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FOOD AND FEEDING BIOLOGY OF GREASY GROUPER *Epinephelus tauvina* (FORSSKAL,1775) ALONG THE VERAVAL COAST, GUJARAT, INDIA

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ABSTRACT

The Greasy grouper (*Epinephelus tauvina*) is a marine species typically found in association with rocky substrates and reefs. Groupers are one of the most important carnivorous fishes of coral reefs, feeding mainly on the crustaceans and fishes. The present study investigated the food and feeding biology of *Epinephelus tauvina* collected from the Veraval coast of Gujarat, India. Samples were collected from December 2024 to November 2025. In the current study, variations in feeding intensity of *E. tauvina* categorized as: Empty (15.33%), Trace (13.67%), ¼ full (25.67 %), ½ full (15.00%), ¾ full (17.67 %) and Full (12.67%). The main food groups in the diet of *E. tauvina* were categorized into four categories: teleosts (fishes), crustaceans, cephalopods and semi digested matter. Teleosts (Fishes) included *Parascombrops* sp., *Chelidoperca investigatoris*, *Nemipterus randalli*, *Pseudanthias pillai*, *Bregmaceros maclellandi*, semi digested fish. While crustaceans including *Acetes indicus*, semi digested crustacean and Isopod and cephalopods constituted, *Loligo* sp. and semi digested matter consist of mainly digested mass and semi fluid. The finding was provided valuable insights into the dietary patterns of fish in the study area, thereby enhancing the understanding of their feeding biology.

Key words: Food composition, feeding biology, *Epinephelus. tauvina*, Importance of Relative

Introduction

Food and feeding biology of fish plays a key role in understanding the growth and distribution patterns as well as for analysing the ecological role, its feeding behavior and position of the fish species in the food web ecosystem. Food and feeding habits of fishes is an important parameter to understand the relationship between fishes and food organism, accurate information of fish diets and to analyze exploitation rate of the fisheries potential of the particular regions, Saikia (2015).

Groupers (Epinephelidae) are major targets of artisanal, recreational and commercial fisheries. Heemstra and Randall (1993); Craig *et al.*, (2011) Groupers have white, tender and tasty meat that makes them a highly priced marine food fish. They are the favored species in the live reef fish trade in Southeast Asia and demand the

highest price. The high demand for these fishes in the international markets has caused to indiscriminate fishing, resulting in the depletion of natural stocks at an alarming level. Many smaller species are also highly valued in the aquarium trade. Groupers are being subjected to increasing fishing pressure for food, ornamental display and medical purposes globally. Pauly *et al.*, (2002); Vincent (2006).

Groupers are economically valuable due to their high market demand and good taste. Craig and Hasting (2007) They have a rapid growth rate, resistance to physicochemical environmental stress, and high food conservation efficiency. Most grouper species inhabit the upper trophic levels of their local ecosystems and thus play a significant role in organizing community structure. As top predators in marine ecosystems, they regulate

the abundance and variability of lower trophic levels organisms, increase biodiversity and community stability, and may help buffer against the ecological impact of climate change. Frank *et al.*, (2005); Halpern *et al.*, (2006); Sala (2006)

Materials and Methods

Study area

The study was conducted at Veraval fish landing centers, Veraval, Gujarat. The study area is located between latitudes 20°54'22.2"N and longitudes 70°23'00.9"E situated on the Northwest coast of Gujarat, India. Sampling was carried out from December 2024 to November 2025.

Sampling method

The study is based on the total 300 specimens (154 females and 146 males) of *Epinephelus tauvina* were analyzed ranging from 21.7 to 51.8 cm in total length with mean total length 31.65 cm and 104.6 to 854.2 g in weight with mean total weight 362.81cm *Epinephelus tauvina* samples were collected from Veraval Fish Landing Center, Veraval at Monthly interval and were brought to the laboratory for analysis. To study the feeding habits of *E. tauvina*; sampled fishes were dissected and gut was carefully removed to examine qualitative and

quantitative traits of the various food items in the gut contents, feeding intensity and other related aspects. Pillay (1952). The feeding intensity was assessed by visual observation based on the distension of their stomach and the quantity of food present in the gut and they were classified as full, $\frac{3}{4}$ full, $\frac{1}{2}$ full, $\frac{1}{4}$ full, trace and empty. The number of each item was recorded and expressed as a percentage of the total number of all food items in the sample studied.

