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Mitochondrial DNA Diversity of *Tor tambroides* Valenciennes (Cyprinidae) from Five Natural Populations in Malaysia

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Yuzine B. Esa, Siti Shapor Siraj, Siti Khalijah Daud, Khairul Adha A. Rahim, Jeffrine Rovie Ryan Japning, and Soon Guan Tan (2008) Mitochondrial DNA diversity of *Tor tambroides* Valenciennes (Cyprinidae) from five natural populations in Malaysia. *Zoological Studies* **47**(3): 360-367. In this study, we examined the genetic structure of *Tor tambroides* Valenciennes, an important indigenous freshwater fish species in Malaysia, using sequence analysis of 464 base pairs of the mitochondrial cytochrome *c* oxidase I (COI) gene. In total, 92 *T. tambroides* samples were analyzed from 4 locations on Peninsular Malaysia (*n* = 87) and a single population from Sarawak (Batang Ai, *n* = 5) on Borneo I., and 4 sequences of *Tor douronensis* from Sarawak were used for comparisons. In total, 9 haplotypes were found, with 7 haplotypes being unique and 2 haplotypes being shared among the 5 populations. The phylogenetic analysis using Neighbor-joining (NJ) and maximum-parsimony (MP) methods supported the monophyletic status between *T. tambroides* and *T. douronensis*, thus suggesting their status as different species. The clustering of all *T. tambroides* samples into a single clade suggested that their genetic identity belongs to a single species. The sharing of haplotype HKE4 between Batang Ai of Sarawak (*n* = 4) and Perak of Peninsular Malaysia (*n* = 3) reflects the historical connection of drainages between the regions possibly during Pleistocene glaciation periods. Limited variations were found among all peninsular *T. tambroides* populations. The low level of mitochondrial (mt)DNA differences currently found among *T. tambroides* populations is probably due to the high proportion of the HKE1 haplotype being found in all the populations (0.736 - 1.000), or the small number of samples used in the present study. Overall, the present study was able to shed light on the phylogenetic relationships and genetic structure of *T. tambroides* in Malaysia. http://zoolstud.sinica.edu.tw/Journals/47.3/360.pdf

Key words: *Tor tambroides*, Freshwater fish, mtDNA COI, Population structure.

Cyprinids of the genus *Tor* Gray, commonly known as Mahseer, are one of the important freshwater fishes in Malaysia (Mohsin and Ambak 1983, Roberts 1989, Litis et al. 1997, Ng 2004). *Tor tambroides* Valenciennes, locally known as "kelah" in Peninsular Malaysia (Mohsin and Ambak 1983) and "empurau" in Sarawak (Litis et al. 1997) is one of the important Mahseer used for food as well as the aquarium industry and game fishing (Ng 2004). It is the most common Mahseer found on Peninsular Malaysia and is also found in Sarawak state on Borneo I. *Tor tambroides* inhabits the upper reaches of clean unpolluted river systems with rocky beds through hilly terrain (Singh and Menon 1994).

Tor tambroides can morphologically be identified based on the presence of a long median lobe character that is shorter in the other 2 Mahseers described in Malaysia (*T. douronensis* Valenciennes and *T. tambra* Valenciennes) (Kottelat et al. 1993, Kottelat and Whitten 1996, Rainboth 1996). Nevertheless, *T. tambroides* exhibiting

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