Int. J. Aquat. Biol. (2025) 13(4): 102-111
ISSN: 2322-5270; P-ISSN: 2383-0956
Journal homepage: www.ij-aquaticbiology.com

Original Article

Seasonal shifts in diet composition, stomach fullness, and trophic position of *Synodontis serratus* in Lake Nasser, Egypt

Khaled Y. AbouelFadl*[1], Mahmoud A.H. Kassem[1], Manar Abdellatif[2], AbouBakr A.A. Elkady[1]

[1]Fisheries Department, Faculty of Fish and Fisheries Technology, Aswan University, Aswan, Egypt.
[2]College of Marine Living Resource Sciences and Management, Shanghai Ocean University, Shanghai 201306, China.

Abstract: Analysis of *Synodontis serratus'* feeding habits is crucial to understanding its ecological role in Lake Nasser, Egypt. This study examined seasonal variation in stomach fullness in relation to diet composition and trophic level for *S. serratus* throughout the year, using 361 specimens collected from March 2023 to February 2024. The results from stomach content analysis indicated that *S. serratus* employed an omnivorous, opportunistic feeding strategy, characterized by significant consumption of benthic and pelagic organisms, including aquatic insects, diatoms, crustaceans, nematodes, mollusks, and protozoan zooplankton. There were also seasonal changes; the importance of zooplankton decreased during the summer, while both diet diversity and feeding activity diminished in winter. Stomach fullness reached its minimal levels during late winter and early spring before peaking after summer. The trophic level analysis showed that *S. serratus* mainly operates as a secondary consumer (mean trophic level 3.11), with peak values in March among smaller individuals. This is counterintuitive, given expectations regarding ontogenetic diet shifts and maturity, which would lead to increased resource-use efficiency due to body-size-scaled metabolic demand relative to food resource availability. These results underscore the adaptive dietary strategies exhibited by *S. serratus* and their prominent functional contribution to the food web, indicating that S. serratus is a key species for ecosystem resilience. This necessitates further exploration to guide fisheries management intervention strategies planned for Lake Nasser.

Article history:
Received 3 June 2025
Accepted 24 August 2025
Available online 25 August 2025

Keywords:
Diet composition
Stomach fullness
Trophic level
Prey diversity

Introduction

The feeding ecology of fishes is important for understanding the structure and functions of aquatic ecosystems because fish diets directly affect the flow of energy, cycling of nutrients, and population and community dynamics (Fagbenro et al., 2000; Begum et al., 2008). Investigating food and feeding habits yields practical knowledge about fish biology and physiology, and is crucial for sustainable fisheries management and aquaculture planning (Baker et al., 2013). Dietary composition and trophic relationships of fishes vary with temporal and spatial shifts due to the interaction of numerous environmental factors, prey availability, and growth changes (Friel and Vigliotta, 2006; Adeyemi et al., 2010).

The analysis of stomach contents remains the most effective method for understanding the feeding patterns and interrelationships of fish and other organisms in nature (Baker et al., 2013; Admodisastro et al., 2023). Such studies are fundamental to understanding the ecological impact and defining the role of a species in the food web of several ecosystems (Bachok, 2004; Vagnon et al., 2022). Some recent reviews highlight the importance of combining diet quantification with the estimation of species' trophic level, along with ecosystem-based approaches to managing fisheries, which is vital for integrated species conservation (Briguglio et al., 2025).

The family Mochokidae includes the genus *Synodontis*, which is recognized for its environmental and commercial value, given the significance of its distribution in Africa's inland freshwater habitats (Mekkawy and Hassan, 2011; Akombo et al., 2016; Olowo et al., 2023). Species of *Synodontis* are largely

*Correspondence: Khaled Y. Abouelfadl
E-mail: khaledabouelfadl@aswu.edu.eg

DOI: https://doi.org/10.22034/ijab.v13i4.2569

omnivorous and euryphagous. They consume a wide variety of prey, including insects, crustaceans, mollusks, annelids, seeds, detritus, and algae (Gbaaondo et al., 2025). Additionally, their ventral mouth structure and more flexible feeding strategies allow them to take advantage of diverse seasonal and habitat changes (Friel and Vigliotta, 2006). Studies focusing on the genus *Synodontis* across several African lakes and rivers highlight dietary ontogenetic shifts: younger life stages are more insect- and planktonivorous, whereas older life stages consume macrophytes, fish fry, and detritus (Yongo et al., 2019). There is also evidence of seasonal shifts in diet, which is indicative of changes in environmental factors and prey availability (Yongo et al., 2019).

Although Lake Nasser in Egypt offers abundant commercial opportunities, studies on the feeding ecology, diet composition, stomach fullness, and ecological niche of *Synodontis serratus* are nonexistent. The region is better known for research focused on other parasitic *Synodontis* species or on community ecological studies focusing on broader ecosystem interactions, with scant anthropogenic information on *S. serratus* ontogenetic changes in diet and trophic levels (Adeyemi, 2011).

