

FRESHWATER FISHES OF MANGGARAI FLORES, WITH THE VARIOUS LIMNOLOGY ASPECT

(Jenis ikan air tawar dari Manggarai, Flores, dengan variasi aspek limnologinya)

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ABSTRACT

The diversity of freshwater fishes on Manggarai, Flores Island is very poor. The result of first time exploration in 1994, there were Seventeen species fishes collected of 8 families, including 4 new record species, 4 introduce species from 21 sample sites, 18 rivers and 3 lakes. On a one month expedition in 1994. The dominan family of fishes is Gobiidae.

Habitat types are very variation, the reverine site is consisted of 18 rivers and 3 lakes, habitat types are consisted of 7 types. The habitat 2 is the most habitat type found. The characteristic of this habitat type is: Bottom: sand with large stones and pebbles, water is very clear, rapid current, pH: 3.91 - 8.51, conductivity: 20 - 186 μ S/cm, and temperature during day light was 19 - 25.7 ° celcius. surrounded by primary forest.

Key Words: Diversity, new record, Habitat type, Manggarai, Flores.

ABSTRAK

Keanekaragaman ikan air tawar di Manggarai, Pulau Flores adalah miskin. Sebanyak 17 jenis ikan dalam 8 suku telah terkoleksi, ini merupakan hasil pertamakalinya dari eksplorasi di tahun 1994, termasuk 4 jenis baru dan 4 jenis pendatang, semuanya terkoleksi dari 21 stasiun pengambilan sampel di 18 sungai, dan 3 danau. Jenis - jenis ikan dari suku Gobiidae mendominasi.

Tipe - tipe habitat yang terdapat di lokasi pengambilan sampel di 21 stasiun, 18 sungai, dan 3 danau ini ternyata sangat bervariasi, tipe habitat yang ada berjumlah 7 tipe. Tipe habitat yang paling umum didapat di kawasan ini adalah dengan karakter yang berupa dasar perairan berupa pasir dengan batuan berukuran besar dan batuan berupa kerikil, jernih, deras, keasaman 3,91 - 8,51, daya hantar listrik (DHL) 20 - 186 μ S/cm, suhu disiang hari 19,0 - 25,7 °C dan di kelilingi oleh hutan primer.

Kata kunci: Keanekaragaman, Catatan baru, tipe habitat, Manggarai, Flores.

INTRODUCTION

Flores Island (Fig. 1) is the 2nd longest island in The Nusa Tenggara Timur (NTT) Archipelagos a group of islands in eastern Indonesia. The NTT Archipelago (Fig. 1). Its freshwater fish fauna is poorly known (Ondara, 1982). The first extensive survey in 1994 yielded 17 species fishes belonging to 8 families include four other potential range extentions, but further study is required for these.

Habitat is very variation, the reverine site is consisted of 18 rivers and 3 lake, habitat type is consisted of 7 types. The habitat 2 is the most habitat type found. The characteristic of this habitat type is : the bottom mostly consisted of big stones and pebbles with subtrat a send, water is very clear, and rapid current, pH: 3.91 - 8.51, conductivity: 20

- 186 μ S/cm, and temperature during day light was 19.0 - 25.7 °C.

The areal research is very nature and interisting, there is specific habitat, high altitude and Nature Conservation area i.e. Natural Recreation Park (Natural Resources of Flores Island). The diversity of freswater fishes mostly is very poor. Only a few families of ishes could adapt this type of habitat.

MATERIALS AND METHODS

Specimens were collected from 21 locations including 18 rivers and 3 lakes by electrofishing (120 volt) and hook and line. Specimens obtained were placed directly into a 10% formalin solution for fixation. After fixation, the specimens were transferred into a 75% ethylalcohol storage

