have at least two possible explanations: 1) a 100-yr drought during Expt. 2 may have altered Collembola behavior, lowering their exposure to spider predation; and 2) different combinations of spider guilds were manipulated in the two experiments, differentially affecting patterns of intraguild predation and predation on Collembola.

CHEN, H., M. E. HARMON, J. SEXTON and B. FASTH. Oregon State University, Corvallis, OR 97331. **Woody root decomposition in coniferous forests of the Pacific Northwest: A time series approach.**

Woody root decomposition was studied in Sitka spruce, Douglas-fir, and ponderosa pine forests at Cascade Head, H. J. Andrews, and Pringle Falls Experimental Forests in Oregon, using a time series approach. Species significantly influenced mass loss of fine and small roots during the first 2 years of decomposition. In contrast, no significant species effects on the decomposition of medium, large, jumbo roots were observed. For the same period, site differences had little impact on decomposition of roots, regardless of root size. For fine roots, Oregon ash was the fastest among the 15 species examined during two years of decomposition, losing about 63% of its initial mass. Incense-cedar had the slowest decomposition, losing about 35% of initial mass in the same period. Small roots lost 11–35% of initial dry weight among 8 species in 2 years. For other class sizes, 10% or less of the initial mass was lost in 2 years. Initial substrate quality indices could be used to predict the decomposition rate-constant (k) of fine and small roots. For all fine roots, lignin-cellulose index (LCI) and lignin-phenols:N together were the best predictor. In small roots, the phenols:N ratio was the best predictor. Soil nitrogen availability had no direct influences on woody root decomposition despite a 5-fold difference between sites. Decomposing roots, especially fine roots, could be an important nitrogen source with as much as 70 Kg/ha/year of nitrogen released from dead roots after catastrophic disturbances (e.g., clear-cut, forest fire) in Douglas-fir old-growth forests.

CHESNEY, W. and C. D. ROBLES. California State University, Los Angeles, CA , USA. **A fine scale view of mussel recruitment patterns.**

Whether spatial patterns of adult populations are determined primarily by settlement or post-settlement processes has prompted many recent studies. However, few studies consider fine scale differences in settlement of *Mytilus* spp., even though population dynamics of the adults are the basis of key theory. Using larval collectors, wave dynanometers, laser survey stations, and GIS analysis, we compared patterns of settlement of *Mytilus* spp to wave exposure, topography, and adult population structure in Barkeley Sound, British Columbia and Santa Catalina Island, California. Three-dimensional GIS representations with fine scale resolution (1–4m) were developed by extensive surveying and mass sampling efforts. Comparison of larval settlement and adult distribution patterns show strong differences between *M. californianus* and *M. "edulis* morph" (*M. trossulus* and *M. galloprovincialis*). Settlement of *M. californianus* primarily occurred within the region of adult mussels in areas of high wave exposure, whereas *M. "edulis* morph" settled both within and outside regions of adult populations over the entire gradient of wave exposures.

CHESSON, P.[1] and B. A. BYRNE.[2] [1]University of California Davis CA 95616 USA; [2]Oregon State University Corvallis OR 97331 USA. **The importance of coupled variable recruitment and density dependence in the coexistence of coral reef fishes.**

Coral reef fishes are known for their highly variable recruitment rates. Also, there is increasing evidence that density dependence may occur at a variety of stages in the life cycle, including mortality in early settlement, and growth of adults. These features were incorporated in a metapopulation model of reef fish communities, which showed that spatial and temporal variation in recruitment rates may strongly promote species coexistence when several conditions were satisfied. First, species should have different spatio-temporal patterns of recruitment so that the ratios of the recruitment rates of different species vary in space or time. Second, density dependence must be multispecies with both conspecific and heterospecific densities limiting population growth. Third, coupling between recruitment and density dependence must occur in the sense that density dependence must more strongly limit local population growth when local recruitment is high. Coexistence then occured even though species may differ, up to some maximum amount, in their fitnesses averaged over all environmental conditions. The maximum average fitness difference compatible with coexistence measured the strength by which coexistence was promoted. The strength of coexistence increased with the strength of the coupling between recruitment and density dependence. Moreover, the contribution of any stage in the life cycle to coexistence was diminished by density dependence at prior stages because the coupling of recruitment with density dependence at that stage was diminished by density dependence at prior stages. Density dependence in growth and reproduction may be poorly coupled with recruitment variation and therefore may only weakly affect species coexistence. An important exception was when there were large differences between average recruitment levels at different sites, in which case strong coupling between recruitment and density-dependent growth and reproduction developed over time, strongly promoting coexistence. This work emphasizes that recruitment limitation and density dependence should not be treated as alternative explanations for community structure. The interaction between the two is the dominant feature of coexistence in this model.

