetologists, American Elasmobranch Society, Herpetologists' League, and Society for the Study of Amphibians and Reptiles (ASIH/AES/HL/SSAR), Universidad Autonoma de Baja California Sur, La Paz, B.C.S., Mexico. June 14-20.

Jung, R. E., G. H. Dayton, S. J. Williamson, and S. Droege. 2000. Amphibian surveys by canoe along the Rio Grande in Big Bend National Park, Texas, USA. Joint Meeting of the American Society of Ichthyologists and Herpetologists, American Elasmobranch Society, Herpetologists' League, and Society for the Study of Amphibians and Reptiles (ASIH/AES/HL/SSAR), Universidad Autonoma de Baja California Sur, La Paz, B.C.S., Mexico. June 14-20.

Jung, R. E., S. Droege, and J. R. Sauer. 2000. Streamside salamander surveys in Shenandoah National Park, Virginia, USA. Joint Meeting of the American Society of Ichthyologists and Herpetologists, American Elasmobranch Society, Herpetologists' League, and Society for the Study of Amphibians and Reptiles (ASIH/AES/HL/SSAR), Universidad Autonoma de Baja California Sur, La Paz, B.C.S., Mexico. June 14-20.

- Karanth, K. U. and J. D. Nichols. 2000. Camera trapping big cats: some questions that should be frequently asked. Wildlife Conservation Society, unpublished report. 19 pp.
- Karanth, K. U. and J. D. Nichols. 2000. Technical report on estimation of tiger densities in India using photographic capture-recapture sampling. Final Report to U.S. Fish and Wildlife Service.
- Keane, S. E., J. D. Fraser, L. M. Houghton, and P. A. Buckley. 2000. The effects of gull removal on Piping Plover reproductive rates at Monomoy National Wildlife Refuge, Cape Cod, Massachusetts, 1999. Birds and Aquatic Environments: Science for Management and Conservation, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.

In 1999, we studied the effects of the 1996-1999 Herring/Great Black-backed Gull removal program on habitat use and productivity of Piping Plovers, on South Monomoy Island, Massachusetts. We found fewer gulls in random beach locations in the gull-removal area than in the control area. There were fewer Great Black-backed Gulls near adult Piping Plovers before nesting and near nests in the gull-removal area than in the control area. There were fewer gulls of both species near broods in the gull-removal area than in the control area. Fledging success and productivity were lower in the gull-removal area than in the control area. There was no difference in frequency of disturbance by gulls to adult plovers or to plover broods between the gull-removal and control areas. Brood foraging rates (attempts/min) were lower in the gull-removal area than in the reference area. These observations suggest that, in 1999, gull removal did not improve Piping Plover reproductive rates in the gull-removal area above that found in the control area. Differences in reproductive rates between the areas may have been caused by differences in prey availability-in other words, by better habitat.

- Kendall, W. L. 2000. Coming and going: extensions of Pollock's robust design to open populations. Department of Natural Resources Symposium, Cornell University, April 27-28.
- Kendall, W. L. 2000. Coming and going: estimating movement when only one area is observable, using capture-recapture data. Spatial Processes in Resource Management: a Mini-Symposium, Cornell University, Ithaca, NY.
- Kendall, W. L. 2000. Discussant for session on formal experiments with ringed birds. EURING 2000 Conference, Point Reyes, California, October 1-7.
- Kendall, W. L. 2000. Discussions on mallard survival and model selection. 8th meeting of the Interagency Working Group on Adaptive Management of Waterfowl Harvests in North America, Easton, MD., May 2-5.
- Kendall, W. L. 2000. Goodness-of-fit and related issues [short course session]. EURING 2000 Conference, Point Reyes, California, October 1-7.
- Kendall, W. L. and R. Bjorkland-Kerr. 2000. Estimating demographic parameters using capture-recapture data under Pollock's robust design without assuming closure. Wildlife Society's 7th Annual Meeting in Nashville, TN, September 12-16.
- Kendall, W. L. and R. Bjorkland-Kerr. 2000. Estimating probability of breeding for sea turtle populations based on capture-recapture data. Symposium for Sea Turtle Biology and Conservation, Orlando, Florida, March 2.
- Kendall, W. L. and J. D. Nichols. 2000. Estimating transition probabilities between an observable and unobservable state using capture-recapture data [poster]. EURING 2000 Conference, Point Reyes, California, October 1-7.

Estimating the probability of an animal moving from one state to another is important to many efforts at modeling and understanding population or metapopulation dynamics. The designation of states might be based on factors such as location (e.g., moving from one patch to another),

breeding status (e.g., breeder or non-breeder), etc. When animals are captured/recaptured in each state, then multi-strata models provide a useful tool for estimating these transition probabilities as well as other demographic parameters. When there are two states, but one of the is not observable, another approach must be taken. This poster will present methods for estimating transition probabilities under Pollock's robust design, both with and without the assumption that the population is closed to additions and deletions within a primary period. The former has proven useful for breeding birds, and we anticipate that the latter could be useful for stopover areas and for breeding populations where each individual arrives and departs a breeding area in a staggered pattern. The biggest disadvantage with respect to multi-strata models is the requirement that survival rate be the same for both states.

- Keough, J. R. 2000. Communicating science to the regulated public: Where does the federal research scientist fit in? U.S. Environmental Protection Agency, Wetland Regulatory Science Meeting, Atlantic City, NJ.
- Keough, J. S., organizer and chair. 2000. Symposium: "Innovative uses of stable isotope ratio technology in understanding aquatic ecosystems and landscapes". Quebec 2000: Millennium Wetland Event, jointly organized and conducted by the International Peat Society, the International Association of Ecology, the Society of Wetland Scientists, and the International Mire Conservation Group, Quebec, Canada, August 6-12.
- Keough, J. R. 2000. Comparing the food webs of two estuaries: Green Bay of Lake Michigan and the Chesapeake Bay. USGS Leetown Science Center, Kearneysville, WV.
- Keough, J. R. 2000. Sharing information between research and management....or, making research useful in the real world. Wetland Care Australia Conference, Canberra, Australia.
- Keough, J. R. 2000. Use of stable isotope ratio technology in understanding the Chesapeake Bay. Chesapeake Bay Program, Living Resources Subcommittee, Annapolis, MD.
- Keough, J. R. 2000. Using stable isotope ratios in understanding aquatic food webs. Academy of Natural Sciences, Philadelphia, PA.
- Keough, J. R. 2000. Using stable isotope ratios in understanding aquatic food webs. Department of Biology, George Mason University, Fairfax, VA.
- Lasier, P., P. Winger, K. Bogenrieder, and J. Shelton, Jr. 2000. Impacts and toxic thresholds of sediment-associated contaminants to robust redhorse (*Moxostoma robustum*) in the Lower Oconee River. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 213.

