Study of species diversity of a community by quadrat sampling method and calculation of Shannon-Weiner diversity index for the same community.

ZOOLOGY (H) : SEMESTER I

ZOOACOR02P – UNIT 2

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Introduction: Community is an assemblage of species population in which the population is represented by the individual of a species. A central aim of community ecology is to understand how communities are organized by identifying, describing, and explaining general patterns that underlie the structure of communities. "Biological diversity" [biodiversity] means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems. Species diversity is the most commonly used representation of ecological diversity, refers to biodiversity at the most basic level and is the 'variety and abundance of different types of individuals of a species in a given area'. According to Biological Species Concepts (BSC), species is a basic unit of classification and is defined as a group of similar organisms that interbreed with one another and produce offspring's and share a common lineage. It includes all the species on Earth, ranging from plants such as bacteria, viruses, fungi, algae, bryophytes, pteridophytes, gymnosperms, angiosperms and all the species of animals including unicellular protozoans to mammals. Species diversity data is frequently described by one or more patterns of distribution (Piclou, 1975) and calculated by two types of diversity indices such as Shannon-Weiner indices. Shannon Index is independently derived by Shannon and Wiener from the application of information theory is known as the Sharmon index of diversity. It is sometimes incorrectly referred to as the Shannon – weaver index (Krebs, 1985).

Assumptions and Equation of Shannon Weiner Index : The index provide an alternative approach to the measurement of diversity. These type of indices are called heterogeneity indices (Peet 1974) as they take both species richness and evenness into consideration.

The index assumes that:

(a) All species are represented in the sample, and

(b) Individuals are randomly sampled from an 'indefinitely large' population (Pielou, 1975).

It is calculated from the equation:

$H' = -\Sigma\, pi \ln pi$

Where pi is the proportion of individuals found in the ith species. It is estimated as (ni/N). N is total number of individuals in S species. The value of H' is related to species richness but is also influenced by the underlying species abundance distribution. May (1975) has shown that if the underlying distribution is log normal, 10 species will be required to give a value of $H' < 5.0$.

Interpretation of H: The value of Shannon index usually varies between 1.5 and 3.5 and rarely exceeds 4.5.

Requirements:

1. Quadrat ($1cm^2$ in measurements)
2. Worksheet
3. Pen and pencil
4. Calculator

Procedure: Present study is based exclusively on a hypothetical community chart based on quadrat sampling at college campus. Ten (10) quadrats of $1cm^2$ of size are marked for total counting. Individuals of each species in each quadrat are counted. The observed data are recorded in table-I and data calculated from table-I is reported on table-II. Then the Shannon Weiner index is calculated by the calculation of values pi In pi given at Table II.

Observation :Table-I : Observed Specimens present in quadrat sampling

Specimen	Common Name	Classification upto Classs	Order	Description	No. of Individuals(n)
Specimen1	House Cricket	Kingdom: Animalia Phylum: Arthropda Subphylum: Mabndibulata Class: Insecta	Orthoptera	Cyllindricalbrownish body with thread like antenna and tactile cerci on abdomen	6
Specimen 2	Green Grasshopper		Orthoptera	Overall green wings with patches, brown eyes and pale yellow strip on back	5
Specimen3	Common Mormone		Lepidoptera	Dark black butterflies; male with white spots on forewings and female with red crescent spot on hindwings.	1
Specimen 4	Common Crow		Lepidoptera	glossy-black with rows of white spots on the margins of its wings	3
Specimen 5	Green jewel Beetle		Coleoptera	glossy iridescent in colours with hard elytra	12

Total no. of Individuals (N) : 27

Calculation:

Table-II : Interpretation of proportion of individuals and true density: given in class

Calculation of Shannon index (H): given in class

Conclusion and Interpretation of value H: Certain regions support a more diverse populations than others. Regions that are rich in nutrients and have well balanced climatic factors, such as moderate temperature, proper light and adequate rainfall, show high degree of diversity in their life forms. These species diversity could be measured using various mathematical models such as information-statistic indices. Information-statistic indices such as Shannon-Weiner index can take into account rare species in a community. These indices are based on the rationale that diversity in a natural system can be measured in a way that is similar to the way information contained in a code or message is measured. By analogy, if we know how to calculate the uncertainty of the next letter in a coded message, then we can use the same technique to calculate the uncertainty of the next species to be found in a community.
From the table calculated on basis of quadrat sampling studies the value of H is 1.37 or 1.4 thus the value lies near to common species diversity index and the specimens collected are not rare but common.

Importance : Biodiversity is the most precious gift of nature the mankind is blessed with. The uniqueness of our planet Earth is due to the presence of life manifested through the diversity in flora and fauna. As all the organisms in an ecosystem are interlinked and interdependent, the value of biodiversity in the life of all the organisms including humans is enormous. Besides its ecological and environmental value, biodiversity has significant socio-economic values as well.

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