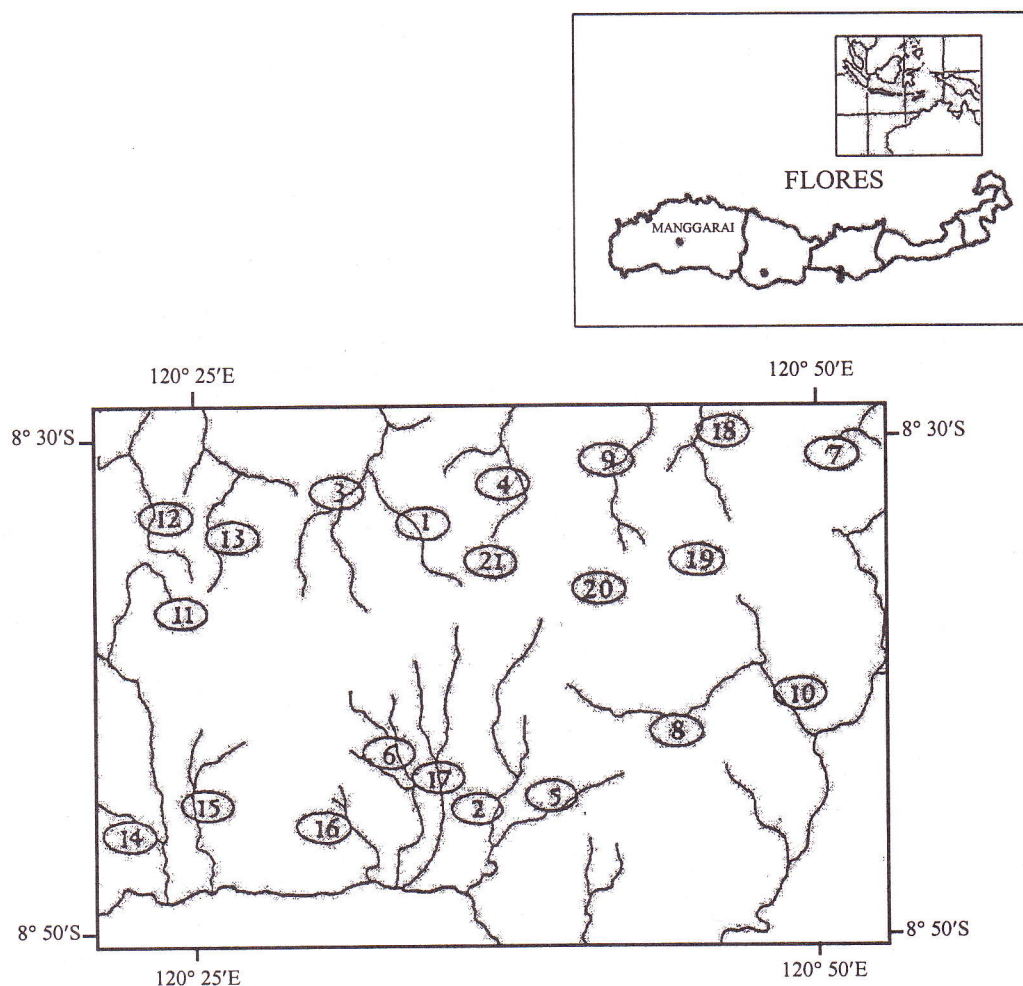
solotion. All Specimens are deposited at Museum Zoologicum Bogoriense, Bogor, Indonesia.

The method of measuring and counting specimens followed that of Hubbs and Lagler (1949). Specimens were identified using idetification keys of Weber and de Beaufort (1912;1916), Kottelat, *et al* (1993), Koumans (1940), and Allen (1991). The list of freshwater

fishes from Flores Island follows the phylogenetic sequence proposed by Eschmeyer (1990).

SAMPLE SITES

Eighteen rivers and 3 lakes were sampled. Most of the sites were small rivers at elevations between 4 - 1380 m above sea level.



SAMPLING LOCATIONS

RESULTS AND DISCUSSION :

ANNOTATED CHECKLIST OF THE FRESHWATER FISHES

There were seventeen species, group into 8 families (Anguliidae, Cyprinidae, Syngnathidae, Scorpaenidae, Cichlidae, Rhyacichthyidae, Eleotridae, and Gobiidae). Those species are noted briefly and presented below.

Angulidae

1. *Anguilla marmorata* (Kaup, 1856)

SL (standard length): 150.0 mm, number of specimen (n): 1, juvenile, registration number of specimen : MZB 6357, collected from Ijong R.,... In a stream; bottom mostly of muddy clay; water very clear; rapid current ; pH: 7.56.

Cyprinidae

2. *Cyprinus carpio* Linnaeus, 1758

SL: 15.5 - 185.2 mm, n:2 (MZB 6372), collected from Ranamese L. and Ranapoja L.,... The species native to freshwater of Eurasia. Introduced to Manggarai region, Flores Isl.. as fish, bred in ponds, and flesh is expensive.

