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Fish Communities of Tropical Headwater Streams Under Multiple Land-use Influence

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ABSTRACT

The intensive development of agricultural activities can be a major threat to the extinction of fish fauna in the tropical headwater streams of Borneo Island. Insufficient information on the influence of multiple land-use on fish communities can lead to failure in preserving ecological buffer zones along stream channels and the loss of aquatic biodiversity. We investigated fish communities of tropical headwater streams in Bau District of Sarawak State that flow through different types of land-uses. It is hypothesised that multiple land-use influent fish diversity and abundance. Fish were sampled at three headwater streams, Sg Bu'un, Sg Dian and Sg Sibomou of Sarawak Kanan River that have multiple land use in the catchment areas. The assessment of land use activities and fish sampling were done once in dry and rainy months. The assessment of land use showed that the distribution of agricultural activities is not consistent across the water catchments of the three headwater streams, which among others could be depending on soil fertility and the interests of the farmers. Oil palm plantation was the major agricultural activity in the catchment of headwater streams. The aboveground biomass varied with the type of land use, size of coverage, and age of the forest or plantation. The fish fauna of the three headwater streams was represented by 25 species in ten families and six orders, which was dominated by the family Cyprinidae. The cyprinids made up 17% of the total individuals with three dominant species are *Barbodes sealei*, *Rasbora cryptica* and *Oxygaster anomalura*. The diversity index of Shannon was significantly different among the three headwater streams. The headwater streams with high coverage of oil palm plantations showed significantly low species richness and high number of individuals. Fish richness and abundance in dry season were significantly lower than rainy season. The less sensitive species such as *Systomus rubripinnis, B. sealei, R. cryptica* and *Parachela oxygastroides* were dominant in three headwater streams in both wet and dry months. The findings of this study may suggest that the width of buffer zone along stream channel could be estimated by integrating size of the major land use in the catchment, precipitation, and management practices of each type of land-use.

Keywords: Agriculture, Borneo, deforestation, fish assemblages, Sarawak

INTRODUCTION

The river ecosystem in Asian countries is exceptional rich of biota as well as high endemicity (Dudgeon, 2000) and support livelihoods of many communities live in the river basin (Rachmatika *et al*., 2005; Olson & Morton, 2018; Funge-Smith & Bennett, 2019). Extensive exploitation of river resources combined with disturbance and pollution from land use activities have contributed a severe threat to the ecosystem and the biodiversity which led to food security issue in concern. However, the present data are insufficient for identifying specific source of each environmental problem. The environmental problem is accelerated over the years and increasingly difficult to manage due to new forms of pollution and disturbance introduced to the rivers. The major challenges in managing environmental problem of river system are due to the difficulty to identify and deal with multiple-stressor effects (Ormerod *et al*., 2010). The effect of multiple stressors varies from upstream to river mouth of which each section of the river has different carrying capacity to dilute the effects. The changes in water catchment resulting from agriculture activities have a negative effect on fish communities (Trautwein *et al*., 2012; Wilkinson *et al*., 2018). The effect