Effect of Mesh Size on Fishing Gear Gill Nets on the Catch in the Sub-District of Teluk Meranti, Pelalawan Regency

Irma Glaudia[1*], Bustari[1], Polaris[1]

[1]Department of Utilization of Fisheries Resources, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia
*Irmagaludia@gmail.com

Article Info

Received
03 August 2023

Accepted
05 September 2023

Keywords:
Meshes,
Gillnets,
Pangkalan Terap.

Abstract

The size of the gill net in the waters of Pangkalan Terap Village is 2.5 inches, 3 inches, and 5 inches, but its use is still based on the current season. This study aims to determine the effect of gillnet mesh size on catches, determine the number, type, weight, and size of catches, and determine the size of gill nets that are effectively used to catch fish in Pangkalan Terap Village. This research was conducted in April - June 2022 in Pangkalan Terap Village, Teluk Meranti District, Pelalawan Regency, Riau Province. The method used in this research is an experimental fishing method with a Randomized Group Design. The results showed that the mesh size of 2.5 inches, 3 inches, and 5 inches in the rainy and dry seasons in Pangkalan Terap Village had a significant effect on the number and weight of fish caught ($F_{count} > F_{Table}$). The number of fish caught in the rainy season was 219 fish weighing 46259 g, while in the dry season, 241 fish weighing 79435g. The types of catches in all nets in both seasons were ten species dominated by Cyclocheillichthys sp. 2.5-inch gill nets are more effectively used because they get the most diverse catches compared to other nets

1. Introduction

Pelalawan Regency is one of the regencies in Riau Province that has fisheries potential with a total length of 1,821.7 km and an area of 34,924.82 ha. Pelalawan Regency has 12 sub-districts, and Teluk Meranti is the largest sub-district, which is ±4,113.03 km^2, consisting of 9 villages/sub-districts, one of which is Pangkalan Terap Village. (BPS Pelalawan Regency, 2021). Some fishing gear used by fishermen in Pangkalan Terap Village is gill nets, rawai, pengilar, and sero. Based on the results of interviews with Mr. Ruslan, a fisherman and former village head in the village, the gill net is one of the fishing gear that is quite often operated because the fishing gear is easy to operate by fishermen, easy to make, and can catch various types of fish. This is appropriate from the number of gill nets, as many as 830 in the Teluk Meranti Sub-district (BPS Kabupaten Pelalawan, 2021).

According to PERMEN-KP No. 18 of 2021, gill nets are an active and passive fishing gear in the form of rectangular nets, equipped with floats, weights, top risers, bottom risers or without bottom risers that are operated permanently, drifted and looped on the surface, to block fish so that they are caught by gilled or twisted.

The surface gill net in Pangkalan Terap Village has a length of 48 m and is operated at a depth of 3 m in the Kampar River in Pangkalan Terap Village. The Kampar River is one of the major rivers in Riau Province, with a length of ±413.5 km, a depth of ±7.7 m, and an average width of 143 m (Kampar District Environmental Agency, 2009). The size of the gill net has an influence on the catch in a fishing area (Saputra et al., 2021). Fishing with gill nets in Pangkalan Terap Village, Teluk Meranti Subdistrict, uses different mesh sizes, namely 2.5 inches, 3 inches, and 5 inches.

Determination of the size of the mesh to be used by fishermen to catch fish is still based on hereditary habits, namely by looking at the type of fish to be caught and the season that is happening, namely the rainy season (characterized by high rainfall and abundant river water) fishermen use smaller meshes, namely 2.5 inches, and the dry season (characterized by low rainfall) fishermen use large meshes, 3 inches, and 5 inches. Based on the explanation above, the author is interested in researching gill nets using 2.5-inch, 3-inch, and 5-inch meshes in the rainy season and dry season to determine the effect of mesh size on gill net catches, determine the number, type, weight, and morphometric size of the catch and determine the size of gill nets that are effectively used to catch fish in Pangkalan Terap Village, Teluk Meranti District.

2. Methodology

2.1. Time and Place

This research was conducted from April 2022 to June 2022 in Pangkalan Terap Village, Teluk Meranti District, Pelalawan Regency, Riau Province.

