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Occurrence and distribution of tetraodontiform fishes of the Andaman and Nicobar Islands, India

Vardhan Patankar[1, 2], Akhila Paranjape[1, 2], Zoya Tyabji[1, 3], Tanmay Wagh[1, 2], Aniruddha Marathe[4]

1 Centre for Wildlife Studies, 1669, 31st Cross, 16th Main, Banashankari 2nd Stage, Bengaluru, 560 070, India. **2** Tata Institute of Fundamental Research, National Centre for Biological Sciences, GKVK Campus, Bangalore 560 065, India. **3** Andaman Nicobar Environment Team, Centre for Island Ecology, Post Bag 1, Junglighat P.O., Port Blair, 744103, Andaman Islands, India. **4** Ashoka Trust for Research in Ecology and the Environment (ATREE), Royal Enclave, Srirampura, Jakkur, Bengalore, 560064, India.
Corresponding author: Vardhan Patankar, vardhanpatankar@gmail.com

Abstract
Some fish groups are common on coral reefs, but we still lack fundamental information about how fish assemblages vary across seascapes. The order Tetraodontiformes, which includes pufferfish, triggerfish, shingles, porcupinefish, burrfish, leatherjacketfish, filefish, and trunkfish, is one such group. We systematically surveyed 75 sites around 52 islands of the Andaman and Nicobar archipelago to evaluate the occurrence and distribution of tetraodontiform fishes. We recorded 25 species from 16 genera and 6 families. We found the distribution of fishes to vary between sites and geographical regions, with the southern Nicobar region having higher species richness than other geographical regions in the island group. Possible reasons for the observed patterns of the occurrence and distribution of tetraodontiform fishes are discussed.

Keywords
Species assemblages; reef fish; disturbance; distributional patterns; natural catastrophe.

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Introduction

Fish of the order Tetraodontiformes are a conspicuous component of coral reefs and are dependent on corals for food and habitat (Tyler 1980, Jones et al. 2004, Wilson et al. 2008, Pratchett et al. 2008, Matsuura 2014). They encompass 8 important fish groups: pufferfish, triggerfish, shingles, porcupinefish, burrfish, leatherjackets, filefish and trunkfish (Mastsuura, 2000, 2001, 2003, 2009, 2011, 2013) and are amongst the most diverse order of reef associated fishes, with over 412 species recorded worldwide (Matsuura 2014). Within coral reef ecosystems they play functional roles of herbivores, macroinvertivores, piscivores, zooplanktivores, and corallivores (Hixon 1991, Hughe 1994, Holmlund and Hammer 1999, McClanahan 2000, Bellwood et al. 2004, Bellwood et al. 2004). Despite their importance to biodiversity, existing information on this group of fishes is limited to taxonomic records and the biology of species. There is limited data on the occurrence and distribution of tetraodontiform fishes from coral reef regions across the world (Matsuura 2014).

Coral reef fishes are vulnerable to declines due to habitat degradation (Graham et al. 2006, 2007, Wilson et al. 2008). Majority of tetraodontiform species are dependent

on reef habitats and are susceptible to habitat loss (Wilson et al. 2008, Pratchett et al. 2008, Matsuura 2014). As in the neighboring reefs of Indo-Pacific, the reefs of the Andaman and Nicobar Islands are impacted by natural catastrophes in the recent past (bleaching in 2002, 2010, 2016 and the 2004 tsunami), resulting in a decline of total live coral cover and loss of habitat (Arthur et al. 1998, Ramachandran et al. 2005, Krishnan et al. 2011, Patankar et al. 2012, Mondal et al. 2013). These natural catastrophes might impact the occurrence and distribution of fishes, including tetraodontiform species.

Apart from a checklist that confirms the presence of 65 species from the island group and a few sporadic occurrence reports, there is a dearth of information on the distribution of tetraodontiform fishes from the Andaman and Nicobar Islands (Rajan et al. 2013). The absence of predisturbance baseline distributional data of this group from the archipelago precludes how disturbances might have played a role in the current occurrence and distribution of this fish group.

In this context, we present baseline information on the occurrence and distribution of tetraodontiform fishes, based on systematic sampling carried out in 75 sites at 52 islands from 6 geographical regions in the Andaman and Nicobar Islands. We discuss the possible reasons for the observed patterns of occurrence and distribution of tetraodontiform fishes and emphasise the need to safeguard the coral reef habitat in these islands.

