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DIET COMPOSITION OF SILKY SHARK (*CARCHARHINUS FALCIFORMIS* MÜLLER & HENLE, 1839): IN THE ARABIAN SEA, OFF SHORE WATER OF PAKISTAN

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ABSTRACT

The objective of this study was to found the trophic niche of the silky shark and to find out the ecological role of this predator in the ecosystem in offshore water in the Arabian sea of the exclusive economic zone (EEZ) of Pakistan where this predator known as apex predator. The samples of stomach taken from September 2016 to August 2017 from the Karachi fish harbor, largest fishing centre of Pakistan. A total of 186 stomach contents were analyzed 111 with food and 75 empty. The composition of diet showed that silky shark preys were fish 52.41%, cephalopod 28.28% crustacean 17.93, turtle 0.69 and plastic piece 0.69 showing carnivores behavior. Silky shark (*Carcharhinus falciformis*) is one of the dominant species found in commercial catch amongst other sharks, caught in by catch of surface gillnet.

Keywords: Diet composition, silky shark, pelagic gillnet, Arabian Sea, offshore water of Pakistan.

INTRODUCTION

Silky shark (*Carcharhinus falciformis* Müller & Henle, 1839) is one of the abundant species found in equatorial and tropical zone worldwide water warmer than 23° C (Compagno, 1984; Last and Stevens, 2009). Common in offshore water of Indian Ocean in the pelagic zone of the exclusive economic zone (EEZ) of Pakistan. Found close to edge of continental shelves and have epipelagic distribution as well as near oceanic island (Bigelow and Schroeder, 1984; Bass *et al.*, 1973; Compagno, 1984). Although silky shark is a common species along the coast of Pakistan, study of its diet composition has not been done yet. The objective of the present work is just to provide initial information on the diet composition of this fish.

In the Indian Ocean, the species found Aldabra Island, Comoros, off Madagascar, Mozambique, and Tanzania, also from Somalia to the Maldives, Sri Lanka, Oman and Red Sea. In the Western Pacific, Silky Shark found in New Zealand, Philippines, New Caledonia, off Thailand, China and Taiwan. In the Western Atlantic it occur USA, Massachusetts, to southern Brazil, Gulf of Mexico, and Caribbean Sea. In Central Atlantic species is also occur from St. Paul's Rocks. It ranges from Madeira, the Atlantic coast of Spain, and from Senegal to northern Angolain the Eastern Atlantic. It also found in the region of the Caroline Islands, Phoenix and Line Islands westwards. Species ranges from Southern Baja California to Peruin the Eastern Pacific. It is also found in the region of the Cocos Island, Hawaiian Islands, Revillagigedo Islands, Clipperton and Malpelos Islands (Marín *et al*., 1998; Last and Stevens, 2009; Ebert *et al*., 2013).

Species found over 18 m depth, in pelagic zone down to 500 m depth and caught water as deep as 4000 meters (Poisson, 2007). Study of the feeding habit identifies the living area of the species which is helpful for conservation and management of the shark species (Galvan-Magana *et al.*, 1989). For develop a complex food web feeding ecology is very important (Navia *et al.*, 2010; Bornatowski *et al*., 2014) and ecosystem module for appraise and anticipate achievable modification through fishing effect (Stevens *et al*., 2000). Further study is useful to identify frequency of a particuler prey in the diet and link between the higher and lower levels of food chain (Bornatowski *et al*., 2014). Food option of predator depend on many elements such as available prey and their movement, prey abundance and size, seasonal variation and ecological factors (Nieland, 1980; Cabrera-Chavez-Costa *et al*., 2010).

