American-Eurasian J. Agric. & Environ. Sci., 12 (10): 1316-1322, 2012
ISSN 1818-6769

DOI: 10.5829/idosi.aejaes.2012.12.10.66186

Diet Composition of Southern Meagre *(Argyrosomus hololepidotus)* in Northwest of Persian Gulf

[1]*Majid Shekari and* [2]*Seyed Ahmad Reza Hashemi*

[1]Department of Fisheries, University of Marine Sciences, Khoramshahr, Iran.
[2]Department Fisheries, Gorgan University of Agricultural Sciences and Natural Resources, Iran

Abstract: In recent years, the stock of Southern Meagre, distributed in Khuzestan Coastal Waters (Iran) has increased dramatically, raising concerns about their predatory impact and their forage requirements. During January 2009 to March 2011, a number of *Argyrosomus hololepidotus* species was captured in main fishing areas of Khuzestan province namely Busafe-Liphe and Bahrakan, northwest of Persian Gulf. The stomach contents of 146 individuals were examined, in which 44 individuals had contained (trace-full) stomachs while 102 individuals had empty stomachs. The value of vacuity index (CV) indicated moderate feeding for this species and percentages of CV in males were higher than in females. Using one-way ANOVA Test, the relationship between CV index and temperature was significant ($P<0.05$). The analysis of Prey occurrence index (FP) and Relative importance for prey index (IRI) results showed that fish is the main food source for *A. hololepidotus*, followed by crustacean (shrimp and crabs) food source and Mollusca (Squid) are as a secondary and accidental food sources. Three teen different species of fish and 3 species of invertebrates were observed in the diet. In overall, the analysis of stomach contents for Southern Meagre indicated that, *Leiognatus bindus* and *Psudorambus elevatus* fishes, dominated the diet male and female which accounted for %22 and %26 of the weight all stomachs respectively.

Key words: Diet Composition · Persian Gulf · Stomach Contents Analysis

INTRODUCTION

Information of diet is important for understand the basic functioning of fish assemblages and is widely used for ecological work and modeling and is becoming an increasingly important component in ecologically based management regime. The downward shift of the trophic composition of the catch worldwide, which was formerly dominated by large carnivorous species [1], has also at attracted attention towards the trophic status of species. In areas with high fish diversity, such as the Persian Gulf which hosts over 1500 species of coastal fishes, the level of the information on the diets of these species is often low and difficult to access [1].

Sciaenid's family contains approximately 70 genera and up to 270 species worldwide, with 28 species restricted to freshwater [2]. The southern meagre (*Argyrosomus hololepidotus*) is a large sciaenid (maximum size 75 kg) [3]. *A. hololepidotus* was observed in south Africa, Madagascar, Namibia, Australia and India, but In fact is Madagascar coastal endemic and lived in semi tropical waters in 21 degrees north latitude and 29 degree south and was be benthic and was found fresh waters, brackish and seawater to 400 m depth [4-7]. This species in young stages was lived Mangrove forests, estuaries and the mature in estuaries and shallow water for spawning they immigrate collectively. This species has migratory and April to November takes over in Khuzestan coastal, Iran [8]. Max. of length, growth coefficient, Max. weight, double time of population, max. age were 200 cm, 0.03 (k), 71 kg, 14 years and 30 year, respectively.

Because of its important role in economy of Khuzestan fishery and also in Persian Gulf region countries this fish is a target species for capture. Different aspects of biological parameters of southern meagre have been studied by different authors are those in Australia waters and in Spanish waters [9-10]. In Persian Gulf, diet composition of *Argyrosomus hololepidotus* have no enough studies and no available information about feeding of the mentioned fish in this area. The objective of this study was to provide information pertaining to diet composition of this species.

Corresponding Author: Seyed Ahmad Reza Hashemi, Gorgan University of Agricultural Sciences and Natural Resources, Gorgan (Iran), Tel: +989177055568.

MATERIALS AND MEIHODS

The main fishing areas of *A. hololepidotus* the on northwest of Persian Gulf are located in Liphe-Busafe and Bahrekan fishing area between 29° 44' to 07 'N and 48° 45' to 49° 50' (Fig. 1).