Methods

Study area. The Andaman and Nicobar archipelago of India is part of the Indo-Myanmar and Sundaland biodiversity hotspot in the southeastern part of the Bay of Bengal. The archipelago includes over 500 islands and encompass an area of 8249 km^2 (Davidar et al. 2014). Coral reefs of the Andaman and Nicobar Islands, are the most diverse reefs along the Indian subcontinent (Pillai et al. 1969). They are situated close to an area of high marine biodiversity known as the "Coral Triangle", which represents 18% of the global coral reef area and contains around 60% of the world's coral-associated species (Briggs et al. 2000). In the Andaman and Nicobar Islands there are 105 Protected Areas (PAs), which includes 5 national parks and 7 wildlife sanctuaries; altogether these emcompass a total area of 671.3 km^2 of marine ecosystems. Two of these PAs are marine national parks: the Mahatma Gandhi Marine National Park (MGMNP) and the Rani Jhansi Marine National Park (RJMNP) in South Andaman (Singh 2003). In the Nicobar Group, Great Nicobar Island is part of the Great Nicobar Biosphere Reserve, and Camorta, Cabra and Menchal islands have traditional marine protected areas (Patankar et al. 2015).

Field surveys. We surveyed 75 sites around 52 islands in 6 geographical regions in the Andaman and Nicobar archipelago. These were 14 islands in North Andaman (Aves, Craggy, Delgarno, East, Excelsior, Kwang Tung, Landfall, Latouche, North Reef, Reef, Ross, Smith, West, and White Cliff islands), 6 islands in Middle Andaman (Eastern Reef, Interview, Long, Middle Button, Sound, and South Reef islands), 11 islands in Ritchie's Archipelago (Guitar, Havelock, Henry Lawrence, Hugh Ross, John Lawrence, Neil, North Bay, North Button, North Passage, Outram, and Strait islands), 11 islands in South Andaman (Boat, Chester, Cinque, Grub, Jolly Buoy, Malay, Red Skin, Rutland, Sister, Tarmugli, and Twins islands), 4 islands in Central Nicobar (Camorta, Katchal, Nancowry, and Trinket islands), and 5 islands in Southern Nicobar (Cabra, Great Nicobar, Kondul, Little Nicobar, and Menchal islands). The number of sites around each island was dependent on the size of the island, east and west aspect, location of reef around the island, and overall accessibility of the reef. The number of reef sites surveyed was highest at Camorta Island (6), followed by Great Nicobar Island and Nancowry Island (4 sites each). We surveyed 2 reefs each at Aves, Katchal, Little Nicobar, Interview, Twins, Cinque, Sister, Rutland and Eastern Reef islands, whereas at all other islands, we surveyed 1 site per island (Fig. 1).

The Forest Department, a branch of Andaman and Nicobar Administration Department issued permits to carry out this study. The protocol set by the Ministry of Environment of Forests was followed and no collection of fish specimens or damage to coral reefs was done.

At each sampling site, data on tetraodontiform fishes

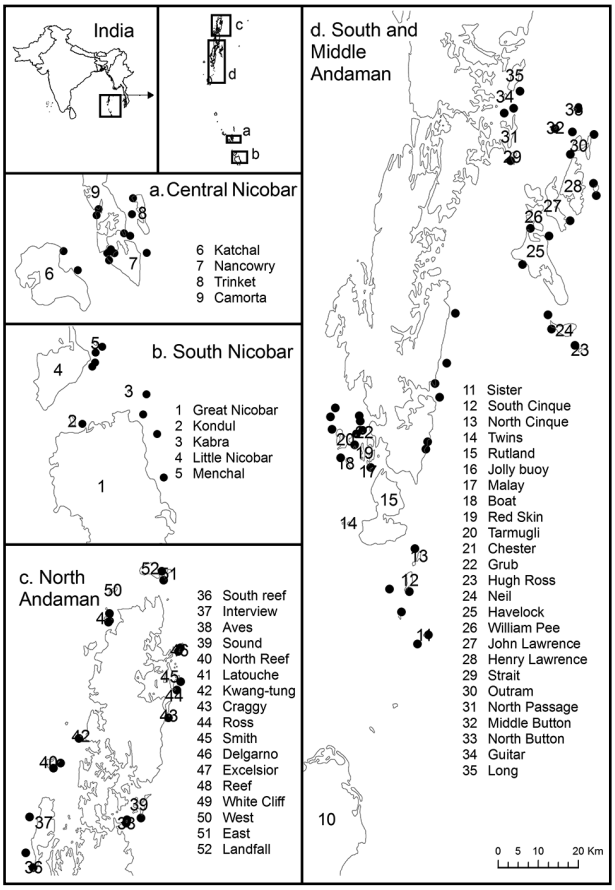

Figure 1. Map of the Andaman and Nicobar archipelago, showing the location of sampling sites.

were collected along 5 belt transects, each 50 m × 10 m, between January 2011 and May 2013 at a depth ranging from 5–15 m using an underwater visual census (Edgar et al. 2004). The abundance of each species was recorded using photography and identified to species based on published descriptions of reef fish (Matsuura 2001, Lieske and Myers 2002, Allen et al. 2012, Froese and Pauly 2015). Tetraodontiform fishes are relatively easy to identify due to their distinct morphological characters. There was no likelihood of confusion with other species. During our underwater surveys, species were identified by the first author (VP) and later verified using field guides. However, since the underwater fish transects were timed, and as many species belonging to the order Tetraodontiformes are cryptic and ambush predators, we were unable to record photographs of all species.

