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SYNOPSIS

Studies of the marine and estuarine meiofauna in Sarawak from 1999 till 2005 were focused on taxonomic composition, abundance, species zonation, species density, species diversity and evenness. In terms of species composition, only nematode and harpacticoid copepodstaxa have so far been studied to genera and species level. However most of the study is still limited to western part of Sarawak only. Many of the other meiofaunal taxa are still not elucidated to their genus and species levels yet. Future meiofauna research in Sarawak should focus on the aspects of seasonality, role of meiofauna in benthic processes, the use of meiofauna as a tool for pollution monitoring and the importance of meiofauna as a diet for juvenile fish, prawn and crabs in the aquaculture industry.

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INTRODUCTION

Studies on meiofauna started long time ago before the term meiofauna or meiofauna was known to science (Kowalesky, 1901; Giard, 1904; Cobb, 1914, 1920; Remane, 1933). In 1942, Mare introduced the term meiobenthos in her account of the benthos of muddy substrates of Plymouth, England.

Defining meiofauna for quantitative studies requires the establishment of practical limits relevant to the size and not to the taxonomic classification (Higgins & Thiel, 1988). Nevertheless, in ecological research it is important to know which sizes of groups are covered when numbers and weights were presented (Higgins &

Thiel, 1988). For general ecological studies on abundance and biomass, size groups referred to what was retained on a sieve with a given mesh size during the processing of sediments, are both sufficient and practical (Higgins & Thiel, 1988). Therefore, Thiel (1983) had defined the meiofauna as organisms that can pass through 1 mm mesh size sieve and retained on the 42 mm sieve.

Coull (1988) pointed that the meiofaunal composition is a homogeneous ecological group. It lives in a wide variety of habitats including marine, estuarine and freshwater habitats, and from beach to the deepest depths of the sea. It is distributed in all kinds of sediments from the softest mud to the coarsest shell gravels. It can also be found on moss, macroalgae, rooted vegetation, fronds, sea ice and various animal structures, such as worm tube, echinoderm spines and coral crevices. Some meiofauna are symbionts living commensally with bivalves, in animal tubes and in association with hydrozoan colonies or woodborers.

Coull (1988) also noted that twenty-two of the thirty-three metazoan phyla have at least some of meiobenthic taxa; the Tardigrada, Loricifera, Kinorhyncha, Gnathostomulida and Gastrotricha which are exclusively meiofauna. Some invertebrates, usually larvae of macrofauna are a part of the meiofauna only during their juvenile stages and known as temporary meiofauna, but many taxa have species that are truly meiofauna throughout their life cycle and known as permanent meiofauna. In addition to the five exclusively meiofauna phyla mentioned above, permanent meiofauna include the Mystacocarida and many representatives of Rotifera, Nematoda, Polychaeta, Copepoda, Ostracoda, Turbellaria, Halacaroidea and some specialized members of the Hydrozoa, Nemertina, Entoprocta, Gastropoda, Aplacophora, Brachiopoda, Holothuroidea, Tunicata, Priapulida, Oligochaeta and Sipuncula.

Coull (1988) also stated that certain meiofauna group was restricted to particular sediment types. Sediments where the median particle diameter is below 125 μm tend to be dominated by burrowing meiofauna (Coull, 1988). Interstitial groups such as Tardigrada and Gastrotricha are normally excluded from muddy

substrates where the interstitial lacunae was closed. In those taxa that have both interstitial and burrowing representatives such as Turbellaria, Nematoda and Harpacticoida, there are differences in the morphologies of mud and sand dwellers. The mud fauna is not restricted to a particular morphology but is generally larger whereas the sand fauna tends to be slender, as it must move through the narrow interstitial openings between the particle sizes. Additionally, most interstitial taxa have adhesive glands for attaching them to the sand grains and they tend to have a low number of eggs (Swedmark, 1964). Hicks (1977) noted that epibenthic and phytal forms tend to be larger and often have the ability to swim for short distances and occur in great abundances.

Very little work on scientific documentation of meiofauna has so far been undertaken in tropical coastal areas, particularly in Sarawak. The aim of this paper is to review the status of meiofauna studies in Sarawak. Special focus will be given on meiofaunal taxa, meiofaunal density and diversity and species zonation.

MEIOFAUNAL TAXA

Studies on the marine and estuarine meiofauna of Sarawak waters began in 1999, when Bejie *et al.* (1999) published a paper on preliminary survey of intertidal meiobenthos distribution in sediment at Kuching Bay, Sarawak. Later papers related to community structure of meiofauna were published by Shabdin and Tengku Balkis (2000), Shabdin *et al.* (2001); Tengku Balkis and Shabdin (2001), and Shabdin *et al.* (2003a; 2003b). The focus of those studies in the early stage was related to the community structure such as higher taxa of meiofauna and its density in the coastal area of Sarawak. Based on the published work, at least 24 meiofauna taxa were recorded in the coastal area of Sarawak (Table 1). Five taxa were recorded in all published works namely Nematoda, Kinorhyncha, Polychaeta, Ostracoda and Harpacticoida. Other taxa were reported as either present or absent by the authors in their studies.

Table 1: Meiofaunal taxa recorded in the marine and estuarine ecosystems along the coastal water of Sarawak.

Taxa	Bejie *et al.* (1999)	Shabdin & Tengku Balkis (2000)	Tengku Balkis & Shabdin (2001)	Shabdin *et al.* (2001)	Shabdin *et al.* (2003a)	Shabdin *et al.* (2003b)
Foraminifera	+	+	+	-	-	-
Ciliophora	+	+	+	-	-	-
Cnidaria	-	+	+	-	-	-
Turbellaria	-	+	+	-	+	+
Gnathostomulida	+	+	+	-	-	-
Nematoda	+	+	+	+	+	+
Gastrotricha	-	+	+	-	+	+
Rotifera	-	+	+	+	-	-
Loricifera	+	-		-	-	-
Kinorhyncha	+	+	+	+	+	+
Polychaeta	+	+	+	+	+	+
Oligochaeta	-	+	+	+	+	+
Tardigrada	-	-		+	-	-
Cladocera	+	-		-	-	-
Ostracoda	+	+	+	+	+	+
Harpacticoida	+	+	+	+	+	+
Thermosbaenacea	+	-		-	-	-
Tanaidacea	-	+	+	+	-	-
Amphipoda	+	+	+	+	-	-
Cumacea	-	+	+	-	-	-
Insecta	-	+	+	-	-	-
Brachiopoda	-	+	+	-	-	-
Gastropoda (larvae)	-	-		+	-	-
Bivalvia (larvae)	-	+	+	-	+	+

+ present, - absent