

## PREYING FREQUENCY OF WHITE-THROATED KINGFISHER, *Halcyon smyrnensis* (LINNAEUS 1758)

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### ABSTRACT

A study was conducted on 'Preying frequency of White-throated Kingfisher, *Halcyon smyrnensis* (Linnaeus 1758) in Bangladesh' from September 2008 to September 2011 at Nikunja-1 in Dhaka City Corporation area. The objectives of the study were to know the average preying frequency per day in different months and seasons. Scan sampling method was followed to study the kingfishers' behaviour. At regular interval (5 minutes), day long observation was made with some observatory equipments. It preyed  $4.1 \pm 2.3$  times per day on an average. They had bimodal feeding patterns, at morning (0701-1200 h) and afternoon (1401-1800 h). At noon they avoided preying. December was the highest preying month and summer was the highest unsuccessful preying season in the year. The food items composed of 36.6% arthropods and 61.1% fishes. Arthropods were preyed for 1.5 times and fishes for 2.5 times on an average per day. In association with arthropods and fishes they also preyed on amphibians and reptiles occasionally. Arthropods were preferred highly during non breeding season but fishes were preferred in breeding season for saving time and energy.

**Key words:** Preying frequency, White-throated Kingfisher, *Halcyon smyrnensis*, Bangladesh.

### INTRODUCTION

White-throated Kingfisher (*H. smyrnensis*) is a common species of a variety of habitats, mostly open country in plains with trees, electric wires and other perches (Ali *et al.* 2010a). It is found in Turkey, northern and central Israel, and Egypt through to Iraq, Iran, Afghanistan, northwestern India (Ali and Ripley 1983) and parts of Southeast Asia (del Hoyo *et al.* 2001, Fry *et al.* 1992).

In India, studies are limited to casual observations and feeding behaviours and breeding of White-throated Kingfisher (*H. smyrnensis*) (Ali *et al.* 2010b, Asokan *et al.* 2009, Balasubramanian 1992, Hore *et al.* 1991, Mukherjee 1975, Oommen

and Andrews 1996 1998, Palkar *et al.* 2009, Sen 1944, Sirinvasulu 2004, Yahya and Yasmin 1991). White-throated Kingfisher is well known for its versatile food and feeding habits (Ali and Ripley 1983, Mukherjee 1975). Many researchers studied about the diets of the White-throated Kingfisher (Ali 1996, Ali *et al.* 2010a, Asokan *et al.* 2009, Burton 1998, Roberts and Priddy 1965, Roza *et al.* 1995, Soud *et al.* 2010, Yahya and Yasmin 1991) in India and Srilanka. In Bangladesh, studies on the Kingfishers are scanty. Some causal information is found in Bangladesh about the kingfishers (Ahsan and Saeed 1990, Husain 1979, Husain *et al.* 1983, Islam *et al.* 1999, Khan 1982, 1986, Reza *et al.*

2003, Sarker 1985, 1986, 1989). Except these observations nothing is known about the Kingfishers in Bangladesh.

Like any other creatures, number of birds including kingfishers is declining, causing imbalance in nature. Although kingfishers are still seen in our wetland, its population are declining due to different factors, as seen in the past to the present days. Their uses are seen diversified (Animal Diversity 2007, Fry *et al.* 1992, Wikipedia 2010). Although they may get benefit from human dams and fish farming, they are at risk of poisoning through bioaccumulation of pollution and toxins in their fish prey (Rayner *et al.* 1991). Thus, necessary measures should be taken immediately to conserve their population in nature. Therefore, one should know the monthly and seasonal variation of preying and preying frequency during breeding and non breeding season. On the basis of this study one can take necessary measures for their conservation and management. Hence, the present study investigates 'the preying frequency of White-throated Kingfisher (*H. smyrnensis*) in Bangladesh'.

## MATERIALS AND METHODS

The study on 'Preying frequency of White-throated Kingfisher (*H. smyrnensis*) in Bangladesh' was done from September 2008 to September 2011. The study was carried out in Nikunja-1, Uttara, Dhaka, Bangladesh. This area is under the Dhaka City Corporation and on the west side of Dhaka Airport highway. There are two Lakes, one on the east (23°49'14.81" to 23°49'36.04" N latitudes and 90°25'02.38" to 90°25'12.30" E longitudes) and the other on the west side (23°49'26.33" to 23°49'30.77" N latitudes and 90°24'55.60" to 90°24'59.82" E longitudes) of the Nikunja-1 residential area. The size of the eastern lake is 668.5 × 17.07 m and western lake is 218.13 × 75.05 m. The northern and southern side of Nikunja-1 is surrounded by Nikunja 2 residential area and Dhaka Cantonment Golf field respectively.

