The Scientific Temper
VOL-X, NO.1&2; JANUARY-JULY, 2019
ISSN 0976 8653, E ISSN 2231 6396
A Web of Science Journal
e-mail:letmepublish@rediffmail.com
Doc ID : https://connectjournals.com/03960.2019.10.37

ECOLOGICAL REALISM AND DIVERSITY STABILITY OF ZOOPLANKTONS IN DIFFERENT CLIMATIC CONDITIONS

CHANDRA BHUSHAN TIWARY
Guest Teacher, Vidya Bhawan Mahila Mahavidyalay, Siwan (Bihar)
Email ID: tiwary_cb@rediffmail.com

ABSTRACT

The impact of ecological realism upon relation between species richness and community variables in three experimental setting increasingly exposed to external forces. The results showed species stability in natural, while moderate deviation in laboratory and minimum in temporary resources. The result also showed that species diversity is less due to both natural and environmental forcing.

Key Words: Ecological realism, Diversity stability, Abundance, Microcosms, Community variables.

INTRODUCTION

The human activities promoting environmental drivers and establishes relation between species and community. The specific ranges of environmental conditions for species stability appear to be highly overlapping (Ives and Carpenter, 2007), while, Romanuk and Kolasa (2002) observed temporal variation as inverse dynamics of species richness and community diversity in lab condition with constant external forces. This disparity in researches underestimates the underlying proximity in diversity and temporal position in community with different environmental circumstances.

Experimental site is also important to conducting an experiment in different artificial and natural conditions. The impact of species richness manipulations on changes in community biomass is important with different environmental context (Srivastava and Velland, 2005). The stabilizing mechanisms may being to shift from those related with biotic interactions such as competition in laboratory (Tilman, 1999) to abiotic forcing in natural conditions. The temporary ponds have least changes in community relative to natural ponds.

There ecological realism was tested with stability breakage in species richness to different community levels, and, certain mechanisms are available to establish relation between species diversity and stability mechanisms (Ives and Carpenter, 2007).This study confirms that over-yielding (Tilman, 1999), statistical averaging (Doak et al., 1998) and struggle response (Tilman, 1999) are desired mechanisms that stabilize temporal difference in community.

METHODS AND MATERIALS

The experimental venue was located at college campus of Vidya Bhawan Mahila Mahavidyalaya, Siwan. The primary venue was in laboratory with complete artificial environment, second established in temporary pond and third in perennial pond on zooplankton community mainly upon existed cladocera and copepod species.

The dilution series were applied with all three zooplankton communities hides particular species loss. The natural and temporary pond water were filtered in a net of 63µm mesh, preserved in 50% ethanol and processed using a dissecting microscope, and, combined in varying proportion to create gradient along species richness. All experiments were conducted from March 2018 to January 2019 with three different replicates to prefer the study The environmental variables were measured for the temporary and natural ponds. Mean species richness and mean abundance was calculated as the mean number of species respectively, in each microcosms or tank over the each sampling periods. The variables in abundance as coefficient of variation (CV; standard deviation/mean), which standardize for difference in abundance (Cottingham et al., 2001).The community variability or CV of summed species determined as;

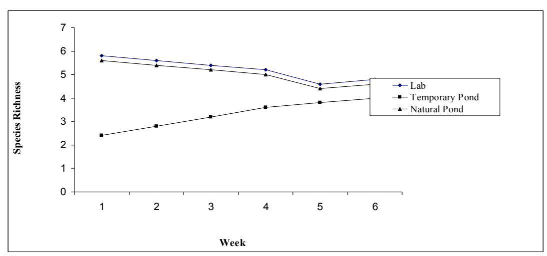
$$CV_{mean} = 1/S\sum_{i=1}^{S} \sigma_i / \mu_i$$

Where CV_{mean} is the mean population variability of all species present in microcosms or experimented ponds, S= number of existed species, σ_i is the standard deviation of population size of species *i* during the course of experimentation, and μ_i is the average size of species *i* during the study.

This method derives unique condition about community variation and also a link to population level (Vogt et al. 2006). The summed variance scaling relationship, and eveness J were calculated as the procedure outlined by Doak et al (1998) and Tilman (1999). Thereafter mean and standard deviation for variables was also calculated for the temporary and natural ponds.

