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FIRST RECORD OF ESCOLAR, *LEPIDOCYBIUM FLAVOBRUNNEUM* (SMITH, 1843) FROM PAKISTANI OFF-SHORE WATER WITH COMPREHENSIVE PROFILE

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ABSTRACT

Five specimens of escolar (*Lepidocybium flavobrunneum*) were collected for the first time from Karachi Fish Harbor, Pakistan in March 2019. These specimens were caught by surface gillnet from the Khori Great Bank (Sindh coast) on 18th March 2019 at a depth between 490 to 560 m. This is a new addition to the fish fauna of Pakistani water. Study was carried out with comprehensive profile.

Keywords: Gempylidae, Escolar, *Lepidocybium flavobrunneum*, Khori Great Bank, gillnet, comprehensive profile.

INTRODUCTION

Family Gempylidae is recognized to have twenty six species belonging to 16 genera which are found worldwide (Nelson, 2006). Members of the Family Gempylidae are known to be mesopelagic to benthopelagic (Nakamura and Parin, 2001). A good number of the species are of brownish or blackish color (Nakamura and Parin 1993). Previously two species *Neoepinnula orentalis*, Gilchrist and Von Bond, 1924 and *Gempylus serpens*is Cuvier, 1829 were reported from Pakistan (Osmany *et al*. 2019).Present paper reports another species *Lepidocybium flavobrunneum*, Smith, 1843 for the first time from Pakistani waters with complete profile.

L. flavobrunneum commonly known as escolar is a benthopelagic, oceanodromous and a large fish, found all over the world in tropical and temperate pelagic zones of the sea which was not previously reported from the northern Indian Ocean (Nakamura and Parin 1993). The present information extends the range of its distribution to Northern Arabian Sea, along Pakistan coast. Escolar is known to occur mostly in the Atlantic and Pacific Ocean (Nakamura and Parin 1993), first time reported from Cape of Good Hope, South Africa. (Eschmeyer 2019). Synonyms of this species are *Cybium flavobrunneum* Smith, 1843; *Xenogramma carinatum* Waite, 1904; *Nesogrammus thompsoni* Flower, 1923; *Lepidosarda retigramma* Kishinouye, 1926 and *Diplogonurus maderensis* Noronha, 1926 (Froese and Pauly 2019)

Escolar is the only species classified in genus *Lepidocybium on* the basis of caudal peduncle with a main larger keel supported by 2 tiny auxiliary keels above and below; dorsal-fin spines VIII to IX; lateral line single extremely undulating, these character help to identify this species without doubt.

The species is closely associated to the member of families Scrombridae and Trichiuridae in having elongate and fusiform body shapes, dental structure, keeled caudal peduncle and have a similar pelagic habitat which group their environmental position.

In recent past worked on morphological character has described of this species (Keller and Kerstetter 2014; Landgren *et al.* 2014).

Description

Body fusiform and faintly compressed, body depth is 17.7% of the total length of the fish, head blunt and compressed at nape, head length is 3.84 times in the standard length (Fig.1). Snout area is broad (Fig.2) Eye large greenish diameter is 20.6 % of the head length and 5.4% of the total length. Maxilla with low curve, reaching below anterior margin of eye. Gill rakers rudimentary, characterize by a few spines; (Fig.3), 4 larger fang-like teeth on anterior roof of mouth, powerful mandible vomer and palatines fang-like teeth in a single line (Fig.4).

Operculum and pre-operculum curved, without spines. (Fig.5), the lower jaw somewhat protruded than the upper jaw and tip of both jaws lacking dermal processes. Length of the upper jaw is 11 times of the total length, vertebrae 31. Body nearly uniformly dark brown, becoming almost black with the age. Caudal fin deeply forked, prominent lateral keel on caudal peduncle, surrounded by two smaller keels above and below (Fig.6).

The size of the first dorsal fin is low compare to second dorsal fin, consisting of VIII-IX short spines occur from a narrow groove. Closely distinct the second dorsal fin has 16-18 soft rays followed by 6 finlets; anal fin with I -II spines and 14 soft rays; followed by 4 finlets pectoral fins has 16 soft rays; pelvic fins well developed, with I spine

and 5 soft rays. Pelvics thoracic lying in a wide groove (Fig.7). Dorsal fins 4.7 times of the total length of the specimen (Smith 1977, Nakamura and Parin 2001).

Small cycloid scales found over the body but absent on snout and upper part of the head Lateral line started from the dorsal region in line with the opercular region, then slide downward vertically near the pectoral fin towards the ventral margin, after a straight section in parallel to belly it rises abruptly, and then downward again to the anal portion and at last ends on the keel of the caudal peduncle (Fig.8).

