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Seasonal Variation in Feeding Habit of Grey Sharpnose Shark (*Rhizoprionodon oligolinx*) Springer, 1964 from the Northern Arabian Sea

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SUMMARY

The Grey sharpnose shark *Rhizoprionodon oligolinx* is classified as Near Threatened (NT) by IUCN. It is a small and frequent shark known as a predator in coastal environments, living in the littoral, inshore, and offshore regions of India, Sri Lanka, Malaysia, Singapore, Thailand, Kampuchea, Sumatra, Java, the Madura Straits, China, Japan, the Palau Islands, Iran, and Pakistan. This study was designed to understand the seasonal variation in the feeding habits of the Grey sharpnose shark in the Northern Arabian Sea of Pakistan. The researchers collected samples of *R. oligolinx* from the Northern Arabian Sea in EEZ of Pakistan braught from the ports of Gawadar and Karachi. A total of 305 stomachs of *R. oligolinx* were collected, out of which 144 contained undigested food. Among the analyzed samples, 102 were from females and 42 from males, both of which contained food. This food item was dominant throughout the year in the stomach of *R. oligolinx*. The overall teleost (bony fish) rate was 72.79%; the female rate was 80.39%, while the male rate was 55.88% (Figure 3), dominated by anchovies.There is limited research on the ecology and diet of *R. oligolinx*in in EEZ of Pakistan, this research verifies previous findings on *R. oligolinx* globally, demonstrative that teleosts are the primary food source in the northern Arabian Sea, followed by crustaceans and cephalopods.

Key word: Diet, *Rhizoprionodon oligolinx*, Pakistan, Coast, Teleosts

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INTRODUCTION

The Grey sharpnose shark *R. oligolinx* (Figure 1) is Near Threatened (NT) according to Rigby et al. (2021); it is a small and frequent shark known as a predator in coastal environments, living in the littoral, inshore, and offshore regions of continental and insular shelves in the tropical Indo-West Pacific (Ebert et al., 2021), including India, Sri Lanka, Malaysia, Singapore, Thailand, Kampuchea, Sumatra, Java, Madura Straits, China, Japan, and the Palau Islands, as well as the "Gulf" Arabian Peninsula from Iran to Pakistan (Rigby et al., 2021) (Figure.2) This species is common and frequently found in shark landings caught in bottom-set gillnets, quite prevalent down to a minimum depth of 36 meters. Males mature between 45 and 53 cm in total length (TL), reaching a maximum size of 93 cm. As a viviparous species, it gives birth to three to seven offspring annually. While pups are born at a size of 25 to 30 cm. Limited studies have been conducted on the biology of this species, which can help determine this species' feeding habits (Rigby et al., 2021; Thomas et al., 2022). In Pakistan, Moazzam and Osmany (2022) provided information on the biology of sharks in Sindh, Pakistan.

Understanding and regulating marine ecosystems, assuring sustainable fishing methods, and protecting these valuable apex predators all depend on research on shark dietary patterns (Calle-Morán et al., 2022). It is easier to evaluate their position in the food chain, detect possible fishery issues, and create successful conservation plans when one is aware of their nutritional requirements and hunting techniques. A number of researchers have studied the feeding ecology of the *Rhizoprionodon* species, i.e., *Rhizoprionodon* (Shaaban et al., 2024), *Rhizoprionodon longurio* (Hernández-Aparicio et al., 2023) and *Rhizoprionodon terraenovae* (Ebersole et al., 2023). The small to moderately large sharks in this genus, commonly referred to as requiem sharks, are found worldwide and are most frequent in inshore coastal waters. *R. oligolinx*'s taxonomic and distribution status has been documented by scientists (Gallo et al., 2010; Purushottama et al., 2017; Ernawati, 2020), while its feeding habits have been noted by Habashi et al. (2021). Because this species has not been observed deeply in terms of feeding habits, this study was designed to understand the seasonal variation in the feeding habits of the Grey sharpnose shark (*Rhizoprionodon oligolinx*) in the Northern Arabian Sea of EEZ of Pakistan.

Figure 1: Fish specimen, pups, jaw and food parts from stomach of *R. oligolinx.*

MATERIALS AND METHODS

The researchers collected samples of the Grey sharpnose shark from the Northern Arabian Sea in EEZ of Pakistan braught from the ports of Gawadar and Karachi in the shark yard at the Karachi Fish Harbour, where the stomach was removed and obtained for an extensive examination.