CHICK, J. H.[1] and J. C. TREXLER.[1] [1]Florida International University, Miami, FL, 33199, USA; [2]University of Chicago, Chicago, Illinois, 60637 USA; [3]University of New Orleans, New Orleans, LA, 70148, USA. **Trophic interactions of large-piscivorous and small-omnivorous fishes in freshwater marshes of the Florida Everglades.**

Two important features of freshwater marshes in the Everglades have not been thoroughly researched. First, a lack of information about large-piscivorous fishes has led to dichotomous descriptions of their importance, from suggestions that they control population growth of small fishes to suggestions that they are too rare to be ecologically important. Second, Everglades marshes support an unusually large standing stock of periphyton, often manifested in a calcareous floating mat. Interactions between grazers and periphyton are complex because nutrient regeneration by omnivores can stimulates algal growth and physical features of mature periphyton mats can impede grazing. We conducted caging experiments to clarify the role of large-piscivorous and small-omnivorous fishes in the Everglades food web. Closed treatments demonstrated that mosquitofish, the numerically dominant small-omnivorous fish, significantly reduced recruitment of macroinvertebrates, but had no significant net effects on periphyton. We also used open and refuge treatments to examine effects of large-piscivorous fishes, and found significantly greater use of the refuge treatment by small fishes, amphibians, and macroinvertebrates. Greater abundance of grazers in the refuge treatment significantly reduced new growth of epiphytic algae but did not affect mature periphyton mats. Our experiments suggest large fishes in the Everglades may be abundant enough to at least influence habitat selection by prey taxa. Additionally, patterns of grazer effects suggest physical features of mature periphyton mats that impede grazing may be critical to food web interactions in this system.

CHIU, C., Y. CHIU and J. CHEN. Academia Sinica, Taipei 11529, Taiwan. **Dynamics of soil microbial biomass C and N of sub-alpine forest and grassland ecosystems in central Taiwan.**

The soil microbial biomass in humid sub-alpine ecosystems in a subtropical region of Taiwan, was characterized. The major study was conducted in central Taiwan, which has an elevation of 2700 m. The climate is temperate mountainous with a mean annual precipitation of 3600 mm and a temperature of 8.8°XC, respectively. Microbial C and N were assessed using the chloroform fumigation-extraction method. The microbial C in grassland and forest sites ranged from 57 to 767 mg C kg^{-1} soil in the lower mineral soil horizons, and 1465 to 3867 mg C kg^{-1} soil in the humus and A horizons. Equivalent values for microbial N were 12.9 to 114.9 mg N kg^{-1} soil in the mineral soil, and 107 to 926 mg N kg^{-1} soil in the surface soils. Microbial biomass C represented 1.4–3.8%, 1.0–4.2% and 0.3–2.5% of the organic C in the surface soils of grassland, transition zone and native *Tsuga* forest, respectively, whereas the microbial N as the percentage of total soil N comprised 6.2–15.7%, 5.3–18.0% and 2.6–11.1%, respectively. There was a close linear relationship between microbial biomass C and N. Ratios of microbial biomass C to N were remarkably consistent both within and between soils. The ratios were 3.82 for grassland, 3.15 for transition zone and 4.06 for *Tsuga* forest with an overall mean C/N ratio of 3.64 (r^2=0.7