Peripheral fishes in the Estuary of Simeulue Island, Indonesia

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Abstract. The objective of the present study was to inventory of peripheral water fishes were conducted in several estuaries of Simeulue Island, Aceh Province, Indonesia. The sampling was done at seven river mouths in August 2017 and May 2018. The fish samples were collected using fishhooks, casting net and gill net. The sampled fishes were taxonomic identified based on several references at the Laboratory of Ichthyology, Faculty of Marine and Fisheries, Syiah Kuala University. The results showed that there were 356 individual of fishes were recorded during the survey, its belong to 10 orders, 25 families, 41 genera and 52 species. The Perciformes was a predominant with a total of 15 families, 27 genera and 35 species. Furthermore, Gobiidae was predominant with the highest number of genera and species (7 genera and 10 species), followed by Eleotridae (4 genera and 4 species), Mugilidae (3 genera and 4 species), and Carangidae (3 genera and 4 species).

1. Introduction
Simeulue Island is one of the outer islands in Aceh Province, the island is located in the Indian Ocean. The island has an area of ± 9,968.16 km² sea waters [1]. The capture fisheries are one of the important sectors that to sustain the economy in this region, especially the potential of the lobster and coral reef fishes. Acccording to Batubara et al. [2] there were 77 species of marine fishes that have economically important found in Simeulue Island waters. In addition to the potential of marine fisheries, Simeulue Island also has 2 main lakes that had the potential of freshwater fish, where Muchlisin et al. [3] reported 11 fish species from both lakes.

Although it has high potential in fisheries resources, very limited information or studies has been carried out on Simeulue Island. So far, the studies that have been conducted previously are about the profile of capture fisheries [1], the socio-economic of lobster commodities [4][5], the suitability study for floating net cage locations [6], the feasibility of seaweed culture [7]and ecotourism [8]. In addition, other research that has been done is about marine and freshwater fishes in Simeulue Waters [2][3], but an inventory of peripheral fish species in the Simeulue estuary has never been carried out. The peripheral fish is the fish has high tolerance to salinity changes, for example the migratory fishes from marine to freshwater to spawn or feeding, and it vice versa. Therefore, research on the inventory of peripheral fish species in Simeulue Estuary area is important to be carried out to complementary data of the ichthyofauna from this island.
2. Materials and Methods

2.1 Time and site
The study was conducted on August 2017 and May 2018 in Simeulue District, Simeulue Island. The sampling was carried out at 7 locations and the GPS coordinates of each location was presented in Table 1 and Figure 1. The explorative sampling method was used in this study.

Table 1. The sampling location and its GPS coordinate

| No. | Location       | GPS coordinate         |
|-----|----------------|------------------------|
| 1   | Alafan         | 2°49'26.8"N, 95°46'10.2"E |
| 2   | Sua-Sua        | 2°24'19.4"N 96°19'07.1"E |
| 3   | Kuala Umo      | 2°33'40.4"N 96°19'01.6"E |
| 4   | Linggi         | 2°31'16.6"N 96°21'07.5"E |
| 5   | Sepoyan        | 2°32'13.6"N, 96°20'02.4"E |
| 6   | Tanjung Raya   | 2°37'11.4"N, 96°13'09.1"E |
| 7   | Amaiteng Mulia | 2°29'10.2"N, 96°22'15.8"E |

Figure 1. The map of Simeulue Island showing sampling locations (red square)

2.2 Sampling and preservation
The sampling points were determined based on information from local fishermen that the location presumed fish was present. The sampling was conducted from 08.00 AM to 10.00 PM using gillnet, casting net and hooks. The sampled fish was counted, washed then photographed for documentation. Then after, the fish sample was preserved in 10% formalin in a plastic jar, labeled and transported to laboratory.