STUDY AREA

The Arabian Sea is a sea region in the northern Indian Ocean that is bounded on the west by the Arabian Peninsula, the Gulf of Aden, and the Guardafui Channel; on the northwest by the Gulf of Oman and Iran; on the north by Pakistan; on the east by India; on the southeast by the Laccadive Sea and the Maldives; and on the southwest by Somalia. Pakistan's coastline is approximately 1,046 kilometers long (Psomadakis et al., 2015), stretching from the Iranian border eastward to the Indian border at the Rann of Cutch. The Makran mountain ranges and the elevation of marine platforms have had a significant impact on the shoreline (Ahmad, 1997; Altaf et al., 2014; Tabassum et al., 2014).

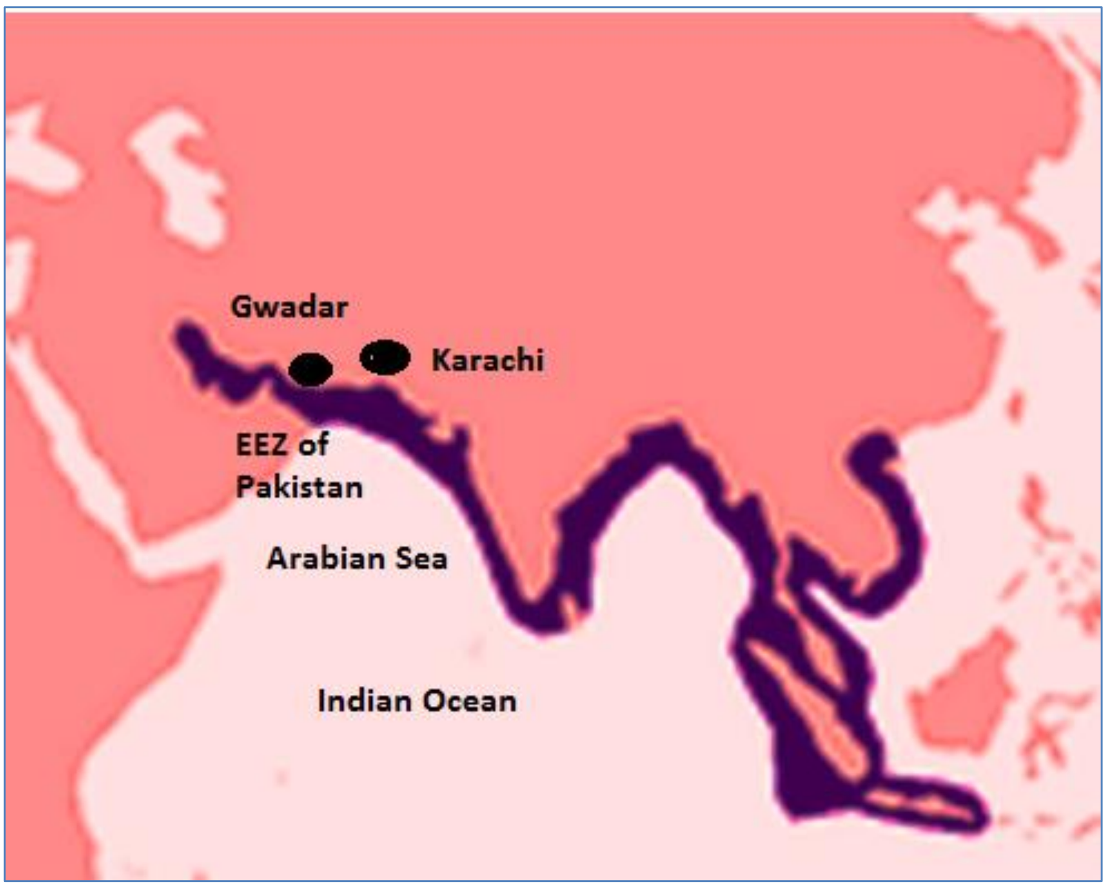

Figure 2: Distribution map of *R. oligolinx*.

METHODOLOGY

The Grey sharpnose shark was identified using the fish identification guide (Psomadakis et al., 2015). Between August 2016 and July 2017, a total of 144 stomachs from grey sharpnose sharks measuring 49 to 63 cm were collected from the yard where viscera, fins, and heads were removed . The samples were taken to the Biological Laboratory of the Marine Fisheries Department for examination. There, the stomach were dissected with pointed scissors and stomach contents transferred into petri dishes. After group-level identification, the food items were categorized into three groups: teleosts, cephalopods, and crustaceans. A date label was placed on selected images of the stomach contents, and the food items were identified to the lowest taxonomic level.