The robust redhorse is a "Species-at-Risk" in the lower Oconee River, GA. The population is composed of aging adults with little natural recruitment. Factors contributing to the loss of early-life stages are unknown, but contaminants associated with fine sediments may play a role. The objectives of this study were to determine toxicities of sediments and pore waters from the Oconee River to early-life stages of robust redhorse and to establish toxic thresholds of metals (Cd, Cu, Mn, Zn) and ammonia, elements potentially threatening this species. Depositional sediments were collected from the only known spawning site and three sites downstream of major tributaries. Sediment pore waters were extracted in the laboratory from all sites and in situ at two sites. Toxicity tests with sediments, pore waters and metal solutions were initiated with eggs, yolk-sac fry and swim-up fry to determine effects on the life stage initially exposed as well as effects manifested in later developmental stages. Survival and growth were test endpoints, and toxicity was observed in both sediments and pore waters. Although the yolk-sac stage was the most sensitive across all tests, sediment toxicity was elicited only in tests initiated with eggs that developed through the yolk-sac stage. Toxicity appeared to be due to Mn in sediment and pore water exposures, but was more prevalent in pore waters. Sediment handling and the associated effects on redox potential contributed to the elevated concentrations of Mn in pore waters. Pore

waters extracted in situ had significantly less Mn and were less toxic than laboratory-extracted pore waters. These data suggest that sediment-associated Mn may impact early-life stages of robust redhorse in the Oconee River.

Linder, G. L., B. A. Rattner, and J. B. Cohen. 2000. Energetic dose: Beyond fire and flint? 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 24.

Nutritional and bioenergetic interactions influence exposure to environmental chemicals and may affect the risk realized when wildlife are exposed in the field. Here, food-chain analysis focuses on prairie voles (*Microtus ochrogaster*) and the evaluation of chemical risks associated with paraquat following 10-d dietary exposures. Reproductive effects were measured in 60-d trials that followed exposure to paraquat-tainted feed: control (untainted feed); 21 mg paraquat/kg feed; 63 mg paraquat/kg feed; and feed-restricted control (untainted feed restricted to 60% baseline consumption). Reproductive success was evaluated in control and treated breeding pairs, and a preliminary bioenergetics analysis was completed in parallel to derive exposure dose. Although reproductive performance differed among groups, feed-restriction appeared to be the dominant treatment effect observed in these 10-d feeding exposure/limited reproductive trials. Exposure dose ranged from 3.70-3.76 to 9.41-11.51 mg paraquat/kg BW/day at 21 and 63 mg paraquat/kg feed stock exposures, respectively. Energetic doses as ug paraquat/kcal yielded preliminary estimates of energetic costs associated with paraquat exposure, and were similar within treatments for both sexes, ranging from 4.2-5.5 and 13.-15.0 ug paraquat/kcal for voles exposed to 21 mg/kg feed stock and 63 mg/kg feed stock, respectively. Given the increasing likelihood that environmental chemicals will be found in wildlife habitat at "acceptable level", the critical role that wildlife nutrition plays in evaluating ecological risks should be fully integrated into the assessment process. Tools applied to the analysis of risk must gain higher resolution than the relatively crude methods we currently bring to the process.

Link, W. A. 2000. 'Oh, what a trapping web we weave': does geometry matter? Department of Natural Resources Symposium, Cornell University, April 27-28.

Link, W. A., E. Cooch, and E. Cam. 2000. Model-based estimation of individual fitness. EURING 2000 Conference, Point Reyes, California, October 1-7.

Fitness is the currency of natural selection, a measure of the propagation rate of an individual's gene into future generations. Its various definitions have the common feature that they are functions of survival and fertility rates. At the individual level, the operative level for natural selection, these rates must be understood as latent features, genetically determined propensities existing at birth. This conception of rates requires that individual fitness be defined and estimated by consideration of the individual in a modeled relation to a group of similar individuals; the only alternative is to consider a sample of size one, unless a clone of identical individuals is available. We present hierarchical models describing individual heterogeneity in survival and fertility rates and allowing for associations between these rates at the individual level. We apply these models to an analysis of life histories of Kittiwakes (*Rissa tridactyla*) observed at several colonies on the Brittany coast of France. We compare Bayesian estimation of the population distribution of individual fitness with estimation based on treating individual life histories in isolation, as samples of size one (e.g. McGraw and Caswell, 1996).

Link, W. A. and J. A. Royle. 2000. Introduction to Bayesian Analysis. A workshop, Evaluation of Quantitative Techniques for Applied Ecological Problem Solving, sponsored by USGS-BRD Cooperative Research Units Program, Estes Park, Colorado, May 23.

Longcore, J. 2000. American Black Duck summer range versus winter range: A dichotomy of riches. Black Ducks and Chesapeake Bay Habitats, a symposium sponsored by the Wildfowl Trust of North America, Chesapeake College, Wye Mills, MD, October 4.

Often the status of the American black duck (*Anas rubripes*) population has been attributed to a single event, less often to multiple events over time and throughout space. The difference in the quality of the habitat, however defined, within breeding areas in the north and on the southerly wintering areas, especially Chesapeake Bay, also has been proposed as affecting black duck status. The obvious question is "What variable cuts across all habitats, time, and space to affect black ducks?" This paper attempts to answer that question by examining the connectivity of seemingly unrelated variables and events associated with the black duck's summer range and its winter range relative to population change. Insights from examples of relations among these variables reveal how results may be confounded, even misleading. A perspective that may be required to ensure future black duck populations is discussed.

Longcore, J. R. and T. A. Haines. 2000. Tree swallows (*Tachycineta bicolor*) bioaccumulate mercury at Acadia National Park. Maine Water Conference, Augusta, ME, April 13.

Boxes at Seal Cove Pond, Hodgdon Pond and Aunt Betty Pond at Acadia National Park, and at Orono, Maine (reference site) were monitored during 1997 - 1999 for nesting tree swallows (*Tachycineta bicolor*). From each nest the 3<sup>rd</sup> egg laid was collected. Food boli were collected from nestling for most nests and 1 nestling ( $\geq 14$  days old)/ box was collected. Samples (food boli, eggs, carcasses, feathers) were prepared by microwave acid digestion for analysis of total mercury by a Merlin Cold Vapor Atomic Fluorescence Spectrometer. Measurable amounts of total mercury (ng/g, wet weight) were detected in all samples. For any year or pond average amounts of mercury equaled; in food boli 72-291, in eggs 227-531, in carcasses 30-73, and in feathers 1,080-4,493. Among years and ponds the factor of increases of mercury were: from food boli to eggs, 1.2-6.1, from food to carcass, 0.23-0.56, and from food to feathers, 8.5-27.7. Mercury in food boli, carcasses and feathers was different among some ponds for some years, but over all, mercury in tree swallow samples from Aunt Betty Pond ranked the highest, followed by Hodgdon Pond, Orono site, and Seal Cove Pond. The source (s) of this mercury is thought to be from atmospheric depositions, because no local point sources of mercury are known for these sites.

Lowe, P., D. Sparling, B. Teels, and N. Melvin. 2000. Sources of variance in developing and IBI assessment for restored wetlands in the Mid-Atlantic states. Quebec 2000: Millennium Wetland Event, jointly organized and conducted by the International Peat Society, the International Association of Ecology, the Society of Wetland Scientists, and the International Mire Conservation Group, Quebec, Canada, August 6-12.

