USGS Patuxent Wildlife Research Center

Current Research Products

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September 1997 — February 1999

Banks, R.C. 1997. In memoriam: John Warren Aldrich, 1906-1995. Auk 114(4):748-751.

Berdeen, J.B. and D.G. Krementz. 1998. The use of fields at night by wintering American woodcock. Journal of Wildlife Management 62(3):939-947.

Because limited information is available regarding preferences for nocturnal habitat during winter, we studied use of nocturnal habitats by American woodcock (*Scolopax minor*) wintering in the Georgia Piedmont (1994-95). During the evening crepuscular period, woodcock on the wintering grounds move from forested to field habitats, presumably to feed, conduct courtship displays, roost, and avoid predators. We conducted crepuscular flight surveys and tracked radio-marked woodcock to compare the use of fields of different sizes (<5.5 ha, 5.540.0 ha, >40.0 ha) and types (seed tree-clearcuts, fallow-old fields, hayfields, pastures). Fields $\geq$ 5.5 ha were used more frequently than fields <5.5 ha ($P < 0.001$). Seed tree-clearcuts and fallow-old fields were more frequently used than pastures ($P = 0.003$). Woodcock also most frequently used fields with greater foliage volume at 0.82.0 m in height and a high percentage of bare soil ($P < 0.001$). Nocturnal use of fields or forests by radio-marked woodcock did not differ among age or sex classes. However, females moved an average of 230 $\pm$ 32.1 m between diurnal and nocturnal locations while males moved 525 $\pm$ 53.1 m ($P = 0.085$). Movements differed among moon phases ($P < 0.003$), ranging from 579 $\pm$ 79.6 m during the new moon to 213 $\pm$ 50.5 m during the full moon. To manage habitat on the wintering grounds, seed tree-clearcuts and fallow-old fields should be created or maintained near preferred diurnal habitats.

Beyer, W.N., D.J. Audet, J.K. Campbell, and L. LeCaptain. 1998. Lead exposure of waterfowl ingesting Coeur d'Alene River Basin sediments. Journal of Environmental Quality 27:1533-1538.

Feces from tundra swans (*Cygnus columbianus* [Ord]), Canada geese (*Branta canadensis* [L.]) and mallards (*Anas platyrhynchos* [L.]) were collected from the Coeur d'Alene River Basin and two reference areas to estimate exposure to lead from mining activities and to relate that exposure to the ingestion of contaminated sediments. The average acid-insoluble ash content of the feces, a measure of sediment, was 18% for Canada geese and tundra swans, and 12% for ducks. The 18% value corresponded to an estimated 9% sediment ingestion rate (dry weight). The 90th percentile for acid-insoluble ash in feces of tundra swans corresponds to an estimated 22% sediment in the diet. The average lead concentration (dry weight) of tundra swan feces from all Coeur d'Alene River Basin wetlands sampled was 880 mg/kg, compared to 2.1 mg kg^{1} from reference wetlands. The 90th percentile of lead in tundra swan feces from the Coeur d'Alene River Basin sites was 2700 mg kg^{1}. Fecal lead concentrations of tundra swans from Harrison Slough, the wetland studied in most detail, were correlated (Spearman's rho = 0.74, $p < 0.05$) with the acid-insoluble ash content of the feces. The very low lead concentrations in feces having low acid-insoluble ash contents established that the sediment was the primary source of the lead ingested by waterfowl. Sediment lead concentrations at 11 wetland sites were closely correlated ($r = 0.91$, $p < 0.05$) with average fecal lead concentrations for all waterfowl, corrected for the average percent acid-insoluble ash in the feces. The regression equation describing this relation, along with estimates of sediment ingestion, provides a straight-forward means of estimating the current exposure of waterfowl to lead and of predicting the potential exposure of waterfowl to lead under plans to clean up the contaminated sites.

Beyer, W.N., D. Day, A. Morton, and Y. Pachepsky. 1998. Relation of lead exposure to sediment ingestion in mute swans on the Chesapeake Bay, USA. Environmental Toxicology and Chemistry 17(11):2298-2301.

Forty-two mute swans (*Cygnus olor*) were collected from unpolluted portions of central Chesapeake Bay in spring 1995. Their intestinal digesta were analyzed for 13 metals (Al, B, Ba, Cd, Cu, Fe, Mg, Mn, Ni, Pb, Sr, V, Zn) and for acid-insoluble ash, a marker of sediment. Because metal concentrations in digesta depend on recent exposure, they are appropriate for evaluating local contamination. Swan livers and sediment samples also were analyzed for the same metals.

Group method of data handling demonstrated that the digesta Al was the best predictor of digesta Pb, and that adding concentrations of other metals as predictors did not improve the accuracy of the estimates of Pb concentrations from Al concentrations. The r^2 of the equation relating the log of digesta Pb to the log of digesta Al was 0.86, whereas the r^2 of the equation relating the log of digesta Pb to the log of digesta acid-insoluble ash was 0.50. Sediment ingestion was critical in determining exposure to Pb, as well as to some of the other metals, and should be considered in ecotoxicological risk assessments of waterfowl. The mean of 7.4% acid-insoluble ash in the digesta corresponded to an estimated 3.2% sediment in the diet. The Pb concentrations in the digesta were 2-3 times the concentration that would have been predicted from sediment Pb concentrations; presumably the swans had ingested clays high in Pb that had settled on the vegetation. The swans were not thought to have been exposed to high Cu concentrations but they had hepatic Cu concentrations that would be considered very high if found in other species.

Beyer, W.N., J.C. Franson, L.N. Locke, R.K. Stroud, and L. Sileo. 1998. Retrospective study of the diagnostic criteria in a lead-poisoning survey of waterfowl. Archives of Environmental Contamination and Toxicology 35:506-512.

Between 1983 and 1986 the National Wildlife Health Center (NWHC) conducted a nationwide study of lead poisoning of waterfowl from federal and state refuges. This survey was done to assist in identifying zones with lead-poisoning problems. One thousand forty one moribund or dead waterfowl were collected and examined. The presence or absence of 13 gross lesions selected as indicators of lead poisoning and 3 lesions indicating body condition was recorded. Lead-poisoning diagnoses were based on the finding of at least 6 8 ppm (wet weight) lead in the liver and either lead shot in the gizzard content or at least one convincing gross lesion indicative of lead poisoning. Four hundred and twenty-one of these waterfowl were diagnosed as lead-poisoned. The NWHC survey provided a comprehensive basis for estimating the sensitivities, specificities, and likelihood ratios of the gross lesions of lead poisoning and the associated hepatic lead concentrations for several species of waterfowl. Some of the 13 defined gross lesions were more common than others; frequencies ranged from 3% to 80% in the 421 lead-poisoned waterfowl. The most reliable indicators of lead poisoning were impactions of the upper alimentary tract, submandibular edema, myocardial necrosis, and biliary discoloration of the liver. Each of the 13 lesions occurred more frequently in the lead-poisoned birds, but each of the lesions also occurred in waterfowl that died of other causes. The number of lead shot present in a bird's gizzard was only weakly correlated with its hepatic lead concentration; however, this weak correlation may have been adequate to account for differences in hepatic lead concentrations among species, once the weights of the species were taken into account. Although lead-poisoned ducks tended to have higher hepatic mean lead concentrations than did lead-poisoned geese or swans, the differences were probably a result of a greater dose of shot per body weight than to kinetic differences between species. Hepatic lead concentrations were independent of age and sex. Ninety-five percent of waterfowl diagnosed as lead-poisoned had hepatic lead concentrations of at least 38 ppm, dry weight (10 ppm, wet weight). Fewer than 1% of the waterfowl that died of other causes had a concentration that high. This 5th percentile, of 38 ppm dry weight (10 ppm wet weight), is a defensible criterion for identifying lead-poisoned waterfowl when interpreting hepatic lead concentrations in the absence of pathological observations.

Blus, L. J. and J. W. Connelly. 1998. Radiotelemetry to determine exposure and effects of organophosphorus insecticides on sage grouse. Pages 21-29 *in* Larry Brewer and Kathleen Fagerstone editors. Radiotelemetry applications for wildlife toxicology field studies: Proceeding of the Pellston workshop on avian radiotelemetry in support of pesticide field studies, January 5-8, 1993. SETAC Special Publication Series SETAC Press, Pensacola, FL. xxiii, 201 pp.

Blus, L.J., M.J. Melancon, D.J. Hoffman, and C.J. Henny. 1998. Contaminants in eggs of colonial waterbirds and hepatic cytochrome P450 enzyme levels in pipped tern embryos, Washington State. Archives of Environmental Contamination and Toxicology 35(3):492-497.

