

SPECIES OF GENUS *SARDINELLA* IN PAKISTAN: A REVIEW

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ABSTRACT

Eight species of *Sardinellas* are reported from Pakistan. Of these *Sardinella longiceps*, *S. sindensis*, *S. gibbosa* and *S. albella* are of common occurrence in Pakistan. Report of *S. atricauda* from Pakistan is possibly because of misidentification whereas there are some doubts about occurrence of *S. fimbriata* and *S. brachysoma* from Pakistan. A key to known species and their distribution from Pakistan are also included in the study.

Keywords: *Sardinella*, *S. albella*, *S. longiceps*, *S. sindensis*, key, distribution.

INTRODUCTION

Genus *Sardinella* was established by Valenciennes (1847) to accommodate *Sardinella aurita* collected from Messina, Sicily, Italy. This genus contains small sized, coastal and pelagic species; some of which can be found even upto a depth of 300 m. *Sardinella spp.*, usually form large schools and feed mainly on zooplankton and phytoplankton. Its annual landings in Pakistan are estimated to be about 45,000 metric tons (Anonymous, 2010) which is mainly used for fish meal production as well as for direct human consumption. Small quantities are also canned for export purposes.

They can be distinguished from other members of Family Clupeidae in having a combination of characters such as hind border of gill-opening with two distinct fleshy outgrowths, 7 to 14 fronto-parietal striae, a symmetrical paddle-shaped second supra-maxilla and the last two anal fin rays distinctly enlarged. *Sardinellas* are commercially very important species. There are 21 valid species of the genus known so far from world over (Whitehead, 1985). From Pakistan 8 species are known. Present paper reviews the genus *Sardinella* occurring in Pakistan. It also provides a key for the identification of the species occurring in Pakistan. It may be mentioned that Anonymous (1999) mentioned occurrence of *Sardinella atricauda* but it seem to be a misidentification because this species is known from Indonesia. Ahmed *et al.* (1962) have studied sardine fisheries of Mekran.

No specific work on taxonomy of *Sardinella* species was carried out except Niazi (1976), Qureshi (1957), Whitehead (1985) and Whitehead *et al.* (1988) who included them as a member of Family Clupeidae. Regan (1917) in his revision on genus *Sardinella* included some species reported from Karachi. *Sardinella longiceps* is one species which is comparatively better studied in Pakistan as compared to other *Sardinella spp.* (Ahsanullah, 1965; 1966a, 1966b; Hasan, 1971 and Hashmi and Khan, 2003). Khatoon and Hussain (1998) have studied the eggs and developmental stages of *Sardinella spp.* Whereas Khan and Waqar (1981) and Moazzam and Rizvi (1980) have mentioned larval and juveniles of *Sardinella* in their studies respectively. Considering paucity of information about *Sardinella* and prevalent confusion about their identification in Pakistan present studies was initiated and it reviews *Sardinella* species reported from Pakistan, were recorded. It also provides a key for the identification of the species occurring in Pakistan.

MATERIALS AND METHODS

Samples of *Sardinella* were collected from various landing centers along the Pakistan coast. Samples were photographed and preserved in 5% neutralized formalin. Various characters of the species were studied following the details provided by Whitehead (1985). For those species which could not be collected from the landing centers but were reported in the literature their illustration and measurements etc. were obtained from published material. Key of the reported species from Pakistan was prepared based on prominent characters and mainly based on Munroe *et al.* (1998).

RESULTS

TAXONOMIC DESCRIPTION

***Sardinella albella* (Valenciennes, 1847) - White sardinella (Fig. 1)**Fig.1 *Sardinella albella*

This species was originally described as *Kowala albella* from Pondicherry, India by Valenciennes (1847). No holotype is known, however, lectotype (MNHN 0665) is housed in Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 1998). It is known to be distributed in the Indo-West Pacific extending from Red Sea, Persian Gulf, East African coasts, Madagascar eastward to Indonesia and the Arafura Sea, north to Taiwan and south to Papua New Guinea and Northern Australia.