2.2. Method

The method used in this research is an experimental fishing method. The experimental method is an observation under artificial conditions, where the conditions are created by the researcher (Diana et al., 2018). The data collected in the study were data on gill net gear specifications, environmental parameter data, and catch data on the number, weight, and type of fish, as well as morphometric measurements, including total length, operculum circumference, fish body circumference, and how it was caught.

This research was conducted using a Randomized Group Design consisting of 3 treatments, namely 2.5-inch, 3-inch, and 5-inch meshes, with ten fishing trips, where each fishing trip was considered one replication. Data on the number of tails and fish weight were then tested using the ANOVA test to determine the effect of mesh sizes 2.5 inches, 3 inches, and 5 inches on the catch obtained.

2.3. Procedure

The steps taken during the research were as follows: Prepare the equipment needed for research, such as 2.5-inch, 3-inch, and 5-inch gill net fishing gear, buckets for catches, measuring instruments, stationery, and supplies, and check the condition of the engine and fuel. Depart for the fishing ground. Lowering the gill net (setting) at 3 m depth. The three nets are put together into a series to make it easier to control the fishing gear. Immersing the net for 2-3 hours. Environmental parameter measurements are water temperature, water depth, water brightness, and water current speed. Lifting of gillnet gear (hauling). Catches were collected, counted, and measured, and the types of catches based on mesh size were documented.

2.4. Data Analysis

The data obtained are presented as tables or graphs and then analyzed descriptively. The effect of gillnet mesh size on catches can be seen using analysis of variance (ANOVA) with decision making if $F_{count} > F_{table}$ at the 0.05 level then the difference between the mean treatment mesh size is said to be real with the symbol ('), but if $F_{count} > F_{table}$ at the 0.05 level then the difference between the mean treatment/group is said to be non-significant or not real with the symbol (ns). The results of the ANOVA test, which showed the effect of gillnet mesh size on catches, were then subjected to further LSD (Least Significant Difference) tests to track differences between treatment mean values

3. Result and Discussion

3.1. Construction of Gillnet Fishing Gear

The gill net construction consists of upper ris rope, lower ris rope or without lower ris rope, net body, buoy, buoy rope, weight, and weight rope. While additional components include anchors and sign buoys (Efkipano, 2012). The three-gill nets in Pangkalan Terap Village owned by one of the fishermen, namely Mr. Ruslan, have the same size made of PA monofilament area material with meshes of 2.5 inches, 3 inches, and 5 inches, 48 m long, 2.04 m high net, and 0.28 thread number which is clear in color. The knot type is a double English knot. The material of the upper ris rope is blue polyethylene with a length of 48 m, a diameter of 3 mm, and a Z twist type. The lower ris rope is also made of green Polyethylene (PE), 50 m long, and 3 mm in diameter. The buoys are made of 26 pieces of rubber, 6 cm long, and weighing 9.04 g, while the weights are 286 pieces of lead with a distance between weights of 38 cm and weighing 5 g.

3.2. Catch Result

Based on rainfall data from BMKG Riau Province, in April, the rainfall was quite high in the Teluk Meranti sub-district area, while from May to June, the rainfall was relatively low, so the first data collection was carried out on April 04, 2022 - April 13, 2022. The gill net catch obtained was 219 fish, weighing 46259 g with different types of fish. The types of catches obtained in 3 mesh treatments in the rainy season are presented in Table 1.

Table 1. Types of Catches in the Rainy Season

No.	Name		Mesh			Quantity (fish)	Weight (g)
	Local	Scientific	2,5"	3"	5"		
1	Wajang	*Cyclocheillichthys* sp.	41	26	0	67	12359
2	Sipongkah	*Parambassis wolfii*	18	8	0	26	2716
3	Selais	*Kryptopterus lais*	8	28	0	36	5040
4	Juaro	*Pangasius polyranodon*	35	0	0	35	4318
5	Leaftail croaker	*Johnius trachycephalus*	0	8	0	8	723
6	Asian redtail catfish	*Mystus nemurus*	0	6	0	6	530
7	Kissing gourami	*Helostoma temmincki*	0	9	0	9	1225
8	Kelabau	*Osteochilus kelabau*	0	0	18	18	9534
9	Silver barb	*Barbonymus gonionotus*	0	0	14	14	9814
Total			102	85	32	219	46259