3. *Puntius binotatus* (Valenciennes 1842)

SL: 13.4 - 91.1 mm, n: 56 (MZB 6258, 6259, 6366 ,6376). Found between 590 and 1380 m altitude, in pools of larger streams with slow current, water always clear. The bottom consist of mixture of sand and mud with small stones. The geographic distribution of this is very wide, but it has not been recorded from Flores Island previously. The most east distribution of the species before was know only in Lombok Island (Weber and de Beaufort, 1916, and Kottelat, et. al. 1993). The present record thus extends the range of the species a considerable distance eastward. General morphology of the Flores *P. binotatus* is similar to fish from other island, but its color pattern is slightly different. According to the indigeneous people *P. binotatus* has existed there for a long time and is considered a native species. However, there remains a possibility that it was introduced.

Syngnathidae

4. *Microphis argulus* (Peters, 1855)

SL: 91,5 mm, n: 1 (MZB 6360), collected from Laku R. Found in a stream; bottom mostly of various-sized stones and sand.

Scorpaenidae

5. *Tetraroge barbata* Gunther, 1860

SL: 28.6 mm, n.: 1 (MZB 6358), collected from Laku R.. Found in an estuary of Laku R. (4 m above sea level); bottom mostly of various-sized stones and sand; pH: 8.17; Near primary forest.

Cichlidae

6. *Oreochromis mossambica* (Peters, 1852)

SL: 5 specimens: 45 - 86 mm, n: 5 (MZB 6371). The species native to freshwater of eastern Africa, introduced to the lakes and pounds of the Flores region and has escaped into rivers of the area. Commonly found in several types of habitat in rivers and lakes. The species has become the most important food fish in Manggarai, Flores.

Rhyacichthyidae

7. *Rhyacichthys aspro* (Civier & Valenciennes, 1837)

SL: 15.2-95.8 mm, n: 10 (MZB 6362 & 6368). Found in streams; bottom mostly of various-sizes. The geographic distribution of this species is very wide, but it has not been recorded from Flores island previously (Koumans, 1953).

Eleotridae

8. *Belobranchus belobranchus* (Valenciennes, 1837)

SL: 18.1-53.15 mm, n: 8 (MZB 6359). Remark: black streak on the body of 4 specimens (SL: 46.0-53.15 mm) was absent or faint. Found in estuarine of Laku R. (4 m above sea level); bottom mostly consists of various-sized stones and sand; pH: 8.7; close to primary forest.

Gobiidae

9. *Istigobius ornatus* (Koumans, 1941)

SL: 29.45 mm, n: 1 (MZB 6364), collected from Laku R.,. Mostly found from the habitat with

bottom of a mixture of sand, pebbles, and with various sizes of stones, in estuary.

10. *Sicyopterus cynocephalus* (Valenciennes, 1837)

SL: 13.8-102.1 mm, n: 163 (MZB 6361, 6374, 6381, 6388). Common in several rivers with various habitat types, but mostly found in a habitat with bottom consists of mixture of sand, pebbles and various size of stones and prefers rocky substrates of big or small streams.

11. *Sicyopterus macrostetholepis*, Bleeker, 1876

SL: 65.0-67.9 mm, n: 2 (MZB 6389), collected from Nunur and Laku R.. Found in streams, bottom consisting of a mixture of sand and pebbles with big stones.

12. *Sicyopterus micrurus* Bleeker, 1876.

SL: 25.5-42.7 mm, n: 63 (MZB 6384, 6387, 6390). Found in streams with bottoms consist of mixture of mud, sand and pebbles, with stones of various size.

13. *Sicyopterus ouwensi*, M. Weber 1913.

SL: 50.0-67.0 mm, n: 9 (MZB 6386). Found in streams over bottoms with a mixture of sand and pebbles with big stones.

14. *Sicyopterus parvei* Bleeker, 1876

SL: 12.4-33.4 mm, n: 13 (MZB 6377). Found in streams over bottoms with a mixture of sand and pebbles with big stones. Remark: dorsal and anal fin are black. Previously only known in Java (Koumans, 1953).

15. *Sicyopterus longifilis* de Beaufort, 1912

SL: 22.0-77.0 mm, n: 23 (MZB 6369, 6375, 6379, 6382). Found in streams with bottom consist mixture of big stones and pebbles. This species was not reported from Flores previously.

16. *Sicyopterus hageni* Popta, 1921

SL: 13.4-92.5 mm, n: 26 (MZB 6370). Lips without median cleft, two narrow lateral clefts were very clear. It was reported that the most eastern limit distribution of the species is Sumbawa and Wetar islands (Koumans, 1953).

