Niche is potentially an important concept but also that it is a difficult one and, further, that many of its difficulties arise from its multiplicity—the fact that it is really not one concept, but several.

Wallace 1987
1. INTRODUCTION

The concept of community is one of the simplest and most basic ideas of modern ecology. Community may be defined as an assemblage of organisms living together at a given point in space and time. Despite the simplicity of the idea of community, it has proven to be exceedingly difficult for community ecologists to define properties and useful principles that apply to all communities. The definitions of community itself suggest the interactive nature of community, whereas some of these interactions are positive for both members (mutualistic) or positive for one with no apparent harm to the other (commensals), those that are negative for one or both species (predation, parasitism, competition). In such cases of negative interactions, arise a problem of persistence of antagonistic pairs of species without the extinction of one over the other. So some mechanism would stabilize these negative interactions and allow persistence.

In a community, where the species are competing with one another on a day-to-day or minute-by-minute basis, and where the environment is homogeneous, it is indisputable that competitive forces will have a powerful effect on community structure. So in practice, interspecific interaction may be an active force and may play a central and powerful role in shaping the communities. An approach to predict what a community should look like, if interspecific competition was shaping it or had shaped it in the past, the predictions may conform that the co-existence of competitors in a community should exhibit niche differentiation or, in turn, a pattern of interspecific interaction is expected whenever there is a niche differentiation.

Niche is a conceptual construct in modern ecology and a term currently in vogue among the community ecologists. It seems this word has filtered in gradually from general usage through the works of early ecologists. Hutchinson (1957) described niche as a
"multidimensional hypervolume", while MacArthur's (1972) niche is the "Resource Utilization Function (RUF)". Among the definitions, RUF niche is considered to be more realistic and demonstratable (Arthur, 1987). Niche of a species may be defined abstractly as a fitness measure in a multidimensional environment space (Levins, 1968). More correctly niches may be characterized as a measure of resource utilization (Pianka, 1983; Giller, 1984). Hence niche concept has been used as (i) a tool for systematically describing the major environmental variables influencing distribution and abundance of single species and (ii) a device for understanding interspecific interactions and community structure.

Using the mathematical models of Lotka (1925) and Volterra (1926), Gause (1934, 1935) experimented and suggested the competitive exclusion principle, which states that two species with identical requirements cannot coexist in a habitat. These studies which were not labelled at that time are now called studies on resource partitioning. The term "resource partitioning" means how species differ in resource use, was introduced in the 1960's (Toft, 1985). Resource partitioning is a mechanism by which niche segregation occurs or niche segregation is the reflection of resource partitioning or rather these patterns and processes are similar and are largely synonyms. Hence, these resource partitioning patterns result form pressures, evolutionary or otherwise, to avoid interspecific competition is more of an issue now, than when most of the studies were carried out. So the primary goal of the resource partitioning study is to describe the limits that interspecific competition places on the number of species that may stably coexist.

The kinds of resource partitioning differences between species, or kinds of dimensions, can be grouped under the three general headings of habitat, food type and time. Habitat variations are the differences in space. These include relatively coarse-scaled or microhabitat differences and relatively fine scale or microhabitat differences and these two terms define the end of a continuum. Food type differences involve food size, food texture and food taxon. Temporal differences can be either diel or seasonal. Most of the resource partitioning studies ranging from protozoans to mammals, found that habitat was the most common mode of partitioning, followed by food type and time the least (Schoener, 1974; 1986).
However, information on resource partitioning in aquatic organisms, especially fishes is limited. Fishes are challenging subjects for studies of resource partitioning. Fishes exhibit indeterminate growth resulting in a complex size structure and many fish assemblages especially coastal ones, are temporally structured. Moreover, the nature of the aquatic habitat obviously provides greater challenges for study than many terrestrial systems (Ross, 1986).

Literature on resource partitioning and allied topics in stream/river fish communities can be "segregated" into pre-80's (until 1983) and post-80's (after 1983). The pre-80's literature includes 17 studies carried out in stream fish assemblages during 1950 and 1983 (Ross, 1986 and references therein) in temperate and tropical regions. Studies in temperate regions outweigh tropical. Among these, 8 studies found food as the important category for resource partitioning (Starrett, 1950; Keast, 1966; Paine et al., 1982; Wynes and Wissing, 1982; Adamson and Wissing, 1977; Zaret and Rand, 1971; Straskraba et al., 1966 and De Silva et al., 1980). But even in some of the studies like Starrett (1950), Paine et al., (1982) and Straskraba et al., (1966) never considered temporal and/or spatial resource axes. Studies of Mendelson (1975), Baker and Ross (1981), Hlohowskyj and White (1983), Matthews et al., (1982), Surat et al., (1982), Maitland (1965) and De Silva and Kortmulder (1977) found habitat as the most important resource axis for niche segregation. But Cadwallader (1975) and Angermeier (1982) suggest temporal axis as the most important category than food or habitat. In habitat partitioning studies, the separation may occur through horizontal, vertical, current, depth etc. A review of these studies has been provided by Ross (1986).

The post 80's literature on resource partitioning shows an exponential growth especially in temperate (North America) regions. But a tight approach on these new community perspectives has been started applying to tropical regions also.

