Concepts of Habitat and Niches

Tadorna tadorna (Brhamni duck).
— Monogamous bird.

An organism response to a variety of environmental factors, and only when all of them are within the range of tolerance can it inhabit a location. The actual location or place where an organism lives is called the habitat.

As habitat describes a locations it can be defined at many levels.

The idea of habitat & niche are closely related, the word niche was first used in ecology. Joshef Grinnell who defined it as the ultimate distributional unit within which a sps. is restrained by the limitations of its physical strt. & its physiology. later on it was realised that what Grinnell had defined was a sps's habitat.

In 1927 Charles Elton an English animal ecologist considered the niche as the basic role of an organism in the community. ie. what it

does its relationship food & enemies. In other words he defined the niche as the occupation of a spp.

The current form of niche, as suggested by G. E. Hutinson 1958 includes all the physical & biological variations that affects the organism's well being

However the niche does not fall along a single axis or environmental factor.

All environmental factors to which an organisms responds are part of it.

A multidimensional niche can be visualise as a 3-dimensional one. Let us consider 3-niche related variables for a hypothetical organisms

Temp. Humidity & food size. If the organism can live only within a certain range of temp., temp. is one dimension of its niche

Suppose that the organism can survive & reproduce only within a certain range of humidity now we have 2-dimensional niche. If the same organism have eat only a certain range of food size; food size is plotted

on a third axis enclosing a new space we get a volume, a 3-dimensional niche. 2-dimensional niche of a bird, blue-grey-gnat catcher is open woods & bushy edges where 2 variables, foraging hides & size of insect prey defining it.

Organisms with a wide range of tolerances occupies a large niche, such organisms are called generalists. Organisms with a narrow range of tolerances occupies a smaller niche and generally called specialists.

Habitat Distruction :—

Habitat alteration leading to its distruction is one of the most imp. causes of sps. extinction.

Cutting & clearing a forest draining & filling a wet land converting a grass land to crp land, constructing highways & industrial complexes & spreading cities greatly reduced available habitat for most sps. When a habitat disappears its unique plant & animal life also disappear.

Because of the rapidity of habitat distruction, no evolutionary time exist for a sps. to adapt

to changed conditions.

Forced to leave, dispossessed animals usually find the remaining habitats filled & faced competition from others of their own kind or from diff. sps. Restricted to marginal habitats, animals may persist for a while & non-reproducing members of a population or succumb to gradation or starvation. As the habitat becomes more & more fragmented, the affected animal populations are fragmented into small isolated populations out of contact others with the same sps. As a result isolated populations have less genetic variations making them less adaptable to environmental change.

The survival of local popul^{n} often depends heavily on immigration of new individuals. As distance bet^{n} local populations increases & the size of local populations declines immigration becomes impossible & when the local popul^{n} falls below some min. level it may become extinct simply through random fluctuations in the reproductive success. Much the same situation exist with plants.

Concept of limiting factor : —

The success of an organism, population or community depends on a complex of condition, any condition that approaches or exceeds the limit of tolerance for the organisms or group in question may be said to be a limiting factor. Environmental relation are indeed complex, so it is fortunate that not all factors are of equal importance for a given situation. As for example O_2 is a physiological necessity for most animals but it becomes a limiting factor only in environments where it is in short supply relative to demand like in a stream receiving sewage if fish are dying, O_2 content in the water would be a limiting factor between it easily gets depleted by decomposition of organic materials being brought by the sewage into the stream on the other hand if small mammals are dying in a field, O_2 will never be a limiting factor as it is constant and abundant in terms of need. Thus, O_2 content be a limiting to air-breathing animals living above the ground.

By combining the idea of the minimum and the concept of limits of tolerance the concept of limiting factors can be explained as follows : —

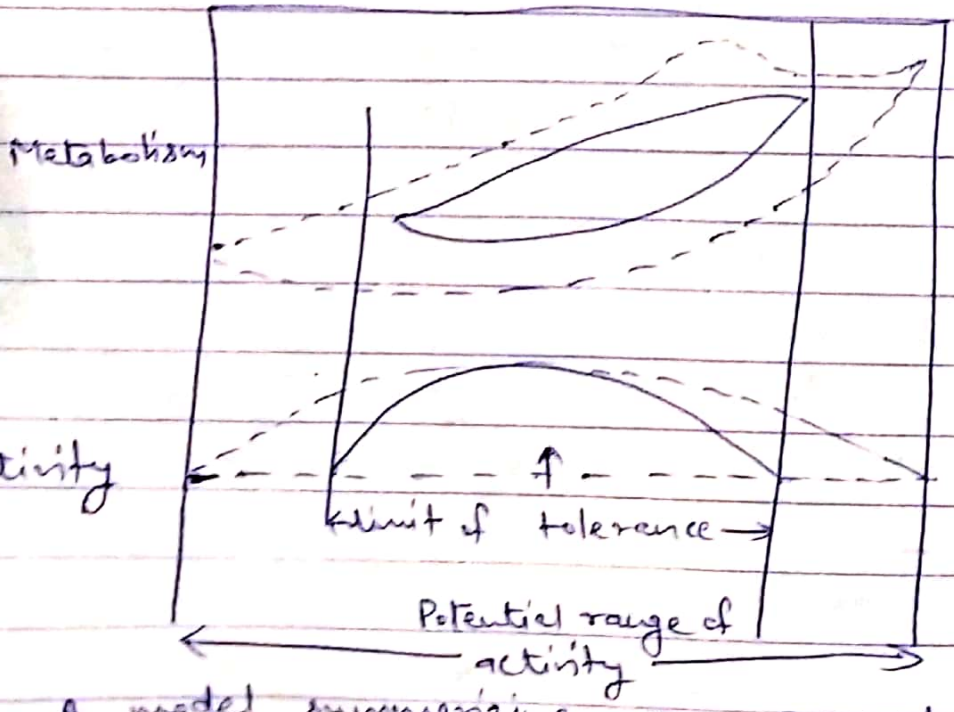
Organisms are controlled in nature by :-

(a) the quantity and variability of materials for which there is a minimum requirements and physical factors which are critical.

(b) the limits of tolerance of the organisms themselves to these and other components of the environment.

If an organism has wide limits of tolerance for a factor which is relatively constant and in moderate quantity in the environment that factor is not likely to be limiting conversely, if an organism is known to have definite limits of tolerance for a factor which also is variable in the environment then that factor may be limiting.

The first and primary attention should be given to factors that are operationally significant to the organism at sometime during its life-cycle.



A model summarizing the general principles of limiting factors.

This diag. brings out the important point that the actual range of tolerance in nature (as shown by the solid lines in the fig.) is almost always narrower than the potential range of activity (dotted lines in the figure).

This can be noted by short term behavioral response in the lab. usually acessory factors or the factor interaction and the metabolic cost of physiological regulation at extreme condition reduces the limits of tolerance at both upper and lower limits. As shown in this figure both the horizontal dimension that is scope and the vertical dimension that is range of metabolic activity may be reduced by these interaction. Also the optimum may be shifted, in this case to the left, thus the limits of tolerance of fish to the mual pollution cannot be determined simply by noting survival in a tank. If a fish has to devote all its metabolic energy to physiological adaptation. It will have insufficient energy for getting food and the reproduction activities required for survival in nature. Adaptation becomes increasingly costly, energy wise as extreme condition are approached. Anything that reduces this cost free energy that can be used for growth and reproduction or for increased activity of other kinds.