

A Study of the Diversity of Freshwater Fish in the Nong Han Reservoir, Sakon Nakhon Province, Thailand

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ABSTRACT: Freshwater fish in the Nong Han reservoir provide a source of food and livelihood for local people who live in this unique aquatic ecosystem. The diversity, in terms of species of freshwater fish, needs to be assessed regularly in order to understand the available fisheries resource. The objectives of this study were to determine the species diversity of freshwater fish in the littoral and limnetic zones. Gill nets (about 2,000 m length and 2 m deep) in different mesh sizes were used to collect freshwater fish in March and April 2011. We found that currently there are at least 23 species (12 families) of freshwater fish in the Nong Han reservoir. We also found that the littoral zone shows a higher species richness and number of individuals than the limnetic zone. Cyprinidae was the major family, with *Puntius brevis* and *Cyclocheilichthys apogon* being the most common species. The results of this study provide valuable information, particularly on the biodiversity, and are relevant to the conservation and restoration of the fisheries in this large body of water.

KEY WORDS: biodiversity, freshwater fish, Nong Han, aquatic environment, Sakon Nakhon Province.

INTRODUCTION

The Nong Han reservoir is the largest wetland ecosystem in the Northeast of Thailand, with an area of about 123 km². The local ecosystem has been affected by the alteration of the natural flow system with man-made dams (DOF, 1993; Koranantakul and Dounsawas, 1993) which has influenced the natural biodiversity, including fisheries resources. This ecosystem is very important to the local communities. It serves as a

source of water and a source of food and income for local people (Dounsawas *et al.*, 2003). It is for this reason important to understand the functioning of the aquatic ecosystem. For conservation purposes and sustainable use, a biodiversity study at different locations is necessary (Smith and Smith, 2004; Doydee *et al.*, 2012). There are various species of aquatic flora in the Nong Han aquatic ecosystem which create the habitats and the niches occupied by many

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freshwater fish, particularly during their juvenile stages. Freshwater fish themselves play important roles in the ecosystem, for example, controlling algae and phytoplankton blooms, and assisting in balancing the ecosystem food web (Doydee *et al.*, 2010). They also serve as a source of food and livelihood for local people. Currently, Nong Han is facing a problem with a loss of biodiversity (Doydee *et al.*, 2012). Critical threats to freshwater biodiversity include overexploitation, water pollution, degradation of habitat and the invasion of alien species (Geist, 2011; Doydee and Jaitrong, 2008).

This study was undertaken in order to investigate the diversity of freshwater fish by determining the species spatio-temporal structure in composition and the dominance and rarity of different species of native freshwater fish in the Nong Han wetland ecosystem.

MATERIALS AND METHODS

Study Area

The Nong Han reservoir, Sakon Nakhon Province, Thailand was selected to be the study area for this research work. The study area is

large: about 123 km² (including bodies of water and the flood plain in the surrounding areas). The water has an average depth of 0.75 m and is at elevation of 158 m above mean sea level (DOF, 1993; Srichalerntam and Koranantakul, 1993). It is located in the Northeast of Thailand within the boundary of the Great Mekong Sub-region (GMS) (Rainboth, 1996; Doydee *et al.*, 2012), about 614 km far from Bangkok and is situated around 17° 11' 56" N -latitude and 104° 11' 9" E - longitude. A total of 18 islands are in the study area. They serve as natural habitat for various organisms. There were two sampling sites namely; littoral zone where water depth is about 0.5-1.0 metres with sandy substrate while limnetic zones has water depth average about 2.0 metres associated with muddy and clay substrate) (Figure 1). The two sites selected on the characteristics of water depth and aquatic plant density were Don Chaing Ban and Don Sawan (Figure 1). Site selection was based on the layout of satellite images derived from GISTDA (2008) namely; Thailand Earth Observation System (THEOS) and actual field observation using Global Position System (GPS) (Doydee *et al.*, 2010).