The feeding habits of freshwater fishes significantly influence the structure, function, and resilience of ecosystems worldwide. The types of food fish eat help govern energy flow and nutrient cycling in a particular region, alongside shaping population and community dynamics, which contribute to the stability of an ecosystem (Fagbenro et al., 2000; Begum et al., 2008). One important concept is dietary plasticity, where fish species adjust their feeding strategies in response to environmental changes—this is especially useful in resource-scarce regions or areas that fluctuate with the seasons (Yongo et al., 2019). New research highlights the importance of seasonal shifts in diets, as well as age-related changes, and how these shifts reinforce resilience while building structure and supporting the food webs of tropical and subtropical lakes. Although Synodontis species have ecological and commercial importance in African freshwater systems, quantitative information on their feeding behavior in large reservoirs, such as Lake Nasser, is lacking.

Therefore, the purpose of this study is to provide the first comprehensive evaluation of seasonal changes in stomach fullness, feeding habits, and the ecological role of *S. serratus* in Lake Nasser, Egypt. This study aims to test the following hypotheses: (1) There are adaptive responses in *S. serratus* diet composition, level of satiation, feeding rank, and trophic position amid freshwater ecosystem shifts and alternate prey abundance, (2) There is a distinct biophysical aged based shift where juvenile stage small fish dominate by invertebrate and zooplankton consumption while larger older fish become more reliant on eating other fishes marked by lower dietary variety, and (3) The noted changes follow those recorded for *Synodontis* species and other bottom-dwelling fish from large tropical lakes around the world. This research has integrated quantitative analyses of stomach contents with an assessment of *S. serratus* trophic level over several months across different size classes to better understand the fish's place in the lake food web and to contribute to effective management plans for this important, commercially fished, and ecologically valuable species.

Materials and Methods

Study area: This research was conducted in Lake Nasser, a large reservoir in southern Egypt formed by the construction of the Aswan High Dam in the 1969s (Aly et al., 2018). The lake spanned approximately 550 km in length and reached a width of 35 km at its broadest point. Its maximum depth reaches 182.9 m in some areas, but the average depth is 25 m. The Egyptian segment measures 324 km and boasts a shoreline of 7,844 km (Elsaey et al., 2024). The lake is situated between latitudes 21.8 and 24.0 and longitudes 31.3 and 33.1, and features 85 side extensions (Khors), 48 of which are on the eastern side and 37 on the western side of the old Nile River channel (Fig. 1) that contribute to its ecological heterogeneity (Abdellatif et al., 2021).

Sampling design and fish collection: 361 samples were collected monthly from March 2023 to February 2024 at multiple locations representing the main habitats and the embayment of Lake Nasser. Fish were

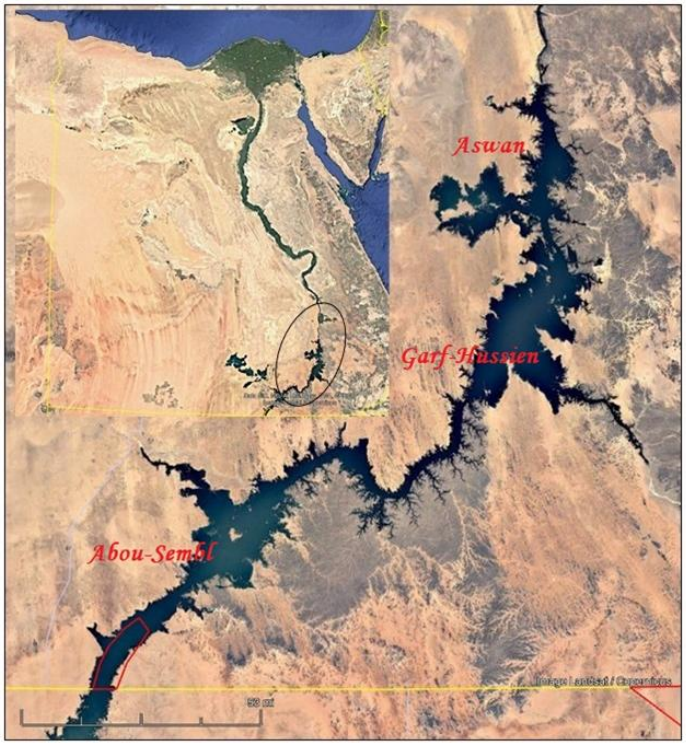

Figure 1. Map of Lake Nasser indicating study area and sampling locations.

collected using standardized gill nets and longlines of various mesh sizes to ensure representative sampling across size classes and habitats (Skelton and Steven, 1996). Immediately after capture, specimens were euthanized in accordance with ethical guidelines, measured for total length (TL, cm) and body weight (g), and transported on ice to the laboratory for further analysis.

Stomach content analysis: In the laboratory, stomachs were carefully excised and preserved at 4°C until analysis, which was performed within 24 hours of collection to minimize post-mortem digestion. Each stomach was opened, and its contents were examined under a stereomicroscope. Prey items were identified to the lowest possible taxonomic level using standard keys (Skelton and Steven, 1996), counted, and recorded.

Quantifying diet composition

Frequency of occurrence (%Oi): The percentage of non-empty stomachs containing each prey type, calculated using the formula of %Oi = NiN × 100%Oi = NNi × 100, where NiNi is the number of stomachs containing prey item ii, and NN is the total number of non-empty stomachs examined (Baker et al., 2013).

Numerical abundance (%Ni): The percentage of individuals of each prey type relative to the total number of prey items counted across all stomachs, calculated using the formula of %Ni = ni∑ni × 100%Ni = ∑ni × 100, where ni is the total count of prey type ii. Prey items were grouped into broader taxonomic or functional categories for quantitative comparisons. The proportion of empty stomachs was also recorded to assess feeding activity.

