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Distribution and Conservation of Endangered Temoleh, *Probarbus jullieni* (Sauvage, 1880)

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Abstract: The freshwater fish, *Probarbus jullieni* (Sauvage), locally referred to as “Temoleh”, is a high-valued freshwater fish in Malaysia and has both cultural and conservation significance. It is widely distributed in the North-east Asian countries such as Thailand, Cambodia, Vietnam and Malaysia. During the recent past, the natural stocks of *P. jullieni* have been decreased severely due to habitat degradation and man-induced hazards in aquatic ecosystem. Despite the vast research that has been conducted on various carp species, little attention has been given to *P. jullieni*. This study reviewed the published information on the status, distribution, reproduction and biodiversity of this commercially important fish species. The findings would greatly be helpful towards the species conservation and aquaculture development of the highly endangered *P. jullieni*.

Key words: Temoleh, *Probarbus jullieni*, distribution, reproduction, conservation

INTRODUCTION

The wild river carp, *Probarbus jullieni* (Sauvage, 1880) belonging to the family Cyprinidae, is one of the commercially important freshwater fish in Malaysia. It has been documented to be the largest species of cyprinids in Peninsular Malaysia (Mohsin and Ambak, 1983). The English names are: Jullien's Golden Carp, Seven-striped Barb, Seven-line Barb, Price Carp and Isok Barb (Phuriphong and Ukkatawewat, 1992; Anonymous, 1994; Rainboth, 1996; FishBase, 2011). In Malaysia, *P. jullieni* is commonly known as “Temoleh” or “Temelian”. *Probarbus jullieni* has attracted considerable interest from fisheries scientists and conservationists due to its large size, high market price, excellent taste, endangered status and alleged migratory behavior (Suvatti, 1981; Roberts, 1993; Anonymous, 1994; Roberts and Baird, 1995; Mattson *et al.*, 2002; FishBase, 2011). In recent years, the stocks of *P. jullieni* have declined drastically from its natural habitats such as lakes and rivers due to pressure from unsustainable fishing and habitat degradation, resulting from intensive development activities such as land clearing, deforestation and dam construction (Chew *et al.*, 2010). These factors have not only destroyed the breeding and feeding grounds but

also caused destruction to the biodiversity of this important fishery.

There is need of increasing concern on reproduction and conservation of the endangered fish, as the information on the early life history of a fish is very important for the optimization of its large-scale seed production, culture and management (Rahman *et al.*, 2004; Miah *et al.*, 2009).

To manage any fish species, knowledge on breeding biology, reproduction and feeding are of prime importance (Rahman *et al.*, 2011; McAllister *et al.*, 2000). Several studies on reproduction, especially on early life history of various endangered species have been reported (Rahman *et al.*, 2009; Chakraborty and Murty, 1972; Rahman, 1975; Mookerjee, 1945; Bruton, 1979; Mollah *et al.*, 2011; Tripathi, 1996; Nakamura and Motonobu, 1971; Martinez-Palacios *et al.*, 2002; Haniffa *et al.*, 2003; Boglione *et al.*, 1992). However, till date, no published information on the breeding and culture of *P. jullieni* is available; in fact there have not been any information on its reproductive biology and feeding ecology from the waters of the countries where the fish is found. This review is therefore, set out with the aim of evaluating literatures on distribution, reproduction and conservation of *P. jullieni*.

Family cyprinidae: These are referred to as 'Carp fish'. The family belongs to the order Cypriniformes. This is the large family of freshwater fishes that commonly called the carp family and its members are also known as cyprinids. Members of this family are characterised by dorsal fin with spine like rays. Premaxilla usually borders the upper jaw, making the maxilla entirely or almost entirely excluded from the gape. Mainly non-guarders, but in some species, males usually build nests and/or protect the eggs. A complete lateral line is present (Suvatti, 1981; Mohsin and Ambak, 1983). From this family, the genus *Probarbus* is generally known to be represented by three species such as *P. jullieni* (Sauvage, 1880), *P. labeamajor* and *P. labeaminor* (Roberts, 1992). However, this review focused mainly on *P. jullieni*.

Taxonomy and identification key: *Probarbus jullieni* belongs to the phylum Chordata, sub-phylum Vertebrata, class Actinopterygii, order Cypriniformes, family Cyprinidae, genus *Probarbus* and species *jullieni*. It can be distinguished from other species of *Probarbus* by the body stripes that extend to every scale row but this only obvious in some larger and more darkly pigmented individuals of *P. jullieni*. There have been no more than three stripes below the lateral line scale row on *P. labeamajor* and *P. labeaminor* and the abdomen is uniformly white. Adults and larger juveniles of *P. jullieni* usually have much more red and sometimes yellow coloration on head, body and fins than the other two species (FishBase, 2011).