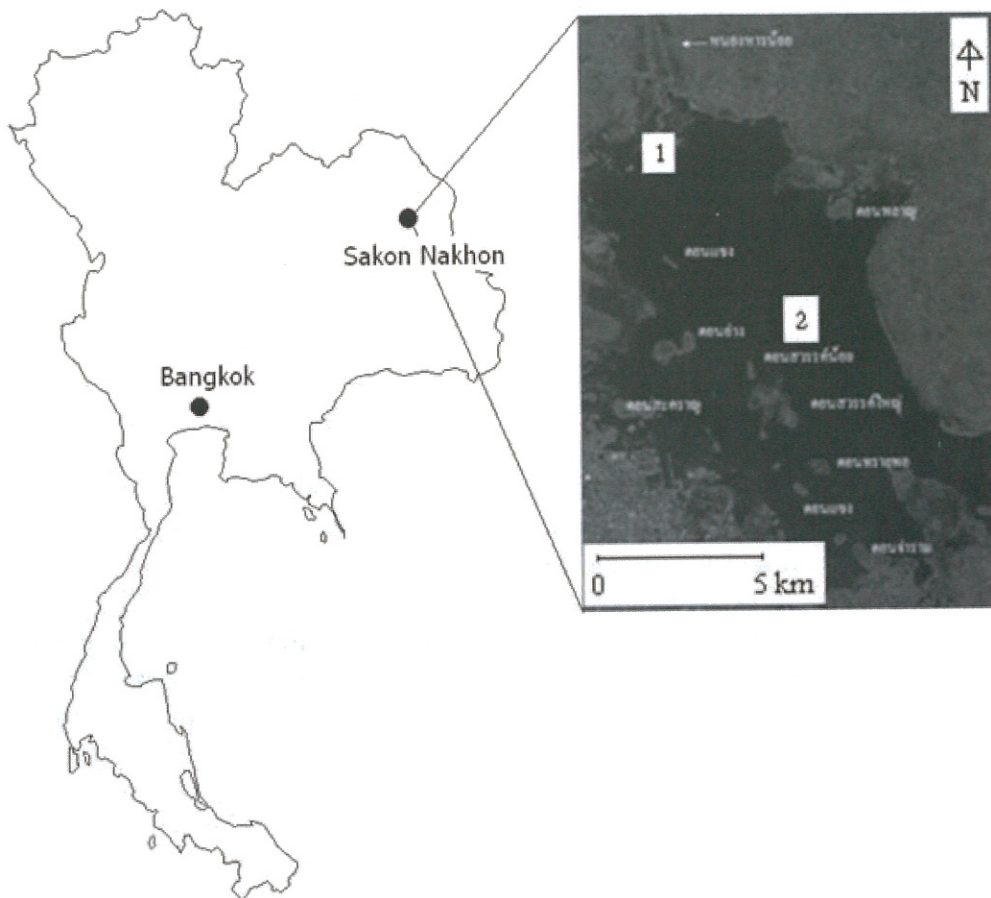


Figure 1. The study area showing the layout of the Nong Han reservoir, Sakon Nakhon Province, Thailand: Don Chaing Ban is in the littoral zone (1) and Don Sawan is in the limnetic zone (2).

Data Collection and Analysis

Data was collected in March and April 2011. The spatial coordinate data of the two sampling sites (Don Chaing Ban and Don Sawan) (Figure 1) and adjacent areas were recorded using a GPS receiver with an estimated accuracy of 10 m or better (Doydee *et al.*, 2012). To validate the coordinates, a geospatial method was used to display the collecting points on remotely sensed data. Gill nets (Doungsawas *et al.*, 2003;

Sutheemechaikul, 2001; Doydee *et al.*, 2012) of about 2,000 m in length and 2 m deep with different mesh sizes (3, 4, 6, 9, 12 cm) were used to collect freshwater fish species. They were set for approximately 10 hours at a time at each sampling site.

RESULTS

Figure 2 illustrates the general overview of the two sampling sites. In all 23 species of freshwater fish were collected and identified (Table 1

and Plates I-IV). The littoral zone had higher species richness than the limnetic zone. Species richness is one index of biodiversity measurement (Krebs, 2009; Vidthayanon, 2005). Table 1 lists the 7 most abundant species of freshwater fish, collected every time at every sampling site. Namely: 1) *Hampala dispar* (Plate I-c), 2) *Henicorhynchus siamensis* (Plate III-b), 3) *Osteochilus hasselti* (Plate III-c), 4) *Puntius brevis* (Plate II-d), 5) *Oxyeleotus marmoratus* (Plate II-e), 6) *Notopterus notopterus* (Plate III-d) and 7) *Tetraodon leiurus* (Plate II-f). We found 4 rare species of fish, including *Trichogaster trichopterus* (Plate I-b), *Mystus nemurus* (Plate I-a), *Channa striata* (Plate I-f) and *Macrogonathus siamensis* (Plate IV-e). During March the number of freshwater fish was collected higher than during April particularly in littoral zone (Table 1). This implied that the environmental

condition in March is suitable for fish to feed and thrive. This corresponded with Department of Fisheries (1993) reported that during late of April to middle of May most of freshwater fish will migrated to upper stream for spawning.