Preying frequency was observed at least once a week in non-breeding season and thrice in a week in breeding season. The birds were watched from dawn to dusk as the species are diurnal. Behavioural data were collected using the focal animal sampling technique of Altmann (1974). In each one hour, there were three 15-minute continuous monitoring periods followed by a 5-minute break. During each 15-minute period, only one bird was monitored. If any important activities were found on another bird those were also noted. A total of 1672 hours in 144 days were spent in the field and 5016 scans were made during the study period.

During preying, the frequency of preying (no. of dive into water or no. of plunge in the air for successful or unsuccessful preying) of different food items by each individual was noted per scan. The average preying frequency per day, per hour and per month in a year and even during breeding and non-breeding season was noted. Daily, monthly and seasonal variation of preying frequency of arthropods and fishes in a year and even during breeding and non breeding season was also noted. To find out the seasonal variation, the year is divided into three seasons, November to February as winter, March to June as summer and July to October as monsoon.

## RESULTS AND DISCUSSION

### Preying frequency

*H. smyrnensis* preyed on a number of different species and more than 70% attempt was successful (n = 267). They preyed on different species of food of which fishes (61.1%) were highly preferred. On an average, they preyed 4.1 ± 2.3 times per day.

### Preying at different day periods

The preying frequency insignificantly varied at different day periods ( $\chi^2 = 2$ , df = 9, p > 0.05). The increasing rate was found from 0701-1000 h. After a long overnight starvation the bird started to prey from early morning but the frequency was related with the sunlight when the highest frequency was at 0901-1000 h. But after 1001 h the frequency

was decreasing and at mid-day (1201-1400 h) (n = 193) they avoided preying. From 1401-1700 h the preying frequency again increasing while the highest was 1501-1700 h which need for their overnight energy requirements (Fig. 1). It was also related with their sunlight. The preying frequency was decreasing as the sunlight decreasing.

Several studies in Corbett National Park, Bandhargarh National Park, and Sundarban National Park also found most hunting by *H. smyrnensis* during the morning or comparatively less in the evening hours (EcoIndia 2008). The White-throated Kingfisher had a typically bimodal feeding pattern, one during the morning (06:00-09:00 hrs) and another during the evening (15:00-18:00 hrs) as shown for other species (Ali *et al.* 2010a, Asokan 1995, Evers 1994, Natarajan 1991, Ramachandran 1998, Rodway 1998, Sivakumaran and Thiyagesan 2003). Feeding activity in the late evening may reflect their need for their overnight

energy requirements (Kelly 1998). The amounts of time spent on scanning activity within time blocks and habitats by the White-throated Kingfisher were inversely correlated to the availability of prey (Ali *et al.* 2010a).

### Monthly preying frequency

The average preying frequency per day was insignificantly varied in different months ( $\chi^2 = 15.6$ ,  $df = 11$ ,  $p > 0.05$ ). There were two peaks in a year. First, in the month of November and December (Fig. 2) when they preyed on arthropods, it was their non breeding season when resting was occurred mainly and arthropods were available then. The other peak was in the month of April and May when they preyed mainly on fishes which was their peak breeding months (n = 193) and they need a large amount of food for their extra energy.

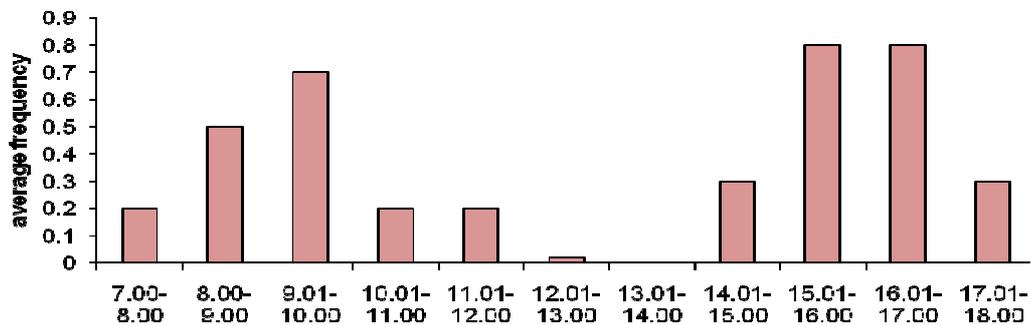


Fig. 1. Preying frequency of total food items at different day periods.