***Stomach fullness assessment*:** Stomach fullness was visually estimated and categorized as empty (0%), quarter-full (25%), half-full (50%), three-quarters full (75%), or full (100%), following established protocols (Adeyemi et al., 2010).

Trophic level estimation: The trophic level (TL) of each individual was calculated based on the relative contribution of each prey category in the stomach, using the following the formula (Baker et al., 2013) of TL = 1+∑j = 1n(Pj×TLj), where Pj is the proportion (by number) of prey category j in the diet, and TLj is the assigned trophic level of prey category j, obtained from Fish Base or relevant literature. The mean trophic level was calculated for the population, and variation was analyzed across months and length groups.

Data analysis: To evaluate the hypotheses, we examined diet composition and stomach fullness across seasons and during continued growth (ontogeny). We also looked at the trophic level. Differences between months and length groups were assessed using Kruskal-Wallis tests with post hoc pairwise comparisons done using Dunn's test when appropriate. This method provides a clear rationale connecting assumptions with research hypotheses, yielding a conclusive result for or against each hypothesis. All analyses were performed using R (R Core Team, 2024).

Results

Diet composition of *S. serratus*: The analysis of stomach contents from *S. serratus* in Lake Nasser serves as an example of exploitation, as well as

Table 1. Food items, frequency of occurrence, and numerical abundance in the diet of *Synodontis serratus* in Lake Nasser.

Food items	**Frequency of occurrence method**		**Numerical method**	
	No. occurrences	**0%**	**No.**	**% N**
Coptdon zillii	74	32.60	144	0.74
Oreochromis niloticus	77	33.92	147	0.75
Insects	108	47.58	1974	10.12
Diptera	101	44.49	1597	8.19
Odonata	94	41.41	1326	6.80
Mollusca	73	32.16	1189	6.10
Nematoda	90	39.65	1934	9.92
crustaceans	89	39.21	1700	8.72
fish remains	79	34.80	300	1.54
Gastropoda	75	33.04	1297	6.65
daphina sp	80	35.24	1804	9.25
copepods	60	26.43	782	4.01
Insect larvae	69	30.40	1065	5.46
Diatoms	99	43.61	2435	12.49
Alge	89	39.21	1808	9.27

feeding by omnivores, showing a high degree of opportunistic eating. Aquatic insects were the primary elements of *S.* serratus's feed, existing in 47.58% of stomachs and constituting 10.12% of the total feed. Among this group, the prevalence of both Diptera and Odonata larvae was equally high, at 44.49 and 41.41%, respectively, contributing 8.19 and 6.80% of prey items, respectively (Table 1). In addition to animal feed, diatoms were also abundant, being present in 43.61% of the examined samples and accounting for 12.49% of the total diet. Crustaceans and nematodes brought about beneficial changes, with occurrence rates of 39.21 and 39.65%, and abundance values of 8.72 and 9.92%, respectively. Regarding acetabuliferous, Daphnia was the most decisive contributor, accounting for 35.24% of stomachs found and 9.25% of the total diet shares, which were further supplemented by copepods, which accounted for 4.01%.

Furthermore, gastropods and other molluscan taxa accounted for 33.04 and 32.16%, respectively, representing 6.65 and 6.10% of the diet. Regarding fish and insect larvae, 34.80 and 30.40% of the samples produced 1.54 and 5.46%, respectively. Algae was found in 39.21% of the stomachs, accounting for 9.27% of the total. Fish species of *Coptodon zillii* and *Oreochromis niloticus* were found in 32.60 and 33.92% of the samples, but they made up a small part of the total (0.74 and 0.75%) (Table 1).

Ontogenetic variation in prey occurrence across length groups: The study of dietary structure by length classes showed distinct and significant ontogenetic changes in prey occurrence (H = 18.93, *P* = 0.004). In both smaller and medium-sized groups (23-27 and 28-32 cm), the stomach content includes high proportions of aquatic insects, especially Diptera and Odonata, and mollusks, as well as frequent mollusks, gastropods, nematodes, and crustaceans like Daphnia and copepods. The presence of diatoms and algae suggests that some autotrophic and detrital components are being utilized, indicating opportunistic behavior at early life stages. With body size increasing (33-37 and 38-42 cm), there is a shift and marked increase in the prevalence of fish prey to *C. zillii*, *O. niloticus*, and fish remains, accompanied by a concomitant decline in the incidence of insects, zooplankton, and almost all benthic invertebrates. This pattern indicates a shift in diet towards larger, more energetic prey.

In the most extreme size categories, 43-47 and 48-52 cm, there is a drastic decline in the frequency and diversity of nearly all prey types, with only a negligible presence of insects, mollusks, and crustaceans. Still, diatoms and algae are present, albeit in lesser proportions, across all size groups. These results, supported by thorough statistical scrutiny,

Table 2. Diet composition of *Synodontis serratus* across length groups in Lake Nasser.

