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Comparison study for natural food of three Iraqi marine Fish species

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Abstract:

The natural food content for three marine species of fish from Iraqi marine waters studied during the period from January to December 2017. The samples of *Planiliza subviridis*, *Tenualosa ilisha* and *Acanthopagrus arabicus* were monthly collected. The biologic measurements were taken for total length (cm) and body weight (g), the stomachs fullness degree and selectivity were studied by determining the percentage of fullness degree according to the preparation of the catching fishes. The total length rates of fish were studied during the period of the study (18.6), (18.7) and (19.9) cm and with a weight rates (58.6), (58.6) and (76.1) g respectively. The highest degree of stomach fullness recorded during the spring, while the lowest in autumn and winter. The study showed that organic detritus of *P. subviridis* formed 31.40% of food contents, whereas *T. ilisha* was filter feeder fish the plankton included 32.44% and 32.33% for animal components, *A. arabicus* was carnivores fish the animal resources formed 55>87%. The values of dietary selectivity of fish in their environment varied according to dietary enrichment, fish feeding activity and environmental temperature.

Keywords: Natural food, Biological measurements, Organic detritus, filter feeder, Carnivores.

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Introduction

Studying fish diets enhanced our knowledge of the functional, ecological and autecology role of fish guild, the previous studies also shows that distribution and spread of fish strongly related to availability of fish food, in addition to provide us information about productivity of water body and highlights on inter and intraspecific relationships [13, 15].

Food segmentation reduces interspecific trophic competition among fish populations, communities and increases presence number of fish species [34]. The variation in niche food and feeding habits reduce diet competition among intraspecific species and allows exploitation entire parts of water medium based on morphology, behavior or physiology of species that facilitate use of available food resources [22]. [27] reported that feeding ecology of sympatric fish populations provide us new ideas about population dynamic of fish species, segregation resources, habitats preferred and prey predator's relationships. Studying of diet ecology give us insights of energy transfer and distribution inside water body during food web and provide information competition interactions, which is especially important for the continued entry of alien species [25]. Fishes food habitats varied to large extent due to the huge differences in structural and functional feature of digestive apparatus which is modified to specific sort of food consistent with the composition and nature of the intestine [8]. [28] stated that fish intestine structure and length vary from species to another with variation in nature of food habits, but intestine dissection and length asymmetric in most population species according to age which is associated with change in the quality of the food preferred [26]. There were many studies have been done dealt with the studies of food and feeding habits of fish in Iraqi marine waters, [35; 2; 20; 9; 14 and 30].

The present study aimed to assess the differences and compare the nature food between the three species of fishes in Iraqi marine waters.

Materials and methods

Fish samples

The natural food content for three species of marine fish from Iraqi marine waters was studied during the period from January to December 2017, Monthly samples were collected for fish of *P. subviridis*, *T. ilisha* and *A. arabicus*, the samples were transferred to the laboratory using cork containers and covered with crushed ice to keep samples fresh, the fishes were taken to study their food content.

Table 1. The quarterly distribution of the months of seasons According the study area.

winter	Jan.	Feb.	Mar.	

spring	Apr.	May	-	-
summer	Jun	July	Aug.	Sep.
autumn	Oct.	Nov.	Dec	-

Biological measurements

The length of the fish and the gastrointestinal was measured using a measuring ruler (cm). The weights (g) were measured by using weight measuring type (Sartorius Germany manufactured), length and weights rates were calculated monthly and divided (seasonally) according to the months of fishing and quarterly according to (table 1).

Food ingredients study

Fish were taken after biological measurements in a large dish and opening the body cavity using laboratory dissection tools, length measurements of the gastrointestinal tract were done, points method was adopted by determined the degree of fullness. The first third of the gastrointestinal tract was selected to examined, the food content and placed on a petri dish and examined using an anatomical and photovoltaic microscope, after being spreads on a glass slide to define the exist species by using the point's methods [12].

Samples were taken to determine the presence of species of nutrients in fish feeding, their degree of presence and spread according to the environmental factors in the area, using the method of [12] which modified by [20], The following references were adopted to determine the types of food species: [29; 24; 3; 4 and 1].

The percentage of food components was determined according to [30]:

$$\text{Percentage of food components} = \frac{\text{Food components ratio (individual)}}{\text{Total food (of all)}} \times 100$$

The equation (Manly`s alpha) used to study food selectivity [16]:

$$\frac{rj}{ni) / ni\Sigma (rj} = \grave{\alpha}$$

$\grave{\alpha}$ = Food preference or selectivity of prey species

n_i = Rate (number× volume) in the habitat

rj = Rate (number × volume) the preys in the digestive tract

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Results and discussion

Table 2. Showing the lengths, weights, intestine length (cm) and fullness degree of the study fishes. It was found that the highest degree of fullness was recorded during spring reaches 20 for all caught fish and the lowest in autumn and winter seasons, reaching 5, the table shows the number of empty stomach by season. The present three species belonging to different families, groups and occupied difference niche in aquatic environment, it is normal to find a functional heterogeneity in the food and feeding habits according to variations in functional and structural variability, addition to its exhibited relatively correlations with the species and fish size due to ontogenetic variation in food with age stage [21]

Table 2. The seasonal rate values of the total length (cm), weight (g), intestinal length (cm) and fullness index degrees of the study species.