Monthly water samples (During January 2009 to March 2011) for analysis of environmental parameters (salinity and temperature) were collected from each station using a Nansen bottle sampler and analyzed as per standard analytical procedures [11]. A total number of 394 individuals of *A. hololepidotus* were captured during 2009 to 2011 using bottom trawl and gill net and instead of also, which collected from recreational fishermen and then transferred in icebox to the laboratory. In the laboratory, total length (±1.0 mm), sex and weight (±0.001 g wet weight) were recorded for each fish. Parameters of the length weight relationship were obtained by fitting the power function $W=a\times FL^b$ to length and weight data where: W is the total wet weight, is a constant determined empirically, L_F is the fork length [12]. In order to verify if calculated b was significantly different from 3, the Students t-test was employed [13].

Stomachs were removed by cutting the alimentary canal anterior to the stomach and posterior to the pylorus and the contents were frozen until processed. The qualitative and quantitative analyses of stomach contents were done and intensity of feeding [14], vacuity index [15], Prey occurrence index [15], were calculated as follows:

Vacuity Index: The index of vacuity or index of emptiness (called the vacuity index CV); it is the percentage ratio between the numbers of empty stomachs (ES) and the total number of stomachs analyzed (TS).

$$CV=ESx100/TS$$

This index gives to estimate of the voracity of the predator fish; the more voracious fish species, the lower percentage of empty stomachs. Because of possible regurgitation of prey that may produce emptier stomachs in samples than in population, this index may not be very robust; therefore, some other indices were also used.

Prey Occurrence Index: The percentage frequency of occurrence of one prey item J, the prey occurrence index, Fp. This is the ratio of the number of stomachs containing the pry item j (Nsj) and number of stomachs that contained food (NS.),

$$Fp = Nsjx\,100/Ns$$

The different values of this index, allow separation of the prey items into three categories: If F>50%, the prey are dominant and characteristic of the predator diet. If 50 % >F>1 0%, the prey eaten are secondary and occur mainly if there is a lack of dominant prey. If F<10%, the prey are eaten accidentally.

Relative Importance for Prey Index: The index of relative importance for a particular prey category i (IRIi), is expressed as:

$$IRI = (\%N + \%W) \times \%F$$

Where %N= the percentage of a prey species by number; %W= the percentage of a prey species by weight; and %F= the percent frequency of occurrence of a prey species.

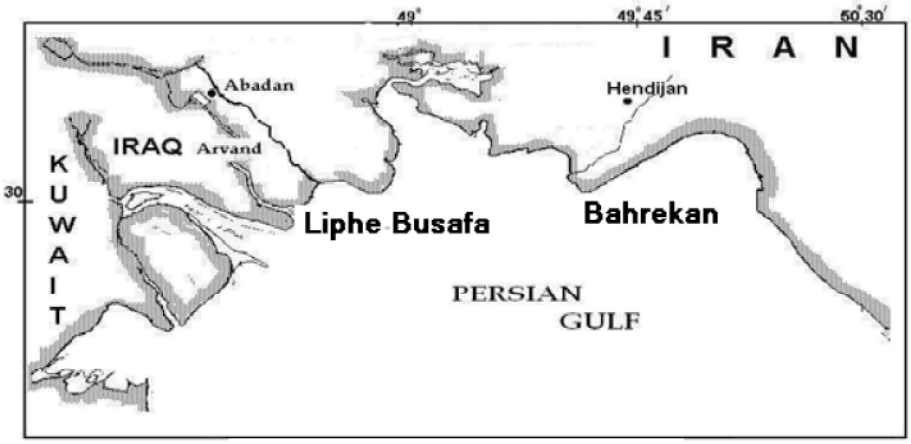

Fig. 1: Location of two landing sites of Southern Meagre in Khuzestan Coastal Waters (Iran)

IRI values were calculated as percent IRI values [16]. In calculating IRI values, we excluded several items appearing in the stomachs, because they were deemed to be non-naturally occurring food items. Several prey species were combined either because of difficulties in identification of partially digested prey to species or because of ecological or taxonomic similarity.

