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Research Article

Feeding habits of Epinephelus *coioides* and *E. bleekeri*, in the northern Persian Gulf and the Oman Sea

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Abstract

The feeding habits of *Epinephelus coioides* and *E. bleekeri* were studied from Oct. 2019 to Sep. 2020 in the northern Persian Gulf and the Oman Sea. According to the results of the stomach content analysis, pelagic and benthopelagic prey were predominant in two species, and bony fishes were the main food for both species. The results of the diet overlap index showed a high overlap for these species: 0.98 in the Persian Gulf and 0.99 in the Oman Sea. It was also found that 64.29% of the prey of *E. coioides* juveniles were from benthic communities, while 21.34% were from demersal communities. Additionally, it was estimated that 100% of *E. bleekeri* juveniles in two regions fed exclusively on benthic preys. The analysis comparing the length classes of *E.coioides* and food overlap revealed that there is a high overlap (0.99) in prey consumed between the Persian Gulf and the Oman Sea, as indicated by the canonical correlation. The significance of the Wilks-Lambda test (p>0.05), also supports this finding. The results of the SIMPER analysis showed a high degree of uniformity in *E.bleekeri* between the Persian Gulf and the Oman Sea (86.92%). This suggests that the prey consumed in different length classes do not overlap between these regions. However, *Leiognathus lineolatus* is the main reason for this difference, accounting for 8.03%. Switching the feeding habits of the studied species from benthic and demersal prey to pelagic, semi-pelagic, and benthopelagic preys requires fisheries management of forage fish and control of fishing gear.

Introduction

Feeding is the primary and crucial interaction among various groups of aquatic animals (Arreguein-Sánchez *et al*., 2002). Knowledge of the forage composition of a species in a specific geographical location is valuable for evaluating ecological performance and its influence on ecological models. Similarly, it can be useful to determine the ecological position of a species within the pyramid network or its feeding level (Heymans *et al*., 2011). Groupers of the genus *Epinephelus* are economically important and highly valuable marine food fish that have been intensively fished since the 1960s (FAO, 2020).The orange-spotted grouper (*Epinephelus coioides*, Hamilton, 1822) and the blacktail grouper (*Epinephelus bleekeri*, Vaillant, 1878), belong to the family Serranidae, are two of the most important demersal fish species in the northern Persian Gulf and Oman Sea(Assadi and Dehghani, 1997; Valinassab *et al*., 2006; Fourooghifard *et al*., 2017). Demersal and benthic fishes were reported to constitute 20% of the total catch in Hormozgan Province, which amounted to 299,898 tonnes. The contribution of *E. bleekeri* and *E. coioides* to the total biomass was estimated to be 0.12 and 0.51 percent in the Persian Gulf, and 0.51 and 0.2 percent in the Oman Sea, respectively (Valinassab *et al*., 2006). Dissection and examination of gut contents is one of the most commonly used methods for studying fish diet, feeding ecology, and feeding habits.

The feeding and trophic relationships of several fish species were studied using an ecosystem approach for fisheries assessment and multispecific ecosystem management in the coastal waters of Hormozgan Province, located in the Persian Gulf (Taghavi Motlagh *et al*., 2014). Information on the diet composition and feeding relationships of *E. coioides* and *E. bleekeri* is valuable for fisheries and harvest management. In order to comprehend the structure of the food web and the dynamics of trophic levels that regulate the proper functioning of the ecosystem, it is crucial to investigate the dietary habits and composition, particularly of apex predators in the food web. This research will provide valuable insights into prey-predator interactions and the transfer of energy in marine communities (Leroux and Loreau, 2015). There are few studies on the dietary habits of juvenile and adult groupers. For example, it is reported that the stomachs of *E. coioides* contained fish, crabs, shrimps and squid (Mohammadi *et al*., 2007), Similar results were reported (Hseu *et al*.,2003), and described the food habits of two types of groupers, *Epinephelus marginatus* and *Epinephelus costae* (López and Orvay, 2005).The diet composition of *Epinephelus sexfasciatus* was also studied (Sallehudin *et al*., 2004). Howover,little to no information was available on the habitat and diet composition of *E. bleekeri*.Understanding the diet composition, trophic relationships, and ontogenetic changes of *E. coioides* and *E. bleekeri* is important for fisheries management in fishing areas. This study was conducted to provide a quantitative overview of the diet of these fish and to interpret their diet in terms of the feeding ecology in the northern waters of the Persian Gulf and the Oman Sea.

