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Niche Classification, Niche Processes and Niche Dynamics: Role of Consciousness

Asima Tripathy^{1*} and Rajat Kumar Pradhan²

¹Post Graduate Department of Zoology and Microbiology, Bhadrak Autonomous College (Department of Higher Education, Govt. of Odisha), Bhadrak, Odisha, India, PIN: 756100,
asimatripathy09@gmail.com

²Post Graduate Department of Physics, Bhadrak Autonomous College (Department of Higher Education, Govt. of Odisha), Bhadrak, Odisha, India, PIN: 756100, 2rkPradhan@gmail.com

ABSTRACT

Niches are usually defined in the ecological sense for species. We develop further the concept of niches for individual and emphasize the importance of the psychological niche in determining the behavior of an individual. We classify the possible categories of niche and their processes. We introduce the concept of genetic niche for the individual which depends on the psychological niche and gives rise to the rest of the niches. Species spatial distributions as well as their abundances are attributed to the breadth of their niches. It is reasonable to assume that species which are able to utilize wider spectrum of resources can attain higher population density and can occupy more areas of the same niche or the other of same kind. Ecological niches are not stable. The species and their niche have an oscillatory dynamics in their parameters e. g. species population and prey density and constitution of abiotic factors.

KEYWORDS: Niche,Niche classification, Conscious niche, Psychological niche, Niche exclusion, niche reconstruction, niche dynamics, evolution

***Corresponding authors**

Asima Tripathy

Post Graduate Department of Zoology and Microbiology,
Bhadrak Autonomous College
(Department of Higher Education, Govt. of Odisha),
Bhadrak, Odisha, India, PIN: 756100,
Email ID: asimatripathy09@gmail.com

1. INTRODUCTION

The universe is a complete psycho-physical whole, of which the observable phenomenal universe is but the physical projection, the rest, perhaps the better part of it, being in the psychic realm. An ‘individual’ can be defined as any finite portion of the universe characterized by the fundamental property of ‘existence’ which it shares with the rest of the universe. As per this definition, it can in general be an object, an event or a process objectively, or an idea, a thought or an experience subjectively, because they all have the common character of existence. . Unless otherwise specified, in this article, we will adhere to the standard meaning of ‘the individual’ as a living entity, an organism possessing a body, and we will come to question this meaning only towards the end. The individual subjects are the perceivers and the physical objects are the perceived; both have the property of existence in common, but the subjects are endowed with the distinct property of awareness or consciousness. They are self-aware as well as other-aware, i.e. aware of the property of existence and of consciousness in themselves as well as in other individuals

Any individual, plant or animal that appears on the earth is surrounded by a huge labyrinth of relationships. The genesis and evolution of such labyrinths around every individual is mind-bogglingly complex. The evolution of the universe is itself the evolution of all these interrelationships among the individuals through which they themselves evolve, presumably towards a better future state of existence. The interdependence of living beings on one another can be of host-parasite, prey-predator, producer-consumer type or of symbiotic or commensalist partnership. A continuous struggle for survival marks the ceaseless efforts of every individual to compete fiercely for its needs that are in common with others. Ignorant of the ultimate purpose of individual existence here, the less evolved creatures driven by sensations and instincts spend their entire lives in the competition with the others for fulfilment of the needs for survival. Little do they realize the operations of a cosmic ordering agency that ever operates ubiquitously to convert all competition to co-operation in the long run.

A niche is a specific domain of interaction of an individual necessary for its survival. It contains specific ingredients, which the organism utilizes for its survival, comfort and joy. Continuous interaction may deplete the available ingredients, the quality and the quantity of the available ingredients in a niche and also of the utility value for the organism. In such situations a change of the niche or of the organism or of both is necessitated leading to adaptive behavior on the part of the organism.