Length group	23 - 27	28 - 32	33 - 37	38 - 42	43 - 47	48 - 52
Number of fish	**118**	**114**	**79**	**38**	**6**	**6**
Coptdon zillii	6	19	23	18	3	3
Oreochromis niloticus	7	30	22	13	2	2
Insects	33	34	22	13	2	2
Diptera	38	27	21	8	2	1
Odonata	44	20	18	8	1	1
Mollusca	21	21	16	8	4	1
Nematoda	22	25	17	16	3	3
Crustaceans	20	31	20	15	0	2
Fish remains	9	27	20	15	3	3
Gastropoda	20	25	14	10	1	2
Daphina sp	18	20	20	12	3	3
Copepods	11	17	15	14	0	0
Insect larvae	16	20	17	9	1	3
Diatoms	22	35	19	16	1	2
Alge	24	22	18	19	3	2

illustrate a stark shift in dietary habits from a highly variable, invertebrate- and plankton-rich diet in medium and smaller individuals towards a heavier reliance on other fish and a lower dietary variety in larger individuals—an obvious case of ontogenetic dietary shift (Table 2).

Seasonal variation in the diet: The monthly assessment of stomach contents revealed distinct seasonal shifts in the dietary structure. Insects, especially Diptera and Odonata, show a substantial increase in numbers during the warmer months (May-August), with peak values in June and July (Insects: 33 and 13; Diptera: 29 and 8; Odonata: 44 and 8, respectively). The presence of mollusks, nematodes, crustaceans, and fish remains also increases during this period, indicating intensified summer feeding activity coupled with an increase in resource availability. Calcareous algae and diatoms, although present throughout the year, also reach their maximum abundance in June and July. *Daphnia* sp. and copepods have the same trend, with *Daphnia* sp. reaching 30 in June and 10 in July. Fish prey, such as *C. zillii* and their remains, and *O. niloticus*, also show maxima from May to July.

On the other hand, the colder months from December to February tend to exhibit lower frequencies across almost all prey categories, indicating reduced feeding activity and lower food availability. Significant differences in seasonal changes in diet composition are observed ($P<0.001$), supporting the dependence of these conditions on the environment and the organism's feeding behavior (Table 3).

Stomach fullness patterns across length groups: The absence of empty stomachs in the 43-47 cm class group indicates no unfed individuals were recorded for this length class. The highest number of empty stomachs was observed in the 28-32 cm group, followed by the 23-27 and 33-37 cm groups, indicating a marked heterogeneity in feeding behaviors. In all other length classes, the 43-47 cm group exceeded the rest of the length classes in 25% fullness, indicating maximum count in that category. The 48-52 cm group had the most 50% fullness counts, while 75% fullness was highest in the 38-42 cm group. Most frequently 100% full stomachs (fully full, verging on euphemistically termed 'stuffed') were in the 43-47 cm group, where they were most frequent, succumbing to 38-42's prominence, who, quite paradoxically, were least frequent in the 23-27 cm group. In both 25 and 100% fullness, there were 43-47 attained feeding maxima, while the rest of the smaller groups (23-32 cm) were empty, with predominantly empty and minimal feeding events (Figs. 2, 3).

Stomach fullness percentages across months: The results provide a clear picture of changing stomach fullness by month, with seasonal variation clearly

Table 3. Diet composition of *Synodontis serratus* across months in Lake Nasser.

Months	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
No. of Fish	22	23	47	20	32	51	24	15	18	36	30	43
Coptdon zillii	3	1	2	4	6	23	9	4	5	11	3	3
Oreochromis niloticus	2	0	4	3	3	27	8	7	4	9	5	5
Insects	5	1	4	7	9	33	13	5	5	14	8	4
Diptera	2	4	11	15	17	29	8	1	9	5	4	0
Odonata	0	0	3	8	25	44	8	0	4	2	2	1
Mollusca	4	2	4	3	3	28	5	4	4	9	4	3
Nematoda	6	3	3	5	6	27	8	4	7	9	8	4
Crustaceans	3	1	3	5	7	27	9	8	5	10	6	5
Fish remains	3	1	5	3	5	27	7	4	4	11	3	6
Gastropod	3	0	3	5	6	25	7	6	2	9	6	3
Daphina sp	6	1	1	3	6	30	10	6	3	8	3	3
Copepods	3	0	2	0	1	28	6	6	3	7	2	2
Insect larvae	4	0	3	3	1	30	9	3	3	6	3	4
Diatoms	3	2	6	3	7	25	18	7	4	17	4	2
Alge	6	1	4	6	8	26	15	3	5	6	2	5