Results and Discussion

Feeding intensity

Feeding intensity in various months:

Among the 300 stomachs (154 females, 146 males) of *Epinephelus tauvina* analyzed, 29.00% (N= 87) had empty stomachs, and stomachs with trace amounts of food exhibit poor feeding; 40.67% (N=122) had part-full stomachs ($\frac{1}{4}$ full and $\frac{1}{2}$ full) showing moderate feeding; and 30.34% (N=91) had full stomachs ($\frac{3}{4}$ full and full) showing active feeding behavior. In the current study, variations in feeding intensity of *E. tauvina* categorized as: Empty (15.33%), Trace (13.67 %), $\frac{1}{4}$ full (25.67 %), $\frac{1}{2}$ full (15.00%), $\frac{3}{4}$ full (17.67 %) and Full (12.67%) (Fig. 1). Feeding intensity of both the sexes of *Epinephelus tauvina* of each month is shown in Table 1 (males) and Table 2 (females). Fish were classified as active feeders (full and $\frac{3}{4}$ full), moderate feeders ($\frac{1}{4}$ full and $\frac{1}{2}$ full) and poor feeders (trace empty) based on the condition of their stomach.

In males, feeding intensity of *Epinephelus tauvina* categorised as: Empty (12.97%), Trace (20.01%), $\frac{1}{4}$ full (17.99%), $\frac{1}{2}$ full (18.22%), $\frac{3}{4}$ full (19.59%) and Full (11.21%). Active feeding behavior was noted throughout the study period except in the months of December with peak during August (57.13%), October (42.85%) and September (38.02%) followed January (11.11%). Higher percentage of moderate feeding was noticed in November (50 %) followed by December (20%). The very highest percentage of poor feeding was found during December (60%), January (55.55%) and lowest in August (4.76%). Maximum percentage of empty stomachs was reported during May (26.67%) and January (22.22%).

In females, feeding intensity of *Epinephelus tauvina* categorized as: Empty (17.23%), Trace (23.53 %), $\frac{1}{4}$ full (25.63%), $\frac{1}{2}$ full (9.37%), $\frac{3}{4}$ full (16.05%) and Full (9.06%). Active feeding was observed highest in December (48%), followed by August and October (33.33%). A very highest percentage of moderate feeding was recorded in March (57.17%) followed by August and October both (44.44 %). A significantly higher

