

AN ANNOTATED CHECKLIST OF THE FAMILY ACANTHURIDAE (PISCES) FROM PAKISTAN: NORTHERN ARABIAN SEA

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ABSTRACT

A total of 19 species of acanthurids are reported from Pakistan including *Naso annulatus*, *N. elegans*, *N. brevirostris* and *N. vlamingii*, which are reported for the first time from the Pakistan coast (Northern Arabian Sea). Of the reported species, the presence of *Acanthurus dussumieri*, *A. melanurus*, *A. nigricans*, *A. triostegus*, and *Ctenochaetus strigosus* in Pakistani waters could not be verified. The presence of *A. monroviae* in Pakistan is of great significance as this species was previously recorded from the Atlantic Ocean and Mediterranean Sea only. Its occurrence in Pakistan may be attributed to anti-Lessepsian migration through the Red Sea.

Keywords: *Naso elegans*, *N. annulatus*, *N. brevirostris*, *N. vlamingii*, Northern Arabian Sea, Pakistan

INTRODUCTION

Fishes belonging to the family Acanthuridae, which includes surgeonfishes, doctorfishes, tangs and unicornfishes, are circumtropical in distribution. The fishes of this family are well diversified in the Indian and Pacific oceans whereas there are only five species reported from Atlantic Ocean. Many species belonging to this family have bright colours, and thus, are popular as aquarium fishes. While reviewing the fishes from Pakistan Psomadakis *et al.* (2015) reported 7 species of family Acanthuridae. Prior to this studies only a few species were recorded, some of these with doubtful occurrence. It was Murray (1880) who reported for the first time two species i.e. *Acanthurus mata* and *A. melanurus* from Sindh waters. Later on Qureshi (1969) reported another two species i.e. *A. nigrofuscus* and *Ctenochaetus strigosus*. In the checklists of marine fishes from Pakistan Hoda (1985, 1988), Hussain (2003) and Jalil and Khalil (1973, 1981) have listed three species i.e. *A. gahhm*, *A. mata* and *A. sohal*. Hoda (1985, 1988) also reported *A. triostegus* from Pakistan. Randall (1984) while describing the fishes of western Indian Ocean has shown distribution of *A. dussumieri* in Pakistani waters.

Members of family Acanthuridae are known to inhabit coral reefs occupying it various niches (Montgomery *et al.*, 1989). No coral reefs are reported from the coast of Pakistan except for a few areas along the coast of Pakistan which have coral assemblages (Ali *et al.*, 2014), still present study reports a well diversified acanthurid fauna from coastal and offshore waters.

MATERIALS AND METHODS

Published scientific literature was examined for the records of various acanthurid species occurrence from Pakistan. In addition, specimens of family Acanthuridae collected during 2005 and 2017 from Karachi Fish Harbour, which is the largest fish-landing centre for domestic fleet operating along coastal and offshore waters of Pakistan. No foreign vessel is allowed to land their catch at this fish harbour; therefore, it is certain that the species collected from this harbour are of Pakistani origin. In addition, some specimens collected by observers on board tuna fishing vessels are also included in the present study. Samples collected from the Karachi Fish Harbour, were photographed and salient features and measurement are recorded, before, their preservation in 5 % neutralized formalin.

RESULTS

An enumeration of the species already reported from Pakistan is made which indicates that only eight species were previously reported. The paper reviews the status of previously species as well as reports of four new records from Pakistan. The species already reported and those recorded for the first time from Pakistan coast are arranged in alphabetical order.

Species of Family Acanthuridae recorded from Pakistan

1. *Acanthurus dussumieri* Valenciennes, 1835

Commonly known as the eyestripe surgeonfish, it was shown to have a questionable distribution in Pakistani waters by Randall (1984); however, no authentic record or sample is available to verify the presence of this species in Pakistan. In the region, it is reported from Oman, Yemen and India, therefore, its occurrence in Pakistan cannot be overruled.

2. *Acanthurus gahhm* (Forsskål, 1775)

This species, which is commonly known as the black surgeonfish, is reported from Pakistan by Hoda (1988), Hussain (2003) and Jalil & Khalil (1972, 1981). No specimen of this species is available in any local fish museum or observed during the present study. This species is known to be endemic to the Red Sea and the Gulf of Aden (Sommer *et al.*, 1996; Zajonz *et al.*, 2000). Unless any authentic record of this species is made, its presence in Pakistan is doubted, however, included in the key to species occurring in Pakistan.