Of the total of 23 species (Table 1) the golden little barb (*Puntius brevis*) (Plate II-d) and the beardless barb (*Cyclocheilichthys apogon*) (Plate III-f) were the most common species in the Nong Han aquatic ecosystem. Beardless barb fish were collected at all sites, except at Don Sawan during March 2011 (Table 1). These two species are economically important freshwater fish. For example, the Thai people use them for making salted and fermented fish, and also to supply the ornamental fish market, therefore, generating income and improving their quality of life.

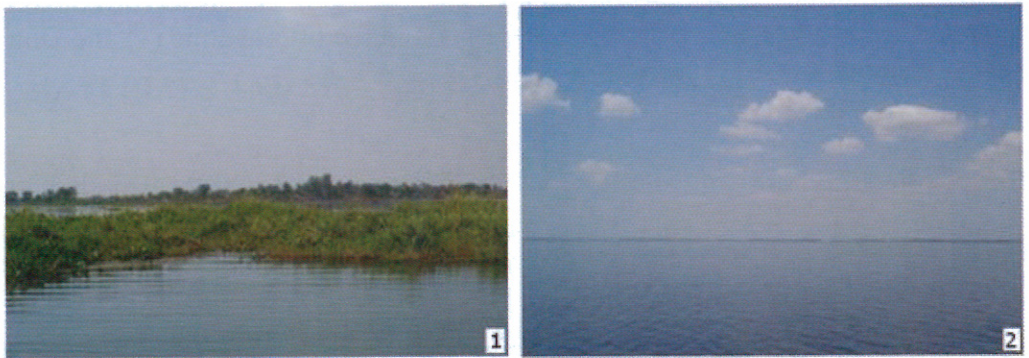


Figure 2. General views of the environmental status in the two study sites, Nong Han reservoir, Sakon Nakhon Province, Thailand: Don Chaing Ban (1) and Don Sawan (2).

Table 1. The data for freshwater fish in the Nong Han reservoir collected using gill nets at Don Chiang Ban (1) and Don Sawan (2) in March and April, 2011.

The freshwater fishes species arranged alphabetically in families	Common name	Vernacular name	Sites of Collection			
			March		April	
			1	2	1	2
Anabantidae	Common climbing perch	Pla mo thai	+	-	+	-
1. <i>Anabus testudineus</i>						
2. <i>Trichogaster trichopterus</i>	Three - spot gourami	Pla kradi mor	+	-	-	-
Bagridae						
3. <i>Mystus multiradiatus</i>	Iridescent mystus	Pla kayang kang lay	-	+	-	+
4. <i>Mystus nemurus</i>	Yellow mystus	Pla kod lueng	+	-	-	-
Centropomidae						
5. <i>Parambassis notatus</i>	Siamese glassfish	Pla pan kra jok	+	+	-	-
Channidae	Striped snake - head fish	Pla chon	+	-	-	-
6. <i>Channa striata</i>						
Cichlidae						
7. <i>Oreochromis melanopleura</i>	Striped tilapia	Pla mo tes kang lay	-	+	-	+
Cyprinidae						
8. <i>Barbodes gonionotus</i>	Common silver barb	Pla ta pien khao	+	-	+	-
9. <i>Cyclocheilichthys apogon</i>	Beardless barb	Pla sai tan ta dang	+	-	+	+
10. <i>Hampala dispar</i>	Eye - spot barb	Pla krasub jud	+	+	+	+
11. <i>Henicorhynchus siamensis</i>	Jullien's mud carp	Pla soy khao	+	+	+	+
12. <i>Labiobarbus siamensis</i>	Barb	Pla sa	+	-	+	-
13. <i>Osteochilus hasselti</i>	Bonylip barb	Pla soy nok kao	+	+	+	+
14. <i>Osteochilus lini</i>	Lini barb	Pla na mong	+	-	+	-
15. <i>Puntius brevis</i>	Golden little barb	Pla ta pien say	+	+	+	+
16. <i>Puntius orphoides</i>	Red - cheek barb	Pla kam cham	+	-	+	+
Eleotridae						
17. <i>Oxyeleotris marmoratus</i>	Marbled sleepy goby	Pla bu say	+	+	+	+
Matacembelidae						
18. <i>Macrogathus siamensis</i>	Spotted spiny eel	Pla load	+	-	-	-
Nandidae						
19. <i>Nandus nebulosus</i>	Bornean leaffish	Pla seao dam	+	+	+	-
20. <i>Pristolepis fasciatus</i>	Striped tiger nandid	Pla mo chang yeap	+	-	+	-
Notopteridae						
21. <i>Notopterus notopterus</i>	Grey feather back	Pla salad	+	+	+	+
Siluridae						
22. <i>Ompok bimaculatus</i>	Butter catfish	Pla Cha on	+	+	-	+
Tetraodontidae						
23. <i>Tetraodon leiurus</i>	Puffer fish	Pla pak pao	+	+	+	+
Total species in each site			21	12	15	12

Remarks: + = present; - = absent

Plate I. Freshwater fish collected from Nong Han, Sakon Nakhon Province, Thailand during March-April 2011.



