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Abstracts

HABITAT FRAGMENTATION ALTERS FOOD WEB STRUCTURE

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The process of habitat fragmentation and more specifically the generation of edge habitat may play a large role in determining the trophic structure of food webs across landscapes. For example, edges have been shown to increase the strength of species interactions such as predation. If predation rates increase in fragmented landscapes due to increased edge, one would also expect predator biomass to increase at the expense of prey biomass thereby changing trophic structure. To test this hypothesis, we compared biomass among trophic levels in three experimentally fragmented landscapes with equal amounts of tall vegetation (habitat) and short vegetation (matrix): 1) contiguous tall vegetation in a square (high core-to-edge habitat ratio), 2) tall vegetation interspersed with short vegetation in a checkerboard pattern (moderate core-to-edge habitat ratio), and 3) tall vegetation in a ring around short vegetation (low core-to-edge habitat ratio). We found that fragmentation treatments with a low core-to-edge habitat ratio had greater predator biomass and a greater predator-prey biomass ratio than treatments with a high core-to-edge habitat ratio. Predator trophic level biomass increased disproportionately relative to prey trophic level biomass in landscapes with a greater degree of edge habitat. These results demonstrate that the way in which habitats are fragmented can impact trophic levels differently. While research on habitat loss and fragmentation primarily focuses on the persistence of single species populations or the biodiversity of a single taxonomic group, this work focuses on food web structure, which can also be effected by fragmentation. Successful conservation in fragmented landscapes will require knowledge of the effects of fragmentation on both biodiversity and food web structure.

Keywords: *habitat configuration, patch shape*

TREES GET DIBS: FOREST ARCHITECTURE AND SPECIES-ENERGY RELATIONSHIPS IN NORTH AMERICA

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Available energy consistently explains a majority of the variance in species richness at broad spatial scales for a variety of taxa. In plant communities, however, species richness among herbs, forbs and graminoids appears to be largely independent of regional gradients in available energy. In forests, the structure of the tree canopy may strongly influence the energy available for photosynthesis by herbaceous plants. Thus, we hypothesize that small-statured plants may exhibit a distinct regional species-energy relationship from canopy tree species. Using USDA Forest Inventory and Analysis records from across North America, we show that while overall forest vascular plant species richness exhibits a monotonic increase with regionally estimated

available energy, this pattern is driven exclusively by woody plant species. After incorporating a measure of the amount of light blocked by the canopy, the overall effect of regional energy gradients on understory plant species richness is not significant, in part because while woody plants exhibit a positive relationship, herbaceous plants exhibit a negative relationship. These results indicate that discrete differences in growth form may influence the organization of plant communities along energy gradients at different scales.

Keywords: *Forest architecture, species richness, Forest Inventory and Analysis*

TEMPORAL AND SPATIAL VARIATION TO ANT OMNIVORY IN PINE FORESTS

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To understand omnivore function in food webs we must know the contributions of resources from different trophic levels, and how resource use changes through space and time. We investigated the spatial and temporal dynamics of pine (*Pinus ponderosa*) food webs that included the omnivorous ant *Formica podzolica*, using direct observation and stable isotopes. *Formica podzolica* is a predator of herbivorous and predatory arthropods, and a mutualist with some aphids. Observations of foragers (2001) showed that in early summer (June) ants fed upon equal parts non-mutualist herbivores (31% prey biomass), mutualist aphids (27%), and predators (42%); ant trophic position was thus between that of primary and secondary predator (trophic level=3.4). In late summer (September) ant feeding remained relatively constant upon nonmutualist herbivores (53%) and mutualist aphids (43%), but ant feeding upon predators fell (4%), thus shifting ant trophic position to that of a primary predator (trophic level=3.0). Feeding on honeydew increased from 25% of ants in early summer to 55% in late summer. By increasing the frequency of their interactions with mutualist aphids, ants maintained a constant supply of arthropod prey through the summer, despite a two-thirds decline in arthropod biomass in pine canopies. Stable isotope analysis ($\delta^{15}N$, $\delta^{13}C$) of six pine food webs dispersed over 150 ha (2002) placed ant trophic level at 3.3 for early summer. There was significant variation among these trees in ant trophic position (range 3.2 to 3.6), but no indication of positive spatial autocorrelation. The combined results from this work shows that across two years *F. podzolica* fed on average at, or slightly above, the trophic position of primary predator, but trophic positioning varied both temporally and spatially by approximately 0.4 trophic levels.

