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**K.K. Idreesbabu**  
Scientist, Coral Reef Research,  
Department of Science and  
Technology, UT of Lakshadweep  
682 555, India.

**N. H. Cernohorsky**  
Research Fellow, Department of  
Botany and Zoology, Faculty of  
Science, Masaryk University,  
Kotlářská 2, Brno 61137, Czech  
Republic

**S. Sureshkumar**  
Associate Professor, Department of  
Aquaculture and Fishery  
Microbiology, MES Ponnani  
College, Ponnani 679 586, India

**Correspondence:**  
**S. Sureshkumar**  
Associate Professor, Department  
of Aquaculture and Fishery  
Microbiology, MES Ponnani  
College, Ponnani 679 586, India.

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## New record of five Butterflyfishes (Family: Chaetodontidae) from the Lakshadweep Archipelago, Western Indian Ocean, with notes on occurrence of four additional species

**K.K. Idreesbabu, N. H. Cernohorsky and S. Sureshkumar**

### Abstract

Five new records of Butterflyfishes (Family: Chaetodontidae), viz. *Chaetodon andamanensis*, *C. decussatus*, *C. guttatissimus*, *C. interruptus* and *C. lineolatus*, are reported from the atolls of Lakshadweep archipelago, India. The occurrence of four additional species viz. *C. madagaskariensis*, *C. triangulum*, *Forcipiger longirostris* and *Heniochus pleurotaenia* were also confirmed. The extension of range of these coral reef associated fishes to these underexplored reefs points towards the need for an extensive scientific survey of fish biodiversity in Lakshadweep archipelago. A check list of the Butterflyfishes of the Lakshadweep Archipelago is also provided.

**Keywords:** Arabian Sea, Chaetodontid, First record, Reef fishes, India.

### 1. Introduction

Lakshadweep archipelago, formerly known as the Laccadive Islands, is a Union territory of India and forms the northernmost segments of the Chagos – Maldives– Laccadive oceanic ridge. Due to its location and due to governmental restrictions it has been rather isolated from the rest of the world. This isolation has led to greater protection from direct human impacts, but has also resulted in very few scientific studies being carried out in these waters. Although most of the studies that exist are focused on fish, in comparison to other coral reefs of the Indian Ocean, like Maldives, Seychelles, or the Chagos Archipelago, the fishes of Lakshadweep have still received far less attention, and Lakshadweep's fish fauna is yet to be fully discovered.

The first taxonomic study of fishes from these islands was done by Jones and Kumaran <sup>[1]</sup>, which was based on samples acquired by commercial and sustenance fishing. However, most of the fishing gears used are inefficient in reef ecosystems and no *in situ* observation of the fishes using underwater devices was carried out. The more recent and complete work of Murty <sup>[2]</sup>, done on reef fishes of Lakshadweep, was also based on samples collected through fishing operations. Although a few *in situ* fish studies using visual census methods exist, it still seems that these fish species-lists may be far from complete <sup>[3, 4, 5, 6]</sup>. During an ongoing research project on habitat selectivity and abundance of butterflyfish population in Lakshadweep, we found 28 species of Chaetodontids compared to the previous 18 species reported by earlier studies <sup>[2,4]</sup>.

The fish populations of Lakshadweep have managed to stay very close to pristine due to its isolation and due to the local artisanal fisheries focusing predominantly on skipjack tuna, *Katsuwonus pelamis* (L.) which are caught using a traditional pole and line fishing method. The expected high biodiversity and good reef health in Lakshadweep waters are of great importance regarding the conservation of biodiversity in the Arabian Sea of Western Indian Ocean. Moreover the chance for the report of new species or extension of range of many fishes are expected if more intensive surveys are carried out in the archipelago using modern underwater technology. Hence an attempt to fully document of the region is made.

