



Diel collections indicated increased species richness in seagrass associated epifaunal macroinvertebrates community

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Abstract

Diel patterns of epifaunal macroinvertebrates associated with sea-grass beds are poorly investigated. This pattern indicated misconception in population and community dynamics, diel cycle, and overall functional activities in an ecosystem. A three-day diel sampling period was permanently established in four stations in Eastern Samar, Philippines, patterned of the same sites in an unpublished study by Pacoma, 2016. Collecting samples was done at 7:00-9:00 am and 7:00-9:00 pm, using a transect-quadrat method laid on seagrass beds perpendicular to the coastlines. Results show that there are 60 species identified throughout the collection period, composed of 9 species of echinoderms, 32 species molluscs, 5 species poriferans, 10 species arthropods, 3 species annelids, and; 1 species reptile. Dominated by mollusks *Canarium* sp., *Pinna muricata*, *Nassarius margaritifer* and *Trochus* sp. in all the sampling sites, some commercially important mollusks were also sampled, such as *Gafrarium aequivocum*, *Callista erycina*, and *Fragum* sp. Other notable species such as *Clypeaster* sp., *Holothuria* sp. and *Euapta* sp. were present in both nocturnal and diurnal sampling. Species richness compared to daytime collection of Pacoma, 2016 showed higher richness in the diel sampling. This shows that seagrass-associated epifaunal macroinvertebrate communities are more diverse at nocturnal than diurnal times. Diel diversity demonstrated a distinct community structure which indicates higher richness and abundance. Seagrass beds dispense several ecosystem functions, which makes them a preferred habitat in shallow waters. This suggests that patterns of the dynamics in seagrass beds, diurnal-diel cycle community structures shifts, and activities within this ecosystem are complex; thus, conservation mechanisms should be accorded within this pattern.

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Introduction

Community structures of macroinvertebrates patterned to diel variations are crucial for gaining a coherent understanding of the dynamics in aquatic ecosystems. Information on the diel periodicities of macroinvertebrates would allow us to understand the ecological roles of taxa or groups. It may also provide valuable tools in designing fieldwork studies and strategies (Guareschi *et al.*, 2016). Nighttime is an integral part of the diel cycle. Various macroinvertebrates were recorded to demonstrate nocturnal activities in different aquatic ecosystems, such as feeding or avoiding predation (Elliott, 2000, 2002; Hampton & Duggan, 2003; Florencio *et al.*, 2011). Different lifeforms have shaped their biochemical, physiological, and behavioral processes to survive patterned on tidal, lunar, and diel cycles (Schnytzer *et al.*, 2018).

Usually, field sampling happens during the day, and the theoretical depiction of epifaunal seagrass communities is based on this representation. In the study of Rueda *et al.*, 2008, a total of 118 species were identified of which 88 species were in daytime collections, and 102 species were in nocturnal collections. A total of 16 species composed of gastropods, bivalves and cephalopods were restricted only to the diurnal samples and 30 species were limited only to the nocturnal specimens. This showed that nighttime has a higher abundance compared to daytime.

Epifaunal macroinvertebrates associated with seagrasses exhibited patterns of diel variability (Hughes, 2009). Observed behaviors on diel variations have been linked to increasing nocturnal activity, diurnal net avoidance, nocturnal migration onto adjacent seagrass beds, habitat patchiness and predator avoidance (Greening & Livingston, 1982; Bauer, 1985; Garcia Raso *et al.*, 2006, Florencio *et al.*, 2011).

An unpublished study of Pacoma (2016) in intertidal waters in Eastern Samar, Philippines, showed variations in epifaunal macroinvertebrate community structures associated with seagrasses. A total of 28 species were identified, implying macroinvertebrate communities in intertidal zones as distinct habitats.

This study, however, adhered to daytime collections that may limit knowledge of diel variability (Larkin *et al.*, 2018). Extending to night collections may entail more inclusive community structures and behavioral patterns. Thus, this study aims to describe the epifaunal macroinvertebrates associated with seagrasses: (1) abundance during diurnal and nocturnal periods and; (2) patterns of diurnal and nocturnal community structures.