The resource partitioning pattern in animal communities through habitat, diet and time has been the nucleus of discussion among community ecologists (Schoener, 1970; Grossman, 1986b; Freeman et al., 1988). Grossman (1986a) analyzed ecomorphological and trophic similarities in an intertidal fish assemblage in a Californian beach. Community structure and
The importance of trophic segregation in Virgin River, USA (Greger and Decon, 1988) Campbell River Estuary, Canada (Macdonald et al., 1987) New Zealand Rivers (Shirvell and Dungey, 1983) and rocky intertidal region, California, USA (Grossman, 1986a) have also been reported. The microhabitat usage and patterns emerged from the natural forces and the process to niche specializations and community structure development have been studied in stream fish assemblages in North Carolina, USA (Grossman and Freeman, 1987) lower Matarrana river fish assemblage in Spain (Grossman et al., 1987b) upper Matarrana river fish assemblage in Spain (Grossman et al., 1987a) and South eastern black creek, USA (Ross et al., 1985, 1987). A similar study on Ozark minnows was done by Gorman (1988) in Roubidoux creek of Missouri, USA. Temperature regulated microhabitat usage has also been studied mainly in North America (Baltz et al., 1982, 1987).

While analyzing the structural aspects of communities, it would be rather worthwhile to look into the factors that influence the structure of animal communities. Of many theories suggested, Equilibrium-nonequilibrium hypothesis by Connell (1978) is an important one. This hypothesis was later viewed as stochastism and determinism (Grossman et al., 1982) and was described in fish assemblages. The same description became a major issue of controversy (Yant et al., 1984; Rahel et al., 1984; Herbold, 1984; Gorman, 1986b; Grossman et al., 1985) leading to two schools of thought via deterministic and stochastic. One group contended that communities are near their equilibria and are structured predominantly by intrinsic, deterministic or biotic forces such as interspecific competition. Opposed to this viewpoint, another group views that communities are predominantly nonequilibrium such that extrinsic, stochastic or abiotic factors play a major role in shaping the communities. Many workers provided empirical evidence to either phenomena (Moyle and Senanayake, 1984; Moyle and Vondracek, 1985; Grossman et al., 1987a, 1987b; Schlosser, 1988; Grossman and Freeman, 1987; Grossman, 1986b; Ross et al., 1985, 1987; Freeman et al., 1988) and still the debate continues (Ebeling et al., 1990).
Besides the review on resource partitioning studies in fishes by Ross (1986), another overview of community structure patterns (Helfman, 1978 and reference therein) in fishes discusses the general topics of temporal structure in fish communities. The importance of ontogenetic changes in the roles played by individuals in a variety of communities and the relative contribution of stochastic and deterministic phenomena to the composition and diversity of coral reef communities and the possible importance of planktonic interactions as related to the stochastic/deterministic debate.

Studies on modern ecological perspective on niche segregation and community structure in tropical stream fishes date back to early 70's by Zaret and Rand (1971) in a Panama lowland stream, South America. In that study, they suggested interactive segregation of fish species through food overlap estimations and supported competitive exclusion principle. Later in 1978, a study on Panama stream (Gorman and Karr, 1978) identified stream depth, bottom type and current as three important dimensions in habitat diversity and tried to correlate the habitat characteristics and presence-absence of fish. These habitat characteristics which Gorman and Karr identified became the measure of microhabitat variables in recent studies. But after a break of few years, the analysis of tropical fish communities on a tight and precise approach was developed and was carried out in Sri Lankan rainforest stream (Moyle and Senanayake, 1984). This study more or less tried to avoid the erroneous patterns in methodology for microhabitat and trophic estimates in streams and came out as a successful attempt to describe the ecological structure of fish assemblages in tropical areas.

But in India, a major part of the oriental region with immense spread of water bodies and diverse fish fauna, no one tried to conduct studies on this perspective rather concentrated on individual species, organisms or ecosystems. A more pluralistic or holistic approach on the study of fish communities was pioneered in South India in later 80's through a Dutch initiative (Arunachalam et al., 1988). In that study, the fish assemblages in upland stream pools of a South Indian River was thoroughly investigated on a synecological point of view and quantified the resource axes of fish community and interpreted the community process in tropical stream pools (Arunachalam et al., 1988, 1991).
The studies by Arunachalam et al (1988) concentrated only on the hill stream pools in upland area. But the habitat diversity varied with lowland rivers. So the present study was designed to comprehend the patterns and processes in lowland tributaries and main channel river habitats, including hill stream habitats. The lowland tributaries/drain habitats, main channel/river habitats are supposed to be highly dynamic and heterogeneous to homogeneous in nature. The fish communities with same members in different habitats like hill streams, lowland tributaries, lowland main channel habitats would be of high interest and have never been studied in India. The spatial variability pattern among these habitats and the availability of microhabitats and food in these habitats would influence differently on the structuring of these fish communities in various part of the same river system. Longitudinal resource gradients from headwater to downstream would focus the differences in the structuring forces of fish communities along this dimension. So an attempt was made to study the fish communities at different levels of a South Indian River System which originates from highland and flows through mid and lowlands. The resource partitioning pattern of same fish species in different habitat types at different geographical levels would emerge a new pattern in community interpretations. With this view, the study addressed the following questions:

1. Does the fish community structure perfectly?

2. What are the resource axes on which the fish community is structured?

3. Does macrodistribution of fish species follow a temporal/spatial variability pattern?

4. What are the niche variables that influence the structure of fish communities?

5. Do the niche variables influence differently on the structure and organisation of fish communities?

6. What would be the relative importance of each niche variable on the structuring
of fish communities?

7. Do the physical, chemical and geomorphological variations influence the structuring of fish communities?

8. Do the ecomorphological attributes imply any type of niche specializations in fish communities?

9. Does the spatial diversity pattern on resource availability reflect any morphological changes in fish communities?

10. What are the forces (deterministic or stochastic) that structure the fish communities?

Could it predict the possible changes in fish community structure in a long run on an ecological or evolutionary perspectives?

12. Can a modelling be possible on fish community structure and function? If so, whether such a model can incorporate the land-water interactions and associated changes in fish communities?

13. Would it imply any possibility of using the indices like Index of Biotic Integrity and a probable implementation of the same in tropical running waters?

14. How far the conclusions fit with general community theories?