

DIVERSITY INDEX OF DRIFT GILLNET CATCHES IN SEI BEROMBANG VILLAGE, PANAI HILIR DISTRICT, LABUHAN BATU REGENCY, NORTH SUMATERA

Indeks Keanekaragaman Hasil Tangkapan Jaring Insang Hanyut (Drift Gillnet) Di Kelurahan Sei Berombang Kecamatan Panai Hilir Kabupaten Labuhan Batu Sumatera Utara

Eka Anjar Sari Nasution, Yun Alwi, Rizky Janatul Magwa*, Nurhayati, Fauzan Ramadan, M Hariski

Fisheries Resource Utilization Study Program, Faculty of Animal Husbandry, Jambi University

Jambi - Muara Bulian Street, Muaro Jambi District

*Corresponding author: rizkymagwa@unja.ac.id

ABSTRAK

Sei Berombang Village has significant potential natural resources in the fisheries sector. The waters of Sei Berombang Village are estuarine, where river water mixes with seawater. The fishing gear used in the study at Sei Berombang Village was a drift gillnet with a mesh size of 2 inches and a boat size of 3 GT. The research was conducted from January 8 to February 5, 2024, in the waters of Sei Berombang Village. This study aimed to determine the species diversity of fish caught by drift gillnets. The research used survey and observation methods. Data analysis included catch composition, diversity index, evenness index, and dominance index. The results showed that the catch using drift gillnets in the waters of Sei Berombang Village consisted of 15 species. The primary catch by drift gillnets, from highest to lowest, included pomfret with 1,001 individuals (19.81%) and the lowest being mullet with 375 individuals (7.42%). The highest bycatch was sweet shrimp with 714 individuals (14.13%), and the lowest was crab with 36 individuals (0.71%). The highest discard was pufferfish with 120 individuals (2.37%), and the lowest was baji fish with 5 individuals (0.1%), with the total catch weighing 541.5 kg and the total number of catches being 5,053 individuals. The obtained diversity index was 2.39, categorized as moderate; the evenness index was 0.88, categorized as high; and the dominance index was 0.11, categorized as low.

Keywords: Composition Of Catch, Diversity, Index Of Dominance, Uniformity

ABSTRAK

Kelurahan Sei Berombang memiliki banyak sumber daya alam terutama di bidang perikanan. Perairan Kelurahan Sei Berombang merupakan perairan muara dimana percampuran antara air sungai dan air laut. Alat tangkap yang dipakai pada saat penelitian di Kelurahan Sei Berombang yaitu alat tangkap jaring insang hanyut dengan *mesh size* 2 inci dengan ukuran kapal 3GT. Penelitian ini dilakukan tanggal 08 Januari sampai 05 Februari 2024 di Perairan Kelurahan Sei Berombang.

Tujuan dari penelitian untuk mengetahui keanekaragaman jenis ikan yang tertangkap pada jaring insang hanyut. Penelitian ini menggunakan metode survey dan observasi. Komposisi hasil tangkapan, indeks keanekaragaman, indeks keseragaman dan indeks dominansi digunakan untuk analisis data. Hasil penelitian ini menunjukkan bahwa hasil tangkapan menggunakan alat tangkap jaring insang hanyut di perairan Kelurahan Sei Berombang terdiri dari 15 spesies. Jumlah hasil tangkapan utama jaring insang hanyut dari yang tertinggi yaitu pada ikan bawal sebanyak 1.001 ekor (19,81%) dan yang terendah pada ikan belanak sebanyak 375 ekor (7,42%), Untuk hasil tangkapan sampingan yang tertinggi ialah udang manis 714 ekor (14,13%), dan yang terendah ialah kepiting sebanyak 36 ekor (0,71%), dan untuk hasil tangkapan buangan yang tertinggi ialah ikan buntal sebanyak 120 ekor (2,37%) dan yang terendah ialah ikan baji sebanyak 5 ekor (0,1%) dengan berat hasil tangkapan keseluruhan sebanyak 541,5 kg dengan jumlah hasil tangkapan sebanyak 5.053 ekor. Nilai indeks keanekaragaman yang didapat yaitu 2,39 dalam kategori sedang, nilai indeks keseragaman yang didapat yaitu 0,88 dalam kategori tinggi dan nilai indeks dominansi yang didapat yaitu 0,11 dalam kategori rendah.