17. *Stiphodon semoni* Weber, 1895

SL: 14.75-20.35 mm, n: 8 (MZB 6363).

This species usually occupies freshwater habitats close to the sea, prefers rocky substrates in small streams.

Limnology aspect

Some parameter of the sampling site were measured in the field and were summarized in Table 1 (see also Fig. 1 for the location of study sites).

Considering the parameters summarized in Table 1, those sites could be classified into 7 main habitat types (6 sites were surrounded by primary forest, 1 site near secondary forest and 1 site near rice fields). These habitat types are presented briefly:

1. Bottom sand and clay, with stones of various sizes, surrounded by primary forest.
2. Bottom Sand and mud, with stones of various sizes, surrounded by primary forest.
3. Bottom mud and sand, with stones of various sizes, surrounded by primary forest.
4. Bottom mostly sand and mud with pebbles, surrounded by primary forest.
5. Bottom sand and clay, with stones and pebbles, surrounded by primary forest.
6. Bottom muddy clay with stones, near secondary forest (abandoned plantation) or near wet rice - field
7. Muddy clay substrate with little water plants at the edges (lakes character), surrounded by primary forest.

The diversity of freshwater fishes of Manggarai, Flores is poor compared to continental areas of Southeast Asia. For example, the Kapuas river of Borneo has nearly 300 species (Roberts, 1984). A one month survey in 1994, resulted in the collection of only 17 species in 8 families (appendix 1 and 2). The low diversity of the study site may relate to the poor habitat conditions, such as: fast flow, rapid currents, sand and stone on the bottom of water body and rolling topography. Most of the studied rivers and lakes were having those poor habitat character. As the consequences, only a

few species were captured from each river, and in Wau river (site 14) for example, no fish was captured.

The dominant family is Gobiidae, a group that is particularly well adapted for life in relatively fast flowing, rocky streams. All of the Flores species have a modified pelvic fin that forms a suction apparatus used for clinging to stones. *Sicyopterus cynocephalus* was the most widespread fish, occurring in 7 rivers (see appendix 2).

The highest of distribution (33.3%) and abundance (23.3) at species i.e.: *S. cynocephalus*. The highest number of species (11 species) and

abundance (19.8) at the sites i.e.: Wae Laku river (site 17).

In addition to the new locality record for *P. binotatus*, four additional species appear to represent new records, i.e.: *Rhyacichthys aspro*, *Sicyopterus parvei*, *S. longifilis* and *S. hageni* (see systematic species. of Manggarai, Flores). However, further study is required to confirm them.

The fauna includes two introduced species, *Cyprinus carpio* and *Oreochromis mossambica*. These were either introduced accidentally or in the case of the higher lakes, were introduced for fisheries purposes.

