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Diets of Three Cyprinid Species from Huai Pa Dang Reservoir, Thailand

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ABSTRACT.– Gut contents of the cyprinid fish *Barbodes gonionotus* (Bleeker, 1850), *Barbodes schwanenfeldi* (Bleeker, 1853) and *Puntioplites proctozysron* (Bleeker, 1865) from Huai Pa Dang Reservoir, Phetchabun Province, northern Thailand were examined seasonally during May 2010 to February 2011. They were found to have consumed diverse food items, including aquatic insect fragments, copepods, cladocerans, ostracods and plant materials, with chironomid larvae being the main component in all three species. Although omnivorous, they all appeared to consume more animals than plants. The proportion of each food item in the diet depended on the season and fish species ($P < 0.05$). The niche breadth of *B. gonionotus* was higher than that of *B. schwanenfeldi* and *P. proctozysron*. The length-weight relationship of these three species ranged between 1.416 and 3.685, revealing that they have allometric growth. Their condition factors were higher than 1, indicating that they were in good condition. This basic ecological data, derived from gut analysis, may be useful to manage the development of fish food and in choosing species of fish for aquaculture in the future.

KEY WORDS: Cyprinidae, dietary overlap, length-weight relationship, niche breadth

INTRODUCTION

Huai Pa Dang is a natural reservoir located in Muang District, Phetchabun Province, northern Thailand, and lies at latitude 16° 27' N and longitude 101° 45' E. It is a major water source used for drinking water supply and crop irrigation, and is also an important area for native fish breeding. Members of the fish family Cyprinidae are widely distributed in Huai Pa Dang Reservoir all year round, and in particular *Barbodes gonionotus* (Bleeker, 1850), *Barbodes schwanenfeldi* (Bleeker, 1853) and *Puntioplites proctozysron* (Bleeker, 1865) are harvested in high quantities from Huai Pa Dang Reservoir (personal communication). Both *B. gonionotus* (Bleeker, 1850) and *B. schwanenfeldi* (Bleeker, 1853) commonly occur from Thailand through to Indonesia, while *P. proctozysron* (Bleeker, 1865) is distributed from Malaysia to northern Thailand, including Cambodia and Vietnam (Rainboth, 1996). These three fish species are widely distributed in all regions of Thailand, and are an important natural food source for local people, particularly *B. schwanenfeldi* which is also popular as an ornamental fish due to its colors (Vidthayanon, 2003).

According to Nyanti et al. (1999), a survey of fish fauna may provide basic and valuable information in the assessment of environmental impacts of economic development in the future. Identification of the dietary items of these fish then is useful to understand and manipulate the food availability in the natural habitats where they live to provide the potential for more optimal fishery yields (Al-Zibdah and Odat, 2007). The analysis of both the quality and quantity of fish diets is important for indicating patterns in fish survival (Islam et al., 2004), while studies on the fish feeding habits and fish food are useful to identify some of the higher trophic level relations in an aquatic ecosystem (Dadzie, 2007). However, there is no published data on the food composition of *B. gonionotus, B. schwanenfeldi* and *P. proctozysron* from the Huai Pa Dang Reservoir. The purpose of this work was to study the (1) diet composition, niche breadth, dietary overlap, (2) length-weight relationship (LWR), condition factor (K), and (3) gut fullness and relative length of gut (RLG) of *B. gonionotus, B. schwanenfeldi* and *P. proctozysron*.

MATERIALS AND METHODS

Fish were sampled seasonally between May 2010 and February 2011 from Huai Pa Dang Reservoir, Phetchabun Province of northern Thailand, and were kept in 10% (w/v) formalin. Body weights of all fish were weighed to the nearest 0.1 g, and their total length (TL) and fork length (FL) were measured to the nearest 0.1 cm. The gut of each fish was removed and measured as the gut length (GL, cm) before being opened to observe the gut fullness, scored as 0–4 based on Amisah and Agbo (2008), and contents. For the contents, semi-permanent slides of diet compositions were prepared as reported (Hanjavanit and Sangpradub, 2009), and examined under the light microscope. Food items were grouped according to their taxonomic category (order or family level) based on Sangpradub and Boonsoong (2006), and Chittapalapong and Somchan (2007). Each type of food prey was counted to determine a percentage frequency of occurrence (%F) and a percentage of number (%N) (Hyslop, 1980). Levin's measure was analyzed to determine the niche breadth, and the Morisita-Horn index was applied to determine the dietary overlap (Krebs, 1999). The calculated value of the Morisita-Horn index of overlap between species within 0–1 was as follows: 0.00–0.29 = low, 0.30–0.60 = medium, 0.61–1.00 = high overlap with biological significance (Langton, 1982).