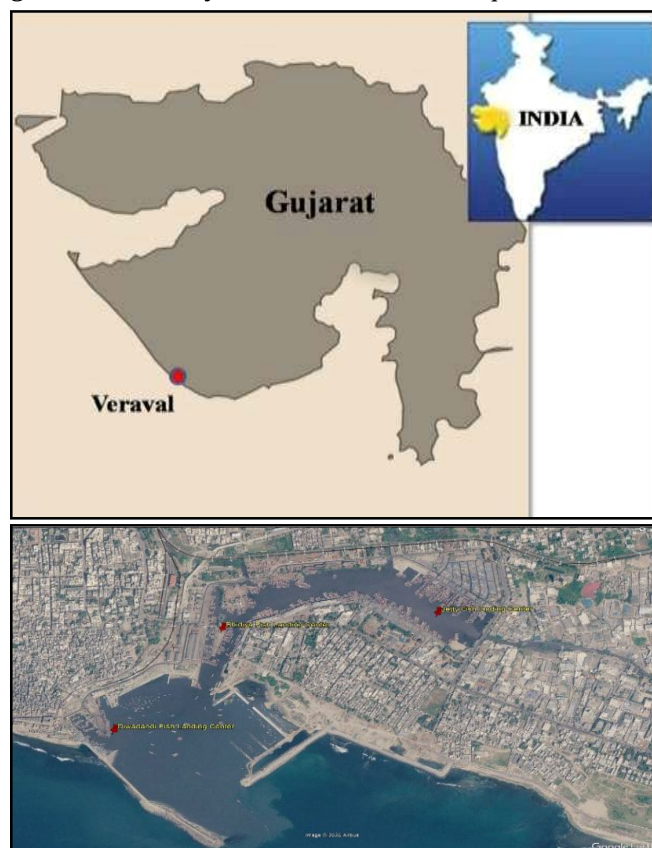


Fig. 1: Map illustrating sampling area at Veraval Fish Landing Centers, Gujarat.

Table 1: Monthly variation in feeding intensity (%) of male *Epinephelus tauvina*.

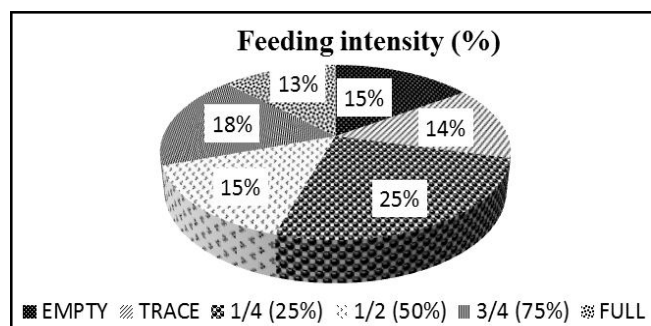
Month	No. of specimens	Poor feeding		Moderate feeding		Active feeding	
		Empty	Trace	¼ full (25%)	½ full (50%)	¾ full (75%)	Full
Dec-24	5	20.00	40.00	0.00	20.00	0.00	20.00
Jan-25	9	22.22	33.33	11.11	22.22	11.11	0.00
Feb-25	10	20.00	10.00	10.00	30.00	20.00	10.00
Mar-25	7	14.28	14.28	28.57	14.28	28.57	0.00
Apr-25	17	11.76	29.41	5.88	17.65	29.41	5.88
May-25	15	26.67	20.00	13.33	20.00	6.67	13.33
Aug-25	21	0.00	4.76	28.57	9.52	42.85	14.28
Sep-25	21	0.00	14.28	38.09	9.52	23.81	14.28
Oct-25	21	4.76	19.04	14.28	19.04	23.81	14.28
Nov-25	20	10.00	15.00	30.00	20.00	5.00	20.00
Mean	146	12.97	20.01	17.99	18.22	19.59	11.21

percentage of ¾ full stomachs were found in December (32%) exhibiting high feeding intensity. High percentage of poor feeding was found during January (71.42%), February (65%) and lowest during December (16%). Maximum percentage of empty stomachs was observed during January (57.14 %).

Food intensity in various Size group

Variation in feeding intensity of both the sexes of *Epinephelus tauvina* according to size groups is given in Fig. 2 (Males) and Fig. 3 (Females).

In males, feeding intensity of *Epinephelus tauvina* categorized as: Empty (17.34%), Trace (15.88%), ¼ full (15.84%), ½ full (14.74%), ¾ full (4.33%) and Full (17.57%). Low active feeding behaviour was observed with peak during 40-45 cm (20%) and 45-50 (22.22%) groups. A very highest percentage of poor feeding was reported in 45-50 cm (55.55%) and 40-45 cm (53.33%) size groups while lowest in 30-35 cm (8.33%) size groups. Higher percentage of empty stomachs was noticed in 40-45 cm and 45-50 cm (33.33%) size groups. Moderate feeding behaviour was higher in size group of 25-30 cm (52.78%) followed by 50-55 cm (50%). A higher percentage of ¼ full stomachs were found in 25-30 cm (30.56%), and 30-35 cm (22.22%) revealing moderate feeding intensity.

