Coexistence in a community of Viverridae

A.H. Maddock
Department of Zoology, University of Natal, Pietermaritzburg 3200, South Africa.

An investigation of the trophic, spatial and temporal niches of a community of coexisting viverrids in a reserve along the south coast of Natal revealed that a high degree of overlap along one niche dimension was usually balanced by low overlap along another dimension, even where multidimensional niche overlap was high. *Genetta tigrina* and *Galerela sanguinea* overlap considerably along the trophic niche but are nocturnal and diurnal respectively and have different prey. Coexistence of *G. tigrina, G. sanguinea, Atilax paludinosus* and *Herpestes ichneumon* is facilitated by differences along one of the main niche dimensions. An exception was the two diurnal species, *G. sanguinea* and *H. ichneumon*, which overlapped considerably along all three niches. However, coexistence between these species may be facilitated by body-size differences. These viverrids appear to have sufficiently broad trophic or spatial niches, or to select resources not preferred by the other species such that competition for any one resource is normally limited.

Niche partitioning between Sooty Shearwaters and Whitechinned Petrels at sea

S. Jackson
Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Rondebosch 7700, South Africa.

Sooty Shearwaters, *Puffinus griseus*, and Whitechinned Petrels, *Procellaria aequinoctialis*, are the most numerous non-breeding species off the west coast of South Africa. Although Sooty Shearwaters occur closer inshore than do Whitechinned Petrels, the overlap during winter allows the possibility of interspecific competition for food. The two species differ in morphology and behaviour and so differ in their diets. Sooty Shearwaters are able to dive deeper than Whitechinned Petrels and prey more heavily on mesopelagic fish such as Lantern-fish, *Lamponyctodes hectoris*, and Light-fish, *Maurolicus muelleri*, in the upper 10 m of the ocean. Whitechinned Petrels appear to rely more on trawler offal. This resource partitioning can only have existed since the advent of trawlers in the southern Benguela region, although Whitechinned Petrels may have scavenged from whaling vessels or from whales themselves before this.

Chemical composition of faeces from large herbivores at the Addo Elephant National Park as an index of veld utilization

T. Erasmus and A. Hall-Martin*
*Department of Zoology, University of Port Elizabeth, P.O. Box 1600, Port Elizabeth 6000, South Africa, and *National Parks Board, P.O. Box 787, Pretoria 0001.*

Faeces collected monthly at the Addo Elephant National Park over a period of one year from four species of elephant, rhinoceros, buffalo and eland were analysed for macro-nutrients (protein, acid detergent fibre, acid detergent lignin and ash) as well as for some micro-nutrients (Na, K, Ca, P, Mg, Cu and Fe). All these components varied with season and were influenced by rainfall and temperature. The greatest variation was observed in the case of the buffalo and the least in the case of the elephant. Moreover, each species produced faeces with a typical and different chemical composition, presumably reflecting the composition of their respective diets. This is interpreted as an indication of how these large herbivores consume the available nutrients.

Waders on rocky shores: does resource depletion lead to competition?

P.A.R. Hockey and R.G. Ryan
Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Rondebosch 7700, South Africa.

The feeding ecology of dense, multi-species wader flocks was studied on exposed rocky shores at Marcus Island (33°03'S, 17°58'E), South Africa. Nutrient runoff from seabird aggregations enhances intertidal productivity with concomitant high densities of waders. Species utilized intertidal zones in different proportions and were segregated temporally during the tidal and diurnal cycles. Foraging overlap was greatest on the upper shore during the austral autumn when migrant breeding birds foraged longer to meet increased energy requirements of laying down pre-migration fat reserves. During this period, rates of aggression were high and directly related to foraging activity. Wader diet differed in the proportions of prey species taken and the sizes of prey items, but these differences only related to low-shore prey species. On the structurally simple upper shore there are few major prey species and these were exploited by all the smaller waders. There was little evidence of competition during summer, when wader energy requirements were low and most foraging occurred on the low shore. Foraging periods were extended during the austral autumn, causing considerable diet overlap and severely depressing prey populations. High rates of aggressive interactions and age-related dietary differences suggest that direct competition for high quality prey occurred at this time. These observations, coupled with severe prey depletion during the pre-migration period, suggest that prey availability during this period may be an important factor limiting wader populations.

Does competition or disturbance regulate Bald Eagle populations?

A.J. Hansen
Centre for Resource Ecology, Department of Botany, University of the Witwatersrand, Johannesburg 2001, South Africa.

