



## DIVERSITY, DISTRIBUTION AND CONSERVATION OF FRESHWATER FISHES IN MOUNT HARRIET NATIONAL PARK, ANDAMAN AND NICOBAR ISLANDS

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### INTRODUCTION

Mount Harriet national park lies between 10°43'57"N latitudes and 92°43'41" to 92°47'11" E longitudes. The area of park is about 46.62 km<sup>2</sup> and there is also a proposal to extend the area by another 1700 hectares to include the adjacent hill ranges on Southern part and to conserve the marine ecosystem along the Eastern coast (Fig. 1). The park possesses various hill ranges, which generally lie in the north and south direction as islands. From these, numerous spurs and ridges branch out in east and west directions. The hills are steeper on the east than on west. The principal peaks are Mt. Koyob (460m, the highest peak of N.P), Mt. Hext. (424m), Mt. Harriett (422m), Mt. Godridge (377m) and Mt. Carpenter (373m). The park is covered with different types of thick green vegetation. The beaches on eastern coast are generally rocky with a few sandy patches. The park also possesses a few fresh water streams, arising from the hill ranges and draining into the east coast also in the west as small streams which fulfill the water required by the villagers and residents of Bambooflat, Stewart Gunj, Nayapuram, Wimberly Gunj, Mannarghat, Malapuram, Wrightmyo, Kallatang and Shoalbay areas. There is one impoundment as earthen dam on one of the stream at Bambooflat, has a capacity of 230 million liter was constructed in 1990 as a water storage facility. The Chief Commissioner, Andaman and Nicobar islands declare his

intention to constitute the Mount Harriett national Park under subsection (1) of section 35 of Wildlife (Protection) Act 1972 (No. 53 of 1972) and was notified vide Notification No. 161/CF/HQ/12(6) 2 on Wednesday, dated 13th November 1979. The major forest types from Mt. Harriett National Park include Giant Evergreen Forest, Andaman Tropical Evergreen Forest, Andaman Semi Evergreen Forest, Andaman Moist Deciduous Forest and Littoral Forest. Mount Harriett National Park is one of the few pristine areas within the Andaman Archipelago, where, almost all the major groups of animal's characteristics of tropical rain forests are well represented. The composition of terrestrial fauna of National Park shows greater similarities with that of Myanmar and Indo-China. Some species are restricted only to Andaman and sometimes even to certain islands, while some are common to both the groups of islands. Hitherto, 529 species are known from Mount Harriett National Park, of which 149 are endemic to species/subspecies level (Kailash and Rajan, 2004). The highest endemism has been recorded in case of butterflies, which is more than 66 per cent followed by the birds (50 per cent). These two groups have been extensively studied. Information on freshwater fishes of Mount Harriett National Park is inadequate. This research aimed at diversity and distribution of fish in Mount Harriet streams and also to assess the

status of the freshwater fishes. Nelson (2006) estimated 27,977 valid species of fishes under 62 orders, 515 families and 4,494 genera, and the eventual number of extant fish species was projected to be close to 32,500. About 11,952 species or 42.72 %, normally live in freshwater lakes and rivers that cover only 1 % of the earth's surface and account for a little less than 0.01% of its water. The secondary freshwater species number 12,457 and the remaining 3568 species are exclusively marine. Some early contributions on freshwater fish fauna were on diversity and distribution (Day, 1870, 1875-78; Hora 1925; Mukerji 1935; Herre (1939, 1940, 1941) listed 112 and 490 species including shoreline, coral reef fishes and very few freshwater fishes from the streamlets of Andaman Islands; study on Gobiidae (Koumans 1940); Silas, and Dawson, 1961; Sen, 1975. Rema Devi (2010) listed 23 species, of these only 8 are primary fresh water fishes and others are secondary fresh water fishes encountered in fresh water habitats and 39 species of fishes visiting fresh water.

#### MATERIALS AND METHODS

A short study was undertaken from May 2011 to August 2012, to assess the species diversity and composition of freshwater fishes in five tributaries of freshwater streams in the foothills of Mount Harriet National Park, South Andaman. Riverine substrate is dominated by boulders with small patch of muddy or silted areas. The banks of the streams are generally steep, with overhanging trees and assorted shrubs. At each site GPS coordinates were recorded on a Garmin series GPS unit. Cast nets and hand line were used for fish sampling, which was done from 8.00 a.m. to 1.00 p.m. in addition to this bamboo traps were used in the night to collect freshwater eels. Netted and trapped fishes were then stored by species in water-filled buckets. The majority of the fishes, after on field studies made, were released in the stream with no harm done. All the material studied has been deposited in the reference collections of Zoological Survey of India at Port Blair.

## RESULTS

A total of 152 individuals of 24 species belonging to 6 orders, 12 families and 19 genera (Table 1) were collected from the streams of Mount Harriet National Park, South Andaman (fig.1). Brief description of the individual fish species sampled during the field visits.

### Class OSTEICHTHYES

#### Order ELOPIFORMES

Body slender and compressed; gill openings wide; paired fins with long axillary scale; no spines in fins; ventral fins abdominal; caudal fin deeply forked; scales cycloid.

#### Family MEGALOPIDAE

Body somewhat compressed; slightly deep-bodied; no scutes on belly; mouth terminal, fairly large; bony gularplate located under mouth; single dorsal fin, the last ray elongated; anal fin origin slightly behind last dorsal ray; no spines in fins; scales on body large; caudal fin forked.

Genus : *Megalops* Lacepede, 1803

#### *Megalops cyprinoides* (Broussonet, 1782)

*Clupea cyprinoides* Broussonet, 1782. Ichthyol., pl. 9.

*Megalops cyprinoides*: Smith, 1986. in Smith & Heemstra, Smith's Sea Fishes, p. 156, fig. 37.1.

*Diagnostic features*: D. 18-20; A. 26-28; P. 15-16; V. 10-11; Ll. 38-40. Body fusiform; mouth superior; lower jaw projecting; a median gular bone under side of chin; upper jaw extending to hind border of eye; last dorsal ray elongated and filamentous. Body blue-green above, flanks silvery.