Species	Season	Total length (cm)	Weight rate (g)	Number of fishes	Stomach length rate (cm)	Number of empty stomachs	Rate of fullness degree (20)
Planiliza subviridis	Winter	16.13	53.6	20	49.7	2	15
	Spring	17.23	69.94	24	51.4	0	20
	Summer	18.9	69.82	22	56.3	6	10
	Autumn	17.4	58.6	20	51.9	6	10
Tenualosa ilisha	Winter	18.6	54.3	24	44.2	4	5
	Spring	19.4	59.4	22	48.1	4	15
	Summer	19.1	55.9	26	48.8	8	10
	Autumn	18.7	58.6	20	44.6	2	5
Acanthopagrus arabicus	Winter	20.1	71.3	28	13.1	6	5
	Spring	22.3	93.2	22	14.7	2	20
	Summer	21.4	82.6	26	14.6	4	15
	Autumn	19.9	76.1	24	12.9	8	5

Fig. (1), illustrates the fullness degree of the stomach according to the number of caught fish during the period of experiment and the number of empty stomach, the highest degree of fullness recorded (20) in spring and the lowest degree of fullness recorded (5) in the fall in autumn and winter. Fish biological activates in summer and temperate seasons more than winter, so feeding intensity is strongly variable seasonally, being highly in summer comparison to winter, so the fullness degree higher in summer and spring season [23].

The length of the gastrointestinal tract was three times the total length of the body of *P. subviridis* as it`s depend on a herbivores nutrition, while the gastrointestinal tract of *Tenualosa ilisha* was almost double as it was because it is depend on mixed feeding, whereas the gastrointestinal tract of *A. arabicus* was shorter than Previous fishes because it was depend on animal resources in feeding. The gastrointestinal tract length differ in fishes according to the nature of food resource, which consume by species such as the herbivores species have longer gastrointestinal than omnivores or carnivorous species may be due to the plant resources needs more digestive process comparison with animal food components [21].

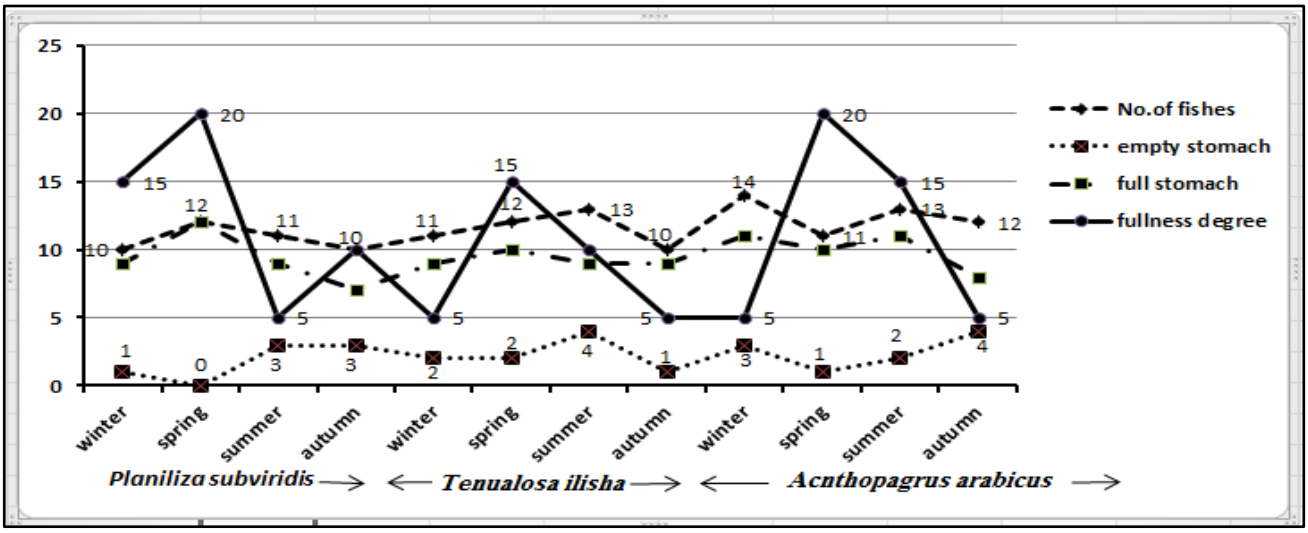

Fig. 1: The degrees of fullness for the study fishes.

