Description of trigger fishes (family: Balistidae) and file fishes (family: Monacanthidae) from Visakhapatnam coast of India with an account on first record of *Paramonacanthus pusillus* (Ruppell, 1828) from India

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ABSTRACT

The present paper provides a record of species of fishes of the two families Balistidae (Trigger fishes) and Monacanthidae (file fishes) under Tetradontiformes. Trigger fishes are generally edible, except for some large specimens that are toxic as there were occasions where eating the flesh of these fishes had led to most virulent poisoning. In spite of abundance of file fishes in Indian waters, these species have been inadequately described. Balistidae was represented by seven species belonging to five genera: *Abalistes, Balistes, Balistoides, Canthidermis, Odonus* and *Sufflamen* and Monacanthidae by six species belonging to three genera *Aluterus, Lalmohania* and *Paramonacanthus*, in the catches of Visakhapatnam coastal waters. Of these *Paramonacanthus pusillus* (Ruppell, 1828) forms the first record from Indian waters, while *Canthidermis maculata* (Bloch, 1786), *Paramonacanthus japonicus* (Tilesius, 1865) and *Paramonacanthus choirocephalus* (Bleeker, 1852) were recorded for the first time from Visakhapatnam, north of Chennai.

Keywords: Balistidae, Monacanthidae, *Paramonacanthus pusillus*, Species composition, Visakhapatnam

Introduction

A detailed review on taxonomy and systematics of Tetradontiformes, focusing primarily on contributions since 1980 was carried out by Matsuura (2015). Fishes of the family Balistidae are popularly called as trigger fishes, cosmopolitan in the tropical seas and constitute an important component of the coral reef community and are held in high esteem by marine aquarists throughout the world primarily because of their striking colour pattern. Commercial fisheries exist for certain species of trigger fishes, except for some large specimens which are occasionally toxic. On the East African coast, most trigger fishes are skinned as soon as they are caught and the flesh is then used as bait (Sahayak, 2005). Monacanthids commonly referred to as ‘file fishes’ and ‘leather jackets’ are harvested in large quantities throughout the world (Miller and Stewart, 2009). They are solitary and gather in small groups but some form monogamous pairs that patrol a home range as territory and some swim openly in the water column. However, the colour pattern of some file fishes and leather jackets may be put to a surprising advantage for e.g., juveniles of *Aluterus scriptus* mimic floating leaves avoiding predation. Day (1878) described 13 species under the genus *Balistes* and four species under one genus *Monacanthus* from Indian sub-continent. Munro (1955), Jones and Kumaran (1980), Rao (2003), Rao et al. (2000), Mishra and Krishnan (2003), Barman and Mukherjee (2004), Krishnan et al. (2007), Venkataramani and Jayakumar (2010) reported and described trigger and file fishes found around India. Sahayak et al. (2013, 2014a) carried out taxonomic studies on species of family Balistidae using morphological characters like shape of teeth, nasal apertures, gill rakers and scales as identification characters. Sahayak et al. (2014b) reported and described *Canthidermis maculata* from west coast of India and Mandapam.

The first reference to the Balistids represented at Visakhaapatam by Russell (1803) who recorded two species of Samudrum yellakah (=*Abalistes stellatus*) and Rahtee yellakah (=*Sufflamen fraenatus*). Sujatha (2003) described three species namely *Balistes elliott*, *Sufflamen chrysopterus*, *S. fraenatum* which are valued as aquarium fishes from Visakhapatnam. With regard to Monacanthids, although Hutchins (1994a, b; 1997; 2001; 2001a; 2002) provided taxonomic, morphological and phylogenetic data for all monacanthid species in the world, there are no comprehensive account of fishes of this family in Indian waters.

Though trigger fishes and filefishes are represented in the Indian waters, these species have been inadequately described. Manish Kumar et al. (2010) reported occurrence of *Paramonacanthus japonicus* from Vellar Estuary. These fishes are relatively more common in trawl bycatches and
by traditional gear operating along the inner half of the continental shelf off Visakhapatnam (17°10’-18°10’ N latitude and 82°50’ - 84°10’E longitude). There are only limited studies on these fish species, however, the prospects to commercial exploitation is slowly being recognised, especially in Indian waters. The present study describes the species of fishes of the families Balistidae and Monacanthidae from Visakhapatnam coast of India with an account on the first record of *Paramonacanthus pusillus* (Ruppell, 1828) from Indian waters.

**Materials and methods**

The present study is based on random samples collected mainly from trawl bycatches at Visakhapatnam Fisheries Harbour during the period of January 2009 to December 2012. Samples were also collected from traditional fish landing centres from the catches of hook and line, shore seine as well as trammel net. Meristic counts and measurements of specimens of families Balistidae and Monacanthidae follows Matsura (1980, 2015), Hutchins, 1994a and Sahayak *et al.* (2013). For monacanthid species, morphometric data were taken following Berry and Vogele (1961).