2. NICHE CLASSIFICATION

Several distinct niches for the individual as well as the species can be identified which are briefly defined and explained below. We begin with the psychological niche of the individual as the most basic niche of all which determines its genetic, physiological, ecological, organizational, social and cultural niches in that order by manifesting in more and more grosser and broader realms of operation of the individual. The *fundamental niche* of a species includes the total range of environmental conditions that are suitable for its existence, survival and perpetuation without competition. But, in reality, competition (either inter-specific or intra-specific) is unavoidable and as a result the organism is forced to occupy a niche that is narrower than the fundamental niche called *realized niche*. Although convexity has been generally assumed for the niches, there have been studies indicating that the realized niche may under certain reasonable assumptions be of larger dimensions than the fundamental niche. Competition thus has a positive role to play in evolution as it expands the realized niche dimensions.

The functional part of the *trophic niche* is the *functional niche* of a species and refers to its place in the food chain and is a relevant concept for the ecosystem. But, it must be borne in mind that those in lower trophic levels form the functional niche of a species while it itself is the trophic niche of those in higher trophic levels.

2.1. Psychological Niche: It is primarily the psyche characterized by its inherent core character and subsidiary characters that guarantee the fulfillment of its urges for survival, freedom and joy. It determines the genetic make-up of the organism and places the individual in a surrounding according to the urges in the psyche. As a result, it also contains a labyrinth of relations of the organism with the rest of the world. Only in humans it is highly structured and most expanded and has great deal of ramifications unlike in lower animals where it is limited and has only relations and images concerning its habitat i.e. food, nest, mate, offspring and territory. Psychological niche for different individuals are differently constituted. But they serve the same purpose of granting balance, comfort and joy to the individual by the fulfillment of the urges that are inherent in it. In particular, the *emotional niche* is the emotional part of the psychological niche and is the most powerful determinant of the individual's state of life, comfort, stability, security, peace and joy.

Similarly, we can define the *intellectual niche* as another aspect of the psychological niche as the intellectual domain in which one specializes and finds oneself comfortable intellectually by means of interaction with similar others. As an area of its own psyche, it pertains to rationality, analysis, justice, ethics and morality etc. The interaction or contribution could be in the form of deliberation, composition, authorship or guidance and supervision. Another dimension of the

humans is their religious and spiritual aspiration which places them in a distinct spiritual niche of their choice. Taking religion as a subset of the spiritual aspirations in man, we can define the *spiritual niche* in a broader sense. The intellectual niche and the spiritual niche are mainly applicable to humans in the advanced stages of evolution.

2.2 Genetic Niche: In our earlier works, we have taken the individual as primarily a psychic entity and as such, its genetic make-up is its genetic niche in which it is placed and which distinguishes it from others. This niche is carved out of the morphic field in accordance with its predominant urges that make up its core^[6,9]. It is the root of the physiological niche or the body in which the individual seeks a comfortable residence. No two individuals have the same genetic make-up. Each individual has its own DNA that is its genetic niche. Alteration in the genetic niche by niche construction is a continuous process through the experiences undergone in the psychological niche of an organism. This is the fundamental principle of meta-evolution.

2.3 Cell Niche : Each cell has a life of its own and has an environment of its own and in this sense the niche concept can be applied to every living cell. It has proved specifically useful in the study of the interactive dynamics of adult stem cells and their niches. The highly specialized cellular microenvironment for the *in vivo* healthy operation of (adult) stem cells is called stem cell niche^[18]. This takes us beyond niche concept for organisms and species to that for cells, which are nothing less than organisms, if not conscious individuals themselves.

2.4 Physiological Niche: The physiological niche is confined to the body and the ingredients necessary for its upkeep in a healthy functioning condition accompanied with an inner sense of wellbeing. If this is threatened, there is fear of losing one's physiological existence and the organism has to resort to struggle for getting back that state of individual wellbeing. The threats are mainly from invading disease-causing organisms and from natural calamities and Prey-Predator Relationships that threaten individual existence. The concept of physiological niche here is the bodily encasement of the individual and as such includes all biological processes inherent in the living organism and hence goes beyond the confusing presentation in the literature so far.