3. *Acanthurus mata* Cuvier, 1829 (Fig. 1)

Material Examined

Acan-11/2004/MFD 63 cm. October 13, 2004-Karachi Fish Harbour (KFH);

Acan-523/2013 MFD- 60 cm. November 4, 2013 –KFH.

Acanthurus mata which is commonly known as the elongate surgeonfish, was reported from Pakistan by Hoda (1985, 1988), Murray (1880, Psomadakis *et al.* (2015) and Qureshi (1969). Randall (1984) who reported this species as *A. bleekeri*, has shown its distribution to be extended to Balochistan coast. Later on, Randall (1987) discussed nomenclature of *A. bleekeri* and consider it to be a synonym of *A. mata*. Randall (1995, 2005) Randall and Lim (2000) and Kuitert & Debelius (2001) also considered *A. bleekeri* as the synonym of *A. mata*, however, Winterbottom *et al.*, (1989), Goren and Dor (1994), Chen *et al.* (1997), Fricke (1999) and Bearez *et al.* (2008) have retained *A. bleekeri* as a valid species.



Fig. 1. *Acanthurus mata*- 69cm-(KFH)

4. *Acanthurus melanurus* Cuvier, 1835

This surgeonfish was recorded from Sindh (now in Pakistan) by Murray (1880) but no further information about the reported specimen is available. Bauchot and Randall (1996) reviewed the types of acanthurid fishes in the collection of MNHN, Paris including the type of *Acanthurus melanurus* which was observed to be a small juvenile from Pondicherry, India whose validity could not be confirmed. Considering its doubtful status, the species, therefore, is not included in the key to species occurring in Pakistan.

5. *Acanthurus monroviae* Steindachner, 1876 (Fig. 2)**Material Examined**

- # Acan-121/2003/MFD 69 cm October 11, 2014-KFH
- # Acan-678/2013/MFD 60 cm November 04, 2013 -KFH
- # Acan-763/2014/MFD 43 cm. April 21, 2014-KFH

This species which is commonly known as Monrovia doctorfish, is reported from Pakistan by Psomadakis *et al.* (2015). It was originally described by Steindachner (1876) from Monrovia, Liberia, and deposited its holotype (NMW 58842) in the Naturhistorisches Museum Wien, Vienna, Austria. Later, this species was recorded from the Eastern Atlantic Ocean including southern Morocco to Angola, Cape Verde and São Tomé in Gulf of Guinea (Eschmeyer, 2015). It is also found in the western Mediterranean, off the Spanish coast (Crespo *et al.*, 1987), in the southern Mediterranean (Hamida *et al.*, 2004), and in the eastern Mediterranean along the coast of Israel (Golani and Sonin, 1996). On the western Atlantic coast, it is reported from Brazil (Luiz-Júnior *et al.*, 2004).

Specimen of *A. monroviae* collected from Pakistan comes in conformity with the description of specimens found in the Atlantic Ocean and Mediterranean Sea as given by Whitehead *et al.* (1986), except for the absence of prominent undulating darker lines along flanks. Despite absence of these undulating lines the specimen from Pakistan they are adequate similarity with the specimens of this species described from Atlantic Ocean and Mediterranean Sea.

6. *Acanthurus nigricans* (Linnaeus, 1758)

Hoda (1985, 1988), in the checklist of fishes of Pakistan listed *A. nigricans* without any details. Taxonomy of white-cheek surgeonfish, as it is commonly known, has been controversial since long. Randall (1987) considered this species to be a valid and reported its wide distribution in the tropical Pan-Pacific area as well as Cocos-Keeling Islands and Christmas Island in the Indian Ocean. It has not been reported from Northern and Western Indian Oceans. In the absence of any authentic record, its record from Pakistan is doubted.