Table 1. Some information of limnology aspect on the sampling site

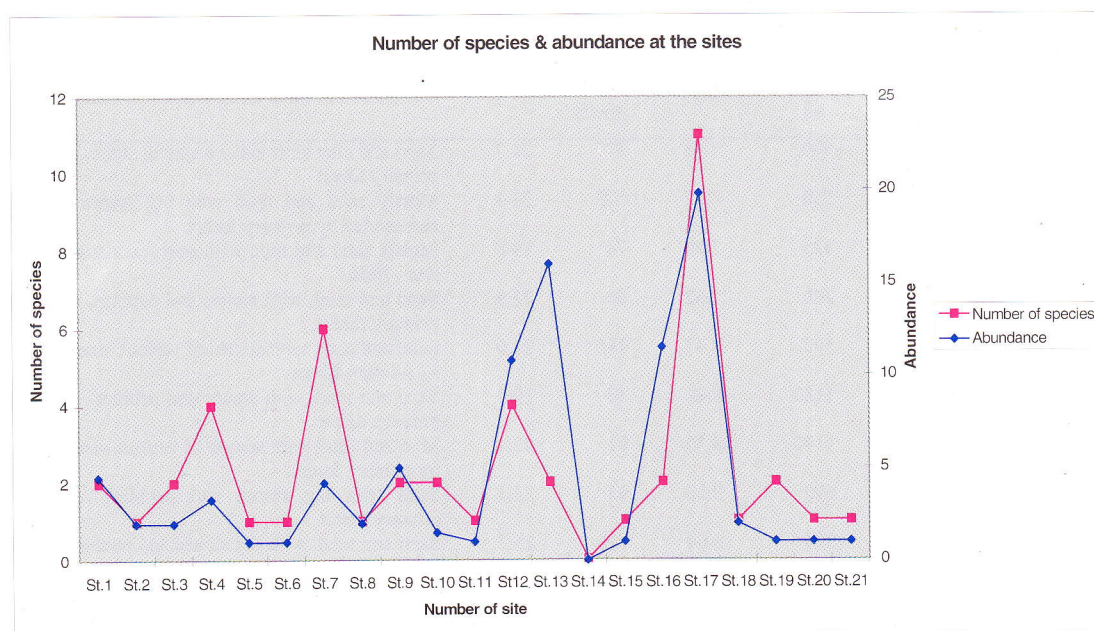
| Site | Number of the river and lake | Alt (m) | PH | Conductivity | T °C | Bottom of the water body and surroundings |
|------|------------------------------|---------|------|--------------|------|---|
| 1 | Mantar R. | 600 | 7.93 | 87 | 21.7 | Sand and clay with various size of stone, surrounded by primary forest |
| 2 | Bobong R. | 550 | 8.17 | 173 | 24.3 | Mostly sand and mud with big stones and pebbles, surrounded by primary forest. |
| 3 | Gari R. | 925 | 7.80 | 74 | 19.8 | Mostly sand and mud with pebbles, surrounded by wet rice - field. |
| 4 | Kawit R. | 260 | 7.62 | 60 | 22.9 | Sand and mud, with stones and pebbles, surrounded by primary forest. |
| 5 | Dangi R. | 590 | 8.41 | 186 | 21.0 | Sand and clay, with stones of various sizes, surrounded by primary forest. |
| 6 | Mura R. | 1120 | 8.03 | 40 | 19.0 | Sand and mud, with stones and pebbles, surrounded by primary forest. |
| 7 | Rancang R. | 1140 | 8.30 | 91 | 23.7 | Mud and sand with stones of various sizes, surrounded by primary forest. |
| 8 | Mokel R. | 690 | 8.13 | 95 | 23.1 | Sand with big stones and pebbles, surrounded by primary forest. |
| 9 | Rana R. | 390 | 8.04 | 110 | 25.7 | Sand and mud, with big stones and pebbles, surrounded by primary forest. |
| 10 | Watu R. | 600 | 8.10 | 99 | 23.7 | Sand and clay, with stones of various sizes, surrounded by primary forest. |
| 11 | Muli R. | 500 | 8.51 | 180 | 24.9 | Sand with big stones and pebbles, surrounded by primary forest. |
| 12 | Nunur R. | 850 | 7.90 | 64 | 19.8 | Sand with big stones and pebbles, surrounded by primary forest. |
| 13 | Ijong R. | 700 | 7.56 | 62 | 23.5 | muddy clay with stones, near secondary forest (abandoned plantation) or near wet rice - field |
| 14 | Wau R. | 1190 | 3.91 | 82 | 16.8 | Stones, surrounded by primary forest. |
| 15 | Nunung R. | 1250 | 7.61 | 53 | 19.3 | Sand with big stones and pebbles, surrounded by primary forest. |
| 16 | Cangelam R. | 1380 | 6.73 | 91 | 19.4 | Muddy clay substrate surrounded by primary forest. |
| 17 | Laku R. | 4 | 8.17 | 173 | 24.3 | Sand with stones of various size, near primary forest. |
| 18 | Lelang R. | 800 | 7.91 | 55 | 24.3 | Sand and clay, with stones of various sizes, surrounded by primary forest. |
| 19 | Ranamese L. | 1950 | 7.96 | 105 | 21.7 | Muddy clay substrate surrounded by primary forest. |
| 20 | Ranapoja L. | 1500 | 7.60 | 69 | 19.0 | Muddy clay substrate surrounded by primary forest. |
| 21 | Ranasiay | 1500 | 6.55 | 20 | 21.9 | Muddy clay substrate surrounded by primary forest. |

Stream-dwelling fishes were mainly found over mixed rock, pebble and sand bottoms with clear water, rapid currents and with the following range of physical and chemical features: pH: 3.91-8.51, conductivity: 20-186 μ S/cm, and temperature during day light 19.0-25.7 °C (see appendix 1).