## 2. Materials and Methods

Lakshadweep is an archipelago in the Arabian Sea (8° and 12°30' N, 71° and 74° E) off the West Coast of India with 20,000 km<sup>2</sup> of territorial water and 400,000 km<sup>2</sup> of Exclusive Economic Zone. Lakshadweep Archipelago consists of 15 atolls and 5 submerged sand banks. These atolls constitute 11 inhabited, 16 uninhabited islands, and 3 submerged reefs. The total lagoon area for these atolls is 4,200 km<sup>2</sup>. Belt transects <sup>[7]</sup> and timed swims techniques were used to record the occurrence and abundance of species of the family Chaetodontidae. Belt transects (20m x 5m) were placed horizontal to the reef flat in the shallow back-reef as well as on the outer-reef slope and observed to quantify the density of chaetodontids. Timed swims could cover large areas and were particularly useful to sample species that are unevenly distributed or occurred in low densities <sup>[8]</sup>. During the survey, fishes were photographed and video documented and specimens were collected to confirm correct identification. In the laboratory the species were identified primarily using standard references <sup>[9, 10]</sup>. The genus and species classification was done following Eschmeyer and Fricke <sup>[11]</sup>. Further validity and correct nomenclature of the fishes were checked in FishBase <sup>[12]</sup>. The fishes were identified up to species level and their abundance was recorded on underwater data sheets <sup>[13]</sup>. Data on occurrence alone are presented in this paper.

## 3. Results

This paper presents the occurrence of nine additional chaetodontidae species found from Lakshadweep of which five are new records: *Chaetodon andamanensis* Kuitert and Debelius 1999, *Chaetodon decussatus* Cuvier 1829, *Chaetodon guttatissimus* Bennett 1833, *Chaetodon interruptus* Ahl 1923, *Chaetodon lineolatus* Cuvier 1831. The other four species, *Chaetodon madagaskariensis* Ahl 1923, *Chaetodon triangulum* Cuvier 1831, *Forcipiger longirostris* (Broussonet 1782), and *Heniochus pleurotaenia* Ahl 1923 have been reported previously. However the basis for these reports is uncertain, as neither specimen deposits nor photographs exist. Therefore we present them here to confirm their occurrence in Lakshadweep. The photographs of the species are presented in figures and voucher specimens have been deposited in the reference collection of Western Ghats Regional Centre of Zoological Survey of India, Calicut <sup>[20]</sup>. For *Chaetodon interruptus*, *C. madagaskariensis*, *Forcipiger longirostris* and *Heniochus pleurotaenia*, we present only photographic evidence as no specimens could be collected. Table 1 provides the list of all species of the family reported from the Lakshadweep Islands.

**Table 1:** Check list of the butterflyfish of the Lakshadweep Archipelago

Sl. No.	Scientific Name	Reference
1	<i>Chaetodon andamanensis</i> Kuitert and Debelius, 1999	Present study
2	<i>C. auriga</i> Forsskål, 1775	[1]
3	<i>C. bennetti</i> Cuvier, 1831	[1]
4	<i>C. citrinellus</i> Cuvier, 1831	[1]
5	<i>C. collare</i> Bloch, 1787	[1]
6	<i>C. decussatus</i> Cuvier, 1829	Present study
7	<i>C. fulcula</i> Bloch, 1795	[1]
8	<i>C. guttatissimus</i> Bennett, 1833	Present study
9	<i>C. interruptus</i> Ahl, 1923	Present study
10	<i>C. kleinii</i> Bloch, 1790	[1]
11	<i>C. lineolatus</i> Cuvier, 1831	Present study
12	<i>C. lunula</i> (Lacepède, 1802)	[1]
13	<i>C. madagaskariensis</i> Ahl, 1923*	[16]
14	<i>C. melannotus</i> Bloch and Schneider, 1801	[1]
15	<i>C. meyeri</i> Bloch and Schneider, 1801	[1]
16	<i>C. trifascialis</i> Quoy and Gaimard, 1825	[1]
17	<i>C. triangulum</i> Cuvier, 1831*	[16]
18	<i>C. trifasciatus</i> Park, 1797	[1]
19	<i>C. vagabundus</i> Linnaeus, 1758	[1]
20	<i>C. xanthocephalus</i> Bleeker, 1853	[1]
21	<i>Forcipiger flavissimus</i> Jordan and McGregor, 1898	[21]
22	<i>F. longirostris</i> (Broussonet, 1782)*	[4]
23	<i>Heniochus acuminatus</i> (Linnaeus, 1758)	[1]
24	<i>H. dipherutes</i> Jordan, 1903	[2]
25	<i>H. monoceros</i> Cuvier, 1831	[1]
26	<i>H. pleurotaenia</i> Ahl, 1923*	[16]
27	<i>H. singularius</i> Smith and Radcliffe, 1911	[2]
28	<i>Hemitaurichthys zoster</i> (Bennett, 1831)	[1]
	*Confirmed in the present study	