Material and methods

Study area

This study was conducted in the northern part of the Persian Gulf and Oman Sea, specifically in the Hormuzgan Province. The study area is located between latitudes 25º 23' N and 28º 57' N, and longitudes 52º 41' E and 58º 00' E. Sampling was carried out seasonally from Oct. 2019 to Sep. 2020, using R/V Ferdows-1 in the form of a stern trawler, as well as landing sites (Fig. 1).

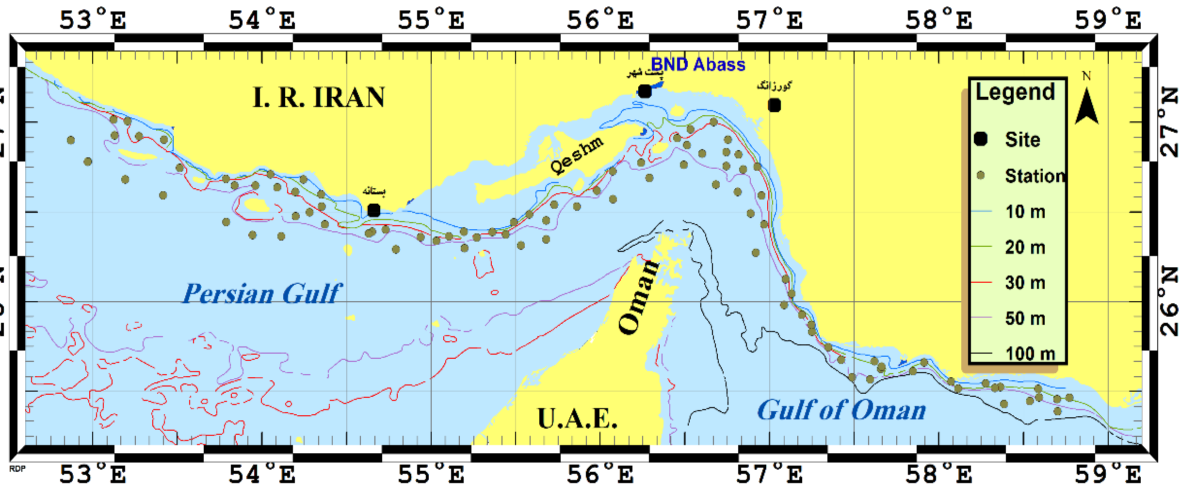


Figure 1: Sampling areas of Landing centers and research vessels in the northern Persian Gulf and Oman Sea (2019-20).

Sampling

After obtaining biometric measurements (total length in cm), the specimens (261 *E. coioides* and 337 *E. bleekeri*) were dissected and placed in labeled containers. Then, the stomach samples collected from onboard the vessel were frozen and stored at -18°C, while those from the landing sites were placed in ice powder. The stomach samples were obtained by removing the entire stomach, from the esophagus to the intestine (Amundsen *et al*., 2019). Then, all samples were taken to the Zoological Laboratory of the Persian Gulf and Oman Sea Ecological Research Institute (PGOSERI).

Diet analysis

The samples were carefully cut into lateral sections. Then, they were poured onto a 500 µm sieve and washed thoroughly with tap water. The prey items that were retained in the sieves were sorted and identified under a stereoscopic microscope, using standard references, to determine the lowest possible taxon (Carpenter *et al*., 1997; Fischer and Bianchi, 1984; De Bruyne, 2003). Then, they were counted and weighed using a digital scale (0.01 g). When counting individual prey items, the index components were considered as one prey item. For example, one carapace of a crab or shrimp was counted as one prey item. To compare feeding between adults and juveniles of two species, the length of sexual maturity was used, for *E. coioides* (Grandcourt *et al*., 2005), and *E. bleekeri* (Fishbase, 2022), were 43.5 and 36.0 cm, respectively.

Trophic level

The trophic level (T.L) was estimated using Troph Lab software (Gascuel and Pauly, 2009) based on the weight percentage of prey in the predator's diet (Pauly *et al*., 2000):

$$TLi = 1 + \sum_{j=1}^{G} \mathrm{DC}ij * \mathrm{TL}j$$

Where, DC*ij* is the proportion of prey (j) in the diet of consumer i; TLj is the trophic prey (j); while G is the number of groups in the diet of (T.L of prey items is used from the FishBase dataset).

