

# Spanner Barb at Thepchana Waterfall, Khao Nan National Park, Thailand

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**Abstract**—This study investigated morphology of the Spanner Barb (*Puntius lateristriga* Valenciennes, 1842) and water quality at Thepchana waterfall. This study was conducted at Thepchana Waterfall, Khao Nan National Park from March to May 2007. There were 40 Spanner Barb collected with 20 males and 20 females. Males had an average of 5.57 cm in standard length, 6.62 cm in total length and 5.18 g in total body weight. Females had an average of 7.25 cm in standard length, 8.24 cm in total length and 10.96 g in total body weight. The length (L) – weight (W) relationships for combining sexes, males and females were  $\text{Log}W = -2.137 + 3.355\text{log}L$ ,  $\text{log} W = -0.068 + 3.297\text{log}L$ , and  $\text{log} W = -2.068 + 3.297\text{log}L$ , respectively. The Spanner Barb were smaller size fish with a compressed form; terminal mouth; villiform teeth; ctenoid scale; concave tail; general body color yellowish olive, with slight reddish tint to fins; vertical band beginning below dorsal and horizontal stripe from base of tail almost to vertical band. They also had a vertical band midway between the eye and first vertical band. There was a black spot above anal fin. The bladder looked like J-shape. Inside of the bladder was found small insects and insect lava. The body length and the bowels length was 1:1 ratio. The water temperature ranged from 25.00 – 27.00 °C which was appropriate for their habitat characteristics. Acid - alkalinity ranged from 6.65 – 6.90 mg/l. Dissolved oxygen ranged from 4.55 – 4.70 mg/l. Water hardness ranged from 31.00 – 48.00 mg/l. The amount of ammonia was about 0.25 mg/l.

**Keywords**—Spanner barb, morphology, water quality.

## I. INTRODUCTION

**S**PANNER Barb is one of the most important fishery resources in southern Thailand and very abundant in Thepchana Waterfall, Khao Nan National Park, Nakhon Si

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Thammarat, Thailand. The Spanner Barb, or T-barb is a tropical freshwater fish belonging to the Cyprininae, sub-family of the Cyprinidae family. It originates in inland waters in Asia, and is found from the Malay Peninsula to Borneo. These fishes are inhabiting clear mountain streams strewn with rocks and boulders, and frequently found below waterfalls. They live in a tropical climate in water with a 6.00-6.50 pH, a water hardness of 10 dGH, and a temperature rang of 25.00 – 28.00 °C. They feed on worms, benthic crustaceans, insects, and aquatic plant matter.

Despite its importance to fisheries, little is known about the ecology of this species, particularly concerning sex ratio and size structure. Departure from 1:1 sex ratio is not expected for most fish species, although some fish populations may present a strong bias in this ratio. Such difference may be attributed to various causes, namely temperature influences on sex determination [2], selective mortality by sex through differential predation [3], and differentiated sexual behavior, growth rate, or longevity expectations. Sex ratio and size structure constitute information basic in assessing reproductive potential and estimating stock size populations [4]. Most studies available on this subject were done in temperate zones [5, 6]. This study aims to examine the length-weight relationship of Spanner Barb at Thepchana Waterfall, fish morphology and water quality. The results are imperative for future project of conservation of Spanner Barb in the Khao Nan National Park.

## II. MATERIALS AND METHODS

### A. Study Area

Thepchana Waterfall (0.8°46.045' N and, 0.99°48.146' E) was located at Khao Nan National Park, Nakhon Si Thammarat Province, southern Thailand, with an area of 436 km<sup>2</sup>. Khao Nan National Park was a large tropical rainforest, contains several wildlife habitat types, and many waterfalls (Fig. 1). Thepchana Waterfall is clear, sandy and boulder bottomed with less than 1 m in depth. The waterfall plays an important role in regional aquatic ecology, mainly for juvenile fishes that use the area as a rearing ground.

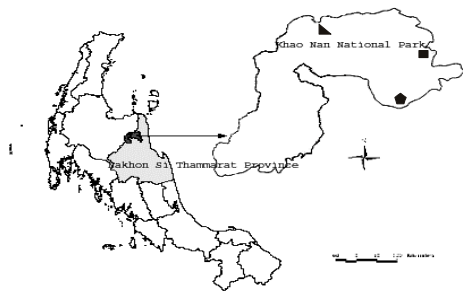


Fig. 1 Location of sample sites from (▲) Thepchana Waterfall, Khao Nan National Park, Nakhon Si Thammarat, Thailand

### B. Data Collection

The fish were caught by trawling with scoop nets mesh size  $5 \times 5$  mm,  $1.35 \text{ m}^2 = 1.50 \times 0.90$  m), gill nets (mesh  $5 \times 5$  mm;  $1.35 \text{ m}^2 = 1.50 \times 0.90$  m), and cast nets (mesh  $7 \times 7$  mm). The fish samplings were taken in three stations: upstream, middle stream and downstream with the distance of 500 m between each station. The samplings were done in triplicate in each spot. Sex was determined macroscopically by gonad observation after dissection; gonad state was determined according to Vazzoler [4]. Fish length was measured to the nearest 0.01 cm and weighed to the nearest 0.1 g.