RESULTS AND OBSERVATIONS

The species diversity (S) is very high in natural and laboratory rather than temporary site (mean=5.2 and 3.37; Fig. 1), and, community diversity is also showed peak value in comparison to temporary pond (mean N=257.34, 90.22 and 65.7; Fig. 2). Community and mean population variability declines inversely in the laboratory and temporary site (Figure 3 and 4), however, natural site is stable.



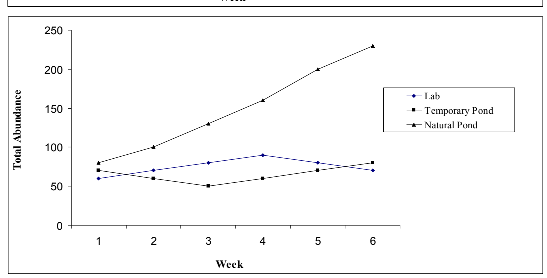
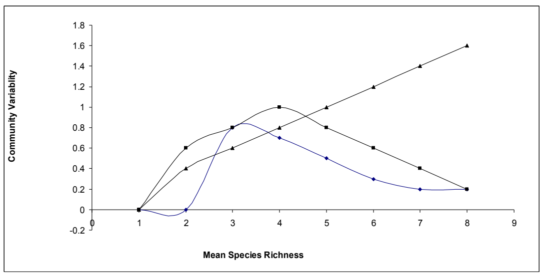


Figure1& 2: Species richness and Abundance in laboratory, temporary and natural pond.

In the temporary pond, species richness showed 16.8% (p=0.036) of the variance in community structure and 17.9% (p=0.025) of the variance in population fluctuations. In the natural pond, species richness not responds on variation in either community or population fluctuations. There was a strong intimacy between different sites and species richness on population and community structure (Figure 4). There was no relationship between species richness and evenness, J' for all experimental settings ($F_{2,76}$=0.721, p=0.489).



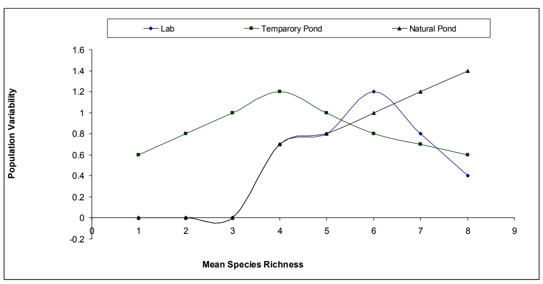


Figure3 and 4: Mean Species richness and Community Variability in different sites.

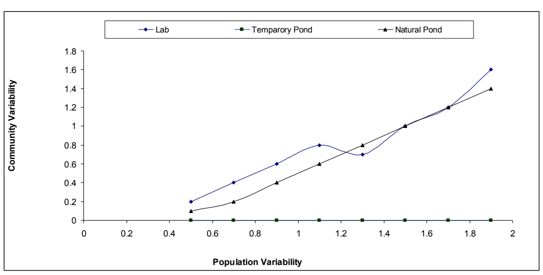


Figure5: Population dynamics and Community structure in laboratory and experimental ponds.

The summed variances declined inversely to species richness in the laboratory but stable in the artificial and natural ponds confirmed biotic pressure only in temporary settings, while less effected in other experimental settings. The summed covariance was higher in the natural setting than other artificial pond without biotic interaction.

Environmental variables: This study revealed that species richness and population variation were separate entity without any proximity to environmental constraints within the temporary pond. The summed abundances and summed variances were in close proximity to climatic gradients with increasing water depth and temperature.

In the natural setting, species richness was least with higher SD of temperature (adjusted R^2=0.09, p=0.06). The community attributes was correlated with water depth and temperature (adjusted R^2=0.147, p=0.068). In contrast, population variability, abundance and variance were unaffected by environmental factors.

DISCUSSIONS

The biodiversity declines have focused species loss to the continued functioning of ecological systems. The study of diversity variation has shown that diverse communities are more stable than others (Cottingham et al 2001). In the natural system, however, the environment may affect both diversity and stability. The laboratory experiment mask the effect of biotic variables and thus provide clue by which community stabilization and population abundance might differ between controlled and more natural ecosystems.