STATISTICAL ANALYSIS

Data were analyzed and graph were designed with the help of MS Excel (2010).

RESULT

A total of 305 stomachs of *R. oligolinx* were collected; out of these, 161 were empty and discarded, while the others were analyzed. Among these stomachs, 102 were from females and 42 from males that contained food. Food items were categorized into three groups: teleosts, cephalopods, and crustaceans. Teleosts dominated both female and male diets in terms of the combined percentage of food items found in the stomachs of this fish (Figure 3).

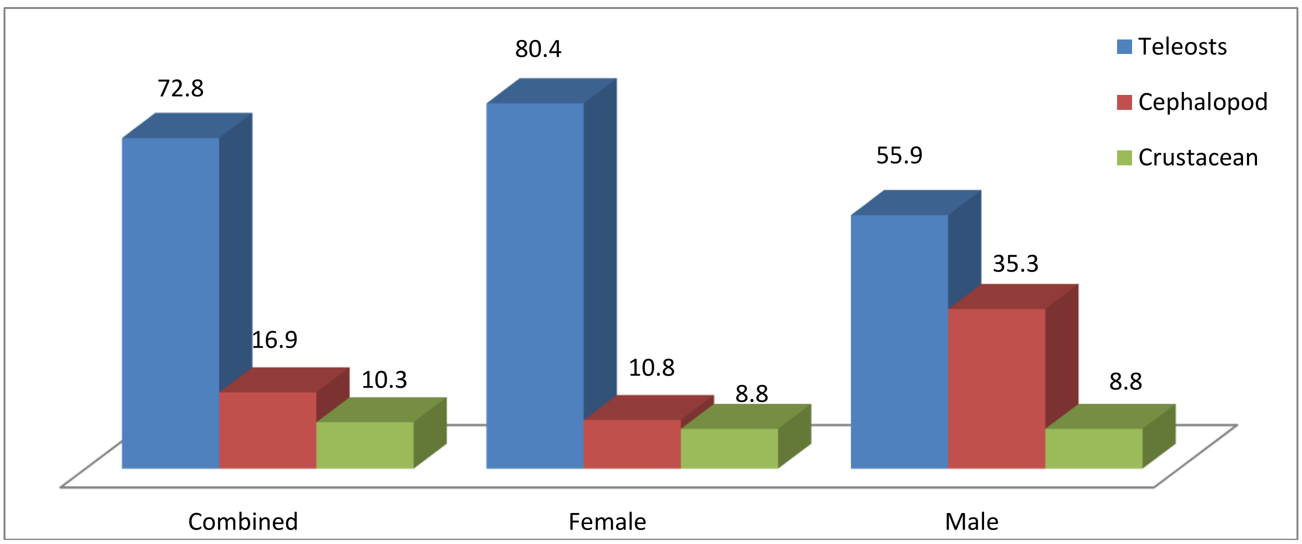

Figure 3: Percentage of food item on group level in *R. oligolinx*.

TELEOSTS

This food item was dominant throughout the year in the stomach of *R. oligolinx*. The overall teleost (bony fish) rate was 72.79%; the female rate was 80.39%, while the male rate was 55.88% (Figure 3), dominated by anchovies. Fishes belonging to 17 families, including Muraenesocidae (*Muraenesox spp.*), Dorosomatidae (*Sardinella spp.*), Engraulidae (*Stolephorus indicus*, *Thryssa dussumieri*, *T. mystax*), Chirocentridae (*Chirocentrus nudus*), Aridae (catfish), Synodontidae (*Saurida tumbil*), Hemiramphidae (*Hyporhamphus spp.*), Serranidae (*Epinephelus diacanthus*), Sillaginidae (*Sillago sihama*), Nemipteridae (*Nemipterus randalli*), Sciaenidae (*Johnius spp.*), Polynemidae (threadfin), Mugilidae (mullet), Trichuridae

(*Lepturacanthus savala*), Scombridae (*Rastrelliger kanagurta*), Stromateidae (*Pampus argenteus*), and Cynoglossidae (tongue sole) were found in the stomach (Figure 4). A similar pattern was found in females, where 14 families, including Muraenesocidae (*Muraenesox spp.*), Dorosomatidae (*Sardinella spp.*), Engraulidae (*Stolephorus indicus*, *Thryssa dussumieri*, *T.mystax*), Chirocentridae (*Chirocentrus nudus*), Aridae (catfish), Hemiramphidae (*Hyporhamphus sp.*), Serranidae (*Epinephelus diacanthus*), Sillaginidae (*Sillagosihama*), Nemipteridae (*Nemipterus randalli*), Sciaenidae (*Johnius spp.*), Trichuridae (*Lepturacanthus savala*), Scombridae (*Rastrelliger kanagurta*), Stromateidae (*Pampus argenteus*), and Cynoglossidae (tongue sole) were observed in the stomach (Figure 5).