7. *Acanthurus nigricauda* Duncker and Mohr, 1929 (Fig. 3)**Material Examined**

- # Acan-345/2010/MFD 57 cm. May 19, 2010-KFH

This species is reported from Pakistan by Psomadakis *et al.* (2015). A specimen was examined during the present study was collected from commercial landings at Karachi Fish Harbour, has typical dark brown colouration without any lines or spots on the body. There is long pointed black streak enclosing and extending anteriorly from peduncular spine and a prominent horizontal black band about as long as snout extending posteriorly from a short distance behind eye. Its caudal fin is brown and with a distinct white posterior margin. In general appearance and colouration the specimen from Karachi comes in conformity with description given by Randall (2001).

This species was originally described a new variety *A. gahhm* var. *nigricauda* from New Britain and Mussau Island (Papua New Guinea) by Duncker and Mohr (1926) which was later given a status of a separate species by Randall (1987). It has a widespread distribution in the Indo-Pacific area and reported from East Africa, south to Natal and east to the Society Islands and Tuamotu Archipelago, islands of Micronesia northwards to Ryukyu Islands, Japan and southwards to the Great Barrier Reef, Australia and New Caledonia (Froese and Pauly, 2015; Randall, 1998). It is absent from the Red Sea, the Arabian Peninsula and the Hawaiian Islands (Randall, 2001).



Fig. 2. *Acanthurus monroviae* 43 cm (KFH)

8. *Acanthurus nigrofuscus* Valenciennes, 1835

Qureshi (1969) reported this species from Pakistan as *A. matoides* Valenciennes, 1835. Commonly known as the brown surgeonfish, this species is widely distributed in the Indo-Pacific area extending from Red Sea south to Transkei, South Africa, and east to the Hawaiian and Tuamotu islands, north to southern Japan, south to the southern Great Barrier Reef, New Caledonia, and Rapa (Froese and Pauly, 2015; Randall, 1986).

A. matoides is included in the synonym of *A. nigrofuscus* by Randall (1956), however, Kottelat (2013) and Randall (2001) consider it to be a synonym of *A. xanthopterus* Valenciennes 1835. However, Chen *et al.* (1997) and Krishnan and Mishra (1994) retained this as a valid species. There is neither any specimen of this species was collected during the present study nor any record or details of specimen mentioned by Qureshi (1969) are available, therefore, occurrence of this species from Pakistan cannot be ascertained.



Fig. 3. *Acanthurus nigricauda* 57 cm (KFH)

9. *Acanthurus lineatus* (Linnaeus, 1758)

The lined surgeonfish, as it is commonly known, was reported from Pakistan by Hoda (1985, 1988), Hussain (2003) and Jalil and Khaliluddin (1972, 1981). This species is widely distributed in the Indo-Pacific area including East Africa, South Africa, Mozambique Channel, Seychelles, Madagascar and western Mascarenes east to Hawaiian Islands, Marquesas Islands and Tuamotu Archipelago, north to southern Japan and Ogasawara Islands, south to southern Great Barrier Reef and New Caledonia (Eschmeyer, 2015). No detail about the specimens collected from Pakistan is available, therefore, authenticity of its occurrence in Pakistan cannot be ascertained.

10. *Acanthurus triostegus* (Linnaeus, 1758)

Commonly known as the convict surgeonfish, this species was reported from Pakistan by Hoda (1988). This species is known from throughout Indo-Pacific and eastern Pacific including East Africa, Seychelles, Mozambique Channel, Madagascar and Mascarenes east to Panama, north to southern Japan and Ogasawara Islands, south to Lord Howe Island, New Caledonia, Kermadec Islands and Pitcairn Islands (Eschmeyer, 2015). In the Arabian Sea it is known from India (Pillai *et al.*, 1983; Mohan and Pillai, 1988), Oman (Al-Jufaili *et al.*, 2010) and Socotra Island (Zajonz *et al.*, 2000). No specimen of this species is available in any local fish museum or observed during the present study, however, considering its reports from the nearby countries, occurrence of this species in Pakistan cannot be overruled.



Fig. 4. *Acanthurus xanthopterus* 38 cm (KFH)



Fig. 5. *Acanthurus xanthopterus*) – Spine on caudal peduncle.

1. *Acanthurus xanthopterus* Valenciennes, 1835 (Fig. 4-5)

Material Examined

Acan-562/2013/MFD 38 cm. September 20, 2013-KFH (collected from off Ras Mauri, Karachi coast).

