FOOD COMPOSITION AND NICHE CHARACTERISTIC OF GIANT FEATHERBACK (*Chitala lopis*, Bleeker 1851) IN KAMPAR RIVER, INDONESIA

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ABSTRACT

This paper provides information on the diets of *Chitala lopis* in Kampar River, Riau Province based on study conducted from Mei 2009 to November 2010. Fish species were obtained from fishers using modified nets, traps, hooks and lines. Specimens were cold with cool box at the point of collection and transported to the laboratory. A total of 176 fish specimens were inspected and their stomach contents were examined. The month-wise collection and experiments were made to exhibit the seasonal variation in food preferences, and feeding habit of the fish. Frequency of occasion and numerical methods were used in this study. Results of denote that *C. lopis* fed on juvenile fish, shrimp, plant material, insects, worms, benthos, gravel and unidentified organism. The consumption of shrimp tends to increase due to giant featherback's size, which relates to wider mouth, energy, location (water depth) and gonad development, also there is an increase of shrimp consumption during dry season. In giant featherback, the percentage of consumed shrimps is associated with sex and season, meanwhile the consumption of small fish and plant material is related to fish's size, sampling station and maturity index. Giant featherback tends to be more selective consuming certain food's group while growing.

KEYWORDS: Giant featherback, food composition, niche, Kampar River

INTRODUCTION

Giant featherback is an English name for *Chitala lopis* which is synonymous with *Notopterus chitala*. This species belongs to family Notopteridae in Osteoglossiformes order (Kottelat *et al*., 1993; 1997). The existent of Indonesian giant featherback origin from Asia mainlands which is distributed through Great River that connected between Asia mainlands with mainland is Indonesia. Nowadays giant featherback distributed in almost all major rivers and their watersheds, flood areas and lakes in Sumatra, Kalimantan and Java Island.

Over fishing activities, unfriendly fishing gears and changing environmental conditions led to declining fish species (Pollnac & Malvestuto, 1991), including giant featherback. Directorate General of Fisheries (2000) recorded an annual production of giant featherback in Indonesia continued to decline, namely: 8,000 tons (1991), 5,000 tons (1995) and 3,000 tons (1998). Linearly, the annual production of Kampar River's giant featherback also decreased, with 50 tons in 2003, 30 tons in 2004, 20 tons in 2005, 9 tons in 2006 and 10 tons in 2007 (Riau Fisheries, 2008).

Appropriate management strategies are extremely needed to avoid the extinction of Kampar River's giant featherback, these strategies including efforts to increase domestication of this species in order to reduce pressure on its natural populations and design effectively management strategies for its sustainability in nature. Therefore it is important to understand the dynamics of food composition and niche characteristic, this information is not only providing basic information for domestication efforts but also reflecting the condition of giant featherback's habitat in nature as the basis for population management. The research objectives are to examine the dynamics of food composition and niches characteristics in order to formulate and develop management strategies of giant featherback in the Kampar River.

MATERIALS AND METHODS

Study Area

Kampar River in the island of Sumatera emanates in the mountainous Bukit Barisan that is substantial for Riau Province fisheries. The river has 413.5 kilometer long, its average depth is 7.7 m and width is 143 m. The total catchment of Kampar River is approximately 12.000 km^2.

Catch Sampling and Laboratory Procedures

Fishes were randomly sampled almost monthly from five sampling stations located along the Kampar River (Fig. 1). The fish specimens were collected by modified nets, traps, hooks and lines from May 2009 to November 2010.