*Habitat*: Found in creeks and coastal waters. Distribution: Into-West Pacific, from east coast of Africa, Gulf of Oman, coasts of India, Andaman Is., Sri Lanka to Indonesia and Philippines to China Sea.

#### Order ANGUILLIFORMES

Body snake-like with low dorsal and anal fins, continuous with caudal fin; ventral fins absent; pectoral fins present or absent; no spines in fins; gill openings narrow as a slit or hole on each side; scales absent or small, embedded; maxilla toothed.

## Fish Diversity

Table 1: List of species grouped into orders and families

Order	Family	Species
ELOPIFORMES	Megalopidae	<i>Megalops cyprinoides</i> (Broussonet, 1782)
ANGUILLIFORMES	Anguillidae	<i>Anguilla bengalensis bengalensis</i> (Gray, 1834) <i>Anguilla bicolor bicolor</i> (McClelland, 1844)
CYPRINIFORMES	Cyprinidae	<i>Rasbora daniconius</i> (Hamilton, 1822)
SILURIFORMES	Clariidae Heteropneustidae	<i>Clarias magur</i> (Hamilton 1822) <i>Heteropneustes fossilis</i> (Bloch, 1794)
CYPRINODONTIFORMES	Aplocheilidae	<i>Aplocheilus panchax</i> (Hamilton, 1822)
PERCIFORMES	Kuhilidae Cichlidae Gobiidae Eleotridae Anabantidae Channidae	<i>Kuhila mugil</i> (Forster, 1801) <i>Kuhlia rupestris</i> (Lacepede, 1802) <i>Oreochromis mossambicus</i> (Peters, 1852) <i>Awaous grammepomus</i> (Bleeker, 1849) <i>Bathygobius fuscus</i> (Ruppell, 1830) <i>Glossogobius giuris</i> (Hamilton, 1822) <i>Sicyopterus microcephalus</i> (Bleeker, 1854) <i>Stenogobius gymnopomus</i> (Bleeker, 1853) <i>Belobranchus</i> sp. (new species) <i>Butis butis</i> (Hamilton, 1822) <i>Eleotris andamensis</i> Herre, 1939 <i>Eleotris fusca</i> (Bloch & Schneider, 1801) <i>Giuris margaritacea</i> (Valenciennes 1837) <i>Anabas testudineus</i> (Bloch, 1792) <i>Channa gachua</i> (Hamilton, 1822) <i>Channa punctatus</i> (Bloch, 1793)

## Family ANGUILLIDAE

Body slightly robust, tail compressed; small embedded scales on body; median fins continuous around tail; dorsal fin origin mid way between pectoral base and anus; lips thick; lateral line complete with small pores.

Genus *Anguilla* Schrank, 1798

*Anguilla bengalensis bengalensis* (Gray, 1831)

*Muraena bengalensis*, Gray, 1831. *Illust. Nidian Zool.*, pl. 95.

*Anguilla bengalensis bengalensis*: Talwar & Jhingran, 1991. *Inland Fishes of India and Adjacent Countries* 1: 74

**Diagnostic features:** Dorsal origin nearer to anus than pectoral base; teeth a narrow band, toothless groove between innermost row and outer rows on jaws; vomerine tooth band very narrow posteriorly. Body olive-yellow, mottled with brown, lighter latero-ventrally.

**Habitat:** Found in creeks and back waters.

**Distribution:** India, Andaman Is. and Sri Lanka.

*Anguilla bicolor bicolor* Mc. Clelland, 1844

*Anguilla bicolor* Mc Clelland, 1844. *J. nat. Hist., Calcutta*, p. 174, pl. 6, fig. 1.

*Anguilla bicolor bicolor*: Castle, 1986. in Smith & Heemstra, *Smith's Sea Fishes*, p. 160, fig. 39.2.

**Diagnostic features:** Dorsal fin origin slightly before anus; close-set broad bands of teeth on jaws and vomer; vomerine tooth band broad posteriorly. Body dark bluish-brown, lighter below from head to anus.

**Habitat:** Found in creeks.

**Distribution:** Indian Ocean, from Kenya, Madagascar, Seychellies, Mauritius, coasts of India and Andaman Islands.

## Order CYPRINIFORMES

Small to moderate sized fishes; mouth protractile and toothless; barbells present or absent; single dorsal fin with no spines; adipose

fin absent; ventral fins abdominal; body with cyloid scales; head scaleless; lateral line present; branchiostegal rays 3.

#### Family CYPRINIDAE

Body compressed, abdomen rounded or with sharp edge; mouth terminal; no teeth in jaws; lips thin; barbells present or absent; pharyngeal teeth well developed in one to three rows; anal fin short based; head naked.

#### Genus *Rasbora* Bleeker, 1860

#### *Rasbora daniconius* (Hamilton, 1822)

*Cyprinus daniconius* Hamilton, F. 1822. An account of the fishes found in the river Ganges and its branches: 327, 391, Pl. 15 (fig. 89).

*Rasbora daniconius* Liao, T. Y., S. O. Kullander, and F. Fang 2010. Phylogenetic analysis of the genus *Rasbora* (Teleostei: Cyprinidae). *Zoologica Scripta* v. 39 (no. 2): 166.

**Diagnostic features:** D. 9; A. 7; P. 14; V. 9; Ll. 32-34; Ltr.  $4\frac{1}{2} + 1 + 2\frac{1}{2}$ . Body oblong and compressed; mouth small; lips simple; lateral line almost complete. Body olive, sides and belly silvery; a distinct black stripe from eye to base of caudal fin, edged above and below by a thin golden line; a dark narrow stripe above anal fin.

**Habitat:** Found in pools and streams.

**Distribution:** Pakistan, India, Andaman Island, Sri Lanka, Bangladesh, Burma and Mekong.

#### Order SILURIFORMS

Body elongate and compressed, naked or covered with bony plates; eyes small, majority of the fishes have barbells extending from each side of the upper and lower jaws; spines often present at front of the dorsal and pectoral fins; no ventral fin spine; adipose dorsal fin usually present; pectoral fin low in position.