The data was processed in Excel and SPSS ver.19 packages. Statistical analysis consisted of one way analysis of variance for means of vacuity stomachs in different months and seasons in each sex and used paired t-test differences for mean vacuity stomachs of male and female during survey.

RESULTS

The total lengths of 144 fish in the size range 89 to 145 cm were measured. Major and minor range length fishery supporting in the 117-124 and 96-103 cm range respectively. Length frequency Percentage groups of this species during period 2009-2010 are presented in Fig. 2.

In this study, because of migratory this species 4 months of the year (December, January, February and March) was no found sample in Khuzestan coastal. From the total number of caught fishes, 74 were males and the remaining were females. According to table 1, mean ±SD length values for this species were 1150±18 and maximum and minimum total length was 810mm and 1430mm respectively. Mean±SD weight values were 16025±480 gr and maximum and minimum weight were 5700gr and 27500 gr respectively (Table 1).

The results of CV index showed random monthly variation in the values (Fig. 2). The results showed that mean CV index was higher in males than in females. The highest and lowest values were in May and June respectively. There was a significant difference between means of vacuity stomachs of each sex in different months. Using one-way ANOVA Test, the relationship between CV index and temperature was significant ($p<0.05$).

The results of feeding regarding sex are shown in Fig. 3 and 4. The values of FP index of males and females showed in Table 2. Females had a higher volume of fish in stomach contents, but the shrimps were higher in males. Squid was not seen in the male's stomachs (Table 3). It also shows that when fish grows in length, feeding on crustaceans reduces and an increase feeding on fish occurs. between mean values of environmental parameters and intensity of feeding (Fig. 3) indicated that, there is significant correlation between Water temp and intensity of feeding ($p<0.05$).

The main fish food items were *Cynogluss arel, Psudorambus elevatus, Thrssa himiltoni, Uepenus sulphureus, Leiognatus bindus, Saurida tumbil, Johnius belangeri, Nemipetrus japnicus, Otolithes ruber, Nematalosa nasus, liza kluzingeri, Caranus para,*

Table 1: Average values (±SD) of size corresponding of Madagascar meagre in Khuzestan Coastal Waters (2009-2011)

		Length characteristics (mm)			Weight characteristics (g)		
Sex	n	min	max	Mean± SD	min	max	Mean± SD
Males	74	890	1390	1120±11	8300	27000	15222±440
Females	70	810	1430	1180±13	5700	27500	16942±509
Total	-	-	-	1150±12	5700	27500	16052±480

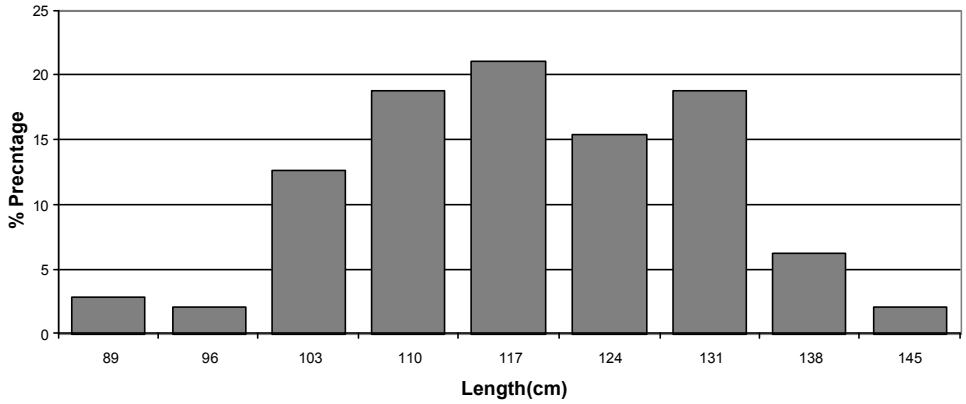

Fig. 2: Percentage frequency of length *A. hololepidotus* in Coastal Waters of Iran during 2009-2011.

