

MARINE RECORD

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Fishes of Lakshadweep archipelago: new records, review and a revised checklist

Rajkumar Rajan^{1*}, P. T. Rajan², S. S. Mishra³, Abdul Raheem C. N.⁴, Shrinivaasu S.¹, Surendar C.¹ and Damodhar A. T.⁴

Abstract

Extensive studies on fish diversity in Lakshadweep waters began with Jones and Kumaran's in 1964. Reports after these authors were sparse and sporadic until the turn of this century. Although recent reports have increased the tally, targeted studies are lacking, and there is a possibility of listing more species for this region. Studies on the diversity and abundance of fishes are due, given the atoll system undergoing rapid changes: structural decline due to several bleaching related coral mortality events, changes in the seagrass meadows, and the increase in fishing reef-associated species. These circumstances call for a revised checklist of fishes for this region, for the latest dates back to 1991. Thus, we present an inventory of ichthyofauna of Lakshadweep atolls based on published literature and incorporating 15 new species records identified through a rapid survey. The new species records for this region are presented here with the diagnostics of these species. The checklist shows 856 species of 432 genera, 43 orders, and 144 families known from these islands, including 16 freshwater forms. 49.3% of the contribution is from 14 fish families having > 15 species each, while the remainder 131 families contributed 52.5%, which have < 15 species. About 154 species belonging to 12 families are known to contribute to the commercial fisheries of these islands. The new records reported in this work for this region are found in the Maldives, and Sri Lanka proves the zoogeographical affinity of these two regions with the Lakshadweep archipelago.

Keywords: Fish diversity, Lakshadweep Islands, New records, Revised checklist, Taxonomy

Background

Lakshadweep archipelago is the northernmost chain of atolls at the Laccadive-Chagos ridge, situated between 12° – 8° N and 71° – 74° E in the Arabian Sea, and separated from the Maldives by the nine-degree Channel, consists of 15 atolls and three prominent submerged reefs. The atolls have a reef area of 933.7 km², including a lagoon area of 510 km² (Bahuguna and Naik 1994). The islands are small, from 0.1 – to 4.4 km² in size, and together with the islets, cover a total land area of 32 km². The lagoons support a rich growth of benthic macroalgae and seagrass, and hitherto, more than 100 species of flora have been recorded (Rao 1991). The atoll reefs share much of their fauna with the Maldives, with some faunal affinity to mainland India's reefs (Rao

1991). Coral diversity comprises 133 coral species under 44 genera, with species *Acropora* and *Porites* being common (Pillai and Jasmine 1989, Caeiro 1999). An account of 152 species of meiofauna, 69 species of Polychaeta, 17 species of Sipuncula, seven species of Echiura, 13 species of Stromatopoda, 79 species of Insecta, 168 species of Mollusca, and 72 species of Echinodermata have been so far reported, along with four species of marine turtles (Ghosh 1991). The extensive coral reefs, lagoons, and the surrounding oceanic depths contribute to this archipelago's rich and varied fish fauna. The fish diversity in these waters also receives a particular interest due to the Arabian Sea's confluence with the Indian Ocean and Western Pacific.

Alcock's (1890) account of deep-sea fishes was the first on fishes of Lakshadweep. Several works ensued: Alcock 1891, 1892, 1894, 1896, Gardiner 1901–1905, Hornell 1910, Ayyangar 1922, Ellis 1924, Burton 1940, Mathew and Ramachandran 1956, Balan 1958. Extensive works,

* Correspondence: raj@zsi.gov.in

¹Marine Biology Regional Centre, Zoological Survey of India, Chennai 600028, India

Full list of author information is available at the end of the article



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however, on fishes of Lakshadweep came about only in the sixties after Jones (1964) and Jones and Kumaran (1964a, 1964b, 1965a, 1965b, 1966, 1967, 1968, and 1970). Jones (1969) prepared a 'Catalogue of fishes from Laccadive Archipelago' based on the reference collections in Central Marine Fisheries Research Institute (CMFRI), listing 528 species. Later, Jones and Kumaran (1980) published a comprehensive account describing 603 fishes from Lakshadweep. Studies after Jones and Kumaran's have been sparse, except Venkateswarulu and Ilango (1982), who added 16 species, and Balachandran and Nizar (1989) added three more. The compiled checklist by Rao (1991), at this time, presented 740 fishes. However, at the turn of the century, several new reports from this group of islands were published, including 16 species from these island's freshwater bodies (Nasser 1999, Nasser et al. 2002, Murty 2001, 2002, Anand and Pillai 2002, 2005, 2007, Sluka and Lazarus 2006, Ajithkumar et al. 2012, Vinoth et al. 2012, Aneeshkumar et al. 2012, 2013, Prabhakaran et al. 2013, 2013a, Randall and Bineesh 2014, Idreesbabu et al. 2014, Noushad et al. 2014, Barman et al. 2014, Joshi et al. 2011, Nair et al. 2014, Sahayak et al. 2014, Abdussamad et al. 2015, Aneeshkumar et al. 2015, Sirajudheen and Khan 2014).

