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Research Article

Feeding habits of the flying gurnard, *Dactylopterus volitans* (Linnaeus, 1758), on the continental shelf of Côte d'Ivoire, West Africa, Côte d'Ivoire

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Abstract

The feeding habits of the flying gurnard, *Dactylopterus volitans*, caught by industrial trawlers operating on the continental shelf of Côte d'Ivoire were examined. A total of 1337 specimens, including 351 males and 986 females were collected at the fishing harbour of Abidjan from January 2019 to December 2020. The diet of fish with a size ranging from 60 to 390 mm standard length was described using the prey-specific index of relative importance (%PSIRI), combining occurrence, numerical and weight percentages. The stomach contents revealed that 901 (67.38%) stomachs were empty, whilst 436 (32.62%) were full. The diet was composed of twenty-six prey items including shrimps, teleost fishes, crabs, bivalves, gastropods and cephalopods. Based on the PSIRI (%), the most important prey items were shrimps (41.11 %PSIRI), especially *Penaeus notialis* (20.10 %PSIRI) and teleost fishes (31.87 %PSIRI). Crabs (19.38 %PSIRI) are considered as secondary preys, whereas the other preys such as cephalopods (4.95 %PSIRI), gastropods (1.38 %PSIRI) and bivalves (1.31 %PSIRI) were incidental preys. The presence of a variety of mobile preys in the stomachs indicates that this species is a carnivorous feeder.

Introduction

Studying the diet of marine species is crucial to understanding ecological interactions with marine ecosystems (Nielsen *et al*., 2017) and implementing sustainable management measures for fishery resources (Chivers *et al*., 2013). The flying gurnard, commonly known as *Dactylopterus volitans*, is one of the species of particular importance in this field and plays a significant role in the local market. This fish belonging to the family of Dactylopteridae is distinguished by its enlarged pectoral fins, which enable it to fly over the seabed in search of food (Mazza, 2019). As a demersal predator found in tropical and subtropical waters (Daros *et al*., 2012), the flying gurnard is a species of ecological interest, attracting the attention of researchers and marine resource managers. Understanding the feeding habits of *D. volitans* is an essential step in determining its position in the trophic chain in order to assess its potential impact on prey populations and the ecosystem (Layachi *et al*., 2007). Several studies have been carried out on this species, including those of Segadilha *et al*. (2017), Didierlaurent and Rochefort (2018), and Mazza (2019). However, these studies have generally been limited to prey classification.

In the eastern central Atlantic region, particularly within the Gulf of Guinea, there is a notable absence of research focused on the diet of this species. Consequently, this study aims to examine in detail the food choices of *D. volitans*, by analysing the types of prey consumed, seasonal preferences and variations according to fish sizes. This analysis can enhance our understanding of the significance of this species within the marine ecosystem, predict the impacts of changes in its diet, and supply essential insights to inform conservation and sustainable management strategies for its populations.

Materials and methods

Study area and sampling

This work was carried out in the Ivorian Exclusive Economic Zone (EEZ). This zone, located in the Gulf of Guinea, is bounded to the North by the West African coast, to the south by the parallel 5°N, to the west by the Cape of Palms (8°W), and to the east by the Cape of Three Points (2'30'W) (Colin *et al*., 1993). It covers an area of 200,000 km^2 (Fig. 1) and according to Morlière and Rebert (1972), it is characterized by two main seasons with cold seasons (July–October and January–February) and warm seasons (March–June and November–December). Catches comes from industrial trawls targeting demersal resources for the local market. These vessels, ranging in gross tonnage from 50 to 295 tonnes, have a 15-day autonomy in fuel and ice, and are equipped with 10 storage holds. In general, each trawler carries out a 12-day fishing campaign, with three-hour hauls during the day and four-hour hauls at night. Samples were collected at the fishing harbour of Abidjan, Côte d'Ivoire, between January 2019 and December 2020.

For each specimen, the standard length (SL) was measured to the nearest mm and the total mass to the nearest 0.1 g. After dissection, the sex was recorded and stomach was removed, opened and their contents weighed to the nearest 0.001 g. In order to identify and quantify the different prey species, the stomach contents were placed in a petri dish and weighed, along with the empty stomachs. The contents were then separated by prey types, and each type was counted, weighed and identified to the lowest possible taxonomic level, using the keys of Carpenter and De Angelis (2014, 2016). Preys, which were too damaged and difficult to be identified were classified as unidentified.