Table 2: Fluctuations in intensity of feeding prey of Southern Meagre in Khuzestan Coastal Waters (2009-2011)

	N%	W%	F%	IRI%	N%	W%	F%	IRI%
Prey	Female				Male			
Squid	1.75	3.58	1.75	1.75	-	-	-	-
Portanidae	1.75	2.97	1.75	1.75	-	-	-	-
Parapenaeopsis stylifera	5.26	3.98	5.26	5.26	20.48	2.76	20.84	20.84
Saurida tumbil	1.75	8.09	1.75	1.75	-	-	-	-
Uepenus sulphureus	1.75	3.58	1.75	1.75	-	-	-	-
Otolithes ruber	1.75	11.26	1.75	1.75	1.2	1.7	1.2	1.2
Nematalosa nasus	10.53	4.09	10.53	10.53	14.46	10.26	14.46	14.46
Cynogluss arel	5.26	12.28	5.26	5.26	10.84	2.76	10.84	10.84
Thrssa himiltoni	3.51	4.09	3.51	3.51	14.46	10.62	14.46	14.46
Johnius belangeri	22.81	13.31	22.81	22.81	4.82	2.97	4.82	4.82
Caranus para	5.26	7.16	5.26	5.26	1.2	10.62	1.2	1.2
Psudorambus elevatus	26.32	14.43	26.32	26.32	1.2	1.06	1.2	1.2
Leiognatus bindus	7.02	2.05	7.02	7.02	21.69	4.25	21.96	21.96
liza kluzingeri	-	-	-	-	14.46	37.15	14.46	14.46
Tenualosa ilisha	-	-	-	-	1.2	4.25	1.2	1.2
Scomberomorus commerson	-	-	-	-	1.2	18.26	1.2	1.2
Fish Others	5.26	5.26	5.26	5.26	7.23	3.61	7.23	7.23

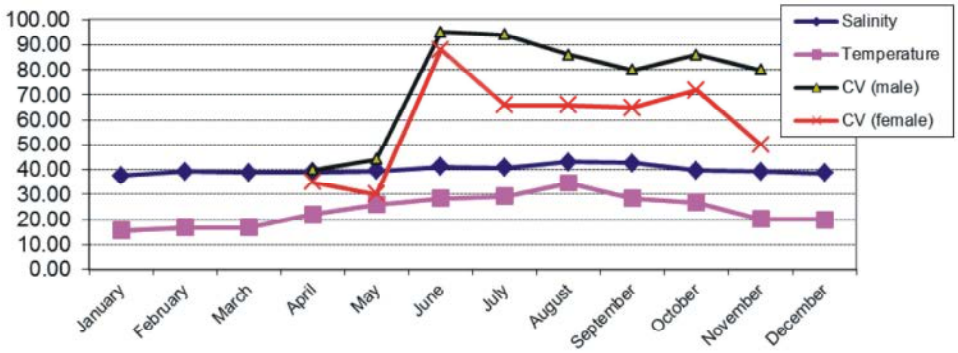

Fig. 3: Monthly variation of CV (male and female) of Southern Meagre in Khuzestan Coastal Waters (2009-2011)

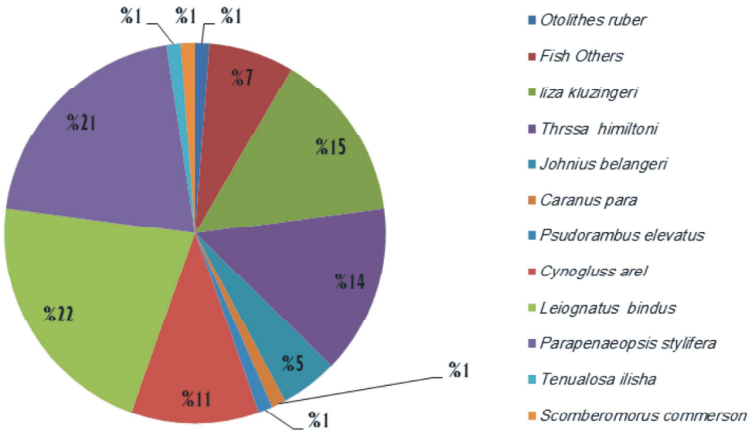

Fig. 4: Frequency of prey occurrence in stomachs of Southern Meagre (male) in Khuzestan Coastal Waters (2009-2011)