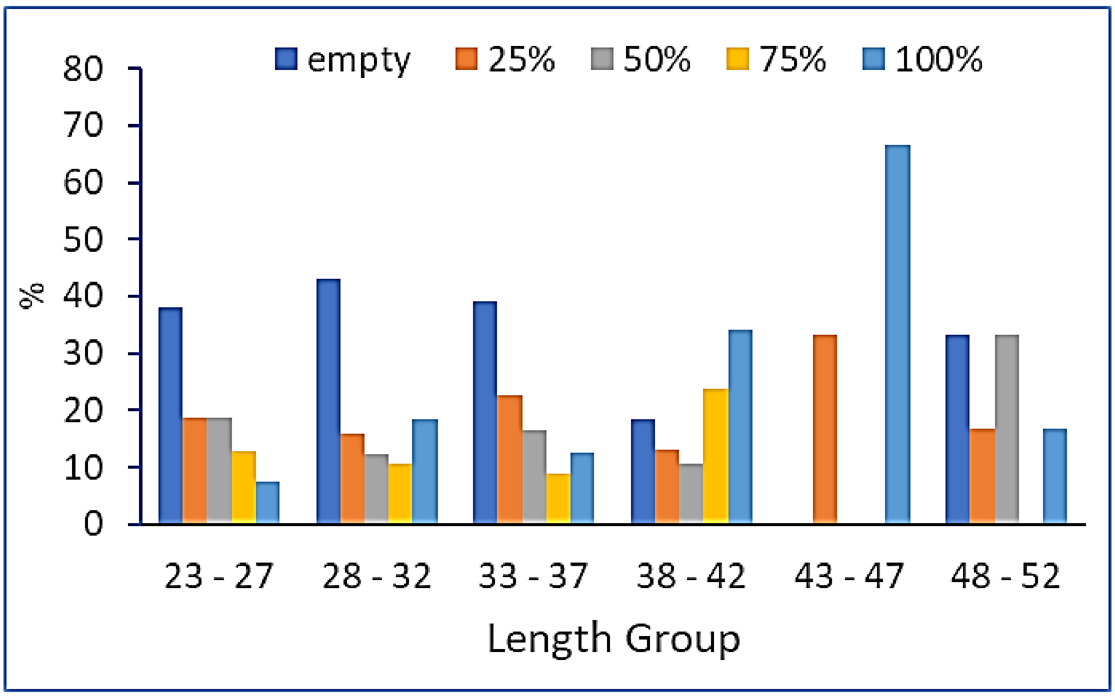

Figure 2. Stomach fullness distribution across fish length groups of *Synodontis serratus*.

observable. The highest rates of empty stomachs are observed in February, March, and December, with a peak of 82.6% in February. The lowest percentage is recorded in the intake months of June, July, and August, when it completely bottoms out to zero. The 25% fullness category reaches its highest prominence in April, when it peaks at 45%, and is completely absent in July and August. Half full (50%) is best represented in July, when it reaches 33.3%, but struggles to gain traction in February and September, where this category is non-existent. 75% of full stomachs reach their peak in August (33.3%), but they are least frequent in January (0%). July and August are best represented by completely full (100%) stomachs, with 54.2 and 66.7%, respectively, but show a complete absence in January, February, March, April, September, November, and December.

Trophic level variation: The *S. serratus* population from Lake Nasser had an average trophic level of 3.11, confirming its status as a secondary consumer in the

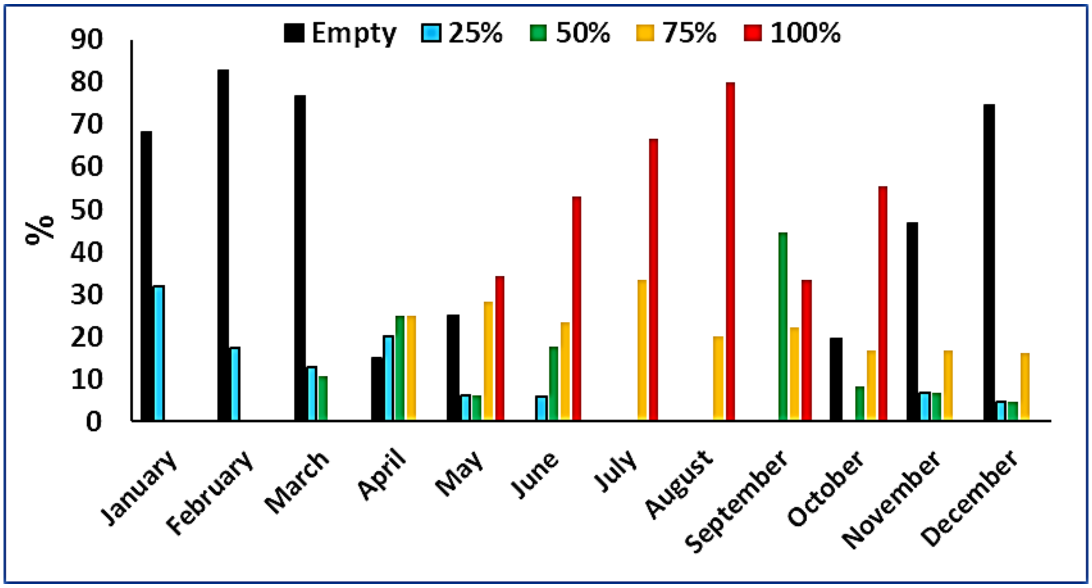

Figure 3. Stomach fullness distribution of *Synodontis serratus* across months in Lake Nasser.