**Fig. 1:** Variation in degree of fullness (%) of stomach of *Epinephelus tauvina*.

In females, differences in feeding intensity of *E. tauvina* categorized as: Empty (15.62%), Trace (19.78%), ¼ full (28.52%), ½ full (9.87%), ¾ full (12.66%) and Full (13.55%). High poor feeding (27.65 %) behavior was observed followed by moderate feeding (46.74%) and active feeding (11.30%) behavior. Active feeding was recorded maximum in the 35-40 cm (50%), 30-35 while lowest in 30-35 (24.24%) size groups. A very highest percentage of moderate feeding was noticed in size groups of 30-35 cm (51.51%), while lowest in 45-50 cm (40%). A significantly higher percentage of ¼ full stomachs were found in 50-55 cm (50%), 21-25 cm (17.07%) revealing high feeding intensity. Poor feeding behavior percentage were 45-50 cm (60%), 35-40 cm and 50-55 cm (50%) size groups.

Out of 300 stomachs examined, 29.00% (N=87) had empty stomachs, and stomachs with trace amounts of food; 40.67% (N=122) had part-full stomachs (¼ full and ½ full) showing moderate feeding; and 30.34% (N=91) had full stomachs (¾ full and full) in the current study. Similarly, Uskelwar *et al.*, (2018) examined 362 individual's stomachs for *Epinephelus diacanthus* and recorded 17.26% were full, 15.32% were three quarter full, 20.80% were half occupied, 17.62% were occupied up to a quarter and 28.99% were empty stomachs.

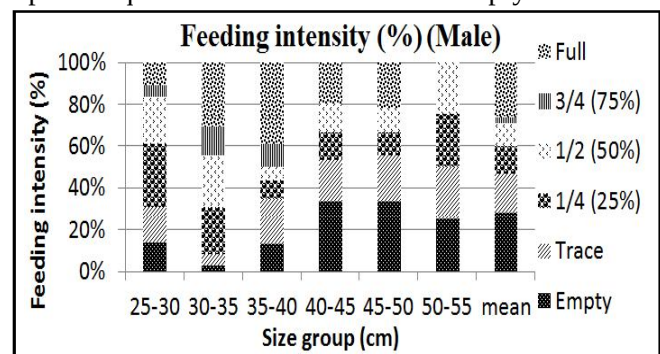
**Fig. 2:** Size wise variation in feeding intensity (%) of male *Epinephelus tauvina*.

Table 2: Monthly variation in feeding intensity (%) of female *Epinephelus tauvina*.

Month	No. of specimens	Poor feeding		Moderate feeding		Active feeding	
		Empty	Trace	¼ full (25%)	½ full (50%)	¾ full (75%)	Full
Dec-24	25	12.00	4.00	28.00	8.00	32.00	16.00
Jan-25	21	57.14	14.28	9.52	0.00	14.28	4.76
Feb-25	20	35.00	30.00	10.00	15.00	10.00	0.00
Mar-25	23	34.78	8.69	39.13	13.04	4.35	0.00
Apr-25	13	0.00	46.15	30.76	7.69	15.38	0.00
May-25	15	13.33	33.33	20.00	6.67	20.00	6.67
Aug-25	9	0.00	22.22	33.33	11.11	22.22	11.11
Sep-25	9	0.00	44.44	22.22	11.11	11.11	11.11
Oct-25	9	0.00	22.22	33.33	11.11	11.11	22.22
Nov-25	10	20.00	10.00	30.00	10.00	20.00	10.00
Mean	154	17.23	23.53	25.63	9.37	16.05	8.19

Behzadi *et al.*, (2025) examined 261 species of *E. coioides*, 32 stomachs were full of prey and 179 had empty stomachs, and 337 species of *E. bleekeri* 98 had full stomachs and 239 samples had empty stomachs.

In the current investigation, feeding intensity was highest in maturing and spent specimens as well as in spawners. However, lower and moderate feeding intensity was observed in peak spawning and post spawning period in March-April, May-November, respectively. Likewise, among the adults the feeding intensity was high during maturing stages, but low in mature and spawning individuals and again high in the spent and spent recovering ones. Similar results were also made by Venkatasan (1969) with higher percentage of empty stomach was noticed in mature fisher, suggesting that well developed goods hinder feeding and thus empty stomach occurred during breeding season.