MATERIALS AND METHODS

In one year study total of 186 stomach of silky shark, 111 with food and 75 empty of size range 52 cm to 267 cm was examined from September 2016 to August 2017 which was obtained from the shark yard of Karachi fish harbor. In this process during shark cutting whole stomachs of both sexes were collected and brought in the Biological Laboratory of Marine Fisheries Department, Karachi where these dissected with the help of scissor. Food item were recorded and group wise picture with label taken for record. Prey was identified on lowest available taxon. Method of frequency of occurrence (FO) has used (Hyslop, 1980)

RESULTS

Diet of both sexes were recorded but except in the month of November 2016 when squid and Ribbon fish found in the stomach of male no food item found in the stomach of male so a combined study of both sexes has formulated. According to this study fish 52.41 %, cephalopod 28.28 %, crustacean17.93 %, turtle 0.69 % and plastic pieces 0.69 % were found (Fig.1)

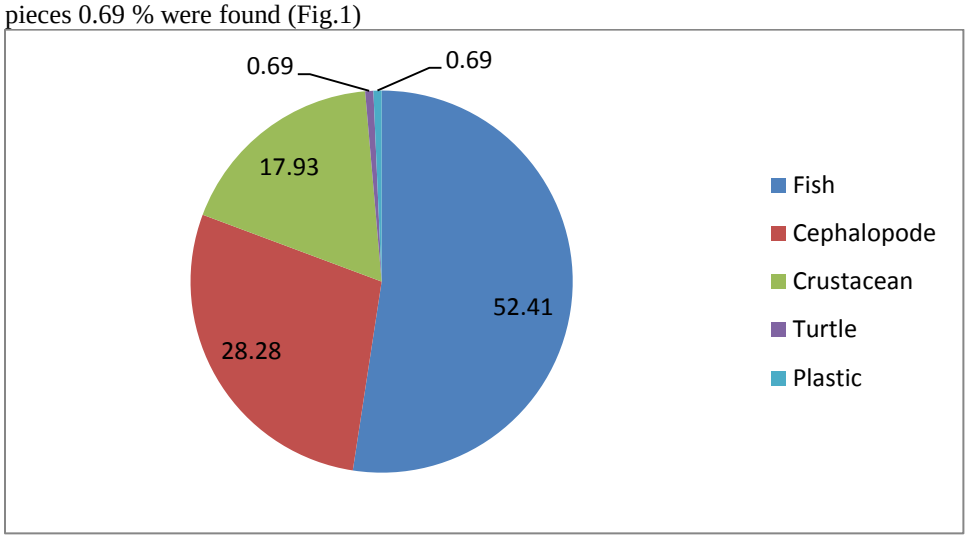


Fig.1. Percentage of diet

Fish

Fish were 52.41 % of the total diet. Miscellaneous were 36.83 %, followed by Scombridae (*Axis thazard, Katsuwonus pelamis, Thunnus albacares*) 11.84 %, Didontidae 9.21 %, Exoccoetidae 9.21 %, Nemipteridae 6.58 %, Cynoglossidae 5.26 %, Carngidae 3.95 %, *Lepturacanthus savala* 2.63 %, Priacanthidae 2.63 %, Eel 2.63,*Aballastes stellatus* 2.63 %, Muraenesocidae 1.32 %, Sphyraenidae 1.32 %,Silaginidae 1.32 % and *Epinephelus diacanthus* 1.32 % of the total fish diet. Didontidae found only in the month of September (Fig.2).

In September shallow water species like Hemiramphidae and Sillaginidae observed in a small specimen of about 54 cm, in January cynoglossidae observed in some medium size specimens about 75 to 80 cm shows the approach in shallow water and bottom in smaller size specimen.