Data analysis

NMDS[1] based on the Bray-Curtis similarity index and discriminant analysis was used to compare the overlap in feeding in the length classes of two species in each region and to make a comparison between the Persian Gulf and the Oman Sea (Mitu and Alam, 2016). Hierarchical Clusteringan alysis was also conducted to determine the overlap in diet composition of the two species. Prey species responsible for similarity and dissimilarity coefficients between the length classes in the Persian Gulf and the Oman Sea were determined using SIMPER[2] (percentage similarity), and ANOSIM (similarity analysis). The statistical analyses were carried out using SPSS [3] ver.18 software(Ludwig and Reynolds, 1988). All sampling and analytical procedures were carried out in the PGOSERI zoological laboratory according to the protocol ISO ISC / 17025.

Results

Trophic level

T.L. was estimated from stomach contents (4.47±0.79, 4.36±0.77; (TL±Se)), in the Persian Gulf and (4.41±0.78, 4.39±0.78; (TL±Se)), in Oman Sea for *E. coioides* and *E. bleekeri* , respectively.

Diet composition

Dietary components were divided into Osteichthyes,Chondrichthyes, and Crustaceans. The Osteichthyes were identified as the main diet for two species (Tables 1 and 2). Of the 261 *E. coioides* species examined, the stomachs of 32 samples were full of prey, while the remaining 179 had empty stomachs. 98 out of the 337 *E. bleekeri* specimens had full stomachs, while the remaining 239 samples had empty stomachs. The stomach contents of both species showed that pelagic and benthopelagic prey were dominant in both species. According to the results obtained, the most dominant prey of *E. coioides* was *Carangoides* sp. (N=8, *f*=13.11%; W=146.2g, *f*= 15.08%), and (N=7, *f*=13.73%; W=100.7g, 22.41%), in the Persian Gulf and Oman Sea, respectively (Table 1). *L. lineolatus* and *L.bindus* (N=28, *f*=15.91%; IRI=10%), and batoid fishes (W=6.4g, *f*=8/36%), and shrimps (N=8, *f*=13.79%), *N. japonicus* (W=53.7g, *f*=11.07%), and *Carangoides* sp. (IRI=0.39%), were estimated the main prey

[1] - Non-metric multidimensional scaling

[2] - One-way Analysis of Similarities

[3] - Statistical Package for the Social Sciences

of *E. bleekeri* in the Persian Gulf and Oman Sea (Table 2). The results of the food overlap index showed a high overlap for two species in the Persian Gulf (0.98) and Oman Sea (0.99) (Table 1). Diet composition by number (N%), weight (W%), abundance index (P.O%), and relative importance percentage index (IRI, IRI%), of the prey of *E. coioides*.

Table1: Diet composition by number (N%), weight (W%), index of frequency of occurrence (P.O%), and percentage Index of Relative Importance (IRI, IRI%) of prey items of *E. coioides*.