Revisions of fish diversity studies are required, on an emergency basis, as the diversity in these atolls is threatened mainly due to coral decline, the disappearance of seagrass, and the shift from oceanic to reef-dependant fisheries. The coral decline is clear from previous studies: A 40% decline in coral cover over the last two decades has resulted due to the successive massive bleaching events in 1998, 2010, and 2016, with the reduction in corals like *Acropora*, that provide structural complexity to the reefs (Rajan et al. 2015, Yadav et al. 2018). Arthur (2004) observed changes in fish composition during the recovery phase, from 2000 to 2003, where coral affiliates like *Oxymonacanthus longirostris* were cited as rare, despite being commonly observed before 1998. The latest studies further confirm the impact of coral decline on fish abundance (Karkarey 2018; Rogers et al. 2017) and diversity (Komyakova et al. 2018). Secondly, the seagrass habitats in these reefs are also changing in recent years. Turtle grazing has been shown to reduce the production rates in meadows (Kelkar et al. 2013) and cause shifts in seagrass species dominance (Kelkar et al. 2013). However, the reasons for the low seagrass cover currently (Geevarghese et al. 2017) in the lagoons from the previously abundant covers (Koya et al. 2012; Nobi et al. 2012) are not clear. Healthy seagrass meadows in tropical reefs invariably sustain high fish diversity, known as nursery habitats for many fish species and support subsistence seagrass-based fishery (Gillanders 2006; Nordlund et al. 2017; Jianguo et al. 2018).

The decline in seagrass meadows in these atolls is a concern for fish diversity and fisheries. Thirdly, there is a shift in fishing practices recently, from the predominantly tuna fishery (pelagic, open ocean) to the reef-dependant fishery (Karkarey 2018) forced by the current market (local) trends. Continuance of this fishery shall cause changes in fish species assemblages and may be detrimental to the reef's recovery by reducing the herbivore populations (Arthur 2004; Karkarey 2018).

By presenting the checklist, this manuscript aims to aid current and future studies on fish diversity - verify what is present now and monitor changes, which are essential given the threats to fish diversity in this region.

Materials and methods

The compiled fish species list consolidates over 125 years of accrued information from published literature, including inventories and faunistic surveys, field guides, taxonomic and fishery studies. We supplemented this review through a rapid survey covering 28 stations in four atolls (Agatti, Kadmat, Bangaram & Bitra) from 20.11.2014 to 12.12.2014. Except for two stations each in the lagoons of Kadmat and Agatti, other stations were on the reef slope, with atleast six stations on each island. The dive time at each station varied from 1 to 2 h. The divers noted the species sited at each station which were also photographed. A cumulative of 786 photos of fishes were taken. The fish species identified in the field were revalidated from the photos and consultations between observers. The works of Jones and Kumaran (1959–1980) were taken as the base and consulted to incorporate findings from other publications and our survey results. Publications of non-taxonomic nature were also considered to include several species names presented in the list (Additional file 1). The systematic arrangement of families follows van der Laan et al. (2019) with minor changes. Species in each family were arranged alphabetically. The scientific names of fishes used in the cited literature were updated following recent usage, and hence junior synonyms were omitted. The first available taxonomic reference for a species is cited with the page number. Those taken from non-taxonomic works are marked with an asterisk (*) and those from unpublished work (Ph.D. theses) are marked with a double asterisk (**). The names reported without any taxonomic information and excluded from this list are appended, citing causes for exclusion as in Additional file 2.

Results and discussion

A total of 90 species belonging to 30 families and 13 orders were recorded during the rapid survey under the current study (the list is attached as Additional file 3). Fifteen species are reported as new additions to the

Lakshadweep reefs (Table 1), where four species, namely *Sebastapistes cyanostigma* (Bleeker, 1856), *Zoramia virdiventer* Greenfield, Langston & Randall, 2005, *Ecsenius yaeyamaensis* (Aoyagi, 1954) and *Naso tonganus* (Valenciennes, 1835), have not hitherto been reported from Indian waters, from the Andaman Islands in the east to Lakshadweep in the west. Table 1 shows the status (yes/no) of previous reports of the new species records in Indian waters from Andaman and Nicobar Islands and the mainland coast of India.

The diagnostics of the new species records are presented below with extracts from the original descriptions, observations in-situ and the field photographs. The original description of the species can be referred from the citation corresponding to the author(s)' name, which is cited in full. Underwater photos of these species along with the map of the photograph's location are provided in Figs. 1, 2, 3 and 4.

1. *Neotrygon indica* Pavan-Kumar et al., 2018

(Indian Ocean Blue-spotted mask ray)

Neotrygon indica Pavan-Kumar, Kumar, Pitale, Shen & Borsa, 2018, *Comptes Rendus Biologies*, 341 (2): 128, Figs. 1A, B and 2 (Type locality: Gulf of Mannar, Tamil Nadu, India, 9.12°N, 79.46°E).

Diagnosis: Disc is kite-like, wider than long; naked with few dorsal denticles; snout short and gently rounded; two papillae are present inside the mouth; tail is about as long as the disc with upper and lower cutaneous folds; a pair of sharp spines on the upper surface of the middle part of

the tail. The body is pale brown in colour with small bright ocelli with blue centers, several dark speckles, and few scattered black spots; a conspicuous occipital mark present; underside of the disc is white; tail with black and white bands behind the sting (Fig. 1).

Distribution: Indian Ocean: India and Sri Lanka. It is usually found in sandy areas adjacent to reefs.