**Results and discussion**

List of fishes along with common names, number of specimens of each species collected, length range in mm TL, maximum recorded size in literature for species of the families Balistidae and Monacanthidae represented in the catches is given in Table 1. A comparison of meristic characters of species belonging to the five genera *Abalistes*, *Balistes*, *Balistoides*, *Canthidermis*, *Odonus* and *Sufflamen* of the family Balistidae and three genera *Aluterus*, *Lalmohania* and *Paramonacanthus* of the family Monacanthidae is given in Table 2.

| Species | Common name | n’ | Sex | Length range (mm TL) | Max length in Fishbase 2016 (cm TL) |
|---------|-------------|----|-----|----------------------|-------------------------------------|
| **Balistidae** | | | | | |
| *Abalistes* Swainson, 1839 | | | | | |
| *A. stellatus* (Anonymous, 1798) | Starry triggerfish | 20 | 14 | 2 | 2 | 110-450 | 60 |
| *Balistes* Linnaeus, 1758 | Queen triggerfish | 3 | 3 | | | 50-77 | 60 |
| *Balistoides* Fraser-Brunner, 1935 | Titan triggerfish | 3 | | | | 220-420 | 75 |
| *Canthidermis* Swainson, 1839 | Rough triggerfish | 24 | 14 | 9 | - | 210-375 | 50 |
| *Odonus* Gistel, 1848 | Red toothed triggerfish | 2 | 2 | | | 180, 184 | 50 |
| *Sufflamen* Jordan, 1916 | Halfmoon triggerfish | 2 | 2 | | | 190 | 30 |
| *S. fraenatum* (Latereille, 1804) | Masked triggerfish | 29 | 23 | 2 | 4 | 139-332 | 38 |
| **Monacanthidae** | | | | | |
| *Aluterus* Cloquet, 1816 | Unicorn leatherjacket filefish | 25 | 13 | 11 | 2 | - | 105-565 | 76.2 |
| *A. scriptus* (Osbeck, 1765) | Scribbled leatherjacket | 1 | 1 | - | - | - | 590 | 110 |
| *Lalmohania* Hutchins, 1994 | Matted leatherjacket, bristle tail filefish | 12 | 11 | 1 | - | - | 130-164 | 7.2 SL |
| *Paramonacanthus* Bleeker, 1866 | Pig faced leatherjacket | 8 | 8 | - | - | - | 93-115 | 11 |
| *P. japonicus* (Tilesius, 1809) | Hairfinned leatherjacket | 4 | - | - | - | 88-102 | 12 SL |
| *P. pusillus* (Ruppell, 1829) | Sinhalese leatherjacket | 3 | 3 | - | - | - | 120-125 | 14.6 SL |
Paramonacanthus of the family Monacanthidae are presented in Tables 2 and 3 respectively. During the present study Paramonacanthus pusillus (Ruppell, 1828) was recorded for the first time from Indian waters, Canthidermis maculata (Bloch, 1786), Paramonacanthus japonicus (Tilesius, 1809) and Paramonacanthus choirocephalus (Bleeker, 1851) are recorded for the first time from Visakhapatnam, north of Chennai. Coloured photographs of 13 species recorded in the present study are given in Fig. 1 - 13. Photographs of swimbladder for Balistoides viridescens and Sufflamen fraenatum and photographs of liver given for Abalistes stellatus (Anon., 1798) and Sufflamen fraenatum (Latreille, 1804) along with the figures of respective species. Genus and species diagnostic characters are given for all thirteen species along with detailed description of the species P. pusillus that is the first record from Indian waters.

Family Balistidae

Genus: Abalistes Swainson, 1839

Leiurus Swainson, 1839, Nat. Hist. Monocard. Anim., 2: p. 326.

Abalistes Jordan et Seale, 1906, Ball. Bur. Fish., 25, p. 364 (type-species, Balistes stellaris Bloch et Schneider, 1801 = Balistes stellatus [LACEPEDE], 1798).

Diagnosis: A deep groove before eye and below nostrils.

Teeth white, uneven, each one not notched. Enlarged osseous scales above pectoral fin and just behind gill opening forming flexible tympanum. Scales covered with regular longitudinal rows of pointed tubercles which are more crowded on head than on body and tail. Caudal peduncle depressed, broader than depth; caudal fin double emarginate, in large specimens upper and lower marginal lobes produced into filaments. Anal 24-25.

One species was represented in the catches off Visakhapatnam

Abalistes stellaris (Bloch & Schneider, 1801)

Balistes stellaris Bloch and Schneider, 1801. Syst. Ichth., p. 476. (Type locality: Mauritius)

Common name: Starry triggerfish

Diagnosis: See generic characters

Colour: Entire body dark bluish brown. Dark brownish black band from snout to before gill opening. First dorsal, soft dorsal, anal and pectoral fins bluish brown. Caudal bluish brown, outer middle portion of the caudal fin dusky.