(a)

YELLOW MYSTUS (*Mystus nemurus*)

(b)

THREE - SPOT GOURAMI (*Trichogaster trichopterus*)

(c)

EYE - SPOT BARB (*Hampala dispar*)

(d)

RED - CHEEK BARB (*Puntius orphoides*)

(e)

IRIDESCENT MYSTUS (*Mystus multiradiatus*)

(f)

STRIPED SNAKE - HEAD FISH (*Channa striata*)

Plate II. Freshwater fish collected from Nong Han, Sakon Nakhon Province, Thailand during March-April 2011.



(a)

BUTTER CATFISH (*Ompok bimaculatus*)

(b)

BARB (*Labiobarbus siamensis*)

(c)

COMMON SILVER BARB (*Barbodes gonionotus*)

(d)

GOLDEN LITTLE BARB (*Puntius brevis*)

(e)

MARBLED SLEEPY GOBY (*Oxyeleotris marmoratus*)

(f)

PUFFERFISH (*Tetraodon leirus*)

Plate III. Freshwater fish collected from Nong Han, Sakon Nakhon Province, Thailand during March-April 2011.



SIAMESE GLASSFISH (*Parambassis noratus*)



JULIEN'S MUD CARP (*Henicorhynchus siamensis*)



BONYLIP BARB (*Osteochilus hasselti*)



GREY FEATHERBACK (*Notopterus notopterus*)



BORNEAN LEAF-FISH (*Nandus nebulosus*)



BEARDLESS BARB (*Cyclocheilichthys apogon*)

Plate IV. Freshwater fish collected from Nong Han, Sakon Nakhon Province, Thailand during March-April 2011.



LINIBARB (*Osteochilus lini*)



STRIPED TIGER NANDID (*Pristolepis fasciatus*)



STRIPED TILAPIA (*Oreochromis melanopleura*)



COMMON CLIMBING PERCH (*Anabus testudineus*)



SPOTTED SPINY EEL (*Macrogathus siamensis*)

DISCUSSION

Geist (2011) reported that the freshwater ecosystem functions with both abiotic and biotic processes, which presents a major challenge for researches operating in the Nong Han aquatic environment. They both have an important role in freshwater stocking for human utilization in urban areas, while simultaneously serving as habitat and niches for many organisms (Doungsawas *et al*, 2003; Suthemechaikul *et al*, 2001; Koranantakul and Doungsawas, 1993). This study revealed that the highest species richness of freshwater fish was in Don Chaing Ban, a littoral zone (Figures 1 and 2) where up to 21 species were found (Table 1) out of a total of 23 species. In littoral where sunlight can be penetrated until the bottom of the lake then generated various species of aquatic plants and this phenomena is opposite with limnetic zone. The abundance of aquatic plants in this zone serves as habitat and provides niches for many freshwater fish particularly during the fingerling stage, and thus contributes to the conservation of species biodiversity.

The lowest species richness was in Don Sawan (Figures 1 and 2) which returned only 12 species (Table 1). Implied that this zone has less aquatic plants and because of that a low diversity of fish similar to the studied of Doydee and co-authors (2012). On the other hand, because the limnetic zone is open water with an abundance of phytoplankton and

zooplankton the fish in this zone are likely to be bigger in average length and weight than fish in the littoral zone (Smith and Smith, 2004), which is confirmed here by the study of Doydee and his co-authors (2012).

CONCLUSION

The diversity of freshwater fish was studied in the Nong Han reservoir to obtain informative data on the species composition in both the littoral and limnetic zones during March and April 2011. Twenty-three species of freshwater fish were found and are identified in the illustrations below. The study revealed the present status of native fish species. The restoration of the diversity of freshwater fish in this lake should be started in the littoral zones by using the dominant species. The protection of the habitat of fish must proceed with the awareness and cooperation of local people. The availability of stocks must be taken into account for sustainable fisheries resource management.

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