Remarks: The species resembles *Neotrygon kuhlii* (Müller & Henle 1841), but differentiated from it by the presence of a moderately large number of small ocellated blue spots, a low number of medium-sized ocellated blue spots, a high number of dark speckles, a few dark spots, a conspicuous occipital mark and by the absence of large ocellated blue spots (Pavan-Kumar et al., 2018). It could be added here that *Neotrygon kuhlii* is now considered to be endemic to Solomon Island.

2. *Taeniura meyeni* Müller & Henle, 1841 (Round ribbon tail ray)

Taeniura meyeni Müller & Henle, 1841, *Syst. Beschr. Plagiost.*: 172, [Pl. 55] (Type Locality: Mauritius).

Diagnosis: Disc is almost rounded; the buccal cavity is with 4 or 5 papillae; tooth rows are about 40 in each jaw; dorsal and caudal fins are absent; tail is stout with a large sharp spine on the dorsal surface and with a conspicuous ventral cutaneous fold; dorsal surface of the disc is rough with widely distributed granulations. The surface of the disc is grey, mottled with black spots and blotches of irregular size; the ventral fold of the tail is black (Fig. 1).

Table 1 List of new species records from Lakshadweep reefs. The status (yes/no) of previous reports of these species, from Andaman and Nicobar Islands and the mainland coast of India, is also shown

Sl No.	Species	Previous records	
		Andaman Nicobar Islands	Mainland Coast of India
1	<i>Neotrygon indica</i> Pavan-Kumar et al., 2018	Yes	Yes
2	<i>Taeniura meyeni</i> Müller & Henle, 1841	Yes	Yes
3	<i>Sebastapistes cyanostigma</i> (Bleeker, 1856)	No	No
4	<i>Pseudanthias ignitus</i> (Randall & Lubbock, 1981)	Yes	No
5	<i>Zoramia virdiventer</i> Greenfield, Langston & Randall, 2005	No	No
6	<i>Lutjanus rivulatus</i> (Cuvier, 1828)	Yes	Yes
7	<i>Monotaxis heterodon</i> (Bleeker, 1854)	Yes	No
8	<i>Parapercis millepunctata</i> (Gunther, 1860)	Yes	Yes
9	<i>Helcogramma striata</i> Hansen, 1986	Yes	No
10	<i>Ecsenius yaeyamaensis</i> (Aoyagi, 1954)	No	No
11	<i>Thalassoma amblycephalum</i> (Bleeker, 1856)	Yes	No
12	<i>Nemateleotris magnificus</i> (Fowler, 1938)	Yes	No
13	<i>Ctenochaetus truncatus</i> Randall & Clements 2001	Yes	No
14	<i>Naso hexacanthus</i> (Bleeker 1855)	Yes	No
15	<i>Naso tonganus</i> (Valenciennes, 1835)	No	No

Distribution: Indo-West Pacific - from the Red Sea, east coast of Africa east to the Marquesas Islands, north to southern Japan and Ogasawara Islands, south to Queensland (Australia). Usually found on sandy clays adjacent to coral reefs.

Remarks: This is also a widely distributed species, however, the present report is its first record from the Lakshadweep sea.

3. ***Sebastapistes cyanostigma* (Bleeker, 1856)**
(Yellow-spotted scorpionfish)

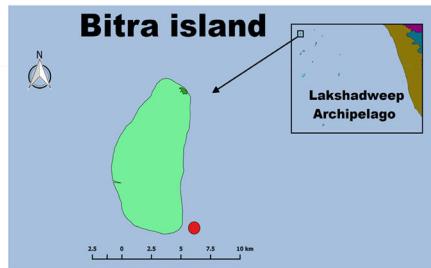
Scorpaena cyanostigma Bleeker, 1856, *Natuurk. Tijdschr. Ned. Indië*, 11 (2): 400 (Type locality: Kajeli, Buru, Molucca Islands, Indonesia).

Sebastapistes cyanostigma: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 1: 237.

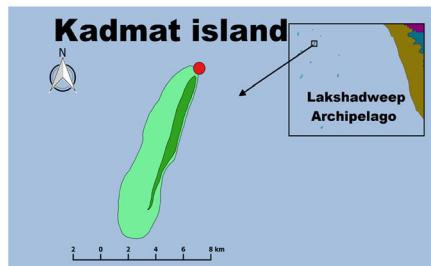
Plate I



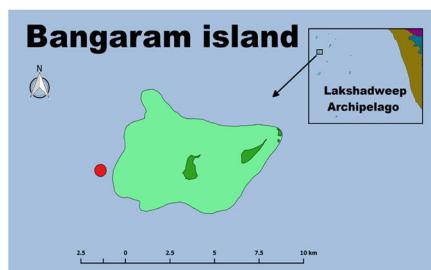
Neotrygon kuhlii (Muller & Henle, 1841)



Taeniura meyeni Muller & Henle, 1841



Sebastapistes cyanostigma (Bleeker, 1856)



Pseudanthias ignitus (Randall & Lubbock, 1981)

