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Fisheries Management of Terubuk (*Tenualosa macrura*) with an Ecosystem Approach (EAFM) in the Bengkalis Strait, Bengkalis Regency, Riau Province

Pengelolaan Perikanan Terubuk (Tenualosa macrura) dengan Pendekatan Ekosistem (EAFM) di Perairan Selat Bengkalis Kabupaten Bengkalis Provinsi Riau

Rizki Adiwanarta[1*], Adriman[2], Deni Efizon[2]
[1]*Department of Marine Science, Postgraduate, Universitas Riau, Pekanbaru 28293 Indonesia*
[2]*Department of Aquatic Resources Management, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru 28293 Indonesia*
**email: adiwanarta@gmail.com*

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Abstract

Fish resources are one of the natural resources that must be used as much as possible for the welfare of the community, especially around Riau Province, where part of its territory is a coastal area that has a wealth of marine biological resources that have the potential to be developed at present and in the future. One type of marine biological resource that has high economic value is the most abundant fish resource. The methods used in this study are the direct observation survey method, interviews, and distributing questionnaires. The data used in this research consists of primary and secondary data. Primary data is obtained from the results of observations and measurements made in the field, including interviews with respondents, while secondary data is in the form of excerpts from previous research journals and activity report documents obtained from related institutions or agencies. grouping based on composite value, i.e., domains that qualify as "moderate," namely economics, and domains that qualify for the "good" stage, namely the institutional domain, and finally the domains that qualify for the "excellent" stage are the domain of fish resources, the domain of fishing techniques, and the social domain. Therefore, the priority for improvement as well as the spotlight are given to the economic domain. The status of the best fisheries management in Bengkalis Regency as a whole is considered to be in good criterion condition (aggregate score: 71). However, specifically based on the values between domains, three groupings based on composite values can be obtained, namely, domains that qualify as "moderate," namely the economic domain and habitat and ecosystem. Domains that qualify as "good" are institutional domains and social domains. While the domains that qualify as "very good" are the domain of fish resources and the domain of fishing techniques, Domains that qualify as "good" are institutional domains and social domains.

Keywords: EAFM, Terubuk, Bengkalis

Abstrak

Sumber daya ikan merupakan salah satu kekayaan alam yang harus dipergunakan sebesar- besarnya untuk kesejahteraan masyarakat, terutama disekitarnya Provinsi Riau yang sebagian wilayahnya merupakan kawasan pesisir yang memiliki kekayaan sumberdaya hayati laut yang potensial untuk dikembangkan pada saat ini maupun pada masa mendatang. Salah satu jenis sumber daya hayati laut yang memiliki nilai ekonomis tinggi adalah sumber daya ikan terubuk. Metode yang digunakan pada penelitian ini adalah metode survei pengamatan langsung,

wawancara dan penyebaran kuesioner. Data yang digunakan dalam penelitian terdiri dari data primer dan data sekunder. Data primer didapat dari hasil dari pengamatan dan pengukuran di lapangan termasuk wawancara dengan responden, sedangkan data sekunder berupa kutipan jurnal penelitian terdahulu dan dokumen laporan kegiatan yang diperoleh dari lembaga/instansi yang berhubungan Berdasarkan hasil penilaian keseluruhan setiap domain melalui pemberian nilai skor berdasarkan kriteria yang telah ditentukan, maka performa pengelolaan perikanan terubuk di Kabupaten Bengkalis saat ini menunjukkan bahwa terdapat tiga pengelompokan berdasakan nilai komposit, yaitu domain yang berkualifikasi "sedang" yaitu ekonomi, dan domain yang berkualifikasi tahap "baik" yaitu domain kelembagaan, serta terakhir domain yang berkualifikasi tahap "baik sekali" adalah domain sumber daya ikan, domain teknik penangkapan ikan dan domain sosial. Oleh karena itu, prioritas perbaikan, dan juga sorotan diberikan pada domain ekonomi.Status pengelolaan perikanan terubuk di Kabupaten Bengkalis secara keseluruhan dinilai dalam kondisi kriteria yang baik (Agregat skor: 71). Namun secara khusus berdasarkan nilai antar domain di dapat tiga pengelompokan berdasakannilai komposit, yaitu domain yang berkualifikasi "sedang" yaitu domain ekonomi dan habitat dan ekosistem. Domain yang berkualifikasi "baik" yaitu domain kelembagaan dan domain sosial. Sedangkan domain yang berkualifikasi "baik sekali" adalah domain sumber daya ikan dan domain teknik penangkapan ikan.