The most dominant fish species caught in the 2.5-inch mesh treatment is wajang (*Cyclocheillichthys* sp.), at 3-inch mesh is selais (*Kryptopterus lais*), and at 5-inch mesh is kelabau (*Osteochilus kelabau)*. Based on the number (fish) and weight (g) of catches obtained, the most dominant species of wajang (*Cyclocheillichthys* sp.) caught as many as 67 fish with a weight of 12359 g. The least caught fish species was *Cyclocheillichthys* sp. The least caught fish species was the Asian redtail catfish, which amounted to 6 fish weighing 530g. The type of catch in the wet season by fish species is presented in Figure 1.

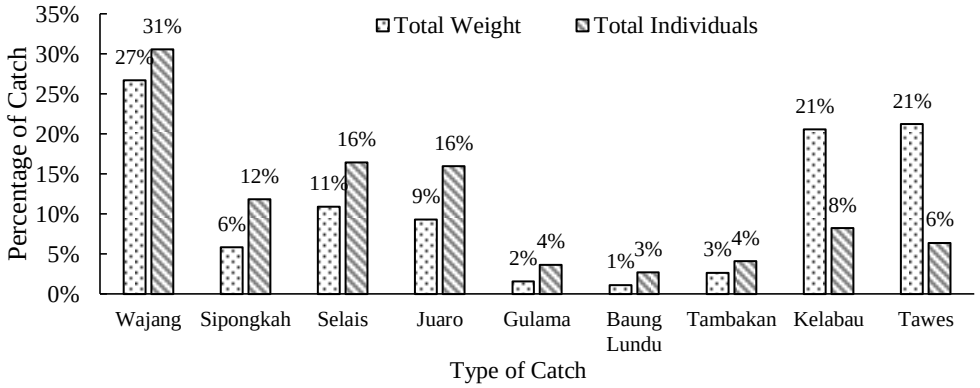

Figure 1. Percentage of Catch Type in the Rainy Season

The number of catches in the 2.5-inch mesh is more dominant than other meshes, which obtained as many as 102 fish, but the lowest total catch weight is 12084 g, while the least number of catches is in the 5-inch mesh treatment, which is 32 but has a heavier catch weight of 19348 g. The larger the mesh size, the fewer fish are caught, while the small mesh size produces more catches. The larger the mesh size, the fewer fish caught, while the smaller mesh size produces more catches (Irpan et al., 2018).

This study was also conducted during the dry season (low rainfall) on May 24, 2022 - June 02, 2022. The catches obtained in the dry season at 2.5-inch, 3-inch, and 5-inch meshes are presented in Table 2. The total catch obtained was 241 fish, weighing 79435 g, and eight different fish species. The dominant fish species caught in the dry season at 2.5-inch and 3-inch meshes are wajang, as many as 90 fish weighing 24461 g, and at 5 inches belida (*Chitala lopis*) as many as 16 fish. The least caught species is Asian redtail catfish, totaling

ten fish weighing 2293 g. The Bagridae family was the most abundant. The Bagridae family is generally found in peat swamp areas (Santoso & Wahyudewantoro, 2019). The number of catches obtained in the dry season was also more dominant in the 2.5-inch mesh compared to other meshes, namely 111 fish with a total weight of 23099 g, while the least number of catches was in the 5-inch mesh treatment, namely 38 fish with the most dominant total weight of 30482 g. The number of catches in the dry season was more dominant in the 2.5-inch mesh treatment. Anggrayni and Zainuri (2022) stated that the smaller the mesh size used, the greater the chance of catching fish that can be caught. The percentage of fish species caught in the dry season is presented in Figure 2.