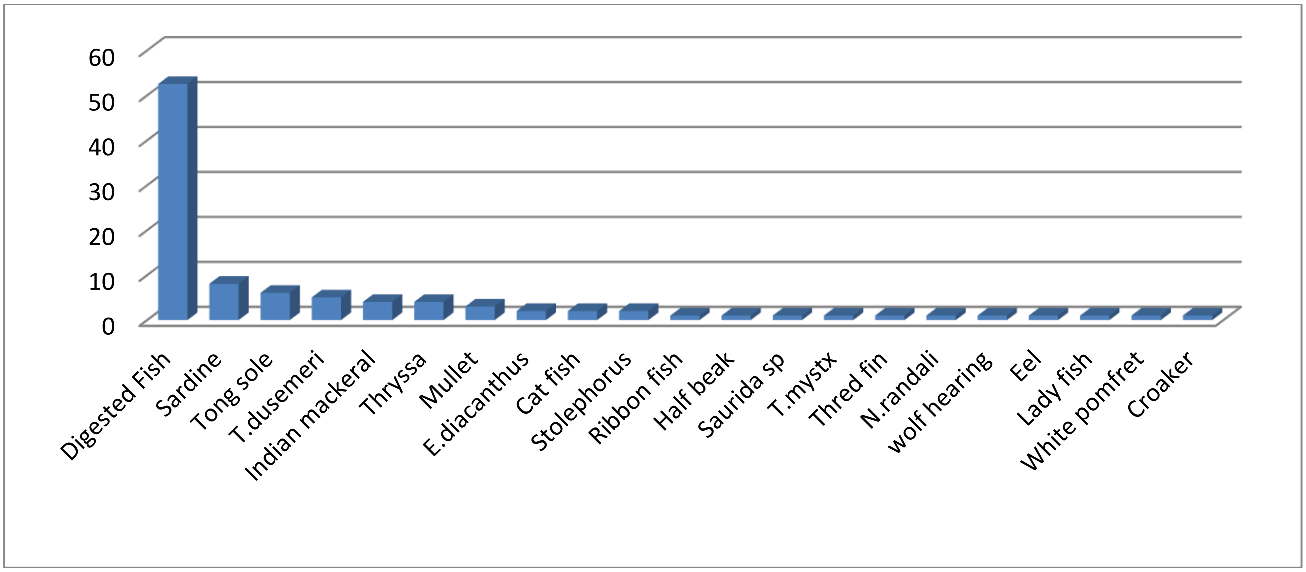

Figure 4: Combined percentage of teleosts in *R. oligolinx.*

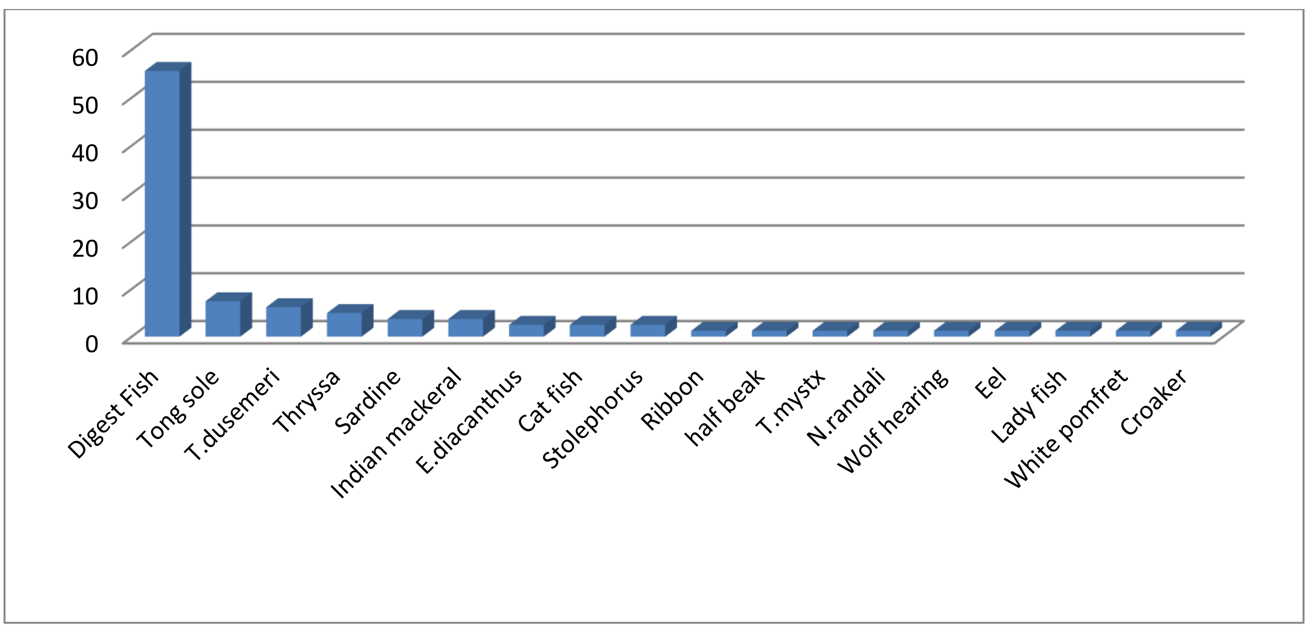

Figure 5: Percentage of teleosts in female of *R. oligolinx.*

In males, only five families of teleosts, including Dorosomatidae (*Sardinella spp.*), *Synodontidae* (*Saurida tumbil*), *Scombridae* (*Rastrelliger kanagurta*), *Polynemidae* (threadfin), and Mugilidae (mullet), were found in the stomach (Figure 6). A variety of teleosts were found in females throughout the study period (Figure 5), while limited fish items were found in males (Figure 6).

