Fish biodiversity in false gharial habitat (*Tomistoma schlegelii* Müller, 1838) in Labuhan Batu district

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Abstract. The purpose of this research was to determine the fish biodiversity in the False Gharial (*Tomistoma schlegelii*) habitat at Aek Kundur, Labuhanbatu District. This research was conducted from February to April 2019. The sampling locations was determined based on information from local people. Fish samples were caught using gillnets, fishing rods, and *durung* (trap). The sampling was done one time every month for three months at three sampling stations. The diversity index (H'), Evenness index (J') and similarity index (SI) were analyzed in this study. The results showed that the highest number of fish caught was *Anumalura oxygaster* (188 individuals) and the lowest number of fish was *Monopterus albus* (1 individual). The highest diversity index (H') value was at station 1 (2.224) and the lowest at station 2 (2.202) categorized as medium level. The evenness index value at station 1 was 0.867, station 2 was 0.856 and station 3 was 0.826, indicate the high evenness. While the highest Similarity Index (SI) was found at stations 3 and 1 (90%) and the lowest SI was recorded at stations 2 and 3 (80%). It is concluded that the diversity index value in Aek Kundur is categorized as medium level. The Evennes index value is categorized as high uniformity of population, and the fish community was in stable condition.

1. Introduction

Biodiversity acts as the stability of ecosystems, germplasm sources and economic resources. The loss or extinction of biodiversity can cause disruption of the ecosystem balance. Several factors that contribute to decline diversity of fish worldwide, for example; water pollution, eutrophication, illegal fishing, loss of spawning habitat and reduces food supply, hydropower dams development, surface water fluctuations, introduction of alien fish that can cause disease and genetic loss [1-5].

According Suharsono [6], there were 3424 species of freshwater fish occurred in Indonesian waters, of these 237 species are endemic. Wahyuni and Zakaria [7] stated that biodiversity plays a crucial role to stabilize the ecosystems, germplasm sources and economic sources. The loss or extinction of one biodiversity can cause disruption of the ecosystem balance. Damage to aquatic ecosystems also affects the lives of fish both in quality and quantity [8].

Study related to fish biodiversity found in False Gharial habitat on the Kundur River has never been done. The data from the research are very useful to get clear information about the biodiversity of fish found in False Gharial habitat. A high fish biodiversity reflects a quite healthy river ecosystem. If
the life of the river ecosystem runs in a balanced, it can be ascertained that the food chain cycle will also be balanced. Furthermore, this information is very useful for efforts to preserve the River ecosystem. In an effort to keep crocodile habitat as protected animals, while aiming at the preservation of fish genetic resources. Therefore, the objective of the present study was to determine the fish biodiversity in the False Gharial (Tomistoma schlegelii) habitat at Aek Kundur, Labuhanbatu District.

2. Material and Methods
2.1 Place and materials research
The research was conducted from February to April 2019 on the Aek Kundur River, located was in the Kebun Pangkatan Sipef Village, Pangkatan Subdistrict, Labuhanbatu District, Sumatera Utara Province. The sampling locations was determined based on information from local people. The stations was at coordinate 99° 55’ 41" E, 2° 5’ 39” N, 99° 55’ 55” E, 2° 5’ 48" N and 99° 56’ 18” E, 2° 5’ 42” N.

The tools used in this research were as follows: Global Positioning System (GPS), fishing rods with various modified forms of hook and ballast. Fishnets with 3 meters long and 1 meter wide, durung, taxonomic identification book and Fish Identification Key Kottelat [9].

2.2 Research procedure
Fish sampling was carried out using nets, fishing rods, and durung which were scattered at several points along the river flow. Sampling was done 3 times and was done once a month. The fish caught were then identified in the STKIP Labuhanbatu Ecology Laboratory by looking at the morphological structure, namely by looking at the fish's body shape, fish head shape, fish mouth, fish fin, fishtail and fish scales by the guidelines from Kottelat identification key book [9] and taxonomy and counting the number of caught.

2.3 Data analysis
a. Diversity Index
\[ H' = - \sum Pi \log Pi \]
Description:
H’ = Shannon – Wiener diversity index
S = number of species
\( \log \) = logarithms
Pi = number of individuals for each type (i = 1,2,3,... etc)

With the value of H’ According to Rappe [10]:
H’ ≤ 2,0 = Low biodiversity
2,0 < H’ ≤ 3,0 = Medium biodiversity
H’ ≥ 3,0 = High biodiversity

b. Evenness Index (J’)
\[ J' = \frac{H'}{\log (S)} = \frac{H'}{H_{maks}} \]
Description:
J’ = Evenness indeks
S = number of species found
H’ = Shannon – Wiener diversity index
H_{maks} = \log ^2 (S)

With J’ value:
J’ < 0,4 = Low evenness populations
0,4 < J’ < 0,6 = Medium evenness populations
J’ > 0,6 = High evenness populations
c. Similarity Index (SI)

\[ SI = \frac{2c}{a+b} \times 100 \]

Description:
SI = Similarity Index (%)
a = number of species at location a
b = number of species at location b
c = the same number of species in locations a and b

With Criteria:
SI = 75 – 100% : very similar
SI= 50 – 75% : similar
SI = 25 – 50% : not similar
SI = ≤ 25% : not very similar

Data analysis in this study was carried out with the assist of Plymouth Routines software in Multivariate Research Version 7. The software was used to make a dendogram.

