Full Paper

POPULATION OF Osteochilus spp. AS A BASE OF SUSTAINABLE FISHING IN SERAYU RIVER

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Abstract

The increasing demand for freshwater resources generated by human population growth, urbanization, industrialization and irrigation have resulted in a decline or loss of freshwater fish such as Osteochilus spp. The aims of research were to analysis the population of Osteochilus spp in terms of abundance, longitudinal distribution and sex ratio and to determine environmental factors of river driven these populations. The research was carried out at upper part of Serayu River during wet season (January – March) and dry season (June - August) 2007. Fishes were collected by using electro fishing and stratified random sampling was applied by dividing this river into five strata based on altitude. The results showed that the total abundances of Osteochilus spp. was 149 individuals and composed by O. hasselti (47) with 8.30 – 24.35 cm and 11.20 – 198.70 g, O. microcephalus (101) with 11.35 – 25.21 cm and 17.9 – 206.5 g and O.kahajanensis (1) with 17.30 cm and 68.60 g. The size of population O. hasselti and O. microcephalus gradually increased from 7 and 4 individuals in stratum A became 27 and 12 individuals in stratum D, and then increased up to 43 and 17 individuals in stratum E. The sex ratio of O. hasselti was 10:16 and O. microcephalus was 20:23. Both species were longitudinaly distributed in Serayu River. It seems that the population of O. hasselti and O. microcephalus were more influenced by physical factors such as depth and current rather than chemical factors i.e. DO and pH at Serayu River.

Key words: fishing, Osteochilus, population, serayu, sustainable

Introduction

There are 5,886 rivers in Indonesia (Directorate General of Water Resource Development, 1991), but less is known about the ecological factors important for determining the distribution and community structure of freshwater fish. Even, there is no available report illustrating the situation in Central Java, where most of the upper part of rivers are heavily shaded and surrounded by secondary forest. These parts are important ecosystems as biodiversity reservoir of aquatic organisms. The upper parts of stream are threatened by deforestation which increases the temperature and sediment load. The course of their flows are threatened by dam construction which eradicates high gradient sector and alters the flow pattern down stream or canalization which reduces the heterogeneity of river bed and the number of available ecological niches (Kottelat & Whitten, 1996). Commonly, rivers receive organic matter from agricultural areas, housing and traditional food industries causing destruction of stream habitats, and degradation of water quality.

Fish is chosen as the focal or flagship group of species since they are species rich; out of 25,000 known fish species over 40% or 10,000 are known exclusively from freshwaters (Kottelat & Whitten, 1996). The total number of freshwater fish species in Java is 132 species with land area about 132,570 square km. About 9% or twelve species are endemic species, there are six species from the Cyprinidae, one species from the Balitoridae, one species from the Cobitidae, one species from the Akyidae, one species from the Hemiramphidae and two species from the Gobiidae (Kottelat et al., 1993; Kottelat & Whitten, 1996).

Family cyprinidae contributed up to 70% of all freshwater fish in Banyumas Rivers and the most common species was Osteochilus hasselti (Lestari, 2004). While in Indonesian freshwater, 24 species of Osteochilus are documented and one of them Osteochilus kappeni is endemic species (Fishbase, 2007).

On the other hands, the knowledge of the Indonesian fish fauna is regarded as not well develop, it is demonstrated by the list of additions and new discoveries species. The present fish increase about 18% in four years only (Kottelat et al., 1993). Concerning to the lack of scientific information and crucial role of river in human life, a research
is necessary to obtain basic data of fish in order to enable develop strategies of sustainable fishing (Raven & Wilson, 1992; Prins & Wind, 1993) and to determine fish communities for management of river habitat (Maitland & Morgan, 1997).

Materials and Methods

This study was conducted in the Serayu River from January to March and June to September 2007. Observations were started at the upper part and continued along the water body up to the Panglima Soedirman Reservoir. This river was divided into 5 strata based on the altitude and each stratum consists of 3 sampling sites since of the micro habitat differences (Figure 1 and Table 1).

The fish sampling was performed during the day only (08.00 pm—18.00 am). Concerning that the efficiency of electric fishing is highest in such a condition as follows depth < 1 meter with low current, solitary and non migratory fishes with size > 30 cm (Casselman, et al. 1990 & Lestari (2008), meanwhile the conditions of the 15 sampling sites were varied, the combined seine net and electric fishing was applied mostly in this research it means that this combined method was the primary collection method (Gorman & Karr, 1978 and American Public Health Association, 1989).
Fish collection from each sampling site were coded, recorded and counted. They were fixed in 10% formalin and preserved in 70% ethanol. Fish was identified to the species level according to the taxonomic keys of Saanin, 1986; Kottelat et al., 1993 and Fishbase, 2007. The population was analysed by counting the number of individuals (Krebs, 1972) per sampling site for 30 minutes effective time or about 100 meter square.

In order to compare the river properties in the five strata, data of physical and chemical parameters and population of Osteochilus spp were analyzed by ANOVA (Zar, 1984). And then, interactions between physio-chemical parameters and the population of Osteochilus spp. were determined by calculating Pearson correlation (Zar, 1984) runs by program Statsoft (1989).