Data analysis. We used non-randomized species accumulation curve or collectors curve (Ugland et al. 2003) with sites ordered by increasing latitude. Use of collectors curves is not common, but they can be useful when the objective is to visualize species distribution rather than estimating species richness. We predict that, with a constant rate of species turnover from south to north and the species accumulation curve would gradually rise towards the total species richness and then flatten as all species will get reported. However, if certain islands contribute to a larger number of unique species, then there would be a sudden jump in the curve followed by a relatively flat region. We compared communities among regions based on species richness and abundance. We used R (version 3.2) for all data analysis (R Development Core Team 2015).

Results

Family Balistidae

Balistapus undulatus Park, 1797
Figure 2A

We observed 149 individuals at 37 islands (51 sites) in all 6 geographical regions studied. Body dark brown with oblique curved orange lines on posterior head and body; an oblique band of narrow blue and orange stripes from around the mouth to below the pectoral fin; a large round black blotch around peduncle spines; rays of soft dorsal, anal, pectoral, and caudal fins orange.

Balistoides conspicillum (Bloch & Schneider, 1801)
Figure 2B

We observed 3 individuals at Cinque Island in South Andaman. Body black with large white ventral spots; lips orange; top of snout with a yellowish band; back having a pale patch with dark spots.

Melichthys indicus Randall & Klausewitz, 1973
Figure 2C

We observed 146 individuals at 23 islands (29 sites) in all 6 geographical regions studied. Body dark grey to black, with jet black fins, white bank at bases of dorsal and anal fins and white margin around tail.

Melichthys niger (Bloch, 1786)

We observed 5 individuals at 3 islands (3 sites) in 2 geographical regions. Body black with bluish scale margins, pale blue to white band at the base of dorsal and anal fins, blue marking on upper head and yellow mark on cheek.

Melichthys vidua (Richardson, 1845)

We observed 1 individual at Rutland Island in South Andaman region. Body brown with yellowish snout and pectoral fins; white dorsal and anal fin with black margins; white tail with wide pink margin.

Odonus niger (Rüppell, 1836)
Figure 2D

We observed 389 individuals at 10 islands (34 sites) in 4 geographical regions. Pale blue head, dark blue to a purplish body; 2 blue lines extend from eye towards the mouth. We observed a large shoal of 138 individuals at Little Nicobar Island.

Pseudobalistes fuscus (Bloch & Schneider, 1801)
Figure 2E

We observed 2 individuals at 3 islands (3 sites) in the East Andaman and Central Nicobar regions. Body blue to bluish grey with yellowish scale spots; pale blue to muddy red margins on all fins.

Pseudobalistes flavimarginatus (Rüppell, 1829)

We observed 36 individuals at 17 islands and 29 sites in 5 geographical regions. Brown body with black spots and crosshatch pattern, pale orange snout and cheeks, yellow to orange margins on fins.

Rhinecanthus aculeatus (Linnaeus, 1758)

We observed 4 individuals at 3 islands and 3 sites in the South and Central Nicobar region. Body brownish dorsally, white ventrally, with a tapering dark bar through eye, large black patch on lower body, 3 rows of black dots on base of tail.

Sufflamen bursa (Bloch & Schneider, 1801)
Figure 2F

We observed 28 individuals at 13 islands (15 sites) in 6 geographical regions. Body grey to brown with white chin and belly; yellow or brown scythe-shaped mark below the eye.

Sufflamen chrysopterus (Bloch & Schneider, 1801)
Figure 2G

We observed 205 individuals at 35 islands (46 sites) in 6 geographical regions. Body dark brown, with chin and belly bluish; narrow yellow-orange bar behind eye, tail yellow-brown, edged with white.

Xanthichthys mento (Jordan & Gilbert, 1882)

We observed 4 individuals at 2 islands (3 sites) in the South and Central Nicobar regions. It has yellow-gold with black scale margins forming crosshatch patterns and bright red tail; blue lines on the cheek.