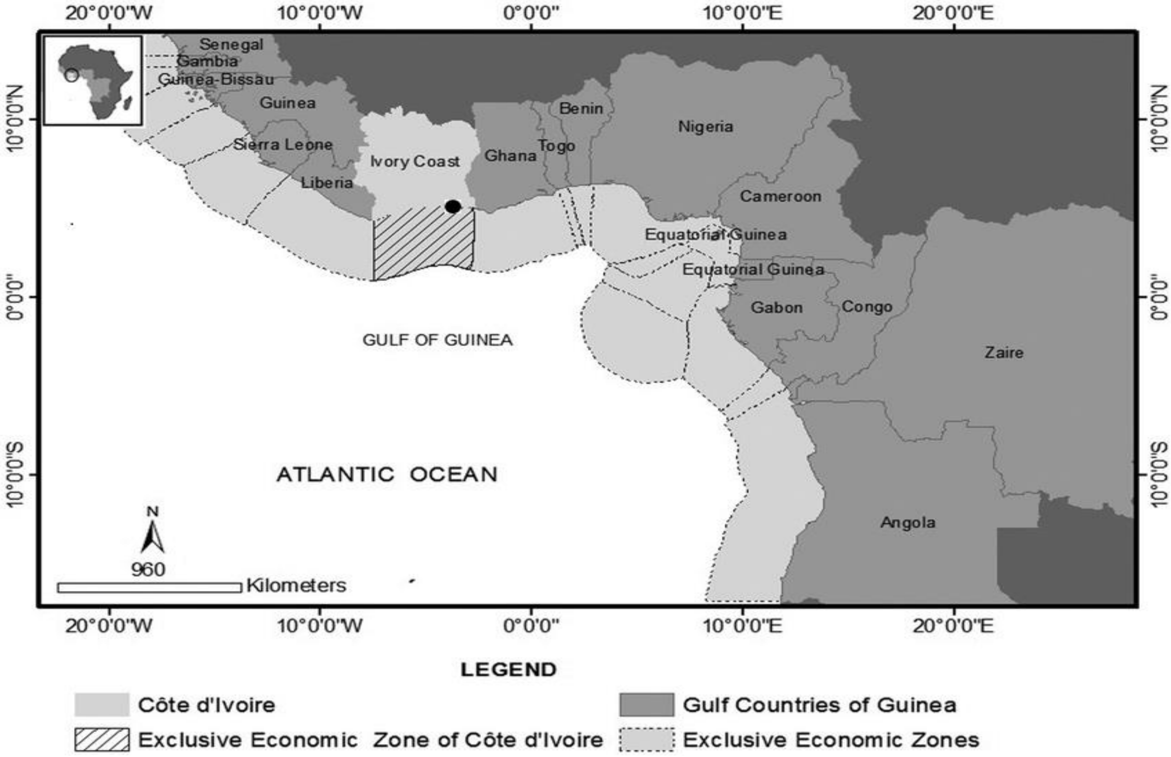

Figure 1: Study map showing landing (●) and sampling areas (▨) for the flying gurnard *Dactylopterus volitans*.

Data analysis

The vacuity coefficient (CV) was used to appreciate the degree of digestion of this species. This vacuity coefficient was determined using the following equation:

$$\%\ \mathrm{CV} = \frac{\mathrm{n_i}}{\mathrm{n}} \times 100$$

Where, n_i is the number of empty stomachs and n is the total number of stomachs examined. The importance of prey items was determined using the prey-specific index of relative importance (%PSIRI) proposed by Brown *et al.* (2012), the prey-specific abundance ($\%PA_i$), the average percent abundance (%Ai) and the frequency of occurrence (FO) as follow:

Prey-specific abundance ($\%PN_i$, $\%PW_i$):

$$\%\mathrm{PA_i} = \frac{\sum_{j=1}^{n} \%\mathrm{A_{ij}}}{\mathrm{n_i}}$$

Average percentage abundance (%Ni, %Wi):

$$\%\mathrm{A_i} = \frac{\sum_{j=1}^{n} \%\mathrm{A_{ij}}}{\mathrm{n}}$$

Frequency of occurrence (FO):

$$\%\mathrm{FO} = \frac{\mathrm{n_i}}{\mathrm{n}} \times 100$$

Where, $\%A_{ij}$ is the abundance (by counts or weights) of prey category i in stomach sample j, n_i is the number of stomachs containing prey i, and n is the total number of stomachs.

The %PSIRI was then calculated as:

$$\%\mathrm{PSIRI_i} = \frac{\%\mathrm{FO_i} * (\%\mathrm{PN_i} + \%\mathrm{PW_i})}{2} = \frac{\%\mathrm{N} + \%\mathrm{W}}{2}$$

Where $\%FO_i$ is the frequency of occurrence for prey type i, $\%N_i$ is the percent by number of prey type i in all stomachs containing prey type i, and $\%W_i$ is the percent by weight of prey type i in all stomachs containing prey type i.

The classification of prey items followed the method of Rosecchi and Nouaze (1987). For this purpose, preys were first sorted in decreasing order of importance according to their PSIRI and then a cumulative %PSIRI was calculated. The first single item, or item groups, for which cumulative %PSIRI value was equal to or greater than 50% was considered as preferred food. The %PSIRI values of other important prey items were then added to that of the preferred food until the %PSIRI reached 75%, and these were considered as secondary prey. Food items between a %PSIRI of 75 and 100% were considered as incidental preys.