This species was reported from Pakistan by Psoadakis *et al.* (2015). A specimen of yellowfin surgeonfish is collected from off Ras Mauri, near Karachi, has typical purplish to brownish gray. It has an indistinct region of dull yellow anterior to eye and to a lesser extent posterior from eye. It has a whitish band across base of caudal fin which is not very prominent. Its dorsal and anal fins are brownish yellow with 4 longitudinal blue bands and a blue-grey band at base. It has distinct colour pattern of pectoral fin which has the outer 1/3 bright yellow. Spine on caudal peduncle black fits in a yellow socket (Fig. 5).

According to Randall (2001) this species has a wide distribution in the Indo-Pacific region but absent from the Red Sea and the Persian Gulf. It is reported from East Africa to French Polynesia and Hawaii, as well as the tropical eastern Pacific (lower Gulf of California and Clipperton Island to Panama and the Galapagos Islands). It is also known from western Pacific from southern Japan to the southern Great Barrier Reef (Australia).

2. *Ctenochaetus strigosus* (Bennet, 1826)

This species was reported from Pakistan by Qureshi (1969). According to Randall (2001), this species has a widespread distribution in the Indo-Pacific region and Hawaii. Its distribution ranges in the western Pacific from southern Japan to the southern Great Barrier Reef (Australia). From the region it was recorded from Oman by Al-Jufaili *et al.* (2010), Socotra Island (Yemen) by Zajonz *et al.* (2000) and from Kitten Island, Lakshadweep (Arabian Sea) by Kumaran *et al.* (1989). In the absence of any authentic record, its occurrence in Pakistan cannot be ascertained.

3. *Naso annulatus* (Quoy and Gaimard, 1825) (Fig. 6-7)

Material Examined

Acan-1,0132/2017/MFD 83 cm. March 24, 2017- 65°16.700'E; 24°46.500'N 68 km south of Kund Malir, 1156m (only Photograph and clip of live specimen)

Naso annulatus is reported for the first time from Pakistan coast. This species which is commonly known as whitemargin unicornfish is usually plain brown or olivaceous in color which is paler below. It has black caudal rays with narrow margins. Its pectoral fins with white distal margins (Fig. 7). Specimen from Pakistan are almost greyish white which is paler below. Its lips are broadly white edged,



Fig. 6. *Naso annulatus*. Specimen collected from South of Kund Malir in March 2017

It was originally described as *Priodon annulatus* by Quoy and Gaimard (1825) from Timor Island, southern Malay Archipelago. Its holotype (MNHN A-4155) is housed in Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 1998; Bauchot and Randall, 1996). According to Eschmeyer (1998) this species is known from Red Sea, Indo-Pacific area including East Africa, Oman, Madagascar, Seychelles and Mascarenes east to Hawaiian Islands, Marquesas Islands and Gambier Islands, north to southern Japan, south to Western Australia, Queensland (Australia), New Caledonia, Lord Howe Island, Norfolk Island, and Tonga; Clipperton Island. Present paper extends its distribution to further north to Pakistan coast.



Fig. 7. *Naso annulatus* showing white margin of pectoral fin

14 *Naso brevirostris* (Cuvier, 1829) (Fig. 8)

Material Examined

Acan-1,008/2017/MFD 69 cm. February 2, 2017- 67°15.071E; 23°21.800N Swatch Area 278 m (only Photograph); # Acan-1,712/2017/MFD 38 cm. Jun 06, 2017-KFH

Naso brevirostris is reported for the first time from Pakistan coast. This species which is commonly known as spotted unicornfish is characterized in having a distinctive humped back and prominent horn in adult males. Profile of its snout from mouth to eye strongly sloping, forming an angle of about 40° to horizontal axis of body (Randall, 2001). It has typical olive brown colouration with a few scattered small dark-edged pale spots on postorbital head and body above pectoral fins.



Fig. 8. *Naso brevirostris* collected from Swatch area in February, 2017

It was originally described as *Naseus brevirostris* by Cuvier (1829) but no specific locality was identified; possibly from Indonesia. Its types are not known. According to Eschmeyer (1998) this species is known from Red Sea, East Africa, South Africa, Mozambique Channel, Seychelles, Madagascar and Mascarenes east to Galápagos Archipelago, north to southern Japan, Ogasawara Islands and Hawaiian Islands, south to Lord Howe Island. It is recently reported from Oman (Al-Mamry *et al.* (2016). Present paper extends its distribution to further north to Pakistan coast.