Distribution: This species is previously recorded from Visakhapatnam (Russell, 1803), Madras (=Chennai), Gulf of Mannar, Laccadive Archipelago and Andaman and Nicobar Islands.

Table 2. Comparison of meristic characters of seven species of family Balistidae

| Meristic characters | Abalistes stellatus | Balistes vetula | Balistoides viridescens | Canthidermis maculata | Odonus niger | Sufflamen fraenatum | Sufflamen chrysopterum |
|---------------------|---------------------|----------------|-------------------------|-----------------------|--------------|----------------------|-----------------------|
| First dorsal        | II                  | III            | III                     | III                   | III          | III                  | III                   |
| Second dorsal       | 26-27               | 30-32          | 26                      | 24-25                 | 34           | 30                   | 26                    |
| Anal                | 24-25               | 29-31          | 24                      | 22                    | 30           | 27                   | 24                    |
| Pectoral            | 14-15               | 18             | 14                      | 14                    | 14           | 14-15                | 13                    |
| Caudal              | 12                  | 12             | 10                      | 10                    | 10           | 11-13                | 10                    |
| Gill rakers         | 31-38               | 18             | 31-33                   | 25                    | 33           | 24-28                | 16                    |
| Lateral transverse scale | 23-26             | 20             | 28-32                   | 22                    | 30-33        | 24                   | 24                    |
| Lateral line pored scale | 42-46             | 62             | 28-31                   | 42-46                 | 38           | 50-54                | 47                    |

Table 3. Comparison of meristic characters of six species of the family Monacanthidae

| Genus Species | A. monoceros | A. scriptus | L. velutina | P. choirocephalus | P. japonicus | P. pusillus |
|---------------|--------------|-------------|-------------|-------------------|--------------|-------------|
| Second dorsal | 46-48        | 45          | 25-26       | 25-28             | 27-29        | 26          |
| Anal          | 48-50        | 47          | 25          | 26-29             | 27-29        | 26          |
| Pectoral      | 14           | 14          | 10-11       | 11-12             | 12           | 12          |
| Caudal        | 10-12        | 12          | 12          | 12                 | 12           | 12          |
| Gill rakers   | 31           | 34          | 18          | 21-22             | *            | 21          |

*Not recorded
Fig. 1. *Abalistes stellatus* juveniles - a) 380 mm TL; b) Liver

Fig. 2. *Balistes vetula* - 77 mm TL

Fig. 3. *Odonus niger* - 180 mm TL

Fig. 4. *Balistes viridiscens* - a) 315 mm TL juveniles, b) swimbladder

Fig. 5. *Canthidermis maculata* - 320 mm TL female

Fig. 6. *Sufflamen chrysopterum* - 125 mm TL

Fig. 7. *Sufflamen fraenatum* a) 172 mm TL female, b) 260 mm TL male, c) swimbladder, d) Liver
Fig. 8. Lalmohania velutina (a) 120 mm TL juvenile, (b) Spine structure, (c) First dorsal spine anterior view, (d) 93 mm TL juvenile

Fig. 9. Aluterus monoceros 490 mm TL female

Fig. 10. Aluterus scriptus 590 mm TL juvenile

Fig. 11. Paramonacanthus choirocephalus (a) 125 mm TL juvenile, (b) First dorsal spine anterior view

Fig. 12. Paramonacanthus japonicus (a) 102 mm TL juvenile, (b) First dorsal spine anterior view

Fig. 13. Paramonacanthus pusillus (a) 120 mm TL juvenile, (b) First dorsal spine anterior view
Genus Balistes Linnaeus, 1758

Balistes Linnaeus, 1758, *Systema Naturae*, vol. I, p. 327 (type species, *Balistes vetula* (Monotypic) Linnaeus, 1758).

**Diagnosis:** A deep groove before eye and below nostrils. Teeth white. Caudal peduncle not depressed. Scales on posterior part of body without keels. Scales covered with small spines or tubercles forming 10-12 longitudinal ridges. Dorsal and anal more or less elevated anteriorly, angulate posteriorly. Anterior rays of dorsal and outer rays of caudal filamentous in large specimens, swim bladder rounded, anal rays 29-31.

One species was represented in the catches off Visakhapatam.

**Balistes vetula** Linnaeus 1758

*Balistes vetula* Linnaeus, 1758. *Systema Naturae*, 10, vol. I, p. 327 (Type locality: Ascension Island)

**Common name:** Queen trigger fish

**Diagnosis:** See generic characters.

**Colour:** Preserved specimen brownish dorsally. First spine brown, membrane between first and second spine black, second dorsal, anal and pectoral hyaline. Caudal dull yellow. Dorsal brown with elongate brown spots, sides yellow with brown oval spots, under side from snout to pelvic rudiment yellow without spots. Yellowish brown with brown oval spotted horizontal lines dorsally and on sides. Yellow with brown spots ventrally in 50 mm TL specimen. Brown spots from snout to caudal fin in 77 mm TL preserved specimen. These spots appear from post-orbital region to caudal fin base.