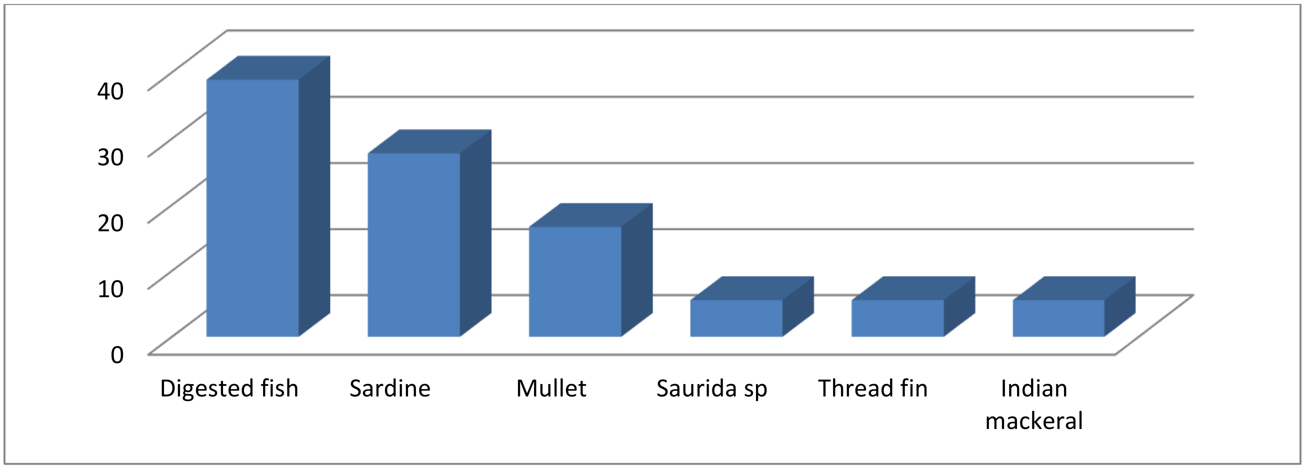

Figure 6: Percentage of teleosts in male of *R. oligolinx*.

CEPHALOPOD

The second dominant group combined percentage of cephalopods was 16.91% of the total diet in *R. oligolinx*; including females, it was 10.78%, whereas in males it was 35.29% (Figure 3). Squid (*Uroteuthis duveseli*) dominated with 95.65%, followed by *Sepia* spp. with 4.34%. In females, the percentage of squid (*Uroteuthis duveseli*) was 47.82%, with no other items found; in males, squid (*Uroteuthis duveseli*) was 47.82% and Sepia sp. was 4.34% (Figure 7).