Meristic counts and morphometric character according to the range for the species given by Waite (1904), Myers (1932), Munro (1949), Schultz and Springer (1956), Matsubara and Iwai (1958), Bartlett and Backus (1962), Merrett (1968) and Nakamura and Parin (1993) with detailed description of the species is below.

Total length measured 75 cm, forked length 72 cm, standard length 68 cm, body depth is 23 cm which is 17.25 % of total length, head length is 20 cm which is 3.4 of standard length, eye 4.2 cm which is 20.5% of the head length and 5.4% of the total length, upper jaw is 6.8 cm which is 11 time of the total length, distance of dorsal fin was 17 cm which is 4.4 cm of the total length.

Distribution

L. flavobrunneum is circumglobal in tropical and temperate seas of the world but not present from most of the southern part of the Caribbean Sea (Nakamura and Parin, 1993) **(**Fig.9). This species is found from North West South Africa, Madeira Islands (Noronha 1926); Japan; Atlantic coast of Canada; Peru; Hawaii; California; New South Wales (Munro, 1949); Gulf of Mexico; (Schultz and Springer, 1956) Bahamas (Bartlett and Backus, 1962); Isles Comores in the Indian Ocean; (Grey, 1953, Schultz and Springer, 1956, Bartlett and Backus, 1962, Leim and Scott, 1966, Merrett, 1968, Nakamura, 1978). New Caledonia (Fourmanoir, 1970); New Zealand (Paulin and Habib,1980); North West Spain (Quero *et al.*. 1989, 1992); West Portugal (Quero *et al.*, 1999) and Ireland (Quigley and Flannery, 2005). In Australia it is recorded from southern Queensland around the south of the continent and up to the west coast to the north-west shelf of Western Australia (Yearsley and Ward, 1999). In contrast to its wider range of distribution throughout the tropics, reports from the Indian Ocean was limited by the occurrence of this species during 2004-2006 in the landings of large meshed gill nets operated off the Tuticorin coast in the Gulf of Mannar and from the Nagapattinam coast, North East coast of India (Mohan, 2011). In neighbor area species reported from Andaman sea in 2016 (Noshad *et al.*, 2018) It has been recorded off the Gulf coast of Florida during a monthly survey from 2003 to 2004 (Richardson *et al.*, 2010). Found between 30° E - 80° E; 45° S - 30° N to 77°E - 150°E; 55°S - 24°N (Froese and Pauly, 2019). A study conducted on the distribution occurrence and on genetic variation on DNA level (Quigley *et al*., 2005; Brendtro *et al.*, 2008; Kerstetter *et al.*, 2008)

Particulars of Specimens Collected from Pakistan

Comprehensive assessment of one of the specimen of *L. flavobrunneum* was analyzed in detail which is one of five specimen collected at Karachi Fish Harbor. These were caught in the pelagic gillnet from an area which has a depth of 490-560 m at swatch area on 18th March 2019. Specimen brought in the biological laboratory of Marine Fisheries Department, Karachi and identified as *L. flavobrunneum* on the basis of the key given in FAO Species Catalogue, "Snake mackerels and cutlass fishes of the world families Gempylidae and Trichiuridae (Nakamura and Parin, 1993). For further authentication detailed of morphological and mearstic character supported by photograph sent to concerned taxonomist and after confirmation the specimen was preserved in 5% formalin solution and kept in the museum of Marine Fisheries Department, Karachi.

Fig.1. Picture of *Lepidocybium flavobrunneum*


Fig.2. Snout


Fig.3.Gilrakers


Fig.4.Teeth


Fig.5.Operculum


Fig.6.Keels.