It was reported by Bianchi (1985), Froese and Pauly (2002), Hoda (1985, 1988), Hussain (2003), Jalil and Khaliluddin (1972, 1981), Majid *et al.* (1992), Qureshi (1957) from Pakistan without mentioning any specific location whereas Whitehead (1985) and Whitehead *et al.* (1988) shown its distribution along Sindh and Balochistan coasts. It was also reported from Karachi by Niazi (2001) from Korangi Creek by RETA (2003) and from Sindh creeks by Niazi (1976). This species is among the common sardinellas found in Pakistan and locally known as 'Chako'. It is mainly utilized for fish meal production.

***Sardinella atricauda* (Günther, 1868) - Bleeker's blacktip sardinella**

This species was originally described as *Clupea atricauda* from Ceram, Indonesia by Günther (1868). Its holotype (BMNH 1867.11.28.31) is housed in Natural History Museum, London, United Kingdom (Eschmeyer, 1998). This species is known from Western Pacific area including Indonesia, Hawaii, Thailand and Western Samoa (Froese and Pauly, 2012). According to Anonymous (1999), there is a specimen (BMNH 1889.2.1.1883) labeled to be from Pakistan.

The record of this species from Pakistan seems to be a misidentification possibly of *Sardinella melanura* from which is difficult to separate. Therefore, this species is not included in the key for the species reported from Pakistan.

***Sardinella brachysoma* Bleeker, 1852 Deepbody sardinella Fig. 2.**Fig. 2 *Sardinella brachysoma*

This species was described from Jakarta, Java, Indonesia, by Bleeker (1852). No holotype of this species is known, however, lectotype (BMNH 1867.11.28.38) is housed in Museum of Natural History, London, United Kingdom (Eschmeyer, 1998). This species is known from Indonesia, Thailand, India, Australia, China, Myanmar and Papua New Guinea and Taiwan. It was listed from Pakistan by Hussain (2003) without giving any specific details. Froese and Pauly (2012) shown distribution of *Sardinella brachysoma* extending into Pakistani waters and beyond, however, it requires further verification to ascertain its distribution in Pakistani waters.

***Sardinella fimbriata* (Valenciennes, 1847) - Fringescale sardinella (Fig. 3)**



Fig.3. *Sardinella fimbriata*

This species was originally described as *Spratella fimbriata* from Malabar coast, India by Valenciennes (1847). No holotype is known, however, lectotype (MNHN 3227) is housed in Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 1998). According to Froese and Pauly (2012), this species is known to be distributed widely in the Indo-West Pacific area including southern India, Bay of Bengal to the Philippines, extending upto eastern tip of Papua New Guinea.

From Pakistan, this species is reported by Ahmad (1988), Anonymous (1999), Froese and Pauly (2002), Hoda (1985, 1988), Hussain (2003), Jalil and Khaliluddin (1972, 1981) and Qureshi (1957) without giving any specific location. Abildgaard and Khan (1994) and Misra (1959) reported this species from waters of Sindh whereas Khan and Waqar (1981) reported its larvae to be occurring in Manora Channel, Karachi. Niazi (1976) reported this species from creeks along Sindh coast. Aitken (1907), Day (1878, 1889) and Sorley (1932) reported this species from Sindh as *Clupea fimbriata*.

Despite its report from Pakistan, Whitehead (1985) pointed out identification of this species from western Indian Ocean including from Pakistan is not correct and mostly confused with *Sardinella gibbosa* or *S. albelli*.

***Sardinella gibbosa* (Bleeker, 1849)- Goldstripe sardinella (Fig. 4)**



Fig. 4 *Sardinella gibbosa*.

This species was originally described as *Clupea gibbosa* from Makasar, Sulawesi, Indonesia by Bleeker (1849). No holotype is known, however, neotype (BMNH 1867.11.28.46) is housed in British Museum of Natural History, London, U. K. (Eschmeyer, 1998). This species is reported from Indo-West Pacific including Persian Gulf, East Africa and Madagascar to Indonesia, north to Taiwan and Korea south to the Arafura Sea and northern Australia (Froese and Pauly, 2012).