#### Family CLARIIDAE

Body cylindrical and elongate; head broad and flattened; eye small; anterior nostrils tubular behind upper lip; posterior nostrils rounded slits behind nasal barbells; four pairs of barbells; labrynthic organ well developed or vestigial;

dorsal fin base very long, not preceded by spine; no adipose fin; pectoral with strong spine; skin naked.

#### Genus *Clarias* Scopoli, 1777

#### *Clarias magur* (Hamilton 1822)

*Macropteronotus magur*, Hamilton, F. 1822. An account of the fishes found in the river Ganges and its branches: 146, 374, Pl. 26 (fig. 45).

*Clarias magur*, Ng, H. H. and M. Kottelat 2008. The identity of *Clarias batrachus* (Linnaeus, 1758), with the designation of a neotype (Teleostei: Clariidae). *Zoological Journal of the Linnean Society* v. 153: 370.

**Diagnostic features:** D. 70-76; A. 45-58; P. I, 8-11; V. 6. Body elongate, head compressed; occipital process narrow, mouth terminal with villiform teeth on jaws; vomerine teeth villiform in a cressentic band or two pyriform patches; barbells four pairs, the maxillary pair extending beyond base of pectoral fin and nasal pair extend to gill openings; dorsal fin inserted anterior to tip of pectoral fins; pectoral spine strong and serrated on both edges. Body greenish-blue, flanks and belly pinkish with numerous pale to white spots on flanks; dorsal fin yellowish with red margin.

**Habitat:** Found in pools, ponds and rivers.

**Distribution:** Pakistan, India, Andaman Is., Sri Lanka, Burma to Philippines.

#### Family HETEROPNEUSTIDAE

Body elongate and compressed, head flat; dorso-lateral side covered with osseous plates; mouth small; four pairs of barbells; air-sac elongated; dorsal fin without spine; adipose fin absent; anal fin extremely long; pectoral fin with strong spine; body naked.

#### Genus *Heteropneustes* Muller, 1840

#### *Heteropneustes fossilis* (Bloch, 1794)

*Silurus fossilis* Bloch, 1794. *Nat. Ausland. Fische.*, 8: 46, pl. 370, fig. 2.

*Heteropneustes fossilis*: 1991. Talwar & Jhingran, *Inland Fishes of India and adjacent countries*, 2: 689, fig. 219.

**Diagnostic features:** D. 6-7; A. 65-68; P. I, 7; V. 6. Occipital process not extending to base of dorsal fin; four pairs of barbells; pectoral spine strong

and serrated; anal fin separated by a distinct notch from caudal fin. Body dark purplish-brown above, lighter below with two lateral yellowish bands.

*Habitat:* Found in ponds, swamps and rivers.

*Distribution:* Pakistan, India, Andaman Is., Sri Lanka, Bangladesh to Thailand.

#### Order CYPRINODONTIFORMES

Body fusiform, compressed, elongate or moderately elongate; opercular bones without spines; single dorsal fin; both dorsal and anal fins inserted on rear half of body; no spines in fins; upper or both jaws extremely elongate; branchiostegal rays 4-15.

#### Family APLOCHEILIDAE

Body fusiform and compressed, upper jaw protrusible; villiform teeth on jaws and vomer; single dorsal fin, inserted on posterior third of body; no spines in the fin; ventral fin bases set close together, fin rays 6; large cycloid scales on body; lateral on head, not on body.

Genus *Aplocheilus* Mc Clelland, 1839

*Aplocheilus panchax* (Hamilton, 1822)

*Esox panchax* Hamilton, 1822. *Fishes of Gages*, p. 211, 380, pl. 3, fig. 69.

*Aplocheilus panchax* : Talwar & Jhingran, 1991. *Inland Fishes of India and adjacent countries*, 2: 752, fig. 241.

*Diagnostic features:* D. 8; A. 15; P. 14; V. 6. Ls. 33. Body elongate and compressed; eyes large, 3.3-3.4 in head; mouth terminal; anal fin square shaped; ventral fins small; caudal fin rounded. Upper part of body greenish, dull white ventrally; fins light yellow; a black at base of dorsal fin; margin of anal fin reddish.

*Habitat:* Found in streams and ponds.

*Distribution:* Pakistan, India, Andaman Is., Bangladesh, Burma and Malayan Archipelago.

#### Order : Perciformes

Family: *Kuhliidae* (Flagtails)

Body elongate-oval and fairly compressed, with weakly ctenoid scales. Preopercle serrate; opercle with two exposed flat spines. Mouth with fine teeth in bands on jaws, also on vomer and

palatines; tongue toothless. Fin spines strong; a notch before soft dorsal fin; anal fin with 3 spines. Dorsal and anal fins each with a well developed scaly sheath; no scaly pelvic axillary process. Branchiostegal rays 6.

Genus *Kuhila* Gill, 1861

*Kuhila mugil* (Forster, 1801)

*Sciaena mugil* Forster, 1801, *Systema Ichthyol.*: 541 (type locality: Tahiti).

*Kuhila rupestris* : Talwar & Jhingran, 1991. *Inland Fishes of India and adjacent countries*, 2: 814.

*Diagnostic features:* D. X 10-11; A. III, 10-13; P. I 13; V. I 5. Ll. 48-56. Body rather oval, its depth 2.7 to 3.1 times in standard length. Gillrakers 23-25 on lower arm of first arch. Caudal fin covered with small scales, larger basally. Colour in life bluish above, silvery on flanks and belly; fins yellowish; caudal fin with two prominent black oblique bands across each lobe and a narrower black band along middle rays of fin.

*Habitat:* Inhabits freshwater and estuaries, rarely in seas.

*Distribution:* Indo-West Pacific.

*Kuhila rupestris* Lacepede, 1802

*Centropomus rupestris* Lacepede, 1802, *Hist. nat. Poiss.*, 4: 252 (type-locality: Reunion Is.)

*Kuhila rupestris*: Talwar & Jhingran, 1991. *Inland Fishes of India and adjacent countries*, 2: 814.