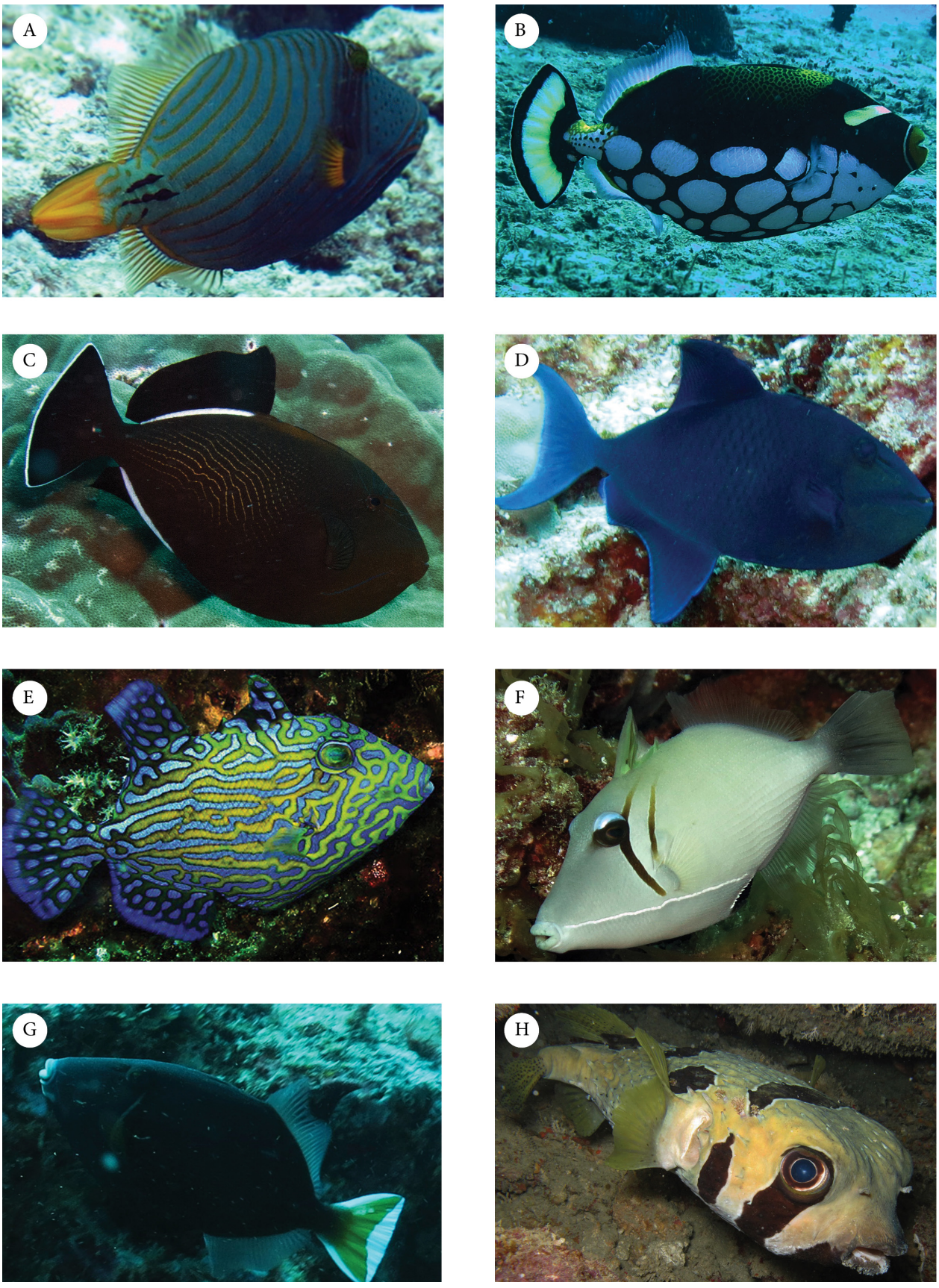

Figure 2. Some fish species belonging to the order Tetraodontiformes from the Andaman and Nicobar Islands. **A.** *Balistapus undulatus.* **B.** *Balistoides conspicillum.* **C.** *Melichthys indicus.* **D.** *Odonus niger.* **E.** *Pseudobalistes fuscus.* **F.** *Sufflamen bursa.* **G.** *Sufflamen chrysopterus.* **H.** *Diodon liturosus.*

