# Study Food Spectrum of the Migratory Fish Species *Sillago suezensis* (Forsskal, 1775) (Sillaginidae) in Syrian Marine Waters (Latakia Governorate)

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**Abstract**

This study examined 338 individuals of the migratory fish species *Sillago suezensis*, collected from the marine waters of Lattakia province from 23 June 2022 - 23 June 2023. using locally employed fishing methods. The findings on the dietary system of this species reveal that *Sillago suezensis* is a predatory carnivore. Its diet consists of six types of prey: Oligochaetes, which were preferred prey, while Polychaetes from the genus *Phyllodoce* sp were secondary. Other rare prey included amphipods from the genus Hyale, crabs (*Portunus* sp.), shrimp (*Penaeus* sp.), and Stomatopods from the genus *Squilla* sp.

**Keywords:** *Sillago suezensis;* Sillaginidae; Food spectrum; Syrian marine waters

## Introduction

Analyzing stomach contents provides valuable insights into fish positioning within their specific food web environments [1,2]. Additionally, food quality and quantity are crucial factors directly affecting growth and indirectly influencing maturation and mortality in fish [3].

The dietary habits of *Sillago sihama* have been studied in various geographic regions: in India [4-7]; in the northern Persian Gulf [8]; along the Karachi coast of Pakistan [9]; and in Thailand [10].

In Iraq, dietary studies on *Sillago sihama* and *Sillago arabica* described the Morphology of the digestive tract and dietary habitat of *S. sihama* in Khor Al-Zubair, northwestern Persian Gulf [11]. Other studies have focused on dietary composition and interspecies dietary overlap in Khor Al-Zubair [12], feeding activity, intensity, and habits of *S. sihama* in Iraqi Marine Waters [13], as well as the dietary components of juvenile *S. sihama* and

interspecies overlap in the Shatt Al-Basra Canal, Iraq [14]. A single study on *Sillago arabica* diet in the Shatt Al-Basra Canal was published [14], along with a nutritional assessment of *S. sihama* and *S. arabica* based on diet composition, feeding activity, intensity, and niche breadth in the southern Shatt Al-Arab River, Iraq [15]. To date, no study of the nutritional spectrum has been conducted on the fish species *Sillago suezensis* in its original habitat or in the areas to which it migrated in the eastern Mediterranean (Syrian coast - Latakia) (Figure 1).

## Materials and Methods

Fish samples of the species *Sillago suezensis* were collected from three fishing sites—Ras Al-Basit, Lattakia, and Jableh—along the coast of Lattakia Province (Figure 1 & 2). Sampling was conducted at various depths reaching up to 50 meters, using local fishing methods, with samples collected every 15 days from the beginning of June 2022 to the end of June 2023. The total number of fish specimens collected was 338 (Figure 2).
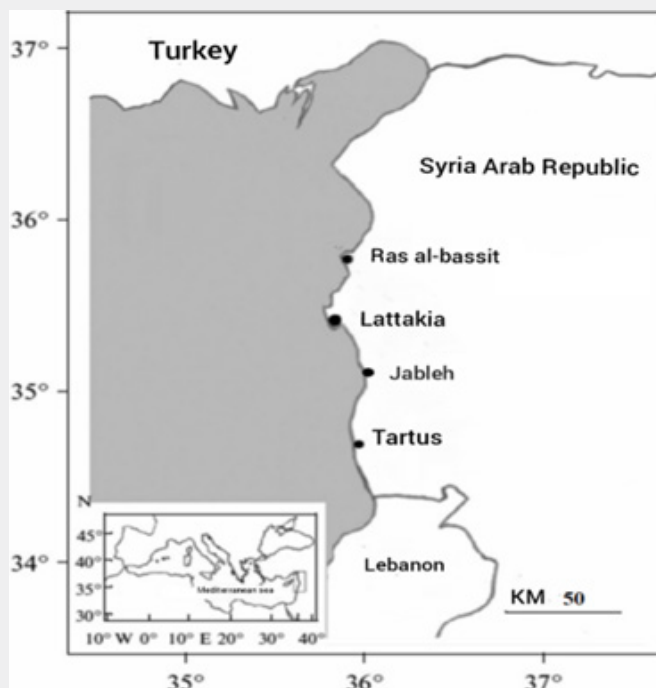
**Figure 1:** *Sillago suezensis.*



**Figure 2:** Fish Sampling Locations (Map adapted from Ali [16]).

After collecting samples of *S. suezensis*, they were immediately transported to the Marine Science and Aquatic Environment Laboratory. Morphometric measurements were taken, including total length (TL) and standard length (SL), accurate to the nearest 0.1cm, and total weight (TW), accurate to the nearest 0.01g.