To assess the overlap in diets between juveniles and adults and between cold season and warm season, the Morisita–Horn index (Cλ) was used (Smith and Zaret, 1982). It is calculated according to the following formula:

$$C\lambda = 2\frac{\sum_{i=1}^{n}(P_{xi}P_{yi})}{(\sum_{i=1}^{n}(P_{xi}^2 + P_{yi}^2)}$$

Where, P_{ix} and P_{iy} are the proportions (based on %PSIRI) of a prey i consumed by the predator x and y, respectively, following the sex and marine seasons.

The overlap is lower in values between 0 and 0.29, medium in values between 0.30 and 0.59, and high in values over 0.60 (Smith and Zaret, 1982).

Fish size groups

Fish were grouped into two categories according to the size at first sexual maturity (N'Zi *et al*., 2023): juvenile individuals (n=76) with sizes inferior to 176 cm, and adult individuals (n=360) with sizes equal to or larger than 176 cm.

Feeding strategy

Costello's diagram (1990) modified by Amundsen *et al*. (1996) was used to obtain the feeding strategy of each species. It also allows the analysis of the importance of prey items and their contribution to the extent of the trophic niche. The diagram is an in-plane representation of specific abundance index ($\%S_i$) as a function of frequency of occurrence (%FO). The $\%S_i$ is calculated according to the formula:

$$\%\mathrm{Si} = \frac{\mathrm{n_i}}{\mathrm{n}} \times 100$$

Where, n_i is the total abundance of prey i and n is the total abundance of all prey only in the set of stomachs containing prey i.

Graphical interpretation can be obtained by examining the distribution of prey along the diagonals and axes. The diagonal running from the bottom left corner to the top right corner measures the importance of the prey. Dominant preys are located in the upper part and rare prey in the lower part. The vertical axis represents the predator's feeding strategy in terms of specialization or generalization.

Statistical analyses

The Kruskal-Wallis test was performed to analyse monthly variations in vacuity. A chi-square (χ^2) test was applied to assess significant differences between seasons. The Spearman's rank correlation test was used to evaluate differences in diet composition.

Results

Vacuity index

A total of 1337 stomachs were analysed, of which 901 were empty and 436 contained food. The corresponding vacuity index was 67.38%. The vacuity index remained high throughout the year, with a higher value in June (90.58%) and a lower value in October (43.26%) (Figs. 2 and 3). However, there was no significant difference by month (Kruskal-Wallis test, H=11.00; p>0.05). The vacuity index was also analysed seasonally. During the cold season, 398 stomachs out of 662 were empty, giving a value of 60.12%. In contrast, during the warm season, 503 empty stomachs were identified out of 675 stomachs examined, giving a vacuity index of 78.51%. This result indicates a higher vacuity index during the warm season than during the cold season, but the difference was not significant (χ^2=2.44; p>0.05).

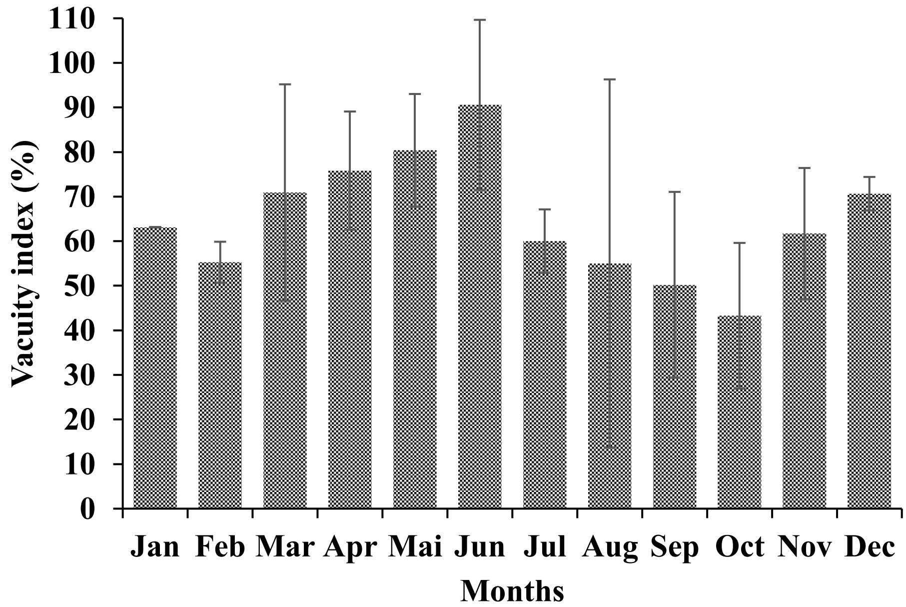

Figure 2: Vacuity index of *Dactylopterus volitans* from January 2019 to December 2020 in the Ivorian Exclusive Economic Zone.