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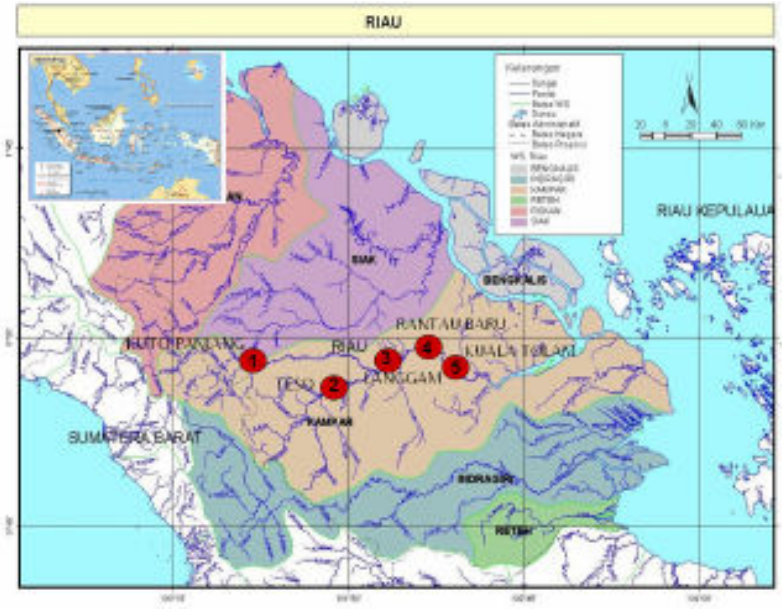

Figure 1. Five sampling stations located along the Kampar River, Indonesia (marked with red dot).

Samples were cold in iced blocks at the point of collection before being transported to the laboratory of Biology, Research Institute for Inland Fisheries for analysis. Data on size, sex and maturity stage were gathered for all fish samples. Body weight and gutted weight were measured to the nearest 0.1 gram (g), gonads to the nearest 0.1 mg after depleting excess water with a pile of filter paper while standard length was measured in centimeter employing a measuring board. Specimens were operated and the gut grabbed to repeal the stomach. The contents were cleared into petridish for analysis. The gonad maturity was classified into four stages: I immature; II developing or recovering spent; III maturing; and IV ripe based on Cassie modification (Effendi, 1997; 2002).

Diets Analysis

- ***Index of preponderance***

Index of preponderance (IP) was calculated using the formula of Natarajan & Jhingran in Effendie (1979). In The index of preponderance method, the occurrence of food items was revealed as the percentage of the total number of stomach containing food.

Ontogenic variations in size, sampling stations, maturity and season-related diet were investigated by employing correspondence analysis in SPSS 12.0 for 3 size classes of fish namely small, medium and large-size fish. Size classes were derived from all fish length pooled across the sampling months. Small size was grouped ranged from 401 to 610 mm, the medium size was pooled between 611 to 750 mm and finally the large size was grouped between 751 to 960 mm. The ranged was tried to be as similar as possible, however in order to make good interpretation a group has longer size range than the others.

- ***Niches***

Extensive analysis of dietary niche was conducted in order to see the proportion of food resources utilized by the fish. Broad niche was calculated using the formula proposed by Levins *in* Krebs (1989).

RESULTS AND DISCUSSION

RESULTS

Total Catch

There were 176 giant featherbacks collected during sampling periods (Fig. 2). Overall size ranged from 401 to 960 mm and weight ranged from 350 to 7100 g. Proportion of catch composition dominated by a small group, with its percentage ranging from 54.05 - 79.49% (Fig. 3).

Fish samples were analyzed based on season, which can be distinguished according to the dry season (April, May, June, July), intermediate (February, March, August, September) and rainy season (October, November, December, January) referring to meteorology station. *The greatest number* of fish was captured in the rainy season and had the least catch occurred during the dry season (Fig. 4).

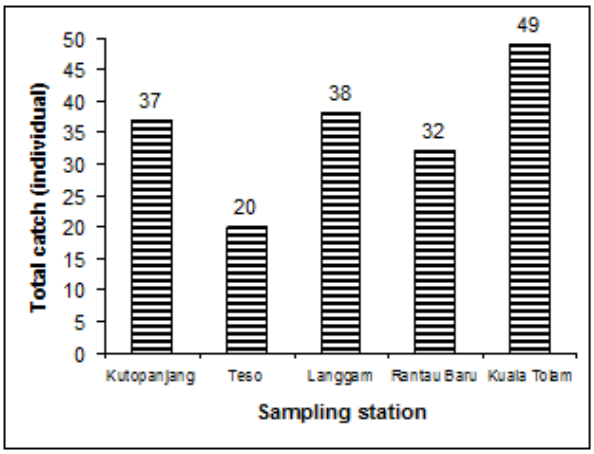

Figure 2. The amount of fish collected at each sampling station during sampling period.