The LWR of fish were calculated from the equation $W = aL^b$, where W = total body weight (g), L = TL (cm), a = intercept (constant) and b = slope (growth exponent) (Wootton, 1992; Ayoade and Ikulala, 2007). The slopes of the length-weight regressions (b) were compared to 3 (Cube law) by the student's *t*-test (Zar, 2010) to estimate whether the species had an isometric ($b = 3$), negative allometric ($b < 3$) or positive allometric ($b > 3$) growth pattern (Wootton, 1992; Kalayci et al., 2007). The condition factor (K) was computed using the equation $K = 100W/L^b$, with the same symbols as above, as reported previously (Swingle and Shell, 1971; Ayoade and Ikulala, 2007). The student's *t*-test was used to test the significance of any differences in K among seasons (Zar, 2010). The RLG of each species was determined from the equation RLG = GL/FL (Yamagishi et al., 2005. The Chi-squared test for independence (χ^2) was used to test the significance of the relationships between the %N of each food item and fish species or season (Zar, 2010).

RESULTS AND DISCUSSION

Diet composition

Table 1 lists the obtained %F and %N of various food preys in the guts of each cyprinid species. In the hot season, *B. gonionotus* fed on nine different categories of food items, of which the four most important were chironomid larvae (37.8%N), aquatic insect fragments (25.8%N), plant parts (18.6%N) and copepods (12.5%N). In the rainy season the diet diversity of *B. gonionotus* increased to 12 categories of food items, with the three most prevalent food categories being chironomid larvae (35.5%N), copepods (22.0%N) and aquatic insect fragments (11.7%N). In the cool season, *B. gonionotus* fed on eight food items with the three most dominant food items being chironomid larvae (34.7%N) followed by molluscs (26.9%N) and aquatic insect fragments (11.5%N). Over all seasons, *B. gonionotus* consumed 13 different types of food items (Table 1), the composition of which agrees with Nithirojpakdee et al. (2006) who reported that *B. gonionotus* in the Bangphra Reservoir, Chonburi Province, Thailand mainly fed on aquatic insect larvae, followed by plant parts, oligochaetes, zooplankton, adult insects and phyto-plankton. In addition, *B. gonionotus* from the Mekong River in Cambodia were reported to feed on both plant and animal matter (Rainboth, 1996), while *B. gonionotus* in rice fields in Bangladesh fed on aquatic plants, algae, zooplankton and aquatic insects (Yousuf Haroon, 1998).

For *B. schwanenfeldi*, these fish fed on eight food items in the hot season with the two most important being chironomid larvae (63.3%N) and aquatic insect fragments (17.1%N). In the rainy season, they also consumed eight different types of food items with chironomid larvae (53.4%N) and aquatic insect fragments (29.1%N) still being the most prevalent. In the cool season, *B. schwanenfeldi* fed on nine different categories of food, with chironomid larvae (50.1%N) still the most important and followed by gastropods (17.6%N). Over all the seasons, *B. schwanenfeldi* fed on 12 different food types (Table 1), but this composition differed from that reported previously in Thailand that *B. schwanenfeldi* only fed on aquatic plants and aquatic insects (Vidthayanon, 2004). However, Rainboth (1996) reported that the diet of *B. schwanenfeldi* from the Mekong River in Cambodia was slightly broader, in that it included aquatic plants, submerged land plants, filamentous algae, small fish and occasionally insects.

With respect to *P. proctozysron*, nine different categories of food items were found to have been consumed in the hot season, with chironomid larvae (51.2%N) and cladocerans (27.0%N) the main foods. In the rainy season, eight different categories of food items were found, with copepods (54.5%N) and chironomid larvae (27.4%N) as the most prevalent. In the cool season, they also fed on eight different categories of food items, with copepods (31.0%N), chironomid larvae (26.9%N), and molluscs (23.1%N) being the dominant items. Over all three seasons, *P. proctozysron* consumed 11 different food categories (Table 1), which was broadly similar to the reported diet for *P. proctozysron* from the Ubon Ratana Dam, Khon Kaen Province in Thailand of aquatic insects, zooplankton, gastropods, insect larvae, microbenthos, macrophytes, epiphytic algae, phytoplankton and detritus (Kakkaeo et al., 2004). Likewise, Rainboth (1996) reported that *P. proctozysron* from the Mekong River in Cambodia consumed mostly insects, zooplankton and some algae. That the diet composition here for these three fish species at the Huai Pa Dang Reservoir revealed a greater variety of food items for each of the three species than in previous studies at other sites is probably