### 3.1 New records of Butterflyfish from Lakshadweep archipelago

#### 3.1.1 *Chaetodon andamanensis* Kuitert and Debelius 1999



**Fig 1:** *Chaetodon andamanensis* in the lagoon of Agatti Atoll. The specimen collected and deposited in Zoological Survey of India, WGRC, Calicut (inset specimen Reg.No.ZSI/WGRC/IR.V.2496)

#### Material Examined

D.XIV, 17; A.IV, 14; P.14; V.I, 5. TL 104 mm, SL 89 mm, Body depth: 52 mm. A single specimen was collected from Agatti lagoon (10°50'43.99"N, 72° 9'23.08"E), from the back-reef in 1.2m depth. The specimen is deposited in Zoological Survey of India, WGRC, Calicut with specimen number- ZSI/WGRC/IR.V.2496.

#### Diagnosis

Bright yellow body with brownish grey line running along horizontal scales rows on the body originating from behind head, darkest and thickest along upper side and fading ventrally; head with black vertical band across eye, with pale blue margin; black spot with pale blue margin on upper part of caudal peduncle; caudal fin yellow with transparent margin [14, 15].

#### Distribution

In Eastern Indian Ocean: from the northern Sumatra and the Andaman Sea westward through Sri Lanka to the Maldives [15].

**Remarks:** Two sightings were made on the backreef of Agatti Island (10°50'57.64"N, 72° 9'27.12"E and 10°50'43.99"N, 72° 9'23.08"E). It is unclear whether these were two separate individuals or the same individual as the locations of the two sightings were only 450 m apart. This species is considered a sibling species of *Chaetodon plebeius* from the Eastern West Pacific and these two are still often confused [15]. There are a few studies where *Chaetodon plebeius* has been reported from Lakshadweep [4, 16]. However, the species observed had most likely been *C. andamanensis*, which had been probably misidentified

as *Chaetodon plebeius*, despite the absence of the blue blotch on the upper sides of the body. Due to the character of the oceanic currents around Lakshadweep and the fact that *C. andamanensis* is very rare in Lakshadweep, it is quite plausible that it has spread to Lakshadweep from the Maldives only recently.

#### 3.1.2 *Chaetodon decussatus* Cuvier, 1829

**Material Examined:** D. XIII, 24; A.III, 20; P.14; V.I, 5. TL 95 mm, SL 76 mm, Body depth: 50 mm. A single specimen was collected from Kavaratti lagoon (10°33'40.09"N, 72°37'15.65"E), from the back-reef in 2 m depth. The specimen is deposited in Zoological Survey of India, WGRC, Calicut with specimen number- ZSI/WGRC/IR.V.2507.

**Diagnosis:** Black area covering most of the back part of the dorsal fin and continuing down to the end of the anal fin; anal fin with yellow stripe; a dark bar through middle of caudal fin; a black band over eye connected at nap; tips of dorsal spine white.

**Distribution:** throughout Indo - West Pacific, including Oman Maldives, India, Sri Lanka

**Remarks:** Both of these species are commonly found in the shallow lagoon and on the outer reef of Kavaratti and Agatti Island, especially in sites with high coralline algae cover. It was found at depths ranging from 1-25 meters. As *Chaetodon decussatus* resembles *C. vagabundus* Linnaeus, 1758 (Fig. 2), and both of these species are very common in the waters of Kavaratti and Agatti Island, previous studies [1, 2, 4, 5] which reported only *C. vagabundus*, had most likely misidentified *C. decussatus* as *C. vagabundus*.