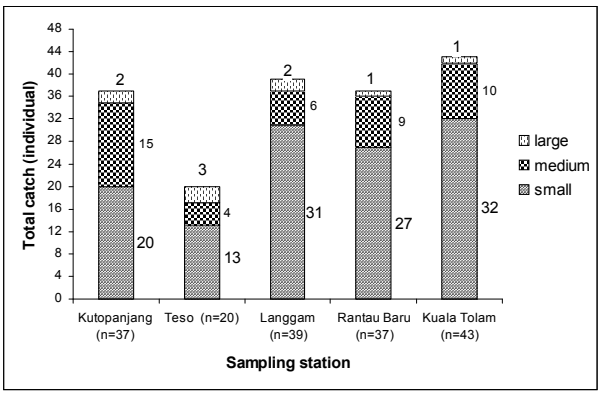

Figure 3. The amount of fish collected based on size.

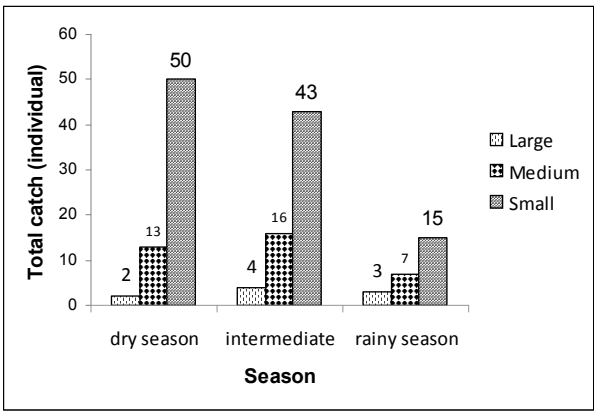

Figure 4. The amount of fish collected based on season.

Food Composition

- ***Food composition in general***

Observations food composition of giant featherback only performed in stomach site because of digested reason. It was assumed that food organism in this stomach site was not digested completely, so it is easier to identify. A number of 153 specimen of giant featherbacks have stomach content while 23 individuals were empty condition. In general there are eight groups of food in giant featherback stomach, i.e small/juvenile fish, shrimp, plant material, insects, worms, benthos (others then worms), gravel and unidentified organism (Fig. 5).

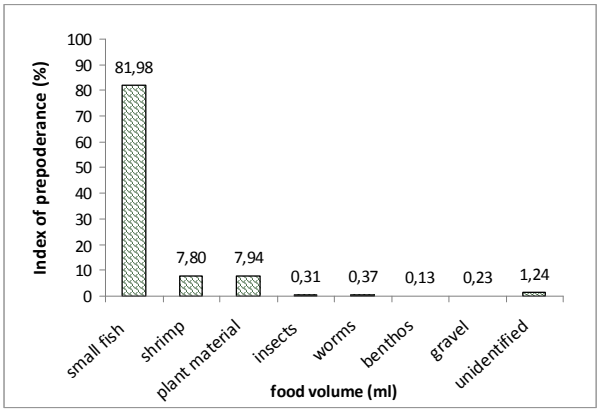

Figure 5. Giant featherback's food composition in general (N = 153).

- ***Food composition based on sex***

The purpose of analysis is to determine whether there is any existed difference between food composition consuming by male and female. After the standardization process (which is comparing male and female giant featherback on the same group size, station, season and maturity index), we concluded that female giant featherback consuming more crustaceans (shrimp) compare to male (Fig. 6).

- ***Food composition based on sex and fish's size***

Both male and female giant featherback consuming more shrimps when they grow, (Fig. 7). However small fish is the dominant food consumed by giant featherback in almost all size both male and female (Fig. 8).

- ***Food composition based on sex and season***

It can be informed that both female and male giant featherback starting to consume shrimps in substantial amount during intermediate and dry season (Fig. 9). There is a tendency, the percentage of crustaceans increased linear with increasing fish's size, especially in rainy season. However, the pattern is not explicit during intermediate and rainy season (Fig. 10).