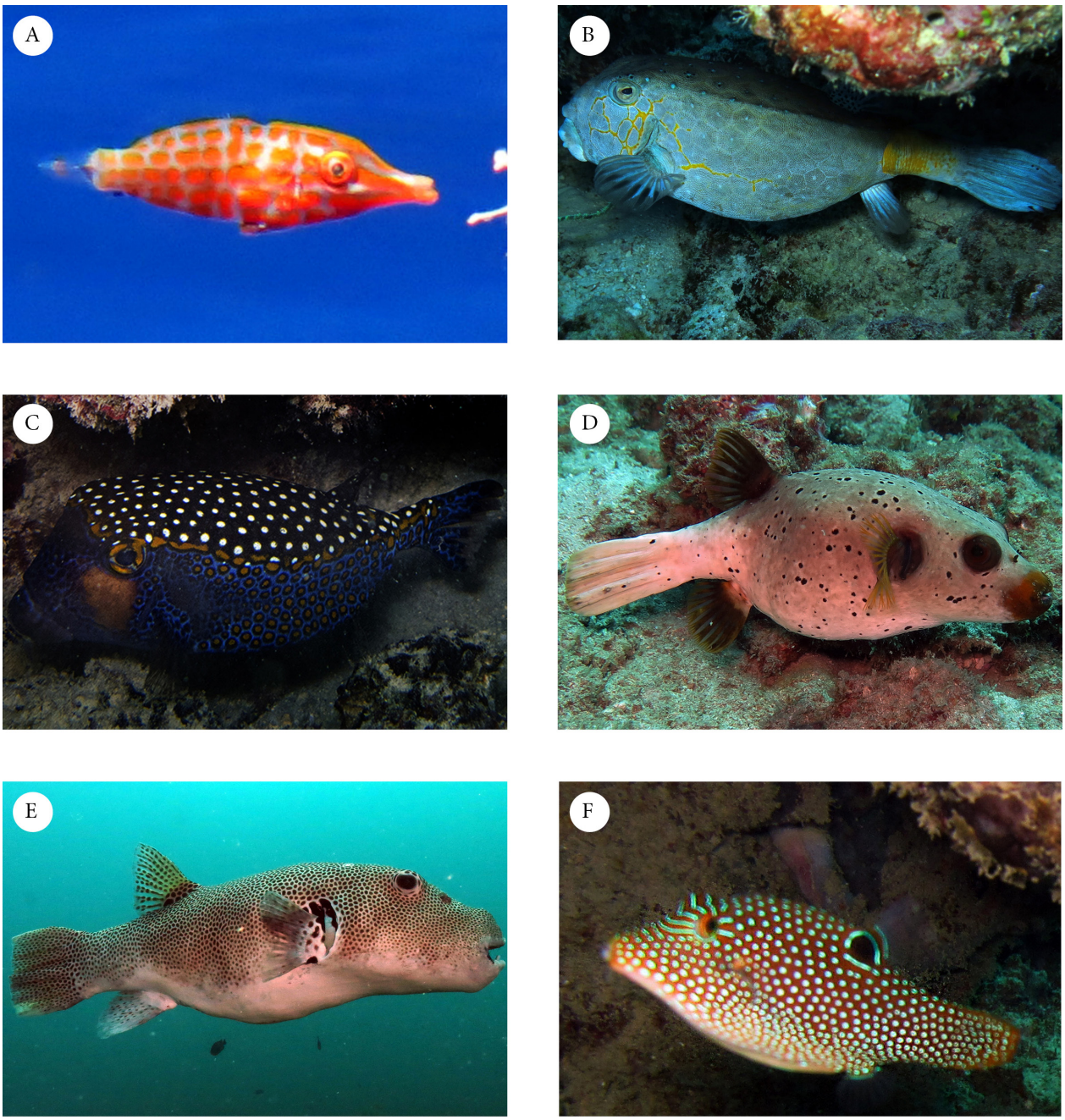

Figure 3. Some species of fish belonging to the order Tetraodontiformes from the Andaman and Nicobar Islands. **A.** *Oxymonacanthus longirostris*. **B.** *Ostracion cubicus*. **C.** *Ostracion melegris*.**D.** *Arothron nigropunctatus*. **E.** *Arothron stellatus*. **F.** *Canthigaster petersii*.

Family Diodontidae

Chilomycterus reticulatus (Linnaeus, 1758)

We observed 2 individuals at Kwangtung Island in the North Andaman region. Body brown to grey with white underside; numerous fixed triangular under-spines; body and fins covered with black spots and 3 dusky bars; dusky bar under eye.

Diodon liturosus Shaw, 1804
Figure 2H

We observed 10 individuals at 6 islands (7 sites) in 5 geographical regions. Body brown with numerous short to long movable spines; large dark brown to black blotches with white margins on the back and around and below the eye.

Family Monacanthidae

Oxymonacanthus longirostris (Bloch & Schneider, 1801)
Figure 3A

Observed 2 individuals from Cabra Island in the Nicobar archipelago. Body blue-green with rows of orange spots; tail with prominent black spot; snout elongate, with mouth small and upturned.

Paraluteres arqat Clark & Gohar, 1953

We observed 20 individuals at 6 islands (6 sites) in 4 geographical regions. Upper body dark brown; body white below, with numerous small white spots.

Family Ostraciidae

Ostracion cubicus Linnaeus, 1758
Figure 3B

We observed 3 individuals at 3 islands (3 sites) in the southern Andaman and central and Nicobar regions. Body yellowish brown, with dark-ringed bluish spots; fins blue with black spots; head and around pectoral fins may have black to blue or yellow margins; snout with a bump on tip.