From Pakistan it was reported by Bianchi (1985), Froese and Pauly (2002), Hoda (1985, 1988), Hussain (2003), Jalil and Khaliluddin (1972, 1981), Majid *et al* (1992) Whitehead (1985) and Whitehead *et al.* (1988). Niazi (2001) reported it from Karachi whereas Khatoon and Hussain (2005) and RETA (2003) listed it from Korangi Creek whereas Niazi (1976) reported it from Sindh creeks including Patiani and Phitti Creek. According to Froese and Pauly this species is often confused with *Sardinella fimbriata* in Indian waters.

Sardinella jussieu (Valenciennes, 1847) - Mauritian sardinella

This species was originally described as *Clupeonia jussieu* from Mauritius by Valenciennes (1847). Its holotype (MNHN A-2208) is housed in Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 1998). *Sardinella dayi* was described by Regan (1917) from Karwar, India is considered to be a synonym of this species whose holotype (BMNH 1912.5.2.2) is housed in Museum of Natural History, London, U. K. (Eschmeyer, 1998).

This species is reported from eastern Indian Ocean including western coasts of southern India, from Bombay south to Sri Lanka; also to Madagascar and Mauritius. It is also known from northwest Pacific including Taiwan, Hong Kong and Viet Nam. From Pakistan it was reported by Hoda (1985, 1988)

Sardinella longiceps Valenciennes, 1847 - Indian oil sardine (Fig. 5)



Fig.5. *Sardinella longiceps*

This species was described for the first time from Pondicherry, India by Valenciennes (1847). No holotype is of the species known, however, lectotype (MNHN 3743) is housed in Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 1998). This species is endemic to northern and western parts of Indian Ocean i.e. from Gulf of Aden, Gulf of Oman eastward to southern part of India and on eastern coast to Andhra but apparently not found in Red Sea or the Persian Gulf (Froese and Pauly, 2012)

Commercially a very important species, it is reported from Pakistan coast by Bianchi (1985), Froese and Pauly (2002), Hoda (1985, 1988), Hussain (2003), Jalil and Khaliluddin (1972, 1981), Majid *et al.* (1992), Qureshi (1957) and Siddiqi (1956) without specifically mentioning about any particular area. It is also reported from waters of by Abildgaard and Khan (1994), Aitken (1907), Anonymous (1953, 1955), Day (1878, 1889), Fowler (1941), Misra (1959), Sorley (1932), Whitehead *et al.* (1988). It is known from Karachi (Anonymous, 1955; Hashmi and Khan, 2003; Misra, 1959; Niazi, 2001) and Sindh creeks (Niazi, 1976).

From Balochistan it was reported by Anonymous (1953), Day (1878, 1889), Whitehead (1985), Whitehead *et al.* (1988), Zugmayer (1913). It is also reported from Makran (Ahmed *et al.*, 1962; Anonymous, 1953, 1955; Misra, 1959; Qureshi, 1952). Aitken (1907), Day (1878, 1889), Sorley (1932) and Zugmayer (1913) as *Clupea longiceps*.

Sardinella melanura (Cuvier, 1829) - Blacktip sardinella (Fig. 6).



Fig. 6. *Sardinella melanura*

This species was originally described as *Clupea melanura* from Vanikoro near Solomon Islands by Cuvier (1829). Its holotype is not known, however, neotype (MNHN 3233) is housed in Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 1998). It is known to be widely distributed in the Indo-West Pacific area including Gulf of Aden south to Madagascar and Mauritius, east to the Arabian Sea and northwestern India. It is also reported from Indonesia to Samoa (Froese and Pauly, 2012).

This species is reported from Pakistan by Bianchi (1985), Froese and Pauly (2002), Hoda (1985, 1988), Hussain (2003), Jalil and Khaliluddin (1972, 1981) and Qureshi (1957) without mentioning any specific location. Anonymous (1953), Misra (1959); Whitehead (1985) and Whitehead *et al.* (1988) reported it from Sindh and Balochistan whereas it was reported from Karachi by Hureau (1991) and from Sindh creeks by Niazi (1976). Qureshi (1952) reported this species from Mekran.

Sardinella sindensis (Day, 1878) - Sindh sardinella (Fig. 7).