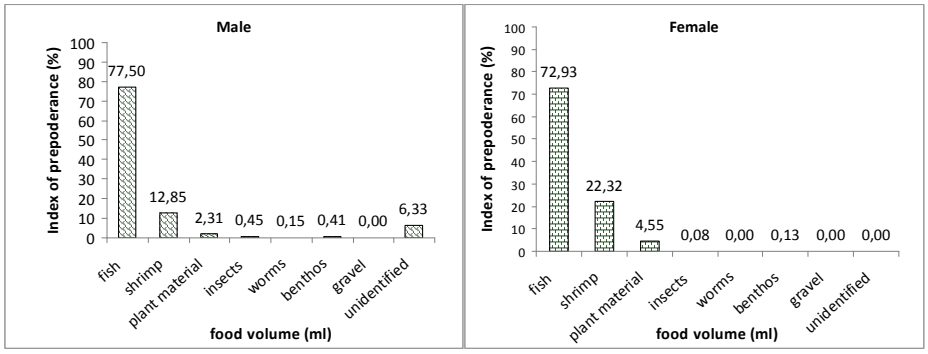

Figure 6. Giant featherback's food composition based on sex, (male, n = 7, female, n = 6).

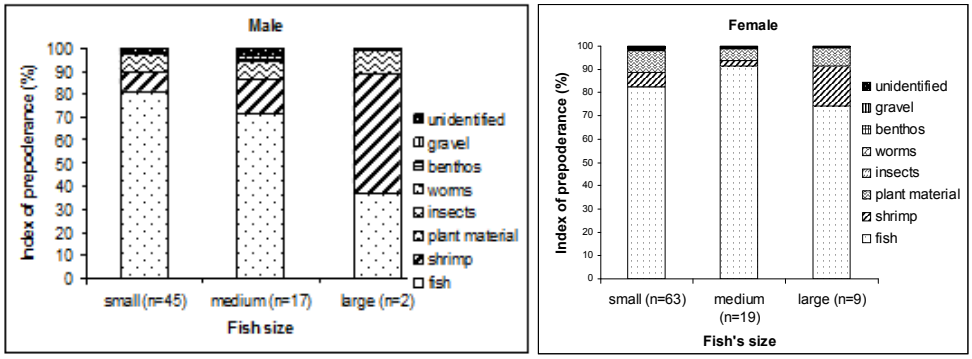

Figure 7. Giant featherback's food composition based on sex and fish's size (small size = 401-610 mm), (medium size = 611-750 mm), large size = 750-960 mm).

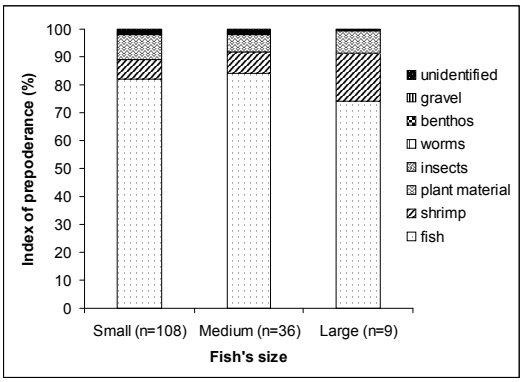

Figure 8. Giant featherback's food composition based on fish's size.

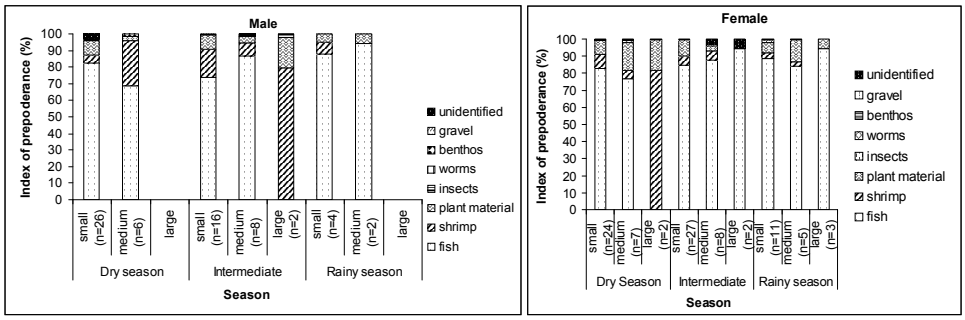

Figure 9. Giant featherback's food composition based on sex and season.