Eggs of Forster's terns *(Sterna forsteri)* collected in 1991 from nesting colonies on Crescent Island (Columbia River) and the Potholes Reservoir in south central Washington generally contained low

residues of organochlorine pesticides and metabolites, 2,3,7,8-tetrachlorodibenzo-p-dioxin, 2,3,7,8-tetrachlorodibenzofuran, and polychlorinated biphenyls (PCBs). Hepatic cytochrome P450 enzyme activity in pipped embryos of Forster's terns from the two colonies seemed unaffected by contaminants. At Crescent Island, examination of 23 Forster's tern eggs with large embryos (19 viable [10 pipped] and four dead [two pipped]) revealed developmental abnormalities in two viable pipped embryos (missing maxilla and deformed pelvic girdle) and a viable prepipping embryos (shortened beak). Our limited sample sizes and number of compounds analyzed preclude us from determining whether or not the abnormalities are related to contaminants. No abnormalities were noted in 10 pipped eggs (nine viable and one dead at collection) of Forster's terns collected from the Potholes Reservoir colony. Eggs of Caspian terns *(Sterna caspia)* collected from Crescent Island in 1991 also contained generally low residues of contaminants, only one developmental abnormality was noted, and limited data indicated that cytochrome P450 enzyme activity apparently was unaffected by contaminants. Organochlorine contaminants were generally low in addled eggs of American white pelicans *(Pelecanus erythrorhynchos)* collected from Crescent Island in 1994

Blus, L.J., B.A. Rattner, M.J. Melancon, and C.J. Henny. 1997. Reproduction of black-crowned night-herons related to predation and contaminants in Oregon and Washington, USA. Colonial Waterbirds 20(2):185-197.

We studied reproductive characteristics of Black-crowned Night-Herons *(Nycticorax nycticorax)* at four colonies in south central Washington and one colony in north central Oregon in 1991. Nest success, adjusted using the Mayfield method, was significantly different between colonies and ranged from 12-84% to hatching and 12-73% to 14 days post-hatching. The mean number of young surviving to 14 days of age in each colony ranged from 0.47-1.94 per nesting female (includes recycling efforts that involve laying more than one clutch). They were marked intercolony differences in clutch size and incidence of recycling. Predation (primarily avian) was a major factor that adversely affected nest success in three colonies and was relatively unimportant in two colonies. Residues of DDE, total polychlorinated biphenyls, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and other compounds in eggs were generally low and apparently had little influence on reproductive success at any of the colonies. Mean eggshell thinning ranged from 7-1 1 % in comparison to a pre-1947 norm for eggs measured in museum collections. Cytochrome P450 enzyme (EROD, PROD, and BROD) induction in livers of pipped embryos by colony ranged from low to average in comparison with other colonies throughout the U.S. Average EROD and BROD activities were highest at Sand Dune Island and were lowest at Potholes Reservoir which was designated the reference colony. In relation to our study of three of the five colonies in the early 1980s, residues of DDE and several related compounds appeared to decline, nest predation rates increased, and nest success decreased at all three colonies.

Boobar, L.R., P.J. Spangler, K.E. Gibbs, J.R. Longcore, and K.M. Hopkins. 1998. Predaceous diving beetles in Maine: Faunal list and keys to subfamilies. Northeastern Naturalist 5(1):1-20.

Records of predaceous diving beetles (Coleoptera: Dytiscidae) collected in Maine are summarized. These records are augmented by field surveys of beetles in Aroostook Co., Maine during 1993-95. Keys to subfamilies are presented with color plates for selected species. A list of diving beetles that have been collected near Maine (state or province) is presented so that investigators will know what additional species might be expected in Maine. Basic taxonomy is presented to facilitate use of keys.

Boulinier, T., J.D. Nichols, J.E. Hines, J.R. Sauer, C.H. Flather, and K.H. Pollock. 1998. Higher temporal variability of forest breeding bird communities in fragmented landscapes. Proceedings of the National Academy of Sciences of the U.S.A 95(13):7497-7501.

Understanding the relationship between animal community dynamics and landscape structure has become a priority for biodiversity conservation. In particular, predicting the effects of habitat destruction that confine species to networks of small patches is an important prerequisite to conservation plan development. Theoretical models that predict the occurrence of species in fragmented landscapes, and relationships between stability and diversity do exist. However, reliable empirical investigations of the dynamics of biodiversity have been prevented by differences in species detection probabilities among landscapes. Using long-term data sampled

at a large spatial scale in conjunction with a capture-recapture approach, we developed estimates of parameters of community changes over a 22-year period for forest breeding birds in selected areas of the eastern United States. We show that forest fragmentation was associated not only with a reduced number of forest bird species, but also with increased temporal variability in the number of species. This higher temporal variability was associated with higher local extinction and turnover rates. These results have major conservation implications. Moreover, the approach used provides a practical tool for the study of the dynamics of biodiversity.

Boulinier, T., J. Nichols, J.R. Sauer, J. Hines, and K. Pollock. 1998. Estimating species richness: The importance of heterogeneity in species detectability. Ecology 79(3):1018-1028.

Estimating species richness (i.e. the actual number of species present in a given area) is a basic objective of many field studies carried out in community ecology and is also of crucial concern when dealing with the conservation and management of biodiversity. In most studies, the total number of species recorded in an area at a given time is taken as a measure of species richness. Here we use a capture-recapture approach to species richness estimation with North American Breeding Bird Survey (BBS) data in order to estimate species detectability and thus gain insight about its importance. We carried out analyses on all survey routes of four states, Arizona, Maryland, North Dakota, and Wisconsin, in two years, 1970 and 1990. These states were chosen to provide contrasting habitats, bird species composition and survey quality. We investigated the effect of state, year and observer ability on the proportions of different models selected, and on estimates of detectability and species richness. Our results indicate that model M_h, which assumes heterogeneous detection probability among species, is frequently appropriate for estimating species richness from BBS data. Species detectability varied among states and was higher for the more skilled observers. These results emphasize the need to take into account potential heterogeneities in detectability among species in studies of factors affecting species richness.

Bowen, Z.H. and M.C. Freeman. 1998. Sampling effort and estimates of species richness based on prepositioned area electrofisher samples. North American Journal of Fisheries Management 18(1):144-153.

Estimates of species richness based on electrofishing data are commonly used to describe the structure of fish communities. One electrofishing method for sampling riverine fishes that has become popular in the last decade is the prepositioned area electrofisher (PAE). We investigated the relationship between sampling effort and fish species richness at seven sites in the Tallapoosa River system, USA based on 1,400 PAE samples collected during 1994 and 1995. First, we estimated species richness at each site using the first-order jackknife and compared observed values for species richness and jackknife estimates of species richness to estimates based on historical collection data. Second, we used a permutation procedure and nonlinear regression to examine rates of species accumulation. Third, we used regression to predict the number of PAE samples required to collect the jackknife estimate of species richness at each site during 1994 and 1995. We found that jackknife estimates of species richness generally were less than or equal to estimates based on historical collection data. The relationship between PAE electrofishing effort and species richness in the Tallapoosa River was described by a positive asymptotic curve as found in other studies using different electrofishing gears in wadable streams. Results from nonlinear regression analyses indicted that rates of species accumulation were variable among sites and between years. Across sites and years, predictions of sampling effort required to collect jackknife estimates of species richness suggested that doubling sampling effort (to 200 PAEs) would typically increase observed species richness by not more than six species. However, sampling effort beyond about 60 PAE samples typically increased observed species richness by < 10%. We recommend using historical collection data in conjunction with a preliminary sample size of at least 70 PAE samples to evaluate estimates of species richness in medium-sized rivers. Seventy PAE samples should provide enough information to describe the relationship between sampling effort and species richness and thus facilitate evaluation of a sampling effort.

Bowen, Z.H., M.C. Freeman, and K.D. Bovee. 1998. Evaluation of generalized habitat criteria for assessing impacts of altered flow regimes on warmwater fishes. Transactions of the American Fisheries Society 127(3):455-468.

Assessing potential effects of flow regulation on southeastern warmwater fish assemblages is problematic because of high species richness and our poor knowledge of habitat requirements for most species. A previous attempt to reduce the complexity of describing habitat requirements for diverse assemblages defined five "key habitat" types based on quantitative descriptions of depth, velocity, substrate, and cover for assessing the effects of streamflow alteration on fish communities. Our study investigated relationships between availability and temporal stability of key habitats and fish abundances at regulated and unregulated sites in the Tallapoosa River system. Fish assemblage characteristics at seven sites were quantified based on 1,400 electrofishing samples collected during 1994 and 1995. Simulations were used to model availability and temporal stability of key habitats at regulated and unregulated sites, Associations between fish assemblages and availability or stability of key habitats were identified using correlation analysis. We found that hydropeaking dam operation reduced the average length of time that shallow-water habitats were stable during the spring and summer and also reduced year-to-year variation in the stability of shallow-water habitats compared to unregulated sites. Within-site comparisons of fish and habitat variables indicated that differences in fish abundances correlated with differences in the availability and temporal stability of shallow-water habitats. Additionally, groups of stream fishes defined by taxonomy or differences in orientation to the substrate and feeding mode responded similarly to changes in key habitat availability. These findings demonstrate that the temporal and spatial availability of key habitats could serve as a useful measure of the potential effects of flow alteration on lotic fish assemblages, and suggest that both short-term temporal stability of key habitats as well as annual variation in key habitat availability are important for maintaining diverse fish assemblages.

Bowen, Z.H., M.C. Freeman, and D.L. Watson. 1996. Index of biotic integrity applied to a flow-regulated river system. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 50:26-37.

Buckley, P.A., C.M. Francis, P. Blancher, D.F. DeSante, C.S. Robbins, G. Smith, and P. Cannell. 1998. The North American Bird Banding Program: into the 21st century. Journal of Field Ornithology 69(4):511-529.

