

ZOOLOGY

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ABSTRACTS

The Adaptive(?) Significance of Brood Reduction in the Red-winged Blackbird (*Agelaius phoeniceus*). JAMES D. HENGEVELD, Department of Biology, Indiana University, Bloomington, Indiana 47405.—In hatching synchrony experiments on redwings from 1981-3, results indicated that synchronous hatching was not a necessary precursor for brood reduction. Starvation was essentially the same among nests with synchronous hatching and those with the natural degree of hatching asynchrony. When coupled with the finding that young from nests in which one or more chicks starved tended to fledge at lower weights than young from starvation-free nests, these results led me to question the significance of the brood reduction process itself. The critical issue, however, is not a comparison between young from reduced broods and those in which all chicks have survived but rather a consideration of whether survivors of reduced broods do better than they *would have* if their sibling(s) had not starved. During the 1984 breeding season, I attempted to address this question by substituting healthy young of the appropriate age for starved young in half of the nests in which brood reduction occurred. I then monitored the growth rates, starvation, and fledging weights of chicks from the experimental and control groups. Chicks from experimental nests (nests with substitutions) fledged at lower weights than chicks from the control nests seeming to indicate that the sacrifice of a chick is beneficial to its siblings. However, sample sizes thus far are too small to make any definitive conclusions. (Supported in part by a grant from the Indiana Academy of Science to J.D. Hengeveld).

Patterns of Relative Fecundity in Snakes. JOHN B. IVERSON, Department of Biology, Earlham College, Richmond, Indiana 47374.—Interspecific brood size-body length comparisons for snakes indicate that the two variables are positively correlated. Three factors (reproductive mode, taxonomic group, and habitat type) are identified as significant correlates of relative fecundity. Snakes with the highest relative fecundities are typically viviparous, tend to be from certain taxonomic (phylogenetic?) categories (primarily the Natricinae, Xenodontinae, and Viperinae), and/or are most often aquatic, semi-aquatic, or semi-fossorial.

Light Microscopic and Ultrastructural Features of the Gut of the Balsam Woolly Aphid, *Adelges piceae* Ratz. MOHINDER S. JARIAL, Center for Medical Education, Ball State University, Muncie, Indiana 47306.—The structure of the gut of the balsam woolly aphid was studied by dissection, light microscopy and electron microscopy. The gut is a simple but slightly coiled tube and falls into three distinct regions, namely, foregut

comprising mouth, sucking pump, pharynx and esophagus; midgut consisting of stomach and intestine; and hindgut representing the rectum. The horseshoe shaped sucking pump and adjoining pharynx is connected to the stomach by the esophagus which is a long, slender tube lined by cuticular intima. The stomach or the first part of the midgut appears very dark in the dissected specimens that have over-wintered. The stomach leads into the intestine or the second part of the midgut. The intestine is longer and relatively smaller in diameter, bends on itself and empties into the rectum which narrows to end in the anus. The rectum has extremely thin wall containing few mitochondria and is lined with cuticular intima.

The cells in the stomach and intestine present a similar structure, except in the former the epithelial cells are larger and contain an abundance of fine particulate material and membrane bound, magnesium and calcium rich granules of various shapes and forms, and crystalline rods. Isolated muscles with trachea form the outer covering. The basal plasma membrane rests on a basement membrane, and is thrown into numerous infoldings that penetrate deep into the cell. The cells contain well developed nuclei and numerous mitochondria. The striated border exhibits closely packed microvilli projecting into the lumen.

The accumulation of granules in the cells and their occasional release into the lumen of the stomach appears to be related to the process of storage excretion in the absence of Malpighian tubules.

Parental Investment in the Bee *Ceratina calcarata* Robertson (Hymenoptera: Xylocopidae): A Preliminary Study. MICHAEL D. JOHNSON, Department of Biological Sciences, DePauw University, Greencastle, Indiana 46135.—*Ceratina calcarata* nests, each a linear series of brood cells in the hollowed out twig, were examined in a preliminary study of parental investment in this solitary bee. I examined 71 nests, weighed 475 immatures and their provisions, placed each in a gelatin capsule for rearing, and weighed the 200 males and 167 females that emerged.

Preliminary analysis showed that 1) for any nest, females were typically supplied heavier provision masses ($\bar{X}^* = 22.27 \pm 6.29$ mg vs. $\bar{X}^* = 16.67 \pm 2.95$ mg), 2) wet weight of females exceeded that of males ($\bar{X}^* = 11.62 \pm 3.26$ mg vs. $\bar{X}^* = 8.73 \pm 2.89$ mg) even if reared from similar provision masses, 3) females occurred more commonly in the innermost cell, but 4) a comparison of the provision weights did not reflect this sex ratio.