Fig.7. *Sardinella sindensis*

This species was originally described as *Clupea sindensis* from Karachi, Pakistan by Day (1878). No holotype of the species is known, however, lectotype (ZSI 2630) is housed in Zoological Survey of India, Kolkata (Eschmeyer, 1998). This species is considered endemic to Western Indian Ocean. It is reported Arabian Sea, from Gulf of Aden to the Persian Gulf and Bombay (Froese and Pauly, 2012).

This species is reported from Pakistan coast (without mentioning any specific locality) by Ahmad (1988), Aftab and Ali-Khan (1992), Ali-Khan (1976), Ali-Khan and Aftab (1993), Bianchi (185), Froese and Pauly (2002), Hoda (1985, 1988), Hussain (2003), Jalil and Khaliluddin (1972, 1981), Majid *et al.* (1992), Misra (1959), Qureshi (1957), Siddiqi (1956), Whitehead (1985) and Whitehead *et al.* (1988). It was reported from Sindh coast by Abildgaard and Khan (1994), Anonymous (1953), Fowler (1941), Misra (1962), Regan (1917) and Sorley (1932) whereas it was reported from Balochistan by Anonymous (1953), Misra (1959) and Qureshi (1952). From Karachi it was reported by Ali-Khan *et al.* (2001), Anonymous (1999), Day, (1878, 1889), Eschmeyer (1998), Fowler (1941), Jenkins

(1910), Misra (1959), Niazi (2001), Whitehead (1973) and Whitehead and Talwar (1976). It was reported from Korangi Creek by Ahmed and Abbas (1999, 2000), from Manora Channel by Khan and Waqar (1981) and from Paradise Point by Moazzam and Rizvi (1980). From Sindh creeks it was reported by Anonymous (1955), Niazi (1976) and from Tidal Link Canal, Badin District by Jafri (2004) and Jafri *et al.* (2000).

DISCUSSION

Eight species of genus *Sardinella* are reported from Pakistan. Of these, record of occurrence of *S. atricauda* is possibly based on misidentification as this species is known only from Western Pacific. According to Whitehead (1985) identification of *S. fimbriata* from western Indian Ocean including from Pakistan may not correct and this species mostly mixed up with *S. gibbosa* or *S. albelli*. Similarly Froese and Pauly (2012) shown distribution of *S. brachysoma* extending into Pakistani waters but to ascertain this further studies will be required.

Among sardinellas, *S. longiceps* seems to most common species occurring Pakistan followed by *S. sindensis*, *S. gibbosa* and *S. albelli*. Other species are of rare occurrence. A key to known species (excluding *S. atricauda*) is prepared to facilitate workers in future.

KEY TO THE SPECIES OF GENUS *SARDINELLA* REPORTED FROM PAKISTAN COAST

- | | | |
|---|--|----------------------|
| 1 | Head longer than 29-35% of the body length; gill raker count 150-253 | <i>S. longiceps</i> |
| - | Head less than 29 % and gill rakers less than 127 | 2 |
| 2 | Lower gill raker 88-127 | <i>S. jussieu</i> |
| - | Lower gill raker less than 87 | 3 |
| 3 | Vertical striae on scales continuous, or overlapping, across centre of scale | <i>S. brachysoma</i> |
| - | Vertical striae on scales discontinuous, not meeting at centre | 4 |
| 4 | Numerous perforations on posterior part of scales | <i>S. gibbosa</i> |
| - | Few to no perforations on posterior part of scales | 5 |
| 5 | No perforations on posterior part of scales; no dark spot at dorsal-fin origin | <i>S. melanura</i> |
| - | Tips of caudal fin black | |
| - | Few perforations on posterior part of scales; dark spot at dorsal-fin origin | 6 |
| 6 | More scute (38-77) | <i>S. sindensis</i> |
| - | Less scutes (29-32) | 7 |
| 7 | Lower gill rakers numerous (54 to 82, usually more than 55); scales without well-developed posterior median extensions; perforations on posterior part of scales few | <i>S. fimbriata</i> |
| - | Lower gill rakers fewer (41 to 68, usually less than 60); scales somewhat produced posteriorly; perforations on posterior part of scale more numerous | <i>S. albelli</i> |

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