Cam, E., J.E. Hines, J.-Y. Monnat, J.D. Nichols, and E. Danchin. 1998. Are adult nonbreeders prudent parents? The kittiwake model. Ecology 79(8):2917-2930.Understanding evolutionary consequences of intermittent breeding (non-breeding in individuals that previously bred) requires investigation of the relationships between adult breeding state and two demographic parameters: survival probability and subsequent breeding probability. One major difficulty raised by comparing the demographic features of breeders and nonbreeders as estimated from capture-recapture data is that breeding state is often suspected to influence recapture or resighting probability. We used multistate capture-recapture models to test the hypothesis of equal recapture probabilities for breeding and nonbreeding Kittiwakes and found no evidence of an effect of breeding state on this parameter. The same method was used to test whether reproductive state affects survival probability. Nonbreeding individuals have lower survival rates than breeders. Moreover, nonbreeders have a higher probability of being nonbreeders the following year than do breeders. State-specific survival rates and transition probabilities vary from year to year, but temporal variations of survival and transition probabilities of breeders and nonbreeders are in parallel (on a logit scale). These inferences led us to conclude that nonbreeders tend to be lower quality individuals. The effect of sex was also investigated: males and females do not differ with respect to survival probabilities when reproductive state is taken into account. Similarly, there is no effect of sex on transition probabilities between reproductive states. Chen, G., G. F. Gee, J. M. Nicolich, and J. Taylor. 1997. Semen collection and fertility in naturally fertile sandhill cranes. Page 258 (abstract) *in* R. P. Urbanek and D. W. Stahlecker, editors. Proceedings of the seventh North American Crane Workshop. North American Crane Working Group, Grand Island, Nebraska. ix, 262 pp.

Clapp, R.B. 1997. Egg dates for Virginia birds. Virginia Avifauna No. 6. Virginia Society of Ornithology, Lynchburg, VA. iii, 123 pp.

Clark, D.R., Jr., C.M. Bunck, and R.J. Hall. 1997. Female reproductive dynamics in a Maryland population of ringneck snakes (*Diadophis punctus*). Journal of Herpetology 31(4):476-483.

Adult female ringneck snakes (*Diadophis punctatus*) collected from a Maryland population during five successive summers laid a total of 50 clutches in which all eggs hatched successfully under laboratory conditions. Mean hatchling mass was not significantly related to female mass or clutch size when each was evaluated in separate analyses, but was significantly related to these factors when they were evaluated in a joint analysis. Mean hatchling masses of 0.6-1 g appear most adaptive; when females are large enough to produce 1-g eggs, the tendency is to produce a larger number of relatively smaller eggs. The relationship of clutch mass to female mass was unaffected by clutch size. Reproductive effort, measured as relative clutch mass (RCM, clutch mass/female mass), increased with age, as indicated by snout-vent length (SVL); also, the relationship of clutch mass to female mass indicated that clutches equaled a larger percentage as female mass increased. Clutch size averaged 3.55 eggs and ranged from 2 to 6. Clutches were laid from 17 June through 21 July (35 d), median 2 July. Clutches hatched during the 20-d interval 8-27 August (median August 18). Larger clutches were laid earlier in the season on average than smaller clutches. Incubation periods for clutches averaged 47 (range 42-51) d. Clutches laid later in the season averaged shorter incubation periods than clutches laid earlier.

Clegg, K. R., J. C. Lewis, and D. H. Ellis. 1997 . Use of ultralight aircraft for introducing migratory crane populations. Pages 105-113 *in* R. P. Urbanek and D. W. Stahlecker, editors. Proceedings of the seventh North American Crane Workshop. North American Crane Working Group, Grand Island, Nebraska. ix, 262 pp.

Objectives were to determine if captive-reared cranes could be led behind an ultralight aircraft (UL) along a migration route and, if after release on a wintering area, they would integrate with wild cranes and migrate north in spring to their natal area without assistance. Greater sandhill cranes (*Grus canadensis tabida*) were used as the research surrogate for whooping cranes (*Grus americana*). In 1995, the senior author raised 15 cranes to fledging and trained them to respond to his vocal imitation of a sandhill crane brood call. Chicks learned to follow him as he walked, drove an all-terrain vehicle (ATV), or piloted an UL. The caretakers were not in crane costumes. Cranes were tame but allowed to roam at will without accompanying humans part of the day and were penned at night. Daily excursions provided exposure to habitats, foods, and predators the birds would encounter after release into the wild. In mid-October 1995, 11 radio-tagged cranes were led in migration from Grade, Idaho to Bosque del Apache National Wildlife Refuge (BdANWR), central New Mexico, and released near wild wintering sandhill cranes. The 1,204km migration took 11 days, including 1 day when the aircraft were grounded due to a winter storm. Hazards encountered enroute included mountainous terrain, turbulent air, and attacks by gold eagles (*Aquila chrysaetos*). On the wintering ground, hazards included crane hunters and coyotes (*Canis latrans*). Within 2 days after release at the BdANWR wintering site, the research cranes were associating with and imitating the behavior of wild cranes. The 4 surviving birds migrated north in spring 1996 and at the time of this writing 2 were within 53 km of their natal area in Idaho.

Committee on Classification and Nomenclature of the American Ornithologists' Union, R.C. Banks, chairman. 1998. Check-list of North American Birds: the species of birds of North America from the Arctic through Panama, including the West Indies and Hawaiian Islands. 7th edition. American Ornithologists' Union, Washington, DC. liv, 829 pp.

Conroy, M.J., J.D. Nichols, and E.R. Asanza. 1997. Metodos cuantitativas contemporancos para entender y manejar poblaciones y comunicades animales. Interciencia 22:247-258.

Custer, C.M., T.W. Custer, P.D. Allen, K.L. Stromborg, and M.J. Melancon. 1998. Reproduction and environmental contamination in tree swallows nesting in the Fox River drainage and Green Bay, Wisconsin, USA. Environmental Toxicology and Chemistry 17(9):1786-1798.

Concentration, accumulation, and effects of PCBs on reproduction in tree swallows (*Tachycineata bicolor*) were studied at four sites in the Fox River drainage and in Green Bay, Lake Michigan, Wisconsin in 1994 and 1995. Total PCBs in eggs and newly hatched young (mean = 3.01 µg/g wet weight, years and sites combined) and 12-day-old nestlings (mean = 2.34 µg/g wet weight) at two contaminated sites (Kidney Island and Arrowhead) were higher than concentrations at two reference sites, (Lake Poygan and High Cliff State Park, years and sites combined, pippers mean = 0.26 µg/g, nestlings mean = 0.01 µg/g). Concentrations of eleven PCB congener were also higher at contaminated compared to reference sites. PCBs accumulated in nestlings at a higher

rate (1.34 6.69 µg/day) at contaminated sites compared to reference locations (0.06 0.42 µg/day). DDE was the only other organochlorine found in all samples; concentrations for all samples averaged ≤ 0.20 µg/g wet weight. Total PCBs and p,p'DDE concentrations did not differ among clutches where all eggs hatched, some eggs hatched, and no eggs hatched.

Custer, T.W., R.K. Hines, P.M. Stewart, M.J. Melancon, D.S. Henshel, and D.W. Sparks. 1998. Organochlorines, mercury, and selenium in great blue heron eggs from Indiana Dunes National Lakeshore, Indiana. Journal of Great Lakes Research 24(1):3-11.

In 1993, 20 great blue heron (*Ardea herodias*; GBH) eggs (one per nest) were collected from a colony at the Indiana Dunes National Lakeshore, Indiana (INDU). The eggs were artificially incubated until pipping and were then analyzed for organochlorines, mercury and selenium. Livers of embryos were analyzed for hepatic microsomal ethoxyresorufin-O-dealkylase (EROD) activity. Brains were measured for asymmetry. Egg-laying began in early April and the mean clutch size was 4.2 eggs per clutch. Organochlorine concentrations were generally low (geometric mean p,p'DDE = 1.6 µg/g wet weight; polychlorinated biphenyl [PCB] = 4.9 µg/g); however, one egg had elevated concentrations of p,p'DDE (13 µg/g) and PCBs (56 µg/g). EROD activity in the embryos analyzed from INDU was not elevated. The frequency (11%) of brain asymmetry was low. Eggshells on the average were 3.4% thinner than eggshells collected prior to the use of DDT. Mercury (geometric mean = 0.9 µg/g dry weight) concentrations in GBH eggs were within background levels. Selenium (4.0 µg/g dry weight) concentrations in eggs were above background levels, but below a concentration threshold associated with reproductive impairment.

Droege, S. 1999. Birds and landscape changes in Northeastern forests. Pages 185-186 *in* M. J. Mac, P. A. Opler, C. E. Puckett Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources. Volume 1. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Eisler, R. 1998. Copper hazards to fish, wildlife and invertebrates: a synoptic review. Biological Science Report USGS/BRD/BSR--1997-0002, Contaminant Hazard Reviews Report 33, U.S. Department of the Interior, Geological Survey. iv, 99 pp.

Selective review and synthesis of the technical literature on copper and copper salts in the environment and their effects primarily on fishes, birds, mammals, terrestrial and aquatic invertebrates, and other natural resources. The subtopics include copper sources and uses; chemical and biochemical properties; concentrations of copper in field collections of abiotic materials and living organisms; effects of copper deficiency; lethal and sublethal effects on terrestrial plants and invertebrates, aquatic organisms, birds and mammals, including effects on survival, growth, reproduction, behavior, metabolism, carcinogenicity, matagenicity, and teratogenicity; proposed criteria for the protection of human health and sensitive natural resources; and recommendations for additional research.