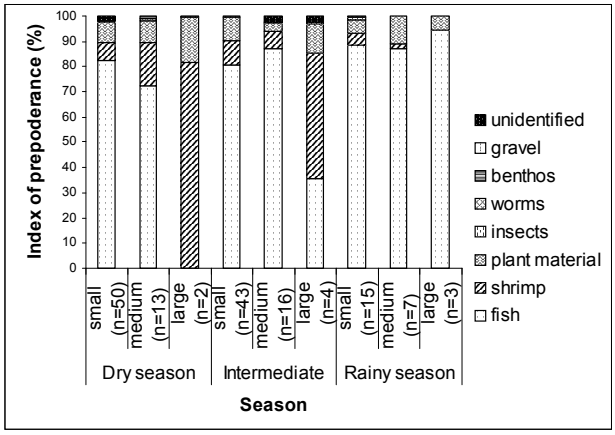

Figure 10. Giant featherback's food composition based on season.

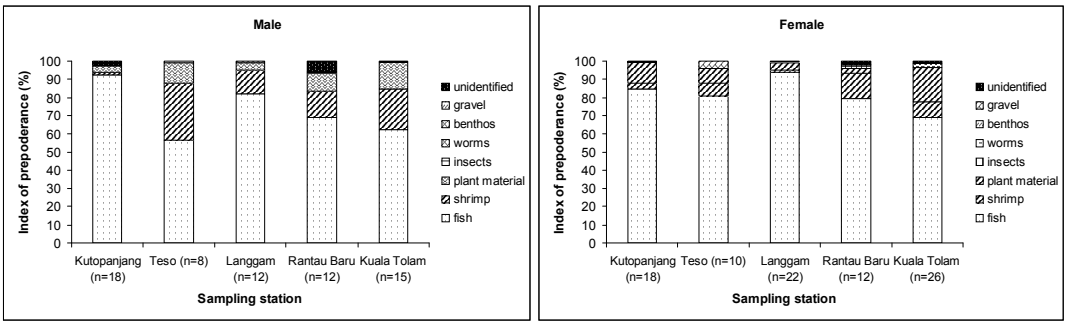

Figure 11. Giant featherback's food composition based on sex and sampling station.

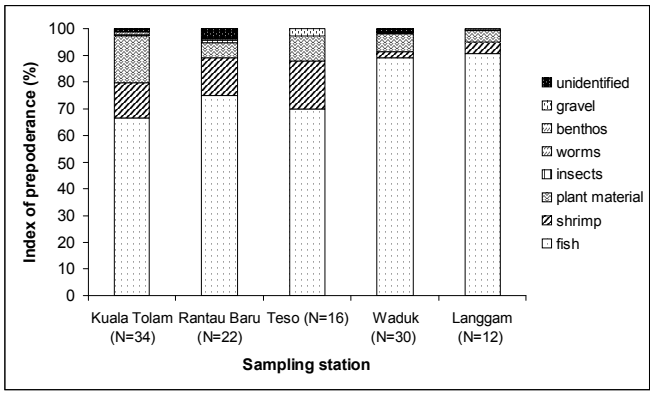

Figure 12. Giant featherback's food composition based on sampling station.

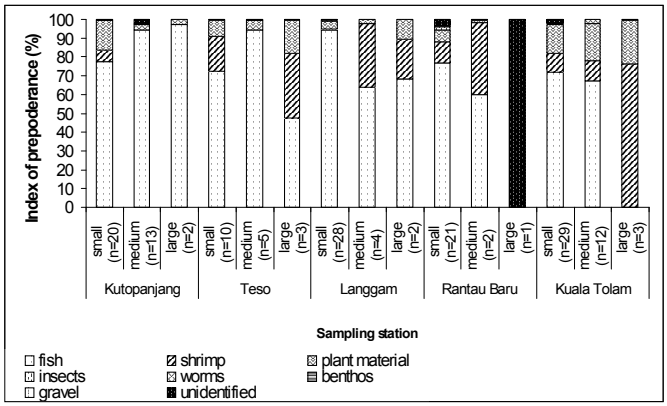

Figure 13. Giant featherback's food composition based on fish's size and sampling station.

