

Indicators of Diminished Organic Matter Degradation Potential of Polychaete Burrows in Philippine Mariculture Areas

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Sediments from underneath fish cages and in mesocosm tanks were examined to establish indicators of diminished organic matter degradation potential of polychaete burrows from increased mariculture activities in Bolinao-Anda, Pangasinan, Philippines. Results showed that simple sediment characteristics may be used as sediment quality indicators to describe the contribution of burrows to biodegradable processes in sediments with extremely high deposition of organic particles. The indicators of diminished organic matter degradation potential of polychaete burrows are low redox potential (-113 to -150 mV for *F. Spionidae* and *F. Eunicidae*) at the 1 cm surface layer, absence or decreased size of burrow openings, presence of H_2S , disappearance of apparent Redox Potential Discontinuity Layer (aRPD), formation of black sediment, and presence of *Beggiatoa* (sulfide oxidizing bacteria) and gas bubbles.

Key Words: burrows, mariculture, organic matter recycling, polychaetes, sediment quality indicators

INTRODUCTION

In coastal areas, the oxygen-containing layer of the sediment is typically only a few millimeters thick (Revsbech et al. 1980; Revsbech and Jorgensen 1986; Holmer et al. 2005). The infauna extends this oxygenated layer into burrows by means of bioturbation processes such as irrigation, ventilation and mixing of the sediments (Reise 2002). Upon deposition of organic matter (OM), oxygen is consumed first by aerobic respiration, and then bioavailable OM is further remineralized via fermentation and different processes of anaerobic respiration. Once SO_4^{2-} has become the predominant terminal electron acceptor via sulfate reduction, the sediment starts to show the Fe-sulfide black color (Lyle 1983; Hall et al. 1990; Karakassis et al. 1998) and emit the rotten egg smell of H_2S .

Sediments below fish cages are usually anoxic, have a low redox potential (Hargrave et al. 1993), high organic material content (Hall et al. 1990), impoverished or depleted in benthic fauna (Brown et al. 1987; Ye et al. 1991; Holmer and Kristensen 1992; Lu and Wu 1998), and contain mats of the sulfide-oxidizing bacteria *Beggiatoa* (Ross 1989; Hall et al. 1990; Holmer and Kristensen 1992; Karakassis et al. 1998). Hargrave et al. (2008) showed that pH, redox potentials and dissolved sulfides can be used as indica-

tors of the biogeochemical changes related to organic matter enrichment in marine sediments. The indicators of anaerobic sediments are known but changes in organically enriched sediments containing burrows and their qualitative indicators to serve as a monitoring tool for fish farmers has yet to be documented and developed. This study compares sediment cores in an area with and without organic matter deposition from fish farming. It aims to identify indicators of diminished organic matter degradation capacity of the burrows with the influence of mariculture feed input.

MATERIALS AND METHODS

The study was conducted in 2006 and composed of 1) a sediment mesocosm experiment designed to examine induced effects of organic particle inputs; and 2) a comparative observational or field study between milkfish cage and no-cage areas of Bolinao-Anda waters, Pangasinan located at the northwestern Philippines to represent difference of organic matter input.

Sediment Preparation

Sediments for mesocosm cores were collected in March 2006 from a neritic no-cage area using an Ekman grab (4L) and sieved through a 0.3-mm mesh steel sieve to remove