Eisler, R. 1998. Nickel hazards to fish, wildlife and invertebrates: a synoptic review. Biological Science Report USGS/BRD/BSR--1998-0001 and Contaminant Hazard Reviews Report 34 . U.S. Department of the Interior, Geological Survey. 76 pp.

This account is a selective review and synthesis of the technical literature on nickel and nickel salts in the environment and their effects on terrestrial plants and invertebrates, aquatic plants and animals, avian and mammalian wildlife, and other natural resources, The subtopics include nickel sources and uses; physical, chemical, and metabolic properties of nickel; nickel concentrations in field collections of abiotic materials and living organisms; nickel deficiency effects; lethal and sublethal effects, including effects on survival, growth, reproduction, metabolism, mutagenicity, teratogenicity, and carcinogenicity; currently proposed nickel criteria for the protection of human health and sensitive natural resources; and recommendations for additional research.

Eisler, R. 1998. Contaminant hazard reviews. [Reports No. 1-28 on CD-ROM.]. U.S. Department of the Interior, U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD.

This compact disc (CD) contains the first 28 reports in the Contaminant Hazard Reviews (CHR) that were published originally between 1985 and 1994 in the U.S. Department of the Interior Biological Report series. The CD was produced because printed supplies of these reviews--a total of 84,000--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 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, or acrolein. Each report reviewed and synthesized the technical literature on a single contaminant and its effects on terrestrial plants and invertebrates, aquatic plants 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., D. R. Clark, Jr., S. N. Wiemeyer, and C. J. Henny. 1999. Sodium cyanide hazards to fish and other wildlife from gold mining operations. Pages 55-67 *in* José M. Azcue, editor. Environmental impacts of mining activities: emphasis on mitigation and remedial measures. Environmental Science Series. Springer-Verlag, Berlin. xx, 300 pp.

Ellis, D.H. and R.L. Bunn. 1998. Caribou antlers as nest materials for golden eagles in northwestern Alaska. Journal of Raptor Research 32(3):268.

There are few published records of antlers in golden eagle (*Aquila chrysaetos*) nests. This note reports extensive use of caribou (*Rangifer tarandus*) antlers in three golden eagle nests in the Cape Kruzenstern region of northwestern Alaska. The importance of antlers to this population of eagles can be explained at least in part by (1) the lack of suitable woody vegetation on the open tundra, (2) the similarity of antlers to sticks, and (3) the abundance of antlers, especially cow caribou antlers, in the region.

Ellis, D. H., B. Clauss, T. Watanabe, C. Mykut, M. Kinloch, and C. H. Ellis. 1997. Results of an experiment to lead cranes on migration behind motorized ground vehicles. Pages 114-122 *in* R. P. Urbanek and D. W. Stahlecker, editors. Proceedings of the seventh North American Crane Workshop. North American Crane Working Group, Grand Island, Nebraska. ix, 262 pp.

Ten greater sandhill cranes (*Grus canadensis tabida*), trained to enter and ride in a specially equipped truck, were transported at 80± days of age from their rearing site at Patuxent Wildlife Research Center (Patuxent), Maryland, to a reintroduction site located within the species' former breeding range in northern Arizona. After 5 additional weeks of training, these juvenile cranes were led south ca 600 km to a wintering area on the Arizona/Mexico border. Nine of the 10 survived the trek, 495 km of which was flown, although only a few cranes flew every stage of the route. Their longest flight was 77 km. Major problems during the migration were power line collisions (three, one fatal), eagle attacks (none fatal), and overheating (when air temperatures exceeded ca 25°C). All cranes that entered training quickly learned to follow the truck, and their tenacity when following under unfavorable conditions (e.g., poor light, extreme dust, or heat) showed that cranes could consistently be led over long distances. We cannot predict if the cranes will retrace their route unassisted when adults, but 2 cranes returned 130 km to the starting point of the migration after the flock was scattered by an eagle during our migration south. Three other cranes were recovered 55 km from the attack site and on course toward the starting point.

Ellis, D.H., M.H. Ellis, and P. Tsengeg. 1997. Remarkable saker falcon (*Falco cherrug*) breeding records for Mongolia. Journal of Raptor Research 31(3):234-240.

During 1994 and 1995 surveys, we located over 80 Saker Falcon (*Falco cherrug*) breeding sites in Mongolia. Over half of the eyries had features that were in some way remarkable or previously undescribed in the scientific literature. Ten were on utility poles, two on bridges, three on

abandoned buildings, and one was on a truck tire on a pole. Seven sites were very near buzzard nests, and two more were in buzzard nests that were used the same season. Five sites were on cliff tops accessible by walking. Four were on very short cliffs, two were on broken/sloping cliffs, and one was at the base of a cliff. Five were on the tops of stone pillars. Six were in very short elm trees. Eyrie composition was also sometimes remarkable: one was a suspended uric acid (excrement) platform without underlying support, three were trash nests, and two were composed largely of bones.

Ellis, D.H., D. Hjertaas, B.W. Johns, and R.P. Urbanek. 1998. Use of a helicopter to capture flighted cranes. Wildlife Society Bulletin 26(1):103-107.

Using a helicopter, we pursued 12 sandhill cranes *(Grus canadensis)* and captured 6. In forested habitat, cranes could be forced down, but we were unable to deploy the pursuit team, so cranes could not be captured. In open habitat, every crane we pursued was captured. Target cranes were forced to the ground in 0.3-14 minutes. Adjusting pursuit distance (50-150 m) was essential in promoting fatigue and in preventing escape of target cranes.

Ellis, D.H., S.R. Swengel, G.W. Archibald, and C.B. Kepler. 1998. A sociogram for the cranes of the world. Behavioural Processes 43:125-151.

The behavioral repertoire for the world's 15 species of cranes includes over 100 behavioral acts with clear social significance. Each species performs at least 60 discrete social postures, vocalizations, displays, and activities. Because all but a handful of the stereotyped social displays are common to all species, the presence or absence of social displays was useful only to a limited degree in comparing the relatedness of established crane taxonomic groups. However, the breadth of the repertoire for each species and for the family Gruidae tentatively places cranes at the apex of social complexity (at least for stereotyped displays) in the animal world.

Ellis, D.H., P. Tsengeg, and P.L. Whitlock. 1998. Saker falcon research and conservation efforts in Mongolia, 1997. Falco : The Middle East Falcon Research Group No. 11:7.

Erwin, R. M. 1997. Enhancing waterbird habitat with dredged materials: Some suggestions for improvement. Pages 106-108 *in* Proceedings of the Second Marine and Estuarine Shallow Water Science and Management Conference : April 3-7, 1995, Atlantic City, New Jersey. EPA/903/R/97009 United States Environmental Protection Agency, Philadelphia, PA. ii, 331 pp.

Erwin, R.M., J.D. Nichols, T.B. Eyler, D.B. Stotts, and B.R. Truitt. 1998. Modeling colony site dynamics: a case study of gull-billed terns (*Sterna nilotica*) in coastal Virginia. Auk 115:970-978.

We developed a Markov process model for colony site dynamics of Gull-billed Terns (*Sterna nilotica*) in coastal Virginia. We used the model and data on colony site occupation from 1993 to 1996 to estimate model parameters. Each year, we monitored the breeding numbers of Gull-billed Terns and their frequent colony associates, Common Terns (*Sterna hirundo*) and Black Skimmers (*Rynchops niger*) at colony sites along about 80 km of the barrier island region of Virginia. We also monitored flooding events and renesting. We developed the model for colony survival, extinction, and recolonization at potential colony sites over the four-year period. We then used data on annual site occupation by Gull-billed Terns to estimate model parameters and test between different structures reflecting competing hypotheses. Results revealed a dynamic system, but provided no evidence that the dynamics were Markovian , i.e. the probability of occupancy of a site in one year was not influenced by whether it had been occupied the previous year. Nor did the colony-level reproductive success the previous season seem to affect the probability of site occupancy. Site survival and recolonization rates were similar, and the overall annual probability of a site being occupied over the course of the four-year period was estimated to be 0.59 Of the total of 25 sites that were used during the four-year period, 16 were used in only one or two years while only three were used all four years.. Flooding and renesting were frequent in both habitat types in all years. The frequent flooding of nests on shellpiles argues for more effective management; augmentation with shell and sand to increase elevations as little as 20 cm could have reduced flooding at a number of sites. The low colony-site fidelity we demonstrate suggests that an effective management approach is to provide a large number of alternative sand and/or

shellpile sites that the terns may use. Sites not used one year may still be used in subsequent years.

Farrell, T.A. and J.L. Marion. 1998. An evaluation of camping impacts and their management at Isle Royale National Park. Research/Resources Management Report . U.S. Department of the Interior, National Park Service, Isle Royale National Park, Houghton, MI. 98 pp.