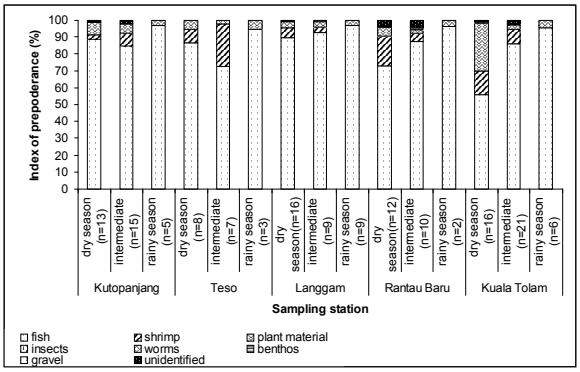

Figure 14. Giant featherback's food composition based on season and sampling station.

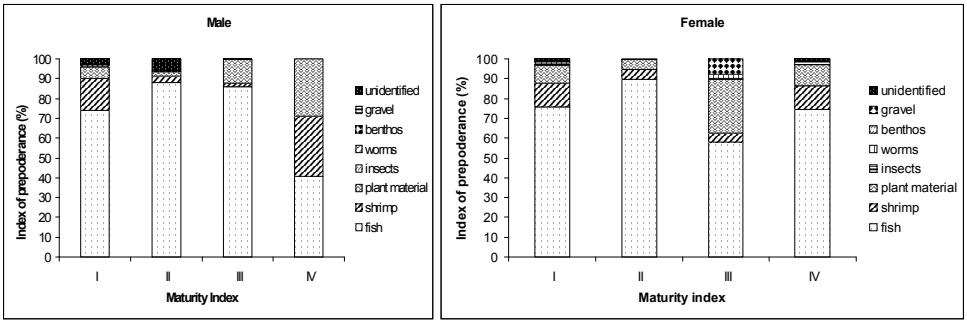

Figure 15. Giant featherback's food composition based on sex and maturity index.

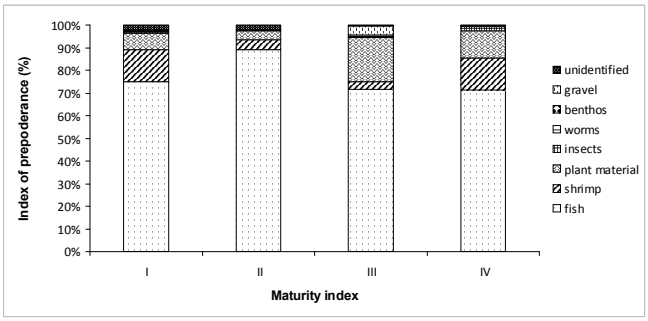

Figure 16. Giant featherback's food composition based on maturity index.

- ***Food composition based on sex and sampling station***

Small fishes become the major food of giant featherback both male and female in every sampling station (Fig. 11). Giant featherback in Waduk Kutopanjang and Langgam station exhibit less shrimps consumption (Fig. 12), compare with others station.

- ***Food composition based on fish's size and sampling station***

Food composition was variable based on giant featherback's size and station (Fig. 13). However, there was a substantial plant material consumption in Kuala Tolam station compare to other stations.

- ***Food composition based on sampling station and season***

Giant featherback only consumed small fishes during rainy season in every station (Fig. 14). Food consumption was highly variable during dry season and intermediate, even though small fish still become major giant featherback's food.

-***Food composition based on sex and maturity index***

Small fishes were remain the major giant featherback's food, however there is a substantial shrimp consumption during the stage IV of maturity index, especially in male (Fig. 15). In the standardization schema (comparing maturity index

Figure 17. Giant featherback's food composition based on sampling station and maturity index.

with the same size, sex, season and station), the consumption of shrimp was seen on every stage of maturity index (Fig 16).

- ***Food composition based on sampling station and maturity index***

Station Teso and Kuala Tolam exhibit high consumption level of shrimp during the fourth stage of maturity index, whereas no existed shrimp in giant featherback's stomach in Langgam and Kutopanjang during the sampling period (Fig. 17).

- ***Correspondence food composition***

High consumption level of shrimps was detected at station Teso and Koala Tolam (Fig.18). Kuala Tolam has also exhibited a magnitude level of plant materials consumption, whereas small fishes were more consumed in Langgam, Rantau Baru and Waduk Kutopanjang (Fig. 19). Shrimps have strong correspond with sex and season, meanwhile the level consumption of small fishes and plant materials are highly related with fish's size, sampling station and maturity index.