Ostracion meleagris Shaw, 1796
Figure 3C

We observed 2 individuals at Camorta Island from the Central Nicobar region. Back dark brown with white spots; head and sides blue with bright orange spots, area below eye pale pinkish.

Family Tetraodontidae

Arothron **hispidus** (Linnaeus, 1758)

We observed 20 individuals at 7 islands (23 sites) in the Central and Southern Nicobar regions. Upper body grey; lower body pale grey coloured with white spots; eye with white ring around it; large white-edged black ring around pectoral fin base.

Arothron nigropunctatus (Bloch & Schneider, 1801)
Figure 3D

We observed 30 individuals at 19 islands (23 sites) in 5 geographical regions. Body white with black markings; lips black, thick; mouth protruding; base of pectoral fins black, with a few scattered black spots.

Arothron stellatus (Anonymous in Lacépède, 1798)
Figure 3E

We observed 3 individuals at 3 islands (3 sites) from the East Andaman region. Body pale grey with a dense covering of black spots and irregular blotches around pectoral fin base.

Canthigaster amboinensis (Bleeker, 1864)
We observed 4 individuals at Sister Island in the South Andaman region. Body brown to orange, with small blue and blackish spots, underside bluish; head with dark brown to blue spots and bands; on the body.

Canthigaster coronata (Vaillant & Sauvage, 1875)

We observed 2 individuals at Menchal Island in the Southern Nicobar region. Head white with a dark brown bar between eyes; body white with 3 wedge-shaped dark brown to black saddles on back outlined with yellow-orange spots.

Canthigaster petersii (Bianconi, 1854)
Figure 3F

We observed 4 individuals at 2 islands (2 sites) from the East and Southern Andaman regions. Body brown with white spots on the back, orange around mouth region; black spot on dorsal fin base.

Canthigaster valentini (Bleeker, 1853)

We observed 6 individuals at 4 islands (4 sites) in the East Andaman and Central and Southern Nicobar regions. Body white with light brown spots and 4 dark brown to brackish saddles, the middle 2 saddles extend onto the ventral side.

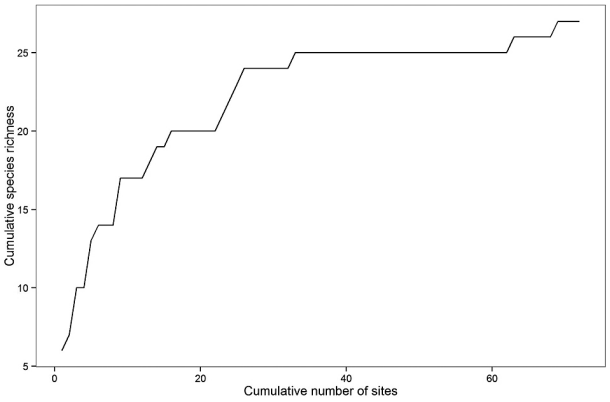

Figure 4. Non-randomized cumulative species accumulation curves with sites ordered from southern Nicobar to northern Andaman Islands. The reported number of species was highest at sites located at Nicobar and South Andaman regions, where they contribute to 17 out of the 25 species reported. Among islands towards higher latitudes, the curve shows an increase at the Japanese bunker site after which only 3 species were added to the curve for 39 sampled islands in middle and North Andaman regions.

Patterns in species richness. We documented 25 species across 16 genera and 6 families (Table 1). Cumulative species richness was highest in Southern Nicobar, Central Nicobar, and South Andaman regions (Fig. 4). Nine species were found only on a single island, while most species (n = 17) were found at fewer than 5 islands.

The highest species richness within the 6 regions was in the Central Nicobar and Southern Nicobar regions (n = 17 spp.), as compared to Middle Andaman region (n = 7 spp.) (Table 2). A few species, i.e., *Balistapus undulatus*, *Melichthys indicus*, *Sufflamen bursa*, *S. chrysopterus*, and *Arothron nigropunctatus*, were common at all sites (n = 52). In contrast, *Balistoides conspicillum*, *Melichthys vidua*, *Chilomycterus reticulatus*, *Oxymonacanthus longirostris*, *Ostracion melegris*, *Canthigaster amboinesis,* and *C. coronata* were rare and were reported only once during our surveys (Table 1).

Discussion

We provide baseline data on the occurrence and distribution of fish belonging to the order Tetraodontiformes from 6 geographical regions in the Andaman and Nicobar Islands. We recorded 25 species belonging to 6 families and 16 genera. Out of these six; Red Tailed Triggerfish (*Xanthiycthys mento*), Spotfin Burrfish (*Chilomycterus reticulatus*), False Pufferfish (*Paraluteres arqat*), Peter's Tobi (*Canthigaster petersii*), Spider-eye Pufferfish (*Canthigaster amboinensis*) and the Crowned Pufferfish (*Canthigaster coronata*) could be possible new records as they are not previously recorded from the Andaman and Nicobar Islands.