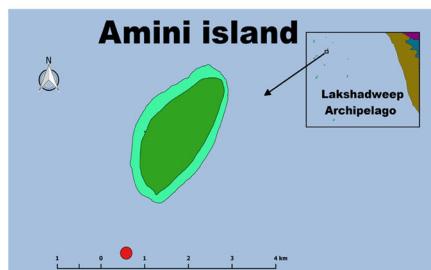
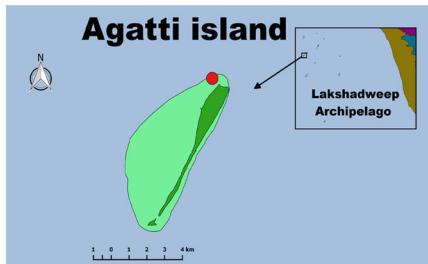
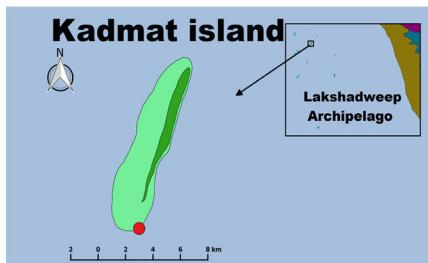


Fig. 1 New species records (Nos. 1–4) along with the site locations at which photographed

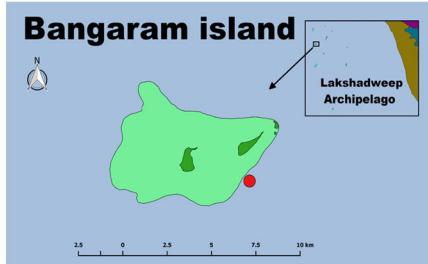
Plate II



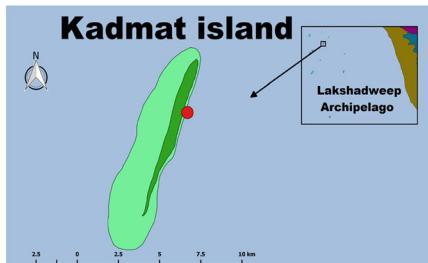
Zoramia virdiventer Greenfield, Langston & Randall, 2005



Lutjanus rivulatus (Cuvier, 1828)



Monotaxis heterodon (Bleeker, 1854)



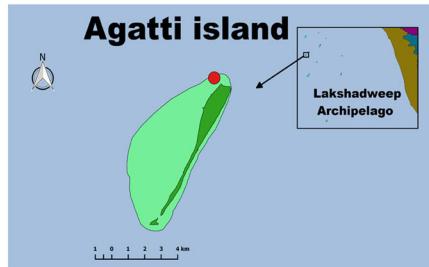
Parapercis millepunctata (Gunther, 1860)

Fig. 2 New species records (Nos. 4–8) along with the site locations at which photographed

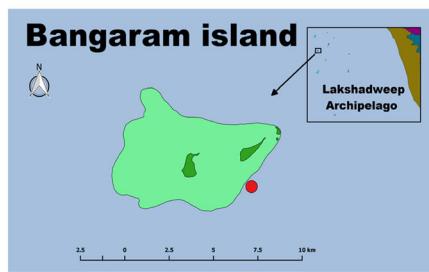
Diagnosis: D XII, 9; A III, 5–6; P 15–16; LSS 42–45. Scales ctenoid; two suborbital ridges ending with the blunt spine; lacrimal spines five, three of which extending ventrally over upper lip; body depth about 2.7–2.8 in SL. The body pink to reddish in colour with numerous small white spots and yellow blotches; fins yellowish (Fig. 1).

Distribution: Indo-west Pacific – the Red Sea to East Africa to the Line Islands and Samoa, Australia (Queensland and the Timor Sea) in the south to Ryukyu and Ogasawara Islands in the north. Found as solitary or in small groups among branches of *Pocillopora* corals in surge-affected shallow reefs.

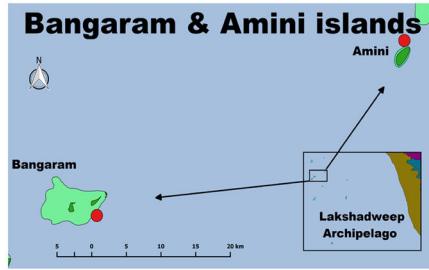
Plate III



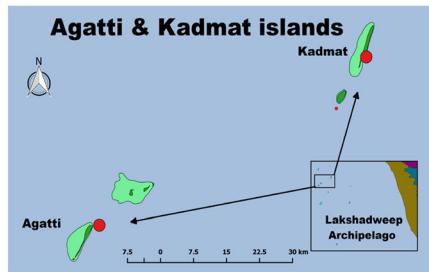
Helcogramma striata Hansen, 1986



Ecsenius yaeyamaensis (Aoyagi, 1954)



Thalassoma amblycephalum (Bleeker, 1856)



Nematoleotris magnifica Fowler, 1938

Fig. 3 New species records (Nos. 9–12) along with the site locations at which photographed

Remarks: Although widely distributed, the present report from Lakshadweep is its first record from Indian waters.

4. *Pseudanthias ignitus* (Randall & Lubbock, 1981)
(Flame anthias)

Anthias (Mirolabrichthys) ignitus Randall & Lubbock, 1981, Contrib. Sci. (Los Angeles), 333: 18, Fig. 12 (Type

locality: Lagoon reef, Villingili Island, North Male Atoll, Maldives).