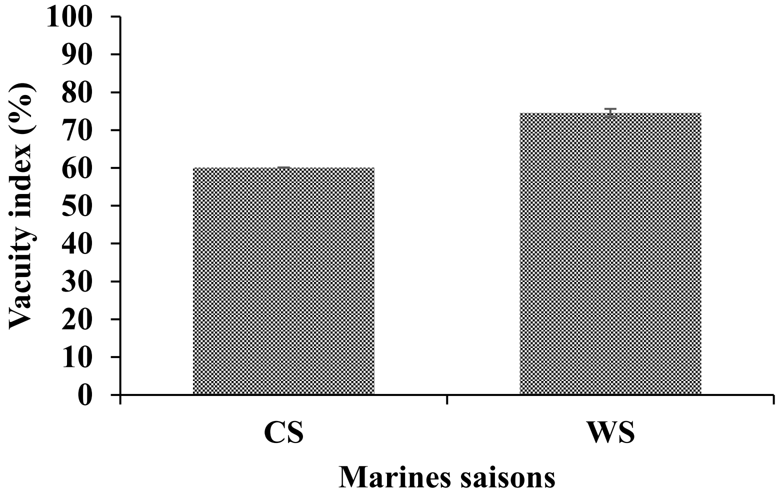

Figure 3: Seasonal vacuity index of *Dactylopterus volitans* from January 2019 to December 2020 in the Ivorian Exclusive Economic Zone. CS: cold season; WS: warm season

Overall diet composition

The diet of *D. volitans* revealed twenty-six types of prey items including shrimps, teleost fishes, crabs, bivalves, gastropods and cephalopods (Table 1). Based on the prey-specific relative importance index, the most important prey were shrimps (41.11 %PSIRI), especially *Penaeus notialis* (20.10 %PSIRI) and teleost fishes (31.87 %PSIRI). Crabs (19.38 %PSIRI) can be considered as secondary preys, whereas the other preys such as cephalopods (4.95 %PSIRI), gastropods (1.38 %PSIRI) and bivalves (1.31 %PSIRI) were incidental preys.

Table 1: Diet composition of *Dactylopterus volitans* population. Frequency of occurrence (%FO) percent prey-specific number (%PN), percent number (%N), percent prey-specific weight (%PW), percent weight (%W), prey-specific index of relative importance (%PSIRI).

Categories	Species	%FO	%PN	%N	%PW	%W	%PSIRI
Shrimps		**65.37**	**267.22**	**41.18**	**259.83**	**41.03**	**41.10**
	Penaeus notialis	30.96	65.16	20.18	64.68	20.03	20.10
	Scyllarides herklotsii	12.61	48.77	6.15	40.87	5.16	5.65
	Sicyonia galeata	2.52	87.67	2.21	82.85	2.09	2.15
	Stomatopoda	5.73	15.51	4.31	26.03	3.17	2.73
	Unidentified shrimp	13.54	50.12	8.33	45.4	10.59	10.47
Fish		**55.05**	**517.92**	**32.14**	**497.08**	**31.60**	**31.87**
	Brachydeuterus auritus	5.96	44.37	2.65	46.61	2.78	2.71
	Chloroscombrus chrysurus	0.23	16.67	0.04	35.20	0.08	0.06
	Hippocampus punctulatus	0.46	32.14	0.15	29.59	0.14	0.14
	Ilisha africana	2.75	55.24	1.52	54.51	1.50	1.51
	Pagellus bellotii	3.44	30.89	1.06	61.01	2.10	1.58
	Pentanemus quinquarius	13.30	64.36	8.56	60.43	8.04	8.30
	Pteroscion peli	2.06	46.11	0.95	47.27	0.98	0.96
	Sardinella aurita	1.83	51.67	0.95	53.66	0.98	0.97
	Schelidonichtys lucerna	0.69	39.86	0.27	11.27	0.08	0.18
	Solea senegalensis	0.46	38.33	0.18	21.97	0.10	0.14
	Sphoeroides pachygater	0.69	30.95	0.21	11.87	0.08	0.15
	Unidentified fish	23.17	67.34	15.60	63.67	14.75	15.17

Categories	Species	%FO	%PN	%N	%PW	%W	%PSIRI
Crabs		**30.05**	**185.32**	**18.91**	**189.55**	**19.86**	**19.38**
	Calappa rubroguttata	1.83	54.57	1.00	51.57	0.95	0.97
	Petrolisthes galathinus	5.96	68.63	4.09	72.39	4.32	4.20
	Unidentified crab	22.25	62.12	13.82	65.59	14.59	14.21
Cephalopods		**12.39**	**94.01**	**5.29**	**78.80**	**4.60**	**4.95**
	Octopus vulgaris	3.90	58.54	2.28	45.50	1.77	2.03
	Sepia officinalis	8.49	35.47	3.01	33.30	2.83	2.92
Gastropods		**2.52**	**116.19**	**1.45**	**104.60**	**1.30**	**1.38**
	Bankivia fasciata	1.38	53.19	0.73	43.81	0.60	0.67
	Margarites ryukyuensis	1.15	63.00	0.72	60.78	0.70	0.71
Bivalves		**5.05**	**38.15**	**1.02**	**88.00**	**1.61**	**1.31**
	Cerastoderma glaucum	0.46	4.76	0.02	10.55	0.05	0.04
	Donax venustus	2.98	33.40	1.00	22.95	0.68	0.84
	Unidentified bivalve	1.61	0.00	0.00	54.49	0.87	0.44
Total				**100**		**100**	**100**

Diet composition with fish size

Major food items did not vary with fish size classes. The juveniles fed preferentially on shrimps (PSIRI=45.76%) and teleost fishes (PSIRI=32.13%), with the major secondary food item being crabs (PSIRI=16%) and cephalopods (PSIRI=3.09%). The other prey items were consumed in small quantities.