*Diagnostic features:* D. X 10-12; A. III, 9-10; P. I 12-13; V. I 5. Ll. 38- 44. Body rather oval, its depth 2.6 to 3 times in standard length. Gillrakers 17-19 on lower arm of first arch. Colour in life silvery, in fresh most scales with a large dusky spot; juveniles often with oblique blackish blotch on each caudal lobe merging with growth to give broad vertical bar in adults.

*Habitat:* Inhabits freshwater and estuaries, rarely in seas.

*Distribution:* Indo-West Pacific.

Family CICHLIDAE (Cichlids)

Body moderately deep and compressed. Single nostril on each side of snout. Teeth on jaws; palatines and vomer edentulous. Dorsal fin with

12 to 22 spines and 8 to 23 soft rays; anal fin with 3 to 16 spines and 6 to 24 soft rays. Lateral line interrupted or abruptly ceasing, usually with 30 to 40 scales. Pseudobranchiae absent. Branchiostegal rays 6. Air bladder large and simple.

Genus *Oreochromis* Gunther, 1889

*Oreochromis mossambicus* (Peters, 1852)

*Chromis (Tilapia) mossambicus*, Peters, 1852, *Montab. Akad. Wiss., Berlin*: 681 (type locality: Mozambique).

*Oreochromis mossambica*, Jayaram, K. C. 2010. *The freshwater fishes of the Indian region*: 463.

**Diagnostic features:** D XV-XVI 10-12; A III 10-11; P 14-15; V I 5. Body elongate, deep and compressed; Upper profile of body more convex than lower. Mouth large; teeth in 3 to 5 series on jaws. Caudal fin truncate; 30 to 32 scales in lateral line. Colour of females and non breeding males watery grey to yellowish, with 3 to 4 dark blotches; body of breeding males deep black. Dorsal fin black with a red margin; pectoral fins translucent red; caudal fin with a broad red margin.

**Habitat:** Found in primarily brackish waters and also freshwaters.

**Distribution:** East Africa; an introduced species in India and other countries.

**Remark:** This species was introduced in India in August 1952 and is cultured in freshwater ponds. These fish are suitable for farming because they can breed easily and are hardy and also high yielding. In Andaman Islands it was introduced in 1970 in ponds, due to tsunami of 2004 this fish penetrates in creeks and some of the freshwater streams. The introduction of alien species can have a profound and devastating impact upon an ecosystem. Since the introduction of the Tilapia, some of the species are either extinct or only occur in very small populations. Tilapia now comprises 40% of the fish biomass. Their introduction has probably led to the extinction of native climbing perch (*Anabas* sp) in some of the freshwater streams.

## Family ELEOTRIDAE

Small to moderate fishes; teeth in jaws small conical in several rows; no lateral line; canals and pores present on head; branchiostegal rays 6; ventral fins widely separated; second dorsal short based, much less than caudal peduncle length; anal fin origin behind dorsal origin; scales ctenoid or cycloid; body and most part of head region scaled.

Genus *Belobranchus* Bleeker, 1857

**Diagnostic features:** D. VII, 8; A. 8; P. 19-23; V. I, 5; Ll. 70; Ltr. 20; predorsal scales 30. Body elongate, cylindrical anteriorly, compressed posteriorly; head depressed; snout convex; lower jaw prominent; anterior nostril in a rim; teeth in front in a few rows, outer row a little enlarged; no distinct pore on head; supraopercular groove distinct; a mucous canal round each eye; continued in the supraopercular groove; first branchiostegal ray form a spine; first dorsal fin obtuse, 3<sup>rd</sup> to 6<sup>th</sup> rays longest; caudal fin rounded. Colour dark to obvious above, dark to yellowish below; 4-5 longitudinal dark reddish-brown stripes radiating from eye to preopercle; 8-9 longitudinal dark blotches on body; fins yellowish to orange; dorsal fins with longitudinal stripes; pectoral fin base with dark blotch; a dark spot at caudal peduncle. **Habitat:** freshwater pools and streams. **Distribution:** Andaman Islands. **Remark:** New to India

Genus *Butis* Bleeker, 1856

*Butis butis* (Hamilton, 1822)

*Cheilodipterus butis* Hamilton, 1822. *Fishes of Gange*, p. 57, 367.

*Butis butis*: Hoese, in Smith & Heemstra, 1986. *Smith's Sea Fishes*, p. 808, fig. 241.1.

**Diagnostic features:** D. VI + I, 8; A. I, 8; P. 18-20; V. I, 5; Ls. 28-30. Depth 5.4-5.9 in standard length; head depressed; maxilla reaches below front edge of eye; predorsal scales 22-24. Body dark with several longitudinal lines; caudal fin dark, upper margin light; base of pectoral with black spot.

**Habitat:** Found in back water and creeks.

Relationship of the genus *Belobranchus* with other genera of Eleotridae (Larson and Murdy 2001)

<i>Eleotris</i>	<i>Butis</i>	<i>Belobranchus</i>	<i>Ophiocara</i>
Rear of preopercle with a ventrally directed spine (covered by skin); predorsal scales 35-53.	Bony irregular ridge or row of spiny serrations above eye and on top of snout (spines may be indistinct) Lower jaw distinctly anteriormost, chin protruding; head without fleshy knobs or barbels on chin; distinct black spot on pectoral base or on bases of pectoral fin rays.	No bony irregular to spiny ridge above eye or top of snout, Head without elongate papillae or branched barbels. Head scaleless; first (or first and second) branchiostegal rays with anteriorly-directed spine; sensory papillae on head in longitudinal pattern.	Sensory papillae on head arranged in transverse pattern ;Usually 33-42 scales in a lateral series; body brown with 2-3 wedge-shaped whitish to yellowish bars across back, when live, body with pale golden speckles.

*Distribution:* Indo-West Pacific, from east coast of Africa to Sri Lanka, Andaman Is. to Australia.