Kata Kunci: Indeks Dominansi, Keanekaragaman, Keseragaman, Komposisi hasil tangkapan

INTRODUCTION

Sei Berombang is one of the coastal villages in Panai Hilir District, Labuhan Batu Regency. Sei Berombang Village is a village that is close to Kuala, so it has very large natural resource potential in the fisheries sector in Labuhan Batu Regency with a water area of 34,243 Ha (Munthe *et al.*, 2021). Sei Berombang Village has calm waves and currents, the water is murky brownish with a sandy bottom. Sei Berombang sub-district has 7 villages and 1 sub-district, namely: Sei Tawar, Sei Penggangan, Sei Sanggul, Sei Lumut, Sei Sakat, Sei Baru, Wonosari. Sei Berombang has 2 river basins, namely the Barumon river and the Blade river (Nasution *et al.*, 2015).

Sei Berombang Village is classified as a strategic area because of its position close to Tangkahan general. The many sea areas, coastal areas and small islands in Sei Berombang Village are very important as a mainstay for fishermen's economic development. The potential natural resources for fishermen in the Sei Berombang area are said to be the greatest in Labuhan Batu Regency, but only a small portion of the potential has been utilized. Most of the people of Sei Berombang Village work as fishermen. The number of fishermen in Sei Berombang Village reached 941 people (Saragih, 2022). There are 3 occupational groups of fishermen, namely owner fishermen (juragan), catch fishermen and worker fishermen (Lubis, 2020). Apart from working as fishermen, some people in Sei Berombang Village process their catches and make crafts to increase their income. Small fishermen really need the role of the owner fisherman (juragan) as the person with the most power and control of the economy to control all activities of the Sei fishing community. Wavy (Lubis, 2020).

Sei Berombang Village fishermen carry out fishing operations in areas where lots of fish gather (fishing grounds). Fishing areas are places where populations of organisms can be used to produce fisheries. In fishing activities, efforts need to be made to catch fish efficiently and optimally. Fishing operations in Sei Berombang Village with a distance of ± 1 mile. The types of fishing gear found in Sei Berombang Village are ulukah (tangkul), longline, gill nets, trawls (anchovy trawls), traps, sondong, fishing rods. Has 10 units of drift gill net fishing equipment with a vessel size of 3 GT. Fishermen in Sei Berombang Village go to sea starting at 04:00 WIB when the water is still high and can make 17-20 trips in a month. Drift gill nets are operated by drifting to a depth of ± 7 meters.

The catch of fishermen in Sei Berombang Village consists of several types, namely pelagic fish (mackerel, pomfret), non-pelagic fish (squid), demersal fish (sangge, stingray and snapper), shrimp (rajungan, sweet shrimp, kelong shrimp) and other types. The daily catch can reach 20-120 kg with the daily income of IDR. 100,000 – Rp. 500,000. The total amount of catch production in 2020 was 3,545.81 tons (Lubis & Prasetyo, 2021).

Diversity within a population shows species richness in terms of the number of aquatic species (Satrioajie, 2012). The fish diversity index is important to study, because the diversity index is data for fisheries management. The diversity of fish in waters is very important because biologically there are many species or ecosystems that play an important role in supporting life in this area. One of the basic things needed to support catch management is the availability of data on diversity indices. Sustainable management of marine resources is important to maintain the diversity of catches in the Sei Berombang Village area. Sei Berombang sub-district has a wide variety of catches. This diversity can be a source of economic life for the local community and is an important part of the marine ecosystem that needs to be preserved. Diversity in Sei Berombang Village is a center for diverse fishing activities and is important for the local community's economy. The gill nets used in Sei Berombang Village have a mesh size of 2. The mesh size really determines the size of the fish caught in the net.

Most of the gill nets that are often used in Sei Berombang Village are basic and surface gill nets with a mesh size of 3 inches. Meanwhile, researchers use drift gill nets with a mesh size of 2 inches, which is still limited and has a very diverse diversity that exists there, so researchers are interested in researching the "Index of diversity of drift gillnet catches in Sei Berombang Village, Panai District Hilir Labuhan Batu Regency, North Sumatra."