Kata kunci: EAFM, Ikan Terubuk, Bengkalis

1. Introduction

Fish resources are one of the natural resources that must be used optimally for the welfare of the community, especially those around it (KKP, 2016). In line with this, DJPT-KPP (2016) stated that development currently focuses on natural resource management, including sustainable fisheries management. Fishery management is an obligation as mandated by Law No. 31/2004, which was reaffirmed in the revision of Law No. In the context of the adoption of this law, "fisheries management" is defined as all efforts, including processes that are integrated with information gathering, analysis, planning, consultation, decision-making, allocation of fish resources, and the implementation and enforcement of laws and regulations in the field of fisheries.

Riau Province, which includes a coastal area, has a wealth of marine biological resources that have the potential to be developed now and in the future. One type of marine biological resource that has high economic value is terubuk fish (*Tenualosa macrura*). Terubuk fish were previously found throughout the estuaries and coastal waters of Sumatra and Kalimantan, which are the base areas for fisheries development. The only area where this fish can still be found is in the waters covering the Bengkalis–Siak–Meranti Islands in Riau Province. The worst fish populations are becoming extinct daily.

According to Lubis et al. (2016), the most abundant fish population was in the 1960s, then began to decrease in the 1970s, and decreased greatly in the 1980s. The terubuk fish population is currently decreasing; this decline is not only due to fishing activities alone but is also caused by a decrease in water quality (pollution), especially in the waters of the Siak River, which is the main spawning location for terubuk fish in Bengkalis waters. Terubuk fishing is carried out when the terubuk fish are on a spawning raid, to take the eggs because the terubuk fish eggs have a high selling value. The high price of eggs makes it attractive for people to make arrests. Although the population of the worst fish continues to decrease.

Based on the available potential, it is very rational if the fisheries sector is found to be one of the resources that must be maintained so that it does not experience extinction while still paying attention to the interests of exploiting its economic potential for the people of Bengkalis Regency and its surroundings, especially the people who are in the coastal areas of Bengkalis and Siak waters, Riau Province. Therefore, to achieve the sustainability of fisheries, especially fish resources, the current approach that can be used for fisheries management is an ecosystem-based indicator assessment approach (Jaya & Zulbainarni, 2015).

So far in 2010, the government has issued a Regulation of the Regent of Bengkalis that regulates habitat protection and the use of terubuk fish. In connection with the expansion of the administrative area of Bengkalis Regency into several regencies, namely Siak and Meranti Regencies and Bengkalis Regency, the Riau Provincial Government issued Riau Governor Regulation No. 78 of 2012 concerning Terubuk Fishery Reserves in Riau Province, covering the three regencies in question. At the national level, the Government of Indonesia,

through the Ministry of Maritime Affairs and Fisheries, has issued Decree No. 59/Men/2011 stipulating the terubuk fish as a limited protected fish species.

This research is focused on evaluating in detail the current condition of terubuk fisheries from the aspects of fish resources, habitat or ecosystem, fishing techniques, economics, social factors, and institutions as well as scientific information for follow-up planning and implementation of terubuk fisheries management in Bengkalis Regency. Therefore, the authors are interested in conducting research on "Terubuk Fishery Management (*Tenualosa macrura*) with an Ecosystem Approach (EAFM) in the Bengkalis Strait, Bengkalis Regency, Riau Province.