**Distribution:** Previous distributional records are from Andaman waters and Gulf of Mannar.

Genus Balistoides Fraser-Brunner, 1935

Balistoides Fraser-Brunner, 1935, *Ann. Mag. Nat. Hist.*, (10), 15, p. 662 (type-species *Balistes viridescens* Bloch and Schneider, 1801).

**Diagnosis:** Upper and lower profiles of head not prominently convex. Mouth terminal; teeth white, uneven, each one notched. A naked longitudinal fold behind corner of mouth. Enlarged osseous scales behind gill opening forming tympanum. A deep groove before eye, below nostrils. Cheek entirely covered with scales except for a fold at the corner of mouth. Scales, at least of tail with large tubercles or spines, several longitudinal rows on posterior part of tail and caudal peduncle, but not extending forward beyond posterior portion of second dorsal fin. Caudal fin rounded. Swim bladder round and single lobed. Anal 24.

One species was represented in the catches off Visakhapatam.

**Balistoides viridescens** (Bloch & Schneider, 1801)

*Balistoides viridescens* Bloch & Schneider, 1801. *Syst. Ichth.*, p. 477. (Type locality: Mauritius)

**Common name:** Dotty triggerfish, Titan trigger fish

**Diagnosis:** See generic characters

**Colour:** Body brownish olive. A broad dark brown band with black spots connecting eyes over inter-orbital space, continued below eye over gill opening to base of pectoral fin. Upper lip and corner of mouth dark brown. Membrane of first dorsal brown with blackish brown spots and stripes. Second dorsal and anal light reddish brown with black margins. Pectoral hyaline, its base brown. Caudal reddish brown, its base and distal part with brownish black, ventral flap brown, outer part of the caudal with brown vermiculations. Upper lip black, lower lip yellow. A black band from snout to below middle of eye. Black spots around eye. Second dorsal, anal and pectoral bases black zone with black spots. Scales of body and tail each with a darker brown spot in the centre. Gill opening white.

**Distribution:** Earlier Indian records are from Gulf of Mannar, Laccadive Archipelago as well as from Andaman and Nicobar Islands.

Genus Canthidermis Swainson (1839)

Canthidermis Swainson, 1839, *Nat. Hist. Monocard. Anim.*, 2, p. 325 (type-species, *Balistes angulosus* Quoy et Gaimard, 1824- *Balistes maculates* Bloch, 1786).

**Diagnosis:** Mouth terminal, teeth white, uneven, each one notched; Cheeks evenly scaly, without naked grooves; scales above pectoral fin base and just behind gill opening not enlarged, not forming a flexible tympanum. Deep groove before eye, below nostrils. Caudal peduncle deeper than its length Caudal fin double emarginated. Third dorsal spine developed extending above dorsal edge of the body. Swim bladder cylindrical. Anal rays 22.

One species was represented in the catches off Visakhapatam.

**Canthidermis maculata** (Bloch, 1786)

*Balistes maculates* Bloch, in Bloch and Schneider 1786. *Nat. Ausland. Fisch.*, 2: 25, pl. 151 (Type locality: American waters).

**Common name:** Rough triggerfish, the spotted oceanic triggerfish

**Diagnosis:** see generic characters

**Colour:** Bluish black dorsally, ventrally dusky, body uniformly covered with pale coloured white spots from snout to caudal fin base, more especially in the lower half
of the body in 200-217 mm TL specimen. These spots are less numerous and larger in adult (>250), second dorsal and anal fins with bluish spots in 200 mm TL specimen, in adult specimens no spots on second dorsal and anal fins. Dorsal, pectoral and caudal fins bluish, anal bluish with grey base. Liver reddish brown.

**Distribution**: Earlier Indian records of this species are from Madras (=Chennai), Gulf of Mannar, Laccadive Archipelago, Cochin backwaters, Andaman and Nicobar Islands and Bay of Bengal.

**Genus Odonus** (Gistel, 1848)

Gistel, J. 1848. Naturgeschichte des Thierreichs, für höhere Schulen. Stuttgart, i-xvi+1-216, pls 1-32 (Type species: *Xenodon (Balistes) niger* Ruppell, 1836)

**Diagnosis**: Grooves present before eyes. Body scales and caudal peduncle scales have round protuberances and ridges. Scales on cheek rhomboid with protuberances and ridges. Caudal peduncle longer than deep. Ventral flap present. Caudal lunate with lobes produced. Anal 30.

One species was represented in the catches off Visakhapatnam.

**Odonus niger** (Ruppell, 1836)

Ruppell, W. P. E. S. Neue Wirbelthiere zu der Fauna von Abyssinien gehörend. Fische des Rothen Meeres. Siegmund Schmerber, Frankfurt am Main: 29-52 (Type Locality: Jeddah, Saudi Arabia, Red Sea).