METHODS

Place and Time

This research was carried out in the waters of Sei Berombang Village, Panai Hilir District, Labuhan Batu Regency, North Sumatra, which was carried out for 25 research days.

Tools and Materials

The materials and equipment used during the research can be seen in Table 1:

Table 1. Materials and Equipment

No	Name	Utility
1	<i>Drift Gillnet 2</i> Inci	To catch fish
2	Scales	To weigh the weight of the catch
3	Stationery	To record catch data such as fish name, weight and number.
4	Questionnaire	To collect data by means of written questions to respondents.
5	Ms. Excel	To process catch data
6	Camera	To document during research

Research methods

The method used in this research is the survey method. The technique for collecting and collecting data on fish and the specific gravity of fish species is carried out by direct observation

of the caught fish, data collection on catches is taken from 10 vessels using drift gill net fishing gear with a mesh size of 2 inches and a vessel size of 3 GT.

Data Analysis

This research uses descriptive analysis to analyze the data. Before analyzing the data, the catch is first identified to find out the common name and Latin name of the species. Identification can be done directly by observing the caught fish, after that the overall weight of the catch is weighed, then the data is processed using Ms. Excel to find out the catch and get the correct results using the formula Susanti *et al.* (2013):

Composition of Catch

The composition of the catch is used to find out the composition of what is caught using the formula Susanti *et al.*, 2013 as follows:

$$P = \frac{n_i}{N} \times 100\%$$

Information:

- P : Species composition (%)
n_i : Number of each fish species (tail)
N : The total number of catches (kg)

A. Main Catch

$$HTU (\%) = \frac{\Sigma HTU}{\Sigma \text{Total Catch}} \times 100\%$$

B. Bycatch

$$HTS (\%) = \frac{\Sigma HTS}{\Sigma \text{Total Catch}} \times 100\%$$

C. Discard

$$HTB (\%) = \frac{\Sigma HTB}{\Sigma \text{Total Catch}} \times 100\%$$

Catch Diversity Index

Diversity analysis is used to determine the diversity of species using the Shanon-Winner equation formula (Brower & Zar, 1990) as follows:

$$H' = -\sum \frac{n_i}{n} \times \ln \frac{n_i}{n}$$

Information:

- H' : Shanon-Winner Diversity Index
n_i : Number of Individuals in a species
N : The total number of individuals of all species

The range of the Shanon diversity index (H') is classified as follows:

Uniformity Index

Uniformity index (E) Shanon-winner (Odum, 1993) produces a uniformity index (E), which shows the distribution pattern of biota in an ecosystem or a measure of the similarity of the number of each in a community. Calculations are carried out using the following formula

$$E = \frac{H'}{\ln S}$$

Information:

- E = Uniformity index
- H' = Shannon-Winner diversity index
- S = Number of species

The Uniformity Index values are grouped into three criteria, namely:

- E < 0,4 : Low level of type uniformity
- 0,4 < E < 0,6 : Medium Type Uniformity Level
- E > 0,6 : High level of Type Uniformity

Dominance Index

The dominance index is calculated using the "Index of Dominance" formula from (Simpson, 1949):

$$C = \Sigma \left(\frac{ni}{n} \right)^2$$

Information:

- C : Simpson Dominance
 - ni : Number of individuals of the species caught
 - n : Total number of species caught
- Simpson's dominance index criteria:
- C < 0,5 : The dominance of caught species is low
 - C ≥ 0,5 : The dominance of caught species is high

RESULT

General Description of Research Locations

This research was carried out in the waters of Sei Berombang Village, Panai Hilir District, Labuhan Batu Regency, North Sumatra. The location of this research is waters with a muddy substrate and sandy bottom. The research locations can be seen in Figure 1.