2. Material and Method

2.1. Time and Place

This research was conducted in Bengkalis Regency, which administratively covers two districts, namely Bengkalis District and Bukit Batu District. This research was conducted from early July 2020 until the end of September 2020.

2.2. Methods

The methods used in this study are the direct observation survey method, interviews, and distributing questionnaires. The data used in this research consists of primary and secondary data. The primary data in question is based on observations and measurements made in the field, including interviews with respondents, while secondary data is in the form of excerpts from previous research reports or journals and activity report documents obtained from related institutions or agencies.

2.2.1. Domain of Fish Resources

Fish size trend indicator. The data collected on the terubuk fish size indicator is morphometric in the form of fork length (FL) in centimeters (cm) and weight (g). The data collection technique begins with the accidental sampling technique, or the random selection of samples from terubuk fish landed in Bengkalis Regency. Sampling was carried out during each fishing season (dark and light months each month)

Catch species composition indicator. Data collection for the fish resource domain with indicators of the composition of the species caught will be carried out by interviewing and sampling, whereby the target species caught will be seen, as well as non-target species (bycatch) that are used or not used. This was accomplished through observation and data collected from interviews with the most experienced fisherman respondents with experience in the relevant fishery.

Endangered species, threatened species, and protected species. The data collected for the indicators of the Endangered Species, Threatened Species, and Protected Species (ETP) categories are data on the number and catch of those included in these indicator categories based on Government Regulation No. 7 of 1999 concerning the Preservation of Plant and Animal Species. There are 7 types of fish (Pisces) and an IUCN Red List category. This was conducted by interviewing respondents who had experience in related fisheries as well as observational data in the past year.

2.2.2. Domain Habitat and Ecosystem

Water Quality. The data collected for this indicator is secondary data from previous research reports. From this data, it aims to see the condition of the water quality of the Bengkalis Strait, which is the habitat or ecosystem of the terubuk fish.

Mangrove ecosystem. The data collected for this indicator is secondary data from previous research reports and research journals. The goal of the data collected is to see how the condition of the mangrove ecosystem in Bengkalis Regency is determined by sampling, which is an important indicator of the habitat of fish or dead fish larvae in Bengkalis Regency's waters and coastal areas.

Unique and special habitats. The data collected for this indicator is secondary data from previous research reports and research journals. From the data collected, the aim is to see how the conditions of the unique habitat of the worst fisheries are found in the waters of the Bengkalis Strait, which is an important indicator of the habitat of fish or the worst fish larvae in the waters and coastal areas of Bengkalis Regency.

2.2.3. Domain of Fishing Techniques

Indicators of destructive or illegal fishing methods. The data collected for this indicator is the number of cases of fishing violations that are the worst. The goal of this data is to identify environmentally hazardous or illegal fishing gear that is used every year.

Production capture selectivity indicator. The data collected for the selectivity indicator of the catch is data on the percentage composition of the catch of terubuk fish and bycatch catches, and if there is an average proportion of juveniles landed by gill net fishermen.

Indicators of certification for fishing vessel crew following regulations. The data collected for indicators of fishing vessel crew certification following regulations are data on the number of samples of gillnet fishing vessels for catching fish recorded in the Bengkalis Strait fishing area and data on the number of fishing vessels operated by certified crew members according to regulations.

2.2.4. Social, Economic, and Institutional Domains

The economic domain has three indicators: household income, asset ownership, and saving ratio. Data collection for fisheries household income indicators, specifically the total monthly income of the most caught fishermen based on interviews with the most exposed fishermen

Furthermore, the social domain consists of three indicators, namely stakeholder participation, terubuk fisheries conflicts, and the utilization of local knowledge on the management of terubuk fisheries resources, As for the institutional domain, it also requires some data to measure each indicator.