TABLE 1. Comparison of the gut contents of *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* from Huai Pa Dang Reservoir, northern Thailand, expressed in terms of the % frequency of occurrence (%F) and % number (%N) of food items in the three different seasons.

Prey category	*B. gonionotus*								*B. schwanenfeldi*			
	Hot		Rainy		Cool		Average		Hot		Rainy	
	%F	%N	%F	%N	%F	%N	%F	%N	%F	%N	%F	%N
Protozoans												
Statoblast of bryozoans												
Rotifers	5.0	1.7	10.3	2.8			5.1	1.5				
Copepods	21.7	12.5	41.0	22.0			35.3	11.5	10.0	4.2	12.5	4.2
Cladocerans			15.4	6.1	8.3	7.7	18.2	4.6	13.3	5.7	8.3	2.1
Ephippiums of cladocerans			7.7	2.3			2.6	0.8			4.2	2.1
Ostracods	3.3	1.0	12.8	3.7			7.6	1.6	6.7	2.5	4.2	1.4
Chironomid larvae	41.7	37.8	48.2	35.5	41.7	34.7	43.8	36.0	66.7	63.3	54.2	53.4
Aquatic insect fragments	28.3	25.8	39.0	11.7	12.5	11.5	26.6	16.3	30.0	17.1	58.3	29.1
Hemipterans	3.3	1.0	12.8	1.4	8.3	7.8	8.2	3.4				
Molluscs (gastropod)					27.1	26.9	9.0	9.0				
Fish scales	1.7	0.6	2.6	0.8	4.2	3.8	2.8	1.7	13.3	1.7	4.16	1.4
Algae			12.8	5.7	4.2	3.8	5.7	3.2	6.7	3.8		
Plant parts	36.7	18.6	23.1	6.7	4.2	3.8	21.5	9.7	13.3	1.7	16.7	6.3
Unidentified items	3.3	1.0	5.1	1.3			2.8	0.8				

due to differences in the classification level as to the lowest possible taxon of prey items used between these studies, as well as to differences between the localities.

The frequency composition (%N) of each food item consumption in each season was significantly different between each fish species (the hot season: $\chi^2 = 95.415$, df = 18, $P < 0.05$; the rainy season: $\chi^2 = 1.094$, df = 20, $P < 0.05$; the cool season: $\chi^2 = 1.208$, df = 20, $P < 0.05$), whilst the %N of each food item eaten by each fish species was also dependent on the season (*B. gonionotus*: $\chi^2 = 1.321$, df = 20, $P < 0.05$; *B. schwanenfeldi*: $\chi^2 = 85.677$, df = 20, $P < 0.05$; *P. proctozysron*: $\chi^2 = 1.305$, df = 16, $P < 0.05$). There were significant relationships between the %N and fish species, and between the %N and season ($P < 0.05$), which is probably due to differences in the availability of the different food categories in the water body between seasons. These findings support those by Schafer et al. (2002), who reported that the feeding habits of fish vary with quantity and type of food items available in the habitat at that time. Fish have been reported to change their food habits seasonally, geographically and with age (Islam et al., 2004; Weliange et al., 2006; Ayoade and Ikulala, 2007).

Niche breadth and dietary overlap

With respect to *B. gonionotus*, the widest niche breadth was found in both the hot and rainy seasons ($B = 4.93$, $B_A = 0.36$) with a narrow niche breadth in the cool season ($B = 4.50$, $B_A = 0.50$). In contrast, for *B. schwanenfeldi*, the widest niche breadth was in the cool season ($B = 3.33$, $B_A = 0.29$) with narrow niche breadths in the rainy ($B = 2.65$, $B_A = 0.23$) and hot ($B = 2.29$, $B_A = 0.18$) seasons, while *P. proctozysron* also had the widest niche breadth in the cool season ($B = 4.37$, $B_A = 0.48$) and a narrow niche breadth in the hot ($B = 2.89$, $B_A = 0.24$) and rainy season ($B = 2.64$, $B_A = 0.23$). In this study, *B. gonionotus* had the broadest niche breadth of the three cyprinid species for all three seasons as well as overall, and so *B. gonionotus* is potentially a