15. *Naso brachycentron* (Valenciennes, 1835) (Fig.9)

Material Examined

Acan-211/2007/MFD 53 cm. August 21, 2007-KFH

This species is reported from Pakistan by Psomadakis *et al.* (2015). It is commonly known as the humpback unicornfish this species is recorded from the widely distributed in the Indo-Pacific are including East Africa, South Africa, Mozambique Channel, western Mascarenes east to Marquesas Islands and Society Islands, north to southern Japan, south to northern Australia, New Caledonia and Tonga (Eschmeyer, 1998). It was originally described from Waigiou, Indonesia. Its holotype (MNHN A-7487) is housed in the Museum National d'Histoire Naturelle, Paris, France (Eschmeyer, 2015; Froese and Pauly, 2015).



Fig. 9. *Naso brachycentron* 53 cm (KFH)

This species can be distinguished from its congeners in having distinctive humped back. A distinct horn is noticeable only in adult males. A few scattered small dark-edged pale spots are present on postorbital head and body above pectoral fins. There is no white margin posteriorly on caudal fin. Profile of snout from mouth to eye strongly sloping, forming an angle of about 40° to horizontal axis of body (Randall, 2001).

16. *Naso elegans* (Rüppell, 1829) (Fig.10).

Material Examined

Acan-870/2016/MFD 61 cm. March 14, 2016- 65°48.321E; 24°31.653N (off Ras Mauri) depth 1,000 m (only Photograph)

Naso elegans is reported for the first time from Pakistan coast. Elegant unicornfish, as it is commonly known is photographed at the offshore waters off Sapat, Balochistan and showed typical colouration. Its dorsal fin yellow with a blue line at base and a black band above this; anal and pelvic fins dark brown; dorsal and anal fins with a narrow blue margin and black submarginal line; caudal fin yellowish with black upper and lower margins and a submarginal black band posteriorly (Randall, 2001). Its caudal fin emarginated.



Fig. 10. *Naso elegans* collected from Ras mauri in March, 2016

It was originally described as *Aspisurus elegans* by Rüppell (1829) from Northern Red Sea. Its holotype (SMF 7644) which is a dried specimen is housed in Forshungs Institut und Natur Museum Senckenberg, Frankfurt, Germany. According to Eschmeyer (1998) this species is known from Red Sea, East Africa and Natal (South Africa), Mozambique Channel, Seychelles, Madagascar and western Mascarenes east to Andaman Sea and western Indonesia. It was not previously known from the Northern Indian Ocean including Gulf of Oman, Persian Gulf or India, however, present paper extends its distribution substantially to the north to the coast of Pakistan. .

17. *Naso hexacanthus* (Bleeker, 1855) (Fig. 11)

Material Examined

Acan-881/2014/MFD 50.4 cm. November 15, 2014-KFH



Fig. 11. *Naso hexacanthus* 50.4 cm (KFH)

This species is reported from Pakistan by Psomadakis *et al.* (2015). It is commonly known as sleek unicornfish and has a wide distribution in the Indo-West Pacific area. It is known from Red Sea, East Africa, Mozambique Channel, Seychelles and western Mascarenes east to Hawaiian Islands, Marquesas Islands and Ducie (Pitcairn Group), north to southern Japan and Ogasawara Islands, south to Lord Howe Island and New Caledonia. Eastern Pacific: Clipperton Island (Eschmeyer, 2014; Froese and Pauly, 2015). From the Arabian Sea, it is reported from Yemen (Zajonz *et al.*, 2000).

It was originally described by Bleeker (1855) from Ambon Island, Molucca Islands as *Priodon hexacanthus*. The species is characterized by having almost fusiform, body which is grayish to greenish brown and paler below. There are two weak immovable bucklers on each side of caudal peduncle.

18. *Naso reticulatus* Randall, 2001 (Fig.12)



Fig. 12. *Naso reticulatus* 57 cm (KFH)

Material Examined

Acan-278/2009/MFD 51 cm. April 16, 2009-KFH; # Acan-612/2013 MFD- 57 cm. October 14, 2013 - KFH;

Remarks The reticulated unicornfish was described from Taiwan and Indonesia by Randall (2001) and later on reported from the Philippines (Randall, 2002), West Bengal, India (Mohapatra *et al.*, 2013) and from Pakistan by Moazzam and Osmany (2015) and Psomadakis *et al.* (2015). Meristic comparison of specimens was made by Randall (2001), from Taiwan, Indonesia, Mohapatra *et al.* (2013) from India and Moazzam and Osmany (2015) from Pakistan which reveals that specimens from the four locations are almost comparable.

