

Population Genetics of *Tor douronensis* in Sarawak – A Revisit

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ABSTRACT

Tor douronensis, known locally as Semah, is one of the valuable resources of Sarawak due to its high nutritional value and demand as game fish. Several molecular studies related to *T. douronensis* have been carried out and deposited in GenBank including the data collected from Ba Kelalan, Layar and Limbang. Although there are other studies on *Tor* spp., the data was not available in GenBank, thus there are not included in the analysis. One fieldtrip to Bakun Dam was carried out on June 2014 with initial aim to assess overall fish diversity. During this sampling, 11 individuals of *T. douronensis* were caught, which later subjected to molecular work to investigate the genetic structure and evolutionary relationship among four of *T. douronensis* in Sarawak using partial Cytochrome c oxidase I (COI) mtDNA gene. A fragment of 465 bp of COI gene of *T. douronensis* was successfully amplified. Based on the phylogenetic trees generated, three clades could be observed namely Central, Southern, and Northern populations; 1st clade (haplogroup I) from Bakun, 2nd clade (haplogroup II) from Layar and 3rd clade (haplogroup III) from Ba Kelalan and Ulu Limbang. Overall, there were 13 haplotypes and none was shared among populations, suggesting low level of inter-population gene flow has been observed. The small number of migrants per generation ($Nm < 1.0$) among the population indicated that the small populations were isolated possibly due to large geographical areas. All population had undergone expansion with a large negative value and significant test of Fu's F in Bakun population suggested recent expansion. In addition, result also suggested that all populations did not deviate from evolutionary neutrality.

Keywords: COI gene, evolutionary neutrality, population expansion, population subdivision, *Tor douronensis*

INTRODUCTION

Tor douronensis Valenciennes (1842) is a member of the mahseer group from the genus *Tor* Gray in the family Cyprinidae. It is one of the most important freshwater fishes in Malaysia (Mohsin & Ambak 1983; Roberts 1989; Litis *et al.*, 1997; Ng, 2004) inhabiting the upper streams and headwaters of most major river systems (Kottelat *et al.*, 1993; Rainboth, 1996). In Sarawak, *T. douronensis* is locally known as Semah. This species has high economic value to the local people.

About a decade ago, the price of *T. douronensis* was valued RM45/kg in the open market in Kapit, Sarawak (Ingram *et al.*, 2005). During field visit to Bakun Dam in April 2013, local people claimed that 'Semah' could fetch a price of between RM60/kg to RM100/kg in Bakun area. Thus in agreement with Ingram

et al. (2005), this species has great potential for freshwater aquaculture industry.

Populations of *Tor* spp. are declining due to degrading environmental conditions by deforestation, logging and development of hydropower dam that may have disturbed their natural habitat (Ng, 2004). Uncontrolled fish harvest (overfishing) due to its high price has also contributed to the reduction of their population size (Ng, 2004). Their distributions in Malaysian Borneo are now limited to the upper streams and protected areas of Sarawak and Sabah (Litis *et al.*, 1997; Nyanti *et al.*, 1999; Ng, 2004).

Although currently not listed by the IUCN as a protected or endangered species, the drastic decline in natural populations of *T. douronensis* has increased awareness among relevant authorities (*e.g.*, Fisheries Department,

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