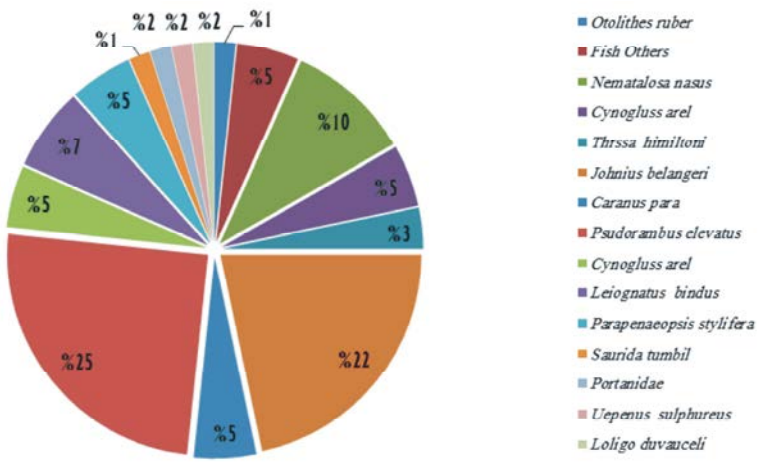

Fig. 5: Frequency of prey occurrence in stomachs of Southern Meagre (female) in Khuzestan Coastal Waters (2009-2011)

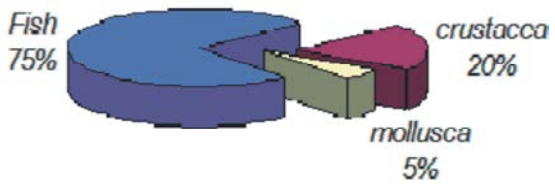

Fig. 6: Frequency of prey occurrence in stomachs of Southern Meagre (total) in Khuzestan Coastal Waters (2009-2011)

Table 3: Intensity of feeding prey of Southern Meagre in Khuzestan Coastal Waters (Iran)

	Fp%	IRI%	Fp %	IRI %
Prey	Female		Male	
Molluscs	1.67	1.75	-	-
Crustaceans	6.67	7.02	20.48	20.48
Fish	91.67	91.23	79.52	79.52

Tenualosa ilisha, Scomberomorus commerson, Parapenaeopsis stylifera (shrimp); Portanidae (carbs) and *Loligo duvauceli* (Squid).

Overall, *Psudorambus elevatus, Johnius belangeri* (for female) and *Leiognatus bindus, Parapenaeopsis stylifera* (for male) were the dominant items in the stomach, which occurred in 46% and 42% of all stomachs respectively (Table 2). Three teen different species of fish and 3 species of invertebrates were observed in the diet. In overall, the analysis of stomach contents for Southern Meagre indicated that, *Leiognatus bindus* and *Psudorambus elevatus* fishes, dominated the diet male and female which accounted for %22 and %26 of the weight all stomachs respectively (Figs. 4&5). The results showed that fish is the main food source for *A. hololepidotus*, followed by crustacean (shrimp and crabs) food source and Mollusca (Squid) are as a secondary and accidental food sources (Fig. 6).

DISCUSSION

Shortage of sample in 4 months was due to migratory on coastal of Khuzestan province simultaneous with low temperature to be on this Coastal Waters [8].

CV value indicated moderate feeding for this species and percentages of CV in males were more than in females. In male, higher percentage of empty stomachs was observed in June. The fluctuations in fullness of stomach did show correlation with temperature. During spawning months, majority of mature fish occurred with empty stomachs [17]. This may be due to the calorific value of food consumed [17] or faster rate of digestion [18]. The presence of considerable quantities of semi digested matter might be due to the rapid digestion that takes place in the tropical waters as the metabolic rate is high [19]. Fishes with empty stomach and poor feeding activity are common in several species of tropical fishes [20].

Based on Fp and IRI indexes, the most important food item was fish, followed by crustaceans and Mollusca. Also, the high number of different food items in stomach content of this species, suggests that they are less selective in their diets and specialize on particular food items.