In the current study, feeding activity classified as active and moderate was found to be highest from August and September to October, while it was lowest during December to February. The greatest feeding intensity, indicated by the percentage of fish with full stomachs, was observed in August, September and March and the lowest was recorded between December and April. The

high feeding intensity recorded could be linked to the enhanced food availability. Similarly, Khileri *et al.*, (2019) observed the presence of empty stomachs were the highest (56.41%) in November whereas lower in March (15.94%). The numbers of stomachs with one half, three fourth and full contents were very less in all months; a maximum of 24%, 33.33% and 36.52% were observed during May, April and February, respectively for *Epinephelus diacanthus*.

In the current study, 32.98% of males had empty stomachs, or with trace; 36.21 % had part-full stomachs; and 30.33% had full stomachs, while in females the percentages were 40.76%, 35.00% and 25.10%, respectively. Likewise, Uskelwar *et al.*, (2018) highest percentage of full stomachs were observed in June (35.75%) and November (23.65%). Maximum number of three-quarter full stomachs were found in November (22.46%) and half-full stomachs in October (35.26%). November recorded the highest percentage of one quarter full stomachs, while more empty stomachs were found in February (45.20%).

Regarding size-wise feeding intensity, the highest feeding activity in females was observed in the 50-55 cm size groups. In males, peak feeding intensity occurred in the 30-35 cm size ranges. Similarly, Uskelwar *et al.*,

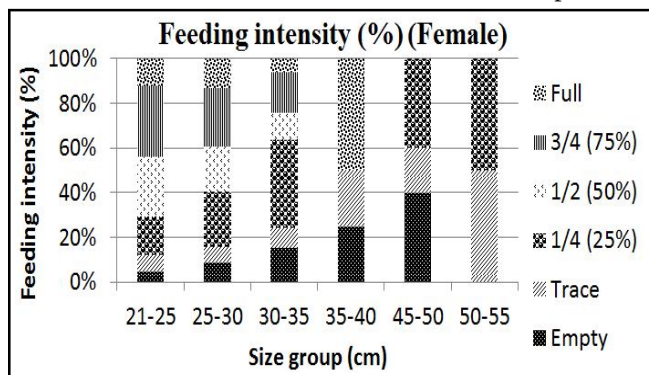
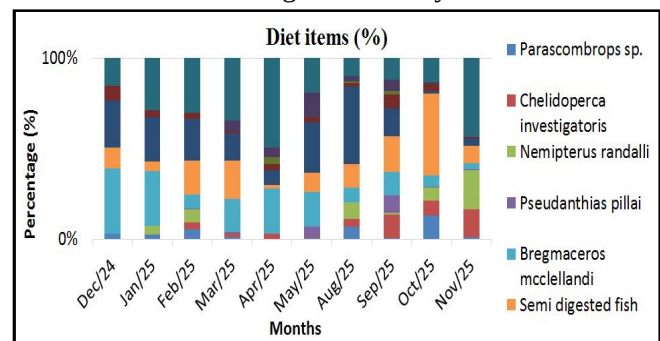
**Fig. 3:** Size wise variation in feeding intensity (%) of female *Epinephelus tauvina*.**Fig. 4:** Monthly variations in index of relative importance (IRI) of various food items of *Epinephelus tauvina*.

Table 3: Monthly index of relative importance (IRI %) of various groups of *Epinephelus tauvina*.

S.N.	Diet items	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Aug-25	Sep-25	Oct-25	Nov-25
1	Teleosts	8.40	7.17	7.23	7.24	5.00	5.92	6.91	9.46	13.39	8.55
2	Crustaceans	11.4	9.42	8.76	5.22	5.09	10.04	15.2	8.34	1.82	1.66
3	Cephalopods	0.00	0.00	0.00	6.43	5.11	13.03	3.04	6.33	0.60	0.00
4	Semi Digested Matter	15.28	28.69	30.34	34.49	49.57	18.89	9.80	11.90	13.58	43.69

Table 4: Monthly index of relative importance (IRI %) of various items of *Epinephelus tauvina*.