Genus *Eleitris* Schneider, 1801

*Eleotris andamensis* Herre, 1939

Herre, A. W. C. T. 1939. on a collection of littoral and freshwater fishes from the Andaman Islands. *Records of the Indian Museum* (Calcutta) v. 41 (pt 4): 344.

*Diagnostic features:* D VI,9; A 9. Scales in longitudinal series 58-60; transverse series between origin of second dorsal and anal 19-20; predorsal scales 38-40. Body thick, robust; eyes are small; mouth strongly oblique, projecting chin; maxillary extends beneath front of eye. Brown, scales darker; a black spot at upper angle of gill opening; three black stripes extend back from the eye; dorsal, anal, pectoral and caudal fins with rows of brown spots.

*Habitat:* Inhabits freshwater. Andaman Islands.

*Eleotris fusca* (Schneider, 1801)

*Poecilia fusca* Scheneider, in Bloch & Schneider, 1801. *Syst. Ichth.*, p. 453.

*Eleotris fusca:* Hoese, in Smith & Heemstra, 1986. *Smith's Sea Fishes*, p. 809, fig. 241.4.

*Diagnostic features:* D. VI + I, 8; A. I, 8; P. 18; V. I, 5; Ls. 62-64. Depth 4.2-4.6 head 4.1-4.2 in standard length. Maxilla reaches to middle of eye; cheek scaled below eye; 8-11 transverse papillae rows along lower margin of preopercle; caudal fin rounded. Head, body and fins dark brown; numerous dark horizontal lines on body.

*Habitat:* Found in freshwater and back waters.

*Distribution Habitat:* Indo-West Pacific, from east coast of Africa to Ryukyu Islands.

Genus *Giuris* Sauvage, 1880

*Giuris margaritacea* (Valenciennes 1837)

*Eleotris aporos*, Bleeker. 1854. *Natuurkundig Tijdschrift voor Nederlandsch Indie*, v: 59.

*Ophieleotris aporos*, Talwar, P. K. and A. G. Jhingran. 1991 *Inland fishes of India and adjacent countries*, 2: 979.

*Giuris margaritacea* Allen, G. R., H. Midgley, and M. Allen. 2002. *Field guide to the freshwater fishes of Australia*. I-xiv: 289.

*Diagnostic features:* D. VII, 8-9; A. I, 9; P. 14-15; V. I, 5; Ll 30; Ltr. 10-11; predorsal scales 13-18. Body large, elongate, anteriorly cylindrical, posteriorly compressed; head dorsally flattened; profile concave; snout pointed; anterior nostrils near margin of snout in short tubes; lower jaw a little prominent; maxillary extends to below anterior part of eye; teeth in many rows, outer row a little enlarged; two longitudinal mucous canal on cheek.

Colour generally greenish brown with 8-10 dark bars across sides and large black blotch at base of pectoral fins; lower half of head tan or yellowish with 3-4 dark brown to reddish stripes radiating from lower part of eye; dorsal fin, ventral and anal fins bordered with red. *Habitat:* Found in freshwater bodies. *Distribution:* Indonesia, Palau, Papua New Guinea, Philippines, Australia, Fiji, Vanuatu, Madagascar, Taiwan, India, Malaysia, Germany, France.

## Family GOBIIDAE

Small fishes; body scaled or naked; head generally with mucus canals and open pores; barbells on head present or absent; usually two dorsal fins, some with single dorsal fin; 1<sup>st</sup> dorsal spines flexible; ventrals separate, partly connected or united to form a disc; membrane connecting two ventral spines or absent; small and conical teeth in one to several rows in jaws; brachioistegal rays free.

Genus *Awaous* Valenciennes, 1837

*Awaous grammepomus* (Bleeker, 1849)

*Gobius grammepomus* Bleeker, 1849. *Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschappen*. v. 22 (6): 34.

*Awaous grammepomus* Koumans, 1953. *Fishes of Indo-Australian Archipelago*, 10: 151.

*Diagnostic features*: D. VI + I, 10; A. I, 10; P. 15-17; V. I, 5; Ls. 50-52; L.tr. 13-15; Predorsal scales 13-15. Head and snout obtusely convex; small flaps on shoulder girdles; lips thick; tongue bilobed; caudal fin obtuse. Body olive green, lighter below; head violet to olive green, two longitudinal black streaks from eye to maxillary; back and sides with irregular blackish streaks; dorsal fins with dark streaks; caudal fin with 7-9 transverse blackish streaks; outer part of pectoral base and middle base of caudal fin with black spots.

*Habitat*: Found in freshwater rivers.

*Distribution*: From India, Andaman Islands to Philippines.

*Exyrias puntang* (Bleeker, 1851)

*Gobius puntang* Bleeker, 1851. *Nat. Tijds. Ned., Indie.*, 2: 486. (Type locality: Rio, Indonesia).

*Exyrias puntang*, Murdy, 1985. *Indo-Pacific Fishes*, No. 10, p. 10, fig. 1 & 2, p. 2B.

D. VI + I, 10; A. I, 9-10; P. 17-18; V. I, 5; Ls. 30-32. Mouth inferior; small teeth in 4-5 rows in each jaw; predorsal scales 10-12. Body dark brown, lighter ventrally; small red spots on anterior part of dorsal body contour and small silvery white spots on posterior part of body; dorsal fin with alternating purple and yellow stripes; anal fin yellow, blackish medially with two red stripes;

dusky spot on pectoral fin; ventral fin blackish. Found in creeks. Indo-West Pacific, from Andaman Island to Ryukyu Is. and New Guinea to New Caledonia. (Photo Rajan)

Genus *Bathygobius* Bleeker, 1878

*Bathygobius fuscus* (Ruppell, 1830)

*Gobius fuscus* Ruppell, 1830. *Atl. Reise. Afrik. Fishce.* p. 137.

*Bathygobius fuscus*, 1986: Hoese, in *Smith & Heemstra, Smith's Sea Fishes.*, p. 781, pl. 122.