2.3 Taxonomic identification
The fish sample were taken from the jar then washed with flowing water. Then after, the sample was weighed for total body weight using a digital balance (Toledo, AB-204. Error= 0.01 g) and measured
for total length using a digital caliper (Mitutoyo, CD-6CS. Error = 0.01 mm). The fish was taxonomically identified based on morphometric characters based on Kottelat et al. [9]; Allen [10]; Inger and Kong [11]; Vida and Kotai [12]; and Ambak et al. [13]. After identification process, the fish sample was re-preserved in 10% formalin for a week then transferred to 75% alcohol for long term storage.

2.4 Data analysis
The data were presented in the figures and tables then analyzed descriptively based on previous reports and related references.

3. Results and Discussion
Total of 356 fish samples were recorded during the sampling period, it was belong to 10 order, 25 families, 41 genera and 52 species of peripheral fishes. Based on family number, Perciformes was predominant (Table 2 and Figure 2a), while based on genera and species number, the Gobidae is predominant (7 genera and 10 species) followed by Eleotridae (4 genera and 4 species) and Mugilidae (3 genera and 4 species), Carangidae (3 genera and 4 species) (Table 3). Based number of genera, Gobiidae dominates with a composition of 17.07%, followed by Eleotridae (9.76%), Mugilidae (7.32%) and Carangidae (7.32%) (Figure 2b).

Furthermore, based on the number of species, the Gobiidae is also dominating the fish composition of Simeulue estuary by 19.23%, followed by Eleotridae Mugilidae, Carangidae and Zenarchopteridae with a value of 7.69% respectively (Figure 2c). Perciformes is also the dominant order of marine fishes in Simeulue Island waters, reaching 69.2% for the number of families, 81.5% of the genus and 87% of the total 77 species [2]. A similar finding in LauikTawar and Laulo of Simeulue is also showed that Perciformes the dominant fish group in these lakes [3]. These finding indicates that the order Perciformes is the dominant order on the Simeulue island waters both of freshwater, brackish and marine fishes. According to Nelson [14] that of all species of bony fishes 41% of them are from the order of Perciformes. This order has 160 families, 1539 genera and 10033 species [15].

In term of family, the study showed that Gobiidae is predominant in estuary of Simeulue Island. According to Latifa et al. [16] Gobiidae is distributed in freshwater, brackish waters and marine waters comprises 258 genera and 1809 species. For comparison, Muchlisin and Siti-Azizah [17] found 7 genus and 10 species of Gobiidae in freshwaters of Aceh Province, of these 3 species, namely Acentrogobius janthinopterus, Glossogobius giuris and Pseudogobius javanicus were found in Simeulue Island. In addition Batubara et al. [2] recorded 1 species of Gobiidae (Periophthalmus kalolo) among marine fishes in Simeulue Island waters.

### Table 2. Total order, family, genus and species of peripheral fishes of Simeulue Island waters

| No | Order          | Family | Genus | Species |
|----|----------------|--------|-------|---------|
| 1  | Anguilliformes | 1      | 1     | 1       |
| 2  | Beloniformes  | 1      | 2     | 4       |
| 3  | Clupeiformes  | 1      | 1     | 1       |
| 4  | Elopiformes   | 1      | 1     | 1       |
| 5  | Gonorynchiformes | 1 | 1 | 1 |
| 6  | Mugiliformes  | 1      | 3     | 4       |
| 7  | Perciformes   | 15     | 27    | 35      |
| 8  | Pleuronectiformes | 2 | 2 | 2 |
| 9  | Scorpaeniformes | 1    | 1     | 1       |
| 10 | Tetraodontiformes | 1 | 2 | 2 |
|    | Total          | 25     | 41    | 52      |
Table 3. The list of order, family, genera and species of brackish water fishes in Simeulue Island