**Common name**: Red-toothed triggerfish

**Diagnosis**: See generic characters

**Colour**: Entire body dark bluish brown. Dark brownish black band from snout to before gill opening. First dorsal, soft dorsal, anal and pectoral fins bluish brown. Caudal bluish brown, outer middle portion of the caudal fin dusky.

**Distribution**: In Indian waters this species is previously recorded from Gulf of Mannar and Visakhapatnam.

**Genus Sufflamen** Jordan, 1916

Sufflamen Jordan, 1916, Copeia, 1918 (29), p. 27 (type species, *Balistes capistratus* Shaw, 1804 = *Balistes fraenatus* Latreille, 1804).

**Diagnosis**: Upper and lower profiles of head concave, straight or slightly convex. Mouth terminal. Teeth white, uneven, notched. Inter orbital space flat. Cheek entirely covered with scales. Enlarged scales above the pectoral fin base and just behind gill opening to form a flexible tympanum. A groove before eye and below nostrils. Enlarged scales covered with regular rows of short conical spines forming longitudinal ridges on posterior part of body, extend to at least middle of body. Caudal fin truncate or slightly emarginated. Swim bladder cylindrical.

Two species were represented in the catches off Visakhapatnam.

**Sufflamen chrysopterum** (Bloch & Schneider, 1801)

**Balistes chrysoptera**: Bloch & Schneider, 1801. Syst. Ichth. p. 466 (Type locality: East Indies and Coramandal)

**Common name**: Half moon-triggerfish

**Diagnosis**: In addition to above generic characters a row small scales behind tympanum; caudal fin double emarginated.

**Colour**: Entire body brown, lips pale, two pale cross bands on chin. First dorsal brown, second dorsal and anal yellowish. Pectoral pale brown. Caudal fin dark with a broad white posterior marginal band.

**Distribution**: In Indian waters this species is previously recorded from Malay Archipelago, Gulf of Mannar, Laccadive Archipelago and Andaman and Nicobar Islands.

**Sufflamen fraenatum** (Latreille, 1804)

**Balistes fraenatus** Latreille, 1804. d'histoire Naturelle, 1re, vol. 24, Tab. Method. Poiss., p. 74.

**Common name**: Masked trigger fish

**Diagnosis**: In addition to above generic characters, no scale row behind tympanum; caudal fin truncate

**Colour**: Body brownish, from underside between snout to pelvic yellow; upper lip brownish black, lower lip yellow with white outer line; yellow spots at corner of mouth. First dorsal spines brownish, basal membrane grey, tip black. Second dorsal and anal fins hyaline with black base, distal region with yellowish tint. Pectoral hyaline. Caudal brownish black. Upper lips reddish pink with yellowish outer line and corner of mouth, lower lip yellow with white outer line. In males, a yellow band passes from corner of mouth towards the base of the pectoral fin. This species shows sexual dichromatism.

**Distribution**: This species is previously recorded from Visakhapatnam, Madras, Gulf of Mannar, Pondichery and Andaman and Nicobar Islands

**Family Monacanthidae**

**Genus: Aluterus** Cloquet, 1816

Aluterus Cloquet, 1816, Dist. Sci. Nat. (Lavraul), 2, 1, Suupl. p. 1135. (ex Cuvier. M. S) Type species *A. monoceros* Linnaeus, 1758).

**Diagnosis**: Body elongate; first dorsal spine slender and feeble (often broken in capture), situated above middle of eye; mouth small and terminal; pelvic rudiment inconspicuous; dorsal 45-46, anal 46-48 and pectoral 14 rays; caudal fin
truncate. Lateral line inconspicuous. Head and body covered with shagree like scales forming a patch in front of eye. Swim bladder cylindrical.

Two species were represented in the catches off Visakhapatnam.

*Aluterus monoceros* (Linnaeus, 1758)
*Balistes monoceros* Linnaeus, 1758. *Syst. Nat.* 10.1, p. 327 (Type locality: China).

**Common name:** Unicorn leatherjacket filefish

**Diagnosis:** Body elongate, deep and compressed. Profile of snout slightly convex. Caudal peduncle longer than its depth; caudal fin short.

**Colour:** Grey dorsally and on sides. Grayish white ventrally. Dorsal and anal fins dull yellow to brownish. Caudal fin grey, the membrane blackish brown.

**Distribution:** In Indian waters this species is previously recorded from Madras (=Chennai), Gulf of Mannar, Cochin backwaters, Andaman and Nicobar Islands and Andhra Pradesh.

*Aluterus scriptus* (Osbeck, 1765)
*Balistes scriptus* Osbeck, 1765, *Iter* (Typelocality: China)

**Common name:** Scribbled leather jacket, scrawled filefish

**Diagnosis:** Profile of snout concave; caudal peduncle as deep as long; caudal fin elongate.

**Colour:** Greenish brown with irregular dark violet and bluish spots and streaks on head and body from snout to caudal fin base. Lower part of head and breast with six bluish violet lines. First dorsal spine brown. Second dorsal and anal fins yellow. Pectoral fin yellowish brown and caudal fin bluish brown. Upper and lower lips dark brown.