Results from the development and application of a monitoring program to assess visitor impacts on back-country campsites at Isle Royale National Park are presented. Survey staff assessed conditions on 244 sites within 36 back-country campgrounds, including 113 individual campsites, 43 group campsites, and 88 shelters. Site conditions are generally quite good. Site size and other areal measures of disturbance are exceptionally small attributed to the placement of most sites on cut-and-fill constructed “benches” within sloping terrain. Relational analyses revealed that campsites in Spruce and Fir forests and under more open forest canopies have significantly lower areal measures of disturbance. Areal disturbance is also reduced on sites where shelters and picnic tables are present, suggesting that these facilities act to concentrate visitor use. Site locational attributes, such as intersite visibility and proximity to trails, indicate a low potential for solitude within some campgrounds. Recommendations regarding site number, distribution, arrangement, facilities, maintenance, and monitoring are offered for management consideration.

Federoff, N.E. 1998. Cranial and dental abnormalities of the endangered red wolf (*Canis rufus*). Acta Theriologica 43(3):293-300.

Three skulls of captive-raised female endangered red wolves *(Canis rufus)* exhibited severe malocclusion of the jaws. Cranial and dental abnormalities (including crowding of upper toothrows, and an extra tooth behind the lower left M3 in one of the three mandibles) were also evident. Ratios of alveolar length of maxillary toothrow to maximum width across the outer sides of crowns of P4 were significantly different ($p=0.008$) compared to unaffected skulls. Significant differences were also evident when ratios of maximum width across inner edges of alveoli of P1 to alveolar length of maxillary toothrow and maximum width across outer sides of crowns of P4 were compared between the two groups. Although the three skulls all exhibited malocclusion, the abnormality expressed itself differently in relation to the effects to each skull. Captive inbreeding may increase the probability and frequency of expressing these anomalies, although inbreeding coefficients calculated for the wolves expressing malocclusion were not considered high (0.0313-0.0508). A wild female red wolf specimen captured in 1921 in Arkansas also exhibited the malocclusion, although not as severely as in the captive females. This demonstrates that this trait was present in wild populations prior to, and not a result of, the captive breeding program.

Foster, M. S. 1997. Evolution of lek social systems in manakins: alternative models and proofs . Pages 7-8 *in* Anais V. Congresso Brasileiro de Ornitologia. UNICAMP, Campinas, Brasil

Foster, M.S. and L.S. DeLay. 1998. Dispersal of mimetic seeds of three species of *Ormosia* (Leguminosae). Journal of Tropical Ecology 14(4):389-412.

Seeds with "imitation arils" appear wholly or partially covered by pulp or aril but actually carry no fleshy material. The *mimetic seed hypothesis* to explain this phenomenon proposes a parasitic relationship in which birds are deceived into dispersing seeds that resemble bird-dispersed fruits, without receiving a nutrient reward. The *hard-seed for grit hypothesis* proposes a mutualistic relationship in which large, terrestrial birds swallow the exceptionally hard "mimetic" seeds as grit for grinding the softer seeds on which they feed. They defecate, dispersing the seeds, and abrade the seed surface, enhancing germination. Any fruit mimicry is incidental. Fruiting trees of *Ormosia* spp. (Leguminosae: Papilionoideae) were observed to ascertain mechanisms of seed dispersal and the role of seemingly mimetic characteristics of the seeds in that dispersal. Seed predation and seed germination were also examined. *Ormosia isthamensis* and *O. macrocalyx* (but not *O. bopiensis*) deceived arboreally-foraging frugivorous birds into taking their mimetic seeds, although rates of seed dispersal were low. These results are consistent with the *mimetic seed hypothesis*. On the other hand, the rates of disappearance of seeds from the ground under the

Ormosia trees, hardness of the seeds, and enhancement of germination with the abrasion of the seed coat are all consistent with the *hard-seed for grit hypothesis*.

Foster, M.S. and J. Terborgh. 1998. Impact of a rare storm event on an Amazonian forest. Biotropica 30(3):470-474.

Francis, C.M., J.R. Sauer, and J.R. Serie. 1998. Effect of restrictive harvest regulations on survival and recovery rates of American black ducks. Journal of Wildlife Management 62(4):1544-1557.

Gardner, A.L. and C.B. Robbins. 1998. Generic names of northern and southern fur seals (Mammalia: Otariidae). Marine Mammal Science 14(3):544-551.

We have resolved a nomenclatural problem discovered during research on the northern fur seal that concerns the correct generic name for this taxon and for fur seals of the Southern Hemisphere. The unfortunate practice by some 19th century authors to use names in their Latinized form, but to date them from their first appearance as French common names led to the use of *Arctocephalus* for southern fur seals when the name correctly applies to the northern fur seal, known today as *Callorhinus ursinus.* However, *Arctocephalus* and *Callorhinus* are antedated by *Otoes* G. Fischer, 1817, which is the earliest available generic for the fur seal of the northern Pacific. The earliest available generic name for southern fur seals is *Halarctus* Gill, 1866. To avoid the confusion that would result from replacing the currently used generic names with those required by strict adherence to the Principle of Priority, we have petitioned the International Commission on Zoological nomenclature to preserve *Arctocephalus* and *Callorhinus* for the southern and northern fur seals, respectively.

Gee, G. F. 1997. Evaluation of semen from non-domestic birds. Pages 68-71 *in* M. R. Bakst and H. C. Cecil, editors. Techniques for semen evaluation, semen storage, and fertility determination. Poultry Science Association, Inc., Savoy, IL. ix, 97 pp.

Ginsberg, H.S., K.E. Hyland, R. Hu, T.J. Daniels, and R.C. Falco. 1998. Tick population trends and forest type. Science 281:349-350 (letter).

Gould, W.R. and J.D. Nichols. 1998. Estimation of temporal variability of survival in animal populations. Ecology 79(7):2531-2538.

Grossman, G.D., R.E. Ratajczak, Jr., M. Crawford, and M.C. Freeman. 1998. Assemblage organization in stream fishes: effects of environmental variation and interspecific interactions. Ecological Monographs 68(3):395-420.

We assessed the relative importance of environmental variation, interspecific competition for space, and predator abundance on assemblage structure and microhabitat use in a stream fish assemblage inhabiting Coweeta Creek, North Carolina, USA. Our study encompassed a ten year time span (1983-1992) and included some of the highest and lowest flows in the last 58 years. We collected 16 seasonal samples which included data on: 1) habitat availability (total and microhabitat) and microhabitat diversity, 2) assemblage structure (i.e., the number and abundances of species comprising a subset of the community), and 3) microhabitat use and overlap. We classified habitat availability data on the basis of year, season, and hydrologic period. Hydrologic period (i.e., pre-drought [PR], drought [D], and post-drought [PO]) represented the temporal location of a sample with respect to a four-year drought that occurred during the study. Hydrologic period explained a greater amount of variance in habitat availability data than either season or year. Total habitat availability was significantly greater during PO than in PR or D, although microhabitat diversity did not differ among either seasons or hydrologic periods. There were significantly fewer high-flow events (i.e., $\geq$ 2.1 m^3/s) during D than in either PR or PO periods. We observed a total of 16 species during our investigation, and the total number of species was significantly higher in D than in PR samples. Correlation analyses between the number of species present (total and abundant species) and environmental data yielded limited

results, although the total number of species was inversely correlated with total habitat availability. A cluster analysis grouped assemblage structure samples by hydrologic period rather than season or year, supporting the contention that variation in annual flow had a strong impact on this assemblage. The drought had little effect on the numerical abundance of benthic species in this assemblage; however, a majority of water-column species increased in abundance. The increased abundances or water-column species may have been related to the decrease in high flow events observed during the D. Such high flow events are known to cause mortality in stream fishes. Microhabitat use data showed that species belonged to one of three microhabitat guilds: benthic, lower water-column, and mid-water-column. In general, species within the same guild did not exhibit statistically distinguishable patterns of microhabitat use, and most significant differences occurred between members of different guilds. However, lower water-column guild species frequently were not separable from all members of either benthic or mid-water-column guilds. Variations in the abundance of potential competitors or predators did not produce strong shifts in microhabitat use by assemblage members. Predators were present in the site in only 9 of 16 seasonal samples and never were abundant (maximum number observed per day was 2). In conclusion, our results demonstrate that variability in both mean and peak flows had a much stronger effect on the structure and use of spatial resources within this assemblage than either interspecific competition for space or predation. Consequently, we suspect that the patterns in both assemblage structure and resource use displayed by fishes in Coweeta Creek arose from the interaction between environmental variation and species-specific evolutionary constraints on behavior, morphology and physiology.

Hadidian, J., J.R. Sauer, C. Swarth, P. Handly, S. Droege, C. Williams, J. Huff, and G. Didden. 1997. A citywide breeding bird survey for Washington, DC. Urban Ecosystems 1(2):87-102.

`DC Birdscape' was initiated in 1993 to systematically count the birds occurring throughout Washington D.C. during the breeding season. It involved a coordinated planning effort and partnership between the Audubon Naturalist Society, the National Park Service, and the National Biological Survey, and engaged the participation of more than 100 volunteers. A method for rapidly assessing the status of bird populations over a large area was developed and incorporated into a Geographic Information System to allow a multidimensional analysis of species presence and abundance across a variety of urban land use areas. A total of 91 species were observed, with an estimated total number of 115, making Washington D.C. almost as `bird rich' as nearby suburban counties. Data from the study clearly indicate that avian species are not randomly distributed throughout the Washington D.C. metropolitan area, and show affinity, at least in part, to some of the most broadly recognized land use patterns that are commonly used to zone and classify urban areas under development schemes. This study represents a prototype that will allow efficient and economical monitoring of urban bird populations.