19. *Naso vlamingii* Valenciennes, 1835 (Fig. 13)

Material Examined

Acan-983/2015/MFD 51 cm. September 17, 2015-KFH.

This species is reported for the first time from Pakistan. Commonly known as bignose unicornfish this species was originally described from Molucca Island, Indonesia by Valenciennes (1835). Its holotype is not known (Eschmeyer, 1998). Elsewhere, it is widely distributed in Indo-Pacific including East Africa, Seychelles, Madagascar and Réunion east to Line Islands, Marquesas Islands and Tuamotu Archipelago, north to southern Japan, south to southern Great Barrier Reef (Australia) and New Caledonia to Eastern Pacific Waif at Galápagos Islands (Eschmeyer, 1998). Although known from Lakshadweep, India (Vijay-Anand and Pillai, 2003) but not known from any other parts of the northern Arabian Sea including Oman (Randall, 1995) and Yemen (Zajonz *et al.*, 2000). Present paper, therefore, extends distribution of this species to further north into Pakistan.



Fig. 13. *Naso vlamingii* 50 cm (KFH)

This species is known for a convexly rounded prominent snout anteriorly on head centred at level of lower edge of eye. It has elevated dorsal and anal fins. Caudal fin is truncate to slightly rounded with a filament developing from each corner in adults. Side of body has vertical blue lines which break up into small blue spots dorsally and ventrally. A broad blue band is present extending from eye to front of rostral protuberance.

Key to the species of family Acanthuridae reported from Pakistan

- 1 A single folding antrorse spine on each side of caudal peduncle; caudal peduncle depth 2.1 to 3.5 times in head length..... 2
- One to 10 fixed bony plates (keeled with age) on each side of caudal peduncle; caudal-peduncle depth 4 to 6 times in head length..... 12
- 2 Teeth fixed, denticulate on all of margin, not elongate, with expanded incurved tips, not more than 26 in upper jaw; dorsal-fin spines VI to IX (usually IX)..... 3
- Teeth movable, with expanded incurved tips which bear only lateral denticulations, 30 to 60 in upper jaw; dorsal-fin spines VIII..... *Ctenochaetus strigosus*
- 3 Snout short, its length 6 to 8.2 times in standard length; mouth small, and teeth small and numerous, 20 to 26 in lower jaw of adults...*Acanthurus mata*
- Snout not short, its length 3.9 to 5.3 times in standard length; mouth usually not small, and teeth not small and numerous, 12 to 22 in lower jaw of adults 4
- 4 Body whitish with 6 narrow vertical black bars (1 on head passing through eye, 4 on side of body, and 1 on caudal peduncle); caudal fin truncate to slightly emarginate, the caudal concavity more than 15 times in standard length; peduncular spine very small; dorsal-fin rays 22 to 24; anal-fin rays 19 to 22*Acanthurus triostegus*
- Body not whitish with vertical black bars; caudal fin of adults emarginate to lunate, the caudal concavity usually less than 15 times in standard length; peduncular spine usually not small; dorsal-fin rays 23 to 33; anal-fin rays 22 to 29..... 5
- 5 Caudal peduncle spine surrounded by a bright orange-yellow spot..... *Acanthurus monroviae*
- Caudal peduncle spine not surrounded by a bright orange-yellow spot 6
- 6 A black spot at base of last few rays of both dorsal and anal fins*Acanthurus nigrofuscus*
- No black spot at base of last few rays of dorsal and anal fins..... 7
- 7 Two longitudinal bands on the side, one from the hind margin of the eye posteriorly, another from the groove around the caudal peduncle spine anteriorly*Acanthurus gahhm*
- No longitudinal bands on the sides..... 8