Southern Meagre are unspecialized and opportunistic carnivores, feeding on a variety in fishes and crustaceans during the day and at night [21]. According to the present study most of the item stomachs were similar observation with Southern Meagre in Australia waters [9] and in Spanish waters [10].

Protoniba dicantus consumes more invertebrates (especial per adult) and is less selective with respect to fish species [22].

The predominance of fish in adult *A. hololepidotus* diets attests to the piscivorous nature of *A. hololepidotus* and corroborates the findings of other studies [9, 10]. Invertebrates constituted a minor percentage of the overall diet. Southern Meagre in Australia waters, feeds on small fish and shrimp (per adult) and large fish and squid (after adult) [9] and in Spanish waters feeds on fish and invertebrate [10]. *P. dicantus* consumes fish is the main food source, followed by crustacean food source and Mollusca are as a secondary and accidental food sources [22]. Knowledge of feeding regimes of fish species is of great importance in understanding their ecological interaction [23]. *A. hololepidotus* having relatively big head and mouth with sharp teeth and usually attack and swallow their prey very quickly [24].

According to Abdel-Azis *et al.* [25] and Parrish [26] the presence of food items in the fish diet is related to availability of food, food selection and the age of fish. The food preference of predatory fishes is very complex and is influenced by many factors such as, prey accessibility, mobility, prey abundance, prey energy content prey size selection and seasonal changes [27]. The diet of most fishes will change with a number of factors, either intrinsic (e.g. size, behavior, taxonomy) or extrinsic (e.g. biotope, region) [28].

ACKNOWLEDGMENTS

The present study was carried out within the framework of the research project "Determination of the ecological relationship among economic fishes in the coastal area of the Persian Gulf" funded by Iranian Fisheries Research Organization (IFRO) and Iran National Science Foundation. Special thanks for presentation of material and spiritual supportive aids and services for this national project and all colleagues that helped during field work. We thank Dr. Maramazi, the manager of the South of Iran aquaculture fishery research center, Ahwaz. We are also very grateful the experts of the South of Iran aquaculture fishery research center, Ahwaz for helping the project work.

REFERENCES

1. Hashemi, S.A.R., S.A. Taghavimotlagh and G.R. Eskandary, 2011. To determine the ecological relationship amongst economic fishes within the Persian Gulf waters. South of Iran aquaculture fishery research center, Ahwaz. Iran, pp: 33. In Farsi.
2. Froese, R. and D. Pauly, 2010. FishBase. World Wide Web electronic publication. http://www.fishbase.org, version 16 June 2010.
3. Hecht, T. and A. Mperdempes, 2001. Screening of *Argyrosomus japonicus* (Sciaenidae) and *Pomadasys commersonnii* (Haemulidea) as candidates for aquaculture in South Africa, Aquaculture: Book of abstracts. World Aquaculture Society, Lake Buena Vista, pp: 286.
4. Griffiths, M.H., 1997a. Influence of prey availability on the distribution of dusky knob *Argyrosomus japonicus* (Sciaenidae) in the great river estuary, with note on the diet of early juveniles from three other estuarine systems. S. Afr. J. Mar. Sci., 18: 137-145.
5. Griffiths, M.H. and P.C. Heemstra, 1995. A contribution to the taxonomy of the marine fish Genus Argyrosomus (Perciformes: Sciaenidae), with descriptions of two new species from southern Africa. Ichthyol. Bull., 65: 1-34.
6. Griffiths, M.H., 1996. Life history of the dusky kob *Argyrosomus japonicus* (Sciaenidae) off the east coast of South Africa. S. Afr. J. Mar. Sci., 17: 135-154.
7. Griffiths, M.H., 1997b. Feeding ecology of South African *Argyrosomus japonicus* (Pisces: Sciaenidae), with emphasis on the Eastern Cape surf zone. S. Afr. J. Mar. Sci., 18: 249-264.
8. Parsamanesh, A., M.T. Kashi and G.H. Eskandari, 2000. Stock assessment of commercial fish in coastal waters of Khuzestan province. Fishery Research Institute, pp: 70.
9. Silberschneider, V. and C.A. Gray, 2007. Synopsis of biological, fisheries and aquaculture-related information on mulloway, *Argyrosomus japonicus* (Pisces: Sciaenidae), with particular reference to Australia J. Appl. Ichthyoi, 24: 7-17.
10. Phelan, M.J., N.A. Gribble and R.N. Garrett, 2008. Fishery biology and management of *Protonibea diacanthus* (Sciaenidae) aggregations in far Northern Cape York Peninsula waters Report for the Australian Fisheries Research Development Corporation, Canberra, ISBN 0-9580542-0-7, pp: 29.
11. Clesceri, S.L., A.E. Greenberg and R.R. Trussel, 1989. Standard Method for the Examination of Water and Wastewater. 17th, EcIn., APHA Press.
12. Biswas, S.P., 1993. Manuel of methods in fish biology, fish biology and Ecology laboratory, Dibruyarh university, Dibrugarh, pp: 157.
13. Zar, J.H., 1996. Biostatistical analysis. 3rd edition. Prentice-Hall Inc., New Jersey, USA., pp: 662.