Most tetraodontiform species occupy wide benthic

Table 1. List of tetraodontiform fishes recorded from the Andaman and Nicobar Islands, India.

Species name	Food/diet	Guild	Position in water column	Distribution					
				NA	MA	EA	SA	CN	SN
Balistidae									
Balistapus undulatus	Algae, echinoderms, fishes, molluscs, tunicates, sponges, hydrozoans	Omnivore	Benthic Feeder	+	+	+	+	+	+
Balistoides conspicillum	Sea urchins, crabs, other crustaceans, molluscs, tunicates	Macroinvertivore	Benthic Feeder	–	–	–	+	–	–
Melichthys indicus	Sponges, algae, crustaceans, small invertebrates	Omnivore	Benthic feeder	+	+	+	+	+	+
Melichthys niger	Phytoplankton, zooplanktons, calcareous algae	Algal feeder	Mid-water	–	–	+	–	–	+
Melicthys vidua	Algae, detritus organisms, crustaceans, octopuses, sponges, fishes	Omnivore	Benthic Feeder	–	–	–	+	–	–
Odonus niger	Zooplanktons, sponges	Zooplanktivore	Benthic Feeder	–	–	+	+	+	+
Pseudobalistes flavimarginatus	Coral polyps, gastropods, crustaceans, molluscs, tunicates,sea urchins	Macroinvertivore	Benthic Feeder	–	+	+	+	+	+
Pseudobalistes fuscus	Sea urchins, crustaceans, molluscs, dead fishes, tunicates, corals	Omnivore	Benthic Feeder	–	–	+	–	+	–
Rhinecanthus aculeatus	Algae, detritus, molluscs, crustaceans, worms, sea urchins, fishes, tunicates	Omnivore	Benthic Feeder	–	–	–	–	+	+
Sufflamen bursa	Sponges, crustaceans, fish eggs, small invertebrates, fishes	Omnivore	Benthic Feeder	+	+	+	+	+	+
Sufflamen chrysopterus	Algae, crustaceans, sponges, small invertebrates, fishes	Omnivore	Benthic Feeder	+	+	+	+	+	+
Xanthichthys mento	Coral polyps, gastropods, crustaceans, mollusc, tunicates, sea urchins	Macroinvertivore	Benthic Feeder	–	–	–	–	+	+
Diodontidae									
Chilomycterus reticulatus	Hard-shelled invertebrates	Macroinvertivore	Benthic Feeder	+	–	–	–	–	–
Diodon liturosus	Coral polyps, crustaceans, mollusc, tunicates, sea urchins	Macroinvertivore	Benthic Feeder	+	–	+	+	+	+
Monacanthidae									
Oxymonacanthus longirostris	Coral polyps	Corallivore	Mid Water	–	–	–	–	–	+
Paraluteres arqat	Molluscs, algae, seaweeds	Micoinvertivore	Benthic Feeder	–	–	+	–	+	+
Ostraciidae									
Ostracion cubicus	Algae, invertebrates, molluscs, sponges, sand dwelling polychaetes, crustaceans, foraminifera, molluscs, crustaceans, fishes	Omnivore	Benthic Feeder	–	–	–	+	+	+
Ostracion melegris	Tunicates, polychaetes, sponges, molluscs, sea urchins copepods, algae	Omnivore	Benthic Feeder	–	–	–	–	+	–
Tetraodontidae									
Arothron hispidus	Fleshy, calcareous, or coralline algae, detritus, molluscs, tunicates, sponges, corals, zoanthids, anemones, crabs, tube worms, echinoderms	Omnivore	Benthic Feeder	–	–	–	–	+	+
Arothron nigropunctatus	Corals (usually *Acropora* sp.), crustaceans, molluscs, sponges, tunicates, algae	Omnivore	Benthic Feeder	+	+	+	+	+	+
Arothron stellatus	Fleshy, calcareous, or coralline algae, detritus, molluscs, tunicates, sponges, corals, zoanthids, anemones, crabs, tube worms, echinoderms	Omnivore	Benthic Feeder	–	+	–	+	–	–
Canthigaster amboinensis	Algae, polychaetes, sea urchins, brittle stars, molluscs, tunicates, sponges, corals, crustaceans	Omnivore	Benthic Feeder	–	–	–	+	–	–
Canthigaster coronata	Gastropods, sponges, algae, bivalves, polychaetes, tunicates, crabs, sea urchins, brittle stars, bryozoans, peanut worms, crustaceans, foraminifera	Omnivore	Benthic Feeder	–	–	–	–	–	+
Canthigaster petersii	Algae, polychaetes, sea urchins, brittle stars, molluscs, tunicates, sponges, corals, crustaceans	Omnivore	Benthic Feeder	–	–	+	+	–	–
Canthigaster valentini	Filamentous green, red algae, tunicates, on smaller amounts of corals, bryozoans, polychaetes, echinoderms, molluscs,, brown, coralline red algae	Omnivore	Benthic Feeder	–	–	+	–	+	+