External morphology: *Probarbus jullieni* is known for its attractive golden colouration with deep black, longitudinal stripes. The colours of the live specimens are very attractive with 7 narrow longitudinal black stripes from tip of operculum to end of the body trunk. *Probarbus jullieni* is one of the largest freshwater fish species in south-east Asia, reaching up to 70 kg in weight and 1.65 m in length (Suvatti, 1981). The biggest specimen of *P. jullieni* was 120 cm in total length and 21 kg in live weight; it is said to be the largest species of the Cyprinids in Peninsular Malaysia (Mohsin and Ambak, 1983).

Distribution of *P. jullieni*: The natural distribution of *P. jullieni* includes the Chao Phraya and Mae Klong River basins in Thailand; the Mekong basin in the Lao People's Democratic Republic (Laos or Lao PDR), Thailand, Vietnam and Cambodia and the Pahang and Perak basins in Peninsular Malaysia (Roberts, 1992), as also described in Table 1. While, the distribution of *P. labeamajor* and *P. labeaminor* is restricted in some countries of the

Table 1: Occurrence and distribution of *Probarbus* spp. in the world

Species	Native country	References
<i>P. labeamajor</i>	Cambodia, Lao People's Democratic Republic and Thailand	Roberts (1992), Roberts and Warren (1994) and Baird (2006)
<i>P. labeaminor</i>	Cambodia, Lao People's Democratic Republic and Thailand	Roberts and Warren (1994) and Rainboth (1996)
<i>P. jullieni</i>	Cambodia, Lao People's Democratic Republic, Thailand, Vietnam and Malaysia (Perak and Pahang)	Smith (1945) and Roberts (1992)

North-east Asia, especially Cambodia, Laos PDR and Thailand (Roberts, 1992; Roberts and Warren, 1994; Baird, 2006; Rainboth, 1996), it can also be found in other neighbouring countries. In Thailand, the fish is found in Mae Klong River and its tributaries, located in the central part of the country and in the Mekong River, located in the Northeastern part (Mattson *et al.*, 2002).

In 1945, populations of *P. jullieni* was thought to have declined for the last 65 years (Smith, 1945) in central region of Thailand. From 1970 to 1995, it had declined by 80-90% below the Khone waterfalls (Roberts and Baird, 1995). Roberts and Warren (1994) reported that at Hee Island, above the Khone waterfalls, 100 individuals can be caught per day but that only 60 were caught per day in 1992 and in 1993, only a maximum of 22 were caught per day and 92 in the whole season. More dramatically, at Say Island in Champasak Province above the Khone waterfalls, the fishery for the species crashed in 1993 although, in the previous year they had caught over 60 fishes (Roberts and Baird, 1995). In the Mekong River, it is known from at least as far upstream as Luang Phrabang, in northern Laos (Davidson, 1975). In 1989, *P. jullieni* was reported to be 'extremely abundant' throughout the Mekong basin in Thailand. The adult of *P. jullieni* appeared to prefer main river habitats, whereas juveniles entered the floodplain during the rainy season (Poulsen *et al.*, 2004). The molecular and morphometric measurements of the sample, collected from Pahang, Malaysia and Thailand, showed two distinct populations but the differences between them indicated that they were the same species with a least degree of separation (Bhassu and Abd Rashid, 2009). The *P. jullieni* is a riverine species found in Thailand, Laos, Cambodia and Malaysia. Natural populations have been extirpated from the rivers of Thailand and are feared to disappear as more impoundments are constructed in the Mae Klong and the Mekong (Mattson *et al.*, 2002). The fact that no spawning grounds have been identified downstream from Stung Treng in the northern Cambodia, suggests that there is only one population between northern Cambodia and the Mekong delta in Vietnam (Poulsen *et al.*, 2004). Self-

ustaining populations of *P. jullieni* may no longer occur in the Chao Phraya or Mae Klong River Basins.

In Malaysia, *P. jullieni* is either extirpated or extremely rare throughout the Pahang River Basin (Baird, 2006). Populations have dropped significantly in the Perak River basin due to hydropower development and subsequent changes in stream hydrology (Baird, 2006). In the recent past, *P. jullieni* was reported as “extremely abundant” in the Mekong but subsequent accounts indicate a significant drop in abundance since 1989 (Roberts and Warren, 1994; Roberts and Baird, 1995; Singhanouvong *et al.*, 1996). Populations in many locations in Lao PDR appear to have declined significantly (Baird, 2006). The *P. jullieni* stock has seriously been impacted by dams in the Perak basin which have destroyed a number of spawning sites (Baird, 2006). Therefore, urgent measures should be taken to protect this species from extinction through the development and application of captive breeding protocols and intensive rearing techniques.