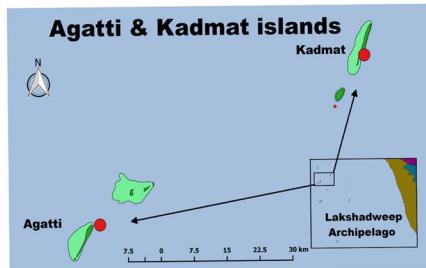
Pseudanthias ignitus: Allen & Erdmann, 2012, Reef Fishes of East Indies, 1: 296.

Diagnosis: DX, 16–17; A III, 7; P 19–20; LL 53–58; GR 11–12 + 22–25; body depth 2.5–3.0 in SL; caudal fin lunate, lobes filamentous; pelvic fin with elongate filament in males. The body is usually orange in color, a lavender

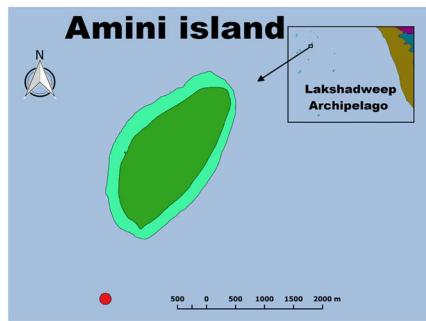
Plate IV



Ctenochaetus truncatus Randall & Clements 2001



Naso hexacanthus Bleeker, 1855



Naso tonganus (Valenciennes, 1835)

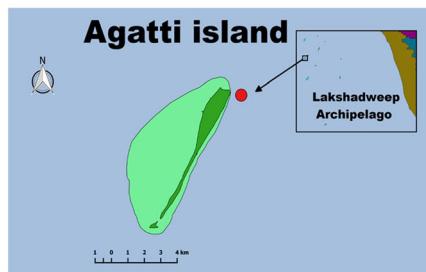


Fig. 4 New species records (Nos. 13–15) along with the site locations at which photographed

margined orange band arises from the snout to the opercle margin, the dorsal fin is red with a yellow posterior base, caudal fin is yellowish with a broad pinkish band along the upper and lower margin (Fig. 1).

Distribution: Indian Ocean - Maldives, Andaman Sea, and north-western Sumatra. Found in lagoonal reefs and the upper edge of steep slopes in shallow water.

Remarks: This species was earlier recorded from the Andaman Islands in Indian waters. Its first description from the Maldives may be an indicator of its occurrence in oceanic islands.

5. *Zoramia virdiventer* Greenfield, Langston & Randall, 2005 (Fragile cardinalfish)

Zoramia virdiventer Greenfield, Langston & Randall, 2005, Proc. California Acad. Sci., 56 (33): 631, Figs. 1E,

4–6 (Type locality: Lagoon side of Pig Island (Tab Island), Madang Province, Papua New Guinea).

Diagnosis: D VI + I, 9; A-II, 9; P 14; LL 24; GR 6–7 + 24–27; body depth 2.5–3.3 in SL; second dorsal fin spine 19.0–21.5% SL; anal fin spine 13.0–16.0% SL. The body color is semi-transparent with silvery reflections anteriorly on the abdomen and operculum; head and anterior part of the body is with scattered blue spots; sometimes a faint blackish band on the sides of snout; a distinct small black spot is found at the middle of caudal fin base, about half of the pupil or more in size; the tip of caudal fin lobes are often black (Fig. 2).

Distribution: Indo-Pacific: Indonesia east to Samoa, Fiji and Marshal Island, north to Japan south to Australia. It is usually found in sheltered reefs in shallow water up to the depth of 15 m.

Remarks: The present report forms its first report from Indian waters, extending its distributional range westward to the Arabian Sea from the earlier known western boundary, Indonesia.

6. ***Lutjanus rivulatus* (Cuvier, 1828)** (Blubberlip snapper)

Diacope rivulata Cuvier, in Cuvier & Valenciennes, 1828, *Hist. nat. pois.*, 2: 414, Pl. 38 (Type locality: Red Sea; Java, Indonesia; Puducherry, India; [Malabar] India, Arabian Sea, western Indian Ocean).

Lutjanus rivulatus: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 2: 453.

Diagnosis: D X, 15; A III, 8 P 17; V I, 5; LL 47–49. Body deep, dorsal profile of head steeply sloped; vomerine tooth patch is crescentic; the posterior profile of anal fin pointed; preopercular notch moderately developed. Body reddish-brown; each scale is with one or two bluish spots; head with fine wavy blue lines; lips whitish; all fins are yellow in color with dusky markings; the caudal fin is grayish with yellow margin (Fig. 2).

Distribution: Indo-Pacific - Red Sea, to the east coast of Africa, through India to Japan and Australia to Tahiti Island. Found in inshore reef areas.

Remarks: It is a commonly occurring species along Indian coastal waters, however, been recorded for the first time from Lakshadweep Islands.

7. ***Monotaxis heterodon* (Bleeker, 1854)** (Redfin emperor)

Pagrus heterodon Bleeker, 1854, *Natuurk. Tijdschr. Ned. Indië*, 6 (1): 54 (Type locality: Sindangole, Halmahera, Indonesia).

Monotaxis heterodon: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 2: 502.