The previous researches about diversity in ecosystem have been focused on exploring the mechanisms that might include positive relationship between diversity and variability of an ecosystem (Vogt et al. 2006). The study about covariance between species pairs were often positively driven by climatic factors competition in natural environment with fluctuations in species abundance.

In the laboratory microcosms with decrease in summed covariance and summed variances as increased species richness drives positive relationship between diversity and variability of aquatic ecosystem. The temporary pond showed an increase in summed variances and summed abundances with species richness also affected by environmental conditions. In the natural pond, temporal variability in community abundances was directly affected by environmental conditions due to increased ecological realism.

The three experiments differed

substantially in physic-chemical conditions, the morphometry and location of the ponds. The colonization and extinction events in the temporary and natural ponds resulted in a less defined diversity gradient but in the laboratory species richness increased due to the increased development of larvae into adults. Initial species composition was relatively similar in all experiments, but in later, the zooplankton population in temporary and natural ponds began to diverge due to colonization and extinction, whereas the species composition in the laboratory remained relatively constant.

The diversity and stability relationship weakens due to decrease of species richness from 35% variance in the laboratory to 17% in the temporary pond to no effect of biotic variability in the natural pond. The gradient in ecological realism increased with greater spatial and temporal variability conditions. The temporal event in the natural pond may not have been long enough to allow strong inter-specific interactions to stabilize community abundances (Cardinale et al. 2007).There is positive diversity and variability relation in the laboratory have resulted from lowered summed variances and co-variances with increasing species richness. The study revealed a direct effect of environmental constraints on species richness only in the natural pond as also noted previously in case of rock pools (Therriault and Kolassa, 2002). There community variability was also directly affected by environmental conditions in natural ecosystems.

The results from early studies suggested that the stabilizing effect of species richness on community abundance is contingent on increased variability of populations (Tilman, 1966). However, recent studies in zooplankton (Steiner et al. 2005) have shown that species richness can stabilize both population and community abundances. This study showed similar patterns for the effect of species richness on temporal variability in mean population abundance stabilized by increasing richness in the laboratory and temporary pond but not in the natural pond. Furthermore, population and community variability were positively correlated in all three experimental sites. These patterns suggest that the stabilizing effect of species richness on community variability may simply be a concept resulting from the stabilizing effect of species richness on populations.

CONCLUSIONS

This study identifies circumstances underlying the diversity-variability relationship can be restricted. The community is more pronounced with great diversity in natural condition, otherwise only species stratification is single factor that would increase prominent to species diversity on population and community level.

REFERENCES

1. Cardinale BJ et al (2007): Impacts of plant diversity on biomass production increase through time because of species complementarity. Proc. Natl Acad. Sci. 104: 18123-18128.
2. Cottingham KL et al (2001): Biodiversity may regulate the temporal variability of ecological systems. Ecol. Lett. 4: 72-85.
3. Doak DF et al (1998): The statistical inevitability of diversity stability relationships in community ecology. Am. Nat. 151: 264-276.
4. Ives AR and Carpenter SR (2007): Stability and diversity of ecosystems. Science 317: 58-62.
5. Romanuk TN and Kolasa J (2002): Environmental variability alters the relationship between species richness and variability of community abundance in aquatic rock pool microcosms. Ecoscience 9: 55-62.
6. Srivastava D and Velland M (2005): Biodiversity-ecosystem function research: is it relevant to conservation. Annu. Rev. Ecol. Evol. Syst. 36: 267-294.
7. Steiner CF et al (2005): Temporal stability of aquatic food webs: partitioning the effects of species diversity, species composition and enrichment. Ecol. Lett. 8: 819-828.
8. Therriault TW and Kolasa J (2002): Desiccation frequency reduces species diversity and predictability of community structure in coastal rock pools. Isr. J. Zool. 47: 477-489.
9. Tilman D (1999): The ecological consequences of changes in biodiversity: a search for general principles. Ecology 80: 1455-1474.
10. Vogt RJ et al (2006): Species richness-variability relationships in multi-trophic aquatic microcosms. Oikos 113: 55-66.

http://www.scientifictemper.com/