TABLE 1. Continued

B. schwanenfeldi				*P. proctozysron*							
Cool		**Average**		**Hot**		**Rainy**		**Cool**		**Average**	
%F	**%N**	**%F**	**%N**	**%F**	**%N**	**%F**	**%N**	**%F**	**%N**	**%F**	**%N**
				8.3	2.2	8.3	2.1			5.6	1.4
6.3	5.9	2.1	2.0								
		7.5	2.8	16.7	6.6	75.0	54.5	33.3	31.0	41.7	30.7
4.2	2.9	8.6	3.6	36.1	27.0	12.5	5.4	10.3	3.8	19.6	12.1
		1.4	0.7			12.5	3.1	5.1	3.8	5.9	2.3
4.2	2.9	5.0	2.3	8.3	2.6	8.3	2.1	5.1	3.8	7.3	2.8
52.1	50.1	57.6	55.6	63.9	51.2	50.0	27.4	39.0	26.9	51.0	35.2
10.4	8.9	32.9	18.4	2.8	0.9	8.3	2.3	10.3	3.8	7.1	2.3
4.2	2.9	1.4	1.0								
18.8	17.6	6.3	5.9					25.6	23.1	8.6	7.7
4.2	2.9	7.2	2.0								
		2.2	1.3	2.8	1.2					0.9	0.4
6.3	5.9	12.1	4.6	2.8	1.6	12.5	3.1	7.7	3.8	7.7	2.8
				13.9	6.7					4.6	2.2

more generalist feeder than *B. schwanenfeldi* and *P. proctozysron*. Indeed, the niche breadth has been reported to quantify the diversity or breadth of the food resources utilized by a given species (Guruge and Amamarasinghe, 2008).

The dietary overlap values between pairs of fish species and the season is presented in Table 2. In this study at the Huai Pa Dang reservoir, *B. gonionotus* and *B. schwanenfeldi* seemed to have high niche overlaps in all three seasons and this was particularly high in the cool season (0.91). The dietary overlap between *B. gonionotus* and *P. proctozysron* was also high, but not as high as in the former two species, in all three seasons and slightly lower in the cool season. Whereas, *B. schwanenfeldi* and *P. proctozysron* had a low overlap in the rainy season and a moderate and high overlap in the cool and hot seasons, respectively. A high overlap is not necessarily coincident with food competition among two species of fish, as the overlap often elevates with increasing prey abundance because it is easier for each fish species to catch more diverse prey types (Macpherson, 1981). However, on the other hand, potential food competition among different species of fish is mostly declined or avoided through different choices of prey species (Fjøsne and Gjøsæter, 1996). Thus, considerable dietary

TABLE 2. Morisita-Horn index of food items between species and seasons based on the %Number of food items of *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* from Huai Pa Dang Reservoir, northern Thailand

Season	***B. gonionotus* and *B. schwanenfeldi***	***B. gonionotus* and *P. proctozysron***	***B. schwanenfeldi* and *P. proctozysron***
Hot	0.82	0.79	0.88
Rain	0.83	0.78	0.48
Cool	0.91	0.73	0.69

overlap does not necessarily mean a high competitive interaction, but competition is involved when there is a short supply of resources (Smith and Smith, 2001).

The LWR and fish condition (K) of the three cyprinid species at the Huai Pa Dang reservoir

The b value, or growth exponent, of *B. gonionotus* ranged from 2.673 in the cool season down to 1.951 in the rainy season and were significantly lower than 3 in all seasons (*t*-test = –1.99051, –0.84496, $P < 0.05$) indicating they had a negative allometric growth (Table 3). For *B. schwanenfeldi*, the b value increased from the hot to the rainy and cool seasons (1.416 to 2.414) and was significantly lower than 3 in all seasons (*t*-test = –1.34351, –0.46845, –1.35648, $P < 0.05$), indicating that *B. schwanenfeldi* also had negative allometric growth. However, while the b values of *P. proctozysron* were also low in the rainy and cool seasons and significantly lower than 3 (*t*-test = –0.67916, –11.35294, $P < 0.05$), showing negative allometric growth, it was significantly higher than 3 in the hot season (*t*-test = 0.63075, $P < 0.05$) indicating a positive allometric growth. Thus, *B. gonionotus* and *B. schwanenfeldi* show negative allometric growth and grow in length more than in weight. However, *P. proctozysron* showed a negative allometric growth in the cool and rainy seasons but a positive allometeric growth in the hot season. Since the b value is an indicator of food intake and growth pattern of fish (Wootton, 1992), this may differ according to the water temperature, food availability and habitat type.