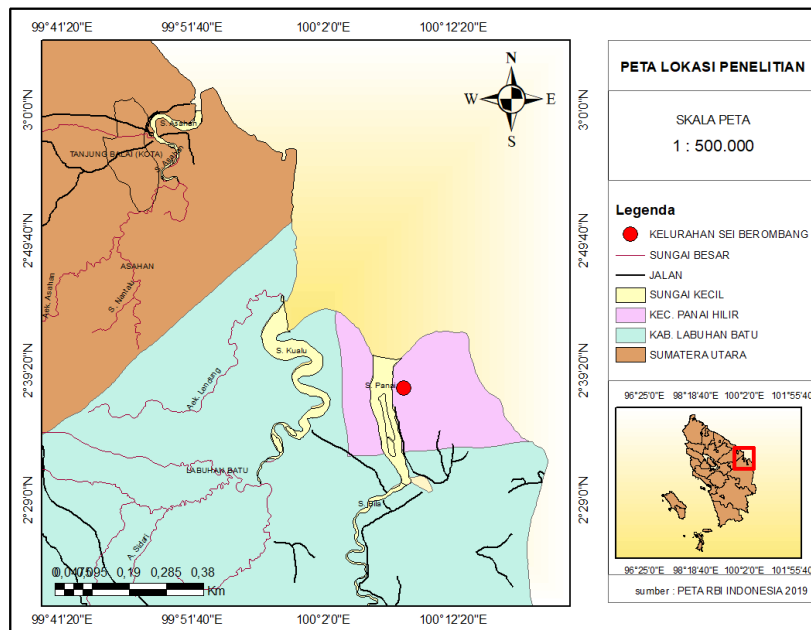


Fig 1. Location map

Sei Berombang Village is one of the Villages located in North Sumatra Province. The geographical location of Sei Berombang Village is located at coordinates at 1° 41'E- 2°44'E North Latitude, 99°33E – 100°22'E East Longitude with an area of 2,516.38 km². To the west it borders Labuhan Batu Regency, to the east it borders Riau Province, to the South it borders South Labuhan Batu Regency and North Padang Lawas, to the North it borders the Malacca Strait and North Labuhan Batu Regency.

The majority of the residents of Sei Berombang sub-district are fishermen, due to its location close to the water. Most fishermen catch around or far from the waters of Sei Berombang. The waters of Sei Berombang Village are estuarine waters that have sandy and muddy bottoms with depths ranging from 9-12 meters. Estuary waters are a mixture of sea water and fresh water. The impact of mixing sea water and fresh water will produce distinctive communities with different environments.

Composition of Drift Gill Net Catches

The drift gill net fishing equipment in Sei Berombang Village is operated to catch fish in the middle of the water or near the surface, with a long floating rope that controls the depth of the net. Drift Gillnet is not installed on the seabed, but is left to drift with the current. Most fishermen in Sei Berombang Village carry out one-day fishing, in one day the operation of drift gill nets for vessels <5 GT in Sei Berombang waters is carried out for 7-8 hours.

Table 2. Composition of Drift Gillnet Catches

No	Local Name	Latin name	Heavy (kg)	Composition of Catch (%)	Amount (ekor)	Composition of Catch (%)
1	Pomfret***	<i>P. niger</i>	108	19,94	1.001	19,81
2	Komo trevally ***	<i>A. Mate</i>	88,1	16,27	491	9,72
3	Happy Fish****	<i>E.tetradactylum</i>	81	14,96	500	9,9
4	Mackarel tuna****	<i>E. affinis</i>	59	10,9	445	8,81
5	Mullet Fish****	<i>M. seheli</i>	44	8,13	375	7,42
6	Gulamah Fish**	<i>J. amblycephalus</i>	45	8,31	279	5,52
7	Stingray**	<i>H. gerardi</i>	29,6	5,47	198	3,92
8	Squid**	<i>Loligo sp.</i>	20,1	3,71	211	4,18
9	Sweet/white Shrimp**	<i>L.vannamei</i>	18	3,32	714	14,13
10	Vinegar Fish**	<i>Gastronomiac</i>	16	2,95	126	2,49
11	Kelong/Windu Shrimp**	<i>P. monodon</i>	13,5	2,49	476	9,42

12	Sole**	<i>C. lingua</i>	9	1,66	76	1,5
13	Crab**	<i>S. olivacea</i> <i>herbst</i>	4,5	0,83	36	0,71
14	Puffer fish*	<i>A. meleagris</i>	3,9	0,72	120	2,37
15	Wedge Fish*	<i>P. indicus</i>	1,8	0,33	5	0,1
Amount			541,5	100	5.053	100
Average/day			36,1		337	