*Diagnostic features*: D. VI + I, 9; P. I, 8; P. 17-18; V. I, 5; Ls. 30-33. Depth 4.5-5.0, head 3.2-3.3 in standard length; head rounded; lips thick; teeth in several rows in jaws; upper three pectoral rays free from membrane; pre-pelvic area scaled; 14-16 predorsal scales. Body dusky with scattered spots; sides of body with faint blotches, extends ventrally; fins dark with dusky markings.

*Habitat*: Found in freshwater and backwaters.

*Distribution*: Indo-Pacific, from east coast of Africa to Japan and Australia

Genus *Glossogobius* Gill, 1862

*Glossogobius giuris* (Hamilton 1822)

*Gobius giuris* Hamilton, 1822. An account of the fishes found in the river Ganges, p. 51, 366, pl. 33 (fig. 15).

*Glossogobius giuris*: Hoese, in *Smith & Heemstra, 1986. Smith's Sea Fishes*, p. 790, fig. 240. 44.

*Diagnostic features*: D. VII + 8-9; A. I, 8-9; P. 19-20; V. I, 5; Ls. 30-32. Head flattened; snout elongate, lips thick; dorsal fins close together; predorsal scales 22-26. Cheek with multiserial rows of papillae. Body is brownish-yellowish with 5-6 dark rounded spots on its sides; dorsal fins with small black spot forming longitudinal stripes; rays of dorsal, pectoral and caudal fins with black spots.

*Habitat*: Found in freshwaters.

*Distribution*: Indo-West Pacific, from east coast of Africa, coasts of India, Andaman Island to Japan and Australia.

*Remarks*: Four species of *Glossogobius* recorded from Andamans, they are *Glossogobius bicirrhosus* (Weber, 1894), *Glossogobius*

biocellatus (Valenciennes, 1837), *Glossogobius celebius* (Valenciennes, 1837) and *Glossogobius giuris* (Hamilton, 1822). The former two species are seldom found in freshwater. In *G. celebius* cheek with only uniserial rows of papillae and in *G. giuris* cheek with multiserial rows of papillae.

Genus *Sicyopterus* Gill, 1860

*Sicyopterus microcephalus* (Bleeker, 1854)

*Sicydium microcephalus* Bleeker, 1854. *Nat. Tijds. Ned. Indie.*, 7: 437.

*Sicyopterus garra* Hora, 1925. *Rec. Indian Mus.*, XXVII, p. 35, pl. ii, figs. 2-5.

*Sicyopterus microcephalus* Koumans, 1953. *Fishes of Indo-Australian Archipelago*, 10: 223.

**Diagnostic features:** D. VI + I, 10; A. I, 10; P. 20; V. I, 5; Ls. 65-68. Snout obtuse; papillae along lower margin; 5-8 canines in lower jaw on each side; dorsal fins separate; 20 predorsal scales. Body violet above, silvery-white below; sides of body with yellow spots in rows, the spots form into stripes on caudal peduncle; fins light reddish-violet; caudal fin with violet streaks, above and below bordered with orange. Habitat: Found in freshwater pools and fast streams and feed on adhesive algae, when ascends a torrential stream, it sometimes climbs up on wet rocks along torrent using the mouth and pelvic fins alternately as suckers. Distribution: Andaman Islands to Indonesia.

Genus *Stenogobius* Bleeker, 1874

*Stenogobius gymnopomus* (Bleeker, 1853)

*Gobius gymnopomus* Bleeker, 1853. *Nat. Tijds. Ned. Indie.*, 4: 270.

Larson, H. K. and E. O. Murdy 2001. Families Eleotridae, Gobiidae. In: Carpenter & Niem, 2001. v. 6: 3602

*Stenogobius gymnopomus* : Kamla *et al*, 1993.

*Environment & Ecology*, 11(4): 814, fig. 2.

**Diagnostic features:** D. VI + I, 10; A. I, 10; P. 15-16; V. I, 5; Ls. 50. Head highly compressed; jaws subequal; finger-like flap on shoulder girdle; dorsal fins separate, 18 predorsal scales. Body light brown with 3 transverse bands on sides; a dark band descends from eye; brown blotches on head; all fins violet with several rows of dark spots.

**Habitat:** Found in backwaters and freshwater streamss.

**Distribution:** Indian Ocean, from coasts of India, Andaman Island to Indonesia.

*Stenogobius gymnopomus*

Family ANABANTIDAE

Body oblong and compressed posteriorly; head broad; operculum serrate with two spines; mouth large, upper jaw prostrusile; jaws with small conical teeth; palatine edentate; single dorsal fin; pectoral and caudal fins rounded; scales ctenoid; two lateral lines.

Genus *Anabas* Cuvier and Cloquet, 1816

*Anabas testudineus* (Bloch, 1795)

*Anthias testudineus* Bloch, 1795. *Nat. Ausland. Fische.*, (6) : 121.

*Anabas testudineus*: Talwar & Jhingran, 1991. *Inland Fishes of India and Adjacent Countries*. 2: 996, fig. 283.

**Diagnostic features:** D. XVI-XVII, 8-9; A. VIII, 9-10; P. 14; V. I, 5; LI. 24-28. Body elongate and moderately deep; depth 3.25-3.4, snout 14.2-16.5 in standard length; jaws with villiform teeth; scales on the body very large; caudal fin rounded. Body dark grey, fading to pale yellow ventrally; a dark spot at base of caudal fin and at base of pectoral fin; dorsal and caudal fins grey; pectoral and anal fins pale.

**Habitat:** Found in fresh water canal and ponds.

**Distribution:** Pakistan, India, Andaman Is, Sri Lanka, Bangladesh, Burma, Indonesia and Philippines. Remarks: *Anabas testudineus*, has been designated as threatened species in Indian waters.

Family CHANNIDAE

Body elongate and cylindrical, mouth large; jaws and palate dentate; eyes located in anterior half of head; single soft dorsal; scales cycloid and ctenoid; caudal fin rounded, air bladder present.

Genus *Channa* Scopoli, 1777

*Channa gachua* (Hamilton, 1822)

*Channa gachua* Hamilton, 1822. *Fishes of Ganges*: 68, 367, pl. 21, fig. 21.