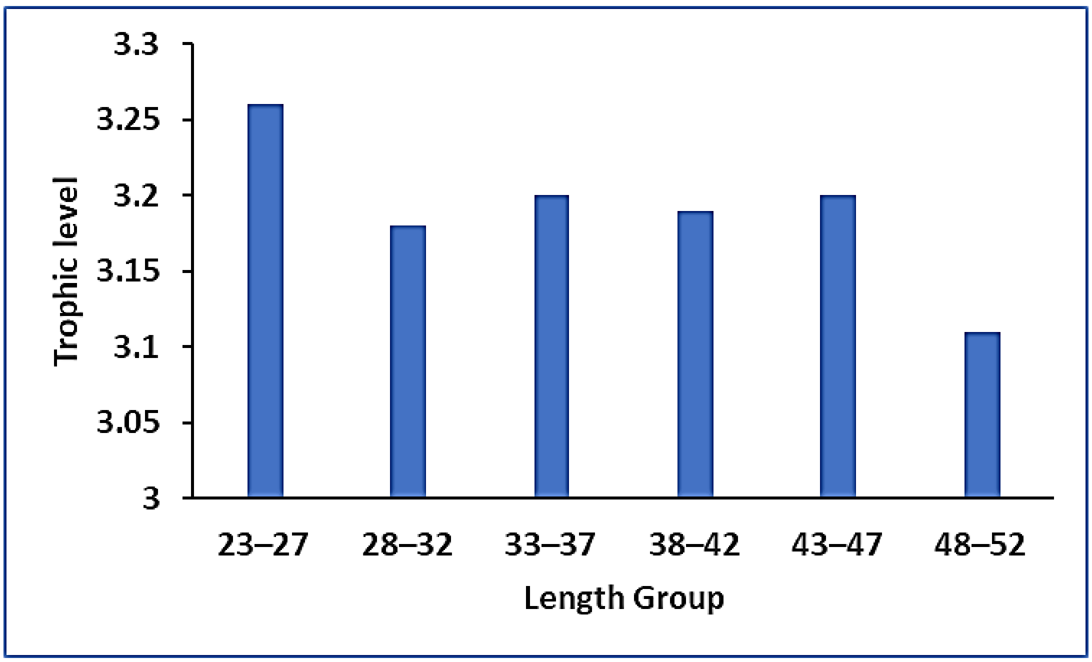

Figure 4. Variation in trophic level of *Synodontis serratus* across length groups in Lake Nasser.

lake's food web. Monthly evaluations revealed considerable changes in mean trophic level, with the maximum value noted in March, suggesting greater predation on higher trophic level prey during this time. The minimum value recorded in August reflects a seasonal increase in foraging on lower trophic resources. For the length categories, the highest mean trophic level was observed in the 23-27 cm group, while the lowest was in the 48-52 cm group, demonstrating ontogenetic differences in feeding strategy (Fig. 4). The results corroborated marked seasonal changes in trophic level among months ($H = 37.23$, $P<0.001$), confirming the existence of significant temporal declines in diet (Fig. 5). In contrast, while differences across length groups were evident, the Kruskal-Wallis test for ontogenetic differences did not attain significance ($H = 10.22$, $P = 0.069$), suggesting that although some detectable patterns are present in the data, they are less pronounced than the seasonal changes.

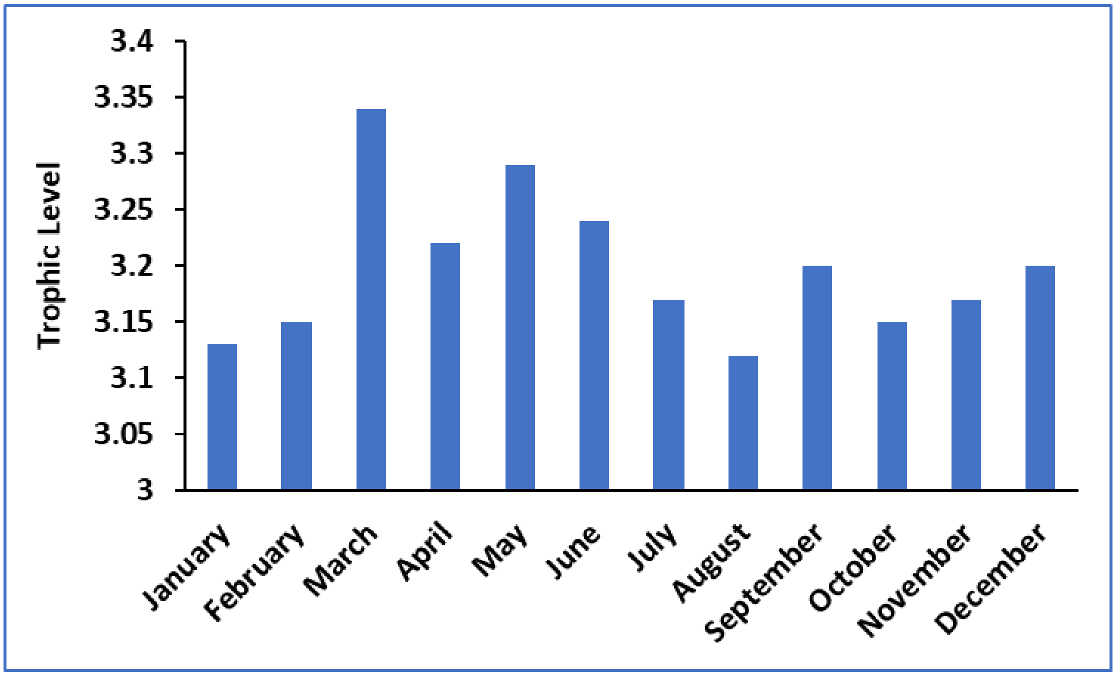

Figure 5. Monthly variation in the trophic level of *Synodontis serratus* in Lake Nasser.