Information: *** Main Catch (HTU)
 ** By-Catch Results (HTS)
 * Discarded Catch Results (HTB)

Table 2 shows that the composition of catches in drift gill nets during research in the waters of Sei Berombang Village varied in number. The catch from drift gill nets was 5,053 fish with an average daily catch of 337 fish weighing 541.6 kg with an average daily catch of 36.1 kg. Regarding the catch using drift gill net fishing gear, there are 15 species, namely pomfret (*Parastromateus niger*), comomo trevally (*Atule mate*), sukain fish (*Eleutheronema tetradactylum*), mackerel (*Euthynnus affinis*), gulamah fish (*Johnius amblohnus amblycephalus*), mullet fish (*Moolgarda seheli*), stingray (*Himantura gerardi*), squid (*Loligo sp.*), sweet shrimp (*Litopenaeus vannamei*), vinegar fish (*Gastronomiac*), kelong shrimp (*Penaeus monodon*), tongue fish (*Cynoglossus lingua*), crab (*Scylla olivacea herbst*), puffer fish (*Arothron meleagris*), wedge fish (*Platycephalus indicus*). Drift gill nets are selective in fishing, meaning they only catch certain types of fish and sizes. When operating a drift gill net, the caught fish will enter or become entangled in the gills or operculum. Meanwhile, shrimp caught in drift gillnet fishing gear will enter or become entangled in the net through the cephalothorax in their body. Its selective nature causes the catch to consist of the composition of the types of fish found in the drift gill net fishing gear (Katarina *et al.*, 2019).

The highest catch of drift gill nets was 1,001 pomfret fish with a weight of 108 kg and the lowest catch of baji fish (*Platycephalus indicus*) was 5 fish with a weight of 1.8 kg. Pomfret is one of the most widely available fish commodities and has a fairly economical price (January, 2018). Pomfret is a fish that can grow in estuarine and slightly muddy areas. The wedge fish (*Platycephalus indicus*) is a fish that lives in shallow, muddy bottom waters. Fishing activities carried out by fishermen do not always get the same results every time, even though fishing activities are carried out with the same effort and in the same fishing area. The number of catches varies according to the fishing season even though fishing operations are carried out with the same effort and in the same fishing area (Notanubun *et al.*, 2022).