The fish were dissected, and the innards removed, and each weighed separately. The stomach was isolated and preserved in 10% formalin to preserve its contents from disintegration (Figure 3).

The following biological indices were studied:

**Stomach vacuity index C.V%**

This index reflects the richness or scarcity of food in the environment. A high value indicates poor environmental conditions, which negatively affects food availability and leads to higher hunger levels within the fish community. Conversely, a lower value suggests a nutrient-rich environment suitable for fish. It is expressed as a percentage [17]:

$$C.V = EV / N \times 100$$

EV: number of empty stomachs

N: total number of examined stomachs.

**Food item frequency index (Fp%)**

This index indicates the availability of prey in the environment and the fish's ability to utilize specific prey items. It is calculated

as follows [17]:

$$Fp = N / M \times 100$$

N: number of stomachs containing prey

M: number of stomachs containing a specific prey type.

The dietary items are classified into three levels of significance based on frequency:

a)    Fp ≤ 10%: Rare food items, indicating this prey are incidental and do not significantly impact the fish's diet.

b)    10% < Fp < 50%: Secondary food items, serving as a basic food source when preferred items are scarce.

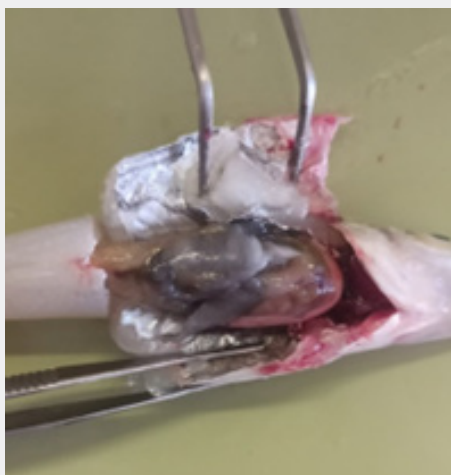c)    Fp ≥ 50%: Preferred food items that define the dietary pattern and supply the main energy needs for the fish.



**Figure 3:** Stomach Weight and Content Examination.

### Feeding index (Q)

This index is calculated as [17]:

$$Q = CN \times CP$$

CN = Numerical ratio of prey.

CP = Weight percentage of prey.

The importance of each prey type for *S. suezensis* was determined based on the feeding index (Q):

a)    Q > 200: Preferred prey.

b)    20 < Q < 200: Secondary prey.

c)    Q < 20: Rare prey.

### Results and Discussion

### Stomach vacuity index C.V%:

The study examined the stomachs of 338 individuals of *Sillago suezensis*, with 113 empty stomachs recorded (69 females, 41 males). The average annual hunger index was 33.43%, with a mean of 20.41% in females and 34.53% in males.

The peak C.V% values were observed in June, July, and November (77%, 100%, and 84%, respectively), while the lowest values were recorded in April, August, and October (0%). Increased feeding activity during these months corresponds to warmer waters [18], which tend to be nutrient-rich, enhancing food availability during these periods (Figure 4).

### Diet composition and prey classification for the studied fish species

The stomach contents were classified according to global taxonomic references [19-21]. Analysis of 338 stomachs from the studied species revealed a total of 1,189 prey items with a combined weight of 26.48 g and an average weight of 0.022g per prey item. These prey items belong to two phyla (Table 1, Figure 5):

a)    Annelida Comprising two classes:

a.    Polychaeta.

b.    Oligochaeta.

b)    Arthropoda including the class Crustacea, which contains the following orders:

a.    Decapods.

b.    Amphipods.