3. Results and Discussion

3.1 Diversity and Shannon-Wiener Diversity Index

The research results from February to April 2019 obtained data on fish biodiversity in Aek Kundur presented in Table 1. A total of 15 species of fish were recorded during the study; of these four species (27%) is Cyprinidae. The similar finding was reported by several researchers that Cyrprinidae is predominant in almost freshwater ecosystem [11-14]. Based on the results of fish observations in Aek Kundur, different diversity index were obtained. The fish diversity index can be seen in Table 2.

The diversity index value found in each station had almost the same value, namely station 1 (2.224), station 2 (2.204) and station 3 (2.222). The diversity index in the three stations was categorized as being medium. This was because the fish that dominate at all stations were small fish such as: Puntius Binotatus, Aplocheilus panchax, Barbodes schwansenfeldii, Osteochilus harrisoni than big fish like; Bagrus nemurus, Channa striata, Channa lucius, Hampala macroleptioda as a predatory fish.

Table 1. Fish Biodiversity in Aek Kundur

| No | Local Name       | Scientific Name                                           | Station |
|----|------------------|-----------------------------------------------------------|---------|
|    |                  |                                                           | 1       | 2       | 3       |
| 1  | Piri-piri        | Anabas testudinensis, Bloch 1792                          | +       | +       | +       |
| 2  | Kepala Timah     | Aplocheilus panchax, F. Hamilton 1822                     | +       | +       | +       |
| 3  | Baung            | Bagrus nemurus, Valenciennes 1840                          | +       | +       | +       |
| 4  | Labosang         | Barbodes schwansenfeldii                                  | +       | +       | +       |
| 5  | Sipticur         | Channa lucius                                             | -       | +       | -       |
| 6  | Bujuk (gabus)    | Channa striata, Bloch 1793                                | +       | +       | -       |
| 7  | Habaro           | Hampala macrolepiota                                      | +       | +       | +       |
| 8  | Zulung - zulung  | Hemirhamphodon pogunognathus                               | +       | +       | +       |
| 9  | Belut            | Monopterus albus                                          | -       | +       | -       |
| 10 | Senggaringan     | Mystus singaringan, Bleeker, 1846                         | +       | +       | +       |
| 11 | Belida           | Notepterus notepterus                                     | +       | -       | +       |
| 12 | Lampam           | Osteochilus harrisoni, Fowler 1905                         | +       | -       | +       |
| 13 | Sulum            | Oxygaster anumalura, Van Hasselt 1823                     | +       | +       | +       |
| 14 | Haporas          | Puntius Binotatus                                         | +       | +       | +       |
| 15 | Sepat            | Tricogaster tricopterus                                   | +       | +       | +       |

**Note:** (+) = found  (-) = not found
Table 2. Shannon-Wiener Diversity Index (H’)

| No | Observation Station | Diversity Index Value | Category     |
|----|---------------------|-----------------------|--------------|
| 1  | Station 1           | 2.224                 | Medium       |
| 2  | Station 2           | 2.202                 | Medium       |
| 3  | Station 3           | 2.222                 | Medium       |

Dominance index at station 1 was 0.004, station 2 was 0.003 and station 3 was 0.003). According to Djumanto and Probosunu [15] that there is an inverse relationship between small fish populations and predatory fish populations. When predatory fish biomass is very low, the biomass of small fish is very high, which is dominated by small fish. The low dominance of predatory fish in the observation area probably because the predatory fish were in prey by False Gharial (T. schlegelii).

3.2 Evenness Index (J’) and Similarity Index (SI)

Evenness index was a value at station 1 (0.867), station 2 (0.856) and station 3 (0.826), more can be seen in Table 3. The evenness index value obtained was almost similar to the research results of [16], which ranged from 0.787 - 0.923 in the category of high evenness population. This was thought to be related to the habitat area with variations in habitat inhabited by fish. According to Binur [16] and Odum [17] if the evenness index value was highest, the abundance between species is almost uniform and the spread of fish is evenly distributed. The similarity index or type similarity index is used to measure changes in composition between habitats. The Similarity Index (SI) in Aek Kundur can be seen in Table 4.

