Leaf litter decomposition in different aquatic habitats

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ABSTRACT

Decomposition rates of leaf litter in different aquatic ecosystems were compared. Fifty grams of dried talisay (*Terminalia catappa* L.) leaves placed in small leaf litter bags were used. These were submerged in a river, an estuary and in the sea at ViSCA, Baybay, Leyte, Philippines.

The highest decomposition rate was recorded in the brackish estuary, with more than 50 percent of the leaf litter processed in a period of 30 days. This might be due to the effects of higher temperature and higher nutrient contents in this site which resulted in higher population densities and activities of the decomposing organisms. Another factor would be the high population density of benthic invertebrates registered in this site.

The decomposition rate in the sea was lowest and reached only less than half of the efficiency of the brackish water environment.

Keywords: *Decomposition, river, estuary, brackish, Philippines*

INTRODUCTION

Terrestrial leaves which fall into streams and rivers form an important component for the aquatic invertebrate community. Leaf fall of the woody riparian vegetation has been recognized as a major pathway of energy input to most stream ecosystem. Studies have shown that leaf litter can make up over 99% of the annual energy budget of a stream (Fisher and Likens, 1973) and form an important food component for the invertebrate community in aquatic ecosystems.

Meanwhile, most of the decomposition studies are conducted in temperate countries. Leaf litter decomposition in aquatic environments in the tropics are largely undocumented.

This study was conducted to document and compare the decomposition rate of talisay (*Terminalia catappa* L.) leaves in different aquatic habitats around ViSCA, Baybay, Leyte.

MATERIALS AND METHODS

Two of the three study sites, namely: riverine and brackish zones were selected along the course of the Calbiga-a river in ViSCA campus, Baybay, Leyte, while the third site was in the marine environment of the same place. Some of the

physico-chemical properties of the three sites are shown in Table 1.

Freshly fallen leaves of talisay (*Terminalia catappa* L.) were collected and air dried to constant weight. Fifty grams of dried leaves were placed whole in fine mesh (5 mm) leaf litter bags (7 x 5 cm). Eighteen of these leaf litter bags were exposed for six months in the three selected sites by placing them in a big nylon bag anchored with hollow blocks to prevent them from being carried downstream. In each site, three bags were harvested at monthly intervals. They were then taken immediately to the laboratory of the Department of Plant Protection, ViSCA for washing to remove soils/sands and debris. The leaves were again air dried and weighed later to get the monthly final weight.

Table 1. Physico-chemical properties of the study sites.

Site	Temp. (°C)	Conductivity µS/cm	Salinity (°/₀₀)	pH
Riverine zone	26	90	0	7.4
Brackish zone	31	4,810	3.1	-
Sea	31	-	28.7	-

RESULTS

Figure 1 shows the decomposition rates of talisay leaves in different aquatic habitats plotted as a function of time. Clear differences in the decomposition rates can be observed. Brackish zone of the Calbiga-a river registered the highest decomposition rate of more than 50% in a period of one month and almost 100% after three months. This was followed by the riverine zone, but only after two months was decomposition rate of more than 50% attained. The marine environment recorded the slowest rate of all the study sites, with decomposition rate still below 50% after two months.