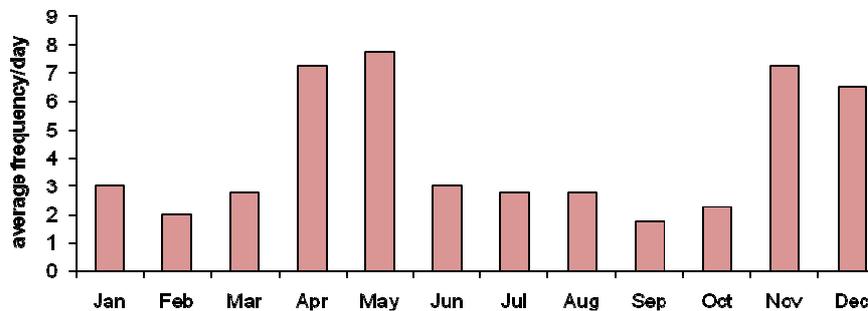
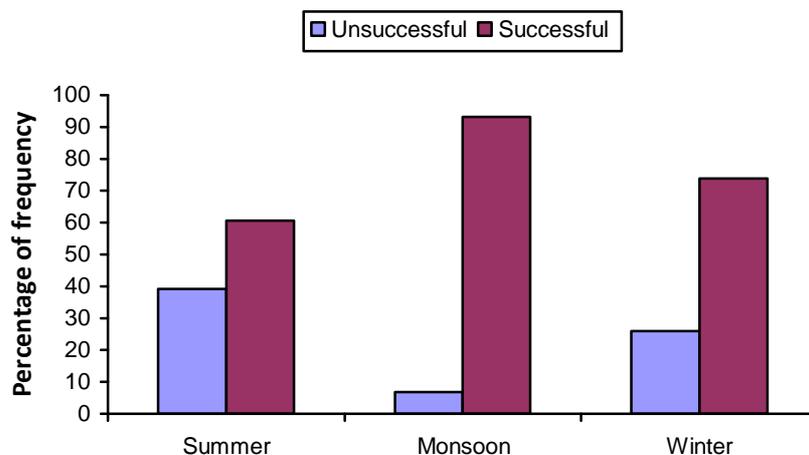


Fig. 2. Monthly preying frequency.



**Fig. 3. Unsuccessful and successful preying frequency in different seasons.**

#### Seasonal preying (n = 193)

The average preying frequency per day was insignificantly varied in different seasons ( $\chi^2 = 1.1$ ,  $df = 2$ ,  $p > 0.05$ ). It was the highest in summer (5.02 times/day) when the breeding was occurred and they had a great demand for food and lowest in monsoon (2.3 times/day) when the aquatic bodies were inundated and breeding season was finished. Ali *et al.* (2010a) reported that the scanning activity of *H. smyrnensis* was greater in monsoon and post-monsoon periods when insect or other prey was abundant and lower in the summer when prey was in short supply at Cauvery Delta in Southern India. Differences in recorded seasonal feeding activity inferred that *H. smyrnensis* fed more often during the summer and less during the monsoon (Asokan *et al.* 2009) at Tamil Nadu in India, where the food resources were generally abundant during the summer, and so the study species took a variety of prey, from insects to large crabs, but in these habitats, insects predominated. They further mentioned that during rainy season (September to January) when the weather was much warmer and rivers and ponds are mostly inundated, *H. smyrnensis* fed aquatic animals like fish and frogs, while during the drier months (February to August) they fed mainly terrestrial

animals at Tamil Nadu in India. It shows that taking of particular food items in particular season is rather similar to Tamil Nadu with that of Bangladesh. Ali *et al.* (2010a) reported that during the monsoon, the study area (Cauvery Delta in Southern India) is generally in wet condition due to the northeast monsoon rainfall that greatly affected prey species (mainly insects) distributions. In the post-monsoon period, cold temperatures might be expected to force kingfishers to devote more time to scanning, while the reverse might be true during the summer. Asokan *et al.* (2009) mentioned that during the drier months (February to August), the *H. smyrnensis* fed mainly terrestrial animals found at Tamil Nadu in southern India.