The mean ± standard deviation of K values for *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* are presented in Table 3, where the mean K values were higher

TABLE 3. Length-weight relationship (LWR) and mean ± standard deviation (SD) of the condition factor (K) values of *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* from Huai Pa Dang Reservoir, northern Thailand.

Fish species	Season (N)	TL (cm)		W (g)		$W = aL^b$					T value (difference of b from 3)	$K = \frac{100W}{L^3}$
		min	max	min	max	a	b	SE	r	r^2		mean±SD
B. gonionotus	Hot (20)	16.5	21.0	65.0	98.7	1.167	2.528	1.660	0.775	0.601	–0.28433*	1.16±0.25
	Rainy (13)	20.5	23.5	130.0	153.0	0.363	1.951	0.527	0.814	0.662	–1.99051*	1.34±0.15
	Cool (16)	14.0	19.5	50.0	110.0	0.039	2.673	0.387	0.879	0.773	–0.84496*	1.49±0.18
B. schwanenfeldi	Hot (10)	14.5	19.0	60.0	90.2	1.408	1.416	1.179	0.861	0.741	–1.34351*	1.47±0.27
	Rainy (8)	16.4	21.0	65.0	98.4	1.249	2.020	2.092	0.819	0.671	–0.46845*	1.14±0.20
	Cool (16)	11.5	16.5	30.0	85.0	0.085	2.414	0.432	0.831	0.691	–1.35648*	1.76±0.29
P. proctozysron	Hot (12)	20.0	26.0	120.0	135.0	0.353	3.685	1.086	0.768	0.590	0.63075*	0.95±0.18
	Rainy (8)	20.0	24.5	120.0	135.0	0.011	2.221	1.147	0.655	0.429	–0.67916*	1.07±0.17
	Cool (13)	16.8	23.0	70.0	150.0	0.142	2.228	0.068	0.972	0.946	–11.35294*	1.33±0.15

*significance $P < 0.05$

N = number of fish examined, TL = total length, W = body weight, min = minimum, max = maximum, a = constant, b = slope (growth exponent), SE = standard error, r = correlation coefficient, r^2 = coefficient of determination.

than 1 in all seasons indicating the fish were in a good condition, except for *P. proctozysron* in the rainy season that had a K value just below 1, but were still in a good condition. The K value of fish can be influenced by sex differences, changes in season, gonad maturity level, stomach fullness and the LWR (Largler, 1956). The K value also provides information when comparing two populations for certain feeding, density, climate, and other conditions, and when following up the degree of feeding activity of a species to verify whether it is making a good use of its feeding source (Weatherley, 1972). In addition, K can be used as a good indicator of the fish's well-being in a natural habitat over time because it is based on the body length and weight, which reveals if the growth profile has either sped up or been retarded (Al-Zibdah and Odat, 2007).

Gut fullness and the RLG

Seasonal variation in the gut fullness of each cyprinid species is presented in Table 4. All three species showed the highest average degree of gut fullness in the hot season with slightly and a lot less in the rainy and cool seasons, respectively, although the gut contents in *B. schwanenfeldi* were lower than the other two species in the hot and rainy seasons. However, the decline in the gut contents in the cool season was less marked in *B. schwanenfeldi* than in the other two species. Thus, the gut fullness pattern was correlated with the season in all three species, with the lowest gut fullness scores during the cool season with a low temperature. This concurs with Santic et al. (2005), who reported that the gut fullness decreases during the winter may be due to either temperature-dependent physiological processes or lower metabolism of the fish and the lowered prey abundance leads to reduced predation during the winter.