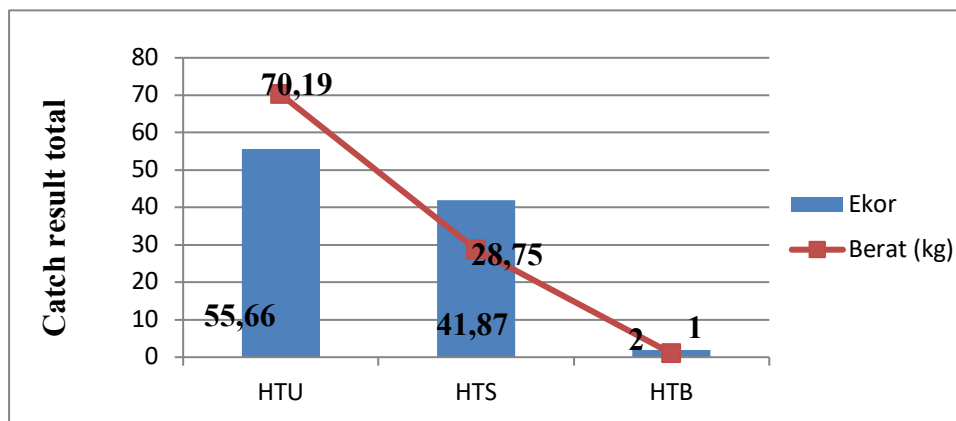


Fig 2. Weight and Number of Catches

1. Main Cath

The main catch is the most important result obtained from a fishing activity. The primary catch is the main target in operations (Eayrs, 2005). Based on Figure 2. The total weight of the main catch caught using drift gill net fishing gear was 70.19% with the highest species being pomfret (*Parastromateus niger*) at 108 kg (19.94%), trevally. komo (*Atule mate*) as much as 88.1 kg (16.27%), sengin fish (*Eleutheronema tetradactylum*) as much as 81 kg (14.96%), tuna (*Euthynnus affinis*) as much as 59 kg (10.9%), fish mullet (*Moolgarda seheli*) as much as 44 kg (8.13%). And the number (of tails) caught in drift gill nets was 55.66% (Figure 2) with the highest species being pomfret fish (*Parastromateus niger*) at 1,001 fish (19.81%), happy fish (*Eleutheronema tetradactylum*) at 500 fish (9.9%), Komo trevally fish (*Atule mate*) as many as 491 fish (9.72%), tuna fish (*Euthynnus affinis*) as many as 445 fish (8.81%), mullet fish (*Moolgarda seheli*) as many as 375 fish (7 .42%). The type of catch in drift gill nets is more dominant in schooling fish species. Species that are often caught in drift gill net fishing gear include mackerel, sardines, layur fish, sangge fish, trevally, mackerel and tembang fish. Marine fish have economic value with quite high protein content (Prasety *et al.*, 2020). Many happy fish and pomfret fish are caught in drift gill nets and are much loved by the public, so they are expensive (Katarina *et al.*, 2019).

2. Bycatch

During the research there were bycatches from drift gill net fishing equipment consisting of 8 species caught, namely gulamah fish (*Johnius amblycephalus*), stingrays (*Himantura gerardi*), sweet shrimp (*Litopenaeus vannamei*), squid (*Loligo sp.*), vinegar fish (*Gastronomiac*), kelong shrimp (*Penaeus monodon.*), tongue fish (*Cynoglossus lingua*), crab (*Scylla olivacea herbst*).

Bycatch can be defined as catch caught other than the main catch and bycatch that is not the main target in catching the species. Bycatch weight was 28.75% (Figure 2) with the highest species being gulamah fish (*Johnius amblycephalus*) 45 kg (8.31%), stingray (*Himantura gerardi*) 29.6 kg (5.47%).), squid (*Loligo sp.*) as much as 20.1 kg (3.71%), sweet shrimp (*Litopenaeus vannamei*) 18 kg (3.32%), vinegar fish (*Gastronomiac*) as much as 16 kg (2, 95%), kelong shrimp (*Penaeus monodon*) as much as 13.5 kg (2.49%), tongue fish (*Cynoglossus lingua*) as much as 9 kg (1.66%), and crab (*Scylla olivacea herbst*) as much as 4.5 kg (0.83%). Stingrays are cartilaginous organisms that have a flat body and pectoral fins that are modified into wings. In general, stingrays have a

habitat in deep waters with muddy bottoms (Graham, 2007). White *et al.* (2019) stated that waters close to river mouths have a higher density of stingrays.

The number (tails) of by-catch was 41.87% (Figure 2) of the highest type of catch, namely sweet shrimp (*Litopenaeus vannamei*) 714 (14.13%), kelong shrimp (*Penaeus monodon*) 476 (9.42%), 279 kg of gulamah fish (*Johnius amblycephalus*), 211 squid (*Loligo sp.*) (4.18%), 198 stingrays (*Himantura gerardi*) (3.92%), Vinegar fish (*Gastronomiac*) as many as 126 individuals (2.49%), tongue fish (*Cynoglossus lingua*) as many as 75 individuals (1.5%), and crabs (*Scylla olivacea herbst*) as many as 36 individuals (0.71%). Hasanah *et al.* (2020) stated that shrimp and fish inhabit relatively similar habitats and interact with each other. One of the important fishery resources in Indonesia is shrimp. The life of crabs is divided into two habitats, namely along land areas and in sea waters. According to Poupin and Juncker, (2010) crabs migrate and live in sea waters, crabs have swimming legs and crabs that live on the beach have walking legs. Types of fish caught by fishermen using drift gill nets include stingrays, white snapper, gulamah fish, hosepipe and red fish (Salim *et al.*, 2017).

3. Discard

Discarded catch is defined as catch that has no selling price on the market. Discarded catches are caught species that are then thrown away or returned to the sea alive or dead (Eayrs, 2005). Based on Table 3, the weight of the discarded catch is 2 species with a weight of 1% (Figure 2), namely puffer fish (*Arothron meleagris*) weighing 3.9 kg (0.72%), wedge fish (*Platycephalus indicus*) weighing 1.8 kg (0.33%). And the number of discarded catches was 2% (Figure 2) with 120 pufferfish (*Arothron meleagris*) (2.37%), 5 wedge fish (*Platycephalus indicus*) (0.1%).

