Analysis of community structure of grouper fish catches (Serranidae) in Medang Deras District, Batubara Regency

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Abstract. Grouper fish is the catch of traditional fishermen in the district of Medang Deras, Batubara Regency, Sumatera Utara Province. Sampling was carried out at two landing stations located in the District of Medang Deras, Batubara Regency. This study aims to determine the value of diversity indices, evenness indices and dominance of grouper catches. The catch of Grouper fish landed in Medang Deras District, all come from the Serranidae family of nine species, and two genera. The Diversity Indices value of grouper at Station I 1.62 and Station II 1.38. The Evenness Indices value at station I 0.74 and at station II 0.71. The Dominance Indices value at station I 0.26 and at station II 0.30. While the temporal indices value of grouper diversity in May 1.74 and in June 1.60, the Evenness Indices in May 0.79 and in June 0.77. The Dominance Indices value in May 0.22 and in June 0.25.

1. Introduction
Reef fish is an important fishery resource, both economically and ecologically. An economically important aspect of reef fish is as a trade commodity and has long been the source of life for millions of Indonesian fishing communities. The high exploitation of reef fish also raises another problem, namely overfishing of reef fish. The most exploited coral fishery commodity is grouper (Grouper). This type of fish has a relatively higher selling price compared to other types of reef fish. Grouper is a fish from the serranidae family with 159 species in the world, 39 species can be found in Indonesian waters, while in Southeast Asia there are 46 species. Grouper fish have habitats on the bottom of tropical and subtropical marine waters. Most grouper species are associated with coral reefs in shallow areas and some live in estuary and rocky, sandy and muddy areas [1].

Medang Deras district is located in Batubara Regency, the majority of residents work as traditional fishermen. Capture fishing is one of the livelihoods of the Medang Deras people, one of which is the effort to catch Groupers. According to information from a number of fishermen in the District of Medang Deras, there has been a decline in demersal fishing efforts in the waters of the Malacca Strait due to weather or natural conditions and a large number of fishing efforts in the area until the seizure of the capture location. In addition, capital requirements for fishing are also a problem for Medang Deras fishermen. The increase in fishing activity is due to many factors, partly because of the high nutritional value of grouper, so that grouper also has a relatively high selling price.

Medang Deras fishermen usually catch Groupers in the waters of the Malacca Strait and around small islands. In the process of catching grouper fish, the dominant fishermen use longline and hand line fishing gear, although there are a some of groupers caught by the Basic Gillnet fishing gear.
Diversity has a large value if individuals are found to be from many different species and genera, and have a value that is small or equal to zero if all individuals originate from one species. Diversity indices is used to determine the diversity of species in a community [2].

This research is expected to be able to complete information about grouper fish catches in Medang Deras District, Batubara Regency. The purpose of this research is to find out the value of diversity indices, evenness indices and dominance of grouper catches of grouper catches landed in Medang Deras District, Batubara Regency.

2. Methodology research
This research was conducted for two months, from May 2019 to June 2019, with an interval of sampling at each location is every week. Sampling was carried out at two grouper fishing stations (Serranidae) in Medang Deras, Batubara, Sumatera Utara Province District (Figure 1). The method used in this study is the Purposive Sampling method. Grouper species identification is done by observing morphology on grouper by using the book Market Fishes Indonesia [3] and by looking at the Fishbase.org website, grouper fish is sought in its entirety.

Analysis of the data used to determine the structure of the grouper community is to use the Diversity Indices (H'), Evenness indices (E), and dominance indices (C), is a form [4]:

2.1 Diversity indices (H')
Diversity indices (H’) diversity indices is used to determine the number of species in a community for this reason, calculations are made using the following formula [5]

\[ H' = - \sum (pi \ln pi) \]  

Where
\( H' \) = diversity indices
\( Pi \) = Number of individuals of each type
\( S \) = Number of types
\( \ln \) = Nature logarithm
\( pi \) = \( ni / N \)
The criteria for diversity indices values are as follows by the value H’ = H’ ≤ 2 = Low diversity; = 2.0 < H’ ≤ 3 = Medium diversity; = H’ > 3.0 = High diversity [5].