Table 2. Types of Catches in the Dry Season

No.	Name		Mesh			Quantity (Fish)	Weight (g)
	Local	Scientific	2,5"	3"	5"		
1	Wajang	*Cyclocheillichthys* sp.	54	36	0	90	24357
2	Sipongkah	*Parambassis wolfii*	11	15	0	26	5251
3	Selais	*Kryptopterus lais*	13	5	0	18	3320
4	Juaro	*Pangasius polyranodon*	33	19	0	52	10985
5	Leaftail croaker	*Mystus nemurus*	0	10	0	10	2293
6	Asian redtail catfish	*Chitala Lopis*	0	0	16	16	13818
7	Kissing gourami	*Osteochilus kelabau*	0	0	15	15	11729
8	Kelabau	*Barbonymus gonionotus*	0	7	7	14	6928
Total			111	92	38	241	79435

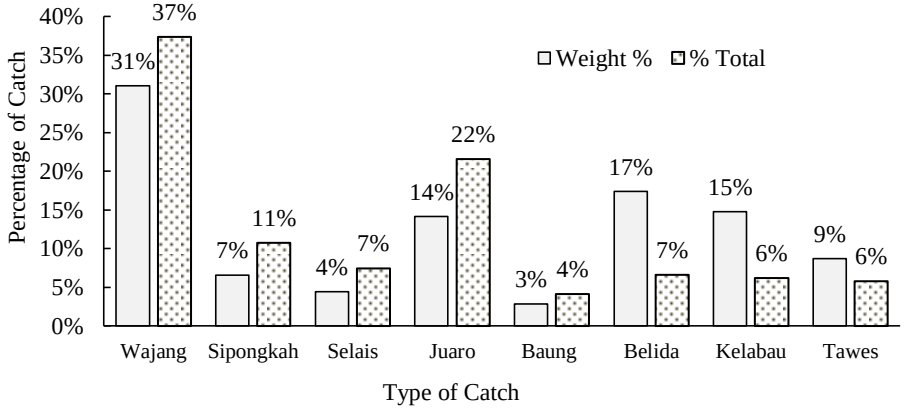

Figure 2. Percentage of Catch Type in the Dry Season

Based on the catches obtained in both seasons, it is known that the fish species obtained in both seasons are also similar. Fish that dominate in both seasons are fish from the Cyprinidae family, namely wajang (*Cyclocheillichthys* sp.). This is because the Cyprinidae family likes flowing waters and water that is not too deep, so this type of fish is found in rivers (Mutiara, 2014). The Cyprinidae family is an omnivorous fish group that can adapt and reproduce quickly, and its habitat dominantly inhabits fresh waters that are not too swift (Irianti et al., 2006).

The catch obtained in the dry season is also more numerous and heavier than during the rainy season. Research by Rais et al. (2015) stated that rainfall has a significant effect on catches, namely in the rainy season, which tends to decrease catches and increase in the dry season. The abundance of fish during the dry season is due to the lack of water area and volume, which has an impact on increasing the density of fish in the waters and is also influenced by the migration of fish from the swamp to the river during the shallow water season.

Water temperature can affect fish appetite and growth. The results of temperature measurements during the study in the rainy season ranged from 26-30^{o}C and 28-30^{o}C during the dry season. Overall, the water temperature shows no big difference between treatments and is still good for life because the optimal water temperature for fish in the tropics ranges from 25-32 C (Urbasa et al., 202019). Current speed is the movement of water that

results in the transfer of water masses. Panjaitan (2000) states that fish will drift if the current speed exceeds the swimming speed of the fish. The current speed in this study was below 0.1 m/s and classified as slow current speed. Waters that have currents <0.1 m/s are categorized as very slow currents. Slow to moderate currents allow food particles from upstream or falling insects and leaves from trees to be held for a long time in the waters carried by currents during rainfall, a food source for fish (Sari et al., 2019).

Water brightness is a measure of water transparency observed visually with a secchi disk or the depth of water that can be penetrated by sunlight. The brightness of the waters in this study ranged from 14 cm to 27 cm and was classified as low due to the large input of runoff from around the river, so the turbidity level of the waters began to be high. Upstream activities influence water brightness. Brightness is closely related to turbidity because turbidity can inhibit the entry of light into the waters. High turbidity can cause the brightness of the waters to decrease. Turbid waters are characterized by dark brown to blackish watercolor. During the rainy season, the water in the river will change. The changing water currents will stir the substrate, and the volume of water will increase (Utami & Syari, 2019). The brightness value in the rainy season is lower than in the dry season because the water conditions are more turbid due to the large amount of suspended solids that dissolve in the waters during the rainy season or due to domestic waste.