Data of Osteochilus spp were used as base in determining the fish that could be caught. As well as, the information of river properties were applied in determining the sites for fishing ground. Both aspects are needed in development the sustainable programs.

Results and Discussion

Results

Like other tropical rivers, the complexity of micro habitat in Serayu River increased from upper to down stream part. Sampling sites in higher level of altitude possessed lower water temperature. For example, strata A with 22°C, it was slightly increased to the down part, became 28°C in strata D and 32°C in strata E (Table 2).

Current was varied from site to other sites, but it trends to be slower to the down part. It was reflected by increasing the duration for each 100 Cm, from 64 seconds in strata A became 197 seconds in strata E.

The longitudinal model plays in the Serayu River, particularly in the upper part. It is true in term of physical habitat characteristics such as depth, and, current. However, chemical and biological determinants were apparently not follow the longitudinal pattern of change. In general the physical and chemical parameters illustrated that Serayu River is remains in natural condition (Table 2).

The total number of Osteochilus spp was 149 individuals composited by 47 of O. hasselti with 8.3-24.35 cm in length and 1.20-198.7 g in weight; 101 of O. microcephalus with 11.35-25.21 cm and 17.9-206.5 g. One individual of O. kahajanesis with 17.30 cm and 68.80 g (Table 3). Most of fish captured in down part was bigger that those captured in upper part. It could be related to the more natural food and space for moving.

The populations of O. hasselti and O. microcephalus gradually increased from stratum A to E. The population of O. hasselti increased from 4 individuals in stratum A became 17 individuals in stratum E. The same pattern was applied in population of O. microcephalus. It increased from 7 individuals in stratum A and became 43 individuals in stratum E (Figure 2).

Table 4 displays that sex ratio of O. hasselti was 1:1.35, O. microcephalus was 1:1.40 and O. kahajanesis with one female (Table 4.). Chi square results showed that the sex ratio of (x² =0.551, p < 0.005 for O. hasselti, x² =0.809, p < 0.05 for O. microcephalus, and x² =0.594, p < 0.05 for O. kahajanesis.
Sampling sites in stratum A seem to be less complexity than others strata, this condition lead to less population of fish. The sites in stratum A only occupied by 17 individuals while sites in stratum E by 43 individuals. Complexity of micro habitat related to natural foods, nursering and spawning grounds, especially increasing in depth will provide more place for those activities (Vannote et al., 1980 and Payne, 1986).

Other reason for the increasing number of fish was probably related to food available in down stream. Since down stream part of river was deposited part, naturally this part was rich part of detritus. This migration appeared to serve the function of placing eggs on suitable spawning substrate, usually gravels or submerged plants or stream feeding sites. Such as Cyprinus carpio used down stream part of the Mississippi River for spawning ground (Welcomme, 2001).

In term of sex ratio aspect, population of *Osteochilus* spp. in Serayu River seems to able to sustain due to more females than males. Like other fishes which possessed number of females was more than males such as Rasbora tawaraensis with 1: 4.72 (Brojo et al., 2001), Puntius gonionotus with 1: 1.12, Puntius bramoides with 1:1.07 (Kartamihardja, 1996) and Labeo cylindricus with sex ratio 1:1.63 (Weyl and Booth, 1999). These sex ratios were more likely to adequate for supporting the population dynamics (Purwanto et al., 1988).

Populations of three species *O. hasseltii*, *O. microchealalis* and *O. kahajenensis* dynamically changed corresponded with the changes of physical parameters. Particularly, altitude drove the population of *O. hasseltii* and *O. microchealalis*. These populations decreased by the increasing of altitude level.

Meanwhile, the changes of *O. kahajenensis* population were drove more by water temperature (Table 5). This study demonstrated that the populations of *Osteochilus* spp. have been driven by physical parameters. Naturally, the levels of altitude closed related to the changes of current, depth, and water...
temperature. From upper to down parts of rivers, the current will decrease, the depth and water temperature will increase (Payne, 1986 and Allan, 1995).

Moreover, Osteochilus species are widely distributed throughout South East Asia (Fishbase, 2007); even this species might be an indicator for disturbance following logging. The physical effects of logging that are presumed to be of important factors to fish including the increasing of suspended sediment, temperature and amount of debris and the decreasing of dissolved oxygen. Greater of suspended sediment leads to lower production of micro algae may cause the declining of species abundance of Osteochilus (Martin-Smith, 1998).

Species Osteochilus microcephalus was more available than Osteochilus hasselti, even O. kahajaniensis occurred in very small population. Female occurred more than male fish. Down part of Serayu River was inhabited by more individuals therefore this part is promoted as fishing ground.

**Conclusion**

Female Osteochilus microcephalus was recommended as a legal fish to be caught rather than Osteochilus hasselti and Osteochilus kahajaniensis for sustainable fishing and downstream part of Serayu was preferable sites for fishing ground.

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