2.5 Ecological Niche: The environmental conditions necessary for a species to sustain in its physical habitat obtaining the necessary energy and nutrients avoiding predators is called the Ecological niche. The habitat for a species with its resources which are to be shared in common with other species forms the ecological niche^[20]. When there is threat of resource depletion there can ensue gory fights among species whereas as long as the resources are in abundance there can be sharing without much fighting. The *Trophic niche* or *dietary niche* and the *reproductive niche* are the most essential subsets of the ecological niche to ensure survival and perpetuation respectively.

2.6 Organizational Niche: An organizational niche is an environment of inter-connected organisms to which an individual belongs because of having specific common interests. An organization is a purposeful coming together of a group of individuals to ensure the achievement of specific common goals. A group is a temporary coming together of individuals to face a common problem. An organization is a more enduring association of individuals which is formed to have a more permanent role in ensuring the survival of the individuals. In general, organizational behavior emerges out of inter-specific or intra-specific competition for definite niches. Often individual organismic interests are required to be sacrificed in order to continue in an organizational niche to ensure survival at the cost of individual comfort. Family or clan or an office is an example of an organizational niche. A family is the smallest organizational niche^[21].

2.7 Social Niche: The social niche consists of the society to which an individual belongs. A society is a multi-dimensional organization that ensures survival and growth of the group of organisms forming it. The society consists of many organizational units which are interlinked with one another for the realization of the common goals for which the society stands. Caste, creed, religion etc form components of social niche. The confusion prevailing in the published literature regarding definition of social niche for humans have been highlighted by Saltz et al^[22] But our concept here is more general and includes all society-forming species.

2.8 Cultural Niche: Cultural niche of an organism consists of the practices in a society or group that it is accustomed to by repeated observance of the same in personal and social conduct. In course of time, it develops its own sets of values, morals and ethics with the ideas of good and bad, right and wrong, acceptable and unacceptable, virtue and vices etc. gets ingrained via gene- culture co evolution. The comfort zone of the cultural niche thus becomes the set of ideas and practices that an individual subscribes to. Through generations of such cultural practice and dogmatism and orthodoxy and may result, leading to stagnation. Interaction between cultures leads to dynamic evolution and reformation of both. For example, the intellectual niche of a poet is different from that of a scientist in their structure, since their vision and methods are different but, they serve the same purpose of providing the individual with a field for investigation and appreciation of nature. Our definition of cultural niche is broader than that of Derex and Boyd²³.

2.9 Conscious Niche: For every organism the niche has both conscious and unconscious components. The totality of living organisms in the niche that the occupant interacts with forms its conscious niche while the rest of its niche made up of nonliving components form the unconscious niche. An element of the conscious niche is a living organism which can have a decisive or instinctive response in contradiction to an element of the unconscious niche whose response is

governed by purely physical forces such as gravitation, friction and electro-magnetic forces. There is an element of unpredictability in the response of a living organism by virtue of its free will that it utilizes for ensuring its own survival and perpetuation.

3. IMPORTANCE OF THE PSYCHOLOGICAL NICHE

The psychological niche is the most basic one that determines the genesis and evolution of the organism. Its moment to moment actions, reactions and interactions are also determined by its motives, urges and characters as also its weaknesses and strengths that are there in the psychological niche.

There is a fundamental difference in the interaction of an organism with its biotic and abiotic niches. The abiotic factors lack the vital and psychological components, while the biotic factors can respond through their vital and psychological apparatus. Thus, a living organism or conscious individual as part of the niche of another will have a drastically different response to exploitation as a resource for the occupant compared to abiotic factors. Ignorant of the utility and of the consequences of exploitation of such conscious beings, the occupant tends to overexploit and thereby cause severe damage and may suffer partial or complete niche loss depending on the conscious response of the later.

3.1. Resistance To Change Due To Insecurity: In lower animals, the struggle is against negative factors that threaten to disrupt its physiological, ecological, or biological niche, is due only to a fear of losing life. In higher animals such as mammals which form groups and societies to ensure collective survival, any threat to the collective psychological niche becomes the adaptative stress for the species. For the individual, a sense of fear grips the organism due to insecurity in the psychological niche, though it may not be life-threatening. In particular, the stress of (a) losing a possession, (b) continuing with an acquired possession and (c) acquiring a possession in future as part of its niche are what determine its struggle and adaptation in its psychological niche.