The preying attempt was not successful in all the cases. Some preying attempt was unsuccessful (27.7%) which was recorded as the highest in summer and lowest in monsoon (Fig. 3). It may be related with the availability of prey species.

#### Preying on different food items in a year

As preying frequency on different food items varied at different day periods, months and seasons, which were more or less dependent on the availability of the food items in the environments, so hourly, monthly and seasonal preying frequency

of different food items are described below separately.

#### Preying on arthropods (n=70)

Out of total preying food items, the arthropods comprised of 36.6% in present study whereas Asokan *et al.* (2009) reported it 83% in southern India. It preyed 1.5 times/day arthropods on an average in the study period. Preying frequency of arthropods was not significantly varied at different day periods in a day ( $\chi^2 = 6.1$ ,  $df = 10$ ,  $p > 0.05$ ). It was the highest at 1601-1700 h (Fig. 4) for being a long overnight starvation period.

Preying frequency of arthropods varied monthly but it was statistically significant ( $\chi^2 = 16.4$ ,  $df = 11$ ,  $p < 0.05$ ). In the month of June through August (Fig. 5), this kingfisher avoided to prey on the arthropods while it remained busy for the caring of their nestlings. The highest frequency was found in December which was their non breeding month and arthropods were available then.

Preying frequency of arthropods varied to some extent seasonally but it was statistically insignificant ( $\chi^2 = 2.6$ ,  $df = 2$ ,  $p > 0.05$ ). The highest was in winter (Fig. 6) because the arthropods are more available in winter season

than in comparison with other seasons. It was so because in winter season as the water rather remains calm and quite and thus the number of arthropods increases in number without any natural disasters. Dhindsa and Saini (1994) reported that birds stand supreme among vertebrates as enemies of insects because they are highly mobile and are able to congregate quickly in large numbers when sudden outbreaks of insect pests occur. In rainy months, most of the larvae, pupae or nymphs of arthropods are rather washed away due to heavy rain or flood water or adults are destroyed due to storm and high wind.

#### Preying on fishes (n=118)

Out of preying food items, fishes comprised of 61.1%. It preyed 2.5 times per day on an average. Preying frequency of fishes varied at different day periods but it was not statistically significant ( $\chi^2 = 3.1$ ,  $df = 10$ ,  $p > 0.05$ ). Fishes were preyed on all through the day. There were two peaks (0801-1000 h and 1501-1600 h) for *H. smyrnensis* (Fig. 4). Highest frequency was during 0801-1000 h when they were very much hungry after long overnight starvation period and 1501-1600 h for overnight energy requirements. No or little fish was preyed on at 1300-1400 h when they preferred to take rest.