Keywords*: food web, omnivory, intraguild predation, stable isotopes*

CONTEXT-DEPENDENT DECISION MAKING IN AMERICAN TOAD (*BUFO AMERICANUS*) TADPOLES

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One well-studied benefit of living in a group is the “dilution effect”. This antipredator strategy of safety in numbers lowers the probability that a particular individual will be attacked. The benefit of group formation and altruistic behavior is even greater when the members of the group are related. By grouping with kin, an altruistic act is helping individuals that share similar genetic

material, thus increasing their indirect fitness. Investigations of group formation in pre-metamorphic amphibians have demonstrated that both group density and relatedness are important factors in choosing a group. For example, American toad (*Bufo americanus*) tadpoles exhibit higher levels of aggregation in the presence of a predator than when in the absence of a predator, and when given a choice between kin and non-kin, will preferentially group with kin. Using a series of six experiments we investigated the relationship between the "dilution effect" and kin group formation. There were two categories of experiments: three without predator cues and three with predator cues (*Lepomis machrochirus*). Two experiments examined the dilution effect by allowing experimental subjects the choice between small and large groups of kin (Experiment 1) and non-kin (Experiment 2). The third experiment was a combination of dilution effect and kin preference. When exposed to kin (Experiment 1), subjects demonstrated a slight preference for the larger kin group. With the addition of a predator (Experiment 4), the preference for the larger group increased but not significantly. When exposed to non-kin (Experiment 2), subjects had no preference for either group. With the addition of a predator (Experiment 5), preference for the larger group increased but not significantly. Finally, when given a choice between a small kin group and a large non-kin group (Experiment 3), subjects spent significantly more time with the small kin group. However, in the presence of a predator (Experiment 6), experimental subjects switched decisions and spent significantly more time with the larger non-kin group. This implies that pre-metamorphic American toads have the ability to make context-dependent decisions, and that a hierarchy of responses exists in which larger group size may be a more effective defense than grouping with kin.

Keywords: Bufo, *tadpole, kin selection, decision-making*

THE TWELVE YEARS OF MAPS RESULTS FROM THE CHICAGOLAND BIRD OBSERVATORY OF THE WATERFALL GLEN FOREST PRESERVE, DUPAGE COUNTY, ILLINOIS

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The Chicagoland Bird Observatory has been operating its MAPS (Monitoring Avian Productivity and Survivorship) bird banding program in collaboration with Institute for Bird Populations since 1992 at the Waterfall Glen Forest Preserve (DuPage Co., IL). From 1992 to 2003, we captured 45 species for a total of 770 birds. Our purpose in this study is to examine the changes in abundance of the commonly captured species to determine whether groups of species share similar patterns of capture counts in the 12 years of our data. Of the 45 species, we chose nine species which lower 95% confidence interval values were greater than 0.5 individuals per year for further analyses. Using a 2-way ANOVA (with no interaction term) of those 608 birds, there was a significance difference across years ($F_{11,588}$ = 17.336, P < 0.05), however, there was no distinct trend of increase or decrease (b = 0.2). As expected, there was a significant difference in abundance among the nine species ($F_{8,588}$ = 90.690, P < 0.05). The *post hoc* Tukey HSD showed three major overlapping groups of species that shared similar abundance pattern; most abundance group consisted of Black-capped Chickadee and Gray Catbird, moderately abundant group was Northern Cardinal, Downy Woodpecker, Red-eyed Vireo, Field Sparrow, Indigo Bunting, and American Robin, and lastly, Blue Jay, Northern Cardinal, and Downy Woodpecker were grouped together also as relatively less common species. From examining the ages of captured birds and from field observations, we concluded that Grey Catbird and Black-capped Chickadee had highest capture counts for apparently different reasons. For Grey Catbird, it was because of relatively higher recapture rates, along with the fact that juveniles tend to get caught with their adults later in the season. For Black-capped Chickadee, it was due to their nature of flocking, especially after juveniles are capable of sustained flight. These findings may indicate

that use of habitats by local birds during summer needs to be examined both from the capture counts and from the age distribution as well.

Keywords: *birds, breeding, Chicago, MAPS*

MALLARD AND LESSER SCAUP FOOD SELECTION DURING SPRING MIGRATION ON SWAN LAKE, IL

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Nutrient reserves obtained during spring migration may affect the reproductive success of waterfowl, by allowing for earlier nest initiation and hatching dates, leading to higher duckling survival. Nutrient storage for use during breeding is observed in some species of arctic nesting geese, which depend on nutrient reserves obtained during spring migration for nesting. Geese arriving on breeding grounds with larger reserves of fat and protein, lay larger, more successful clutches. The affect of reserve size on duck clutch formation is not as well understood. Ducks demonstrate a switch from a diet high in carbohydrates during the fall and over-winter period, to a diet higher in protein during late winter and spring migration, presumably in preparation for breeding. It is unclear if this switch is because of changing dietary needs or depletion of high energy food sources. To address this question we collected feeding female mallards (*Anas platyrhynchos*) (n = 17) and lesser scaup (*Aythya affinis*) (n = 30) during the spring of 2004, while simultaneously collecting food availability data to determine food selection. Food availability data was collected at waterfowl collection points, random points, and in areas of high waterfowl use. This study will increase our understanding of the role nutrient availability during spring migration plays in limiting reproductive success of migratory waterfowl. Furthermore, current wetland management in the Mississippi Flyway focuses on production of high carbohydrate food sources for fall migrating and over-wintering waterfowl. This study will help determine if managers are adequately providing for the nutritional needs of waterfowl during all phases of the annual cycle, or if changes in management practices are needed to meet these needs.

Keywords: *Foods, Lesser Scaup, Mallard, Spring*