Bald Eagles, *Haliaeetus leucocephalus*, are abundant along the northwest coast of North America, due primarily to the presence of large but ephemeral food patches created by spawning anadromous fish. Experimental evidence indicates that both eagle survival and reproduction are regulated by food. The dynamics of the food resource are driven mainly by disturbances including glacial processes, weather fluctuations, and commercial fishing. The food that is available to eagles is divided among individuals by intraspecific competition. When not breeding, eagles gather at food patches and forage by hunting or stealing from conspecifics. Older and larger birds are the most successful pirates and consequently younger and smaller eagles must emigrate or starve as food becomes scarce. Similarly, territorial behaviour during the nesting season results in the best competitors monopolizing suitable habitats so that other eagles must forgo breeding in some years. These findings show that disturbance influences total resource abundance, whereas intraspecific competition mediates the proportion of the resource obtained by individual eagles. I conclude that ecological theory can best be advanced by asking not if competition exists, but rather what its strength is relative to other factors.

Resource partitioning between the five major grazing ungulates in the Umfolozi Game Reserve, Natal

R.H. Emslie
Centre for Resource Ecology, Botany Department, University of the Witwatersrand, Johannesburg 2001, South Africa.

The degrees of dietary separation between white rhinoceros, buffalo, zebra, wildebeest and impala were examined in the 1983/84 wet season in an attempt to shed some light on how these species coexist. Feeding patches were defined (using a 0.25 m^2 circular quadrat) and an assortment of techniques were used to measure what was available, what had been eaten and how it had been eaten. These ranged from broad-scale measurements of all grass species to detailed measurements of every tiller of two key species, *Themeda triandra* and *Panicum coloratum*. These data were then analysed according to a hierarchy of selection (feeding patch, species, tiller size and plant part selection).

Only buffalo selected areas dominated by culmed *T. triandra* (which contributed 59% of their diet). The four other species selected areas where 'short and medium' species contributed between 75% and 90% of the standing biomass. These grazers demonstrated highly significant species selection within short grass areas. Even when grazing the same species, tiller size selection differed between ungulates. Taking *P. coloratum* as an example, the broad-mouthed 'lawn mower' species (wildebeest and white rhinoceros) preferentially grazed the shorter, erect central tillers on a tuft, while the longer, stoloniferous tillers contributed significantly to the diet of the narrower-muzzled and more selective impala and zebra. These data indicated that the main scale of selection was at the feeding patch level, while selection for species and tiller size within patches fur-

ther increased dietary separation. Different digestive systems, body sizes and mouthparts enabled grazers to exploit the large degree of macro- (area, patch) and micro- (species, tiller size) habitat heterogeneity and allow widely differing feeding niches to be adopted, thus enabling coexistence to occur. Dietary overlap would, however, be expected to increase during the dry season.

What does population genetics tell us about coexistence of Sparrowweavers and Sociable Weavers?

J.W.H. Ferguson
Department of Zoology, University of the Witwatersrand, Johannesburg 2001, South Africa.

Whitebrowed Sparrowweavers and Sociable Weavers in the western O.F.S. use similar nest sites and take the same insect and seed foods. Aggressive interactions between these species suggest a competitive relationship that demands an explanation of their coexistence. Interpretation of this situation differs widely according to the assumptions one makes about the evolutionary process. The concept of 'adaptive topography' is widely used in competition theory, suggesting that large, established populations undergo 'fine-tuning' in response to environmental change. Genetically it means that gene frequencies change in response to phenotypic fitness changes in large populations. It is suggested that adaptive topography has a very limited use in explaining such gene frequency changes and that no predictions about gene frequencies as a result of environmental change can be made using this theory. Plocepasserine coexistence is, among others, a result of the characteristics that arose during speciation of the respective species and no special explanation for this phenomenon need be implicated. Aggressive behaviour between the species can be explained at a lower level than that of competition.

An experimental study of foraging competition between two species of gull

D.C. Duffy
Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Rondebosch 7700, South Africa.

Interspecific interactions between foraging Kelp Gulls, *Larus dominicanus*, and Hartlaub's Gulls, *L. hartlaubii*, were studied in food-choice experiments which presented prey of different sizes to mixed groups of the two species and recorded which species arrived first at a prey item, which ended up consuming the prey, and which species stole prey from the other. At single-species flocks, I measured the amount of time necessary for food handling. The two species appeared to partition prey by size. Hartlaub's Gulls reached prey first and usually consumed small prey which had short handling times. Prey requiring longer handling times were often taken over by Kelp Gulls, even when Hartlaub's Gulls reached the prey first. Gulls are typically opportunistic feeders, exploiting rich, local, irregularly-occurring prey. These results suggest that interspecific interactions may determine access to prey by the two species.