3.2 Rupture Of Psychological Niche: One of the most fundamental ingredients in the psychological niche of a human being is its sense of mine-ness towards all things and beings through which its urges for survival, freedom and joy are ensured. The psychological niche, like all other niches, is an ever-changing dynamic one. It is invisible, but its condition of rupture when it loses or stands to lose a portion to which it was attached through mine-ness can be perceived through the visible signs on the face, postures, gestures, activities and attitudes that reflect the psychological state of the individual. All individual suffering, often leading to suicides even, can be traced to such rupture of psychological niche of the individual.

3.2.1 The Three Psychological Attitudes

The attitude of an organism towards things and beings in general, with which it interacts, are of three kinds: Attraction, Repulsion and Neutrality². The need-fulfilling ones are attractive, while the need-inhibiting ones are repulsive and the rest are neutral. There is a continuous shifting of the attitudes as the needs change their nature *i.e.* quality(properties), quantity (amount of quantifiable properties) and intensity (strength of non-quantifiable properties) with time and circumstances. The structure and function of the various niches play important roles in the life of an organism. In general, one individual's niche has a different structure from that of others, although its function may be the same for all.

4. NICHE PROCESSES AND DYNAMICS

Niches undergo many processes in the course of their time evolution in conjunction with the individuals or species which have various modes of interaction with them and among themselves too. In equilibrium, there is no change. It is a robust state against all small perturbations, and by the second law of thermodynamics, is a state of maximum entropy or of maximum disorder, so that no further change is possible if it is considered as an isolated system, since any change would increase entropy and hence change the state. However, naturally occurring systems like a niche or its occupants are mutually interacting as well as interacting with rest of the world. Hence, such equilibrium for them is not attainable or maintainable. For them, only steady states are possible. In steady state, the system is in flux and is changing in quality, quantity and intensity, but still constancy of the rates of interactions is maintained. Thus, we can still have a system (individual or species or niche) that is far from equilibrium and yet maintains its parameters at a constant value (e.g. Homeostasis in individuals or population of species). The *niche breadth* or *niche width* of a species or individual is the totality of the resources utilized by it.

Each of the processes can be seen to be valid for individual niches as well as for species niches.

(a) Niche Overlap : When the requirements are similar along the niche dimensions, niches overlap occurs. And when fundamental niche of one species completely overlaps that of the other, then fierce competition ensues and by the competitive exclusion principle the weaker one gets eliminated. If the niches overlap partially, coexistence is possible in two ways: either one species fully occupies its own fundamental niche, excluding the second species from part of its fundamental niche and leaving it to occupy a smaller realized niche, or both species have restricted realized niches, each utilizing a smaller range of particular niche dimension than they would in the absence of other species. Thus it brings ecological segregation.

(b) Niche Segregation: The major advantage which organisms gain by occupying different niches is the escape from continuous intense competition. It provides suitable substratum and microclimate to species for its survival. Niche segregation avoids confusion of activities between organisms in community which permits more orderly and efficient life cycle on part of each species. Separation into different niches also permits the occupancy of the same area by a large number of species, since they will then better divide the available resources among themselves. This also helps the species in avoiding the conflict with its neighbors and leading a life that is orderly, productive and quite efficient. It is also called *niche separation*.

(c) Niche Saturation: Niches cannot be infinitely similar to each other. Every organism has a separate niche from the other one. The numbers of resources that are available in gross form are limited but in an environment there are infinite resources in micro form through not visible but availed by the organism in every smallest span of its life. However, biotic saturation does not imply that the number of ecological niches is fixed and that all possible niches are occupied, it is only in the context of a species in a particular time period. Even if the niche is saturated in terms of ecology for the existing species still there is free space to be occupied for some other organism that can exist by utilizing the existing unutilized resources. If deeply thought then it is confusing to find whether the organism is the product of the existing niche or the existing niche is the product of upcoming organism? Ecological space is divided into an infinite number of subtly different niches though not specified or defined. It is likely that there are more niches than the currently available number of species. Each species has several mutually exclusive possibilities of future adaptive evolution arising from the trade-offs and all niche changes require a corresponding niche change in other species.