- 8 Upper three-fourths of body with narrow black-edged blue stripes alternating with yellow, the lower fourth pale lavender; peduncular spine very long, 1.9 to 2 times in head length, without a definite sheath; total gill rakers on first gill arch 14 to 17..... *Acanthurus lineatus*
- Colour not as above; peduncular spine not very long, 2.1 to 8 times in head length, with a definite sheath; total gill rakers on first gill arch 16 to 29..... 9
- 9 Mouth small, its width 4.5 to 6 times in head length; maximum number of upper and lower teeth 12; a white line under chin; body depth 1.7 to 1.9 times in standard length; dorsal-fin rays 28 to 33; anal-fin rays 26 to 29..... *Acanthurus nigricans*
- Mouth not small, its width 3.2 to 4.8 times in head length; number of upper or lower teeth 14 or more (in specimens greater than 5 cm standard length); no white line under chin; body depth 1.9 to 2.5 times in standard length; dorsal-fin rays 23 to 28; anal-fin rays 22 to 26..... 10
- 10 A prominent dark mark on shoulder or behind eye *Acanthurus nigricauda*
- No prominent dark mark on shoulder or behind eye 11
- 11 Caudal fin blue with numerous small blackish spots; sheath of peduncular spine white, in contrast to black edge of spine socket; a distinct yellow band crossing or nearly crossing anterior interorbital space; dorsal and anal fins orange-yellow without dark bluish stripes and blue streaks along posterior rays.....*Acanthurus dussumieri*
- Caudal fin without blackish spots; sheath of peduncular spine brown; no distinct yellow band crossing or nearly crossing anterior interorbital space; dorsal and anal fins with alternating stripes of grey-blue and dull orange-yellow.....*Acanthurus xanthopterus*
- 12 A prominent median protuberance or horn on forehead or snout..... 13
- No median protuberance or horn on forehead or snout 15
- 13 A prominent hump on back below anterior soft portion of the dorsal fin; profile of back beneath spinous portion of dorsal fin distinctly concave; males with a long tapering horn that may extend well before mouth; a few pale blue spots usually present behind eye..... *Naso brachycentron*
- No hump on back; profile of back beneath spinous portion of dorsal fin slightly convex; horn extending anterior to eye; no pale blue spots present behind eye..... 14
- 14 Angle of snout to base of horn about 60°; no dark marking on head or body; caudal and pectoral fins with a white posterior margin; lips broadly white-edged *N. annulatus*
- Profile of snout to base of horn nearly vertical; a series of vertical dark gray lines on body; caudal and pectoral fins pale gray without white margin; lip not white edged *N. brevirostris*

- 15 Dorsal spines V. numerous small black spots or irregular lines on about upper 1/2 of body *Naso reticulatus*
- Dorsal spine VI-II 16
- 16 No protuberance or horn developing anteriorly on head of adults; teeth very small, about 85 to 100 in jaws of adults; side of body grey-brown without a spot; no broad blue band extending from eye to front of rostral protuberance *Naso hexacanthus*
- A distinct protuberance or horn developing anteriorly on head of adults; teeth not very small, 60 or fewer in jaws; side of body with vertical blue lines which break up into small blue spots dorsally and ventrally; a broad blue band extending from eye to front of rostral protuberance *Naso vlamingii*

DISCUSSION

The study reveals the presence of 19 species recorded from Pakistan including 4 reported for the first time from the Pakistani coast. Presence of *Acanthurus dussumieri*, *A. melanurus*, *A. nigricans*, *A. triostegus*, and *Ctenochaetus strigosus* previously recorded from Pakistan by other authors could not be verified as no specimen is available in any local museums or repositories. A comparison of the number of species occurring in the Arabian Sea based on Fishbase (Froese and Pauly, 2015) is presented in Table I. A total of 37 species belonging to the family Acanthuridae are recorded from Arabian Sea. The data reveals that 26 species are reported from India (which also includes species occurring on its eastern coast) whereas 22 species are recorded from Yemen. From Oman, 14 species are recorded, but from Iran only one species is listed by Froese and Pauly (2015). Based on the present studies, it seems that despite limited coral reef habitats in Pakistan, the acanthurid fauna is well diversified and comparable to other areas of the Arabian Sea, which are known to have more abundant coral reefs which are preferred habitat for members of the family Acanthuridae.