Class	Ecological niche	Prey items	Persian Gulf					Oman Sea				
			N (%)	W (%)	P.O (%)	IRI (%)	IRI (%)	N (%)	W (%)	P.O (%)	IRI (%)	IRI (%)
Osteichthyes	Pelagic	*Atule mute*	4.92	6.42	3.85	0.22		1.96	3.18	4.55	0.12	
		Alepes djedaba	8.20	25.78	3.85	0.65		-	-	-	-	
		Megalaspis cordyla	3.28	3.79	3.85	0.14		3.92	6.57	4.55	0.24	
		Ilishia sereashi	1.64	1.34	3.85	0.06		1.96	2.69	4.55	0.11	
		Ilishia compresa	1.64	1.82	3.85	0.07		-	-	-	-	
	Semipelagic	*Carangoides malabaricus*	1.64	2.05	3.85	0.07		3.92	5.70	4.55	0.22	
		Carangoides sp.	13.1	15.08	3.85	0.54		13.7	22.41	4.55	0.82	
		Atropus atropus	3.28	3.64	3.85	0.13		1.96	3.41	4.55	0.12	
		Leiognathus fasciatus	-	-	-	-		7.84	8.24	4.55	0.37	
		Pentaprion longimanus	-	-	-	-		7.84	1.18	4.55	0.21	
		Leiognathus bindus	4.92	1.12	3.85	0.12		5.88	1.02	4.55	0.16	
		Leiognathus lineolatus	6.56	1.45	3.85	0.15		3.92	0.27	4.55	0.10	
	Demersal	*Upeneus doriae*	4.92	2.21	3.85	0.14	96.97	1.96	1.40	4.55	0.08	95.32
		Nemipterus japonicus	6.56	6.02	3.85	0.24		-	-	-	-	
		Nemipteridae	4.92	3.39	3.85	0.16		-	-	-	-	
		Terapon jarbua	1.64	0.75	3.85	0.05		3.92	6.45	4.55	0.24	
		Terapon theraps	1.64	2.54	3.85	0.08		3.92	4.79	4.55	0.20	
		Pomadasys maculatum	4.92	5.46	3.85	0.20		3.92	3.83	4.55	0.18	
		Saurida undosquamis	1.64	0.98	3.85	0.05		1.96	1.40	4.55	0.08	
		Saurida tumbil	1.64	1.65	3.85	0.06		1.96	3.74	4.55	0.13	
	Benthic	*Grammoplites suppositus*	1.64	1.44	3.85	0.06		1.96	3.18	4.55	0.12	
Chondrichthyes	Benthic	Batoid fish	3.28	5.84	7.69	0.35	1.21	3.92	10.91	4.55	0.34	1.25
		Rhinbatos punctifer	1.64	2.28	3.85	0.08		1.96	0.22	4.55	0.05	
Crustacea	Benthic	Crab	6.56	2.68	3.85	0.18		11.7	4.34	4.55	0.37	
		Mantis shrimp	3.28	1.53	3.85	0.09	1.82	7.84	3.87	4.55	0.27	3.43
		Shrimp	4.92	0.74	3.85	0.11		1.96	1.20	4.55	0.07	

Length class and prey items

The length class of 80-85 cm, the highest proportion of prey was estimated to be *E. coioides*, However, in the Persian Gulf and the Oman Sea, the lowest proportion of prey was estimated to be *E. bleekeri* in the length classes of 15-20 and 95-100 cm, respectively. The highest and the lowest proportion of prey consumed by *E. bleekeri* were estimated for the length classes (70-75 and 100-95cm), in the Persian Gulf and the length classes (30-35 and 40-45cm), in the Oman Sea, respectively. The results of comparing the diet of adult and juvenile fish from two species, based on their ecological niches in two regions, are presented in Table 3.

Table 2: Diet composition by number (N%), weight (W%), Index of Frequency of Occurrence (P.O%), and percentage Index of Relative Importance (IRI, IRI%) of prey items of *E. bleekeri*.

Class	Ecological niche	Prey items	Persian gulf					Oman Sea				
			N (%)	W (%)	P.O (%)	IRI (%)	IRI (%)	N (%)	W (%)	P.O (%)	IRI (%)	IRI (%)
Osteichthyes	Pelagic	*Atule mute*	2.27	2.93	3.70	2.60		3.45	5.05	4.17	0.18	
		Megalaspis cordyla	2.27	6.46	3.70	4.37		-	-	-	-	
		Thryssa sp.	1.14	1.88	3.70	1.51		-	-	-	-	
		Ilishia sereashi	1.14	1.98	3.70	1.56		-	-	-	-	
		I. compresa	1.14	1.61	3.70	1.37		-	-	-	-	
		Alepes djedaba	-	-	-	-		1.72	3.57	4.17	0.11	
	Semipelagic	*Carangoides* sp.	5.68	7.32	3.70	6.50		8.62	10.04	4.17	0.39	
		C. malabaricus	2.27	4.97	3.70	3.62		1.72	3.57	4.17	0.11	
		Atropus atropus	1.14	1.96	3.70	1.55		-	-	-	-	
		Leiognathus fasciatus	3.41	5.55	3.70	4.48		3.45	4.52	4.17	0.17	
		L. lineolatus	15.91	5.59	3.70	10.75		10.34	2.89	4.17	0.28	
		L. bindus	15.91	4.99	3.70	10.45		5.17	1.53	4.17	0.14	
		Carangoides bajad	1.14	1.80	3.70	1.47		-	-	-	-	
		C. headlandensis	-	-	-	-	97.20	1.72	2.95	4.17	0.10	96.27
	Demersal	*Nemipterus japonicus*	1.14	1.26	3.70	1.20		5.17	11.07	4.17	0.34	
		Nemipteridae	4.55	8.29	3.70	6.42		5.17	6.17	4.17	0.24	
		Terapon jarbua	1.14	3.16	3.70	2.15		3.45	5.88	4.17	0.19	
		T. theraps	1.14	3.18	3.70	2.16		-	-	-	-	
		Pomadasys maculatum	1.14	1.61	3.70	1.37		5.17	5.03	4.17	0.21	
		P. stridens	1.14	1.40	3.70	1.27		-	-	-	-	
		Saurida tumbil	3.41	7.59	3.70	5.50		1.72	2.70	4.17	0.09	
		S. undosquamis	-	-	-	-		1.72	2.54	4.17	0.09	
		Upeneus doriae	6.82	1.47	7.41	4.15		-	-	-	-	
		Johnius vogleri	-	-	-	-		1.72	4.35	4.17	0.13	
		Lutjanus lutjanus	1.14	1.51	3.70	1.33		1.72	2.12	4.17	0.08	
		Parascolpsis vosmeri	-	-	-	-		1.72	3.38	4.17	0.11	
		Scolopsis ghanam	-	-	-	-		1.72	2.72	4.17	0.09	
		Johnius belangerii	-	-	-	-		1.72	3.38	4.17	0.11	
		Grammoplites suppositus	2.27	3.59	3.70	2.93		-	-	-	-	
Chondrichthyes	Benthic	Batoid fish	3.41	8.36	3.70	5.89	0.32	5.17	4.54	4.17	0.20	0.30
Crustacea	Benthic	Crab	7.95	6.17	3.70	7.06		6.90	2.62	4.17	0.20	
		Mantis shrimp	4.55	3.07	3.70	3.81	2.48	5.17	4.31	4.17	0.20	3.43
		Shrimp	6.82	2.29	3.70	4.55		13.79	3.69	4.17	0.36	