3.3. Fish Body Morphometric

Morphometric measurements on the catch are measurements of fish body parts such as total length, operculum circumference, and body circumference. Values of the body range of fish caught at 2.5-inch, 3-inch, and 5-inch meshes are presented in Table 3.

Table 3. Fish Body Morphometric Measurements

Season	Meshes (Inches)	Size (cm)			
		TL	GO	GM	Fish Weight (g)
Rain	2, 5	14 - 34	8 - 14,5	8 - 15	40 - 210
	3	15,5 - 37	10 - 18	7,5 - 19	40 - 341
	5	29 - 30,5	18 - 21,5	20 - 26	500 - 772
Drought	2, 5	20 - 37	10 - 15,5	12 - 20	119 - 300
	3	22 - 37,5	14,5 - 18	10 - 25	190 - 560
	5	31 - 48,5	20 - 30	24 - 31	621 - 1150

Description: TL (Total Length), GO (Opercular Girth), GM (Maximum Body Girth).

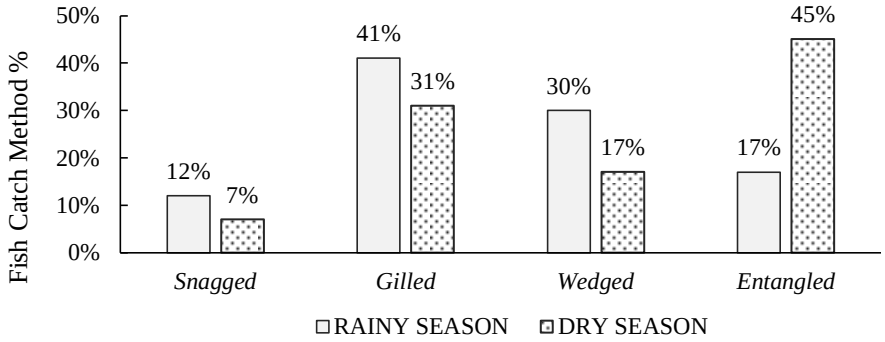

Figure 3. How the fish is caught

The small size of the fish causes the net with a smaller eye size to get more results because the net fish of various sizes are entangled in the gills (gilled), entangled in the whole body of the fish (wedged), or entangled before the gill lid (snagged) (Irpan et al., 2018).

3.4. Fish Caught

The way fish are caught in gill nets is divided into four, namely gilled wedged, snagged, and entangled (Hovgard & Lassen, 2000). The way fish are caught in gill nets in the rainy season is dominated by killing as many as 89 fish, wedging as many

as 66, snagging 27 fish, and entangling 37 fish. However, in the dry season, the way fish are caught in the mesh is dominated by entangling as many as 108 fish while wedging as many as 42 fish, gilled 75 fish, and snagging as many as 16 fish. Fish caught with gillnets are generally gilled entangled in the mesh or entangled in the body of the net. (Dermawati et al., 2019). The shape of the fish's body also affects how it is caught. The percentage of fish caught in 3 sizes of gill nets in both seasons can be seen in Figure 3.

The body shape of fusiform or torpedo fish is generally caught, gilled, and wedged, while the compressed or flat body shape is generally caught, twisted, or entangled. (Rahantan & Puspito, 2012). One of the gill nets with a fusiform body shape is the Kajang fish, while the flat-shaped fish is the sipongkah.

3.5. Effect of Mesh Size on Catch

The effect of mesh size on gill nets in Pangkalan Terap Village can be seen through analysis of variance (ANOVA). The confidence interval used in this analysis of variance is 95% or an error rate of 5% (0.05). The ANOVA test is a statistical test that aims to test the effect of mesh on catch. The results of the analysis of variance (ANOVA) on the total catch in the rainy season obtained a value of F_{count} (119.57) > F_{table} (3.55) or a significance value (0.001) < 0.05 so that Ha is accepted while H0 is rejected, which means that different mesh sizes have a significant effect on the total catch.