For adults, the trophic spectrum also consisted of shrimps (PSIRI=42.56%) and teleost fishes (PSIRI=31.08%) followed by crabs (PSIRI=3.09%) and cephalopods (PSIRI=5.34%), with gastropods (PSIRI=1.21%) and bivalves (PSIRI=1.63%) being in small quantities in the diet (Table 2).

Table 2: Diet composition of *Dactylopterus volitans* according to sex, size and marine seasons caught in the Côte d'Ivoire exclusive economic zone between January 2019 and December 2020.

Prey Categories	Species	Prey-specific index of relative importance (%PSIRI)			
		Sizes		Seasons	
		Juveniles (SL<176 mm)	Adults (SL>176 mm)	Cold (n=264)	Warm (n=172)
Shrimps		45.76	42.56	42.85	38.21
	Penaeus notialis	25.87	20.27	21.79	18.09
	Scyllarides herklotsii	7.62	5.89	6.31	4.65
	Sicyonia galeata	1.32	2.33	1.68	2.91
	Stomatopoda	2.27	2.21	1.98	2.77
	Unidentified shrimp	8.68	11.87	11.1	9.79
Fish		32.13	31.08	30.05	36.60
	Brachydeuterus auritus	1.69	3.04	3.15	2.30
	Chloroscombrus chrysurus	-	0.07	0.19	-
	Hippocampus punctulatus	-	0.16	0.23	-
	Ilisha africana	3.95	0.99	1.11	2.38
	Pagellus bellotii	-	1.91	2.66	-
	Pentanemus quinquarius	8.76	8.28	6.84	11.26
	Pteroscion peli	-	1.17	1.77	0.03
	Sardinella aurita	1.65	0.82	1.23	0.83

Prey Categories	Species	Prey-specific index of relative importance (%PSIRI)			
		Sizes		Seasons	
		Juveniles (SL<176 mm)	Adults (SL>176 mm)	Cold (n=264)	Warm (n=172)
	Schelidonichtys lucerna	-	0.21	0.27	0.02
	Solea senegalensis	-	0.17	0.17	0.12
	Sphoeroides pachygater	-	0.20	0.29	-
	Unidentified fish	16.08	14.03	12.15	19.68
Crabs		16.00	18.18	20.64	15.75
	Calappa rubroguttata	-	1.18	1.62	-
	Petrolisthes galathinus	4.28	4.18	3.99	4.54
	Unidentified crab	11.72	12.82	15.04	11.21
Cephalopods		3.09	5.34	3.60	6.77
	Octopus vulgaris	0.99	2.25	0.73	4.02
	Sepia officinalis	2.10	3.09	2.87	2.75
Gastropods		2.20	1.21	1.13	1.77
	Bankivia fasciata	0.12	0.79	0.61	0.76
	Margarites ryukyuensis	2.08	0.42	0.52	1.01
Bivalves		0.82	1.63	1.73	0.90
	Cerastoderma glaucum	0.16	0.01	0.10	-
	Donax venustus	-	1.05	1.44	-
	Unidentified bivalve	0.66	0.57	0.19	0.90

The Morisita-Horn index showed that *D. volitans* had a high diet overlap between juveniles and adults (Cλ=0.78). According to the Spearman's index, the diets of both juveniles and adults of *D. volitans* (N=436; Rs=0.78; p=0.05) had a consistent relationship, suggesting that the main prey items in their diets were similar. The Kruskal-Wallis test performed (H=2.32, $p>0.05$) did not reveal any significant differences in the diet components of both size groups.

Seasonal variation in diet

Diet did not vary according to marine seasons (Table 2). During the cold marine season, shrimps (PSIRI=42.85%), teleost fishes (PSIRI=30.05%) and crabs (PSIRI= 0.64%) were predominant in stomach, whereas cephalopods (PSIRI=3.60%), gastropods (PSIRI=1.13%) and bivalves (PSIRI=1.73%) were little eaten. In warm season, shrimps (PSIRI=38.21%), teleost fishes (PSIRI=36.60%) and crabs (PSIRI=15.75%) were also more consumed by this species. However, the proportions of shrimps and crabs were slightly higher in the cold season, whereas the proportion of teleost fishes slightly decreased in this season. The Morisita-Horn index indicates that trophic overlap between seasons was high (Cλ=0.94). The Spearman's index revealed a significant correlation in the diets of both seasons (N=436; Rs=0.74; $p<0.05$), indicating that the main prey items were similar. The Kruskal-Wallis test performed (H=2.46, $p>0.05$) did not reveal any significant seasonal variation in the diet of this species.