The occurrence of *Acanthurus monroviae* in the northern Arabian Sea along the Pakistani coast is also a startling revelation, as it is a record of this species outside Atlantic Ocean or Mediterranean Sea. This species was previously reported from Israel in the Mediterranean and in the Atlantic Ocean down to Angola. There are three possibilities that can be attributed to such a disparate distribution.

- With the record from Pakistan, it can be presumed that this species exists in both Atlantic and Indian Ocean (Arabian Sea) but overlooked or has not yet been collected from other areas of Indian Ocean.
- The species may have had historically continuous populations in the Atlantic and Indian oceans but at some point in time these were subsequently separated by the formation of unsuitable habitats inside their distributional range. While discussing discontinuous trans-Atlantic distribution of *A. monroviae*, Luiz-Júnior *et al.* (2004) attributed a similar explanation for its isolated population along the eastern and western Atlantic. They further opined that migrants from one population founded the other via long distance dispersal, which is also a possibility in the case of *A. monroviae*.
- The possibility of anti-Lessepsian migration from the eastern Mediterranean to the North Arabian Sea thorough the Red Sea cannot be overruled. A few marine species are known to have similar migration (Boudouresque, 1999). Genetic investigation of specimens from the northern Arabian Sea, Atlantic, and Mediterranean is required to test whether morphologically similar species from these distantly located areas are also genetically similar.

The patchy distribution of *Naso reticulatus* from Taiwan, Indonesia, the east coast of India, and from Pakistan indicates that this species has a wide distribution and the possibility of the occurrence of this species in other Indo-Pacific areas cannot be excluded. The remaining three new records from Pakistan i.e. *A. nigricauda*, *A. xanthopterus*, *Naso annulatus*, *N. brevirostris*, *N. brachycentron*, *N. hexacanthus* and *N. vlamingii* are known to be widely distributed from the east African coastline to other parts of the Indo-Pacific area; therefore, these records from Pakistan are not unexpected. The presence of a diverse acanthurid fauna from Pakistan, which do not have coral reefs (*sensu stricta*), is astounding. There are, however, some patches of coral assemblages along the coast of Pakistan which may possibly support small populations of species of the family Acanthuridae.

Table 1. List of species found in the countries bordering the Arabian Sea.

Species	Oman	Yemen	India	Iran	Pakistan
<i>Acanthurus blochii</i>		x		x	
<i>Acanthurus dussumieri</i>	x	x			x
<i>Acanthurus gahhm</i>		x	x		x
<i>Acanthurus leucosternon</i>	x	x	x		
<i>Acanthurus lineatus</i>		x	x		
<i>Acanthurus mata</i>	x	x	x		x
<i>Acanthurus melanurus</i>			x		x
<i>Acanthurus monroviae</i>					x
<i>Acanthurus nigricans</i>			x		x
<i>Acanthurus nigricauda</i>					x
<i>Acanthurus nigrofuscus</i>		x	x		x
<i>Acanthurus nigroris</i>			x		
<i>Acanthurus pyroferus</i>			x		
<i>Acanthurus sohal</i>	x	x			x
<i>Acanthurus tennentii</i>	x	x	x		
<i>Acanthurus thompsoni</i>			x		
<i>Acanthurus triostegus</i>		x	x		x
<i>Acanthurus xanthopterus</i>			x		x
<i>Ctenochaetus striatus</i>	x	x	x		
<i>Ctenochaetus strigosus</i>		x	x		x
<i>Ctenochaetus truncatus</i>	x		x		
<i>Naso annulatus</i>	x				x
<i>Naso brachycentron</i>		x	x		x
<i>Naso brevirostris</i>	x	x	x		x
<i>Naso elegans</i>	x				x
<i>Naso fageni</i>	x	x			
<i>Naso hexacanthus</i>		x			x
<i>Naso lituratus</i>		x	x		
<i>Naso reticulatus</i>					x
<i>Naso tonganus</i>			x		
<i>Naso tuberosus</i>		x	x		
<i>Naso unicornis</i>	x	x	x		
<i>Naso vlamingii</i>			x		x
<i>Paracanthurus hepatus</i>			x		
<i>Zebrasoma desjardini</i>	x	x			
<i>Zebrasoma flavescens</i>			x		
<i>Zebrasoma velifer</i>		x	x		
<i>Zebrasoma xanthurum</i>	x	x	x		
Total number of species	14	22	26	1	19

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