Table 3. Explain the percentage of nutrient content according to the sources of the food component within the gastrointestinal tract. The results showed that the organic detritus resources were the most representative percentage in fish food of *P. subviridis* which attained (31.40%), while *T. ilisha* the composition of the food components was determined by close values of food from plant and animal resources which was formed (32.41% and 32.33%) of plankton and animal components respectively. In *A. arabicus* animal resources accounted for the highest percentage of food components, such as animal items, where animal components accounted reached 55.87% of food components and plankton (28.70%) from the animal components of the food, Fig (2). The investigated species ingestion diversified food resources due to the variance in morphological and functional of the fishes that increases the variations in affordable food are related to fluctuations and in the density of resource items in the habitat [19]. A good knowledge of the nature of environment, in which fish live, highlights on nutrition role in aquatic organism communities in different habitat by determining the nature of the interaction among species depending on variations in morphology, behavior, physiology that facilitate use of available food items [34; 15].

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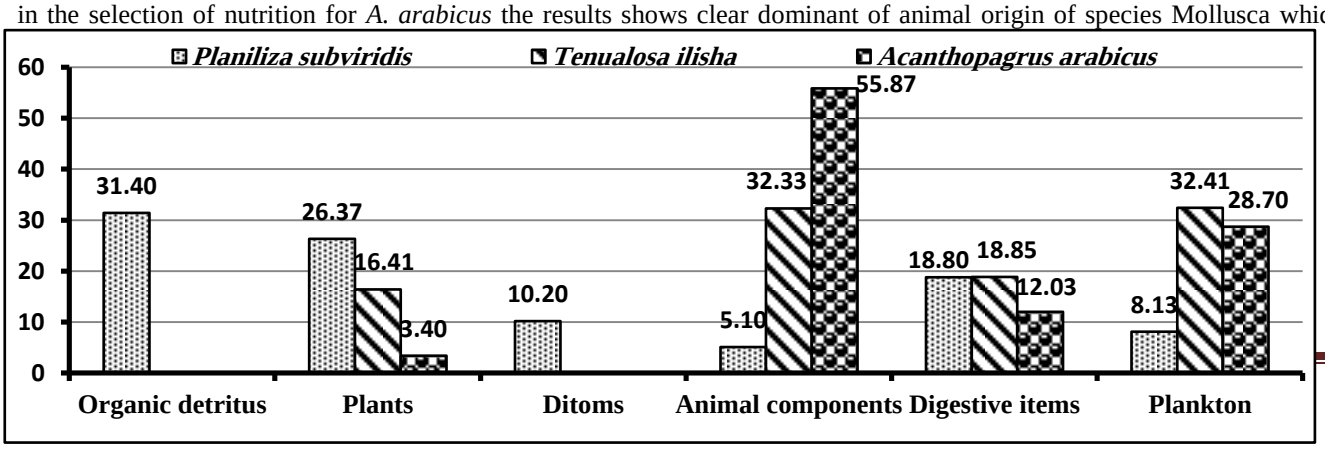
Table 3. The percentage of nutrient content according to the resources of the food component within the gastrointestinal tract.

Species	Plankton	Plant components	Organic detritus	Animal component	Diatoms	Digestible food
P. subviridis	**8.13***	**26.37**	**31.40**	**5.10**	**10.20**	**18.80**
T. ilisha	**32.41***	**16.41**		**32.33***		**18.85**
A. arabicus	**28.70**	**3.40**		**55.87***		**12.03**

Fig. 2: The percentage of nutrient content according to the sources of the food component within the gastrointestinal tract.

Table 4, illustrated the food selectivity of the present study fishes, the results showed that selectivity of food were based on the thrive of nutrition richness of the environment, and the results appear increase in plant selectivity in each stomach of *Planiliza subviridis* and *Tenualosa ilisha* which record 0.1069 and almost between 0.0651 to 0.0657 respectively. Priority in the selection of nutrition for *A. arabicus* the results shows clear dominant of animal origin of species Mollusca which



reached 0.0889 (Fig. 3). The study showed that feeding of the three species revealed partitioning of food sources among the present species due to food selectivity was more pronounced in season, but may be reduce their food overlap, depending on food competition, availability of food resources, food preference, and environmental factors [24]. The uniformity some of items resources among the investigated species did not indicate presence of competition, *P. subviridis* feeding on organic detritus materials which more abundant in our ecosystem and *T. ilish*a filtering the water and extraction the zooplankton from the waters column, while *A. arabicus* carnivores fish . The spatial segregation of the habitat perhaps limits the interactions within species that live in the large ecosystem including complex environment [33; 32].