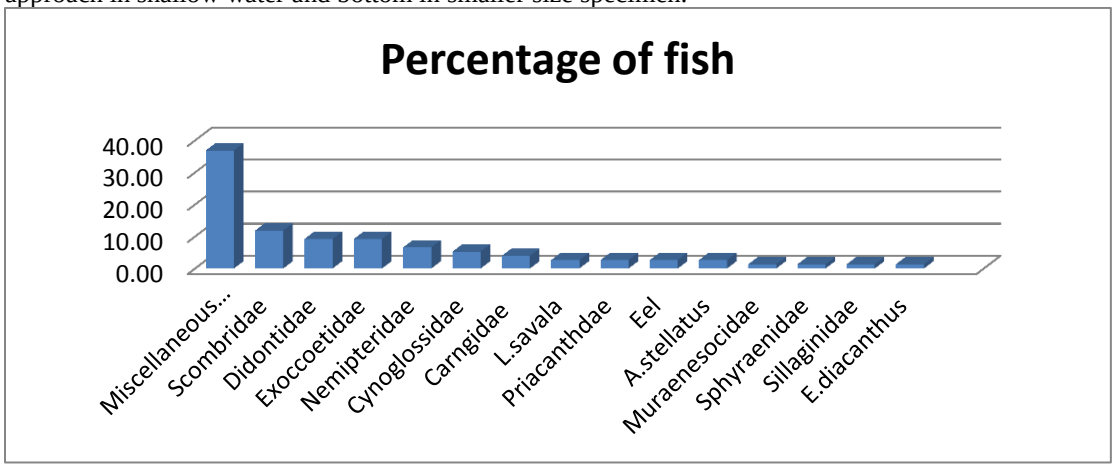


Fig.2. Percentage of fish.

Cephalopod

This group was the second dominant with 28.28 % of the total diet which regularly found in all months but January was peak season, most dominant was Purpleback flying squid (*Sthenoteuthis oualaniensis*) followed by

Sharpearenope squid (*Ancistrocheirus lesuurii)*, few *Abralia sp*. and octopus in January. Squid beak was common in stomach.

Crustacean

This was the third dominant species with 17.93 % comprise by 100 % of Smith's swimming carb (*Charybdis smithii*) in whole and pieces. Found from December to April.

Reptile

Percentage of this group was 0.69 % of the total diet which comprise by a single juvenile of a green turtle (*Chelonia mydas)* found in a female in January (Moazzam and Osmany, 2020).

Plastic piece

Percentage of this item was 0.69 % of the total diet just one piece of rope and plastic ring from a single species found in April.

Hemiramphidae

Didontidae

Didontidae

L. savala

Tuna head

Sthenoteuthis oualaniensis

Fish particles

C. smithii

C. mydas

Sthenoteuthis oualaniensis

Exoccoetidae & Cynoglossidae

Axis thazard

Sthenoteuthis oualaniensis

Eel, Sellar, Priacanthidae

A. stellatus

K. pelamis, Exoccoetidae

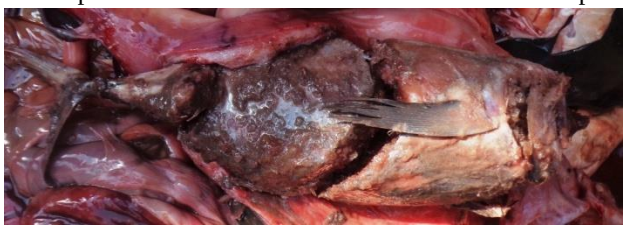
C. smithii

Mix fishes

Plastic piece

Abralia sp

& *E. diacanthus* Octopus



T. albacores

Stomach with food

Stomachs

Fig. 3. Monthly, variety of food items.

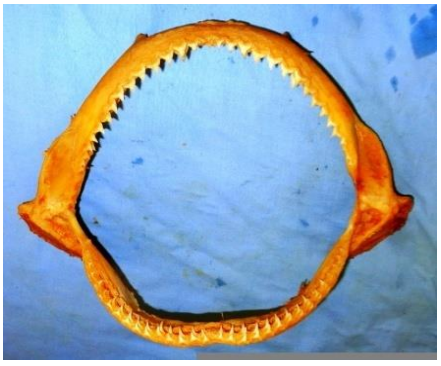


Fig.4. Jaw of Silky shark.

DISCUSSION

Stomach study of the fish indicate the area where fish found and looks for their diet, pelagic sharks depend on their food consist on living animals. One year study of diet composition shows a carnivores behavior. Carnivores need lot of energy for their body functions which they obtained from protein of living animals around them.