Feeding strategy

The Costello diagram modified by Amundsen (Fig. 4) suggests that the flying gurnard *D. volitans* is classified as a generalised carnivore, with a diet consisting of a variety of mobile organisms such as shrimps (FO=65.37%, Si=48.34%) and teleost fishes (FO=55.05%, Si=45.48%). The other preys in the lower left-hand section of the diagram are classified as rare in the diet.

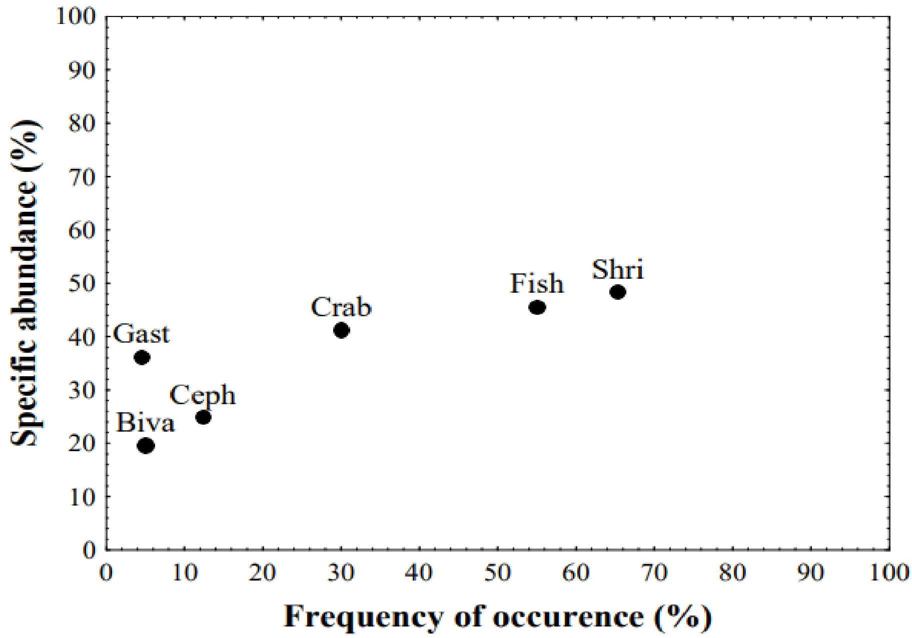

Figure 4: Costello diagram modified by Amundsen *et al*. (1996) showing the Feeding strategy of *Dactylopterus volitans* in the Ivorian Exclusive Economic Zone.

Discussion

Stomach content analysis yielded a high number of empty stomachs with a vacuity rate of 67.38%. This value is higher (50%) compared to that reported in Campos Basin, Brazil by Segadilha *et al*. (2017). In fact, sampling period, predation type, food type, environmental temperature, physiological condition of fish, prey size, and/or level of physical activity are factors that certainly influence digestion in this specie. According to Besbes-Benseddik *et al.* (2015), these factors lead to difference in vacuity coefficient values depending on the biogeographical area. This index remained high throughout the year, with value being higher in the warm season. This fact could be linked to species reproduction, as the increase in this coefficient during the warm season indicates a drop in species feeding activity, probably due to the maturation of gonads. In fact, N'Zi *et al*. (2023) reported that the flying gurnard spawned twice during a relatively long reproductively active period, from May to August and from November to February in thee EEZ of Côte d'Ivoire. According to Layachi *et al.* (2007) and Ferhani *et al*. (2017), the gonads exert increasingly intense pressure on the digestive tract as they grow, leading the fish to feed less. This phenomenon was observed for *Chelidonichthys lastoviza* and *Trigla lyra* in the Saronikos Gulf and the Mediterranean Sea (Caragitsou and Papaconstantinou, 1994; Boudaya *et al*., 2007).

Shrimps and teleost fishes generally dominate the diet of *D. volitans* in the study area, whereas crabs are secondary prey. Alternatively, cephalopods and gastropods are rarely eaten. Segadilha *et al*. (2017) mentioned the dominance of shrimps in the diet of this species on the continental shelf of Campos Basin, Brazil. Boudaya *et al*. (2007) and Ben-Jrad *et al*. (2010) found that this group is the main prey of the gurnard *Chelidonishtis lucerna*, a closely related species in the Gulf of Gabès and the western Mediterranean. Furthermore, most of the prey found in the stomach contents are benthic species, indicating that it is a benthophagous carnivorous predator. Similarly, Daros *et al*. (2012) and Segadilha *et al*. (2017) classified *D. volitans* as a selective predator of benthic macrofauna, with a large proportion of crustaceans and occasional representation of small fishes, polychaetes and gastropods in their stomach contents.