Table 4. Food selectivity of the study fishes in Iraqi marine waters

species	seasons	plankton		Mollusca	Fish	Algae	Shrimp	Copepods	Rotifers	Digestible food
		Zoo	Phy.							
P. subviridis	winter	0.0496	0.0716	-	-	0.0992	-	0.0492	0.06	0.0704
	spring	0.054	0.0744	-	-	0.1052	-	0.0488	0.0524	0.0652
	summer	0.0654	0.0788	-	-	0.1148 *	-	0.0344	0.0412	0.0744
	autumn	0.0384	0.0792	-	-	0.1084	-	0.0384	0.0448	0.0908
	rate	0.0518	0.0761	-	-	0.1069 **	-	0.0305	0.0496	0.0752
T. ilisha	winter	0.0784	0.0696	-	-	0.0588	-	0.0592	0.056	0.0784
	spring	0.0644	0.0676	-	-	0.0712 *	-	0.0608	0.0616	0.0744
	summer	0.054	0.0572	-	-	0.0692	-	0.0688	0.0732	0.0776
	autumn	0.062	0.0652	-	-	0.0636	-	0.0684	0.0696	0.0712
	rate	0.0647	0.0649	-	-	0.0657	-	0.0643	0.0651	0.0754**
A. arabicus	winter	0.0736	0.0564	0.0788	0.0116	0.018	0.0164	0.0452	0.0432	0.0568
	spring	0.0772	0.0404	0.0872	0.022	0.0168	0.0232	0.0476	0.0408	0.0448
	summer	0.0744	0.0408	0.094	0.0164	0.0196	0.0184	0.0488	0.0468	0.0412
	autumn	0.0756	0.0388	0.0956*	0.0184	-	0.0204	0.0528	0.0656	0.0508
	rate	**0.0707**	**0.0441**	**0.0889****	**0.0171**	**0.0182**	**0.0196**	**0.0486**	**0.0491**	**0.0484**

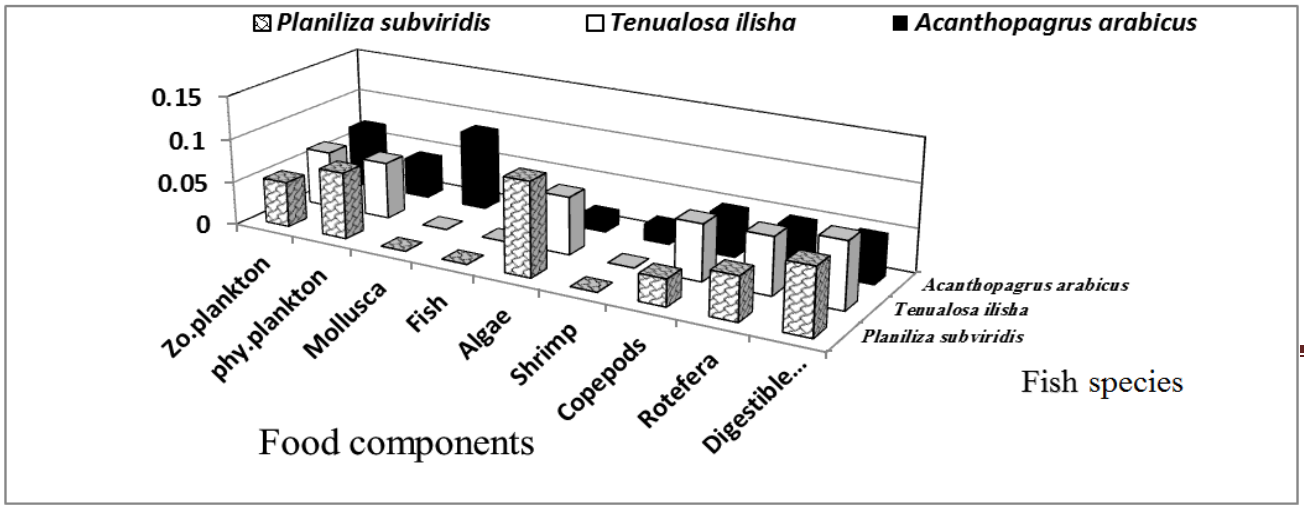


Fig. 3. Food selectivity of the present study fishes in the Iraqi marine waters

The results showed that the three marine species resident in variable habitat and very large divers in food type, so [17] reported that fragmentation of food resources, habitat and time reduce the competition among species in fish assemblage and create opportunities for coexistence. The differences in feeding ecology and trophic specialization reduce the competition among the three species [6].

Conclusions

The functional and morphological variance among the present species created more difference in food resources and the differing presence in the water column reduce the diet competition among the species.

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