2.2 Evenness indices (E) [6]
Evenness, which describes the balance of the distribution of individual types in a community, which is calculated using the equation:

\[ E = \frac{H'}{H_{\text{max}}} \] (2)

Where:
- \( E \) = Evenness indices
- \( H' \) = Diversity indices
- \( H_{\text{max}} \) = maximum species diversity
- \( = \ln S \) (where \( S \) is as many species)

The criteria for evenness indices values are as follows:
- \( E = 0 \): Evenness between species is low
- \( E = 1 \): Evenness between species is relatively balanced

2.3 Dominance indices (C) [5]
Dominance indices used to see the dominance of certain types of fish in a community, with the following equation:

\[ C = \sum(P_i)^2 \] (3)

Where:
- \( C \) = Dominance Indices,
- \( P_i \) = \( n_i / N \)

The criteria for dominance indices are as follows:
- \( C = 0 \): Low dominance
- \( C = 1 \): High dominance.

3. Results and discussion

3.1. Grouper species composition (Serranidae) fishermen catches
488 groupers were found on land in Medang Deras District, Batubara Regency based on the book Market Fishes Indonesia [3] at the study site were found as many as 9 species of Grouper with 2 different genera namely the genus Epinephelus and Cephalopholis (Table 1).

Based on the composition of the grouper species (Serranidae) spatially and temporally, species that are always found on a weekly basis and at each station are Epinephelus coioides species with a total of 135 individuals. Many of Epinephelus coioides are found, this is due to the nature of Epinephelus coioides which is easily adapted to the environmental conditions of the waters from estuarine waters to coral reef areas, where a place Grouper fish (Serranidae) on land are located in estuaries or can also be called estuary areas and in the waters of Batubara Regency there are also many small islands with coral reef ecosystems, thus allowing this type of fish to be frequently found.

Ecosystems is a system ecology consisting of biotic and abiotic where these components interact with each other to form an ecological balance. The component consists of the biophysical environment of the waters, coral reefs and the reef fish community itself (especially groupers) [8]. Therefore, the balance between the three components must be maintained. Reef fish (grouper) interact with coral reefs as the main habitat can be divided into three forms of interaction, namely; direct interaction as a shelter.
from predator predators, especially for young fish, interactions in search of food, which includes the relationship between reef fish and biota that live on corals (including algal plants), indirect interactions as a result of coral structure and hydrological and sedimentary conditions [9].

Table 1. Composition of grouper fish species landed in Medang Deras, Batubara Regency

| No | Family | Genus | Species           | Station I | Station II | Total of Individuals |
|----|--------|-------|-------------------|-----------|------------|----------------------|
| 1  |        |       | *Epinephelus areolatus* | +         | +          | 123                  |
| 2  |        |       | *Epinephelus coioides*  | +         | +          | 135                  |
| 3  |        |       | *Epinephelus tauvina*  | +         | +          | 39                   |
| 4  |        | *Epinephelus*  | *Epinephelus bleekeri* | +         | +          | 29                   |
| 5  | Serranidae |       | *Epinephelus quoyanus*  | +         | -          | 7                    |
| 6  |        |       | *Epinephelus erythrurus* | +         | -          | 6                    |
| 7  |        |       | *Epinephelus sexfasciatus* | +         | +          | 121                  |
| 8  |        |       | *Cephalopholis boenak*  | +         | +          | 13                   |
| 9  |        | Cephalopholis | *Cephalopholis microprion* | +         | +          | 15                   |
|    |        |       | Total              |           |            | 488                  |

Where: (+) found; (-) not found

One factor that is little or many fish catches is the influence of the season. The Regency of Batubara is located in North Sumatra which borders the Malacca Strait which is influenced by two seasons, the west and east seasons. The west season lasts from December to March. The Eastern Season runs from June to September. The transition season occurs between April to May, and October to November. The sea situation in this transition season is changing but relatively calm enough [10].