According to fish sizes and marine seasons, no difference was found in the diet of *D. volitans*, indicating that juveniles and adults feed on similar prey items in the same area. Although juveniles feed on small prey and adults on both small and large preys, in terms of quality, the diet is broadly similar across fish class sizes and seasons. The similarity of diet according to fish sizes and seasons is a relatively common phenomenon in teleost fishes. This similarity was observed in *Chelidonichthys obscurus* and *Chelidonichthys lastoviza* from the Gulf of Gabès (Boudaya *et al*., 2007), *Chelidonichthys lastoviza* from the Gulf of Tunis (Ben Jard *et al*., 2010) and *Seriola carpenteri* from the coastal waters of Côte d'Ivoire (Attemene *et al*., 2020). This result contrasts with that of Segadilha *et al*. (2017) who found a variation in relative abundance of prey, indicating that the diet of flying gurnard varies according to fish size, with increasing diversity of crustaceans at smaller size classes. On the other hand, shrimps and teleost fishes are the main preys, with a clear preference for *Penaeus notialis*. This dominance of shrimps in the diet could be due to their abundance in the environment, as Troadec *et al*. (1969) reported that they are available throughout the year in the coastal waters of Côte d'Ivoire. Sanchez (2002) reported that the accessibility, abundance and energy content of food are factors that can influence the food preference of a given fish. For Koné *et al*. (2014), the right prey for a predatory species, is that which provides maximum energy for minimum capture cost.

Based on the Amundsen graphical analysis, *D. volitans* population displays generalised feeding behaviour that focuses on shrimps and small teleost fishes. This result is justified by the fact that the frequency of occurrence and the specific abundance index of these items are high. In view of these results and those of the authors cited above (Daros *et al*., 2012; Segadilha *et al*., 2017), it is likely that shrimps generally dominate the diet of flying gurnards.

The present study provides a strong basis for increasing our understanding of the trophic ecology of the flying gurnard *D. volitans* found in waters off Côte d'Ivoire. This species can be classified as a generalised carnivorous, with a diet consisting of several mobile organisms such as shrimps and teleost fishes.

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Conflicts of interest
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References
Amundsen, P.A.H., Gabler, M. and Staldvik, F.J., 1996. A new approach to graphical analysis of feeding strategy from stomach contents data modification of the Costello (1990) method. *Journal of Fish Biology*, 48, 607–614. DOI:10.1111/j.1095-8649.1996.tb01455.x

Attemene, L.Y-A., Alla Y. L., N'guessan, Y., Yapi J. N., Blé, M. C. and Yao, K., 2020. Diet of Guinean amberjack, *Seriola carpenteri* (Mather, 1971) from the Exclusive Economic Zone (EEZ) of Côte d'Ivoire (Gulf of Guinea). Ivorian Review of Science and Technology, 36, 69–90.

BenJrad, L., Fehri-Bedoui, R., Ben Slama, S. and Ben Hassine, O. K., 2010. Reproductive biology and diet of *Chelidonichthys lastoviza* (Triglidae) from the gulf of Tunis. *Cybium*, 34(**4**), 353–365. DOI:10.26028/cybium/2010-344-003

Besbes-Benseddik, A., Besbes, R., Ezzeddine-Najaï, S., Jarboui, O. and Mrabet, R., 2015. Régime alimentaire de la dorade coryphène *Coryphaena hippurus* (Coryphaenidae) des côtes tunisiennes. *Cybium*, 39(**1**), 21–29. DOI:10.26028/cybium/2015-391-003

Boudaya, L., Neifar L., Taktak A., Ghorbel, M. and Bouain, A., 2007. Diet of *Chelidonichthys obscurus* and *Chelidonichthys lastoviza* (Pisces: Triglidae) from the Gulf of Gabès (Tunisia). *Journal of Applied Ichthyology*, 23, 646–653. DOI:10.1111/j.1439-0426.2007.00861.x

Brown, S.C., Bizzarro, J.J., Cailliet, G.M. and Ebert, D.A., 2012. Breaking with tradition: redefining measures for diet description with a case study of the Aleutian skate *Bathyraja aleutica* (Gilbert 1896). *Environmental Biology of Fishes*, 95(**1**), 3–20. DOI:10.1007/s10641-011-9959-z

Caragitsou, E. and Papaconstantinou, C., 1994. Feeding habits of piper (*Trigla lyra*) in the Saronikos Gulf (Greece). *Journal of Applied Ichthyology*, 10(**2-3**), 104–113. DOI:10.1111/j.1439-0426.1994.tb00149.x

Carpenter, K.E. and De Angelis, N., 2014. The living marine resources of the eastern central Atlantic. Volume 1

Introduction, crustaceans, chitons and cephalopods, Rome. 683 P.

Carpenter, K.E. and De Angelis, N., 2016. The living marine resources of the eastern central Atlantic. Volume 2 Bivalves, gastropods, hagfishes, sharks, batoid fishes and chimaeras, Rome. 862 P.

Carpenter, K.E. and De Angelis, N., 2016. The living marine resources of the eastern central Atlantic. Volume 3 Bony fishes part 1 (Elopiformes to Scorpaeniformes), Rome. 914 P.

Carpenter, K.E. and De Angelis, N., 2016. The living marine resources of the eastern central Atlantic. Volume 4 Bony fishes part 2 (Perciformes to Tetradontiformes) and Sea turtles, Rome. 820 P.