Ceratina females are larger (and more valued?) and should receive relatively greater parental investment. Thus the mother typically puts a female in the first brood cell after the investment of hollowing a twig and provisioning the cell. Then, the provisioning of each subsequent cell influences the mother's "decision," such that female eggs are typically laid on larger provision masses.

Territorial Behavior in the Prothonotary Warbler, *Protonotaria citrea*, Between- and Within-season Territory Relocations. MICHAEL P. KOWALSKI, 5690 Kings Road, Bloomington, Indiana 47401.—In April of 1983 a study of the population dynamics of a color-banded population of Prothonotary Warblers was begun on the North Fork of Salt Creek in eastern Monroe Co., IN, and was continued in 1984. In 1983 the study area consisted of a 3 km stretch of river, and in 1984 this was expanded to 8.9 km. Territory abandonment and relocation by males was more common than previously suspected. In 1984 a total of 47 males took up residence on the river, 45 of which were captured and color-banded. Nine of these (20%) abandoned their territories and were not seen again during the season. Eight males (18%) abandoned their territories and relocated to a new site on the study area. These new territories averaged

603 m from the first, with the range being between 229 m and 2364 m. Most abandonments and relocations took place after 15 June 1984, and in 5 cases (63%) the males had failed to attract a mate to the first territory. One male who relocated to a territory 2364 m from his first territory eventually returned to the original territory and succeeded in attracting a mate.

In 1983 seven males were marked, and 4 (57%) returned to the study area in 1984. Two of these returned to their 1983 territories, while the other 2 relocated. The average distance relocated by these males was 1000 m, with a range of 782 m to 1220 m. One of the males who returned to his 1983 territory simultaneously held a second territory located 763 m away.

It is suggested that adult dispersal is more common in passerines than is generally thought, and so-called surplus males may in fact be wandering or relocating birds.

A Record of the Freshwater Nemertean *Prostoma graecense* (Böhmig) in Indiana. JAMES R. LITTON, JR., Department of Biology, Saint Mary's College, Notre Dame, Indiana 46556. — *Prostoma graecense* (Böhmig) is a freshwater nemertean that has a very spotty distribution in the United States. Specimens were collected in benthic grab samples (mud) in Lake Marian, a concrete impoundment on the Saint Mary's College campus, during March, April, and May of 1983 and the early spring of 1984 (February, March only). Collections at other times of the year in 1983 or 1984 produced no individuals. All individuals were small (< 5 mm in length; < 0.7 mm diameter), whitish, pale yellow or vermillion, and sexually immature. No gut contents were ever noted or identified. Specimens were also found in two locations in Juday Creek, Saint Joseph County, during May and June, 1984 while collecting benthic samples with a sweep net. Subsequent collections produced no individuals. At both locations the *Prostoma* were associated with rooted aquatic vegetation. All of these individuals were large (> 10 mm in length; > 1.0 mm in diameter), yellowish-red or deep red in color, and sexually mature. Gut contents of the mature individuals showed an almost exclusive diet of small oligochaetes.

Seasonal Abundance of the Psammic Rotifers of Spicer Lake, Indiana. JAMES R. LITTON, JR., Department of Biology, Saint Mary's College, Notre Dame, Indiana 46556. — The psammic rotifer community inhabiting the substrate of the littoral zone of Spicer Lake was studied from March to November, 1983. Thirty-nine species of rotifers were found, but abundances were extremely low (range 0.0 to 7.8 cm⁻³) when compared with other freshwater psammic habitats. Total rotifer density and densities of major genera differed significantly over time, and between depths in the sediment, but not between sites ($p < 0.01$). Highest densities occurred in the top 2.0 cm of sediment in early spring and late fall. Total rotifer density and densities of *Cephalodella* spp. and *Trichocerca* spp. were positively correlated with alkalinity ($p < 0.01$). Densities of all taxa were negatively correlated with variability in water chemistry. Rotifer species were found to be randomly distributed in time and space, with no evidence of competitive exclusion. The density and diversity of the Spicer Lake rotifer community is comparable to that found for highly variable and unpredictable environments.

Visual Signals in Sticklebacks: A Reexamination and Extension of Some Classic Experiments. WILLIAM J. ROWLAND, Department of Biology, Indiana University, Bloomington, Indiana 47405. — Fifty years ago Tinbergen and his coworkers at Leiden, Netherlands began an investigation of the factors that influence the reproductive behavior of the threespined stickleback (*Gasterosteus aculeatus*). By presenting territorial males with simple dummies that varied with respect to only a single feature, these workers

discovered that a few simple stimuli were of paramount importance in eliciting stickleback social behavior. These classic experiments thus provided much of the evidence for concepts such as sign stimuli, releasers, and the innate releasing mechanism. However, recent research suggests that the results of these experiments and their interpretation may have been oversimplified.