Recent conservation efforts by the US Department of Agriculture and US Fish and Wildlife Service encourage land owners through financial incentives and credits to restore wetlands on idled crop lands. Often, these wetland restorations loosely apply guidelines and have little follow up to evaluate restoration methods or management practices. During the past four years we have been developing indices of biotic integrity (IBI) to serve as tools in assessing wetland condition within the Eastern Shore of Maryland and Delaware. These IBIs employ aspects of plant, macroinvertebrate and amphibian communities to measure the health of restored wetlands so that their progress can be measured and different methods of management can be assessed objectively. We used standardized techniques of sampling throughout this period but our study purposefully oversampled these communities through time and space to identify major sources of variance and determine the effects of this variance on the validity of the IBIs. The objective of this paper is to describe the relative importance of variance due to wetland, year, season within a year, and sampling effort on metrics developed from the macroinvertebrate communities inhabiting these wetlands. Each of these sources of variance may have important consequences for the reliability and repeatability of IBI assessments.

McAuley, D. G., J. R. Longcore, and D. A. Clugston. 2000. Dynamics of wetland use by breeding American Black Ducks and Mallards. 2nd North American Duck Conference, Saskatoon, Saskatchewan, Canada, October 11-15.

The American black duck (*Anas rubripes*) has declined during the past several decades. Recently, this decline has been attributed to competition with mallards (*Anas platyrhynchos*). Data from single,

annual waterfowl surveys have been used to document black duck and mallard habitat use. We studied sympatric black ducks and mallards in northern Maine during breeding to document wetland use. We observed ducks from elevated platforms on wetlands to determine numbers and species using each wetland over time; 80% of the wetlands were visited >2 times; mean total time / wetland was 267 min + 15 (SE). Upon arrival, and at 5-min intervals during a visit, we recorded the number of indicated pairs of each species. For each wetland, we determined the most frequently observed grouping of black ducks and mallards recorded during all intervals (e.g., 1 BD pair-9 intervals; 2 MA pairs and 1 BD pair-22 intervals; 0 pairs-3 intervals). One pair, 1 lone male, or no ducks were present during 34% of the intervals. All wetlands, except 1, had >2 different combinations. On most wetlands the predominant grouping was not observed during >40% of the intervals. On average, the number of indicated pairs observed during random 5-min intervals was less than half of the total black duck pairs [2.0 (0.35) vs. 4.4 (0.77),  $P = 0.0091$ ], total mallard pairs [1.1 (0.18) vs. 2.6 (0.34),  $P = 0.0001$ ], and pairs of both species combined [3.2 (0.46) vs. 7.0 (0.99),  $P = 0.0001$ ] as determined for each wetland based on total observations. On wetlands used by both species, random counts missed 1 or both species 51% of the time. Of the 63 wetland observed, 53 were used by both species; random visits detected both species on only 26 wetlands.

Melancon, M. J., A. L. Kutay, B. R. Woodin, and J. J. Stegeman. 2000. Evaluating cytochrome P450 in birds by monooxygenases and immunohistochemistry: possible nonlethal assessment by skin immunohistochemistry. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16, abstract book p. 44.

Six month old Lesser Scaup and nestling Tree Swallows were injected intraperitoneally with beta-naphthoflavone (BNF) or vehicle. Nestling Tree Swallows were also collected from five sites with differing levels of contaminants. Liver samples were taken and stored at -80C until microsome preparation and monooxygenase (MO) assay. Skin and heart samples were placed in buffered formalin until immunohistochemical (IMHC) analysis for cytochrome P4501A (CYP1A). Scaup treated with BNF at 20 or 100 mg/kg body weight showed approximately 20- to 65-fold increases in four MOs. Responses of two of the four MOs were as high at 20 mg/kg as at 100mg/kg. There was no IMHC response in the vehicle-injected ducks, while in skin the IMHC response was the same for both dose levels of BNF and in heart there was response in two of four samples at 20 mg/kg and in all five samples at 100mg/kg. Tree Swallows injected with BNF at 100, but not at 20 mg/kg showed significant increases (ca.5-fold) in two MO activities. There was no IMHC response in control swallows. In skin and heart there were IMHC responses in one of five swallows at 20 mg/kg and four of five swallows at 100mg/kg. There was poor correlation between individual skin IMHC responses and MO activities and PCB concentrations in 47 field-collected Tree Swallow samples, but 14 of the 16 skin samples with positive IMHC responses were from the location with the highest MO activities and PCB concentrations. Although present data do not allow construction of significant dose response curves, the responses in skin make it well worth continuing study on this potential nonlethal technique for biomonitoring contaminant exposure in birds.

Melancon, M. J., J. S. Russell, J. F. Estenik, S. W. Fisher, and H. Dabrow. 2000. Relationship of hepatic microsomal monooxygenases of field-collected snapping turtles (*Chelyda serpentina*) to tissue contaminant concentrations. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16, abstract book p.99.

Snapping turtles were collected by the Ohio State EPA from six locations in Ohio believed to have different contaminant concentrations. Previously we reported significant correlations among four hepatic microsomal dealkylases and CYP1A in these turtles. Herein we compare ethoxyresorufin-O-dealkylase (EROD) and methoxyROD (MROD) to tissue contaminant concentrations. For Fifty-four of these turtles, muscle, fat body and liver tissues were assessed for PCBs and 20 organochlorine analytes and hepatic microsomal dealkylases. Of the contaminants analyzed, only DDE, dieldrin, oxychlordan, trans-nonachlor and PCB 1260 were detected in >25% of each sample type. When EROD and MROD activities were compared to tissue values for these contaminants, they were found to correlate significantly only to DDE, dieldrin and trans-nonachlor.

For an 18 female subset of these turtles, serum PCBs and organochlorine pesticides, egg, fat body and liver dioxins and furans, and hepatic microsomal dealkylases were assessed. EROD and MROD both correlated significantly to serum PCB 105, PCB 138 and DDE, and to egg total PCBs. EROD and MROD did not correlate significantly with liver dioxins and furans, but there were significant correlations between EROD and egg and fat body dioxins and furans, and MROD and fat body dioxins and furans. It is expected that CYP1A-type inducers such as certain PCBs, and halogenated dioxins and furans, but not organochlorine pesticides, would be inducers in turtles. Presumably the correlation of monooxygenase with organochlorine pesticides is fortuitous, and toxic equivalencies are being calculated using a number of systems.