Silky shark is a pelagic species found in all tropical and warmer water, a common species found off shore water of Pakistan with other teleost as by catch of surface gillnet.

The Silky Shark normally found in coastal nursery grounds and shift deeper off shore to oceanic zone as sub-adults, commonly associate tuna schools on which they look to prey (Branstetter, 1987). Ontogenetic diet transfer to occur from lower trophic position to advanced trophic positions as the Silky Shark grows (Rabehagasoa *et al.,* 2012).

Various study of diet composition has been conducted in many parts of the world showed that fish consumed their diet on teleost (mostly Scombridae), cephalopod (mostly Giant squid) and crustacean (mostly crab), few quantities of turtle and others.

Silky shark is one of the most dominant species amongst the other sharks found in the landing. Limited study has been done on its diet. In Mexico study of diet from two location comprised main prey crustacian (*Portunus xantusiiaffinis*) cephalopode (*Argonauta* sp.) and fish (*Euthynus lineatus*) (Barranco, 2008), in the same area study of stomach of few shark including silky shark used for distribution of squid species (Galván-Magaña *et al.,* 2013), squid is frequently found in the stomach in this area (Flores-Martínez *et al.,* 2017)

In South America, Ecuador sea most diet of this species depend on scombride fishes, cephalopod and turtle in one female (Estupiñán-Montaño *et al.,* 2018). In Columbia in stomach study most of the fishes belongs to family scombridae and coryphenidae followed by coastal cephalopod squid (*Lolligo* sp.) and small quantity of crustacean (*Euphylaxr obustus*) and turtle (*Chelonia mydus*) (Acevedo, 1996). In California study show prey mostly depend on crustacean (*Pleuroncondes planipes*) the cephalpode (*Dosidicus gigas*) and fish (*Scomber japonicas*) (Cabrera-Chávez-Costa *et al.,* 2000) During study in Eastern Pacific Ocean it is observed that fish is piscivorous user because of more than 50% fish of Scombride family (*Auxis* sp., *K. pelamis, Thunnus* sp. and *T. albacares*) found in the stomach and declared as opportunistic predators (Duffy *et al.,* 2015). In Srilanka during gut study diet comprised 53 % fish, 46% cephalopod and 1% others (Perera, 2016).

In a study in central Indian Ocean including Mozambique teleost were dominating with 52.24% represented by three groups, scombridae, carangidae and exocoetidae, crustacean was the second dominant group with 38.21% represent by smith's swimming crab (*Charybdis smithii*), mantis shrimp (*Natosquilla investigatoris*) and cephalopod with 7.58% represented squid (*Sthenoteuthis oualaniensis*and *Ancistrocheirus lesueurii*) (Filmalter *et al.,* 2016).

Thirteen to 17 and 14 to 16 tooth series are organized on each side of the lower and upper jaws, respectively (usually 15 for both). The upper teeth are triangular and strongly saw-like, with an indentation in the posterior border; they are straight at the center and become more slanting towards the sides. The lower teeth are tapered, erect, and smooth-edged allow the species on variety of food stuff (Fig.3). This structure allows them to crush the larger prey in many pieces before gulp.

Results of the present study are very close to two other studies in the same region, central Africa (Filmalter *et al*., 2016) and Srilanka (Perera, 2016) in the Indian ocean, fish percentage of three studies are much similar apart from percentage of other two group of cephalopod and crustacean which likely to depend the abundance of other group in the area (Table 1).

Table 1.Percentage of food stuff of three studies in Western Indian Ocean.

Name	Pakistan (Present study 2017)	Srilanka (Perera, 2016)	East Africa (Filmalter *et al*., 2016)
Teleost	52.41	53.00	52.24
Cephalopod	28.27	46	7.58
Crustacean	17.93	0	38.21

Present study revealed well with these results as a high variety of prey items from three main living groups (teleosts, cephalopods and crustaceans) were recognized which is according to the finding of many study worldwide which also shows that silky shark are non-selective feeders and that diet depends on prey availability rather than selectivity.

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