Reproduction: Unlike most other Mekong fishes, *Probarbus* spawns in the middle of the dry season, from December-February. During this time, the mature fish migrates upstream to specific spawning areas (Poulsen *et al.*, 2004). The exact age at maturity of *P. jullieni* is unclear. Mattson *et al.* (2002) reported that the sizes of matured male and female of *P. jullieni* were 5-20 kg and 10-50 kg, respectively. However, in captive rearing conditions, male and female brood stocks attained sexual maturity at 2-7 kg and 5-15 kg, respectively (Mattson *et al.*, 2002). *Probarbus jullieni* spawns during the dry season between November and February (Poulsen *et al.*, 2004). Several spawning sites have been identified within the Mekong River Basin including the Ou River in northern Lao PDR (Viravong, 1996), Loei province in northeast Thailand and Nam Lim in central Lao PDR. The young of *P. jullieni* move out from Tonle Sap River into the Mekong River in October and November (Hogan *et al.*, 2006). Adult fish make upstream spawning migrations. One tagged seven-striped barb moved 135 km upstream from the Tonle Sap River up to the Mekong River (Hogan *et al.*, 2006). At present, the technique for induced spawning is being developed in Thailand (Chockchai *et al.*, 2000) in order to establish a restocking program. Microsatellite DNA is a valuable marker for both assessing and monitoring genetic structure and genetic changes, resulting from a restocking program due to high levels of polymorphism (Taniguchi *et al.*, 2003). A genomic library was constructed by using basically the

same method as described by Takagi *et al.* (1997). Several spawning grounds for *Probarbus* have been identified throughout the basin, suggesting that several distinct populations occur, probably for both *P. labeamajor* and *P. jullieni* (Poulsen *et al.*, 2004).

Conservation: Research on population trends and threats to the species and its breeding and culture technique is needed for conservation. Catch trade and transportation is forbidden in Laos (Kottelat and Whitten, 1996) and is also listed in the Red Data Book in Vietnam (Baird, 2006). International trade is banned. Since 1980, the stocking of indigenous species was initiated as one of the DOF policies on fisheries conservation in natural waters in Thailand (Anonymous, 1988). One of the major reasons is the attempt that these species could self-recruit which could be harvested regularly without regular stocking (Little, 2002). The government is regulating the use of large-meshed gill net in northeastern Cambodia. *Probarbus jullieni* benefited from conservation zones in southern Laos (Baird, 2006). The popular species included for stocking are: temoleh (*P. jullieni*), silver barb (*Barbonymus gonionotus*), broad-head walking cat fish (*Clarias macrocephalus*), common siamese barb (*Henicorhynchus siamensis*), iridescent shark catfish (*P. hypophthalmus*), tinfoil barb (*Barbodes schwanenfeldii*), golden barb (*Barbonymus altus*), black eye shark catfish (*Pangasius larnaudii*) and tiny scale barb (*Thynnichthys thynnoides*) (Miao *et al.*, 2010). At least seven species of giant fish inhabit the Mekong including the critically endangered Mekong giant catfish (*Pangasianodon gigas*) and the giant *Pangasius* (*Pangasius sanitwongsei*) and the endangered seven-striped barb (*P. jullieni*) and the giant barb (*Catlocarpio siamensis*) (Hogan, 2011). *Probarbus jullieni* is listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the IUCN Red List as the endangered species since 1976 (Hogan *et al.*, 2009; IUCN, 2012). In recent years, the natural stocks of *P. jullieni* have been declined drastically. This is clearly revealed by the total landing of *P. jullieni* from the public waterbodies of Malaysia over the years which has decreased drastically from 350 MT in 2003 to only 110 MT in 2007 (Chew *et al.*, 2010). Survival depends on maintaining river habitat and hydrological cycles. This species does not adapt well to reservoirs (Roberts, 1992). Till now, nobody has conducted research on breeding and culture protocols for producing the optimum yield of this species for conservation.

CONCLUSION

Information on distribution, reproduction, biology and conservation of a fish is of prime importance for its proper management, increasing of food security as well as lifting the aquaculture industry of any country. Adequate and proper knowledge on fish biology ensures its availability for culture purposes. *Probarbus jullieni* is a commercially important freshwater carp fish in Malaysia as well as in south-east Asia as a whole. This review has identified the fact that despite the distribution of *P. jullieni* in the region, the fish has been seriously decreasing compared to other freshwater fish. Literature on essential aspects of its life history such as distribution and availability status among others is limited; this is clear indication for more research on this fish, so that its status could be considered in order to properly manage and conserve the species from extinction.

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