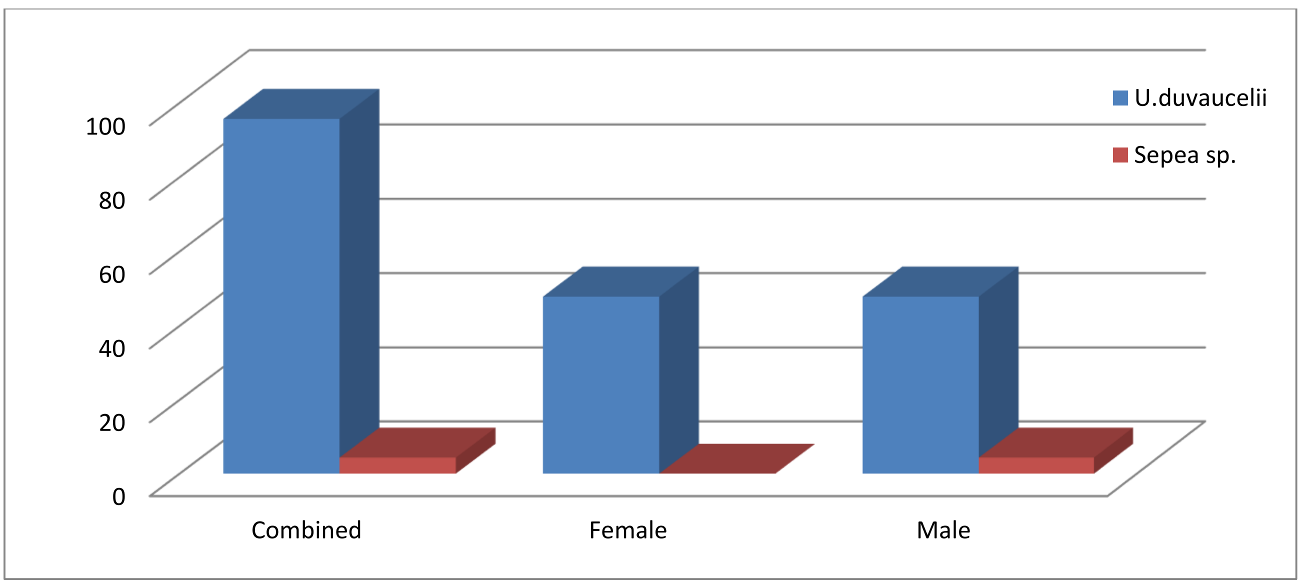

Figure 7: Percentage of cephalopod in *R. oligolinx*.

CRUSTACEAN

This third dominating group's combined percentage was 10.29% of the total diet, including female 8.82% and male 8.82% (Figure 3). Separately, digested shrimp were 42.85%, along with *Prapenaeopsis stylifera* 42.85% and *Penaeus indicus* 14.28% (Figure 8). In females, digested shrimp were 28.57%, *Prapenaeopsis stylifera* 35.71%, and *Penaeus indicus* 7.14% (Figure 8). Males contributed digested shrimp at 14.28%, *Prapenaeopsis stylifera* 7.14%, and *Penaeus indicus* 7.14% (Figure 8).

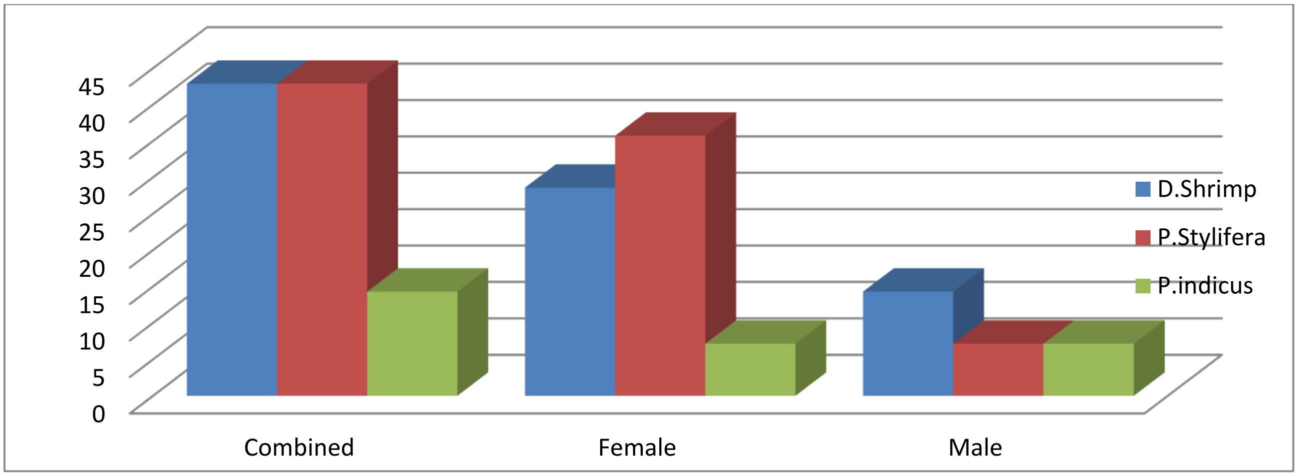

Figure 8: Percentage of crustacean in *R. oligolinx*.