**Distribution:** These species are circumtropical in distribution (Izzo et al., 2008). Previous distributional records of these species in Indian waters are from Madras (=Chennai), Gulf of Mannar, Laccadive Archipelago, Andaman and Nicobar Islands and Cochin.

**Genus Lalmohania** Hutchins, 1994

Hutchins, J. B., 1994b. Description of a new genus and species of monacanthid fish from India. *Rec. West. Aust. Mus.*, 16(4): 567-574. (Type: *Lalmohania velutina*)

**Common name:** Dotted leatherjacket

**Diagnosis:** In addition to the generic characters, first dorsal spine behind middle of eye, slightly curved, its anterior side covered with bony tubercles which grow into small upward directed dorsal spines near the tip of the spine and two rows of (7-9) larger barbs along posterior edge. Second dorsal and anal fin rays are sub equal. Origin of anal below that of second dorsal. Pectoral fan like, upper rays are slightly larger than the lower rays. Pelvic flap small, tip of pelvic bone exposed and armed with a movable barbed spine, pelvic flap covered by rows of abnormal, elongate scales. Caudal fin diamond shaped.

**Colour:** Head and body brown with black spots from snout to base of caudal fin. A lighter curved band from behind gill opening to vertical between origins of second dorsal and anal, often present. Cloudy dark patches scattered on head, a dark brown band from eye to eye or at inter-orbital space, four transverse bands on underside between snout and end of pelvic. First dorsal spine brown, posteriorly the membrane black, second dorsal, anal and pectoral yellow. Caudal fin yellow with two black vertical bands, with small black spots.

**Distribution:** In Indian waters this species is previously recorded from Gulf of Mannar and Visakhapatnam.

**Genus Paramonacanthus** Bleeker, 1866

*Paramonacanthus* Bleeker, 1866, *Systema Balistidorum, Ostracionidorum, Gymnodontidorumque revisum*. *Ned. Tijdschr. Dierkd.* Amsterdam, 3: 8-19.

**Diagnosis:** Body deep, elongate and compressed. Mouth terminal. Lips thin. Six stong compressed and pointed teeth on both jaws, the central pair in each jaw longest and the lateral ones scale like and four teeth in inner series of upper jaw. Inter orbital space convex. Nostrils with two openings pierced by papillae. First dorsal spine originates behind middle of eye with small tubercles anteriorly and two rows of barbs posteriorly. Pelvic rudiment movable with strong bifid spines at its end. Head and body covered with small scales, scales large around eye and base of pectoral fin large. Caudal fin diamond shaped. Posterior margin of ventral flap usually concave.
Three species were represented in the catches off Visakhapatnam. Comparison of morphometric data for three species given in Table 4.

*Paramonacanthus choirocephalus* (Bleeker, 1851)

*Monacanthus choirocephalus* Bleeker, 1851, *Verh. Bat. Gen. xxiv Bijdr. Kennis Balistini*, p. II, p.19 (Type locality: Jakarta, Indonesia)

Common name: Pig faced leatherjacket

**Diagnosis:** First dorsal spine originating behind middle of eye with flap, anteriorly with 12 rows of barbs and posteriorly with two rows of 16 small tubercles or barbs of which eight barbs from base to middle bifurcated directed downward and upward. Caudal fin diamond shaped.

**Colour:** Head and body brownish grey. Second dorsal and anal yellow with two brown bars at its bases. Pectoral hyaline. Body with two indistinct dark bands. Two dark brownish black blotches below soft dorsal fin and indistinct band from behind first dorsal fin to caudal peduncle. Caudal fin yellow with two vertical bars. Male (115 mm TL) broad brownish grey with dark brown irregular bands and spots from snout to gill opening on upper half, lower half brownish grey without spots.

This species shows sexual dichromatism and sexual dimorphism. In male, inter-orbital space convex and in female