Meyers, J. M. 2000. Painted Bunting Breeding Bird Survey trends associated with landscape changes in Georgia and South Carolina. Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

Landscape changes during the first 3 decades of the Breeding Bird Survey (BBS) may account for the Painted Bunting's declining population trend. In the southeastern U.S., it is estimated that this bunting has declined 3.5% per year since 1966. I collected landscape data centered on identical 5-stop areas ( $n = 33$ , 306 ha each) of the BBS during early (1960s -1970s) and late decade (1980s - 1990s). Peak 30-yr counts for Painted Buntings were found at the center of the 5-stop areas. I used stepwise multiple regression analysis to model the mean number of Painted Bunting (in the area during 3 yr, dependent variable) associated with landscape metrics (independent variables). During the early decades the average amount of edge on developed land ( $p = 0.10$ ), average patch size of agriculture land ( $p = 0.01$ ), average size of shrub-scrub and young forest ( $p = 0.09$ ), and average amount of edge for emergent wetlands ( $p = 0.03$ ) explained 40% of the variation in Painted Buntings counts. In the late decades average amount of edge on developed land ( $p = 0.04$ ) and average amount of edge on emergent wetlands ( $p = 0.005$ ) explained 35% of the variation in Painted Bunting counts. Large losses of agricultural land (proportion = 0.177 to 0.094), which was developed or converted to intensively managed pine plantations, may have reduced potential bunting breeding habitat. Shrub-scrub and young forest habitat was constant (proportion = 0.136 to 0.134) but did not affect mean counts of buntings in the late decades. Protected emergent wetlands remained constant also from the early to late decade (proportion = 0.056 to 0.06) and may provide habitat to maintain a smaller Painted Bunting population. At this time, it's unclear how developed land, which is increasing (proportion = 0.036 to 0.088), may be affecting the Painted Bunting population in GA and SC.

Nichols, J. D. 2000. Approaches for the direct estimation of lambda and related parameters using capture-recapture data. EURING 2000 Conference, Point Reyes, California, October 1-7.

Since the papers of Jolly (1965) and Seber (1965), it has been clear that the information needed to estimate rate of population change is found in capture history data for open populations. This estimation can be accomplished using (1) ratios of population size estimates obtained from closed or open models, or direct parameterization of either (2) open models (Pradel 1996; Schwarz pers. comm.) or (3) joint likelihoods for the robust design. Assumptions underlying estimation of lambda are more restrictive than those underlying survival estimation and merit careful consideration. Some results on estimator robustness are presented, and it is shown, for example, that temporal pattern in can be induced by certain assumption violations (e.g., trap response in capture probability; changes in study area size). Direct parameterization permits direct ultrastructural modeling of lambda, which can be used to address questions about the influence of environmental covariates on population growth. In addition, ultrastructural modeling of lambda as a specific function of count statistics can be used to (1) address the question of whether the counts constitute reasonable "indices" of abundance and, if the answer is "yes", (2) incorporate this extra information into the estimation of lambda. Direct estimation of lambda has been considered primarily for single-age, single-stratum models, but extension to more complicated situations is discussed. This direct approach to estimation of lambda is contrasted with an approach that uses survival and reproductive rate estimates in conjunction with projection matrix asymptotics. These estimates of lambda correspond to different quantities, both of which have value for specific uses.

Finally, methods are presented for direct capture-recapture estimation of analogs of other quantities associated with projection matrix asymptotics (e.g., elasticity).

Nichols, J. D. 2000. A lecture on the FWS adaptive harvest management program for midcontinent mallards. A course, "Monitoring and Adaptive Management for Endangered Species," held at the National Conservation Training Center, Shepherdstown, WV, June 8.

Nichols, J. D. 2000. Early evolution of adaptive harvest management for North American waterfowl: Selective pressures and preadaptation. New Insights and Incites in Natural Resources Management, 65th North American Wildlife and Natural Resources Conference, Chicago, Illinois, March 23-28.

Nichols, J. D. 2000. On the evolution of waterfowl harvest management. 8th meeting of the Interagency Working Group on Adaptive Management of Waterfowl Harvests in North America, Easton, MD., May 2-5.

Nichols, J. D. 2000. Population limitation and regulation in ducks [Invited Plenary Lecture]. 2nd North American Duck Conference, Saskatoon, Saskatchewan, Canada, October 11-15.

Although there are still multiple concepts of population regulation, the idea of a stationary probability distribution of population size appears to capture the essential features of most such concepts. In this context a factor can be defined as limiting if a change in the level of that factor moves the system from one stationary probability distribution to a different one. Time series of duck population size estimates represent some of the best such series available for any vertebrates in terms of both series length and use of approximately unbiased estimates. Nevertheless, commonly-used methods designed to test for regulation and density-dependence using such series are not recommended, as virtually all tend to provide misleading inferences in the face of sampling variation and covariation. If attention is moved away from long-term time series and focused on experimental manipulation of putative limiting factors, then abundance is a good response variable. Such studies can yield strong inferences about population limitation, although the mobility of ducks can sometimes obscure results. Time series of estimated abundances and vital rates (e.g., survival and reproductive rates) provide some opportunity to obtain inferences about the density-dependence of vital rates. Analyses of such data often focus on fitting relationships between abundance estimates and the vital rates. Although such analyses can be useful, they can also be criticized as being phenomenological. More mechanistic modeling frequently requires thought about the meaning of density, both in terms of spatial scale (perhaps the average "neighborhood density" throughout a population is more relevant than a density metric based on total population size) and in terms of critical resources that are potential limiting factors (number of ducks per unit resource will likely be more useful than the usual ducks-per-unit-area density metric). Previous studies relevant to duck population regulation will be reviewed, and some directions for future studies will be suggested.

Nichols, J. D., J. R. Sauer, E. Cam, and J. E. Hines. 2000. Using estimates of species richness to test ecological theory. Ecological Society of America, 85th Annual Meeting, Communicating & Advancing Ecology, Snowbird, Utah, August 6-10.

Confronting theory with information from the real world is healthy, but often very difficult. Biodiversity studies frequently sample species richness, but most sampling methods are surprisingly flawed. Superficial use of survey data that use these methods can lead to biased estimates because probabilities of detecting species are  $< 1$ . Fortunately, capture-recapture estimators can be applied in many ecological studies to estimate species richness. We use these estimators to address questions of temporal variation in species richness, species-area relationships, and nested subset analyses. With respect to species-area relationships, we show that positive relationships of form similar to those frequently reported in the literature are a natural consequence of species detection probabilities  $< 1$ . Use of species richness estimates that account for detection probabilities produces species-area relationships with smaller slopes than those based on raw counts. The latter relationships confound sampling and ecological

hypotheses, whereas the former are restricted to ecological hypotheses and should be used for testing and estimation. Nested subset analyses are based on species presence-absence data for multiple sites. Current methods do not account for the possibility that absences represent presence, but not detection, of the species. We present estimators for the probabilities of species sharing, and show what values these probabilities should attain in the case of nested and non-nested communities. These ideas lead to a test for nestedness and an index of nestedness when detection probabilities are  $< 1$ .

Nichols, J. D., B. K. Williams, and F. A. Johnson. 2000. Adaptive optimization as an approach to harvest management. Conference: Hunting as Sustainable Resource Utilization: Experiences and Challenges. February 14-16, Trondheim, Norway.