Diversity, Uniformity And Dominance

The diversity index value shows the types of species that exist in the aquatic community. The uniformity index is an index that each individual in one species is found in the community. The diversity index value shows the types of species that exist in the aquatic community. Table 3 shows the indices of dominance (C), uniformity (E), diversity (H).

Table 3. Values of Diversity, Uniformity and Dominance

Indeks	Mark	Category
H'	2,39	Currently
E	0,88	Tall
C	0,11	Low

Information:

H' = Diversity Index
 E = Uniformity Index
 C = Dominance Index

1. Diversity Index (H')

From Table 3 it can be seen that the diversity index value obtained from observations during the research is included in the medium category with a value obtained of 2.39, meaning that the diversity in the waters of Sei Berombang sub-district has a uniform population and there are no dominant species. According to the Shanon-Winner equation (Odum, 1993), diversity is categorized as moderate with no species dominating if the H value is in the range of 1-3. High or

low diversity index values depend on the variation and mesh size of the number of individuals of each fish species caught. So, the level of fish diversity in the population of each species will increase along with the number of fish species and variations in the number of individuals of each species, but along with the decrease in the number of fish species and variations in the number of individuals for each species, the level of fish diversity in an aquatic ecosystem will also increase (Sriwidodo *et al.*, 2013). The diversity index can be used to estimate the condition of the aquatic environment (Iswanti *et al.*, 2012).

2. Uniformity Index (E)

The uniformity index shows the organization and population in a community, with a value of 0.4-0.6. A lower value of this index indicates a smaller population, indicating that the distribution of numbers belongs to different species (Krebs, 1985). The uniformity index in this study was found to be in the high category, namely 0.88, meaning that the number of individuals caught in drift gill nets with a mesh size of 2 inches was uniform and no species dominated. A high uniformity index value will always be followed by a low dominance index value and vice versa if a low uniformity index indicates that one individual is more dominant in the community (Odum, 1993).

3. Indeks Dominansi (C)

Based on the calculation of the dominance index value for catches from drift gill nets with a mesh size of 2 inches in Sei Berombang Village, the value is 0.11 in the low category, which means there are no prominent or dominant species. Among various species, a low dominance index indicates that no species dominates and ecologically indicates that the water conditions are stable and the environmental conditions are quite good (Jumariah *et al.*, 2015). Based on the research results, it can be concluded that although the number of species is uniformly high, the dominance index value is lower, even though there are several species caught in greater numbers. The dominance index is useful for calculating the presence of certain types that dominate a community.

CONCLUSION

The diversity index of catches using drift gill net fishing gear with a mesh size of 2 inches in Sei Berombang Village, Panai Hilir District, Labuhan Batu Regency, North Sumatra, contained 15 species. The diversity index value is 2.39, the uniformity index value is 0.88 and the dominance index value is 0.11. Each shows a moderate value.

ACKNOWLEDGEMENT

The author would like to thank the fishermen who have helped the author in collecting catch data and all parties who have helped the author in completing this research in any way..

REFERENCES

- Brower, J. E and J. H. Zar, 1990. *Field And Laboratory Method From General Ecology*. Brown publisher. Dubugue. Lewa.
- Eayrs Steve and Day Garry. (2005). A Guide to Bycatch Reduction in Tropical Shrimp-Trawl Fisheries. In *Organization*.
- Hasanah, A., Yusuf, H. N., Hufiadi, H., & Suman, A. (2020). Perikanan jaring Arad dan sebaran panjang Udang Kelong di Perairan Meulaboh. *Bawal Widya Riset Perikanan Tangkap*,

12(2), 69–80.