Heinz, G. H. 1998. Contaminant effects on Great Lakes' fish-eating birds: a population perspective. Pages 141-154 *in* Ronald J. Kendall, Richard L. Dickerson, John P. Giesy, and William P. Suk, editors. Principles and Processes for Evaluating Endocrine Disruption in Wildlife. SETAC Technical Publication. SETAC Press, Pensacola, FL. xxiv, 491 pp.

Preventing environmental contaminants from reducing wildlife populations is the greatest concern in wildlife toxicology. In the Great Lakes, environmental contaminants have a history of reducing populations of many species of fish-eating birds. Endocrine effects may have contributed to declines in fish-eating bird populations, but the overriding harm was caused by DDE-induced eggshell thinning. Toxic effects may still be occurring today, but apparently they are not of a sufficient magnitude to depress populations of most fish-eating birds. Once DDE levels in the Great Lakes declined, eggshells of birds began to get thicker and reproductive success improved. Populations of double-crested cormorants *(Phalacrocorax auritus)* and ring-billed gulls *(Larus delawarensis)* have increased dramatically since the bans on DDT and other organochlorine pesticides. Bald eagles *(Haliaeetus leucocephalus)* are still not reproducing at a normal rate along the shores of the Great Lakes, but success is much improved compared to earlier records when eggshell thinning was worse. Other species, such as herring gulls *(Larus argentatus)* and black-crowned night-herons *(Nycticorax nycticorax)*, seem to be having improved reproductive success, but data on Great Lakes'-wide population changes are incomplete. Reproductive success of common terns *(Sterna hirundo)*, Caspian terns *(Sterna caspia)*, and Forster's terns *(Sterna forsteri)* seems to have improved in recent years, but, again, data on population changes are not very

complete, and these birds face many habitat related problems as well as contaminant problems. Although contaminants are still producing toxic effects, and these effects may include endocrine disfunction, fish-eating birds in the Great Lakes seem to be largely weathering these effects, at least as far as populations are concerned. A lack of obvious contaminant effects on populations of fish-eating birds in the Great Lakes, however, should not be equated with a lack of any harm to these birds or with a conclusion that certain contaminants do not need additional control.

Heinz, G.H. and D.J. Hoffman. 1998. Methylmercury chloride and selenomethionine interactions on health and reproduction in mallards. Environmental Toxicology and Chemistry 17(2):139-145.

Adult mallards *(Anas platyrhynchos)* were fed a control diet or diets containing 10 ppm mercury as methylmercury chloride, 10 ppm selenium as seleno-DL-methionine, or 10 ppm mercury plus 10 ppm selenium. One of 12 adult males fed 10 ppm mercury died and 8 others suffered from paralysis of their legs by the time the study was terminated. However, when the diet contained 10 ppm selenium in addition to the 10 ppm mercury, none of 12 males became sick. In contrast to the protective effect of selenium against mercury poisoning in males, selenium plus mercury was worse than selenium or mercury alone for some measurements of reproductive success. Both selenium and mercury lowered duckling production through reductions in hatching success and survival of ducklings, but the combination of mercury plus selenium was worse than either mercury or selenium alone. Controls produced an average of 7.6 young per female, females fed 10 ppm selenium produced an average of 2.8 young, females fed 10 ppm mercury produced 1.1 young, and females fed both mercury and selenium produced 0.2 young. Teratogenic effects also were worse for the combined mercury plus selenium treatment; deformities were recorded in 6.1% of the embryos of controls, 16.4% for methylmercury chloride, 36.2% for selenomethionine, and 73.4% for the combination of methylmercury chloride and selenomethionine. The presence of methylmercury in the diet greatly enhanced the storage of selenium in tissues. The livers of males fed 10 ppm selenium contained a mean of 9.6 ppm selenium, whereas the livers of males fed 10 ppm selenium plus 10 ppm mercury contained a mean of 114 ppm selenium. However, selenium did not enhance the storage of mercury. The results show that mercury and selenium may be antagonistic to each other for adults and synergistic to young, even within the same experiment.

referenced records representing >200 vertebrate species and >100,000 individuals residing in estuaries from Maine through Florida. This relational database can be directly queried, imported into the ARC/INFO geographic information system (GIS) to examine spatial tendencies, and used to identify “hotspots”, generate hypotheses, and focus ecotoxicological assessments. An overview of temporal, phylogenetic, and geographic contaminant exposure and effects information, trends, and data gaps will be presented for terrestrial vertebrates residing in estuaries in the northeast United States.

Rattner, B. A., J. L. Pearson, A. Walz, R. M. Erwin, and M. A. Ottinger. 1997. A new look at contamination of north Atlantic estuarine ecosystems through retrospective terrestrial vertebrate exposure and effects data. Estuarine Research Federation, 14th International Conference, October 12-16, Rhode Island. Abstracts, p. 151.

Although the tendency of many is to continually collect specimens for pollution biomonitoring, valuable predictive information can be gleaned on The State of Our Estuaries by review of existing temporal, geographic, and phylogenetic contaminant data. Retrospective contaminant exposure and effects data for terrestrial vertebrates (CEE-TV) are being compiled for North Atlantic estuaries through searches of published literature, existing databases, and unpublished reports of conservation agencies, private groups, and universities. Summary information is entered into the CEE-TV database, which utilizes a 71-field dBase format, including species, collection time, coordinates, sample matrix, contaminant concentrations and toxic equivalents, biomarker/bioindicator responses, and reference source (N>1500 records). These records are then imported into the ARC/INFO geographic information system (GIS) to examine spatial distribution and trends, and to identify critical data gaps to focus future biomonitoring efforts. A risk assessment will identify contaminants that pose a hazard to resident and migratory terrestrial vertebrates, and also rank and prioritize estuaries in which these biota are potentially threatened.

Robbins, C. S. 1997. Birds, conservation and politics in the land of the Maya. Alaska Bird Conference, Anchorage, Alaska, Migratory Bird Management, U.S. Fish and Wildlife Service, December 3.

Described how BRD's migratory bird research program in Guatemala assisted in the passing of legislation by the Guatemalan government to protect 119,000 acres of rain forest at Cerro San Gil, the largest protected area in Guatemala.

Robbins, C. S. 1997. Mapping neotropical migrants in Belize. Boreal Working Group of Partners in Flight, Anchorage, Alaska, December 4.

Described BRD's research program on habitat use by migratory and resident birds in Belize, including the use of GIS and satellite imagery to map their distribution throughout the country.

Robbins, C. S. 1997. Methodology; and Data Management and Interpretation (two sessions). Training Workshop, "Bird Conservation, from Techniques to Application, Rio Bravo Conservation and Management Area, Programme for Belize, November 8-15.

These two sessions included introduction to sampling techniques for song birds, field demonstrations of mist netting, banding, and point counts, preparation of charts and maps, and use of bird data to promote conservation objectives.

Russell, J., R. Halbrook, M. Melancon, and J. French. 1997. Hepatic monooxygenase induction and pentobarbital induced sleeping-times in mice and shrews. SETAC 18th annual meeting: Bridging the Global Environment: Technology, Communication, and Education, November 16-20, San Francisco, CA.

Hepatic cytochrome P450 induction and corresponding reductions in pentobarbital induced sleep times were evaluated and compared among 4 dose groups of white-footed mice (*Peromyscus leucopus*) and short-tailed shrews (*Blarina brevicauda*) exposed to dietary doses of a PCB mixture (Aroclor 1254 and 1242, 1:2) for 31 days. Dose concentrations for mice and shrews were 0.1, 1.6, and 25 ppm and 0.6, 9.6, and 150 ppm, respectively. Sleep times of exposed animals dosed with sodium pentobarbital were measured on day 31 prior to necropsy. Liver microsomes of shrews

and mice were prepared and assayed for ethoxyresorufin-, methoxyresorufin-, pentoxyresorufin-, and benzyloxyresorufin-O-dealkylase activity (EROD, MROD, PROD, and BROD). EROD was the monooxygenase most readily induced by exposure to PCBs in both species. In shrews and mice, PCB ingestion increased hepatic microsomal enzyme activity in all but the low dose group and pentobarbital induced sleep times were reduced in the highest dose group in mice. A trend towards reduction in pentobarbital induced sleep times in the highest dose group occurred in shrews, however the difference was not significant. Results indicate hepatic enzyme activity and decrease in pentobarbital induced sleep time can be useful biomarkers of contaminant exposure in mice and shrews. However, hepatic microsomal activity appears to be a more sensitive indicator of contaminant exposure than sleep time reduction. Dietary exposure to PCBs resulted in a greater induction of monooxygenase activity in mice than in shrews at all dose concentrations indicating that mice may be more readily induced by PCB exposure than shrews.

Sauer, J. R. 1997. Estimating population change and relative abundance from the North American Breeding Bird Survey. Chesapeake Chapter of the American Statistical Association, September 30.

Sauer, J. R. 1998. Landscape analysis of remotely-sensed habitat data and the North American Breeding Bird Survey: Sense or nonsense? A seminar presented at the Appalachian Laboratory, University of Maryland Center for Environmental Science, Frostburg, Maryland, December 10.

Seaman, B. D. and D. G. Krementz. 1998. Bachman's sparrows in response to growing season prescribed burns in South Carolina. Fire and Forest Ecology: Innovative silviculture & vegetation management symposium, sponsored by Tall Timbers, April 14-16, Tallahassee, FL.