**Fig 2:** Comparison of *Chaetodon decussatus* (A) and *C. vagabundus* (B) photographed and collected from the lagoon of Kavaratti Island. (inset specimen A Reg. No. ZSI/WGRC/IR.V.2499 and B Reg. No. ZSI/WGRC/IR.V.2507)

### 3.1.3 *Chaetodon guttatissimus* Bennett, 1833

**Material Examined:** D.XIII, 23; A. III, 18; P.14; V.I, 5. SL 80 mm, TL 96 mm. Body depth: 48 mm. A single specimen was collected from Agatti outer reef (10°49'37.98"N, 72° 9'18.83"E), from 15 meter depth near the outer reef slope.

**Diagnosis:** Body pale to whitish with dense spotting over the body arranged in rows, spots extending on to dorsal and anal fin; a dark band around caudal peduncle; a black band from nape through eye to lower opercular margin; black

vertical bar at middle of caudal fin, margin of dorsal and anal fins light yellow. The specimen is deposited in Zoological Survey of India, WGRC, Calicut with specimen number- ZSI//WGRC/IR.V.2501.

**Distribution:** widespread Indian Ocean species.

**Remarks:** Eight pairs of *C. guttatissimus* were observed on the outer reef slope of Agatti at the depth ranging from 13-20 meters. This species is present on reefs of neighbouring countries such as the Maldives and Sri Lanka and was thus likely to be present in Lakshadweep as well.



**Fig 3:** *Chaetodon guttatissimus* photographed and collected from outer reef of Agatti Island. (inset specimen Reg. No. ZSI/WGRC/IR.V.2501)

### 3.1.4 *Chaetodon interruptus* Ahl, 1923



Fig 4: Photographic record of *Chaetodon interruptus* observed on the reef slope of Kavaratti Island

**Species description:** D.XIII, 22; A.III, 19; P.14; V.I, 5. SL 77 mm, TL 93 mm. Body depth: 45 mm. *C. interruptus* can be identified by their colour pattern of yellow body with black eye band, large black blotch below the dorsal fin, which spreads down and posterior black band with white posterior margin of dorsal and anal fins (Fig. 4).

**Distribution:** widespread in the Indian Ocean, including the Chagos Archipelago, Maldives and Sri Lanka.

**Remarks:** *C. Interruptus* was observed on the reef slope of Kavaratti Island at 20 meters (10°34'35.42"N, 72°38'50.93"E) and was recently observed at two sites in Minicoy (8°19'48.21"N, 73° 4'36.01"E and 8°18'42.73"N, 73° 4'21.26"E) during Lakshadweep Department of Science and Technology Coral reef monitoring Survey 2011. It is a common species in India and throughout the islands of Maldives, and it is therefore not surprising its observation in Lakshadweep

### 3.1.5 *Chaetodon lineolatus* Cuvier, 1831

**Material Examined:** D. XI, 24; A. III, 21; P. 14; V.I, 5. SL 55 mm, TL 66 mm. Body depth: 32 mm. A single specimen was collected from Kavaratti lagoon (10°33'32.71"N, 72°37'24.34"E), from a patch reef in 2 m depth. The specimen is deposited in Zoological Survey of India, WGRC, Calicut with specimen number-ZSI/WGRC/IR.V.2502.

**Diagnosis:** Body colour is white with a black elliptical marking along the edge of the posterior portion of the back extending across the caudal peduncle to the base of the posterior anal fin rays; broad black band overhead, partially interrupted in front above eye; The dorsal caudal and anal fins are bright yellow.

#### **Distribution**

Widespread throughout the Indo-Pacific. This species is also reported from Sri Lanka, Maldives, and the Chagos Archipelago.