Table 3: Diet composition of *E. coioides*and *E. bleekeri* in the Persian Gulf and Oman Sea, 2019-2020.

Ecological niche	*E.coioides*			
	Persian Gulf		Oman Sea	
	Length Class(TL, cm)			
	15-43.5	43.5-115	15-43.5	43.5-115
Pelagic	7.14	23.40	0.00	10.26
Semi-Pelagic	7.14	36.17	16.67	53.85
Demersal	21.43	34.04	16.67	20.51
Benthic	64.29	6.38	66.67	15.38
	E.bleekeri			
	17-26	26-79	17-26	26-79
Pelagic	0	9.09	0	5.45
Semi-Pelagic	0	51.95	0	32.73
Demersal	0	22.08	0	30.91
Benthic	100	16.88	100	30.91

Accordingly, 85.72% and 83.34% of the prey of *E. coioides* were benthic and demersal in the Persian Gulf and the Oman Sea, respectively. In contrast, juveniles of *E. bleekeri* were found to feed exclusively on benthic organisms in two areas.

Cluster analysis

Cluster analysis revealed that the highest similarity of *E. coioides* prey was observed between length classes 50-55 and 60-65 cm(49.38%) in the Persian Gulf (Fig. 2), and between length classes 20-25 and 50-55 cm (33.16%) in the Oman Sea (Fig. 3).Cluster analysis showed a difference between length classes 45-50 cmand the remaining classes. The highest similarity was found between length classes 20-25 and 25-30 cm (57.63%) for prey consumed by *E. bleekeri* in the Persian Gulf (Fig. 4). However, length classes 55-60 cmand others are estimated to belong to two separate groups in the Oman Sea (Fig. 5).