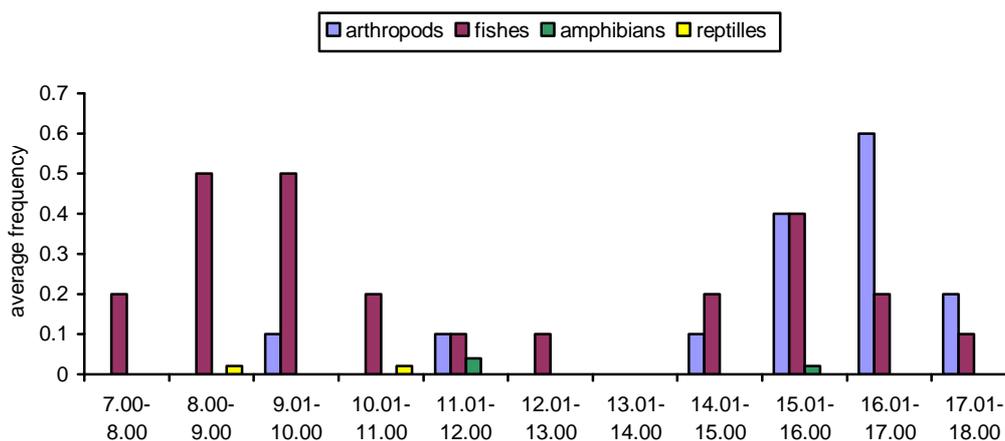
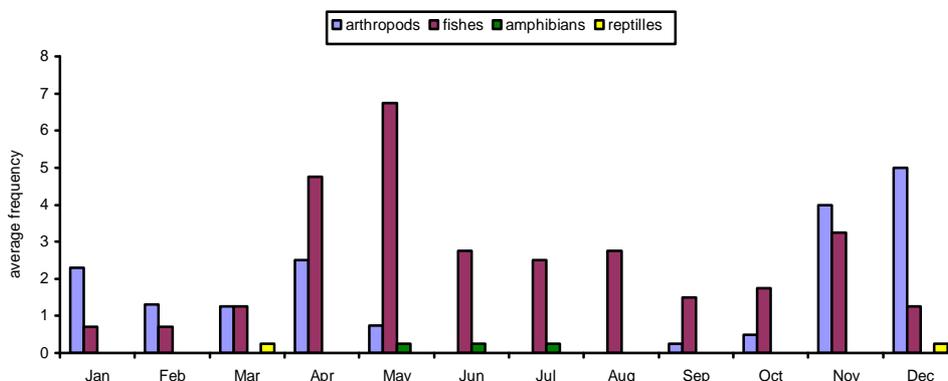
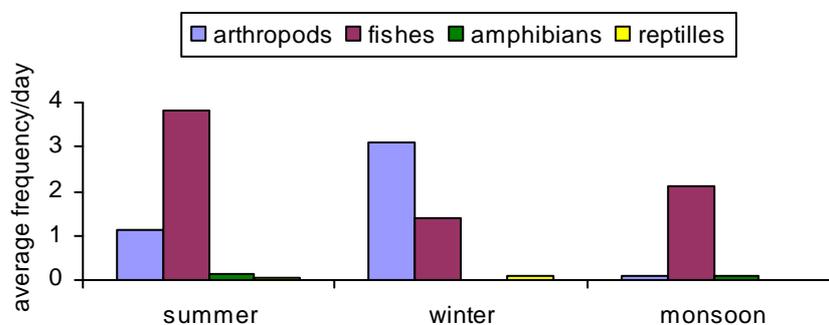


Fig. 4. Preying frequency of different food items at different day periods.



**Fig. 5. Monthly preying frequency of different food items.**



**Fig. 6. Seasonal preying frequency of different food items.**

Preying frequency of fishes varied monthly but it was not statistically significant ( $\chi^2 = 1.5$ ,  $df = 11$ ,  $p > 0.05$ ). In the month of April and May, *H. smyrnensis* preyed on at the highest rate because it was their peak breeding months (Fig. 5).

The average preying frequency per day varied in different seasons but it was not statistically significant ( $\chi^2 = 0.82$ ,  $df = 2$ ,  $p > 0.05$ ). The highest frequency was in summer in all the cases except reptiles (Fig. 6). It was related with their breeding season when they need more food.

*H. smyrnensis* also preyed on amphibians and reptiles occasionally. Amphibian was recorded only in May to July (Fig. 5) when it reared their nestlings and supplied amphibians to the nestlings mainly because the nestlings need different types of food for their growth and developments. This

was also related with the availability of food items in nature. Reptile was preyed in the homestead area when the bird had got chance. According to Asokan *et al.* (2009), it preyed crabs, fishes, amphibians and reptiles which comprised of about 16% of its diet in Tamil Nadu of southern India.

Statistical interference of different food items with total preying frequency in different months and seasons (Table 1) is also analyzed in case of both species.

#### **Preying during breeding and non breeding seasons**

The average preying frequency per day during breeding and non breeding seasons was more or less same. Arthropods were preferred highly during non breeding season but fishes were preferred in breeding season for saving time and energy.

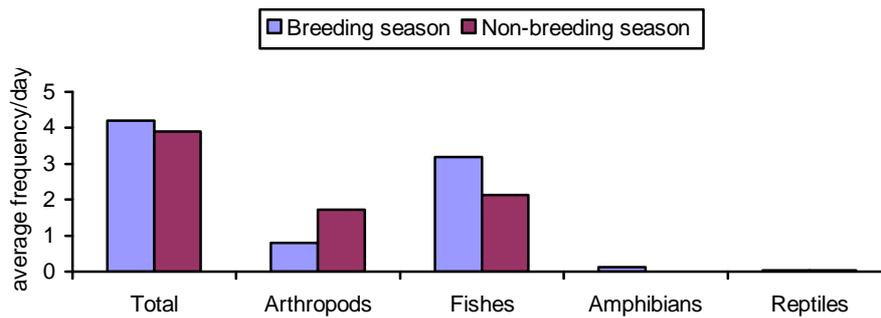
Amphibians and reptiles were recorded occasionally of which amphibians were recorded only in breeding season but reptiles were recorded both in breeding and non breeding season (Fig. 7). It was mainly depend on getting chance.