Diagnosis: D X, 10; A III, 9; P 13–14; LL 44–47; Ltr 5/12.5; Small scales are present on the inner surface of the pectoral fin axil; the jaw is with 5–7 large molariform teeth on sides; body depth 2.2 in SL; eyes are large, 2.7–3.8 in head length. The adults are silvery grey with narrow dark scale margins; pectoral axil is with a black blotch; three or four narrow white bars of 1–2 scales wide, appear on the upper part of the body; each lobe of the caudal fin has an orange band; fins yellowish or reddish (Fig. 2).

Distribution: Indo west-Pacific – Seychelles, Maldives, Sri Lanka, and Andaman Islands of India, Indonesia, Malaysia, Papua New Guinea, Great Barrier Reef, Marshall Islands, and New Caledonia. Found in coral reefs in shallow water as solitary or in small groups. This is the first report of this species from Lakshadweep Islands.

Remarks: This species is very closely similar to *Mona-taxis grandoculis*, which is often recorded from Lakshadweep. However, pale bars on back 3–4 scale wide and scale rows between lateral line and anal fin origin 13.5, differentiates from *M. grandoculis*.

8. ***Parapercis millepunctata* (Gunther, 1860)**
(Blackdotted sandperch)

Percis millepunctata Günther, 1860, *Catalog. Fish. British Mus.*, 2: 241 (Type locality: Sri Lanka).

Parapercis millepunctata: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 2: 756.

Diagnosis: D IV, 20–21; A I, 17–18; P 17; GR 14–17; LL 55–60; predorsal scales 9–11; six canines are present at the front of lower jaw; the last spine of the dorsal-fin is joined with first dorsal soft ray at the level of spine tip. Dark and light brown spots are noted on the back; the lower half white with two rows of spots, where the upper row is rounded and lower row elongate; the upper row of the spots is ocellated in males, while females are with a smaller dark brown spot at this position; middle of the caudal fin is with a white streak (Fig. 2).

Distribution: Indo-Pacific- the Maldives, Sri Lanka to the Pitcairn group of islands, north to the Ryukyu (Japan) and Ogasawara islands, south to the southern Great Barrier Reef (Australia) and New Caledonia. It occurs in sand-rubble bottoms near reefs in shallow water.

Remarks: This is the first report of this species from Lakshadweep islands, though it has been reported in the Indo-Pacific including the Andaman Islands.

9. ***Helcogramma striata* Hansen, 1986** (Tropical striped triplefin)

Helcogramma striata Hansen, 1986, *Bulletin of Marine Science*, 38 (2): 349, Fig. 18 (Type locality: Toga Point rocks, Miyakejima, Izu Islands, Japan).

Diagnosis: D III + XI–XV + 9–12; A I, 17–22; P 15–17; V I, 2; LL pored 14–20, continuous; LSS 38–39; head scaled on nape, belly naked; mandibular pores 3 + 2 + 3; one free pterygiophore is found between the second and third dorsal fins. Upper two-thirds of the body red with three continuous white or bluish-white stripes, 6–7 spots are observed between the lowermost two stripes; eyes are with a yellow ring (Fig. 3).

Distribution: Indo-west Pacific – from Sri Lanka, eastward to the Andaman Sea, to Line Islands, Fiji, and Australia (Western Australia and Queensland) in the south to Taiwan, Japan, and Ogasawara Islands in the north.

Remarks: The present record extends its distributional range further westward to Lakshadweep Islands. Holleman (2007) reviewed the genus *Helcogramma*

and stated the occurrence of *H. striata* from Sri Lanka and eastwards. This species is closely similar to *H. maldivensis* Fricke and Randall, which has broken longitudinal stripes, naked nape, and lesser lateral scales (36–37).

10. *Ecsenius yaeyamaensis* (Aoyagi, 1954) (Yaeyama blenny)

Salarias yaeyamaensis Aoyagi, 1954, *Zoological Magazine Tokyo [Dobutsugaku Zasshi]*, 63 (5): 213, Figs. 2–3 (Type locality: Iriomote Island, Okinawa Prefecture, Ryukyu Islands, Japan).

Ecsenius yaeyamaensis: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 2: 821.

Diagnosis: D XI–XII, 13–15; A-II, 14–17; V I, 3; lateral-line tubes reach up to below the 10th or 11th dorsal-fin spine; nasal cirri are present on the posterior rim of anterior nostril; the body depth at anal-fin origin is 5.3–5.7 in SL. The body is light brown at the abdomen, and the cheek is pale whitish; the interrupted dark stripe is found behind the eye; lower margin of the cheek is black; the base of the pectoral-fin base is with a Y-shaped mark, sometimes with white spots and blotches on the side (Fig. 3).

Distribution: Indo-West Pacific: Sri Lanka to Vanuatu, north to southern Japan, south to Australia and New Caledonia. Found in sheltered and coastal reefs in shallow water, solitary or in small groups.

Remarks: The present report is the first record from Indian waters and extends its distributional range westward to the Lakshadweep Sea, from the earlier known western boundary, Sri Lanka.

11. *Thalassoma amblycephalum* (Bleeker, 1856)
(Bluntheaded Wrasse)

Thalassoma amblycephalum Bleeker, 1856, *Natuurk. Tijdschr. Ned. Indië*, 11 (2): 400 (Type locality: Kajeli, Buru, Molucca Islands, Indonesia).