Sparling, D. W. 1998. Field evidence for linking Altosid applications with increased amphibian deformities in southern leopard frogs. Joint meeting of the Great Lakes and Central Division Working Groups of the Declining Amphibian Populations Task Force, March 20 & 21, Milwaukee Public Museum, Milwaukee, Wisconsin.

During the summer of 1997 we repeatedly sprayed Altosid, a formulation of 4% methoprene used for mosquito control, on six constructed macrocosms. Six additional macrocosms were sprayed with Abate-4E, containing the organophosphate pesticide temephos, and six were sprayed with water (controls). The wetlands were created on an impermeable foundation for research purposes and averaged 215 m^2 in area and 0.5 m deep. Application rates and frequency of Abate-4E and Altosid followed label directions and mimicked procedures for mosquito control in National Wildlife Refuges. In early September juvenile frogs and metamorphing tadpoles were collected with dip nets from each pond and examined for deformities. In all, 91 juveniles and metamorph southern leopard frogs (*Rana utricularia*) were collected from Altosid sprayed wetlands with 14 (15%) demonstrating deformities. Seventy-seven juveniles and metamorphs were collected from control wetlands with three (4%) showing deformities. Only six juveniles and metamorphs were collected from Abate-4E wetlands and none showed deformities. Deformities included missing or deformed hind limbs (9 of 10 involving only the right hind limb), missing eyes, and abnormal color. The differences in rate of deformities was dependent on treatment (X^2=6.44, p< 0.02). The number of leopard frogs caught per unit effort (tadpoles and juveniles) differed among treatments (p=0.032) with Abate-4E wetlands producing fewer individuals per capture effort than either Altosid or control wetlands.

Sparling, D. W., C. Bishop, and G. Linder. 1998. Where should we be headed in the study of ecotoxicology of amphibians and reptiles? The Wildlife Society 5th Annual Conference : Wildlife Toxicology in Northeastern North American Ecosystems, September 22-26, Buffalo, NY.

Compared to fish, birds, and reptiles, the ecotoxicology of amphibians and reptiles has not been well studied. This is despite the occurrence of several contaminant-related events among herps including apparent global declines of amphibian populations, deformed amphibians in parts of North America, feminization of alligators in Florida, and severely reduced populations of many sea turtles. To stimulate research interest in the area of herp ecotoxicology, the authors solicited experts in the field to contribute to a compendium of review and synthesis articles. Topics such as effects of pesticides, metals, organic contaminants, and acidification on herps; current theories of amphibian deformities, endocrine disruption, declining amphibian populations; and discussions

of using herps in risk assessment, laboratory studies and field investigations were presented in the book. This paper gleans the most salient research needs from each of these topics and aspects of each topic and discusses them in relation to ongoing research in the field.

Spendelow, J. A., I. C. T. Nisbet, J. J. Hatch, H. Hays, G. D Cormons, J. Burger, M. Gochfeld, C. Safina, M. England, J. D. Nichols, and J. E. Hines. 1997. Recent major changes in overwinter survival and metapopulation dynamics of the endangered western north Atlantic roseate tern breeding population. 21st Annual Meeting of the Colonial Waterbird Society, Lafayette, LA., Oct. 29 - Nov. 2.

Multistratum capture-recapture models were used to examine geographic and temporal variation in survival and movement probabilities of breeding adult Roseate Terns from 1988-1996 at 6 of the largest nesting colonies of this endangered population in the Massachusetts-Connecticut-New York area. During this period the regional breeding population showed an increasing trend except between the 1991-1992 breeding seasons when it decreased about 15%. The drop in breeding population size between these two years is believed primarily due to the effect of Hurricane Bob which passed through this area in August 1991 near the beginning of the migration period. The average annual overwinter survival rate of adults for all years except 1991-1992 was 0.83 and the average overwinter survival rate of adults for 1991-1992 was 0.67; the loss (mortality) rate of breeding adults from 1991-1992 (0.33) was almost twice the typical (0.17) loss rate.

Springborn, E. G., J. M. Meyers, and L. K. Duncan. 1998. Home range and movements of painted buntings in managed pineoak forest and shrubscrub habitat on Sapelo Island, GA. North American Ornithological Conference, April 6-12, St. Louis, MO.

The Painted Bunting (*Passerina ciris*) population of the southeastern United States has declined 2.8% annually from 1966 to 1994 (Breeding Bird Survey). Important source breeding habitat for this species exists along the Atlantic coast, especially on undeveloped coastal islands. We radiotracked 20 Painted Buntings on Sapelo Island, GA, from April to July, 1997, to determine home range and movements in managed and unmanaged habitats. After-hatching-year female and after-second-year male buntings were studied in managed pine-oak forest (age 60 yr) and unmanaged shrub-scrub habitat by homing to radio-marked birds and recording GPS locations. We calculated home ranges (95% volume) using the fixed kernel method with a smoothing parameter chosen by least squares cross validation. Males and females occupied similar-sized home ranges (1.95 ha for males, 2.10 ha for females, $P = 0.68$). Buntings occupied larger home ranges in managed pine-oak forest (2.38 ha) than in shrub- scrub habitat (1.73 ha, $P = 0.10$) and traveled 75 m further (mean square distance from center of home range) in managed pineoak forest. Birds of managed pineoak forest flew long distances (>300 m) to coastal marshes, to freshwater marshes, and to moist forest clearings. In shrub-scrub habitat, buntings occupied a compact area and rarely moved long distances. We observed evidence of polygamy and possibly polyandry. Painted Bunting home ranges for the first year of our twoyear telemetry study suggest that for successful nesting, buntings may require more habitat and travel longer distances in managed forests than in unmanaged shrub-scrub habitat.

Teets, M. J., J. J. Hatch, J. A. Spendelow, and J. M. Zingo. 1997. Post-fledging parental care in roseate terns. 21st Annual Meeting of the Colonial Waterbird Society, Lafayette, LA., Oct. 29 - Nov. 2.

Almost nothing is known about parental care in seabirds once the chick has left the nest. The allocation of post-fledging parental care in the Roseate Tern was quantified at the breeding colony on Falkner Island, Connecticut, during the 1997 breeding season. Differences in the number of feeds per hour delivered by parents to one-fledgling versus two-fledgling broods were examined. Brood splitting occurred upon the fledging of the first (A) chick in two-chick broods. Male parents provided most of the feeds to the first fledger with occasional feeds to the second (B) fledger. Female parents provided most of the feeds to the B-fledgers with very occasional feeds to the A-fledger. Usually, the A-fledger disappeared from the island several days before the B-fledger disappeared. The male adult disappeared at the same time as the A-fledger; female adults continued to feed the B-fledger either until the B-fledger disappeared or was abandoned. Single-fledge broods' parental care was not allocated differentially by the sex of the parent. More information is needed to find out how long these associations last.

Twedt, D. J., A. B. Elliot, R. R. Wilson, D. A. Grossuesch, J. L. Henne-Kerr, L. M. Gericke, D. L. Mackey, and R. B. Hamilton. 1998. Avian densities in reforested habitats of the Mississippi Alluvial Valley. Warren County Forestry Association.

Twedt, D. J., R. R. Wilson, R. Hamilton, and J. Henne-Kerr. 1998. Avian nest success in relation to forest type and silvicultural treatment in the Mississippi Alluvial Valley. North American Ornithological Conference, April 6-12, St. Louis, MO.

We estimated daily survival rates, predation rates, and brood parasitism rates for 526 opencup nests in mature, bottomland hardwood forests at Tensas River National Wildlife Refuge, LA and 455 opencup nests in young, managed cottonwood forests at Fitler Managed Forest, Fitler, MS from 1994 to 1997. Daily nest survival was higher ($P<0.01$) in bottomland forest ($S=0.95$; nest success=30.4) than in managed cottonwood forest ($S=0.93$; nest success=7.2). However, the species assemblages differed between forest habitats. Separate analyses of 5 species common to both forest types revealed no difference ($P>0.14$) in daily nest survival. Within bottomland hardwood forests, we found no difference ($P=0.91$) in daily nest survival between pre- and post-treatment years in forest stands subjected to single-tree harvests, but survival was higher ($P<0.01$) in uncut bottomland hardwood forests than in harvested forests. Harvest impacts varied by species; post-harvest nest survival declined for Acadian Flycatcher but was unchanged for Northern Cardinal. Daily nest survival rates were similar ($P=0.93$) in planted and coppiced cottonwood forests. Rates of brood-parasitism and nest predation were higher ($P <0.01$) in managed cottonwood forests (0.24 parasitized; 0.65 predated) than in bottomland forests (0.08; 0.39). Timber harvest in bottomland hardwood forests tends to shift avian species assemblages, nest survival, brood parasitism, and nest predation rates closer to those of young, managed cottonwood forests.

Warren-Hicks, W. J., K. R. R. Solomon, J. H. Gentile, J. Butcher, B. A. Rattner, W. G. Landis, and R. Wenger. 1998. Linking stressors and ecological responses. 19th Annual SETAC meeting, Nov. 15-19, Charlotte, NC.

Wilson, R. R., A. B. Elliot, and D. J. Twedt. 1998. Spring migrants in forested wetlands of the Mississippi Alluvial Valley. North American Ornithological Conference, April 6-12, St. Louis, MO.