According to [11] for the grouper season (Serranidae), it can reach its peak in the transition season between the west to east season which is in March to May and in the transition season between the east to west season in September to November the number of groupers is low, therefore in this study the total grouper catch in May was more than in June.

Based on the diversity indices ($H'$), grouper fish landed at station I was higher at 1.62 compared to location II at 1.38. This is because the number of species found at station I is greater (9 species)
compared to the number of species found at station II (7 species). But the diversity indices values in the two locations are still in the low category.

Grouper diversity indices values at station I and at station II can be classified as low diversity values. The low value of diversity is due to the small number of grouper species found. According to [5] adding species diversity is influenced by the distribution or distribution of individuals in each species, because even though there are many types of communities, if the distribution is uneven, species diversity is considered low.

Evenness Indices aims to describe the even distribution of species composition in a waters. The Evenness Indices value at station I 0.74 and at station II 0.71. The Evenness Indices value (E) of Grouper (Serranidae) at each station is shown in Table 2. At station I 0.74 and at station II 0.71 This value states that the evenness between species is low, meaning that the individual wealth owned by each - very different species. The Evenness Indices can showed the distribution of each species of fish in an ecosystem. The smaller the value (E), the smaller the evenness of a population and the distribution of individuals that dominate the population while the greater the value, the greater the evenness of a population where the types and total individuals of each species in ecosystem are relatively the same or evenness [13].

Dominance indices is used to determine the extent to which a species or genus dominates a group. The dominance indices value at station I 0.26 and at station II is 0.31. This value is relatively low because the value is between 0-1. This proves that no particular species dominates. Dominance indices is used to determine the extent to which a species or genus dominates a group.

The total catch of Grouper (Serranidae) at Station I is higher than Station II. At station I the total number of fish individuals landed was 302 individuals and at station II it was 181 individuals. This is caused by differences in fishing gear used by fishermen and the length of time of fishing at each station. In the process of catching grouper (Serranidae) fishermen at station I use Rawai fishing gear with trip 4-6 days, fishing line with trip 1-3 day) and some grouper fish (Serranidae) are caught with basic gill nets, while at station II in the process of catching grouper (Serranidae) the fishermen at station II only use fishing gear fishing rods and some grouper fish (Serranidae) are caught with basic gill nets. According to [14] catches are not only influenced by fish abundance at any given moment, but also depend on the number of units and the efficiency of fishing gear units, the length of fishing operations and the availability of fish to be caught.

3.3 Temporal community structure of grouper (Serranidae)

Research data results on May, there were 9 species, 2 genera with 303 individuals and in June 8 species, 2 genera with 185 individuals (Table 3).

| Month | Total (N) | Total Species (S) | Diversity (H') | Evenness (E) | Dominance (C) |
|-------|-----------|-------------------|----------------|-------------|--------------|
| May   | 303       | 9                 | 1.74           | 0.79        | 0.22         |
| June  | 185       | 8                 | 1.60           | 0.77        | 0.25         |

Based on Table 3 can be seen Diversity Indices values (H') temporally the results of the analysis show that the value of H' in May was 1.74 and in June was 1.60. Diversity indices value per month is still classified in the low category.

The Evenness Indices illustrates whether the distribution of the number of individuals of each type is obtained evenness or not. The evenness indices value in May 0.79 and in June 0.77. The evenness indices did not differ much between months of observation, because the number of species in May and June did not differ much. The Dominance of species in both months is also not much different, that is,
in May the dominance indices is 0.22 and in June is 0.25, this value indicates that in the grouper community (Serranidae) there is no dominance of a type because dominance indices value (C) <1.

4. Conclusions
The conclusion of this research is the catch of Grouper fish landed in the District of Medang Deras, Batubara Regency overall comes from the Serranidae Family of 9 species, and 2 genera. The Diversity Indices value of grouper (Serranidae) at station I 1.62 and at station II 1.34. Evenness Indices value at station I 0.74 and at station II 0.71. The value of the Domination Indices at station I 0.26 and at station II 0.30. Diversity Indices value of grouper (Serranidae) in May 1.74 and in June 1.60, the Evenness Indices in May 0.79 and in June 0.77. The Dominance Indices value in May 0.22 and in June 0.25.