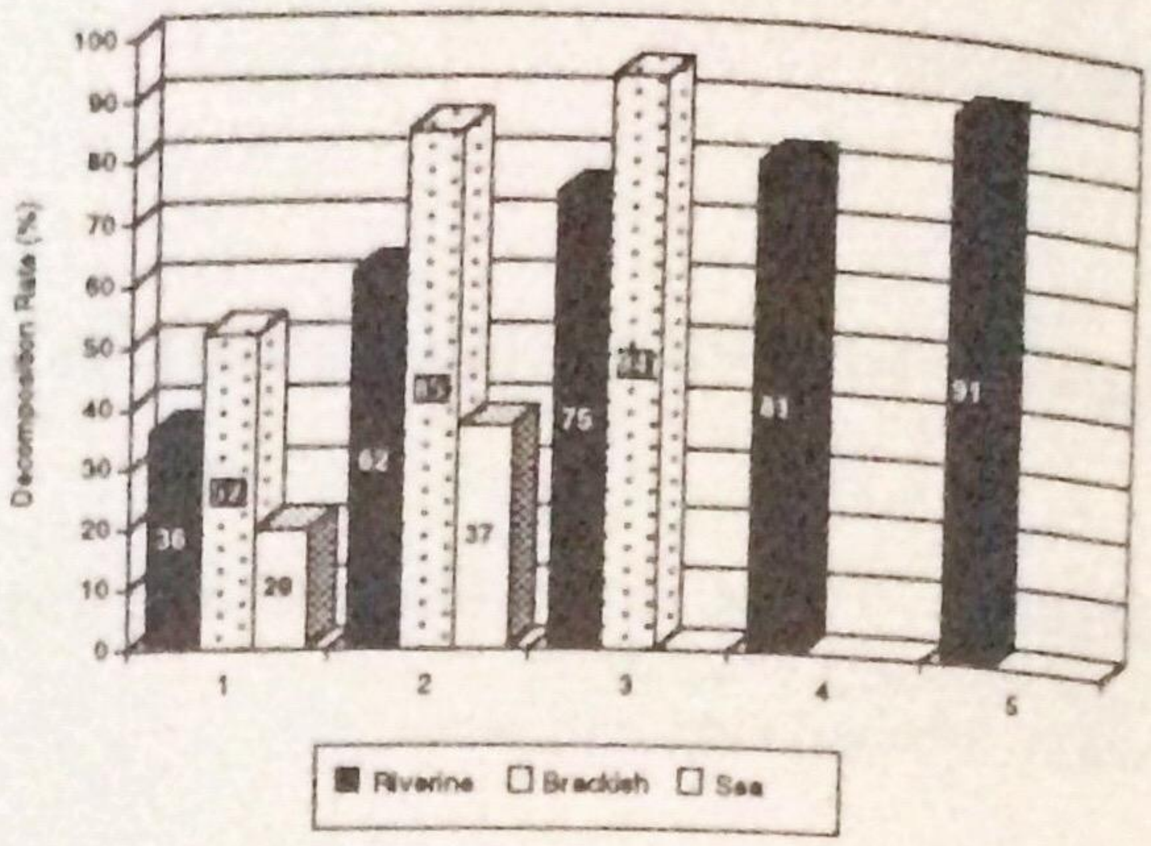


Figure 1. Decomposition rates of leaf litter in different aquatic ecosystems

The missing data after few months of initial exposure were due to the losses of leaf litter bags which were either carried downstream during heavy rain or were taken out from the water and removed by curious passers-by.