The mean RLG value for *B. gonionotus* was greater than 1 in the hot and rainy

TABLE 4. Gut fullness and the relative length of gut (RLG) range (mean±SD) of *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* from Huai Pa Dang Reservoir, northern Thailand

Species	Season	Empty Gut (N)	Non-empty Gut (N)	No. of fish with gut fullness / total no. fish (%)					Average gut fullness score	RLG range (mean ± SD)
				0 (empty)	1 (¼ full)	2 (½ full)	3 (¾ full)	4 (full)		
B. gonionotus	Hot	2	18	2/20 (10.00)	3/20 (15.00)	2/20 (10.00)	3/20 (15.00)	10/20 (50.00)	2.80	1.06–1.53 (1.34±0.12)
	Rainy	2	11	2/13 (15.30)	2/13 (15.30)	1/13 (7.70)	2/13 (15.30)	6/13 (46.20)	2.60	1.03–1.26 (1.12±0.09)
	Cool	8	8	8/8 (50.00)	2/8 (12.50)	2/8 (12.50)	2/8 (12.50)	2/8 (12.50)	1.25	0.92–1.14 (1.00±0.60)
B. schwanenfeldi	Hot	1	9	1/10 (10.00)	2/10 (20.00)	2/10 (20.00)	2/10 (20.00)	3/10 (30.00)	2.40	0.94–1.14 (1.00±0.05)
	Rainy	1	7	1/8 (12.50)	2/8 (25.00)	1/8 (12.50)	2/8 (25.00)	2/8 (25.00)	2.25	0.81–1.10 (0.97±0.09)
	Cool	6	10	6/16 (37.50)	4/16 (25.00)	1/16 (6.25)	1/16 (6.25)	4/16 (25.00)	1.56	0.82–1.16 (0.92±0.09)
P. proctozysron	Hot	0	12	0/12 (0.00)	1/12 (12.50)	1/12 (12.50)	2/12 (16.6 6)	3/12 (37.15)	2.75	0.99–1.05 (1.02±0.02)
	Rainy	0	8	0/8 (0.00)	3/8 (37.15)	1/8 (12.50)	1/8 (12.50)	3/8 (37.15)	2.50	0.97–1.37 (1.08±0.13)
	Cool	6	7	6/13 (46.15)	5/13 (38.46)	0/13 (0.00)	0/13 (0.00)	2/13 (15.30)	1.00	1.14–1.35 (1.23±0.07)

seasons, and was 1 in the cool season, while that for *B. schwanenfeldi* was 1 in the hot season, and nearly (just below) 1 in the rainy and cool seasons. For *P. proctozysron*, the RLG was greater than 1 in all seasons. Thus, from this gut analysis, *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* are omnivores that feed on a larger proportion of animal components than plants, consistent with having a RLG of more than 1. This is based on the notion that a RLG of greater than 1 represents an omnivore or herbivore and a RLG of less than 1 represents a carnivore (Yamagishi et al., 2005). The diet composition shows that these three species mainly feed on chironomid larvae, followed by gastropods and ostracods, which inhabit the bottom of the reservoir, and that the fish also fed on pelagic copepods, cladocerans, aquatic insects, hemipterans, plant parts and algae, which dwell along the water column. Accordingly the fish are benthopelagic, a notion that is supported by previous work on these three species at the Chao Praya River of Thailand (Froese and Pauly, 2011). Even though *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* (family Cyprinidae) have a similar external morphology, *P. proctozysron* prefers to feed more on copepods and cladocerans than *B. gonionotus* and *B. schwanenfeldi*. This may be related to their habitat and the differences in the mouth morphology. Rainboth (1996) reported that *B. gonionotus* was found at the midwater to bottom depth, and *B. schwanenfeldi* at the midwater depth, whereas *P. proctozysron* was found in standing and slowly moving water, and usually found around submerged aquatic or inundated terrestrial vegetation. Such differences in habitats may considerably influence the diet (Godinho, 1994). Moreover, the fish in the genus *Barbodes* have a small, terminal mouth with the lower lip separated from the lower jaw by a shallow groove (Arkthaweewat, 2004), whereas fish in the genus *Puntioplites* have a relatively sub-terminal mouth, which may affect their feeding performance (Vidthayanon, 2003).

CONCLUSION

Knowledge on fish feeding can provide data about the habitat and feed availability in the environment and lead to an ecological and behavioral understanding of the fish species (Ferrareze and Nogueira, 2007). The diversity of the dietary food composition of *B. gonionotus*, *B. schwanenfeldi* and *P. proctozysron* at Huai Pa Dang Reservoir revealed that this habitat is suitable and is a remarkable area for the conservation of the diverse composition of the benthopelagic community, which could be important for the effective management of other commercially important fish species in the Huai Pa Dang Reservoir.

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