The results of the analysis of variance (ANOVA) on the total weight of the catch in the rainy season also obtained a significance value (0.001) < 0.05 or F_{count} (65.38) > F_{table} (3.55), thus proving that each mesh size also affects the weight of the gill net catch in Pangkalan Terap Village. Irpan et al. (2018) also stated that the gill net has a significant effect on the total number (fish) of fish caught because the large mesh size of the gill net will produce a small number of catches when viewed in terms of total size (weight, length, and height).

The small mesh size will produce many catches in terms of the total number of catches. Follow-up tests with LSD (Least Significant Difference) showed that the number and weight of catches in mesh sizes of 2.5 inches with 3 inches, 3 inches with 5 inches, and 2.5 inches with 5 inches in the rainy season were significantly different.

The significant probability value of the ANOVA test based on the catch in the three treatments in the dry season also showed significantly different results at the 5% level. The mesh size factor in the dry season obtained a significance value of (0.001) < 0.05 or Fhitung total number (118.431) > F_{table} (3.55) and F_{count} total weight (28.157) > F (3.55), so that Ha is accepted while H is rejected. F_{table} (3.55), so Ha is accepted. At the same time, H0 is rejected, which means that the difference in mesh size has a significant effect on the total and weight of the catch, so it can be concluded that the mesh size of a large gill net will produce a small amount of catch when viewed in terms of total size (weight) and a small mesh size will produce a large amount of catch when viewed in terms of the total number (fish).

This is to the research of Making & Yulianto (2014) on the effect of different meshes on the catch of gill nets that using meshes of 1.75 inches and 2 inches will give different results. The weight of the catch in a 2-inch mesh size is greater than the weight of the catch in a 1.75-inch mesh. The results of the LSD further test obtained on the catch in the dry season also showed that the 2.5-inch mesh was significantly different from 3 inches and 5 inches. This means that the difference in mesh size of 2.5 inches with 3 inches and 5 inches gives a real difference to the average total catch (fish and weight).

4. Conclusion

Based on the results of the study, it can be concluded that there is an influence of the mesh on the catch in Pangkalan Terap Village, Teluk Meranti District. The number of catches during the study in both seasons obtained catches with different numbers, types, and weights of fish, where in the rainy season, as many as 219 fish weighed 46259 g, and in the dry season, 241 fish weighed 79435 g. The types of fish caught were ten species dominated by wajang (*Cyclocheillichthys* sp.). The fish caught were ten species dominated by wajang (*Cyclocheillichthys* sp.).

References

[BPS] Badan Pusat Statistik. (2021). *BPS Kabupaten Pelalawan dalam Angka 2021*. Pangkalan Kerinci: Pelalawan.

Anggrayni, F.D., & Zainuri, M. (2022). Pengaruh Perbedaan Ukuran Mata Jaring (*Mesh Size*) terhadap Hasil Tangkapan

pada Perikanan Tangkap Jaring Insang (*Gill Net*) di Perairan Desa Sedayulawas, Kabupaten Lamongan. *Juvenil: Jurnal Ilmiah Kelautan dan Perikanan*, 3(3).

Badan Lingkungan Hidup Kabupaten Kampar. (2009). *Status Lingkungan Hidup Daerah Kabupaten Kampar*.

Dermawati, D., Palo, M., & Najamuddin, N. (2019). Analisis Konstruksi dan Hasil Tangkapan Jaring Insang Permukaan di Perairan Kabupaten Maros Provinsi Sulawesi Selatan. *Jurnal Ipteks Pemanfaatan Sumberdaya Perikanan*, 6(11).

Diana, F., Kautsar, T., & Hafinuddin, H. (2018). Pengaruh Kedalaman yang Berbeda terhadap Hasil Tangkapan Udang Galah (*Macrobrachium Rosenbergii*) dengan Menggunakan Alat Tangkap Bubu di Desa Cot Seumeureng Kecamatan Samatiga Kabupaten Aceh Barat. *Jurnal Perikanan Tropis*, 5(1): 83-92.