Fig.7. Pelvics thoracic


Fig.8.Lateral line

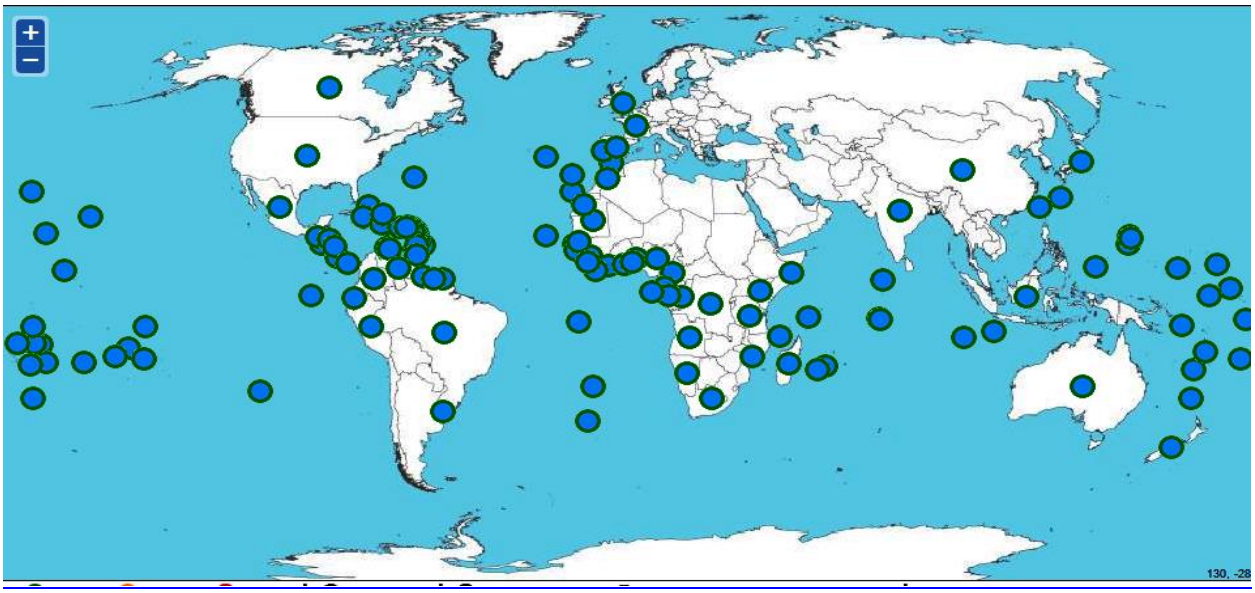
Fig.9. Distribution map of *Lepidocybium flavobrunneum.* https://www.fishbase.

DISCUSSION

Psomadakis *et al.* (2015) reported only one member of family Gemplydae i.e. *Neoepinnula orentalis* (Sack fish) from Pakistan. Osmany *et al.* (2019) added another species *Gempylus serpens* **(**Snake mackerel) from Pakistani water.

Habitat

In 1993 Nakamura and Parin studied the arrangement of the lateral line in escolar, which is synchronized with its mesopelagic environment. It feeds generally, crustaceans, squids and fishes like bramids, coryphaenids, scombrids and trachipterids (Shcherbache, 1987; Kirsten *et al.*, 2008). *Thunnus albacares* (Yellowfin tuna) prey upon him in juvenile stage of this species.

Behavior

Species has below density of retinal ganglion cells due to which there is high visual sensitivity. Species have six to eight layer of rod cell provide much enhanced vision (Landgren *et al.*, 2014). Speed of the *L. flavobrunneum* is not comparable with tunas and with sensitive and feeble visual power of eye collectively improve resolution in the upper direction shows that the *L. flavobrunneum* like pike is a ambush predator which casually moves the temperate

surface water in night to look for prey despite of feeble skylight. When escolar target his prey they attack rapid sudden and perfectly from behind. In this process prey might be unable to find escolar very late due to his dark color before hunt.

Depth

Occurrence of depth of this species has discussed in various studies. Specie is generally have restricted distribution between depth of 100 to 500 m of the continental shelf margin and the greater part of the slope (Parin and Becker, 1970). Species found in mesopelagic waters between 200-885 m and moves to upper zone vertically into epipelagic waters at night (Nakamura and Parin, 1993; Nakamura and Parin, 2001). It is an oceanodromous fish usually found between 200 and 1100 m depths (Riede, 2004). This species is seldom caught at depths of 50 m (Kerstetter and Graves, 2006). A deep dwelling species mostly over the continental slope from 0 to at least 2,000 m (Smith *et al.,* 2015), Movement and distribution of this species had observed in Windward Passage of Caribbean sea of Cuba with the help of satellite archival tagging, it has observed that fish normally travel almost straight near surface but then begun a duel movement in deeper water and moved in water between 100 to 800 m and mostly stay at 250 m depth (Kerstetter *et al.,* 2008). *L. flavobrunneum* is not a targeted specie, it is caught as a by catch of tuna generally from the depths of 100 to 300 m, along other large pelagic fishes like large tunas, marlins, sharks and gempylid species like *Ruvettus pretiosus*in New Zealand sea (Paulin and Habib, 1980).