(d) Niche Exclusion: The competitive exclusion principle states that two species that use the same resource in the same way in the same space and time cannot coexist and must diverge from each other. More explicitly, in its generalized form as Volterra-Gause principle, it states that “under constant conditions, no two species utilizing, and limited by, a single resource can coexist in a limited system: The niche of a species consists of its role in the ecosystem (herbivore, carnivore, producer etc), its tolerance limits (e.g. soil pH, humidity) and requirements for shelter, nesting sites etc, all varying through time. In other words, complete or whole niche competitors cannot coexist^[25]. One species will often exhibit an edge over the other in resource utilization. The superior competitor will make more efficient use of the limited resource. Ultimately the inferior competitor will be excluded from the area and replaced by the superior competitor. Thus one of the two competitors will always overcome the other leading to either the extinction of the less evolved or an evolutionary

or behavior shift towards a different ecological niche. Consequently *niche shift* is said to occur in such cases.

The individuals or species have their definite niche and even when niche sharing is there, at a finer level the niche is actually divided among all the stake-holders into as many parts. As long as this complete segregation of the niche is not achieved, there is competition among the parties. Whatever be the niche, the sharing is seen on the surface only, while actually clear segregation of the boundaries of the niches of each of the share-holders is the precondition for peaceful coexistence and stability of the sharing individuals or species. Occasional trespassing or misappropriating of another's niche does lead to gory fights among animals.

Other niche processes that can be defined in context of various inter-individual, inter-specific, intra-specific interactions and other natural processes include:

(e) Niche Reduction: In any kind of niche sharing niche reduction occurs for the parties involved but niche loss is a permanent affair where there is niche gain by the other party by niche invasion or encroachment. This can also be called *niche shrinkage*. **(f) Niche invasion:** Complete and permanent forcible occupation of the niche by subjugation and even removal of the weaker occupant by a mighty new comer. **(g) Niche encroachment:** Partial but permanent occupation of another's niche.

(h) Niche infringement: Partial but temporary occupation of another's niche. **(i) Niche incursion:** A very localized but permanent entry into the niche of relatively more powerful one by a less powerful one which the former is likely to ignore as of being of little consequence. **(j) Niche loss:** There may be partial or complete niche loss due to sharing. By the exclusion principle, the less capable of the competing species for a particular niche will be completely driven out and hence will suffer complete niche loss. **(k) Niche gain:** The more capable of the competing species acquires total possession of the niche for which the competition was there and thus there is niche gain of that portion which was earlier shared by the less capable one. Such total niche gain is also called *niche succession*.

(l) Niche Imbalance: Niches are dynamic in character. Apart from the biotic factors, the niche is subject to many natural processes such as environmental changes, earthquakes, landslides, meteor showers, floods, famines and so on. These can bring about serious systemic imbalance in the configuration and constitution of the niche and affect species population and composition on a large scale and may even lead to adaptive divergence of the species. Darwin saw ecologically mediated adaptive divergence as the mechanism of species formation, although without an appreciation of the genetic complexities involved^[26]. Simpson viewed the process of speciation in explicitly adaptive and ecological terms, as did Dobzhansky and Clause in case of plant speciation. It leads to the niche processes briefly enumerated in (e) to (k) in the above paragraph.

(m) Niche Construction: An organism may influence the niche by virtue of its distinctive traits which go to shape up its modes of interaction with the biotic and abiotic as well as social factors. It is called niche construction and is a very common behavior of organisms^[22]. It provides insight into evolutionary genetics and the genetic variations.