Food Niche

- ***Food niche based on size classes***

Food niche ranged from 1.023-3.054 and 0.023-0.614 after standardization scheme. The highest food niche was 3.054 found in 401 - 470 size class, while the lowest food niche was 1.023 in size class of 821 – 960 (Tab. 1).

- ***Food niche based on sampling station***

Based on sampling station, food niche ranged from 1.752 - 3.235 and 0.188 - 0.558 after standardization schem (Tab. 2). Kuala Tolam was the highest food

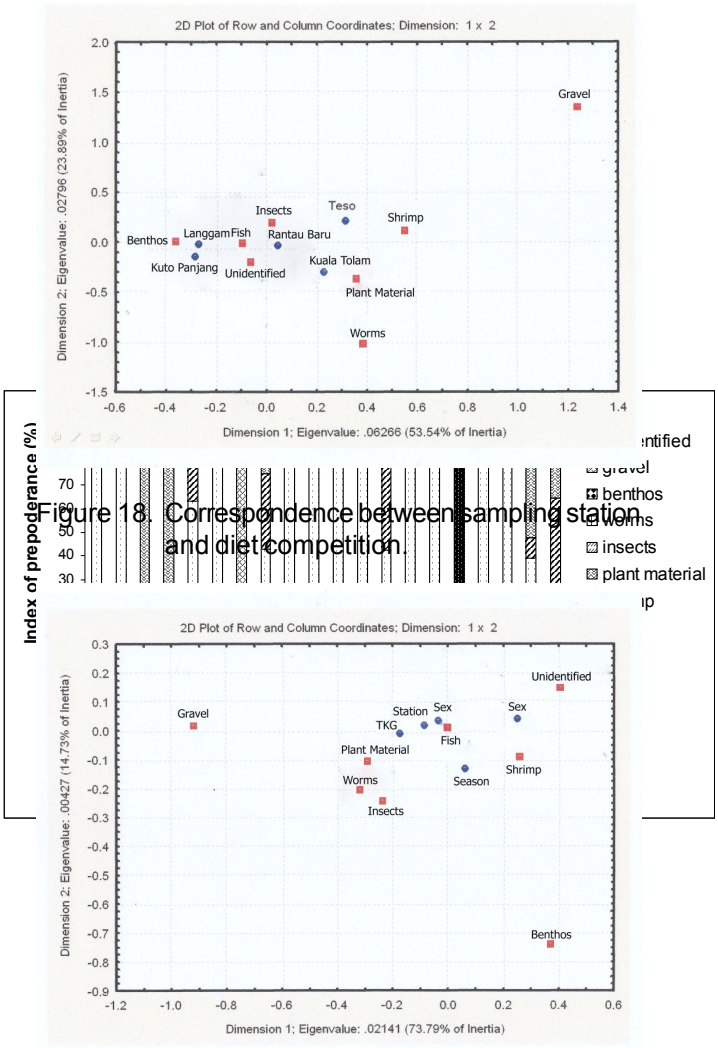

Figure 18. Correspondence between sampling station and diet competition.

Figure 19. Correspondence between food index with season, size, sampling stations and maturity.

niche with 3.054, while Waduk Kutopanjang as the lowest food niche's station with 1.752.

Table 1. Food niches based on size classes of giant featherback

Classes size	Niche value	Standardization
401-470	3.054	0.228
471-540	1.975	0.122
541-610	2.259	0.523
611-680	1.906	0.302
681-750	1.614	0.614
751-820	2.138	0.379
821-890	1.023	0.023

Table 2. Broad dietary niche based on Giant Featherback sampling station

Sampling station	Food niche	Standardization
Waduk Kutopanjang	1.752	0.188
Teso	2.659	0.276
Langgam	1.96	0.24
Rantau Baru	2.522	0.19
Kuala Tolam	3.235	0.558

DISCUSSION

The major food items of *Chitala lopis* in Kampar River were similar, mainly juvenile/small fish, shrimp, plant material, insects, worms, benthos (other than worm), gravel and unidentified organism. The feeding habits were identical to those notified by Adjie & Utomo, (1994) in the Lempuing, Musi River; and Adjie *et al*. (1999) on *Chitala lopis* from Batanghari River, Jambi. The presence of high percentage of certain food, juvenile fish, in their stomach marked preference for specific food type as also found in *C. chitala* larvae actively feed on several types of organisms (tubifex, chironomous larvae and plankton) (Sarkar *et al.*, 2006) and *Oreochromis niloticus* fed on mainly macrophytes (Oso *et al.*, 2006). Examination of the diet showed that there was high percentage of plant material of *C. lopis* from Kuala Tolam station in their stomach. This result was strongly related to appearance of dense riparian vegetation along the sampling station. Effendi (1997) stated that the availability of food, flavor, food size, color, texture and taste are the factors govern the food consumption.