The length-weight relationship for each sex and combined sexes were determined from samples. The length-weight relationship was calculated using Rounsefell and Everhart equation:  $W = aL^b$  [7], where  $W$  was wet weight (g) and  $L$  was the body length (cm) and  $a$  and  $b$  were parameters of regression.

We determined food items by analyzing stomach contents. We carried out on 20 fish specimens, corresponding to 50% of the total collected. Food items were deposited on a Petridish. Analyses were performed with a stereomicroscope for determination of the food items. The fish were identified by Smith [8, 9], Robert [10], and fishes were fixed in the field in 10% formalin and transferred to 70% ethanol. Voucher specimens were deposited in the Ichthyological collection of the Laboratory of the Rajabhat Nakhon Si Thammarat University. In addition, water quality at Thepchana Waterfall based on measurements as described in APHA, AWWA and WWF [11] from March-May 2007 were taken. Water quality measurements were composed of water temperature, air temperature, pH, hardness, ammonia, nitrite, and dissolved oxygen. The amount of dissolved oxygen was measured in the field using the X-mate Mettler Toledo Inlab 681. Acidity, alkalinity, hardness, ammonia, and nitrite were measured in the laboratory using titration methods.

### C. Statistical Analysis

The difference between males and females of the Spanner Barb for the average length and weight by an independent sample  $t$ -test was tested. Linear regressions were used to find some association between body weight and body length.

## III. RESULTS AND DISCUSSION

### A. Spanner Barb Taxonomy and Morphology

There were 40 Spanner Barb collected with 20 males and 20 females. The sex ratio (male:female) at Thepchana Waterfall was 1:1. Males had the average standard length of 5.57 cm, the average total length of 6.62 cm and the average weight of 5.18 g. Females had the average standard length of 7.25 cm, the average total length of 8.24 cm and the average weight of 10.96 g.



*Puntius lateristriga*

Kingdom	Animalia
Subphylum	Vertebrata
Class	Actinopterygii
Order	Cypriniformes
Family	Cyprinidae
Genus	Puntius
Species	<i>Puntius lateristriga</i> Valenciennes, 1842
Max. size:	18.0 cm (total length)
Environment:	Benthopelagic; freshwater
Climate:	Tropical
Importance:	Aquarium: commercial
Resilience:	Medium, minimum population doubling time 1.4-4.4 years (preliminary K or fecundity.)
Distribution:	Known from Mae-Klong, Mekong and Peninsular Thailand river systems, occurs in Sumatra, Java and Western Borneo, in Malaysia most common primary freshwater fish in drainages of Pulau Tioman.
Biology:	Usually inhabits clear mountain streams strewn with rocks and boulders, frequently found below waterfalls [13].

TABLE I  
ANATOMY AND FEEDING HABIT OF SPANNER BARB AT THEPCHANA WATERFALL, KHAO NAN NATIONAL PARK

Anatomy	
Body Shaped	Compressed form
Mouth	Terminal mouth
Teeth	Villiform
Scales	Ctenoid scales
Tail	Forked tail
Stomach shape	J-shaped
Intestine (cm)	10
Feeder	Worms, benthic crustaceans, insects, and plant matter
Body Lengths: Intestine	1:1
Average Standard Lengths (cm)	5.57
Male	7.25
Female	
Average Total Lengths (cm)	
Male	6.62
Female	8.24
Average Weights (g)	
Male	5.18
Female	10.95

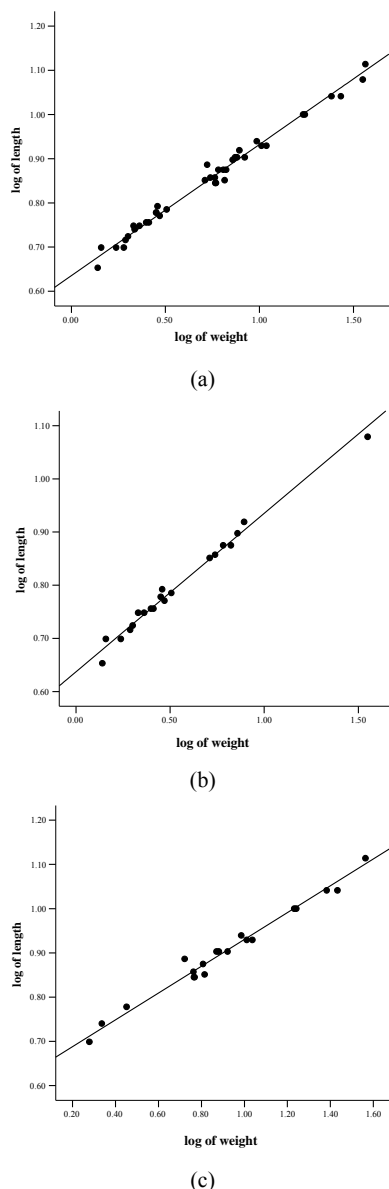


Fig. 2 Relationship between total length (cm) and body weight (g) of (a) combined sexes, (b) males and (c) females