Reference

[1] Habibi H, Sugiyanta, Yusuf C 2011 Perikanan Kerapu dan Kakap-Panduan Penangkapan dan Penanganan [Grouper and Snapper Fishing - Guidelines for Arrest and Handling] Jakarta WWF- Indonesia
[2] ChouL M 1984A Review Reef Survey and Management Methods in Singapore Singapore Department of Zoology
[3] White W T, Last P R, Dharmadi, Prisantoso B I, Pogonoski J J, Puckridge M, Blaber S J M 2013 Market fishes of Indonesia Canberra Australian Centre for International Agricultural Research 438 p
[4] Astuti R, Yongvittner, Kamal M M 2016 StrukturKomunitasIkanKerapu (Serranidae) yang Didarafatkan di Kecamatan Peukan Bada, Provinsi Aceh [Grouper Community Structure (Serranidae) Landing in Peukan Bada District, Aceh Province] Jurnal Ilmu dan Teknologi Kelautan Tropis 8 pp 73-84
[5] Odum E P 1993 Dasar-dasar Ekologi [Basics of Ecology] 3rd Edition Yogyakarta Universitas Gadjah Mada Press
[6] Brower J and Zar J H 1990 Field and Laboratory Method from General Ecology Third Edition Dubuque, Lowa Wm. C. Brown Publishers
[7] Latuconsina H, Nessa M N, Rappe R A 2012 Komposisi spesies dan struktur komunitas ikan padang lamun di perairan Tanjung Tiram, Teluk Ambon Dalam [Species composition and structure of seagrass fish communities in the waters of Tanjung Tiram, Teluk Ambon Dalam] Jurnal Ilmu dan Teknologi Kelautan Tropis 4 pp 35-46
[8] Chabanet P, Ralambondrainy H, Amanieu M, Faure G, Galzin R 1997 Relationships between coral reef substrata and fish Coral Reefs 16 pp 93–102
[9] Choat J H, Bellwood 1991 Interactions amongs herbivorous fishes on a coral reef: influence of spatial variation Marine Biology 89 pp 221-34
[10] Jimmi 2009 Keanekebaragaman dan Kelimpahan Ikan Kerapu (Serranidae) di Daerah Reservasi (Zona Inti) dan Non-Reservasi (Zona Pemukiman) Taman Nasional Laut Kepulauan Seribu, Jakarta [Diversity and Abundance of Grouper (Serranidae) in Reservation Areas (Core Zone) and Non-Reservation (Settlement Zones) Kepulauan Seribu Marine National Park, Jakarta] MSc Thesis Institut Pertanian Bogor
[11] Yulianto I, Wiryawan B, Taurus A A, Wahyuningsrum P I, Kurniawati V R 2013 Dinamika Perikanan Kerapu Di Taman Nasional Karimunjawa [The Dynamics of Grouper Fisheries in Karimunjawa National Park] Marine Fisheries 4 pp 175-81
[12] Marzuki S, Djamal R 1992 Penelitian Penyebaran, Kepadatan Stok dan Beberapa Barometer Biologi Induk Kakap Merah dan Kerapu di Perairan Laut Jawa dan Kepulauan Riau [Research on Distribution, Stock Density and Biological Parameters of Red Snapper and Grouper Parent in the Java Sea and Riau Islands] Jurnal Penelitian Perikanan Laut 8 pp 49-65
[13] Krebs C J 1989 Ecological methodology New York Harper and Row Publisher 652p
[14] Sriati 2011 Kajian Bio-ekonomi Sumberdaya Ikan Kakap Merah yang didaratkan di Pantai Selatan Tasikmalaya, Jawa Barat [Bio-economic study of red snapper resources landed on the south coast of Tasikmalaya, West Java] Jurnal Akuatik 2 pp 70-90