Diagnosis: Dorsal rays VIII, 13; Anal rays III, 11; pectoral rays 15; lateral line scales 26–27; jaws with one pair of canine teeth anteriorly. The caudal fin is truncate to slightly emarginate. Becoming lunate in large males. Attains to 15 cm. Male reddish with vertical green lines, yellowish zone on the nape, green head with pair of pink lines, and yellow pectoral fins with a large blue spot on the outer portion. Female pale greenish on the back with broad dark brown, mid-lateral stripe, and white on the lower half. Occurs in aggregations over shallow reefs, the upper edge of the lagoon, and seaward areas (Fig. 3).

Distribution: Indo-Pacific. This is the first report of this species from Lakshadweep islands, though it has been known from the Andaman Islands.

12. *Nemateleotris magnificus* (Fowler, 1938) (Fire goby)

Nemateleotris magnificus Fowler, 1938, *Proc. U. S. Nat. Mus.*, 85 (3032): 132 (Type locality: Buka Buka Island, Gulf of Tomini, Sulawesi, Indonesia).

Diagnosis: D VI + I, 28–32; A I, 27–30; P 19–20; V I, 5; GR 5–6 + 17–19; LSS 110–130; body depth - 4.4–4.9 in SL; first dorsal fin elongate, and when appressed reaches beyond one-third of the second dorsal fin base; posterior body scales are with 12 or more ctenii. The anterior body is pale grey to whitish in color; snout yellow; posterior part of the body is red in color; dorsal pennant is pale yellow (Fig. 3).

Distribution: Widely distributed in Indo-Pacific - from East Africa to the Hawaiian, Marquesan, and Pitcairn islands, north to the Ryukyu Islands, south to New Caledonia and the Austral Islands. Found in outer reef slopes in shallow water.

Remarks: This species was earlier known from Andamans in Indian waters and the present report is its first record from Lakshadweep.

13. *Ctenochaetus truncatus* Randall & Clements 2001 (Indian gold-ring bristle-tooth)

Ctenochaetus truncatus Randall & Clements 2001, *Indo-Pacific Fishes*, No. 32: 25, Pls. 3C, 6 F–H (Type locality: Off point just north of the main settlement, La Digue, Seychelles).

Diagnosis: D VIII, 25–27; A III, 23–25; P 15–16 (rarely 17); body depth - 1.8–2.1 in SL; The teeth are movable with expanded incurved tips which bear only lateral denticulations (fewer than 5); the posterior dorsal soft rays are longer than anterior; a single folding antrorse spine is on each side of the caudal peduncle, in a well-defined deep groove; caudal fin truncate to lunate, its concavity at most 16.5 in SL. The body is with numerous small blue to yellow spots in life; the edge of the orbit is with a partial or complete yellow rim; the color is young bright yellow (Fig. 4).

Distribution: Widely distributed in the Indian Ocean: South Africa, East Africa, Mozambique Channel, Al-dabra, Madagascar, and Mascarenes, east to the Andaman Sea, Indonesia, Christmas Island, and Cocos Keeling Islands. Found in sheltered lagoon and outer reef slopes.

Remarks: This is the first report of this species from Lakshadweep islands, though it has been known from the Andaman Islands.

14. *Naso hexacanthus* (Bleeker 1855) (Sleek unicornfish)

Priodon hexacanthus Bleeker, 1855, *Natuurk. Tijdschr. Ned. Indië*, 8 (3): 421 (Type Locality: Amboin Island, Molucca Islands, Indonesia).

Naso hexacanthus: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 3: 1031.

Diagnosis: D V-VII (usually VI), 26–29; A-II, 27–30; P 17–18; V I, 3; body depth 2.6–3.0 in SL; The top of the head is without any protuberance or horn; a short groove is found in front of the eye; a pair of bony plates are present on the caudal peduncle, which develops into a knife-like keel in large adults; the caudal fin is emarginate in young. The body is brown or bluish-grey to pale blue, shading to yellowish towards ventral half; cheek and opercle are margined black or yellowish-brown (Fig. 4).

Distribution: Indo-Pacific: the Red Sea and East Africa, Mozambique Channel, Seychelles, including the Mascarene Islands to the Hawaiian, Marquesas, and Ducie islands (Pitcairn Group), north to southern Japan and Ogasawara Islands, south to Lord Howe Island and New Caledonia and Clipperton Island in Eastern Pacific.

Remarks: This report forms the first record of this species from Lakshadweep islands, thus confirming its' listing by Arthur (2004). This species has been known from Andaman Islands.

15. *Naso tonganus* (Valenciennes, 1835) (Bulbnose unicorn fish)

Naseus tonganus Valenciennes (ex Quoy & Gaimard), in Cuvier & Valenciennes, 1835, *Hist. nat. poiss.*, 10: 292 (Type locality: Tongatapu, Tonga Islands, South Pacific).

Naso tonganus: Allen & Erdmann, 2012, *Reef Fishes of East Indies*, 3: 1034.