Benziger, A., S. Philip, R. Raghavan, P. H. Anvar Ali, M. Sukumaran, J. C. Tharian, N. Dahanukar, F. Baby, R. Peter, K. R. Devi, K. V. Radhakrishnan, M. A. Haniffa, R. Britz, et A. Antunes, 2011. Unraveling a 146 years old taxonomic puzzle: validation of Malabar snakehead, species-status and its relevance for channid systematics and evolution. PLoS ONE v. 6 (no. 6): 1-12.

*Diagnostic features:* D. 32-38; A. 20-23; P. 14-15; V. 6; Ll. 39-47. Body fairly rounded; eye 5.5-6.0 in head; 4-5 scale rows between preopercular angle and posterior border of orbit; predorsal scales 12. Body greenish-black, ventral side pale; a row of dark oblique bands above and below lateral line; pectoral fins with a series of alternate blue and pale orange vertical bands; outer margin of caudal fin orange and barred. Habitat: Found in streams. Distribution: Afghanistan, Pakistan, India, Andaman Islands, Nepal, Sri Lanka, Burma, Bangladesh.

*Channa punctatus* (Bloch, 1793)

*Ophiocephalus punctatus* Bloch, 1793. Nat. Ausland. Fische., 7: 139, pl. 358.

*Channa punctatus:* Talwar & Jhingran, 1991. Inland Fishes of India and Adjacent Countries, 2: 1020, fig. 290.

*Diagnostic features:* D. 32, A. 22; P. 16; V. 6; Ll. 39. Body elongate; eye 8.1-8.35 in head; scale rows between preopercular angle and posterior border of orbit present; predorsal scales 12. Upper side of body and flanks dark-green, ventral side pale yellow; several dark blotches on sides of body; dorsal, anal and caudal fins dusky. Habitat: Found in freshwater streams. Distribution: Afghanistan, Pakistan, India, Andaman Is., Sri Lanka, Nepal, Bangladesh, Burma and China.

*Channa striatus* (Bloch, 1793)

*Ophiocephalus striatus* Bloch, 1793, *Natutges. ausland. Fische*, (7):141, pl. 359 (type locality: Malabar)

*Channa striatus:* Talwar & Jhingran, Inland Fishes of India and Adjacent Countries, 2: 1022, fig. 291.

*Diagnostic features:* D. 37-46, A. 23; P. 15; V. 6; Ll. 50-57. Body elongate; eyes moderate, 6-7 in head; Mouth large; lower jaw with 4 to 7 canines

behind a single row of villiform teeth which deepens to six rows at symphysis; villiform teeth on vomer and palatines; caudal fin rounded; predorsal scales 18 to 20. Upper side of body and flanks dark-green, ventral side pale yellow; several dark blotches on sides of body which form angular bands; dorsal, anal and caudal fins dusky.

*Habitat:* Fund in freshwater streams.

*Distribution:* Pakistan, India, Sri Lanka, Nepal, Bangladesh, Nepal, Burma, Malay Archipelago, Thailand and south China.

## DISCUSSION

Fauna on the Mount Harriet National Parks have high levels of endemism (Kailash and Rajan, 2004) and this is true in the case of freshwater fishes of Andaman Islands (Vijay and Priya, 2009). Of the 24 species recorded 12 were native freshwater fishes, including 2 endemic fishes and a new species of the genus *Belobranchus* sp. as new to India. Though the numbers of primary freshwater species are few there are 6 species endemic to Andaman waters viz. the syngnathid *Microphis insularis* (Hora), eleotrid *Eleotris andamanensis* Hora, syngnathid *Microphis insularis* (Hora), two new species of the genera *Sicyopterus* sp. (Gill) and *Schismatogobius* sp. (de Beaufort) and a gobiid fish *Acentrogobius caninus* (Valenciennes) as a new record (Vijay and Priya 2009) and *Belobranchus* sp. Bleeker (Rajan and Sreeraj). The hill stream gobioid fish *Sicyopterus garra* Hora, described from Andaman Islands is relegated to the synonym of *Sicyopterus microcephalus* (Bleeker) (Koumans, 1940).

Five species of freshwater fish have been introduced deliberately or accidentally in the freshwater streams of Mount Harriet National Park. Streams of Wimberley Gunj have been altered by water diversion, channel modification, introduced species, and water quality degradation compared to streams of Mannarghat, Kalatang and Shoal Bay, South Andaman. The Andaman Islands, with freshwater streams ranging from the relatively pristine to the highly degraded, offer an opportunity to examine the impacts of human disturbance on native stream

**Table 1.** Native, Exotic and Endemic Freshwater species and their status

Species	Native	Exotic	Endemic	Status
<i>Rasbora daniconius</i>	✓			Very common
<i>Clarias magur</i>		✓		common
<i>Heteropneustes fossilis</i>		✓		common
<i>Aplocheilichthys panchax</i>	✓			Very common
<i>Oreochromis mossambica</i>		✓		common
<i>Awaous grammepomus</i>	✓			Rare
<i>Glossogobius giuris</i>	✓			Common
<i>Sicyopterus microcephalus</i>	✓			Very Common
<i>Stenogobius gymnopomus</i>	✓			Very Rare
<i>Belobranchius</i> sp.	✓		✓	Very Rare
<i>Eleotris andamensis</i>	✓		✓	Rare
<i>Eleotris fusca</i>	✓			Common
<i>Exyrias puntang</i> (Bleeker, 1851)	✓			Rare
<i>Giuris margaritacea</i>	✓			Common
<i>Anabas testudineus</i>		✓		Very Rare
<i>Channa gauchua</i>	✓			Common
<i>Channa punctatus</i>	✓			Common
<i>Channa striatus</i>		✓		Rare

communities. For example, urbanization is often accompanied by stream-channel modification and reduced canopy cover, resulting in higher water temperatures and greater fluctuations in daily temperature. Even in relatively pristine streams, diversions can result in decreased flow velocity and water depth, reducing habitat availability. Many nonnative aquatic species are better adapted than native species to degraded habitats; once established in these habitats, they can cause further reduction in native populations through competition, predation, and the introduction of parasites or diseases. Poisoning, dumping of solid waste and diverting water flows to encroach land are the major threats. Creating awareness, controlling poisoning fishing and protecting the breeding grounds of fishes are some of the measures recommended to counter these threats. The most urgent initiative appears to be a national reserve system 'gap analysis' which would identify those ecosystems most at risk. A comprehensive national assessment of the conservation status of freshwater ecosystems should be undertaken immediately. Such a study would provide a platform for the systematic expansion of the nation's freshwater protected

areas, as well as a catalyst for innovative 'bottom-up' conservation approaches driven by local stakeholders. The new findings have indicated that more new species can be found in undisturbed regions. However, many of the native species are threatened due to habitat loss and invasive species.