Preying of different food items varied at different day periods during breeding and non breeding seasons but it was not statistically significant (breeding:  $\chi^2 = 1.5$ ,  $df= 10$ ,  $p > 0.05$ ; non breeding,  $\chi^2 = 2.3$ ,  $df= 5$ ,  $p > 0.05$ ). Preying

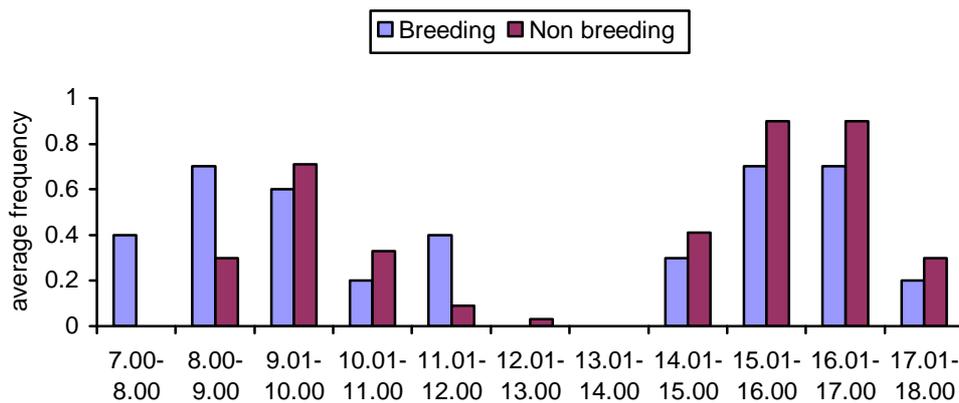
frequency was highly preferred at 0801-0900 h and 1501-1700 h during breeding (n = 100) but it was at 1501-1700 h during non breeding season (n = 93) (Fig. 8). During breeding, they had a pressure for the nestlings in the morning after a long overnight starvation period afternoon for going to overnight starvation. But in non breeding season in the afternoon they mainly preyed on arthropods which were available then.

**Table 1. Statistical interference of different food items with total preying frequency in different months and seasons.**

Variables	Month		Season	
	r (df=1, p=0.05)	Statistical interference	r (df=2, p=0.05)	Statistical interference
Fishes : total food items	0.7	Significant	0.7	Insignificant
Arthropods : total food items	0.6	Significant	0.4	Insignificant
Amphibians : total food items	0.107	Insignificant	0.15	Insignificant
Reptiles : total food items	0.108	Insignificant	0.1	Insignificant
Fishes : arthropods	-0.09	Insignificant	-0.44	Insignificant



**Fig. 7. Preying of different food items in breeding and non breeding seasons.**



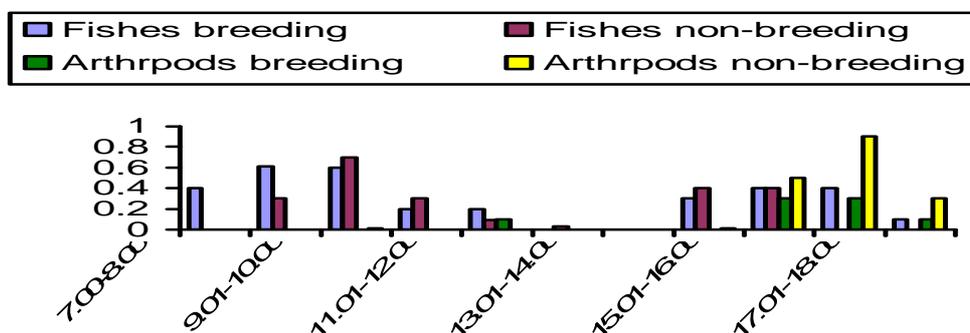
**Fig. 8. Preying frequency of different food items at different day periods in breeding and non breeding seasons.**