Chivers, L.S., Lundy, M.G., Colhoun, K., Newton, S.F., Houghton, J.D. and Reid N., 2013. Identifying optimal feeding habitat and proposed Marine Protected Areas (pMPAs) for the black-legged kittiwake (*Rissa tridactyla*) suggests a need for complementary management approaches. *Biological Conservation*, 164, 73–81. DOI:10.1016/j.biocon.2013.04.022

Colin, C., Gallardo, Y., Chuchla, R. and Cissoko, S., 1993. Environnements climatique et océanographique sur le plateau continental de côte d'ivoire. Environnement et ressources aquatiques de côte d'ivoire. Tome I : le milieu marin, édition ORSTOM Paris. pp 76–110. (In French)

Costello, M.J., 1990. Predator feeding strategy and prey importance: a new graphical analysis. *Journal of Fish Biology*, 36, 261–263. DOI:10.1111/j.1095-8649.1990.tb05601.x

Daros, F.A., Bueno, L.S., Vilar, C.C., Passos, A.C. and Spach, H.L., 2012. Checklist of rocky reef fishes from the Currais Archipelago and Itacolomis Island, Paraná state, Brazil. *Check List*, 8(**3**), 349–354. DOI:10.15560/8.3.349

Didierlaurent, S. and Rochefort, G., 2018. In DORIS: *Dactylopterus volitans* (Linnaeus, 1758). Available at: https://doris.ffessm.fr/ref/specie/1202 (accessed on 22/01/2019)

Ferhani, K., Hemida, F. and Chakour, S.C., 2017. Contribution à l'étude du régime alimentaire de la Melva (*Auxis rochei*) de la côte Algérienne. *Collective Volumes of Scientific Paper ICCAT*, 73 (**8**), 2688–2694.

Koné, A., N'Da, K., Kouassi, K.S. and Agnissan, A.J.P., 2014. Régime alimentaire de deux requis : *Sphyrna zygeana* (Linnaeus, 1758) et *Isurus oxyrinchus* (Rafinesque, 1809) des côtes ivoiriennes. *International Journal Innovation Applied Studies*, 8, 1173–1186.

Layachi, M., Melhaoui, M., Abdallah, S., Ramdani, M. and Srour, A., 2007. Etude préliminaire du régime alimentaire du Rouget-barbet (*Mullus barbatus* L., 1758) de la côte nord-est méditerranéenne du Maroc (Nador) au cours de l'année 2001 (Poissons, Mullidae). *Bulletin de l'institut scientifique de Rabat, section sciences de la terre*, 29, 25–41.

Mazza, G., 2019. *Dactylopterus volitans*, Monaco nature encyclopedia, discover the biodiversity. Available at : https://www.monaconatureencyclopedi a.com/dactylopterus-volitans/?lang=en (accessed on 18/02/2019)

Morlière, A. and Rebert, J.P., 1972. Etude hydrologique du plateau continental ivoirien. Centre de Recherche Océanologique Abidjan *Document Scientifique*, 3(2), 1-30. (In French)

N'zi, N.N.R., Konan, K.J., Joanny, T.G.T. and Ouattara, N.I., 2023. Reproductive biology of the flying gurnard *dactylopterus volitans* (Linnaeus, 1758) from the coastal waters of Cote d'Ivoire. *International Journal of Zoology and Applied Biosciences*, 8(**6**), 26–32. DOI:10.55126/ijzab.2023.v08.i05.001

Nielsen, J.M., Clare, E.L., Hayden, B., Brett, M.T. and Kratina, P., 2017. Diet tracing in ecology: Method comparison and selection. *Methods in Ecology and Evolution*, 9, 278–291. https://doi.org/10.1111/2041-210X.12869

Rosecchi, E. and Nouaze, Y., 1987. Comparison of five dietary indices used in stomach content analysis. *Review of Research from the Institute of Maritime Fisheries*, 49 (**3-4**), 111–123.

Sánchez, P.R., 2002. Stomach content analysis of *Mugil cephalus* and *Mugil curema* (Mugiliformes Mugilidae) with emphasis on diatoms in the Tamiahua lagoon, México. *Revista de Biología Tropical*, 50(**1**), 245–252. DOI:10.1111/j.1095-8649.2010.02863.x

Segadilha, J.L., Nascimento, P.S., Mauro, F.M., Serejo, C.S., Ramos, T.R., CardosoI, A., Martins, A.S. and Costa, P.A.S., 2017. The carcinofauna found in stomach contents of the flying gurnard (*Dactylopterus volitans*) on the continental shelf of the Campos Basin, Brazil. *Journal of Natural History*, 1-11. DOI:10.1080/00222933.2017.1401138

Smith, E.P. and Zaret, T.M., 1982. Bias in estimating niche overlap. *Ecology*, 63, 1248–1253. DOI:10.2307/1938851

Troadec, U.P., Garcia, S. and Petit, P., 1969. Shrimp exploitation in Côte d'Ivoire: Solid reasons for optimism. *Maritime Fisheries*, 1095, 434–436.