- Iswanti, S., Ngabekti, S., Kariada, N., & Martuti, T. (2012). Distribusi dan Keanekaragaman Jenis Makrozoobentos di Sungai Damar Desa Weleri Kabupaten Kendal. *Unnes Journal of Life Science*, 1(2), 86–93.
- Januari. (2018). Tren Produksi Hasil Tangkapan Ikan Bawal (*Pampus sp.*) yang Didaratkan di Pos Pembelian Ikan di Kota Tarakan Kalimantan Utara. *Skripsi*. Program Studi Manajemen Sumberdaya Perairan Fakultas Perikanan Dan Ilmu Kelautan Universitas Borneo Tarakan.
- Jumariah, J., Agustina, F., & Notowinarto, N. (2015). The Structure Community of the Shrimp (Crustacea) at Teluk Sepaku River, Buluh, Bulang Districk, Batam Island. *Simbiosis*, 4(2), 118–131.
- Katarina, H. N., Dwi Kartika, W., & Wulandari, T. (2019). Keanekaragaman Jenis Ikan Hasil Tangkapan Nelayan di Kelurahan Tanjung Solok Tanjung Jabung Timur. *Biospecies*, 12(2), 28–34.
- Lubis, S. M., & Prasetyo, A. (2021). Potensi Satasabang Sebagai Kawasan Minapolitan Dalm Roadmap Sistem Inovasi Daerah Kabupaten Labuhan Batu dengan Analisis SWOT. *Jurnal Inovasi Pembangunan Kelitbangan*, 9(2), 151–166.
- Lubis, V. R. (2020). Stratifikasi Sosial Masyarakat Nelayan di Kelurahan Sei Berombang Kecamatan Panai Hilir Kabupaten Labuhan Batu Sumatera Utara. *Jurnal mahasiswa*, 1–12.
- Munthe, A. A., Sepriani, Y., & Sitanggang, K. D. (2021). Analisis Peluang Usaha Toko Pertanian di Beberapa Kecamatan Kabupaten Labuhan Batu. *Jurnal Mahasiswa*, 2, 12–20.
- Nasution, Y. S., Bathara, L., & Hamid, H. (2015). Margin pemasaran Ikan Teri Nasi (*Stolephorus commersonii*) di Kelurahan Sei Berombang Kecamatan Panai Hilir Kabupaten Labuhan Batu Provinsi Sumatera Utara. *Jurnal Online Mahasiswa*, 2(1).
- Notanubun, J., Ngamel, Y. A., & Bukutubun, S. (2022). Keragaman Jenis Hasil Tangkapan dan Sinkronisasi Waktu Tangkap Jaring Insang Permukaan di Perairan Ohoi Tuburngil Kabupaten Maluku Tenggara. *Jurnal Sumberdaya Akuatik Indopasifik*, 6(3), 259–270. <https://doi.org/10.46252/jsai-fpik-unipa.2022.vol.6.no.2.230>
- Odum, E.P. (1993). Dasar-Dasar Ekologi. Terjemah Tjahjono Samingan. Edisi Ketiga. Yogyakarta : Gadjah Mada University Press
- Poupin, J., & Juncker, M. (2010). Guide Des Crustacés Décapodes Du Pacifique Sud A Guide To The Decapod Crustaceans Of The South Pacific. www.crisponline.net/5Cnwww.oecil.nc
- Prasetyo, G. W., Mochammad, R., dan Ronny, I. W. (2020). Distribusi Ukuran dan Ukuran Panjang Berat Ikam Bawal (*Pomfret fish*) yang Tertangkap pada *Drift Gillnet* di Perairan Paloh, Kalimantan Barat. *Jurnal Enggano*. 5(3): 334-349.
- Salim, G., & Kelen, P. B. (2017). Analisis Identifikasi Komposisi Hasil Tangkapan Menggunakan Alat Tangkap Jaring Insang Hanyut (*Drift Gillnet*). *Herpodon Borneo*, 10(1), 13–22.
- Satrioajie, W. N (2012). Biologi dan Ekologi Kerang Bulu Anadara (*Cunearea pilula*). *Oseana*, 37(2): 1-9.
- Simpson, E. H. (1949). Measurment Of Diversity. *Nature*, 168: 688.
- White, W. T., Baje, L., Simpfendorfer, C. A., Appleyard, S. A., Chin, A., Sabub, B., Rochel, E., & Naylor, G. J. P. (2019). Elasmobranch Bycatch in the Demersal Prawn Trawl Fishery in The Gulf Of Papua, Papua New Guinea. *Scientific Reports*, 9(1), 1–16. <https://doi.org/10.1038/s41598-019-45715-w>