Immature fishes were fed with almost equal intensity throughout the year; this finding was similar to *Cyprinus carpio* var *specularis*, reported by Manon & Hossain (2011). The consumption of shrimp in *C. lopis* tends to increase as raises in body and mouth size. Labropoulou *et al.* (1997) stated that ontogenetic switches in feeding habits are a general phenomenon among fish and result from increases in body and mouth size that permit fish to capture a broader range of prey sizes and types. Ontogenetic variations in diet composition were also observed on hairtail (*Trichiurus margarites)*, ranging from 121 to 561 mm PLs (Yan *et al,* 2012). Related to energy, larger fish needs more energy than small fish, so they prefer more energy food (Effendie 2002). This research informed that higher shrimp's consumption detected during maturity index in stage IV. It was logical, since shrimp contains lots of cholesterol. Cholesterol substances were needed to stimulate the formation steroid hormones that play an important role in gonad maturation process. Yan *et al* (2012) informed with increasing gonad maturity stages, higher feeding intensity and fewer empty stomachs were observed.

C. lopis pointed season differences in diet composition and feeding intensity, as also observed in many teleost species such as fish species in a boreal tidal basin (Kellnreitner *et al.*, 2012). There is a substantial increase of shrimp consumption during dry season, while only limited to juvenile fishes were consumed during rainy season. According to Effendie (1997), the amount and variety of food consumed usually depend on age, place and time. Juvenile fish was less present during the dry season, so the giant featherback move deeper to the bottom, this condition is contrast during rainy season as a result of spawning season. Low shrimp consumption has been detected in Langgam and Waduk Kutopanjang, presumably due to the water depth. In deeper waters, the oxygen content lower and *high* concentrations of *organic materials,* so that this life zone *supports less shrimp*-like crustaceans *species.* In giant featherback, the percentage of consumed shrimps has been correspondence with sex and season, meanwhile small fish and plant material are related to fish's size, sampling station and maturity index.

Small giant featherback consumed more variety food group compared to large fish, it assumed that small sized to have wider niches breadth than large giant featherback. Giant featherback tend to more selective consumed foods when they grow as carnivore fish. According to Nikolsky (1963) carnivorous and predatory fish tend to be more specialists. Giant featherback from Kuala Tolam station exhibited the most broad michrohabitat niches, meanwhile species from Kuto Panjang reservoir has very narrow niches, tend to be specialists, relying on comparatively few

food sources. The classification of broad niches is linked to food's abundance, fish condition and the ability of fish to utilize the available food. Lagler (1972) mentioned that not all types of food resources will be consumed, but depending on food's size, the availability of food in nature and the food's taste. The maintenance of natural populations is an important aspect of sustainability. This study showed that based on food consumption and broad niches Langgam station is the most suitable habitat for giant featherback, which can be designed as conservation area.

CONCLUSION

The major food items of *Chitala lopis* in Kampar River were mainly juvenile/small fish, shrimp, plant material, insects, worms, benthos (others then worm), gravel and unidentified organism. Immature fishes were known to feed with almost equal intensity throughout the year. However the consumption of certain food, such as shrimp, tends to increase as proceeds from raises in body, mouth size and gonad maturity stages. There is a substantial increase of shrimp consumption during dry season, while only limited to juvenile fishes were consumed during rainy season.

Small sized giant featherback consumed more variety food's group compared to large fish, it assumed that small sized to have wider niches breadth than large giant featherback. Giant featherback tend to more selective consume certain foods when they are growing because they are carnivore fish. Giant featherback from Kuala Tolam station exhibit the most broad michrohabitat niches, meanwhile species from Kuto Panjang reservoir has very narrow niches, tend to be specialists, relying on comparatively few food sources. This study showed that based on food consumption and broad niches Langgam station is the most suitable habitat for giant featherback, which can be designed as conservation area.

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