#### **Remarks**

Two pairs of *C. lineolatus* were observed in the Kavaratti lagoon (10°33'32.71"N, 72°37'24.34"E), at depths of 2-3 meters, on the outer reef of Kavaratti Island (10°34'49.75"N, 72°38'29.46"E) at 9 meters, and outer reef of Agatti Island (10°51'25.96"N, 72°12'0.65"E) at 10 meters. *C. lineolatus* was always found feeding along with *Heniochus monoceros*. Being the largest species of butterflyfish and common in the Maldives it is odd to not have been reported from the Lakshadweep archipelago previously.

Three of the nine species, *Chaetodon madagaskariensis*, *Chaetodon triangulum*, *Heniochus pleurotaenia*, have been mentioned in a Ph.D. thesis<sup>[16]</sup> but because the basis for these records is uncertain and due to the increased difficulty of accessing data from such studies, we have decided to present the three species here along with proper

photographic documentation and specimen details in order to confirm their presence on Lakshadweep reefs. Similarly the species *Forcipiger longirostris* has been briefly mentioned in an earlier study [4]. The identification is, however, ambiguous, which is supported by the fact that

"*Forcipiger* sp." has been used throughout their study. For this reason we also present this species in this paper with photographic evidence to confirm its occurrence in Lakshadweep reef ecosystems.



**Fig 5:** *Chaetodon lineolatus* photographed and collected from the outer reef of Kavaratti Island. Juvenile of *C. lineolatus* (inset above) and adult (inset below) (Reg. No. ZSI/WGRC/IR.V.2502)

### 3.1.6 *Chaetodon madagaskariensis* Ahl, 1923



**Fig 6:** Photographic record of *Chaetodon madagaskariensis*, observed on the outer reef of Kavaratti Island

### Species description

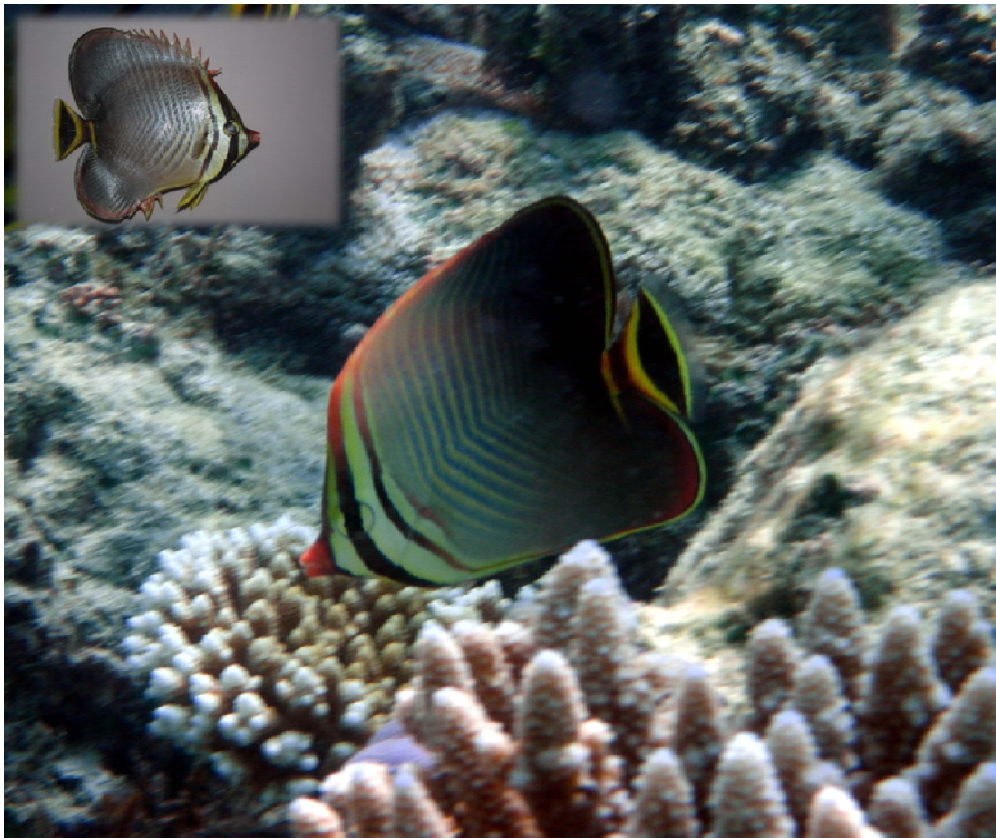
D.XII – XIII, 18 - 20; A.III, 15 - 17; P.14; V.I, 5. Maximum TL 130 mm. It is easily identified by its colour pattern. The body is silver at the head becoming white towards the tail, with a triangular orange patch at posterior dorsal fin and the caudal peduncle. There are a series of about eight dark grey chevron lines on the sides of the body. Between the eyes and the start of the dorsal fin on the nape, there is a black patch rimmed with white. The base of the caudal fin is white, followed by an orange patch and a white rim. The dark band passing through the eye also possesses white margins.