Nichols, J. D., B. K. Williams, and F. A. Johnson. 2000. The role of population monitoring in the management of North American waterfowl. Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

Despite the effort and expense devoted to large-scale monitoring programs, few existing programs have been designed with specific objectives in mind and few permit strong inferences about the dynamics of monitored systems. The waterfowl population monitoring programs of the U.S. Fish and Wildlife Service, Canadian Wildlife Service and state and provincial agencies provide a nice example with respect to program objectives, design and implementation. The May Breeding Ground Survey provides an estimate of system state (population size) that serves two primary purpose in the adaptive management process: identifying the appropriate time-specific management actions and updating the information state (model weights) by providing a basis for evaluating predictions of competing models. Other waterfowl monitoring programs (e.g., banding program, hunter questionnaire survey, parts collection survey, winter survey) provide estimates of vital rates (rates of survival, reproduction and movement) associated with system dynamics and variable associated with management objectives (e.g., harvest). The reliability of estimates resulting from monitoring programs depends strongly on whether considerations about spatial variation and detection probability have been adequately incorporated into program design and implementation. Certain waterfowl surveys again provide nice examples of monitoring programs that incorporate these considerations.

Nichols, J. D., B. K. Williams, and F. A. Johnson. 2000. The role of population monitoring in the management of North American waterfowl. Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

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Perry, M. C. 2000. Anthropogenic factors affecting diving duck distribution and abundance in Chesapeake Bay. 2nd North American Duck Conference, Saskatoon, Saskatchewan, Canada, October 11-15.

Diving ducks wintering in Chesapeake Bay during the last 50 years have accounted for 23% of Atlantic Flyway and 9% of North American populations based on aerial surveys. Continental and local factors have affected these populations. Numbers of ruddy ducks and 5 pochard species have declined, whereas, goldeneye and sea duck (scoter and oldsquaw) populations have remained stable. The bufflehead is the only diving duck species that has increased in numbers. Loss of submerged aquatic vegetation (SAV) due to degradation of water quality, has been a contributing factor, although, many other factors related to human population increases have been implicated in the changes in the distribution and abundance of diving ducks. Patterns of hunters have changed due to declines in Canada goose populations, and changes in hunting have affected diving ducks, especially sea ducks. Changes in the quantity and quality of available food in the Chesapeake Bay and species-specific responses to changes are likely contributing to population declines. The percentage of invertebrates in the diet of most pochards and ruddy duck has increased as SAV declined. The redhead did not alter food preference for SAV, and populations of this species have declined from over 100,000 to less than 1000. New food habits research is being conducted to further explain the changes in distribution of diving ducks in Chesapeake Bay that are related to habitat conditions. Anthropogenic factors affecting diving duck populations include direct and indirect causes, including excessive development of Bay tributaries, increased year-round boat traffic, and increased levels of contamination.

Perry, M. C., P. C. Osenton, and E. J. R. Lohnes. 2000. Moist-soil management of wetland plants and invertebrates. Quebec 2000: Millennium Wetland Event, jointly organized and conducted by the International Peat Society, the International Association of Ecology, the Society of Wetland Scientists, and the International Mire Conservation Group, Quebec, Canada, August 6-12.

Moist-soil management has become an increasing concern for wildlife refuge managers charged with concurrently providing optimum habitat for waterfowl and shorebird species. Although management for seed producing plants has been the priority in the past, recent concerns for declining shorebird foods have encouraged managers to consider invertebrate production in their management schedules. The objective of this study was to determine if management of impoundments (especially drawdown date) could be modified to obtain optimum invertebrate production without reducing the normal plant production. Management techniques were tested in 15 impoundments (0.8 - 6.4 ha in size) and 12 experimental pools (0.06 ha each) to test invertebrate response (diversity and biomass) from different management strategies. Invertebrates were collected from benthic soil samples and with floating emergence traps. Results indicated that invertebrate production in impoundments was not reduced when impoundment drawdown occurred the previous year and that productivity was actually higher with some organisms, such as the midge flies (Chironomidae). Numerous water depths of impoundments were taken with GPS-determined locations that have been entered into a GIS program of each impoundment. A contour map of each impoundment was created that can be used to determine size of mud flats created with any level of drawdown. Invertebrate sampling is now used in conjunction with the contour maps in models that can predict invertebrate productivity based on management strategies.

Petersen, M., P. Flint, C. Dau, J. Hines, and J. D. Nichols. 2000. Annual survival rates and site fidelity of Stellar's eiders molting along the Alaska peninsula. 2nd North American Duck Conference, Saskatoon, Saskatchewan, Canada, October 11-15.

Rattner, B. A. and R. F. Shore. 2000. Ecotoxicology of wild mammals. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 43.

An international group of 32 scientists has critically reviewed the scientific literature on exposure and effects of environmental contaminants in wild mammals. Although the absolute number of

toxicological studies in domesticated and wild mammals eclipses that for birds, a detailed examination of scientific publications and databases reveal that information for "wild" birds is actually greater than that for "wild" mammals. Of the various taxa of mammals, ecotoxicological data is most noticeably lacking for marsupials and monotremes. In contrast, rodents (comprising 43% of all mammal species) have been studied extensively, despite evidence of their tolerance to some organochlorine compounds, rodenticides, and even radionuclides. Mammalian species at greatest risk of exposure include those that consume a high percentage of their body weight on a daily basis (e.g., shrews, moles and bats). Aquatic mammals tend to bioaccumulate tremendous burdens of lipophilic contaminants, although storage in their fat depots may actually limit toxicity. Carnivores appear to be more sensitive to adverse effects of environmental contaminants than herbivores. Remarkably few of the thousands of compounds manufactured worldwide have been toxicologically evaluated in wild mammals, and concentrations of even fewer have been monitored in tissues. Overarching research needs include: development of new exposure/effects models and better methods for estimation of species sensitivities; generation of comparative data on contaminant bioavailability, sublethal responses and detoxication mechanisms; enhanced understanding of pesticide, industrial contaminant and metal interactions; identification of endocrine disruptive contaminants and their overall ecological significance; and finally, estimating the relative contribution of environmental contamination as a factor affecting wild mammal populations.

Reinecke, K. J., M. J. Petrie, D. W. Demarest, and T. E. Moorman. 2000. Variation of winter body mass of Mallards in the Mississippi Delta. 2nd North American Duck Conference, Saskatoon, Saskatchewan, Canada, October 11-15.

