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Horizontal distribution of zooplankton in Tangerang Coastal Waters, Indonesia

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Abstract

Zooplankton plays an important role in aquatic ecosystems. It has both horizontal and vertical distribution. This research was conducted in Tangerang coastal waters with the purpose to determine horizontal distribution of zooplankton and its correlation to water quality. The results showed that there were 12 groups of zooplankton found in Tangerang coastal waters dominated by Crustacean. Based on Morisita Index, zooplankton in Tangerang coastal waters has been grouped as patchy pattern distribution. Horizontal distribution of zooplankton was divided into two clusters of site location and more influenced by pH and ammonia.

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Keywords: horizontal distribution; Morisita index; Tangerang coastal waters; water quality; zooplankton groups.

1. Introduction

Zooplankton is heterotrophic organism that plays important role in aquatic environment. In aquatic food webs, zooplankton, as primary consumers, transfers energy from primary producers (phytoplankton and bacteria) to higher trophic levels (aquatic insects and fish) [1,3]. Zooplankton abundance is related to environmental factors such as physicochemical and temporal fluctuations [4,5], thus zooplankton could be used as bioindicators of the aquatic ecosystem state.

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Tangerang coastal waters is a tropical aquatic ecosystem receiving many organic matters input from surrounding river [6]. The organic matter sources from anthropogenic activities, such as agriculture, aquaculture, industry, and domestic activities in surrounds coastal waters area. This might disturb aquatic environment, particularly living organism such as zooplankton. Zooplankton abundance and distribution is influenced by physicochemical parameters (current, wind, waves, and water quality) and season [4,7]. The zooplankton community structure fluctuates as a result of anthropogenic activities in such waters [8].

Many researches on zooplankton diversity and distribution had been conducted in various type of waters to determine the relation of zooplankton to environmental factors [4,9,12]. Nevertheless, there is lack of information on zooplankton distribution in tropical waters, especially in Tangerang coastal waters. Tangerang coastal waters has high abundance planktivorous fishes, thus it is important to understand about zooplankton composition and distribution in order to maintain sustainability of aquatic resources regarding its role in aquatic ecosystem. The aim of this research was to explore horizontal distribution of zooplankton in Tangerang coastal waters based on taxa composition, abundance, and water quality.

2. Materials and Methods

2.1. Study area

The research was conducted using a vessel in Tangerang coastal waters, Banten Province, Indonesia. Sampling site was divided into five sites with 51 sub sites, those were Kronjo (K; K01-K09), Mauk (M; M01-M06), Rawa Saban (R; RS01-RS15), Tanjung Pasir (T; T01-T15), and Dadap (D; D01-D08) (Figure 1). Those sampling sites were determined by considering the input from river that disembogues in each site. Kronjo represented Sipanjang and Cipasilian River; Mauk represented Cimandiri, Cileleus, and Cimauk River; Rawa Saban represented Cirarab and Cisadane River; Tanjung Pasir represented Cisadane River; and Dadap represented Dadap and Kamal River. Samples of zooplankton and water were collected three times in April, August, and November 2013.

2.2. Sample collections

Zooplankton samples were collected using plankton net (mesh size 25 μm) and preserved by 1% Lugol solution [13]. Furthermore, zooplankton were identified morphologically [14] and the taxa number was counted with SRC (Sedgewick Rafter Counting Cell) using census method [15] under a stereomicroscope.

Water samples were collected using Van Dorn water sampler for ammonia (NH3-N) analysis [13]. Temperature and salinity (SCT meter), pH (pH meter), DO (DO meter), and depth (scaling rope) were measured in situ.

2.3. Data analysis

- Diversity index (H'), evenness index (E), and dominance index (C)
  Zooplankton abundance (N) was calculated using abundance formula [13]. Zooplankton diversity was analysed using Shannon-Wiener diversity index (H') [15]. Zooplankton evenness and dominance were analysed using Evenness index (E) and Simpson dominance index (C) [15]
- Zooplankton distribution pattern
  Zooplankton distribution pattern was determined using Morisita index [16]. The validity of index was tested by Chi-square test [17]. The $\chi 2$ value obtained from test ($\chi 2$ test) was compared to $\chi 2$ from Chi square table ($\chi 2$ table). The higher value of $\chi 2$ test shows that there is randomly significantly different, vice versa.
- Horizontal distribution
  Clustering was conducted to identify similarity of zooplankton abundance and water quality in Tangerang coastal waters. Based on ANOVA two-factor without replication, there was not any intertemporal differences on chemical and physical parameters value ($p=0.75$), and also zooplankton abundance ($p=0.36$). In consequence, further cluster analysis was only conducted spatially.

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