Using fish from Dutch and American populations I reexamined and extended the dummy presentation experiments. I found that territorial males attacked nuptially colored (red undersides) or headdown dummies less than nonred or horizontal dummies, respectively. This may be because red undersides and/or headdown posture are indicative of rival males and thus elicit avoidance as well as aggression in a subject. I also found that males court (and attack) dummy females in headup "courtship" posture less than those presented horizontally. This suggests that the primary function of headup posture in both male and female sticklebacks is appeasement of aggression and that such appeasement has a suppressing effect even on the male's courtship. Results confirmed the importance of the gravid shape of females in eliciting male courtship. Furthermore, it was found that males preferentially court supernormally large and supernormally gravid dummy females over normal size, gravid dummy females.

Venom Antigens in Oral Secretions of Colubrid Snakes. SHERMAN A. MINTON, Department of Microbiology and Immunology, Indiana University School of Medicine, Indianapolis, Indiana 46223.—Venom in colubrid snakes is secreted by Duvernoy's gland which lies in the postocular region. It may or may not be associated with enlarged, grooved posterior maxillary teeth. Duvernoy's gland secretion was collected from 11 species of colubrid snakes, some with enlarged grooved or ungrooved teeth, and some with more or less uniform maxillary teeth. Oral secretions were also obtained from two species of boas which lack Duvernoy's gland. These secretions were reacted with 15 commercial antivenoms in Ouchterlony immunodiffusion preparations. Three antivenoms, a polyvalent cobra and a polyvalent and monovalent mamba antivenom, reacted with all colubrid oral secretions; four other reacted with at least five. Reactions consisted of one to three precipitin lines. Boa oral secretions gave weak reactions with polyvalent cobra and mamba antivenoms.

Ouchterlony preparations in which oral secretion and plasma of the same snake species were reacted in alternate wells against antivenoms indicated some reacting antigens were present in both and hence are probably widespread in snake tissues; other antigens were present in oral secretion and not plasma. Immunoelectrophoresis of some colubrid oral secretions indicated the reacting antigens evidently do not correspond to the major toxins of cobra and mamba venoms.

Colubrid venoms share at least three antigens with venoms of African elapid snakes (cobras and mambas) and two with saw-scaled vipers, another genus probably of African ancestry. There is little evidence of shared antigens between colubrids and other vipers, pit vipers, or coral snakes, but one antigen is shared with Australian elapids.

Physiology of Vocalization by an Echolocating Bird. RODERICK A. SUTHERS, School of Medicine and Department of Biology, Indiana University, Bloomington, Indiana 47405.—Oilbirds (*Steatornis caripensis*; Steatornithidae) have a bilaterally asymmetrical bronchial syrinx with which they produce echolocating clicks and a variety of social vocalizations. Vocalizations are initiated by contraction of the sternotracheal muscles which stretch the trachea, reducing the tension across the syrinx and causing the cartilaginous bronchial semi-rings supporting the cranial and caudal edges of the external tympaniform membranes (ETM) to hinge inward, folding the ETM into the syringeal lumen. Sonar clicks are terminated by rapid contraction of a previously

undescribed intrinsic syringeal muscle, the broncholateralis, which inserts on the semi-ring supporting the anterior edge of the ETM. Tracheal airflow at first increases as expiratory effort increases subsyringeal pressure. The initial high rate of airflow drops at the onset of phonation due to the increased syringeal resistance. In the case of a double click, airflow momentarily ceases during the intraclick interval when the ETM temporarily closes the syrinx. Air sac pressure rises to its maximum level at this time. Expiratory airflow rapidly increases as the ETM is abducted from either its closed or phonatory position to its open, resting position. Each sonar click requires about 1 cc of air; a typical agonistic squawk may use about 27 cc of air.

An Experimental Study of Biparental Care in the Dark-eyed Junco. LICIA WOLF, Department of Biology, Indiana University, Bloomington, Indiana 47405.——It commonly is assumed that males of monogamous birds care for their young because without that care success in reproduction would be impossible or reduced. This study examines the significance of male care in the monogamous, double-brooded Dark-eyed Junco (*Junco hyemalis*) by quantitative comparison of reproductive success of females with and without the help of a male. In contrast to male parental care on the survivorship of the young to independence as well as the season-long reproductive success of females. Over two summers, males of 24 breeding pairs were captured at the time their eggs hatched and were held for the remainder of the breeding season; the nests of their mates (experimentals) were subsequently monitored, as were the nests of unmanipulated pairs (controls, $n = 49$). Earlier studies that have addressed this problem report no significant differences in growth rate of experimental and control young in the nest. My preliminary results support these findings, and further, indicate no differences in several other variables that were considered important factors affecting the reproductive success of females: weight of young at fledging, weight loss of nesting females, and interclutch interval. However, fewer young raised by unaided females survived to independence relative to young raised by two parents. Further, fledging success (at least one young that fledged) of experimental broods was slightly higher than that of control broods in both years of the study.