Discussions

The results of this research indicate that *S. serratus* exhibits pronounced dietary adaptability, including seasonal and developmental changes that occur alongside other African and tropical freshwater systems (Yongo et al., 2019). Increased summer consumption of insects and zooplankton alongside greater stomach fullness corresponds with phenomena observed in Lakes Victoria, Kivu, and the Niger River, where resource surges in wet seasons lead to heightened foraging and multitrophic feeding (Isumbisho et al., 2004). Ontogenetic diet shifts exhibit a progressive movement from an invertivore/planktivore strategy employed by smaller individuals towards a more refined piscivorous diet, characterized by lower prey diversity in older fish. This aligns with the scientific literature on globally distributed opportunistic euryphagous fishes, thereby reinforcing the notion that these changes typify the adaptations of benthic fishes to environmental change (Friel and Vigliotta, 2006). With a mean trophic level of 3.11, *S. serratus* is classified as a secondary consumer, exhibiting overarching seasonal and ontogenetic changes that reflect adaptive shifts aimed at preserving ecosystem balance (Baker et al., 2013).

The results also showed significant ontogenetic changes in prey occurrence among the six length groups, with mid- and smaller-sized individuals primarily foraging on a variety of invertebrates and plankton, while larger individuals shifted towards more piscivorous diets with less diversity. These results align with the broader literature on Synodontis species, which are characterized by their highly opportunistic and flexible feeding strategies in African freshwater ecosystems (Yongo and Ojuok, 2015; Yongo et al., 2019; Arame et al., 2021). The previous works suggested feeding patterns of the species, and the emerging core dietary changes based on the size of the fish highlight the importance of the ontogenetic shift in diet in *Synodontis* species, where plankton and insects decrease significantly as the fish gets bigger, while fish, macrophytes, and detrital food items grow in number (Arame et al., 2021).

This growth pattern in fish energy requires habitat use, and more energetically rewarding prey become available as fish grow, as optimal foraging theory suggests (Lévêque and Paugy, 2006). Seasonal analysis revealed dramatic changes in dietary composition and stomach fullness, with the most intense foraging and feeding occurring in summer and a decline in winter. Supported by strong statistical evidence, the results collectively demonstrate the impact of environmental fluctuations and resource availability on feeding behavior (Isumbisho et al., 2004). The lack of diatoms and algae in *S. serratus* across all size classes and seasons demonstrates the extreme capture of *S. serratus* towards autochthonous and allochthonous food sources throughout the lifecycle of the organism (Yongo et al., 2019).

The estimated trophic level for *S. serratus*, 3.11, suggests that it is a secondary consumer within the Lake Nasser food web. The greater ontogenetic and seasonal variation delineated within the trophic level underscores the additional ecological versatility of the species, with high values peaking in March and within smaller size classes, indicative of higher predation on advanced trophic level prey during those times. These observations are in agreement with the positioning of more opportunistic and omnivorous fish species within the freshwater capture fisheries of the tropics (Pauly and Palomares, 2005; Allan and Castillo, 2007). Other related *Synodontis* studies, such as *S. schall* from the Niger River, on ontogenetic dietary broad niches, have also reported unimaginably high niche breadths, further showcasing the adaptive abilities of these taxa (Arame et al., 2021). Low resilience and clear environmental changes position *Synodontis* alongside high levels in the trophic hierarchy, characterized by extreme adaptability, niche breadth, and exceptional endurance of ecological shifts (Friel and Vigliotta, 2006). This especially lends credence to the notion of fathomable alterations in the ecosystem and fisheries activities for biodiversity protection implications concerning the Lake Nasser ecosystem.

Its wide range of food habits and seasonal and ontogenetic changes in prey selection confirm its ecological significance as a keystone species within the lake's food web. Hence, *S. serratus* should be maintained at healthy levels, as these species are crucial to the ecosystem's equilibrium and to the region's fisheries productivity (Allan and Castillo, 2007; Baker et al., 2013).

This study enhances our understanding of how life-history traits and environmental variability influence the ecological roles of benthic fishes in subtropical and tropical lakes by contextualizing these findings within the framework of fish trophic ecology. The dietary versatility of *S. serratus* indicates that this species could function as a stabilizer within the Lake Nasser food web, mitigating fluctuations in prey abundance while supporting ecosystem productivity. These insights directly impact ecosystem-based fisheries management (EBFM) and conservation policies not only for Lake Nasser, but also for similar reservoirs and lakes throughout Africa and other developing regions. Understanding such keystone species with adaptive strategies is crucial for formulating sustainable fisheries resource policies while preserving biodiversity.

Conclusion

This research reveals marked ontogenetic changes and seasonal adaptations in dietary composition, stomach fullness, and trophic position of *S. serratus* from Lake Nasser, Egypt. Juveniles and small adults are more active in foraging compared to larger individuals, whose feeding patterns exhibit a shift toward piscivory during the summer months, which is quite prominent in the winter months. The mean trophic level of 3.11 confirms that *S. serratus* is a secondary consumer in the lake food web. These results strengthen the ecological plasticity of *S. serratus* and its stabilizing role in ecosystem energetics, thereby deepening our understanding of ecosystem-based fisheries management and conservation strategies in Lake Nasser and similar environments.

References

Abdellatif M., Mohammed-Abdallah E., Abouelfadl K.Y., Osman A.G.M. (2021). Age and growth of *Chrysichthys auratus* (Geoffroy 1809) (Family : Claroteidae) from Lake Nasser , Egypt. The Egyptian Journal of Aquatic Research, 48: 417-424.