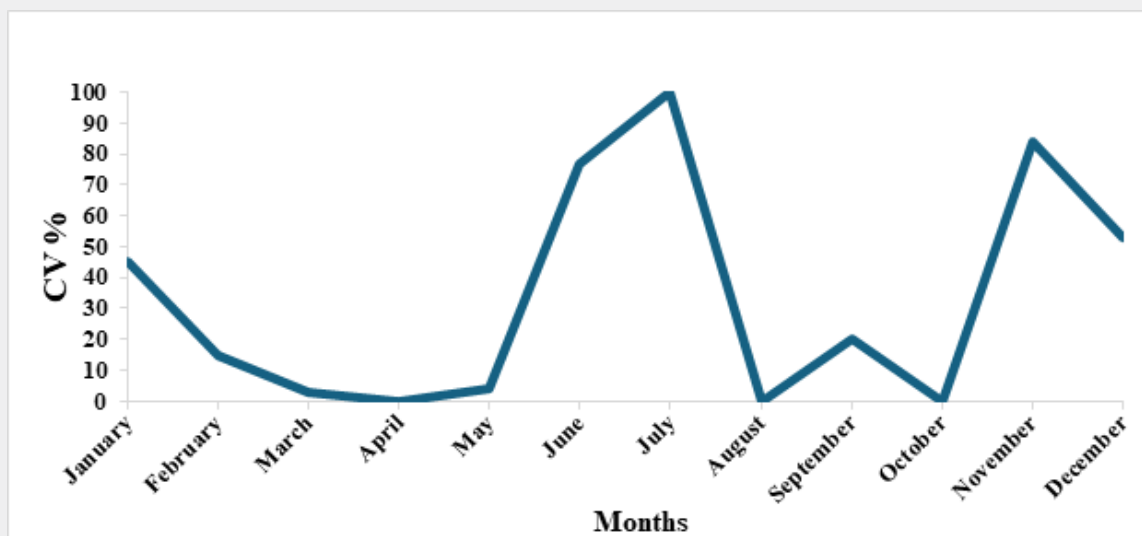c.    Stomatopods.

**Figure 4:** Variations in Stomach Vacuity Index (C.V%) for *Sillago suezensis* in Syrian Marine Waters (Latakia Governorate).
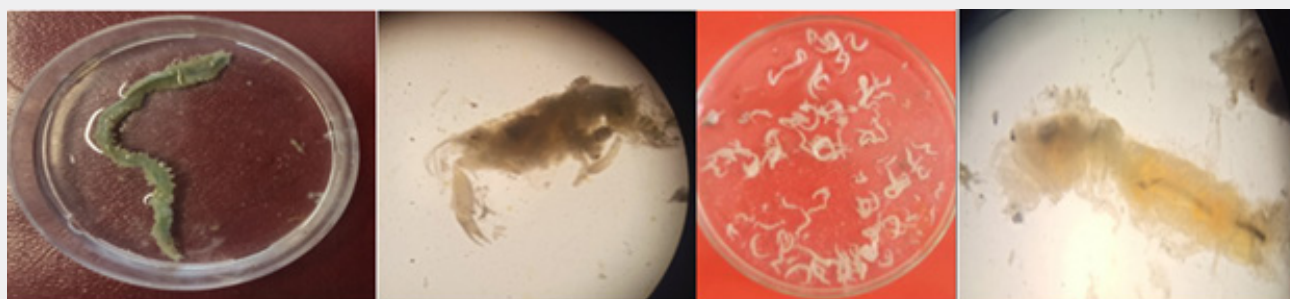


**Figure 5:** Examples of Prey Found in the Stomachs of *Sillago suezensis*.

**Table 1:** Taxonomic Composition of Dietary Components in fish *Sillago suezensis*.

| Phylum | Class | Order | Family | Genus |
|---|---|---|---|---|
| Annelida | Oligocheata | - | - | - |
| | Polycheata | Errantia | Phyllodocidae | *Phyllodoce* sp. |
| Arthropoda | Crustacea | Decapoda | Portunidae | *Portunus* sp. |
| | | | Penaidae | *Penaeus* sp. |
| | | Stomatopoda | Squillidae | *Squilla* sp. |
| | | Amphipoda | Gammaridae | *Hyale* sp. |

## Comparison of study results with previous research

The findings of this study align with those of Abdul-Razak & Abdullah [15], who evaluated the dietary status of *S. sihama* and *S. arabica* in the southern Shatt Al-Arab River, Iraq. In that region, these fish species primarily feed on crabs and shrimp, followed by fish. Variations in the primary dietary components of fish can result from temporal and spatial changes, environmental influences, the availability of food resources, and interspecies competition for food, which collectively affect the percentage contribution of each food type [10,22,23].