### Distribution

This species is distributed along Indian Ocean including Sri Lanka, the Chagos Archipelago, and Maldives.

### Remarks

*C. madagaskariensis* was found many times on the outer reefs of Kavaratti and Agatti atolls in groups of 2 - 5 individuals, at an average depth of 20 meters.



**Fig 7:** *Chaetodon triangulum*, photographed and collected from the leeward back-reef of Agatti Island. (inset specimen Reg. No. ZSI/WGRC/IR.V.2505)

### 3.1.7 *Chaetodon triangulum* Cuvier, 1831

#### Material Examined

D. XI, 23; A. III, 20; P. 20; V.I, 5. SL 85 mm, TL 105 mm. Body depth: 59 mm. A single specimen was collected from Agatti lagoon (10°52'0.58"N, 72°10'39.76"E), in 2 m depth. The specimen is deposited in Zoological Survey of India, WGRC, Calicut with specimen number-ZSI/WGRC/IR.V.2505.

#### Diagnosis

Identified by deep body triangular in shape and black tail fin; snout short and prominent, body purplish brown with narrow cream coloured angularly bent bars on sides, three dark bars on head, a dark purplish bar with pale edge across caudal fin; edge of soft dorsal black; ventral fins light yellow.

### Distribution

This species is distributed along the Indian Ocean; from the coast of East Africa to Christmas Island to the Andaman Sea. This species is also reported from the Chagos Archipelago and Maldives.

### Remarks

*C. triangulum* was encountered in the shallow lagoons of Agatti and Kavarrati atoll at the average depth of 2 meters. *C. triangulum* was found feeding on coral *Acropora* species along with *C. trifascialis* and *C. fulcula* in the Agatti lagoon.

### 3.1.8 *Forcipiger longirostris* (Broussonet, 1782)

#### Species description

D.X - XI, 24 - 28; A.III, 17 - 20; P.15 - 17; V.I, 5. Maximum TL: 22 mm. Distribution: This fish is present throughout the Indo- Pacific region.

**Remarks**

Four pairs of *F. longirostris* were encountered on the outer reef slope of Kavaratti Island (10°34'49.59"N, 72°38'29.29"E) at the depth of 14 meters. The population in Lakshadweep may have decreased after the major

bleaching event in 1998, but the population showed a slight increase recently (personal observation). This species may have previously been confused with *Forcipiger flavissimus* Jordan and McGregor 1898 due to the close resemblance of *F. longirostris* and *F. flavissimus*.



**Fig 8:** Photographic record of *Forcipiger longirostris* observed on the outer reef slope of Kavaratti Island

**3.1.9 Heniochus pleurotaenia Ahl, 1923**



**Fig 9:** Photographic record of *Heniochus pleurotaenia* observed on the outer reef slope of Kavaratti Island



### Species description

D.X, 23 - 25; A.III, 17 - 18; P.14 - 15; V.I, 5. Maximum TL: 17 mm.