**Table 2. Statistical interference of different food items with total preying frequency during breeding and non breeding season at different day periods.**

Parameters	Breeding season			Non breeding season		
	r (df=11)	P	Statistical interference	r (df=9)	P	Statistical interference
Fishes : total food items	0.89	0.01	Significant	0.52	0.05	Insignificant
			Insignificant	0.73	0.01	Significant
Arthropods : total food items	0.54	0.05				
Fishes :arthropods	0.14	0.05	Insignificant	-	-	-

**Table 3. Statistical interference of different food items with total preying frequency in different months during breeding and non breeding seasons.**

Parameters	r (df=4)	p	Statistical interference	r (df=4)	P	Statistical interference
Fishes : total food items	0.94	0.01	Significant	0.91	0.05	Significant
Arthropods : total food items	0.44	0.05	Insignificant	0.36		Insignificant
Amphibians : total food items	0.107		Insignificant	-		-
Reptiles : total food items	-0.288		Insignificant	0.54		Insignificant
Fishes : arthropods	0.124		Insignificant	-0.03		Insignificant



**Fig. 9. Preying frequency of arthropods and fishes at different day periods during breeding and non breeding seasons.**

The statistical interference of different food items with total preying frequency at different day periods during breeding and non breeding seasons (Table 2) and months (Table 3) is also analyzed.

The average preying frequency of the food items at different day periods during breeding season was significantly correlated with the average frequency during non breeding season ( $r = 0.73$ ,  $n = 11$ ,  $p < 0.01$ ). The average preying

frequency of arthropods and fishes at different day periods during breeding and non breeding seasons is also mentioned in Table 2.

#### **Preying of arthropods during breeding and non breeding seasons**

Average preying frequency of arthropods varied per day during breeding and non breeding seasons but it was not statistically significant

(breeding:  $\chi^2 = 2.3$ ,  $df = 10$ ,  $p > 0.05$ ; non breeding:  $\chi^2 = 8.5$ ,  $df = 10$ ,  $p > 0.05$ ). During breeding (1101-1200 h and 1501-1800 h) and non breeding season (0901-1000 h and 1401-1800 h), it frequently preyed on arthropods while the highest frequency was recorded at 1601-1700 h both in breeding ( $n = 22$ ) and non breeding seasons ( $n = 48$ ) (Fig. 9) because arthropods were available then mainly. They preyed on large arthropods during breeding which were supplied for the growth of nestlings.

### **Preying on fishes during breeding and non breeding seasons**

Average preying frequency varied at different day periods during breeding and non breeding seasons but it was not statistically significant (breeding:  $\chi^2 = 3.7$ ,  $df = 10$ ,  $p > 0.05$ ; non breeding:  $\chi^2 = 4.9$ ,  $df = 10$ ,  $p > 0.05$ ). During breeding season, *H. smyrnensis* preyed on all day round except noon both in breeding ( $n = 71$ ) and non breeding seasons ( $n = 44$ ) (Fig. 9). It was highly recorded during 0801 to 1000 h in breeding season but at 0901-1000 h in non breeding season.

The relationship of preying frequencies of different food items at different day periods between breeding and non breeding seasons are mentioned in Table 3.

### **CONCLUSION**

From this study it is known that they preyed a very small amount of fishes and large amount of arthropods as the fish farmer known that they are harmful for fish farming. It occasionally preyed on amphibians and reptiles. Actually it preyed on those animals which are available for them or if the chance arises. The preying frequency was varied hourly, daily, monthly and seasonally. It varied during breeding and non breeding seasons. During breeding season the preying frequency was found more because they had to rear the nestlings. Even during breeding, they preferred to prey on fishes because they had a great demand for themselves

and their nestlings and it is easy to catch than other food items. It is not possible to fulfill their great demand by preying of a very small sized animals like arthropods and it had not possible to get a long leisure time for preying a large quantity of arthropods during breeding season. But if they had got chance to catch other animals they got it. They are beneficial to the aquatic environment as they preyed comparatively weaker and diseased fishes and harmful insects. So they are beneficial for preying harmful pests. For reducing aquatic bodies and nesting habitats their population is declining at an alarming rate. Thus necessary measures should be taken immediately for conserve their population in nature as well as the aquatic environment.

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\*Paper was not originally seen.