## Prey frequency index (Fp%) and Feeding index (Q)

The results indicate that Oligochaetes (Oligochaeta) are the preferred prey with a frequency of 52%, followed by Polychaetes from the genus Phyllodoce sp at 24%, crabs (*Portunus* sp.) at 9%, shrimp (*Penaeus* sp.) at 3%, Amphipods from the genus *Hyale* sp.at 8%, and Stomatopods from the genus *Squilla* sp. at 4% (Table 2 & 3).

**Table 2:** Relative Values of Prey Frequency Index (Fp%) and Feeding Index (Q) for *S. suezensis*.

| Q | Fp% | Preys |
|---|---|---|
| 1986 | 52 | Oligocheata |
| 503 | 24 | *Phyllodoce* sp. |
| 36 | 9 | *Portunus* sp. |
| 10.21 | 3 | *Penaeus* sp. |
| 139 | 8 | *Hyale* sp. |
| 10.36 | 4 | *Squilla* sp. |

**Table 3:** Importance of Prey Based on Feeding Index (Q) and Prey Frequency Index (Fp%) for *Sillago suezensis* in the Marine Waters of Lattakia Province.

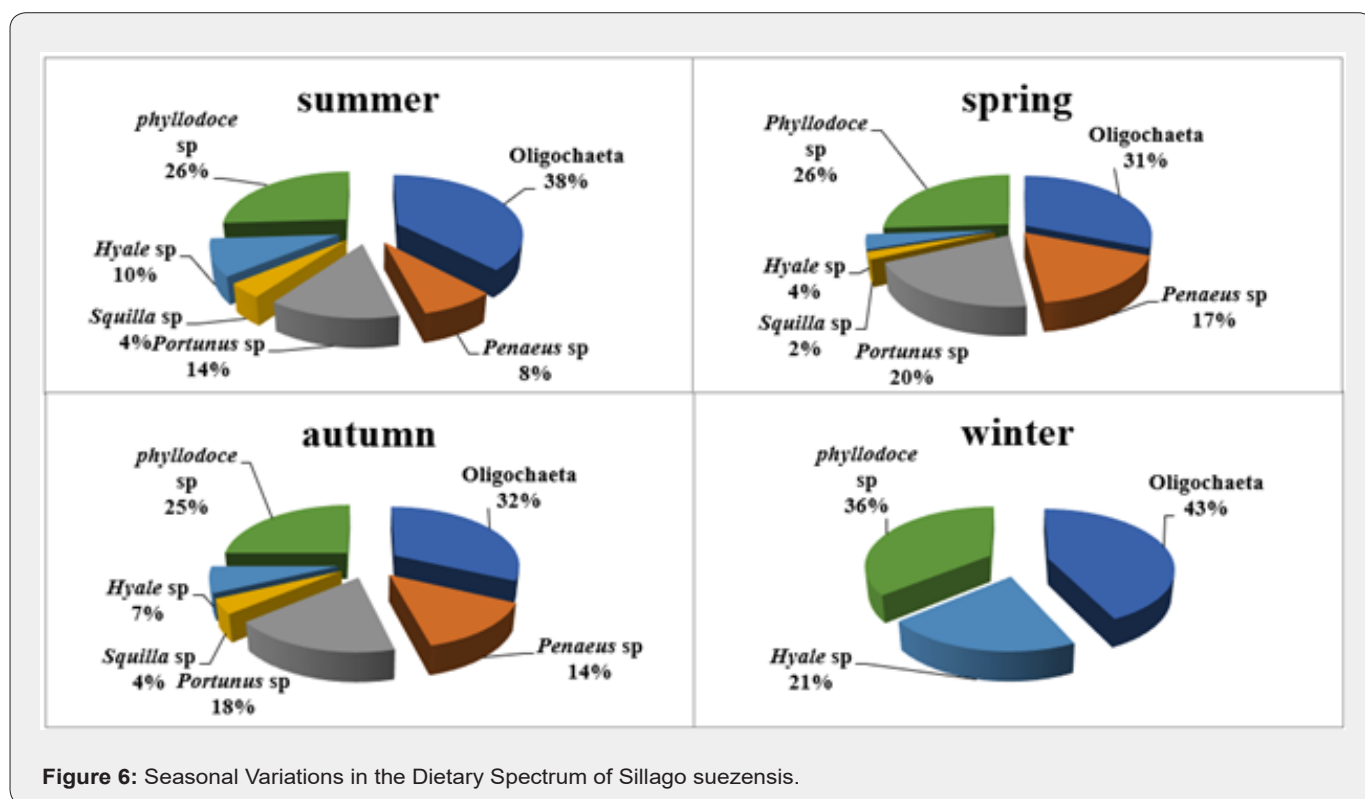| Fp% | Prey Type | Q | Prey Type |
|---|---|---|---|
| Favourite preys Fp ≥ 50% | Oligochaeta | Favourite preys Q > 200 | Oligochaeta |
| Secondary preys 50% > Fp >10% | Polychaeta | Secondary preys 200 > Q > 20 | *Penaeus* sp. *Portunus* sp. |
| Rare preys Fp ≥ %10 | *Penaeus* sp. *Portunus* sp. *Squilla* sp. *Hyale* sp. | Rare preys Q < 20 | *Squilla* sp. *Hyale* sp. |