Competitive release amongst African dung beetles in Australia

B.M. Doube and A. Macqueen*
*Dung Beetle Research Unit, Private Bag X5, Lynn East, Pretoria 0039, South Africa, and *Division of Entomology, CSIRO, P.O. Box 5545, Rockhampton Mail Centre, Rockhampton, Queensland 4068, Australia.*

Five African and one South-East Asian species of dung beetle have become established on pastoral ecosystems in coastal central Queensland, Australia. The population processes of these species have been monitored at Rockhampton in a clay-loam pasture which mostly comprises introduced African grass species. Dung beetle population processes have also been monitored in homoclimatic regions of Southern Africa (Natal lowveld) in pastoral ecosystems in which the soil type, vegetative cover and cattle are similar to the monitor system in Australia. Approximately 80 species of dung beetle are present in the African system. In both localities there were marked seasonal changes in abundance in which all five African species were scarce during winter and abundant during the warm moist months. Within systems there was substantial year-to-year variation in average levels of abundance but in Australia each of the five species was many times more abundant than in Africa. The total biomass of dung beetles was similar in the two systems. This was taken as evidence that interspecific competition was limiting the abundance of these five species in the African dung communities.

Coexistence of two small waders, *Charadrius marginatus* and *Calidris alba*, on a sandy beach

A.A. Crowe and T.M. Crowe
Percy Fitzpatrick Institute of African Ornithology, University of Cape Town, Rondebosch 7700, South Africa.

The foraging behaviour and ecology of White-fronted Sandplovers, *Charadrius marginatus*, and Sanderlings, *Calidris alba*, were studied at a sandy beach near Oukip, Cape Province, South Africa during January 1977 - February 1978. Both species exhibited a tidal cycle in foraging activities. Foraging activity also varied temporally, spatially and seasonally according to environmental variables and their physiological requirements. Interspecific aggression was observed wherever there was spatial and temporal overlap between the species, invariably resulting in Sanderlings being displaced. Sanderlings were involved in very few instances of intraspecific aggression, apparently only during rare instances of high prey density. White-fronted Sandplovers are territorial the year round and vigorously defended their territories against conspecifics and foraging Sanderlings. Each species had characteristic foraging methods and microhabitats, but there is no evidence tha these differences are maintained by competition.

Partitioning of a goby resource amongst four avian predators and evidence for altered trophic flow in the pelagic community of an intense perennial upwelling system

R.A. Cruickshank, R.J.M. Crawford, P.A. Shelton and I. Kruger
Sea Fisheries Research Institute, Private Bag X2, Rogge Bay 8012, South Africa.

Pelagic gobies, *Sufflogobius bibarbatus*, were numerically the most important prey of Jackass Penguins, *Spheniscus demersus*, Cape Cormorants, *Phlacrocorax capensis*, and Bank Cormorants, *P. neglectus*, at islands off the Namibian coast during 1978-1982. These avian predators are able to utilize small gobies near the surface or dive sufficiently deep to exploit larger individuals, and their populations at islands to the north of Lüderitz, where gobies are abundant, have been expanding. Cape Gannets, *Morus capensis*, feed only on large gobies that are occasionally brought to the surface, and the gannet population off Namibia has shown a large decrease since the collapse of the pilchard, *Sardinops ocellata*, resource in the late 1960s and early 1970s. In the intense perennial upwelling system situated between 22°S and Lüderitz, gobies are believed to have partially replaced pilchards during the 1970s. Both pilchards and gobies are able to feed on large diatoms of the genera *Chaetoceros* and *Delphineis*. These genera dominated the inshore phytoplankton in the early 1970s, when biomass levels of both pilchards and gobies were low.

Coesistence of *Amblysomus hottentotus* (Insectivora) and *Cryptomys hottentotus* (Rodentia)

S. McConnell and G.C. Hickman
Department of Zoology, University of Natal, P.O. Box 375, Pietermaritzburg 3200, South Africa.

Sympatry in fossorial mammals generally occurs only between the insectivore and rodent moles. Allopatry within the Insectivora and Rodentia may be the result of competitive exclusion, or simply an effect of adaptation to specific local habitat conditions during speciation. Although insectivores and rodents do not compete for the same foods, competition for other resources (such as space) could be expected to occur as a result of convergence in the subterranean ecotope. The present work is the first detailed study of the association of moles and mole-rats in an area of sympatry, and examines the roles of competition and habitat preferences in determining the distribution of *Amblysomus* and *Cryptomys*.

Specimens of *Amblysomus hottentotus* (Chrysochloridae) and *Cryptomys hottentotus* (Bathyergidae) were collected monthly at Umdoni Park, Natal south coast, and non-sympatric individuals from Pietermaritzburg, Natal, were collected quarterly for comparison. After eight months of sampling, stomach analyses have shown no overlap in diet. Histological