### Distribution

This species distribution is restricted to the north-eastern Indian Ocean and Andaman Sea; from Maldives, southern India, and Sri Lanka throughout the Andaman Sea, down along the western part of Sumatra to northern Java.

### Remarks

A Pair of *H. pleurotaenia* was observed on the outer reef slopes of both Agatti and Kavaratti Island; 10°51'37.53"N, 72°12'6.30"E and 10°34'44.55"N, 72°38'38.64"E respectively, average depth 20 m. It was also observed later around Bangaram Island (10°55'56.01"N, 72°19'0.64"E). These records of *H. pleurotaenia* in Lakshadweep form the western most point of its distribution range.

### 4. Discussion

Up till now Lakshadweep was known to have only 18 species of butterflyfish<sup>[2, 4]</sup>, but during a study on habitat selectivity and abundance of butterflyfish in Lakshadweep, we found 28 species of chaetodontids. Butterflyfishes are well known corallivores and thus in close association with corals among which they also rely on for shelter. However the coral communities changed in Lakshadweep after the 1998 massive bleaching event<sup>[17]</sup>. Therefore butterflyfish communities may have changed in response to the changing coral reef, providing a possible explanation for the new butterflyfish records. However, and more likely, these new records are due to low amount of scientific research done on Lakshadweep coral reefs. More fish species are expected to be encountered as more intensive fish surveys are carried out. The type of methodology used for the collection of data during this study may be the main reason for the five new butterflyfish species recorded from this region, as the majority of coral reef fish studies that have been carried out in Lakshadweep in the past have not obtained data based on underwater observations. They have acquired data from fishing and observations of landings. Gill nets and traps were often used to collect the fish species. Gill nets are, however, unsuitable for collecting many reef fishes as many of them hide among corals. Snorkelling and SCUBA diving with simultaneous recording by photography along the belt transects and timed swims, used in our study, are much more effective for the species composition and population assessment of butterflyfishes<sup>[18, 19]</sup>. The photographs of the species are presented and voucher specimens have been deposited as a primary documentation for further reference if required.

Another plausible explanation for why these species were not recorded before is that they may have been misidentified as other species. For example *Chaetodon decussatus* resembles *C. vagabundus* and both of these species are very common and coexisting in the waters of Kavaratti and Agatti Island, thus earlier researchers<sup>[1, 2, 4, 5]</sup> may have misidentified *C. decussatus* as *C. vagabundus*. In the present study we have collected both the species and accurately identified them. Similarly *C. andamanensis*, considered a sibling species of *Chaetodon plebeius* Cuvier, 1831 from the eastern West Pacific<sup>[15]</sup>, may be confused with *C. plebeius*. There are a few studies<sup>[4, 16]</sup> where

*Chaetodon plebeius* has been reported from Lakshadweep. However the basis for these reports is uncertain, as neither specimen deposits nor photographs exist. Due to the characteristics of the oceanic currents around Lakshadweep and the fact that *C. andamanensis* is very rare in Lakshadweep, it is quite plausible that it has spread to Lakshadweep from the Maldives only recently. The presence of *C. andamanensis* in Lakshadweep is an extension of its geographic range, in which Lakshadweep (Agatti Island) now forms the most western point of its range of occurrence.

The report of five species new to the Lakshadweep waters points towards the urgent necessity of detailed investigation on the occurrence and population of this very important group of fishes. Due to the close tie between butterflyfish and corals the abundance and distribution of these fishes need to be studied to ensure correct future management. Most studies, including this one, have been carried out on reefs of a few densely populated islands. Exploration of other islands, especially uninhabited islands, using underwater surveys may add new records or perhaps even species to the current species list of the region. The high biodiversity and reef health in Lakshadweep are of high importance not only in terms of the very existence of the ecosystem but also in terms of conservation of biodiversity in the western Indian Ocean, as Lakshadweep may act as an important recruiting ground for many reef fishes. Therefore, further studies in this area are much warranted considering its ecological significance and incomplete documentation of underwater fauna.

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