DIET COMPOSITION

The most dominant month combined was October (Figure 9). A combined diet composition of both sexes across the four seasons studied showed that teleosts were the most common food item in the spring (6.6%), followed by crustaceans (0.7%). In the summer, teleosts dominated with 15.4%, followed by cephalopods (0.7%) and crustaceans (0.7%). In autumn, teleosts dominated with 25.0%, followed by crustaceans (14.0%) and cephalopods (8.8%). In winter, teleosts were at 25.7%, crustaceans at 1.5%, and cephalopods at 0.7% (Figure 10).

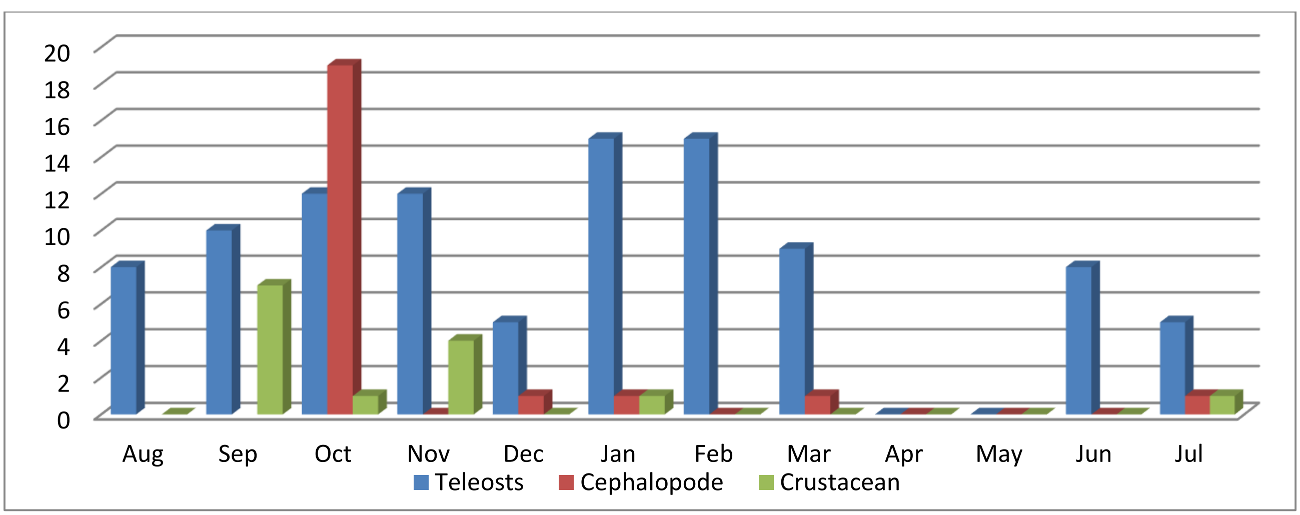

Figure 9: Combined monthly diet composition in *R. oligolinx*.