We compared 400 m long line-transects and three 5-min point counts to assess avian richness and abundance in mixed species bottomland hardwood forests at Tensas River National Wildlife Refuge, LA and managed cottonwood forests at Filter Managed Forest, MS. In 218 paired surveys conducted in 11 forest stands between 24 March and 3 June, 1996 and 1997, we detected more species and total number of individuals using line-transects than point counts. Differences were most pronounced in bottomland hardwood stands recently subjected to single-tree harvest. Species richness did not differ between forest types but number of individuals detected was greater in bottomland hardwoods than in cottonwoods. Despite similarity in species richness, detrended correspondence analysis of avian abundances revealed marked differences in the bird communities using these two forest types during migration. Indicator species analysis detected 27 species indicative of bottomland hardwood forests, including Acadian Flycatcher, Prothonotary Warbler, Red-bellied Woodpecker, and White-throated Sparrow, whereas 15 species were indicative of managed cottonwood forests, including Yellow-breasted Chat, Indigo Bunting, Eastern Towhee, and Eastern Bluebird. Temporal changes in the species composition was also revealed by detrended correspondence analysis. Six clusters of bird species, identified through cluster analysis, depicted short-distance migrants, year-round residents, and long-distance migrants within each forest type.

Winger, P. V. and P. J. Lasier. 1998. Effects of dredge-spoil runoff in the Savannah River. 19th Annual SETAC meeting, Nov. 15-19, Charlotte, NC.

The lower Savannah River distributary, consisting of Front, Middle and Back rivers, encompasses the city of Savannah, GA, Savannah Harbor and the Savannah National Wildlife Refuge. Harbor activities (maintenance and expansion), in conjunction with municipal and industrial discharges, have adversely affected habitat quality and indigenous fish and wildlife resources. The objectives of this study were to ascertain the effects of dredge-spoil runoff on habitat quality in the river. Sediments from 35 river sites and 6 dredge-disposal sites were collected for analysis of metal and

organic contaminants (organochlorine and organophosphate pesticides, PAHs and PCBs) and toxicity testing of solid-phase sediment and sediment porewater using *Hyalella azteca*. Bioaccumulation of contaminants from 6 dredge-spoil sediments was determined using *Lumbriculus variegatus.* Metal residues were measured in livers of marsh ducks (*Anas creca*), wading birds (*Tringa flavipes*) and raccoons (*Procyon lotor*). Most sediments were not toxic, and for those showing toxicity, water quality characteristics (ammonia, alkalinity, salinity) were generally responsible. However, dredge-spoil runoff or pointsource discharge may have contributed to the toxicity shown at 14 sites. Organic contaminants in sediments were at or below detection limits. *Lumbriculus* bioaccumulated arsenic, copper, mercury, selenium and zinc from dredge-spoil sediments. Cadmium, mercury, molybdenum and selenium residues were higher in livers of birds and raccoons than in sediment, and these metals were significantly higher in livers of raccoons living near the river than those living in an upland control area. Evidence of bioaccumulation from laboratory and field evaluations, toxicity of sediments from some areas receiving dredge-spoil runoff and concentrations in sediments demonstrated that some metals present in the dredge spoils are mobile and biologically available and have the potential to impact habitat quality in the lower Savannah River.

Yorks, A. L., M. J. Melancon, and D. J. Hoffman. 1998. Nestling tree swallow (*Tachycineta bicolor*) PCB body burdens and their effects on reproduction and growth. 19th Annual SETAC meeting, Nov. 15-19, Charlotte, NC.

Tree swallows (*Tachycineta bicolor*) were monitored during three consecutive breeding seasons at eight sites in Maryland, Pennsylvania, and New York representing a range of polychlorinated biphenyl (PCB) contamination in order to evaluate if there were any effects on reproductive or growth parameters. Eggs were collected and analyzed to determine contamination due to the females' body burden and establish a baseline PCB level. Composite sediment samples and pooled stomach contents were also analyzed to characterize each site and quantify PCBs from local food sources. Reproductive success was assessed by clutch size, and embryo and nestling survival. Clutch sizes at the two most contaminated sites near Philadelphia PA were generally smaller than at other sites. Nine-day nestlings were ligatured and insects in the food samples were identified to order (suborder for Dipterans), categorized as aquatic or non-aquatic, and analyzed for total PCBs. Growth parameters examined for twelve-day nestlings included body, liver, and heart weights, and bone, culmen, and brain symmetry measurements. A subset of carcasses were cleared and skeletons were stained in order to observe growth and bone structure. Body weights at two contaminated sites were lower than those at control or less contaminated sites. There were no consistent differences between liver and heart weights that related to contamination. While there were only subtle differences between reproductive and growth parameters from nestlings at various sites, body burdens of PCBs correlated strongly with levels in sediment, eggs, and food sources.

Yorks, A. L., M. J. Melancon, C. S. Hulse, J. J. Stegeman, and B. R. Woodin. 1998. Cytochrome P450 monooxygenase activities as a biomarker for PCB exposure and effect in field collected and manually dosed tree swallow (*Tachycineta bicolor*) nestlings. 19th Annual SETAC meeting, Nov. 15-19, Charlotte, NC.

The utility of measuring protein and catalytic function of cytochrome P450s of the CYP1A and CYP2B subfamilies as biomarkers for environmental polychlorinated biphenyl (PCB) exposure in upland birds was examined using Tree swallows (*Tachycineta bicolor*). From 1995 to 1997, nests and nestlings were monitored at eight sites in Maryland, Pennsylvania, and New York. Additionally, eggs and nestlings from one site were dosed with the model cytochrome P450 inducers, ÿnaphthoflavone, 3methycholanthrene, PCB 126, and various Aroclors. Hepatic microsomes were prepared from twelveday old nestlings and analyzed for EROD (CYP1A) and BROD (CYP2B) activities. A subset of microsomal samples were also examined by protein immunoblotting using polyclonal antibodies specific for the CYP1A and CYP2B subfamilies. Heart and skin samples from the nestlings were examined immunohistochemically to determine relative amounts and cellular location of CYP1A. Although BNF induced cytochrome P450s as assessed by enzyme activity and protein immunoblotting, PCBs were ineffective. A range of PCB contamination was seen in composite sediment (0.0216ppm) and egg (0.709.7ppm) samples from the field sites. BROD and EROD activities correlated significantly with each other ($r>0.8$) and with PCB concentrations. Contaminant levels and CYP1A and CYP2B antibody responses of the

nestlings also were correlated. Differences between sites and treatments show that there is a cytochrome P450 biomarker response in nestling Tree swallows which is indicative of contaminant exposure and effects. However, lack of enzyme activity after dosing with PCBs indicates that induction at field sites may be due to other contaminants.

Yorks, A. L., B. A. Rattner, and M. J. Melancon. 1998. Investigations of potential endocrine disruption and sexual dirmorphism in nestling tree swallows (*Tachycineta bicolor*) with a range of PCB body burdens. 19th Annual SETAC meeting, Nov. 15-19, Charlotte, NC.

Polychlorinated biphenyls (PCBs) elicit endocrine disruptive effects in many species, including birds. Tree swallows (*Tachycineta bicolor*) were studied at eight sites, located in Maryland, Pennsylvania, and New York, with a range of PCB contamination to determine effects on gender and gonadal development of nestling offspring. Blood samples were collected from nestlings and genetic sex was determined by polymerase chain reaction amplification of sex chromatin in nucleated red blood cells. Gonads were excised and fixed for subsequent gross and histologic examination. PCB analyses of twelve-day old nestlings indicated that residue concentrations varied considerably among the eight sites. Of the 145 nestlings examined anatomically, the phenotypic sex ratio was 53% female and 47% male. No intersexes were observed. Histological observations revealed some variation such as numbers of spermatogonia and stages of follicular development among individuals. Genotypic evaluation of the 145 nestlings revealed complete concordance with phenotypic observations. Although there were significant differences in PCB exposure among study sites, there was no evidence of abnormal gonadal development or anatomical gender alteration in nestling tree swallows.

Zingo, J. M., J. A. Spendelow, and J. S. Hatfield. 1997. Does the trapping of adult roseate terns adversely affect chick growth? 21st Annual Meeting of the Colonial Waterbird Society, Lafayette, LA., Oct. 29 - Nov. 2.

We evaluated the effects of trapping adult Roseate Terns on chick growth at the Falkner Island colony site in Connecticut, USA, from 1987-1996. We calculated five parameters of chick growth which collectively represent the entire growth curve: linear (*a*) and quadratic (*b*) components of early growth, mass on Day 5 (*Mass5*), linear growth rate (*LGR*), and asymptotic or prefledging mass (*AM*). Trapping significantly reduced *a*, *b*, and *Mass5* compared to untrapped controls. However, effect sizes were much smaller for *Mass5* than for *a* and *b*, suggesting that trapped parents had already begun to compensate. *LGR* and *AM* were not adversely affected by trapping, except for a small but statistically significant reduction in *LGR* if both parents were trapped during late incubation. These results suggest that while trapping adult terns can affect early chick growth and should be taken into account during research, the effects are short-lived and the parent birds compensate. Trapping had little or no effect on later growth (indices of fledgling quality) and thus is unlikely to affect postfledging survival.