Consequences of variation in winter habitat quality have proven difficult to investigate in waterfowl. However, measurements of winter body mass are relatively easy to obtain and provide a means of generating hypotheses for further study. We combined measurements of winter body mass for 533 hunter-killed mallards obtained in the Mississippi Delta during December 1999 and January 2000 with data from studies in winters 1979-80 through 1982-83. We used analysis of variance to assess effects of sex (M, F), age (HY, AHY), winter (1979-80, 1980-81, 1981-82, 1982-83, 1999-2000), and time period (Dec, Jan) on variation in body mass. Effects of sex and age were as expected, and variation among years was consistent with previous interpretations that winter water levels affect food supplies and consequently body mass. In contrast to previous analyses, there was a significant winter x time period interaction ( $P = 0.018$ ), suggesting that decreases in body mass between early and late winter varied among years. The decrease in body mass ( $77.3 \pm 10.0$  [SE]) between early and late winter 1999-2000 was the largest observed, and a linear contrast indicated this decrease was greater ( $P = 0.013$ ) than the mean decrease for winters 1979-80 through 1982-83. Thus, concerns for adequacy of winter food supplies in the Mississippi Delta remain, despite progress made in implementing the North American Waterfowl Management Plan. Our results and those of a recent study in Mississippi suggesting that food resources in rice fields may have decreased over time highlight the need for further assessment of food resources and their consequences for demographics.

Robbins, C. S. 2000. Bird research, monitoring, and conservation in Guatemala. Monthly meeting of the Patuxent Chapter of the Maryland Ornithological Society in Beltsville, MD, March 28.

Robbins, C. S. 2000. Bird research, monitoring, and conservation in Guatemala. Annual lecture sponsored by the Anne Arundel Bird Club at Annapolis, MD, April 6.

Robbins, C. S. 2000. Birding in the 21st Century. Banquet speech at the annual conference of the Maryland Ornithological Society in Hagerstown, May 19.

Robbins, C. S. 2000. Breeding Bird Atlases--Past, Present, and Future. Delmarva Ornithological Society at the Delaware Museum in Greenville, May 17.

- Robbins, C. S. 2000. Forest fragmentation effects on migratory birds and resident birds of the American tropics. Guest lecture at Wayne Kuenzel's ornithology class, University of Maryland, College Park, May 15.
- Roman, C. T. 2000. Response of salt marshes to Open Marsh Water Management: Experiments at Rachel Carson NWR (Maine) and throughout FWS Region 5. US Fish and Wildlife Service, Region 5 Project Leaders Meeting. Shepardsboro, WV., August 14-17.
- Roman, C. T., K. R. Raposa, S. Adamowicz, M. James-Pirri, and J. Catena. 2000. Salt marsh restoration in Narragansett Bay: an example from Sachuest Point. Narragansett Bay 2000 Symposium, Narragansett, RI, January 19-20.
- Royle, J. A. and W. A. Link. 2000. Random effects capture-recapture models and Bayesian shrinkage. EURING 2000 Conference, Point Reyes, California, October 1-7.
- Random effects models are an appealing and natural extension of the conventional fixed effects model used for capture-recapture. These allow for model reduction and improved estimation by exploiting probabilistic relations among parameters. In particular, shrinkage estimation is justified on the basis of best linear unbiased estimation. A common and intuitive approach to shrinkage uses a 2-stage analysis: first, hyperparameters governing relations among parameters are estimated "doing statistics on statistics." Next, these estimates are substituted into expressions for best linear unbiased predictors. There are two possible deficiencies to this approach. The estimated hyperparameters from the first stage of analysis may be unreliable; also, restricting attention to the class of linear estimators may be a source of inefficiency. As an alternative, shrinkage estimators arise naturally in a Bayesian formulation of the problem, where they arise as features of posterior distributions. The posterior mean is never worse than the best linear unbiased estimator, and can be superior. Furthermore, Bayesian modeling accommodates uncertainty in hyperparameter estimation. We illustrate these concepts using band recovery data.
- Runge, M. 2000. Discussions on the importance of functional form of models and pintail modeling. 8th meeting of the Interagency Working Group on Adaptive Management of Waterfowl Harvests in North America, Easton, MD., May 2-5.
- Runge, M. C., F. A. Johnson, and W. L. Kendall. 2000. Optimal harvest theory and the importance of functional form. Wildlife Society's 7th Annual Meeting in Nashville, TN, September 12-16.
- Runge, M., W. Kendall, J. Hestbeck, and H. Laskowski. 2000. Shorebird use of impounded wetlands within Region 5 (Northeast) of the U.S. Fish and Wildlife Service. Birds and Aquatic Environments: Science for Management and Conservation, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.
- Sauer, J. R. 2000. Developing a general conceptual framework for avian conservation science. Invited plenary presentation at Science for Avian Conservation: Understanding, Modeling, and Applying Ecological Relationships, USGS Integration & Collaboration for Emerging Biological Issues & Research Goals (ICEBIRG) Workshop, Oct 31-Nov 2, USGS Patuxent Wildlife Research Center, Laurel, MD.
- Sauer, J. R. 2000. Estimating population change from bird surveys: Separating factors that influence count from factors that influence population dynamics. Festschrift for Norman A. Slade, Lawrence, KS. September.
- Sauer, J. R. 2000. Using breeding bird survey data to estimate population change for birds. Presentation at EPA Meeting, USGS Patuxent Wildlife Research Center, August.
- Sauer, J. R. and D. G. Jorde. 2000. Geographic and population analysis of mid-winter survey data. Black Duck Joint Venture Technical Committee, workshop on the Mid-winter Waterfowl Survey, Nag's Head, NC, February 21.

Sauer, J. R. and W. A. Link. 2000. Population change in raptors from the Christmas Bird Count, 1955 - 2000. Raptor Research Foundation Annual Meeting, Jonesboro, AR, November 8-12.

Sauer, J. R. and W. A. Link. 2000. Quantifying bias in estimates from wildlife surveys. Ecological Society of America, 85th Annual Meeting, Communicating & Advancing Ecology, Snowbird, Utah, August 6-10.

Most wildlife surveys are based on counts, rather than censuses, of animals. These counts represent an unknown proportion of animals present at sample sites. Counts complicate analysis by introducing irrelevant variation; this variation often introduces patterns in counts that do not reflect patterns in the underlying populations. Although the potential for bias in estimation from count is well known, controversy exists regarding appropriate approaches for mitigating the effects of the bias in estimation. Some investigators ignore the potential for bias, while others require estimation of the proportion of animals missed during counting. Occasionally, bias in estimation can be mitigated in analyses by using covariates that control for the effects of changes in the proportion of animals counted. We discuss several classes of covariates that can be used to accommodate differences in detection of animals in wildlife surveys, and describe generalized linear models that can be used for estimation of population change from count data. Example applications of these models include estimation of population change and spatial patterns of relative abundance from the North American Breeding Bird Survey when quality of observers varies over space and time, and estimation of population change in Christmas Bird Counts when counting effort varies. Unfortunately, many factors that influence proportion of animals counted cannot be accommodated through use of covariates; hence, care must be used in design of surveys to minimize the limitations of count data.

Sauer, J. R., M. Otto, and D. Haines. 2000. Statistical designs for monitoring Bald Eagle populations. Bald Eagle Monitoring Workshop, September 19-20.

Shealer, D. A. and J. A. Spindel. 2000. Crime does pay: kleptoparasitic Roseate Terns are high-quality parents. Birds and Aquatic Environments: Science for Management and Conservation, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.