Distribution key CN: Central Nicobar (comprising of Islands: Camorta, Katchal, Nancowry, Trinket), SN: Southern Nicobar (comprising of Islands: Cabra, Great Nicobar, Kondul, Little Nicobar, Menchal); EA: East Andaman (comprising of Islands: Guitar, Havelock, Henry Lawrence, Hugh Ross, John Lawrence, Neil, North Bay, North Button, North Passage, Outram, Strait); MA: Middle Andaman (comprising of Islands: Eastern Reef, Interview, Long, Middle Button, Sound, South Reef); NA: North Andaman (comprising of Islands: Aves, Craggy, Delgarno, East Island, Excelsior, Kwang Tung, Landfall, Latouche, North Reef, Reef Island, Ross, Smith, West Island, White Cliff); SA: South Andaman (Comprising of Islands: Boat, Chester, Cinque, Grub, Jolly Buoy, Malay, Red Skin, Rutland, Sister, Tarmugli, Twins).

Table 2. Species richness and abundance among six geographical regions of the Andaman and Nicobar Islands.

Region	No. of islands	Species Richness (mean, standard error)	Abundance (mean, standard error)
Southern Nicobar	5	17 (7.6 ± 0.5)	339 (67.8 ± 26.7)
Central Nicobar	4	17 (7.5 ± 2.21)	251 (62.75 ± 27.7)
South Andaman	11	14 (3.9 ± 0.71)	150 (13.63 ± 3.02)
East Andaman	10	13 (5.0 ± 0.59)	182 (18.2 ± 3.18)
Middle Andaman	6	7 (2.8 ± 0.79)	60 (10.0 ± 3.6)
North Andaman	14	9 (1.9 ±0.30)	99 (7.07 ± 2.0)

habitats and are omnipresent within geographical, latitudinal and habitat gradients. Our data show that in the Southern Nicobar region species richness of tetraodontiform fish is higher than the other regions. This could be due to the higher live coral cover in this region than in the Andaman Islands. The Southern Nicobar region is also closer to the Coral Triangle, which is believed to be the centre of the origin of coral reefs and has high biodiversity of corals and reef fishes. We found that a few species are apparently restricted to a single site and their overall observed abundance was low. This could be due to problems with detection during sampling or site fidelity of these fish, with preferences to certain physicochemical factors and habitat structure.

Unlike specialist reef fish groups which include the coral-feeding butterflyfish, the herbivorous parrotfish and surgeonfish and predatory groupers and sharks, tetraodontiforms are relatively neglected by surveys to determine fish distribution and while delineating conservation areas (Matsuura 2014). Tetraodontiforms have important ecological functions in balancing the marine food web by feeding on multiple trophic groups (Table 1), which indirectly influence the structure and composition of the reefs. *Oxymonacanthus longirostris*, which is an obligate corallivore, feeds exclusively on *Acropora* polyps. *Xanthichthys mento* are known to congregate in large numbers to feed on zooplankton on the water surface, and contribute to zooplanktivory. *Balistapus undulatus* feeds on sea urchins, which keeps herbivory by sea urchins in check (McClanahan 2000). Considering the complex roles these fish play at multiple trophic levels in the reef environment, it is imperative to improve our understanding of the occurrence and distribution of this fish group in reef areas.

The absence of conclusive documentation of the ecology, habitat requirements and resistance to catastrophes, further reiterates the need for more intensive, detailed sampling of tetraodontiform fishes from the Andaman and Nicobar Islands. Future studies should concentrate on photo-documenting these species presence to establish their range extension and new records. Additional information on the predator-prey relationship between species, temporal variations in their abundance and distributions, as well as impacts of natural and anthropogenic catastrophes on tetraodontiform fish assemblages could reveal important information about the local ecological role in the coral reef ecosystem of the Andaman and Nicobar Islands. Nevertheless, our study provides baseline data needed to carry out future continuous monitoring of reef fish.

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Authors' Contributions

VP collected the data, VP and AP wrote the text and identified the species, ZT and TW helped in preparing the map and in formatting and writing the manuscript. AM carried out the analysis.

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Supplemental Data

Supplementary data of the observations made during this study are available online. This dataset contains information on surveyed regions, name of samples sites, sampling depth, aspects, longitude and latitude, number of transects at each site, depth, ecosystem type, information on different benthic characteristics of the site (i.e., live coral cover, crustose coralline algae, fleshy algae, macroalgae, turf algae, dead coral cover, rubble, sand, soft coral and others), scientific names of tetraodontoform fishes, their size-class, abundance and biomass values and information on feeding guilds, family and water column where they are commonly known to be found.