| Table 4. Comparison of morphometric data of three species of genus *Paramonacanthus* represented in the catches of Visakhapatnam |
|--------------------------|--------------------------|--------------------------|
| **Standard length, SL (mm)** | **P. choirocephalus, n=8** | **P. japonicus, n=4** | **P. pussillis, n=3** |
| **Min-Max** | **Mean±SD** | **Min-Max** | **Mean±SD** | **Min-Max** | **Mean±SD** |
| **75-87** | **68-78** | **96-100** |
| **As percentage of standard length:** |
| Total length | 121.51-132.18 | 126.52±7.40 | 128.38-130.77 | 129.53±5.90 | 125.00-125.00 | 125.00±2.88 |
| Body depth | 41.66-49.41 | 45.52±4.05 | 39.44-44.59 | 41.51±3.20 | 33.33-36.00 | 35.11±2.30 |
| Head length | 33.33-40.22 | 37.17±3.13 | 33.82-41.03 | 37.65±4.20 | 81.58-85.29 | 82.82±2.30 |
| Pre-first dorsal distance | 35.44-39.74 | 38.01±2.25 | 33.82-41.89 | 37.99±4.42 | 38.54±4.20 | 40.85±2.88 |
| Pre-second dorsal distance | 61.02-69.04 | 67.58±4.49 | 61.97-70.27 | 66.18±5.56 | 54.00-60.42 | 56.14±2.30 |
| Distance between I & II dorsal | 24.35-28.23 | 26.12±1.64 | - | - | - | - |
| Pre-pectoral distance | 35.71-41.37 | 38.61±2.76 | 32.35-41.03 | 37.30±4.27 | 36.46-39.00 | 38.15±2.30 |
| Pre-pelvic distance | 52.38-64.70 | 58.45±5.70 | 52.94-61.54 | 56.19±7.27 | 48.96-52.00 | 50.99±2.88 |
| Pre-anal distance | 62.02-71.76 | 67.58±5.41 | 61.97-74.32 | 68.15±5.29 | 62.50-64.00 | 63.50±2.30 |
| First dorsal base | 3.84-7.14 | 5.86±1.03 | 3.85-4.41 | 4.13±0.50 | 4.00±4.17 | 4.06±0.50 |
| Second dorsal base | 30.37-36.47 | 33.68±2.49 | 29.49-36.62 | 32.75±1.50 | 30.21-34.00 | 32.74±2.88 |
| Pectoral base | 4.70-8.00 | 6.20±0.92 | 5.13-7.04 | 5.86±0.50 | 5.21-6.00 | 5.74±0.57 |
| Pelvic base | 3.44-5.33 | 3.88±0.35 | 3.85-4.41 | 4.13±0.50 | 3.13-4.00 | 3.71±0.57 |
| Anal base | 31.03-37.33 | 34.68±1.19 | 29.49-35.21 | 32.40±1.00 | 29.17-34.00 | 32.39±3.46 |
| First dorsal length | 15.18-26.29 | 22.86±4.80 | 22.97-24.36 | 23.67±1.41 | 17.71-20.00 | 19.24±1.73 |
| Second dorsal length | 13.33-19.04 | 16.97±1.90 | 16.18-21.31 | 17.87±1.82 | 22.92-23.00 | 22.97±0.57 |
| Pectoral length | 12.65-16.00 | 14.82±1.19 | 11.76-16.67 | 14.68±2.21 | 11.46-14.00 | 13.15±1.73 |
| Pelvic length | 5.74-8.33 | 6.83±0.75 | 6.41-7.35 | 6.89±0.50 | 7.00-7.00 | 7.00±0.57 |
| Anal length | 11.76-17.24 | 14.48±2.05 | 14.86-19.72 | 16.86±1.50 | 20.83-21.00 | 20.94±0.50 |
| Caudal peduncle length | 7.69-11.39 | 9.57±1.28 | 6.41-11.76 | 9.37±0.50 | 8.33-10.00 | 9.44±1.15 |
| Caudal peduncle depth | 10.25-16.66 | 13.72±1.80 | 11.54-17.11 | 13.46±1.25 | 13.54-15.00 | 14.51±1.15 |
| **As percentage of head length:** |
| Head depth | 96.55-114.28 | 107.10±3.57 | 103.13-113.04 | 106.88±3.30 | 81.58-85.29 | 82.82±1.15 |
| Head width | 36.36-48.00 | 40.50±0.83 | 34.78-43.33 | 39.69±2.44 | 39.47-44.12 | 41.02±1.15 |
| Preorbital | 71.42-80.00 | 75.10±2.55 | 68.75-76.00 | 71.91±2.87 | 79.41-81.58 | 80.86±2.30 |
| Postorbital | 17.27-22.85 | 19.01±1.03 | 16.00-18.75 | 17.20±0.95 | 20.59-23.68 | 22.65±1.15 |
| Snout length | 67.85-76.00 | 71.89±1.99 | 69.57-76.00 | 71.86±2.98 | 73.68-76.47 | 74.61±1.15 |
| Nostril length | - | - | 65.63-76.00 | 69.46±2.16 | 71.05-73.53 | 71.88±1.15 |
| Eye diameter | 25.00-36.00 | 29.35±0.46 | 24.00-33.33 | 29.75±2.06 | 26.32-29.41 | 27.35±0.50 |
| Interorbital width | 21.87-28.57 | 25.41±1.74 | 21.88-28.00 | 24.82±0.50 | 23.53-23.68 | 23.63±0.57 |
| Eye to ID | 15.62-21.42 | 19.03±0.88 | - | - | - | - |
| ID to Eye | - | - | 15.63-21.74 | 18.51±0.50 | 17.65-18.42 | 18.16±0.57 |
inter-orbital space concave. Male (115 mm TL) broad brownish grey with dark brown irregular bands and spots from snout to gill opening on upper half, lower half brownish grey without spots, skin smooth, and scales minute. In females, skin rough and scales small.