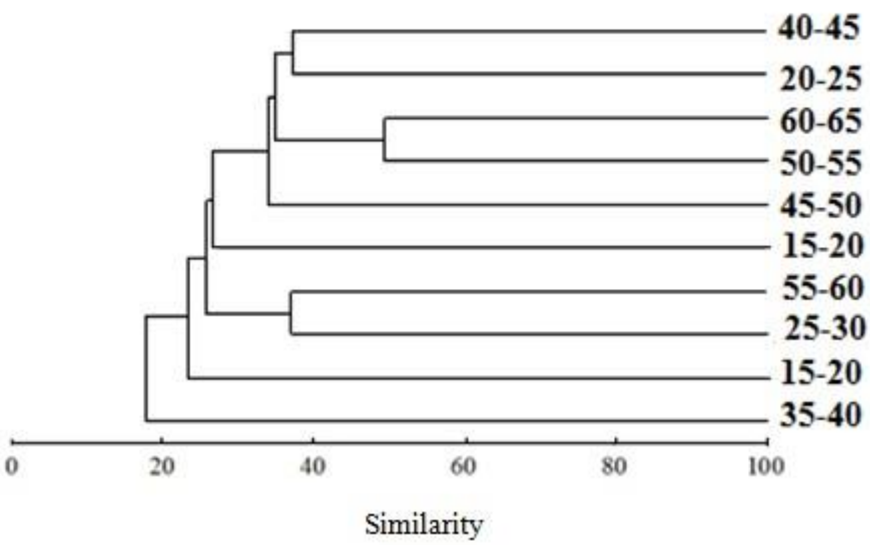
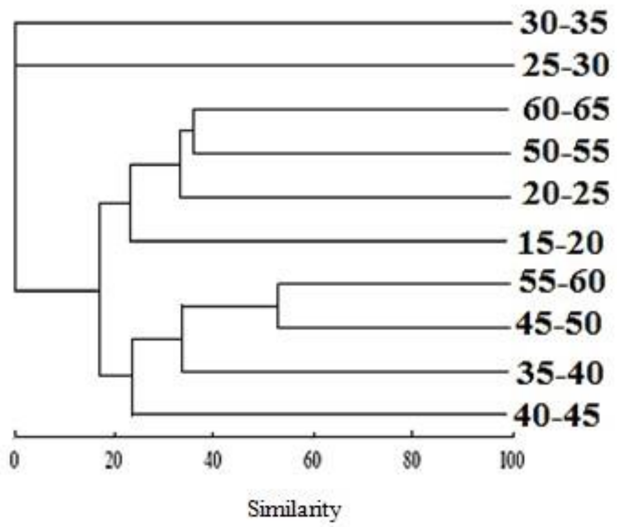


Figure 2: Dendrogram from cluster analysis of prey similarity in the class interval of *E. coioides* in the Persian Gulf.



Figrue 3:Dendrogram from cluster analysis of prey similarity in the class interval of *E. coioides* in the Oman Sea.

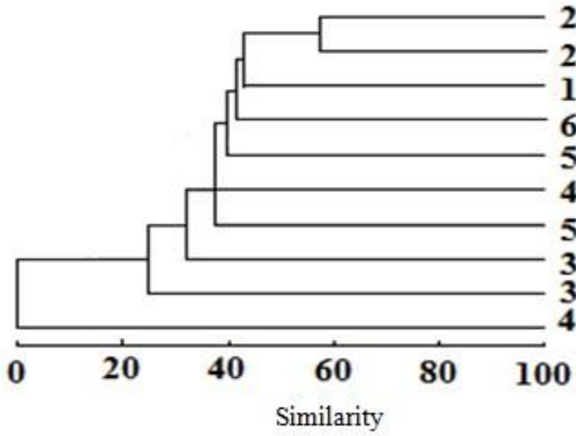


Figure 4: Dendrogram from cluster analysis of prey similarity in the class interval of *E.bleekeri* in the Persian Gulf.

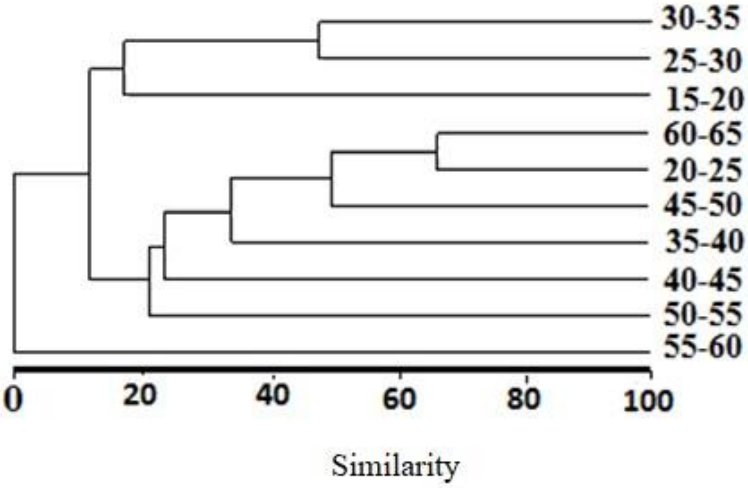


Figure 5:Dendrogram from cluster analysis of prey similarity in the class interval of *E.bleekeri* in the Oman Sea.