Reproductive parameters of birds (e.g., laying date, egg size) often are used to assess the "quality" of a breeding pair, but few behavioral attributes have been identified that consistently explain differences in individual parental quality. From 1995 to 1999, we identified 10 individual Roseate Terns (*Sterna dougallii*) breeding at Falkner Island, Connecticut (USA), that were habitual kleptoparasites (stole fish repeatedly in >1 yr). These individuals provisioned their chicks with food obtained mostly or entirely by theft from other terns. Measures of chick growth and survival between these 10 kleptoparasites and breeding pairs that were never observed stealing or attempting to steal fish were similar for first-hatched (A) chicks. However, second-hatched (B) chicks with a kleptoparasitic parent were heavier at day 3, and had higher mean linear growth rates and asymptotic masses than B chicks from "honest" parents. Although previous studies have demonstrated that differences in quality among parent Roseate Terns are expressed in terms of egg mass and hatch dates of chicks, these effects were negligible when kleptoparasitism was included in an ANOCOVA model. Over a 10-yr period, average productivity (number of chicks fledged per pair) was significantly higher among kleptoparasites ( $1.20 \pm 0.20$  SD) than among non-kleptoparasites ( $0.83 \pm 0.25$ ). We conclude that kleptoparasitic Roseate Terns are among the highest-quality individuals breeding at Falkner Island.

Spindel, J. A. 2000. Recent results and new ideas for Roseate Tern studies. Gulf of Maine Seabird Working Group (GOMSWG) meeting, Bremen, ME, August 7.

Many interesting results of our Metapopulation Project on Roseate Terns in the New York-Connecticut-Massachusetts area would have been difficult (if not impossible) to obtain without the availability of individually-marked birds, especially those whose age and natal colony site are known. Perhaps the most important "take-home message" of what follows is to "band the birds!"

Recent results and thoughts on what might be done next include: (1) Development of multisite model using capture-recapture data to estimate survival to first breeding and age-specific breeding rates show a much higher (~40%) emigration rate of young from Falkner Island, CT to Great Gull Island, NY and Buzzards Bay, Ma than the 10% rate "guesstimated" (assuming emigration and immigration rates at FICT were equal) 10 years ago. These models produce estimates of "survival to age 3" of ~30%. What percentage of the young ROSTs (and COTEs) from the NY-CT-MA area recruit to the GOM breeding population?

(2) Some successful female ROSTs may remain at the FICT colony site up to three weeks after their mates have departed with their fledglings. Why? Does this continued greater responsibility for feeding of the young by males result in differential overwinter survival of the sexes? (3) Some adult bringing fish back, but not feeding (i.e., "teasing"), and some that beg at, chase, or otherwise interfere with adults bringing food back to chicks or recent fledglings are 2- to 4-yr-old nonbreeding birds or failed breeders, and are not the parents of the near/recent fledglings they "hang around". Are they older offspring of the adults whose young they "harass"?

Spendelov, J. A., J.-D. Lebreton, J. E. Hines, R. Pradel, J. D. Nichols, I. C. T. Nisbet, G. Cormons, H. Hays, and J. J. Hatch. 2000. Development and application of new multisite recruitment models for species with delayed maturity and staggered entry into the breeding population: a case study of Roseate Terns. Birds and Aquatic Environments: Science for Management and Conservation, Waterbird Society 24th annual meeting, Plymouth, MA., November 1-5.

New multistage models have been developed that use mark/recapture data to estimate annual survival and movement rates of adults, and also postfledging survival, natal-site fidelity/dispersal, and age-specific breeding rates of birds first banded as chicks in a metapopulation system. The application of these models to data collected since 1988 at several colony sites of the endangered Northwest Atlantic breeding population of Roseate Terns in the Massachusetts-Connecticut-New York area shows that postfledging survival for the usual minimum 3-year maturation period typically is considerably higher than originally thought based mainly on a data from a single site. The results also demonstrate the major impact of an event (most likely Hurricane Bob) that occurred between the 1991 and 1992 breeding seasons on the subsequent survival and fidelity/movement rates of young and adult terns. These general models should have widespread applicability to a variety of species.

Spendelov, J. A., J. D. Nichols, J. E. Hines, J.-D. Lebreton, and R. Pradel. 2000. Modeling postfledging survival and age-specific breeding probabilities in species with delayed maturity: a case study of Roseate Terns at Falkner Island, Connecticut. EURING 2000 Conference, Point Reyes, California, October 1-7 .

We modeled postfledging survival and age-specific breeding probabilities in endangered Roseate Terns (*Sterna dougallii*) at Falkner Island, Connecticut, USA using capture-recapture data from 1988-1998 of birds ringed as chicks and as adults. While no individuals bred as 2-yr-olds during this period, about three-fourths of the young that survived and returned as 3-yr-olds nested, and virtually all surviving birds had begun breeding by the time they reached 5 years of age. We found no evidence of a lowering in age of first breeding of young in the years immediately following a major decrease in the breeding population. There was significant variation among the cohorts in the annual survival of adults, and the annualized survival over the typical minimum 3-yr maturation period of young prebreeding birds, with extremely low values for both groups from the 1991 breeding season. The overwinter mortality rate for adults from 1991-1992 was about twice as high as usual, while only about one-fifth of the otherwise expected number of young from the 1991 cohort returned as breeding birds; this suggests that young fledglings suffered relatively much higher losses than did adults. The annualized survival estimates of young from 1989 and 1990 show that these cohorts of young were not negatively impacted by the event(s) that decimated the young from 1991; the young from 1992 and 1993 had above-average annualized survival estimates. The decrease since 1996 in fidelity of new recruits to this site is suspected due mainly to nocturnal disturbance of adults and predation of young chicks.

Steinkamp, M. J. 2000. Conserving colonial waterbirds at a continental scale: conservation and management based on biology, not boundaries. First International Conference of the North American Colonial Waterbird Conservation Plan, Plymouth, MA, October 30-31.

An International Conference on the Draft North American Waterbird Conservation Plan drew over 120 participants from multiple nations including Canada, Mexico, Greenland, Great Britain, Pacific Island nations, Central America, the Caribbean nations, and the United States. The purpose of the conference was to review and gather comments on the draft conservation plan, released October 2000. The goal of the continental plan is to conserve colonial waterbird populations, in perpetuity, throughout their breeding and wintering ranges. This will require international cooperation and coordination.

As an outcome of the conference, 14 Working Groups consisting of individuals spanning multiple nations were established and will meet over the next 12 months to develop Regional Waterbird Conservation Plans. The North American Waterbird Conservation Plan is one of four bird conservation plans under the North American Bird Conservation Initiative, an initiative focused on integrating continental bird conservation. The Draft Waterbird Conservation Plan can be downloaded for review from the NAWCP website at [www.nacwcp.org](http://www.nacwcp.org).

Steinkamp, M. J. 2000. Developing regional colonial waterbird conservation plans as part of the North American Colonial Waterbird Conservation Plan and the North American Bird Conservation Initiative. January – August, various locations.