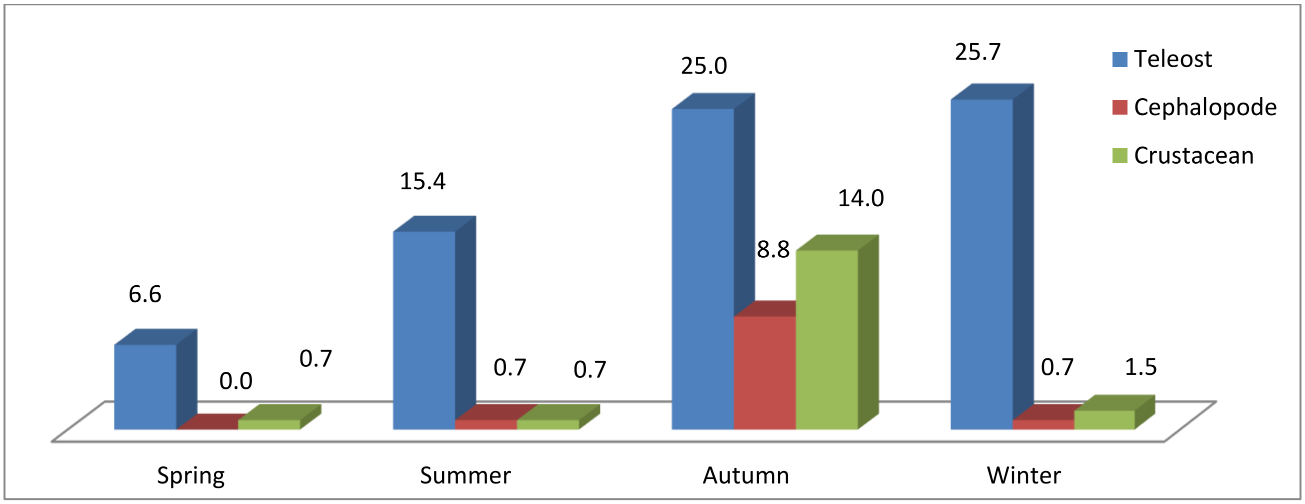

Figure 10: Percentage of diet composition in four seasons of *R. oligolinx.*

DISCAUSSION

Sharks consume a variety of marine species because they are predominantly carnivorous. However, the particular food varies significantly according to the shark's size, species, and habitat. Sharks' digestive tracts are specially designed to break down large prey materials, such as cartilage and bone. They have a small, potent stomach that breaks down food with the help of strong acids and enzymes. Although the intestines are somewhat short, they contain a spiral valve, which is a coiled structure, to enhance the surface area available for absorbing nutrients. Pepsin, the primary digestive enzyme in a shark's stomach, is secreted as pepsinogen, an inactive form that is subsequently activated by the stomach's acidic environment. Pepsin breaks down proteins since it is a protease enzyme. Additionally, the stomach releases concentrated hydrochloric acid to help in food digestion and pepsin activation. Living on or close to the seafloor, benthic sharks consume a wide range of prey, such as mollusks, small fish, and crustaceans. Certain species also consume other sharks as well as cephalopods, such as octopuses and squid. Their diets can vary greatly, with certain species choosing more specialized prey.

Limited research has been done on *R. oligolinx's* feeding habits. During a study in the Eastern Indian Ocean, Purushottama et al. (2017) described that teleosts constituted 81.38%, cephalopods 12.6%, and crustaceans 5.9%. Habashi et al. (2021) reported teleosts at 54.09% and crustaceans at 44.2% along Iran. Moazzam and Osmany (2022) studied teleosts at 71.4%, cephalopods at 7.5%, and crustaceans at 17.1% in the waters of Sindh, Pakistan. The current study's specimens were showed that the stomach of *R. oligolinx* contained teleosts (72.09%), cephalopods (16.09%), and crustaceans (10.29%).

In all studies, it has been established that the most preferred food item of *R. oligolinx* is teleosts, which are available in different varieties and percentages Purushottama et al. (2017) described the diversity of teleost families such as Apogonidae, Cynoglosidae, Mullidae, Serinidae, Scinidae, Carangidae, Dorosomatidae, Platycephalidae, Myctophidae, Nemipteridae, and Trichiridae in the stomach of *R. oligolinx* in their study of the eastern Indian sea. Habashi et al. (2021) reported some quantity of crab in the diet of *R. oligolinx* in Iranian waters. Moazzam and Osmany (2022) reported families of Mugilidae, Dorosomatidae, Platycephalidae, Engraulidae, and Gobiidae, including crab, shrimp, and mantis shrimp in the stomach of *R. oligolinx*, whereas Platycephalidae, Gobidae, crab, and mantis shrimp were not found in the current study.

Tooth structure is really significant in the feeding habits of any species. In *R. oligolinx*, tooth edges are not consistently serrated; adult male anterolateral teeth have taller, thinner, and more flexed cusps than those of females or immature males. Total tooth rows, typically 23–25 on the upper jaw and 21–24 on the lower jaw, enable the species to grasp and smash its prey before swallowing it (Figure 1). Variety of food items, including teleosts, cephalopods, and crustaceans, were found in the current study over different months (Figure 1). FAO (1984) reported that the species is viviparous, with three to five young per litter from yolk-sac placentas. Setna and Sarangdhar (1950) studied *Scoliodonpala sorrah*, synonyms of *R. oligolinx*, and found embryos from September to November, with a size range of 33 mm to 256 mm in Indian waters. Pups in the stomach had a size range of about 250 mm, which is commonly discovered around August (Figure 1) and may explain the empty stomachs observed between April and May in the current study (Figure 9).

CONCLUSION

There is limited research on the feeding habit and ecology of sharks' in Pakistan, this research verifies previous findings on *R. oligolinx* globally, representative that teleosts are the primary food source in the northern Arabian Sea, followed by cephalopods and crustaceans.

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