Efkipano, T.D. (2012). *Analisis Ikan Hasil Tangkapan Jaring Insang Milenium dan Strategi Pengelolaannya di Perairan Kabupaten Cirebon.* Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Indonesia, Depok.

Hovgard, H., & Lassen, H. (2000). *Manual on Estimation of Selectivity for Gillnet and Longline Gears in Abundance Surveys*. FAO Fish. Tech. Pap. 397: 84 pp.

Irianti, R., Rahma, S.Z.Z.N.A., & Fajeriati, N.A. (2021). Keanekaragaman Jenis Ikan Familia Cyprinidae di Sungai Nagara Kecamatan Daha Utara Kabupaten Hulu Sungai Selatan. *Prosiding Seminar Nasional Lingkungan Lahan Basah*, 6(2).

Irpan, A., Djunaidi, D., & Hertati, R. (2018). Pengaruh Ukuran Mata Jaring (*Mesh Size*) Alat Tangkap Jaring Insang (*Gill Net*) terhadap Hasil Tangkapan di Sungai Lirik Kecamatan Jangkat Timur Kabupaten Merangin Provinsi Jambi. *Semah Jurnal Pengelolaan Sumberdaya Perairan, 2*(2).

Making, A.D.L., & Yulianto, T. (2014). Pengaruh Perbedaan Mata Jaring (Mesh Size) Gillnet terhadap Cara Tertangkap Ikan Kembung Perempuan (Scomber neglectus) di Perairan Morodemak, Kabupaten Demak. *Journal of Fisheries Resources Utilization Management and Technology*, *3*(4): 120-129.

Mutiara, D. (2014). Klasifikasi Jenis Ikan Familia Cyprinidae di Sungai Pangi Desa Pengumbuk Kecamatan Rantau Bayur Kabupaten Banyuasin Provinsi Sumatera Selatan. *Jurnal Sainmatika,* 1 (1): 37-41

Panjaitan, M. (2000). Studi tentang *Light Fishing* pada *Purse Seine* di Perairan Sibolga Sumatera Utara. Lembaga Penelitian UR. Pekanbaru. 60p.

Rahantan, A., & Puspito, G. (2012). Appropriate of Mesh Size and Shortening for Gillnet Operated on Tual Waters. *Marine Fisheries: Journal of Marine Fisheries Technology and Management*, 3(2): 141-147.

Rais, A. H., Rupawan, R., & Herlan, H. (2015). Pengaruh Curah Hujan terhadap Kondisi Perairan dan Hasil Tangkapan Ikan di Estuari Sungai Barito. *Jurnal Penelitian Perikanan Indonesia*, *21*(3), 131-138.

Santoso, E., & Wahyudewantoro, G. (2019). Biodiversitas Spesies Ikan Perairan Gambut Air-Kumai Kabupaten Kotawaringin Barat Kalimantan Tengah. *Jurnal Ikhtiologi Indonesia*, 9(2): 315-335.

Saputra, I.M.D.N., Karanga, I.W.G.A., & Puspitha, N.L.P.R. (2021). Pengaruh Perbedaan Ukuran Jaring Insang terhadap Hasil Tangkapan Ikan Tongkol *Euthynnus* sp. di Perairan Tenggara Kabupaten Karangasem. *Journal of Marine Research and Technology*, 4(2): 16-21.

Sari, D., Utami, E., Syari, I.A. (2019). Perbedaan Keanekaragaman Jenis Ikan Berdasarkan Musim di Sungai Penyerang Kecamatan Puding Besar Kabupaten Bangka. *Akuatik,* 13(2): 131-141.

Urbasa, P.A., Undap, S.L., & Rompas, R.J. (2019). Dampak Kualitas Air pada Budi Daya Ikan dengan Jaring Tancap di Desa Toulimembet Danau Tondano. *E-Journal Budidaya Perairan*, 3(1).

Utami, E., & Syari, I.A. (2019). Perbedaan Keanekaragaman Jenis Ikan Berdasarkan Musim di Sungai Penyerang Kecamatan Puding Besar Kabupaten Bangka. *Akuatik: Jurnal Sumberdaya Perairan*, 13(2): 131-141