**Distribution:** In Indian waters, this species is previously recorded from Madras (=Chennai), Gulf of Mannar, Laccadive Archipelago, Pondicherry and from Andaman and Nicobar Islands. This is the first record from Visakhapatnam.

**Paramonacanthus japonicus** (Tilesius, 1809)

*Balistes japonicas* Tsielius, 1809. Description de quelques poissons observes pendant son voyage autour du monde. Memoires de la Societe imperial des naturalists de Moscou., 2:212-249. (Type locality: Japan).

**Common name:** Hairfinned leatherjacket, Japanese leatherjacket

**Diagnosis:** First dorsal spine originates over posterior part of eye. First dorsal fin spine fully erectile, not enveloped; anteriorly with nine rows of tubercles and posteriorly with two rows of barbs. Caudal fin diamond shaped with elongated second filament.

**Colour:** Head and body grey with black bars, dark blotch at anterior base of second dorsal fin. Second dorsal, anal and pectoral pale yellow. Caudal greyish black with two dark transverse bands. Caudal peduncle with two black blotches at dorsal and pectoral fins yellow. Anal fin yellow with black outer margin. Caudal greyish black with two black transverse bands.

**Description:** Body elongate and compressed. Profile of snout convex. Mouth terminal. Six strong, compressed and pointed teeth on both jaws, the central pair in each jaw longest, the lateral ones scale like and four teeth in inner series of upper jaw. Eyes small situated in between first dorsal spine and gill opening. Inter-orbital space concave. Lips thin. Nostrils with two openings pierced by papillae. Gill opening oblique, the upper end below hind border of eye, its lower end below middle of pupil. First dorsal spine originates over posterior part of eye, anterior side of this spine with two rows of blunt spinules those near tip some times bifid and posterior side with two rows of eight distant, strong retorse spines directed upward and downward. Second dorsal and anal fins anguills the outer surface concave, anterior rays much longer than the posterior rays. Pectoral fin like, upper rays slightly longer than the lower rays. Margin of ventral flap concave, ventral rudiment prominently beyond flap. Pelvic rudiment movable with strong bifid spines. Caudal fin diamond shaped. Caudal peduncle short and broad. Head and body covered with small scales, scales large around eye and base of pectoral fin.

**Colour:** Head and body grey. Three black bands on dorsal laterally. First band from front of second dorsal fin to posterior end of second dorsal fin, second band from first dorsal spine to posterior end of second dorsal fin and third band from pectoral fin to base of caudal fin. Caudal peduncle with black spot. Second dorsal and pectoral fins yellow. Anal fin yellow with black outer margin. Caudal greyish black with two black transverse bands.

**Distribution:** This species is reported from Indo-west Pacific, Red Sea to South Africa, northern Australia, north to southern Japan. There are no previous distributional records in Indian waters and this forms the first record of the species from Indian waters.

**A. stellatus** is represented in trawl catches, being rare in shore seine catches. B. vetula and B. viridescens are rare (Table 1) and represented in trawl catches. As stated by Myers (1991) the circumglobal species C. maculata is epipelagic and is often associated with drifting objects, in the present study also the specimens of this species recorded were captured by hook and line from February to April from epipelagic region of deep waters of Visakhapatnam. *S. chrysopterum* is found very rare at Visakhapatnam that were collected from trammel net catches. *S. fraenatum* is represented mainly in trawl catches, being rare in shore seine and trammel net catches.
According to Matsuura (2015) taxonomic challenges still remain in identifying two species of genus Sufflamen viz., H. verres (Gilbert and Starks, 1904) and S. fraenatum (Latreille, 1804). According to Berry and Baldwin (1966), S. verres has 30-33 dorsal rays and 27-30 anal rays while S. fraenatum has 28-30 dorsal rays and 24-26 anal rays. Matsuura (1980) reported S. fraenatum with dorsal rays in the range 27-30 and anal rays from 24 to 27 (n=22) from Japanese waters. Randall (2010) reported S. fraenatum with dorsal and anal rays in the range 27-31 and 24-28 respectively. Specimens of S. fraenatum observed in the present study also have dorsal rays 30; anal rays 27 and show agreement with Matsuura (1980) and Randall (2010). A. monoceros is represented in bycatches of trawlers operated at depth of 35-40 m and L. velutina in trawl and trammelnet bycatches.

Many checklists and illustrated guide books have provided useful information on the taxonomy, distribution and biology of trigger and file fishes from Indian waters. However these species should be revisited with detailed morphological examination as confusion still exists for identification of several related species (Matsuura, 2015). Of the 13 species recorded from Visakhapatnam, Paramonacanthus pusillus is the first record from Indian waters. Canthidermis maculata, Paramonacanthus japonicus and P. choirocephalus are first records from Visakhapatnam, towards north of Chennai along the east coast of India.

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