Diet items	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Aug-25	Sep-25	Oct-25	Nov-25
Teleosts										
<i>Parascombrops sp.</i>	3.096	2.706	5.486	0.811	0.000	0.406	6.794	0.421	13.07	1.113
<i>Chelidoperca investigatoris</i>	0.000	0.000	3.705	2.379	3.089	0.532	4.467	13.18	8.051	15.54
<i>Nemipterus randalli</i>	0.000	4.643	7.096	0.000	0.000	0.021	8.826	0.751	7.480	21.65
<i>Pseudanthias pillai</i>	0.000	0.000	0.683	0.529	0.000	5.524	0.000	9.850	0.516	0.483
<i>Bregmaceros maclellandi</i>	36.14	30.02	7.816	18.31	24.85	19.17	8.129	12.92	5.914	3.289
Semi digested fish	11.18	5.659	18.60	21.38	2.086	9.920	13.23	19.61	45.31	9.249
Crustaceans										
<i>Acetes indicus</i>	26.17	24.58	22.99	14.89	8.072	27.46	42.81	15.34	1.302	4.289
Semi digested crustacean	8.131	3.694	3.286	0.773	3.130	2.670	1.755	7.851	3.933	0.703
Isopod	0.000	0.000	0.000	0.000	4.097	0.000	1.149	1.829	0.233	0.000
Cephalopod										
<i>Loligo sp.</i>	0.000	0.000	0.000	6.431	5.108	13.03	3.039	6.334	0.601	0.000
Other										
Semi digested material	15.28	28.69	30.34	34.49	49.57	18.89	9.804	11.90	13.58	43.69

(2018) observed high feeding intensity for *E. diacanthus* maximum percentage in the size group of 90-100 mm (36.32%) followed by 70-180 mm (29.23%) and 100-110 mm (28.75%) and lowest in the size group of 80-90 mm (18.75%). The highest percentage of fishes was observed in the size group of 180-190 mm (45.08%) while lowest in size group 90-100 mm (22.32%).

Gut content

The main food groups in the diet of *E. tauvina* were categorized into four categories: teleosts (fishes), crustaceans, cephalopods and semi digested matter. Teleosts (Fishes) included *Parascombrops sp.*, *Chelidoperca investigatoris*, *Nemipterus randalli*, *Pseudanthias pillai*, *Bregmaceros maclellandi*, semi digested fish. While crustaceans including *Acetes indicus*, semi digested crustacean and Isopod and cephalopods constituted, *Loligo sp.* and semi digested matter consist of mainly digested mass and semi fluid.

The monthly Index of Relative Importance (IRI) analysis of different food groups revealed that *Loligo sp.* dominated in the months of March to November. Semi-digested matter was the predominant component in March, April, and November. Teleosts (fishes) were most dominant in September, October and November, while crustaceans were the primary food group in August and December. Cephalopods were most significant in May (Table 3).

The monthly Index of Relative Importance (IRI) of various food items and groups is given in Table 4 & Fig. 4. Throughout the study period, semi-digested matter emerged as the most dominant food item during March (34.49%), April (49.57%) and November (43.68%). Teleosts (fishes) highest during October (80.34%) and lowest in the month of April (30.03%). The monthly Index of Relative Importance (IRI) analysis of different food groups revealed that *Loligo sp.* dominated in the months of March to November. Semi-digested matter was the predominant component in March, April, and November. Teleosts (fishes) were most dominant in September, October and November, while crustaceans were the primary food group in August and December. Cephalopods were most significant in May.

Conclusion

In the present study, Crustaceans and teleost fishes were identified as one of the main dietary components of *Epinephelus tauvina*, second only to semi-digested material that was too degraded for specific identification. This indicates that *E. tauvina* has a distinctly piscivorous feeding habit. Cephalopods appeared as secondary constituents of its diet. According to the analysis of the gut contents, crabs, fishes and shrimps were the worst prey items of this species. It is concluded that *E. tauvina* is a carnivore mainly feeding on crabs, fishes and shrimps.

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