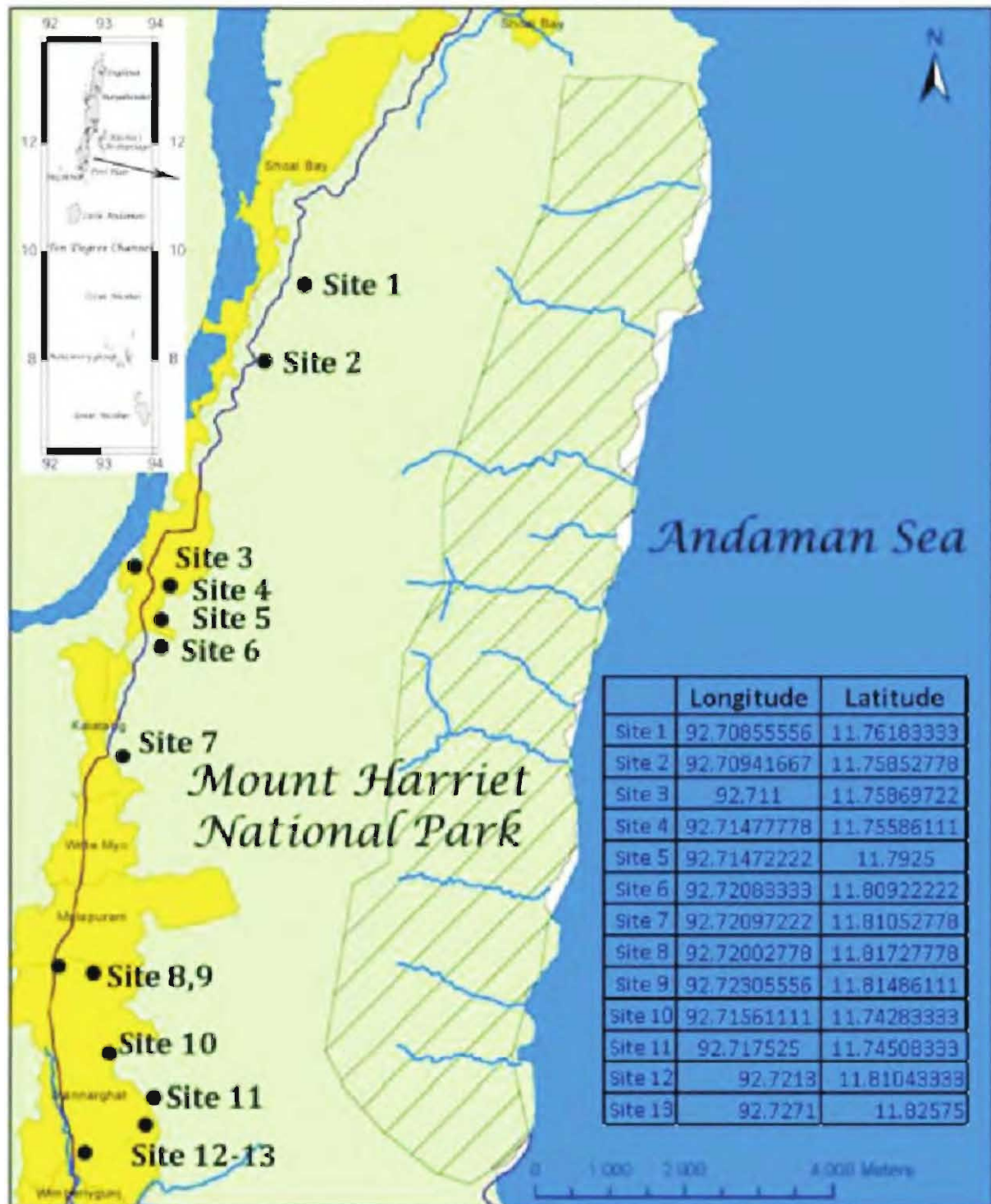
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**MOUNT HARRIET NATIONAL PARK**



Sampling sites in Mount Harriet National Park with GPS coordinates



Freshwater pool and cast netting in the waterfall, Shoal bay, South Andaman



Fish collection with Hook and line



Study tour for forest officials, waterfall, Mannarghat



Insecticide used for catch fish by settlers



Human habitation, altered and polluted streams at Wimberly Gunj



Dumping of inorganic waste materials into the stream, Wimberly Gunj, South Andaman



*Megalops cyprinoides*



*Anguilla bengalensis bengalensis*



*Anguilla bicolor bicolor*



*Rasbora daniconius*



*Clarias magur*



*Heteropneustes fossilis*



*Aplocheilichthys panchax*



*Kuhila mugil*



*Kuhila rupestris*



*Oreochromis mossambicus* (see page 7)

*Oreochromis mossambicus* (see page 7)



*Belobranchus* sp. (to be named by Rajan and Sreeraj) (see page 8)



*Butis butis* (see page 8)



*Eleotris fusca* (See page 8)



*Giuris margaritacea* (See page 8)



*Giuris margaritacea* (See page 8)



*Awaous grammepomus*



*Exyrias puntang* (Bleeker, 1851)



*Glossogobius giuris*



*Sicyopterus microcephalus* using the mouth and pelvic fins alternately as suckers to climb



*Stenogobius gymnopomus*



*Anabas testudineus*



*Channa gachua*



*Channa punctatus*



*Channa striatus*