Adeyemi S.O. (2011). Food and feeding habits of *Synodontis guttatus* at Idah area of river. 10(2): 70-75.

Adeyemi S.O., Akombo P.M., Toluhi O.O. (2010). Food and feeding habits of Synodontis resupinatus. Animal Research International, 7(3): 1281-1286.

Admodisastro V.A., Baharuddin M., Madin J., Raehanah S., Shaleh M., Tan A., Hwai S., Ransangan J. (2023). Gut content analysis and selective feeding behavior of the asiatic hard clam *Meretrix meretrix* (Linnaeus, 1758) in Marudu Bay.Egyptian Journal of Aquatic Biology and Fisheries, 27(5): 939-957.

Allan J.D., Castillo M.M. (2007). Stream Ecology: structure and function of running waters. Springer. 450 p.

Aly W., El-far A., Karisa H.C., Nasr-alla A.M., Abouelfadl K.Y. (2018). Spatial and temporal variation of length-weight parameters and condition factors of commercial fish species in Lake Nasser, Egypt. 17th World Lake Conference, Lake Kasumigaura, Ibaraki, Japan, 2018At: Ibaraki, Japan.

Arame H., Adite A., Adjibade K.N., Imorou R.S., Stanislas S.P. (2021). Food habits, ecomorphological patterns and niche breadth of the squeaker, *Synodontis schall* (Pisces: Siluriformes: Mochokidae) from Niger River in Northern Benin. International Journal of Aquatic Biology, 9(1): 41-54.

Bachok Z. (2004). Diet composition and food habits of demersal and pelagic marine fishes from Terengganu waters, east coast of Peninsular, Malaysia. NAGA Worldfish Center Q, 27: 41-47.

Baker R., Buckland A., Sheaves M. (2013). Fish gut content analysis: Robust measures of diet composition. Fish and Fisheries 15(1): 1-8.

Begum M., Alam M.J., Islam M.A., Pal H.K. (2008). On the food and feeding habit of an estuarine catfish (*Mystus gulio* Hamilton) in the south-west coast of Bangladesh, University Journal of Zoology, Rajshahi University, 27: 91-94.

Briguglio M., Ram P., Abela G., Armelloni E.N., Papadopoulou N., Gaebel C., Hutton T., Abela G. (2025). What do people make of "Ecosystem Based Fisheries Management"? Frontiers in Marine Science, 12.

Elsaey S.E.F., Adam E., Abouelfadl K. (2024). Extension plan for bio-economic management of fisheries at Lake Nasser. Aquatic Science and Fish Resources (ASFR), 5(1): 43-56.

Fagbenro O.A., Adedire C.O., Owoseeni E.A., Ayotunde E.O. (2000). Food composition and digestive enzymes in the gut of Clarias gariepinus, Heterobranchus bidorsalis and their hybrids. Journal of Applied Ichthyology, 16(2): 94-97.

Friel J.P., Vigliotta T.R. (2006). Synodontis feeding ecology. Zootaxa, 1125: 45-56.

Gbaaondo T., Agba S., Igbana T.M., Tsevenda C.A. (2025). Food and feeding habit of some selected fish species from lower River Benue, Makurdi-Nigeria. Asian Journal of Research in Agriculture and Forestry, 11(1): 129-135.

Isumbisho M., Kaningini M, Descy J.P., Baras E. (2004). Seasonal and diel variations in diet of the young stages of the fish *Limnothrissa miodon* in Lake Kivu, Eastern Africa. Journal of Tropical Ecology, 20(1): 73-83.

Lévêque C., Paugy D. (2006). The fishes of African continental waters: Diversity, ecology and use by humans. IRD Éditions, Paris.

Mekkawy I.A., Hassan A.A. (2011). Some reproductive parameters of *Synodontis schall* (Bloch and Schneider, 1801) from the River Nile, Egypt. Journal of Fisheries and Aquatic Science, 6: 456-467.

Olowo U.C., Egun N.K., Oboh I.P. (2023). Some aspects of the reproductive biology of *Synodontis schall* from a lotic freshwater in Nigeria, 26(4): 256-267.

Pauly D., Palomares M. (2005). Fishing down marine food web: It is far more pervasive than we thought. Bulletin of Marine Science, 76: 197-211.

Pm A., Et A., So A. (2016). Diversity and abundance of *Synodontis* (Cuvier, 1816) species in the lower river Benue, Makurdi, Benue State, Nigeria. International Journal of Fisheries and Aquatic Studies, 4(1): 238-242.

Skelton P., Steven M.N. (1996). Book Review : A Complete Guide to the Freshwater Fishes of Southern Africa. Copeia, 1996(3): 755.

Team R.C. (2024). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Vagnon C., Rohr R.P., Bersier L., Cattanéo F., Guillard J., Frossard V. (2022). Combining food web theory and population dynamics to assess the impact of invasive species. Frontiers in Ecology and Evolution, 10.

Yongo E., Ojuok J.E. (2015). Diet composition and feeding habits of Synodontis victoriae in Lake Victoria, Kenya. African Journal of Ecology, 53(4): 496-505.

Yongo E., Iteba J., Agembe S. (2019). Review of food and feeding habits of some *Synodontis* fishes in African Freshwaters. Oceanography and Fisheries, 10(2): 1-5.