Discriminate analysis

The analysis to determine the food overlap in the length classes of *E. coioides* showed a high overlap and no significant difference in prey consumption between the Persian Gulf and the Oman Sea. This was indicated by a canonical correlation of 0.99 and the significance of the Wilks-Lambda test (p<0.05). The NMDS and cluster analysis also showed that the prey species of *E. coioides* overlap in the northern Persian Gulf and Oman Sea. The results of the SIMPER test showed that the similarity coefficient in the Persian Gulf and Oman Sea were 13.85% and 7.98%, respectively. Additionally, the average dissimilarity coefficient for *E. coioides* between the two areas was estimated to be 85.23%. For this species, *Carangoides*sp. in the Persian Gulf, the highest percentage of prey occurring in the length classes was (39.05%, 21.7%), while in the Oman Sea, it was *A. djedaba* with (29.63%, 16.63%). In terms of percentages, these prey items were primarily responsible for the differentiation between the two regions.

SIMPER analysis revealed a high degree of uniformity for *E. blekkeri* between the Persian Gulf and theOman Sea (86.92%). This indicates that the prey consumed in the different length classes in two region did not overlap and it appears that *L. lineolatus* (8.03%) was also involved in differentiating between the two areas.

Discussion

T.L calculated of *E.coioides* close to 4.0(Moniri *et al*., 2015) and 3.9±0.7 (Base *et al*., 2013), similar results were also obtained for *E. bleekeri* (3.9±0.6) and the genus *Epinephelus* sp. (3.8) (Moniri *et al*., 2015),these indiceswas obtained in this study (4.47±0.79, 4.36±0.77; (TL±Se)) in the Persian Gulf and (4.41±0.78, 4.39±0.78; (TL±Se)) in the Oman Sea for *E. coioides* and *E. bleekeri*respectively. It is considered one of the apex predators in the food web (Christensen *et al*., 2008).T.L calculated for*E.coioides* in this survey was close to 4.0(Moniri *et al*., 2015) and 3.9±0.7 (Base *et al*., 2013); also our obtained results for *E.bleekeri* was similar to (3.9±0.6)(Base *et al*., 2013). The T.L of an organism ranges from 2 (herbivorous) to 5 (carnivorous), although levels of 5 are rare, and it is reported for apex predators (Christensen *et al.*, 2008).Although it has been reported that most organisms have adapted to a specific range of prey, their ecological niche in the ecosystem remains constant. An increase in feeding has no effect on their T.L. (Vander Zanden *et al*., 2000), Still, the T.L. of some species changes during their life and is spatially and temporally variable, depending on where a predator lives (Christensen *et al*., 2008). Since the IRI includes W, N and P.O, it canbetter interpret the dietary habits of a species. The IRI for both species showed more than 90% Osteichthyes in both regions (Tables 1 and 2). Other researchers have also identified bony fihes as the highest percentage of *E.coioides* (Mohammadi *et al*., 2007), and the genus *Epinephelus* sp. (Randall, 1995; López and Orvay, 2005). Since the autolysis of Osteichthyes in the stomach of *Epinephelus* sp. (Beukers-Stewart and Jones, 2004) is four times that of crustaceans, it was assumed that crustaceans are the main prey of

Epinephelus sp. (Gerhardinger *et al*., 2006; Machado *et al*., 2008).

The prey species of *Epinephelus* sp. have evolved from demersal fishes (*Pomadasysstridens, P.maculatum* and *Upeneus* sp.) and benthic fishes (*Platycephalus* sp. and *Grammoplites* sp.) to pelagic, semi pelagic and benthopelagic fishes in two studied areas (Table 2), that the findings of this study confirm the previous study in this area (Mohammadi *et al*., 2007). The decline in benthic fish stocks due to overfishing in the last two decades can be explained by the changing diet of *Epinephelus* sp., and a decline in fishing in the marine food web is also reported in these areas (Razzaghi *et al*., 2017). This event was concluded by examining the reduction of T.L of fish brought into landfills around the world (Pauly *et al*., 1998). Due to fishing without selective gears, the contribution of species at the lower end of the food web decreases over time in the marine ecosystem as fishing increases (Pauly and Chuenpagdee, 2003).