The Spanner Barb was peaceful at smaller sizes fish. This fish had a body as a compressed form, terminal mouth, villiform teeth, cycloid scale, forked tail, The Spanner Barb were smaller sizes fish with compressed form, terminal mouth, villiform teeth, ctenoid scale, concave tail, General body color yellowish olive, with slight reddish tint to fins. Vertical band beginning below dorsal; horizontal stripe from base of tail almost to vertical band, also has vertical band midway between eye and first vertical band, black spot above anal fin. The bladder looked like J-shape and inside of the bladder was found small insects and insect larva. The body length and the bowels length was 1: 1 ratio (Table I). This fish anatomy was well suitable for living in a tropical stream where small insect and insect larva were available.

The average length and weight of samples were  $7.35 \pm 2.01$  cm and  $8.06 \pm 8.70$  g for the combined sexes,  $6.44 \pm 1.68$  cm and  $5.18 \pm 7.40$  g for males and  $8.23 \pm 1.97$  cm and  $10.95 \pm 9.11$  g for females, respectively. There was a statistically significant difference between the average length-weight of two sexes (independent sample *t*-test: length:  $t_{38} = 0.004$ ,  $P < 0.05$  for and weight:  $t_{38} = 0.034$ ,  $P < 0.05$ ).

Body length was positively associated with body weight relationships in combined sexes, males and females (linear regression: combined sexes:  $\text{LogW} = -2.137 + 3.355\text{logL}$ ,  $R^2 = 0.987$ ,  $n = 20$ ,  $F_{1,38} = 2772.232$ ,  $P < 0.0001$ ; males:  $\text{logW} = -0.068 + 3.297 \text{logL}$ ,  $R^2 = 0.979$ ,  $n = 20$ ,  $F_{1,18} = 1392.828$ ,  $P < 0.0001$ ; female:  $\text{logW} = -2.068 + 3.297\text{logL}$ ,  $R^2 = 0.979$ ,  $n = 40$ ,  $F_{1,18} = 842.461$ ,  $P > 0.001$ , Fig. 2a-c).

### B. Water Quality at Thepchana Waterfall

TABLE II  
PHYSICO-CHEMICAL PARAMETERS AND HABITAT CHARACTERISTICS AT  
THEPCHANA WATERFALL, KHAO NAN NATIONAL PARK

Parameters	
<b>Physical Parameters</b>	
Weather	Sunny, Overcast
Air Temperature (°C)	27.00-28.00
Water Temperature.(°C)	25.00-27.00
Stream Widths (m)	12.96
Stream Length (m)	11.70
Water Depth (m)	1.00-2.80
Current Velocity(m/s)	0.15-0.25
Elevation (m)	132
Water Condition	clear
Bottom Substrate	rocky and sandy
Habitat Description	Beautiful waterfall Nature trail to the waterfall fast flowing and clear water, rocky and sandy bottom , deep pools
<b>Chemical Parameters</b>	
pH	6.65-6.90
DO (mg/l)	4.55-4.70
Hardness (mg/l asCaCO <sub>3</sub> )	31.00-48.00
Nitrite (mg/l)	0.00
Ammonia (mg/l)	0.25

The physico-chemical characteristics were collected from Thepchana Waterfall (Table II). During this survey, the weather ranged from sunny to overcast. The air temperature and water temperature ranged from 27.00-28.00 °C and 25.00-27.00 °C, respectively. This is due to the location of the waterfall at a relatively high altitude and it being completely enclosed by forest canopy in most parts. During the survey period, the width and depth of the stream ranged from 12.96 m. and 1.00-1.80 m, respectively. It is postulated that due to the variation in the flow regimes caused by the wet and dry season, the width and depth of the streams could fluctuate further. The stream bottom is usually covered by a thin layer of algae and the banks are lined by boulders and rocks.

The current velocity was high at the shallow ripple area ranging from 0.15-0.25  $\text{ms}^{-1}$ . This high velocity is due to the steepness of the stream gradient. All these features are typical of the undisturbed first order stream at high altitudes. This type of river is strongly influenced by the riparian vegetation which generally reduces autotrophic production by the

shading and contributes large amount of allochthonous detritus [12].

The acid-alkali (pH) value ranged from 6.65 – 6.90. Dissolved oxygen ranged from 4.55 – 4.70 mg/l. Hardness ranged from 31.00 – 48.00 mg/l. This is characteristic of upstream water with low alkaline and hardness. The amount of ammonia was 0.25 mg/l.

#### IV. CONCLUSION

The characteristics in the Thepchna Waterfall at Khao Nan National Park is typical of the first order stream at high altitude. The Spanner Barb is dominant species in the family Cyprinidae. These fishes are specially adapted to living in swift flowing mountain rivers. This study suggests that mountain streams in the Khao Nan National Park including Thepdhana Waterfall are very important for freshwater fish diversity and conservation.

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