| Ordo                  | Family         | Genus                  | Species                                |
|-----------------------|----------------|------------------------|----------------------------------------|
| Anguilliformes        | Anguillidae    | Anguilla               | Anguilla bicolor                       |
| Beloniformes          | Zenarchopterida| Hemirhamphodon         | Hemirhamphodon sp.                     |
|                       |                | Zenarchopterus         | Zenarchopterus sp.                     |
| Clupeiformes          | Engraulidae    | Thryssa                | Thryssa sp.                            |
| Elopiformes           | Megalopsidae   | Megalops               | Megalops cyprinoides                   |
| Gonorynchiformes      | Chanidae       | Chanos                 | Chanos chanos                          |
| Mugiliformes          | Mugilidae      | Crenimugil             | Crenimugil crameriabiceps              |
|                       |                | Liza                   | Liza macroleptis                       |
|                       |                | Magil                  | Magil cephalus                         |
|                       | Ambassidae     | Ambassis               | Ambassismiops                          |
|                       | Apogonidae     | Apogon                 | Apogon lateralis                       |
|                       |                | Acentrogobius          | Acentrogobius canescens                |
|                       |                | Amorya                 | Amorya lutea                           |
|                       |                | Glossogobius           | Glossogobius juratus                   |
|                       |                | Oxyarichthys           | Oxyarichthysophthalmoneuma            |
|                       |                | Periophthalmus         | Periophthalmus sp.                     |
|                       |                | Pseudogobiopsis        | Pseudogobiopsis sp.                    |
|                       |                | Redigobius             | Redigobius sp.                         |
| Gobiidae              |                | Carangoides            | Carangoides malabaricus                |
|                       |                | Caranx                 | Caranx sp.                             |
|                       |                | Gnathanodon            | Gnathanodon pschistoculus              |
| Perciformes           | Cichlidae      | Oreochromis            | Oreochromis mossambicus                |
|                       | Belonichthidae | Belonichthys splendens | Belonichthys splendens                 |
|                       | Banaka         | Banakagyrinoides       | Banakagyrinoides                       |
|                       | Batus           | Batus sp.              | Batus sp.                              |
|                       | Eleotris       | Eleotris melanoides    | Eleotris melanoides                    |
|                       | Gerres         | Gerres sp.             | Gerres sp.                             |
|                       | Pomadusys      | Pomadusys sp.          | Pomadusys sp.                          |
| Cichlidae             | Leioagnostidae | Leioagnostus           | Leioagnostus splendens                 |
|                       | Latjanidae     | Latjanus               | Latjanus sehnbergti                    |
|                       | Latjanius      | Latjanus sp.           | Latjanus sehnbergti                    |
|                       | Scatophagidae  | Scatophagus            | Scatophagus sp.                        |
|                       | Siganaidae     | Siganus                | Siganus sp.                            |
|                       | Terapontidae   | Terapon                | Terapon sp.                            |
|                       | Toxotidae      | Toxotes                | Toxotes sp.                            |
|                       | Pleuronectiformes | Cynoglossidae      | Cynoglossus splendens                  |
|                       | Paralichthiidae| Pseudorhombus          | Pseudorhombus sp.                      |
|                       | Scorpaeniformes | Tetrarogidae          | Tetrarogus sp.                         |
|                       | Tetraodontiformes | Carinotetraodon       | Carinotetraodon sp.                    |
|                       |                | Chelonodon             | Chelonodon sp.                         |
Figure 2. (a) Order composition based on family number of Simeulue Island, (b) Family composition based on genera number of fishes from estuary of Simeulue Island, (c) Family composition based on species number of Simeulue Island
Besides the Gobiidae, there was one other family belonging to the gobiid fish group found in this study, namely Eleotridae with 4 genera and 4 species. Thus, Gobiidae is a dominant fish group in the estuary area on Simeulue Island. According to Viswambharan et al. [18] stated that Gobiid fish is estimated to have the highest number of species or reaching 35% of the total species of fish in the order of Perciformes. Taxonomically, gobiids fish consist of 9 families, namely; Gobiidae, Eleotridae, Odontobutidae, Xenisthmidae, Kraemeriidae, Rhyacichthyidae, Schindleriidae, Microdesmidae and Ptereleotridae [19]. This group of fish inhabits various types of waters including fresh, brackish and sea waters [20].

4. Conclusion
A total 52 species of peripheral fishes belong to 41 genera, 25 families and 25 orders were recorded during the study. Perciformes and Gobiidae were predominant order and family, respectively.

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