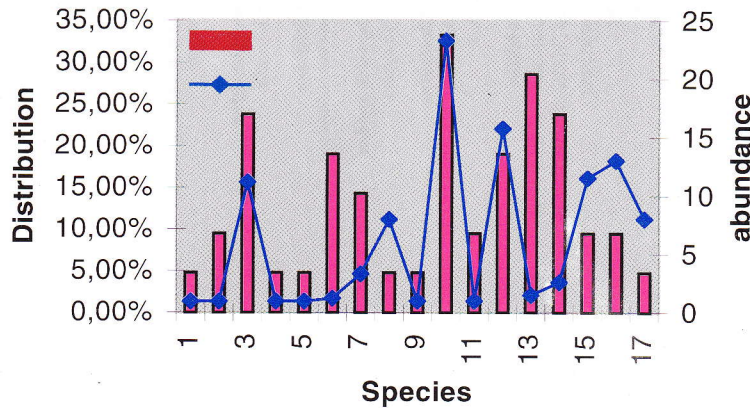
ACKNOWLEDGMENTS

The author wishes to thank: DR. D. J.

Siebert (The Natural history Museum, London), and Ms. I. Rachmatika M.Sc., (Museum Zoologicum Bogoriense, Bogor) for their suggestions and comments. We are also grateful to Mark R. Bezuijen for his help with the English. Technical assistance was provided by Abdul Mun'im. The field research was financially supported. By Department of Forestry, Indonesia.



Distributioni & abundance at the species



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Appendix 1. Species and number of specimens of fishes collected at each of the 21 sampling sites.

| No. | Family and Species name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Dst | Klm |
|--------------------------------|------------------------------------|-----|---|---|-----|---|---|-----|---|---|-----|----|------|----|----|----|------|------|----|----|----|----|-------|------|
| Family: Anguillidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | <i>Anguilla marmota</i> | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 4.8% | 1 |
| Family Cyprinidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | <i>Cyprinus carpio</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | 1 | - | 9.0% | 1 |
| 3 | <i>Puntius binotatus</i> | - | - | 1 | 1 | - | - | - | - | - | - | - | - | 31 | - | - | 21 | - | 2 | - | - | - | 23.8% | 11.2 |
| Family: Syngnathidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | <i>Microphis argus</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 4.8% | 1 |
| Family: scorpaenidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | <i>Tetraroge barbata</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 4.8% | 1 |
| Family: Cichlidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | <i>Oreochromis mossambica</i> | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | 2 | - | - | 1 | - | 1 | 19.0% | 1.25 |
| Family: Rhyacichthyidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | <i>Rhyacichthys aspro</i> | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - | - | - | - | 8 | - | - | - | - | 14.3% | 3.33 |
| Family: Eleotridae | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | <i>Belobranchius belobranchius</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 | - | - | - | - | 4.8% | 8 |
| Family: Gobiidae | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | <i>Istigobius ornatus</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 4.8% | 1 |
| 10 | <i>Sicyopterus cynocephalus</i> | 4 | - | - | 1 | - | 1 | 1 | - | - | 1 | - | 1 | - | - | - | - | 154 | - | - | - | - | 33.3% | 23.3 |
| 11 | <i>S. macrostetholepis</i> | - | - | - | - | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - | - | 9.5% | 1 |
| 12 | <i>S. micurus</i> | - | - | - | - | - | - | 20 | - | - | - | - | 40 | - | - | 1 | - | 2 | - | - | - | - | 19.0% | 15.8 |
| 13 | <i>S. ouwensi</i> | - | 2 | 3 | 1 | - | - | 1 | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | 28.6% | 1.5 |
| 14 | <i>S. parvei</i> | 3 | - | - | - | - | - | 1 | 2 | 5 | 2 | - | - | - | - | - | - | - | - | - | - | - | 23.8% | 2.6 |
| 15 | <i>S. longifilis</i> | - | - | - | 10 | - | - | - | - | - | - | - | - | - | - | - | - | 13 | - | - | - | - | 9.5% | 11.5 |
| 16 | <i>S. hageni</i> | - | - | - | - | - | - | - | - | 5 | - | - | - | - | - | - | - | 21 | - | - | - | - | 9.5% | 13 |
| 17 | <i>Stipodon semoni</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 8 | - | - | - | - | 4.8% | 11.5 |
| Total no. of species | | 2 | 1 | 2 | 4 | 1 | 1 | 6 | 1 | 2 | 2 | 1 | 4 | 2 | - | 1 | 2 | 11 | 1 | 2 | 1 | 1 | | |
| Kemelimpahan | | 4.5 | 2 | 2 | 3.3 | 1 | 1 | 4.2 | 2 | 5 | 1.5 | 1 | 10.8 | 16 | 0 | 1 | 11.5 | 19.8 | 2 | 1 | 1 | 1 | | |