**Figure 6:** Seasonal Variations in the Dietary Spectrum of Sillago suezensis.

## Seasonal variations in the dietary spectrum of *Sillago suezensis*:

The same prey types appear consistently throughout the seasons, but their proportions vary across individual fish, including Males, Females, and Hermaphrodites (Figure 5).

a) In Summer: Oligochaetes dominated at 38.46%, followed by Polychaetes of the genus *Phyllodoce* sp. at 26.07%, crabs (*Portunus* sp.) at 13.59%, shrimp (*Penaeus* sp.) at 7.69%, Amphipods (*Hyale* sp.) at 10.35%, and Stomatopods (*Squilla* sp.) at 3.84%.

b)  In Autumn: Oligochaetes remained the primary prey at 38%, followed by *Phyllodoce* sp. Polychaetes at 35%, *Portunus* sp. (crabs) at 11%, *Penaeus* sp. (shrimp) at 9%, *Hyale* sp. Amphipoda at 4%, and *Squilla* sp. Stomatopoda at 3%.

c)  In Winter: Oligochaetes accounted for 49% of the diet, with *Phyllodoce* sp. Polychaetes at 43%, and *Hyale* sp. Amphipoda at 8%.

d)  In Spring: Oligochaetes were again the main prey at 51%, followed by *Phyllodoce* sp. Polychaetes at 43%, *Portunus* sp. (crabs) at 2%, *Hyale* sp. Amphipoda at 2%, *Squilla* sp. Stomatopoda at 1%, and *Penaeus* sp. (shrimp) at 1%.

These findings are consistent with a study on the feeding habits *of Sillago sihama* in the Zuari Estuary, Goa, India, in terms of prey types, although the proportions differ [24].

## Conclusions and Recommendations

I.  The individuals of this fish species are classified as carnivorous predators.

II.  They feed on six prey types, with (Oligochaeta) being the preferred prey, while Polychaeta of the genus *Phyllodoce* sp. are considered secondary prey. Amphipods from the genus *Hyale* sp. crabs (*Portunus* sp.), shrimp (*Penaeus* sp.), and Stomatopoda from the genus *Squilla* sp. are categorized as rare prey.

III.  Monitoring Migratory Fish Species.

IV.  There is a need to continue monitoring the fish species that migrate into the Syrian marine waters and documenting their presence.

V.  Completing the database on biological studies of economically important species along the Syrian coast and utilizing the results of these studies in the field of aquaculture to increase productivity from an economic standpoint.

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