(n) Niche Degradation: The niche is always a sum of finite useful resources for an organism inhabiting it and therefore in the absence of natural recycling processes, the useful resources will get depleted. Thus the useful components get diminished and the useless and harmful components tend to grow in time. This is habitat degradation or niche degradation and effects niche shift and affects niche segregation. Modern day environmental Pollution is a case of niche degradation due to indiscriminate over-utilization of resources without caring for biodiversity or ecological niche. Such artificial niche degradation is more rapid and disastrous compared to natural niche degradation, since there is not sufficient time for the inhabitants to adapt so fast to the altered ecology, and this is the reason for many of the species that are nearing extinction now due to indiscriminate human activities.

(o) Niche Reconstruction: Once there is niche imbalance or niche degradation the individual or species is no longer able to thrive and consequently undertakes reconstruction of the niche as per its requirements. This is niche reconstruction and it applies to all the niches.

7. CONSCIOUS NICHE PROCESSES

If an individual is surrounded by the psychological, physiological, sociological and ecological niche we must ask ourselves as to what it actually is. Biologically speaking the organism is placed in its physiological niche and as such is identified as the physical body itself and is studied as such. Similarly psychologically also the organism is identified with its psyche and studied as such. In the social context it is placed in the society of other individuals with whom it interacts. In the ecological niche it is in interaction with biotic and abiotic factors. In these last two cases it is not identified with its niche and is studied as a participant in the interactions. But in the first two cases we tend to identify the individual with the niche themselves. Is it really true that the individual is the physical body or the psychological counterpart? Or is it something beneath and beyond the psychological niche.

The niche are not created by the individual though by its existence in a particular niche it can and does modify or alter the niche to a limited extend as much as is required for the fulfillment of its urges. For example in case of organisms showing group behavior the social niche is already in place, when the organism is borne. It learns to adapt to it or alter it in a limited manner depending on its requirements. The same is true of the broader ecological niche as well in context of any organism

placed therein. The possibility of adaptation or alteration of the niche by an organism goes to prove that it is not totally identified with the niche but is different from that. Similarly in the case of the physiological and psychological niche an individual may have the ability to alter them to suit its requirements. In fact these adaptations and alterations are what constitute the chief vehicles of evolution of the organism. We wish to take up the issue of the definition of the individual and its dynamics in niche in future work.

Every individual not only has a definite niche for itself but also is itself the niche of many others serving their needs for survival and perpetuation in different capacities. It brings up the question if all niches are to be granted the status of being conscious whether life, as we so far know it, is explicitly manifest in them or not. The human being is the niche for many micro-organisms and is a conscious organism itself. In this light, the individual as the occupant and niche as its habitat can both be treated as conscious interacting components, which opens up huge possibilities for future exploration. Each of the niche processes can then be regarded as conscious processes with active involvement of the niche itself and not just as an inanimate and abiotic factor being chiseled by the conscious occupant. The occupant and the niche have a mutual fulfilment and mutual evolution through niche processes and niche dynamics.

8. CONCLUSION:

Species spatial distributions as well as their abundances are attributed to the breadth of their niches. A species occurs in a place where its requirements are fulfilled and that is called the niche of the organism. The species abundances can be explained by the breadth of species niches. Ecological niches are not stable. The species and their niche have an oscillatory dynamics in their parameters e.g. species population and prey density and constitution of abiotic factors. The species have some dispersal abilities and are thus able to track spatio-temporally changing habitat availability and deal with it by migration rather than adapting to the changed conditions of the original habitat by mutation process. They thus prefer to change the habitat rather than the habit.

Study of niche by granting consciousness to the niches is a great challenge for future biology which has segregated the universe into living and non-living components. While we have as yet very little understanding of individual consciousness, much less of collective conscious dynamics of groups and species and of the whole living world, to study the rest of the so called non-living world as conscious is certainly too far-fetched. But considering the fact of the abundance of individuals and species as biotic niches of other individuals and species, it seems that ultimately the adoption of a holistic organismic approach to the entire universe as a single conscious wholeness of being may be just around the corner.

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