Community structures reflect the health of the habitat. Environmental monitoring is necessary to analyze the ecological status (Fusari, 2006) providing subsidies for elaborating management and conservation strategies. Even after a large-scale disturbance where seagrass ecosystems are recuperating (Matillano, 2017), community structures of seagrass associated assemblages should be monitored using this outlook.

Materials and methods

Study Sites

This study described the community structure of seagrass-associated epifaunal macroinvertebrates in a month-long diel collection, employing daytime 7:00-9:00am and nighttime 7:00-9:00pm collections. Sampling sites were patterned on Pacoma (2016) study with the exact coordinates in Hernani, Llorente, Balangkayan and; Maydolong, Eastern Samar. The same site collections were used to compare species richness and depict community structure in diurnal collections versus diel collections.

Methods

Using the transect-quadrat method, 50m transect lines with five 1 m² quadrats at 5 m intervals were laid in seagrass beds perpendicular to the coastline. Epifaunal macroinvertebrates sampled specimens were handpicked and grouped per phyla to identify the species richness. Samples were preserved with a 10% formalin-seawater solution for identification purposes and storage.

Results and discussion

A total of 60 species were identified, composed of 9 echinoderms, 32 mollusks, five poriferans, ten

arthropods, three annelids, and one reptile throughout a month-long diel collection. Mollusks *Canarium* sp., *Pinna muricata*, *Nassarius margaritifera*, and *Trochus* sp. were present in all the sampling sites making them the most abundant species. Arthropods present were mostly *Pagurus* sp., *Heteropenaeus* sp., and *Grapsus albolineatus*. Whereas *Clypeaster* sp., *Ophiocoma* and *Archster typicus* were dominant echinoderm species.

Dominated echinoderms

Some species were sampled in selected stations and are not present in other stations. *Protoreaster nodosus*, *Nassarius graphiterus* and *Terebra gemmulata* were only found in Station 1. Meanwhile, *Batillaria* sp., *Pinna muricata*, *Polinices lacteus*, *Tellina radiata*, *Turbo* sp., *Pilumnus* sp., *Rhynchocinetes* sp. and a *Sipunculidae* sp. were only found in Station 2. In addition, *Holothuria scabra*, *Cerastoderma edule* and *Neritina turrata* were only located in Station 3.

Though not abundant compared to other species, some commercially important marine resources were also sampled. Mollusks such as *Gafrarium aequivocum*, *Gafrarium pectinatum*, *Marcia hiantina*, *Scapharca inequivalvis*, *Callista erycina*, *Fragum* sp. and *Tegillarca granosa* were present in sampling sites. Other commercially important species such as *Holothuria* sp., *Echinometa* sp., *Matuta planipes* and *Portunus pelagicus*

Comparing it to the study of Pacoma (2016), there was an increase in species richness when the diel collection was implored. Similarly, mollusks were the highest in both collection methodologies, but notably, a 90% difference was observed among arthropods, echinoderms, and annelids. This shows that more species are active at night compared to the daytime.

Seagrass associated-macroinvertebrates community is a complex ecosystem that could be better described in a diel collection methodology compared to an exclusive daytime collection. Diel variability is related to the functional movements of macroinvertebrates (Greening and Livingston, 1982; Bauer, 1985; Garcia Raso *et al.*, 2006; Rueda *et al.*;

2008), which could be manifested by both daytime and night time collections. If collections are only done in diurnal methods, this could limit a community structure that will not depict diel shift. (Matillano, 2018).

Table 1. Increased number of species collected imploring diel patterns compared to diurnal collections.

Phyla	Diurnal Collection (Pacoma, 2016)	Diel Collections (This study)	% Difference
Echinodermata	5	9	44
Mollusca	13	32	59
Porifera	5	5	No difference
Arthropoda	1	10	90
Annelida	1	3	66
Reptilia	0	1	10
Total	33	60	45

Conclusion

Seagrass-associated epifaunal macroinvertebrate communities exhibited increased species richness employing diel collection compared to a similar unpublished study in selected municipalities in Eastern Samar. A total of 60 species were collected and identified: nine echinoderms, 32 mollusks, five poriferans, ten arthropods, three annelids and one reptile.

Recommendations

Expanded spatio-temporal studies on seagrass-associated epifaunal macroinvertebrate communities are suggested using diel patterns. As diel community structure is more abundant, the effects of lunar phases could also be ascertained in future studies.

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