Stock

Several studies had been conducted in various part of the world for determine the stock of this species. Due to overfishing during 1982 to 1996 catch of this species has increased but average size decreased up to 40 % in the southeastern Atlantic (Brendtro *et al.,* 2008). Levesque (2010) described that over exploitation is not taking place in the northwestern Atlantic, but statistics clearly show a decline in the Escolar stock in the southwestern Atlantic, overall he analyzed that catching of *L. flavobrunneum* are steady in the Western Atlantic, which shows that over exploitation is not taking place in this area. In 2003, worldwide variable catch statistics data of FAO confirmed the catch increased up to its optimum of 76 million tonnes (Smith *et al.,* 2015). During last few decades catch of this species had increased in Maxico Gulf (Brendtro *et al.,* 2008), species caught commercially by local long liners, the total examined catch of *L. flavobrunneum* in this area was 1,485 from January to June 2007-2008 (Beerkircher *et al.,* 2009), species regularly found in the surface long-lining fishing which actually targeted Yellowfin tuna and infrequently swordfish and captured 153 from 79 longline sets from November 1994 to May 1997 (Erickson and Berkeley, 2008), in another study it was 4.23% in number of the total catch from March to December 1997 (González-Ania *et al.,* 2001).During a study from January to April 2004 *L. flavobrunneum* was listed amongst the 10 most common fishes caught by the U.S. Atlantic coastal surface longline fishery that targets swordfish in the Gulf of Mexico and Caribbean water. Composition of this species was 7.5% of the total catch with 64 specimens (Kerstetter and Graves, 2006).

Trade

Escolar is not an aimed species but trade of this fish has commercial value (Graves, 1998). In the Pacific it is generally trapped in longline fisheries targeted for tuna and swordfish and sale for the sushi trade as "super white" and" white tuna". In an experiment it has appeared that marinated fillet of this species in chilly in frozen form provide the best result of freshness (Buchtova *et al.,* 2015).

Length weight relation

Bottom of Form A study was conducted to determine the mean size in eastern Indian ocean and 83.95 cm FL (Rochman *et al*., 2016) determined which become smaller of Western Atlantic ocean 89.5 cm FL (Levesque, 2010) and Pacific ocean 90 cm FL (Nishikawa and Warashina, 1988) but greater than of Canary Island Atlantic Ocean which was 78.90 cm TL (Lorenzo and Pajuelo, 1999). In this study length weight relationship found negative allometric where the length increasing faster than weight. In male b (slope) was 2.28 whereas in female b (Slope) was 2.31, combined 2.29 it was lower than Western North Atlantic where b (Slope) was 2.32 (Levesque 2010), in Gulf of Mexico b (slope) was 3.15 (Keller and Kerstetter, 2014), in Central East Atlantic b (slope) was 2.98 (Gonzalez *et al.,* 1995). Best season for catching was June to August.

Size

This species can attained the size of about 2 m but up to 1.5 m is common (Merrett, 1968, Fourmanoir, 1970) Maximum standard length (SL) of this species was recorded as 200 cm (Nakamura and Parin, 1993) and the maximum weight is 45.0 kg (Nakamura, 1984). Size range 30 to 35 cm is maturity stage of this fish, spawning take

place near oceanic island or continental shelf where larva frequently found (Maskimov, 1970; Nishikawa and Warashina, 1988 and Brendtro *et al.*, 2008).

Risk assessment and public health

Regarding public awareness very limited work has conducted (Karl and Rehbein, 2004; Hawang, 2012). Meat of the fish has bad and good effects on human. *L. flavobrunneum* flesh is fatty and has purgative properties (Bianchi *et al.*, 1993). The occurrence of chemical hazard, biogenic amines/histamine and high waxes ester (Gempylotoxin) in the flesh is a health threat can produce keriorrhea like to oily diarrhea (Kan *et al.*, 2000; Feldman, *et al.*, 2005; Akhter *et al.*, 2009). The fatty acid of this wax ester consist phospholipid, triglycerides, hydrocarbons and sterols (Zara *et al*., 1993). This ester substance found 90% in fillet. (Karl and Rehbein, 2004) This wax ester is not easily digestible in human and may cause of diarrhea and other acute symptom like vomiting, cramp and headache (Zara *et al*., 1993) which commonly called as Gempylid fish poisoning or Gempylotoxism (Roche *et al*., 2002) these illness are life threatening (Akhter *et al*., 2009). It is recommended that more than 170 g meat should not be eaten per single meal (Medellitin, 2014) it is prohibited for trade in Italy and Japan due to purgative side effects. In the Canada and United States, it is not prohibited but adverse effects of its consumption restrictedly watched. Fish is banned in many countries but often sold in Asia (Smith, 1977).

In June 1998 this fish created food poising in Tokyo when histamine were detected from 0.4 to 7.3mg/g effected 21 people of a restaurant (Kan *et al.*, 2000). Largest outbreak of poisoning was reported in August 2003 in California USA due to higher level of histamine that is 2000 to 3800 ppm in which effected many people specially who had eaten up to 2 oz of this fish. There were many symptoms but most common was headache, 67%, facial flushing 62%, palpitation 57% and others (Feldman *et al.*, 2005).

Anti inflammatory character of fish meat has described with harmonization of omega 3 fatty acids and exclusive amino acid (Rudkowska *et al.*, 2010). Fish meat is known to prevent obesity in the presence of omega 3 and unique protein (Pilon *et al*., 2011).

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