A series of eight regional workshops were held at various locations throughout North America, from January to August 2000. These regional workshops were conducted as part of a process to develop the North American Colonial Waterbird Conservation Plan, one of four plans under the North American Bird Conservation Initiative. Individuals representing state and federal agencies, and non-governmental organizations gathered together to form regional working groups. These regional working groups provided important regional data, monitoring protocols, research needs and information and education needs for colonial waterbird conservation. Information gathered at the regional workshops was used to create draft "skeletal" regional conservation plans. These draft plans will be further developed and finalized by the working groups over the next year.

Steinkamp, M. J. and B. Peterjohn, workshop leaders. 2000. Developing continental standards for colonial waterbird monitoring in North America. Plymouth, MA, October 31 - November 1.

A workshop was held to review a draft monitoring manual for colonial waterbirds in North America. The goal of the workshop was to solicit feedback on proposed breeding season standardized method and protocols and to gather additional information on non-breeding season methodologies. This information will be used to finalize a manual to be used by waterbird managers throughout Canada, Mexico, the Caribbean Nations, and the United States.

Tautin, J., P. Doherty, and L. Metras. 2000. Development of a bird banding recapture database [poster]. EURING 2000 Conference, Point Reyes, California, October 1-7.

Recaptures (and resightings) constitute the vast majority of post-release data from banded or otherwise marked nongame birds. A powerful suite of contemporary analytical models is available for using recapture data to estimate population size, survival rates and other parameters, and many banders collect recapture data for their project specific needs. However, despite widely recognized, broader programmatic needs for more and better data for nongame bird research and management, banders' recapture data are not centrally repositied and made available for use by others. To address this need, the US Bird Banding Laboratory, the Canadian Bird Banding Office and the Georgia Cooperative Fish and Wildlife Research Unit are developing a bird banding recapture database. In this poster we discuss the critical steps in developing the database, including: determining exactly which recapture data should be included; developing a standard record format and structure for the database; developing electronic means for collecting, vetting and disseminating the data; and most importantly, developing metadata descriptions and individual data set profiles to facilitate the user's selection of appropriate analytical models. We

provide examples of individual data sets to be included in the database, and we assess the feasibility of developing a prescribed program for obtaining recapture data from banders who do not presently collect them. It is expected that the recapture database eventually will contain million of recapture and resighting records made available publicly for a variety of avian research and management purposes.

- Tautin, J., L. Metras, and S. Morris. 2000. Banding and Ringing in the 21st Century: roles and opportunities. *Living on the edge: Birds 2000*. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.
- Tautin, J., J. D. Nichols, P. Doherty, and M. Conroy. 2000. Mark-recapture models: their application in bird-banding studies. *Living on the edge: Birds 2000*. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.
- Weir, L. 2000. NAAMP: goals, history, and protocols. Kansas Herpetological Society, Kansas City, MO, October 22.
- Weir, L. 2000. North American Amphibian Monitoring Program (NAAMP) overview. Amphibian Monitoring and Conservation Workshop sponsored by the US Army Corp. of Engineers, Baltimore District, held at the National Wildlife Visitor's Center, Laurel, MD, May 15.
- Weir, L. 2000. North American Amphibian Monitoring Program (NAAMP) overview. Third meeting of the Northeast Regional Working Group of Partners in Amphibian and Reptile Conservation (NE PARC), USGS Patuxent Wildlife Research Center, Laurel, MD, October 13-15.
- Weir, L., host. 2000. Regional Coordinator's Meeting of the North American Amphibian Monitoring Program (NAAMP), USGS Patuxent Wildlife Research Center, Laurel, MD, January 12-14 and April 12-14.
- Weir, L., S. Smith, R. Jung, L. Mazanti, and A. Breisch, Set-up Committee. 2000. Third meeting of the Northeast Regional Working Group of Partners in Amphibian and Reptile Conservation (NE PARC), USGS Patuxent Wildlife Research Center, Laurel, MD, October 13-15.

At this meeting, we focused on five important issues in herpetological conservation: Land Conservation, Inventory and Monitoring, Herp Education, Species Risk Assessment, and Model State Herp Regulations. We presented progress reports on action items defined at the first and second meetings, continued to identify and develop conservation priorities and objectives for NE PARC, and fostered collaboration among all interested groups and individuals.

- Winger, P., P. Lasier, and K. Bogenreider. 2000. Combined use of rapid bioassessment protocols and sediment quality triad to assess stream quality. 21st Annual Meeting of the Society of Environmental Toxicology and Chemistry, Nashville, Tennessee, November 12-16. Abstract book, p. 291.

Rapid Bioassessment Protocols (RBP) and the Sediment Quality Triad (SQT) were used to evaluate the biological effects of a municipal waste-water treatment facility (WWTF) on a small southern stream. During major storm events, raw sewage from the WWTF is released directly into the stream. The headwaters of the stream also receive non-point surface runoff from urban areas. RBP analyses, which included benthos, fish and habitat evaluations, and SQT, including the benthos (from the RBP), contaminant analyses (metals, organochlorine pesticides, PCBs and PAHs) and toxicity tests of depositional sediment (exposures of *Hyaella azteca* to solid-phase sediment and pore water) were conducted at five sites on the stream (two upstream of the WWTF and three downstream). The stream has been channelized throughout its entire length, resulting in high, unstable banks, degraded stream channel, and unstable substratum. RBP analyses indicated that the two stations upstream of the WWTF were degraded due to poor physical habitat

quality (unstable benthic substratum and lack of fish habitat). The SQT also showed reduced habitat quality at the two stations above the WWTF, but the cause was attributed to high concentrations of PAHs and metals in the sediments. The increased discharge and stabilized base flow provided by the WWTF improved habitat quality downstream, although conditions were still impaired due to the habitat alteration. Though the causes of degradation were attributed to different factors (physical habitat vs. contamination), there was close concordance between the RBP and SQT in identifying the degraded sites in this stream. The combination of these two procedures provides a robust examination of environmental quality utilizing the weight of evidence approach.

Ziel, H. L., D. G. McAuley, and J. M. Rhymer. 2000. Single paternity clutches in American Woodcock (*Scolopax minor*) [poster]. Living on the edge: Birds 2000. Joint Millennial Meeting of American Ornithologists' Union, British Ornithologists' Union, Society of Canadian Ornithologists, Memorial University of Newfoundland, St. Johns, Newfoundland, August 14-20.

Based on behavioral observations, the mating system of American Woodcock has been variously described as monogamous, a dispersed lek, or resource defense polygyny. Males perform elaborate mating displays that attract females to their display sites where copulations occur. We used microsatellite markers, developed for Ruffs (*Philomachus pugnax*), to assess paternity in American Woodcock. In 3 yr, we collected blood samples from 21 females and broods and 90 males. We found no evidence of multiple paternity within broods; paternity in all broods could be explained by 1 father. For 8 broods, we were able to infer probable fathers from males we sampled in the field. All 8 broods were found close to the singing site of the male or males that matched as possible fathers. Two males may have fathered 2 broods each, suggesting that polygyny may be a component of the woodcock mating system.