DISCUSSION

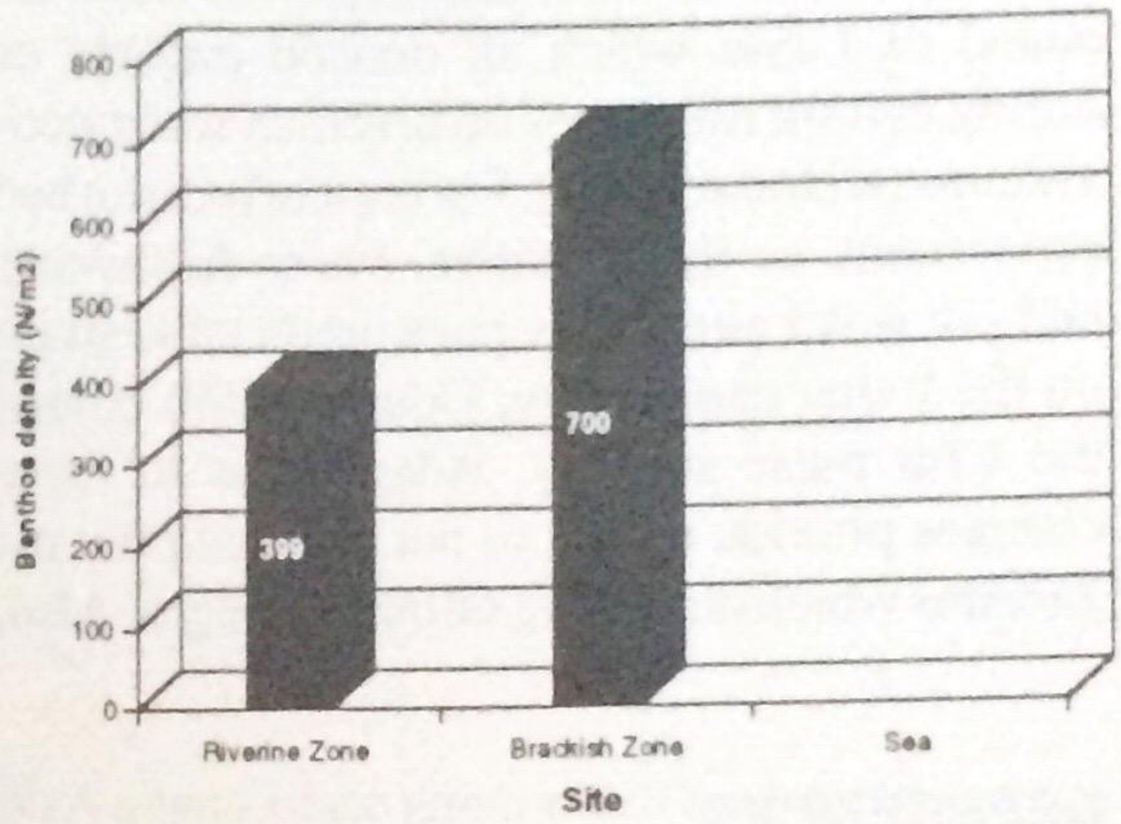
Although the literature concerning the decomposition of leaf litter in running water is extensive (Webster and Benfield, 1986), most of these studies were carried out in temperate countries except for the very few studies conducted in semi-tropical Australia.

The high decomposition rate of all leaf litter recorded in the brackish environment can be attributed to a number of abiotic, biotic and synecological factors:

Abiotic factors: The water temperatures in the brackish environment ranged from (28-31°C) during the investigations compared to the lower temperature in the riverine zone (23-26°C). This high water temperature coupled with high nutrient contents in the brackish zone as a result of the organic wastes and other pollutants from the

college campus as well as the agricultural fields upstream being accumulated in this zone, resulted to the higher population densities and activities of decomposing organisms. High temperature has been cited by Webster and Benfield (1986) and McGeorge et al. (1991) to be an important factor in the decomposition process. They hypothesized that the warm water may have allowed more biological activity. Another factor which may have contributed to the faster decomposition in the brackish zone would be the strong underwater current in this site especially during high tides when mixing of saline and freshwater occurs. This probably had triggered the physical and mechanical disintegration of the leaves.

Biotic and synecological factors: Another factor known to affect litter processing rates is macroinvertebrate (Gessner et al., 1991; McGeorge et al., 1991). They play a key role in processing coarse litter, particularly the shredder functional group (Cummins et al., 1989). The total number of invertebrates is highest in brackish zone than in the riverine zone, dominated by



NOTE: Sea not sampled for invertebrates.

Figure 2. Benthos density in three sites.

Decomposition of talisay leaves (after 3 months) in different aquatic habitats plotted as a function of time.

a gastropod which feeds on almost everything available (Fig. 2). This may have influenced leaf litter processing.

Margraf and Milan (1991) have characterized this zone as being extremely rich in species and about 100 species have been reported from the island of Leyte which all depend entirely or during certain life stages on brackish water ecosystems (Kottelat, 1993). For regularly disturbed ecosystems as the estuaries where freshwater and salt water alternately put a predictable strain on the living community, Odum (1969) coined the term pulse stability. Adaptations to these changes provide access to not adapted prey organisms which die during salinity changes. Also, the nutrient rich brackish environment is the spawning and nursing ground for a number of freshwater and sea fish, and crustacean species which enlarge the food pyramid at the secondary consumers' level. Niche occupation by fish is entirely located at the secondary and tertiary consumer level and primary consumers may depend largely on decomposers, while primary production seems almost neglectable.

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