Table 3. Fish Evenness Index on the Aek Kundur River

| No | Observation Site | Evenness Index Value | Category                   |
|----|------------------|----------------------|----------------------------|
| 1  | Station 1        | 0.867                | High - Evenness Population |
| 2  | Station 2        | 0.856                | High - Evenness Population |
| 3  | Station 3        | 0.820                | High Evenness Population   |

Table 4. Fish Index in the Aek Kundur River

| Station | Diversity Index Value |
|---------|-----------------------|
| 1 Station 1 | 84.6 %     |
| 2 Station 2 | 96 %       |
| 3 Station 3 | 80 %       |

Based on the results of the similarity index analysis (SI), the similarity level of 84.6% was obtained at stations 1 and 2. Furthermore, the similarity level was 80% at stations 2 and 3, and 96% at stations 3 and 1 (Figure 1). This means that in general the conditions of each research station have a level of similarity, hence the species that live in it also have a very high level of similarity (SI ≥ 75%). The same species at stations 1 and 2 was Anabas testudinensis, Aplocheilus panchax, Bagrus nemurus, Barbodes schwanenfeldii, Channa striata, Hampala macrolepito, Hemirhamphodon pugonogathus Mystus singaringan, Oxygaster anumalura, Puntius Binotatus, Tricogaster tricopterus. The same species at stations 2 and 3 was Anabas testudinensis, Aplocheilus panchax, Bagrus nemurus, Barbodes schwanenfeldii, Hampala macrolepito, Hemirhamphodon pugonogathus, Mystus singaringan, Oxygaster anumalura, Puntius Binotatus, Tricogaster tricopterus. And The same species at 3 and 1 was Anabas testudinensis, Aplocheilus panchax, Bagrus nemurus, Barbodes schwanenfeldii, Hampala macrolepito, Hemirhamphodon pugonogathus, Mystus singaringan, Notepetrus notepterus, Osteochilus harrisoni, Oxygaster anumalura, Puntius Binotatus, and Tricogaster tricopterus. Based
on the results of observations at the research site, it was found that many *Sacharum spontaneum* plants that live on the outskirts of Aek Kundur waters, this was thought to affect biodiversity. According to Hasibuan [18], the vegetation in each habitat greatly affects the types of fish, because the vegetation area is a place to find food and shelter for fish. In addition, according to Binur [16] habitat area, habitat cover vegetation, and fishing gear used can affect the similarity index.

![Dendrogram of Aek Kundur Similarity Index](image)

**Figure 1.** Dendogram of Aek Kundur Similarity Index

### 4. Conclusions

It is concluded that there were 15 species of fish recorded during the study, namely *Bagrus nemurus*, *Notepterus notepterus*, *Monopterus albus*, *Anabas testudinensis*, *Channa striata*, *Channa lucius*, *Hampala macroleptioda*, *Puntius Binotatus*, *Aplocheilus panchax*, *Barbodes schwanenfeldii*, *Osteochilus harrisoni*, *Mystus singaringan*, *Tricogaster tricopterus*, *Oxygaster anumalura* and *Hemiramphodon pogunognathus*. The Cyprinidae was predominant in this habitat. The diversity index value in Aek Kundur was at medium category. The uniformity index value is categorized as high uniformity of population, stable community and similarity index values at stations 1, 2 and 3 are very similar.

### References

[1] Syandri H, Junaidi, Azrita and Yunus T 2014 *J. Ecol. Environ. Sci.* 5(1): 109–113.
[2] Aryani N, Suharman I, 2014 *J. Fish. Aquac.* 5(1): 163–166.
[3] Aryani N, Efawani, Asiah N 2014 *Int J Fish Aquat Sci* 2(2): 126–129.
[4] Muchlisin Z A 2012 *Archives Polish Fisheries* 20: 129-135.
[5] Muchlisin Z A 2011 *Jurnal Kebijakan Sosial Ekonomi Kelautan dan Perikanan* 1(1) 79-89.
[6] Suharsono 2014 *Biodiversitas Biota Laut Indonesia*.
[7] Wahyuni T T, Zakaria A, 2018 *Biosfera* 35(1): 23.
[8] Samitra D and Rozi D F 2018, *J. Biota* 4(1): 1–6.
[9] Kottelat M, Whitten A J, Kartikasari S N, and Wirjoatmodjo S 1993 Periplus Editions EMDI Project.
[10] Rappe R, 2010 *J. Ilmu dan Teknol. Kelaut. Trop.* 2(2).
[11] Muchlisin Z A and Siti-Azizah M N 2009 *International Journal of Zoological Research* 5 62-79
[12] Timorya Y, Abdullah A, Batubara A S and Muchlisin Z A 2018 *IOP Conf. Series: Earth and Environmental Science* 216 012044
[13] Irhami S, Fithri A, Batubara A S and Muchlisin Z A 2018 *IOP Conf. Series: Earth and Environmental Science* 216 012023
[14] Muchlisin ZA, Akyun Q, Rizka S, Fadli N, Sugianto S, Halim A and Siti-Azizah M N 2015 *Check List* 11(2): 1560.
[15] Djumanto, Probosunu N, 2011 J. Ikhtiologi Indonesia 11(1) 1–10.
[16] Binur R 2010 Iktiologi Indonesia 10(2) 165–178.
[17] Odum E P, 1994 Yogyakarta: Gadjah Mada University Press.
[18] Hasibuan A 2018 Undergraduate Thesis, Sekolah Tinggi Keguruan Dan Ilmu Pendidikan Yayasan Universitas Labuhanbatu.