The destructive biological and ecological effects of stern trawl components (otter trawls, ropes, chains, etc.) on the benthic communities of the seabed can be suspected in the destruction of the food web and the breakdown of the health of the demersal fisheries ecosystem (Lira *et al*., 2021). The results of the study on trophic structure, which examined the ecological relationships among five dominant commercial species, indicate that fisheries in this area are causing the most significant devastation (Masoomi *et al*., 2023). The overlap of diets was determined using the Pianka index(Pianka, 1973), which ranges from 0 (no overlap), to 1 (complete overlap); values above 0.5 are considered to indicate a high overlap. The results of the dietary overlap index showed a high overlap for two species in the Persian Gulf (0.98), and the Oman Sea (0.99). Higher dietary overlap between *E. coioides* and *E. bleekeri* could lead to a conflict of interest in their shared habitat or competition for the same prey. The overlap between the two species was observed despite the difference in the proportion of prey. This could be attributed to the wide range of habitats utilized by both species throughout their lifetime (Fischer, 1984; Amorim *et al*., 2018). The intensity of food overlap between two species can be considered a critical point, as they feed on the same prey groups with similar T.L. A positive correlation was found between habitat fragmentation and the extent of food overlap or competition among species that share food resources (Platell and Potter, 2001).

Competition for food can lead to a change in diet. The sharing of food and the ability to adapt their diet contribute to the assumption that fish have incredible adaptability to their trophic environment (Gerking, 1994). The low value of the food range for *E. coioides* indicates that this species has a more specific food preference compared to other species (Chuaykaur *et al*., 2020). The dietary range of predators tends to increase when the food supply is low and decrease when the food supply is high (Tse *et al*., 2008). The maximum and minimum consumption in the length classes of two species may be related to the availability of food resources when they are exposed to different regions. Habitat change also significantly affects prey selection for fish at various life stages (Machado *et al*., 2008). Both juveniles and adolescents of the two species predominantly fed on crustaceans, while adults preferred bony fishesas their dominant prey groups. The preference for crustaceans by smaller groups of fish was also found in other species (Haque *et al*., 2021). As mentioned in the results, the similarity of feeding in length classes is highest for *E. coioides* between 50-55 and 60-65 cmin the Persian Gulf (49.38%) and 20-25 and 55-55cm(33.16%) in the Oman Sea (Figs. 2 and 3). Although the similarity in feeding patterns among length classes (50-55, 60-65 cm) of *E.coioides* can be considered a normal phenomenon, the similarity in feeding between two length classes (20-25 and 55-55) in the Oman Sea is likely due to the extended time spent in passive fishing gears (such as trapsand bottom gillnets) and the autolysis of bony fishes in the stomach.

Due to the storms prevalent in the Oman Sea and the seasonal monsoon winds, it takes longer for fisheries cooperatives to retrieve passive gears (Ministry of Fisheries). The difference between the length classes that *E. bleekeri* feed on in the two areas could also be due to the greater steepness of the Oman Seaand the consequent lower availability of *L. linealatus* for this species compared to the shallower depth of the Persian Gulf. The feeding habits of two length classes (20-25 and 25-30 cm) (Fig. 4) in the Persian Gulf are expected to be similar, as it has been reported that juvenile individuals compete for limited food resources (Nunn *et al*., 2012). But the similarity in feeding patterns among length classes 55-60 in Oman Sea and the difference in feeding patterns between length class 45-50 in the Persian Gulf raise questions about the behavioral ecology of *E. bleekeri*. Further research on the feeding ecology of this species is needed. Although the results of the statistical analysis revealed similarities and dissimilarities in the feeding patterns of the two species across the two regions, it was concluded that alternating fish feeding with growth is necessary for the survival of a species. Why fish feeding in a specific area is the most crucial evolutionary process in fish feeding ecology, and the availability of a specific type of food in aregion, is the answer that most scientists provide to this question (Shelby D Gerking, 2014). Fish size, maturity, season, bottom depth, latitude, longitude and type of habitat (Ross, 1986; Clark and Pessanha, 2015), prey availability (Whitehouse *et al*., 2017), energy required for growth and metabolic activities (Specziár and Eros, 2014), are some of the main external or internal factors which influences of fish feeding. In theory, leaving the nursery as the young grow into adolescents or adults affects their feeding habits.

Ultimately, in order to change the diet of the species studied from benthic and demersal species to pelagic, semipelagic, and benthopelagic species, it is necessary to implement fisheries management strategies for forage fish and regulate fishing gear.

Conflicts of interest

The authors declare that they have no competing interests.

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