14. Somasekharan Nair, K.Y.S., 1980. Food and feeding habits of *Otolithe ruber* (Schneider) at Calicut. Indian J. Fish, 26: 133-139.
15. Euzen, O., 1987. Food habits and diet composition of some fish of Kuwait. Kuwait Bull. Mar. Sci., pp: 58-65.
16. Cortes, E., 1997. A critical review of methods of studying fish feeding based on analysis of stomach contents: an application to elasmobranches fishes. Can. J. Fish Aquat. Sci., 54: 738-726.
17. Longhurst, A.R., 1957. The food of the demersal fish of the West African estuary. J. Anim. Ecol., 26: 369-387.
18. Qasim, S.Z., 1972. The dynamics of food and feeding habits of some marine fishes. Indian J. Fish., 19(1 and 2): 11-28.
19. Kalita, B. and N. Jayabalan, 2000. Food and feeding habits of the golden scad *Caranx kalla* (Cuv. and Val.) along the Mangalore Coast. Environ. Ecol., 18(4): 869-873.
20. Zacharia, P.U., 2003. Studies on the fishery, biology and population dynamics of the white fish *Lactarius lactarius* (Bloch and Schneider, 1801) along the Karnataka coast. Ph.D. thesis Mangalore University, India, pp: 188.
21. Randall, I.E., 1967. Food habits of Reef fishes of the West Indies. Stud. Trop. Oceanogr. Univ. Miami, 5: 665-847.
22. Papan, F., A. Mahmodeian and M. Ronagh, 2004. Survey biology of *Protoniba dicantus* on Khuzestan Province. Fisheries Research Institute of Iran, pp: 254.
23. Alberto, S., F. Velasco and I. Olaso, 2003. Polychaetearmelids in the diet of demersal fish from the Southern shelf of the Bay of Biscay. The Marine Biological Association of the UK, Plymouth, UK, 83: 433-670.
24. Koslow, J.A., F. Hanley and R. Wickland, 1988. Effects of fishing on reef fish communities at Pedro Bank and Royal Cays, Jamaica. Mar. Ecol, Progr. Ser., 43: 210-212.
25. Abdel-Azis, S.H., A.N. Khali and S.S. Abdel-Magid, 1993. Food and feeding of guitar fish *Rhinobatos rhinobatos* in the Egyptian Mediterranean habit of the common Waters. Indian J. Mar. Sci., 22: 287-290.
26. Parrish, J.D., 1987. The Trophic Biology of Snappers and Groupers. In: Tropical Snappers and Groupers: Biology and Fisheries Management. Polvina, J. and S. Ralston (Eds.), West views Press, pp: 405-439.
27. Barry, J.P. and M.J. Ehret, 1993. Diet, food preference and algal availability for fishes and crabs on intertidal reef communities in southern California. Environ. Biol. Fish, 37: 82-92
28. Pauly, D., V. Christensen, J. Dalsgaard and R. Froese, 1998. Fishing down marine food webs. Science, 279: 860-863.