Diagnosis: D V, 27–30; A-II, 26–28; P 16–18; V I, 3; body depth 2.2–3.0 in SL; The adults are with a bulbous protuberance on the front of the head extending well beyond the snout tip in large adults; there is a hump on the back; a pair of bony plates is present posteriorly on each side of the caudal peduncle. The body is gray in color; the head and dorsal parts are scattered with numerous small black spots, which are concentrated below the hump in large adults; ventral half of the body is pale gray to white; broad black submarginal bands are found on the pectoral fins, which become prominent on the underside of the fin (Fig. 4).

Distribution: Indo-West Pacific: East Africa to the Samoan Islands, Australia in the south, the Ryukyu Islands in the north. This report forms the first record of this species from Indian waters.

Remarks: This species was earlier confused with *Naso tuberosus* in the western Indian Ocean and probably in Lakshadweep. Johnson (2002) reviewed the *Naso tuberosus* complex and distinguished *N. tonganus* from *N.*

tuberosus. *N. tonganus* may be distinguished from *N. tuberosus* by the more expanded and bulbous snout, which may extend anteriorly well beyond the tip of the upper lip in adults and a prominent hump on the back, apart from the other characters explained in Johnson (2002).

Inclusive of the 15 new records, a total of 856 species of fishes under 432 genera belonging to 145 families and 43 orders are now known from Lakshadweep waters. These numbers, however, are not validated to be the present or existing species richness in these habitats, as the species recorded through the rapid survey are mere 1/10 of the total species records for this region. We suggest extensive surveys for gathering up-to-date species richness data.

The checklist presented here shows that a total of 422 species (49.3%) belong to just 14 families, represented by 15 or more species in each (Table 2). The remainder 131 families contain 15 or lesser number of species, where 18 families are with two species each and 56 families with just one species. The family Labridae is represented by a maximum number of genera (24), followed by Apogonidae (17), Gobiidae (16), Carangidae (15), Pomacentridae, and Blenniidae (14 each). The butterflyfish genus *Chaetodon* is the most diverse with 22 species, followed by grouper genus *Epinephelus* (21 species) and snapper genus *Lutjanus* (17 species). The most commercially significant fish families are Scombridae (14 spp.), Serranidae (30 spp. of 45 spp. known), Lethrinidae (17 spp.), Lutjanidae (21 spp.),

Table 2 Major species-rich fish families recorded in Lakshadweep Islands

Family	Genera	Species	% of species richness
1. Labridae	24	59	6.9
2. Pomacentridae	14	52	6.1
3. Serranidae	11	45	5.3
4. Apogonidae	17	32	3.7
5. Carangidae	15	31	3.6
6. Chaetodontidae	04	31	3.6
7. Acanthuridae	05	27	3.3
8. Muraenidae	07	25	2.9
9. Blenniidae	14	23	2.7
10. Gobiidae	16	22	2.6
11. Scaridae	07	21	2.5
12. Lutjanidae	04	21	2.5
13. Lethrinidae	04	17	2.0
14. Scorpaenidae	09	16	1.9
Subtotal 14	151	422	49.3
Others 131	281	434	50.7
Total 145	432	856	100.0

Carangidae (31 spp.), Mullidae (15 spp.), Sphyraenidae (9 spp.), Belonidae (7 spp.), Istiophoridae (4 spp.), Polynemidae (4 spp.), Coryphaenidae and Xiphiidae (1 sp. each), that combinedly form about 18% (154 species) of the total fish known from Lakshadweep. The 16 species of freshwater fishes reported in the waterbodies in these islands are known to be introduced, representing families Cyprinidae, Characidae, Clariidae, Osphronemidae, Cichlidae, Aplocheilidae, and Poeciliidae (Sirajudheen and Khan 2014), with the species *Gambusia affinis* and *Poecilia reticulata* most commonly reported.

Conclusion

The authors could collect photographic evidence of the 15 species of fishes as new records for the Lakshadweep archipelago within the short period of the survey, suggesting that extensive fish surveys in these waters could add many more species to the present tally from these islands. The authors also observe the need for an up-to-date inventory of species richness in this region. The new records presented in this work, too, are known from the Maldives, and Sri Lanka, indicate the zoogeographical affinity of these regions.

Abbreviations

D: Dorsal fin; A: Anal fin; P: Pectoral fin; V: Pelvic fin; GR: Gill rakers; LL: Lateral line scales; LSS: Lateral scale series; Ltr: Lateral transverse scales; SL: Standard length

Supplementary Information

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Additional file 1. Appendix I.

Additional file 2. Appendix II.

Additional file 3. Supplementary material S1.

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Authors' contributions

RR, ARCN, and SS participated in the Lakshadweep field survey, collected photographs of fishes, and developed the concept for this manuscript. RPT and MSS confirmed the identification of the new species records and finalized the checklist. SC compiled the preliminary checklist. RR and DAT edited the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Declarations

Ethics approval and consent to participate

Not Applicable.

Consent for publication

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Competing interests

The authors declare that they have no competing interests.

Author details

¹Marine Biology Regional Centre, Zoological Survey of India, Chennai 600028, India. ²Andaman & Nicobar Regional Centre, Zoological Survey of India, Port Blair, U. T. of Andaman Nicobar Islands 744102, India. ³Marine Fish Section, Zoological Survey of India, Kolkata 700053, India. ⁴Department of Environment and Forests, Kavaratti, U. T. of Lakshadweep 682555, India.

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