2.3. Data Analysis

2.3.1. Determining Indicator Scores

Data that has been collected from the economy will be tabulated and given a value based on criteria or status for each indicator in the domain, using a simple scoring approach, namely, an ordinal-based Likert score of 1, 2, or 3. The better the indicator status, the greater the value, thereby greatly contributing to EAFM achievements.

2.3.2. Determining Density Levels

Determining the level of density (connectivity) between domains and indicators by determining the domain score from the results of the cognitive mapping of the interrelationships between indicators. This linkage is one of the main characteristics of EAFM. In general, all indicators provide the opportunity to have a continuous relationship with other indicators except themselves. In this context, the density value will also show its effect on the overall calculation.

2.3.3. Calculate the total composite value

Determination of the composite value (total) of all studied EAFM domains The composite value is determined from the average value of all the domains studied in the EAFM assessment. The product of the indicator score and the density score will give the overall value or weight of each attribute.

$$\text{NK-i} = \frac{\frac{\text{Cat-i}}{\text{Cat-max}} \times 100\%}{\text{N}}$$

NKi : Composite value in the i-th domain
Cat-_{i} : The total index value of all indicators in the i-th domain.
Cat-_{max} : The highest possible value in the i-th domain.
N : The number of domains in EAFM.

2.3.4. Determine the Weight Value

Each attribute has a different weighting. The difference in importance of these parameters is seen after specifying all the attributes in the domain. Then set the weight of each attribute according to the degree of influence of the attribute in the domain. The weighting is set on a scale of 0-100. Attributes with a high weight are thought to have the highest importance value in the domain. Weights with low weights are of little importance in the domain. The maximum weighting of each domain is 100, which is evenly divided among each attribute.

3. Result and Discussion

3.1. Domain of Fish Resources

Based on Table 1, the results of the data collection on the catches of terubuk during the study using landed gill nets can be seen. It can be seen that the results of the worst fish catches during the July-September period amounted to 378 fish. Of these, it shows that the percentage of female fish caught was far more dominant, namely 364 fish (96.30%) than 14 male fish (3.70%).

It is suspected that the terubuk fish caught are fish that are in the process of or have undergone a process of changing sex from male to female (protandry hermaphrodites). This is reinforced by the statement of Lubis et al. (2016), which said that the group with an average length of 19.8 cm SL was suspected to be in the process of changing sexes. From the results of the study, it was revealed that the majority of the caught fish were above 19.8 cm SL, which was dominant at 25–27 cm SL (Figure 1).

Based on Figure 1, Samples of terubuk fish were caught dominantly at 25–27 cm in size and weighing 175–200 g. The terubuk samples caught were in accordance with the statement of Lubis et al. (2016), which stated that the terubuk with a group size of 21.4–30.9 cm SL were the most common fish group to be found. Therefore,

for sizes 30 cm and above, it is very rare and few in number. For sizes 20–22 cm, this is the size of a fish that is still in the transition period from male to female, or the female is immature (has not laid eggs). According to Lubis et al. (2016), he further explained that the size of pias (male terubuk) ranged from 15–20 cm SL, and the terubuk group with an average length of 19.8 cm SL was thought to be in the process of changing sex from male (pias) to female (terubuk). Symptoms like this are seen in histologically protruded fish gonad slices (Blaber, 1999).

Table 1. The number of the worst fish sampled during the study in Bengkalis Regency

No	Observation Schedule	Number of Samples (fish)	Male (fish)	Female (fish)
1	July 2020	182	12	170
	Bright Moon	25	0	25
	Dark Moon	157	12	145
2	August 2020	99	1	98
	Bright Moon	39	0	39
	Dark Moon	60	1	59
3	September 2020	97	1	96
	Bright Moon	46	1	45
	Dark Moon	51	0	51
Number of Fish (fish)		378	14	364
Percentage (%)		100	3,70	96,30

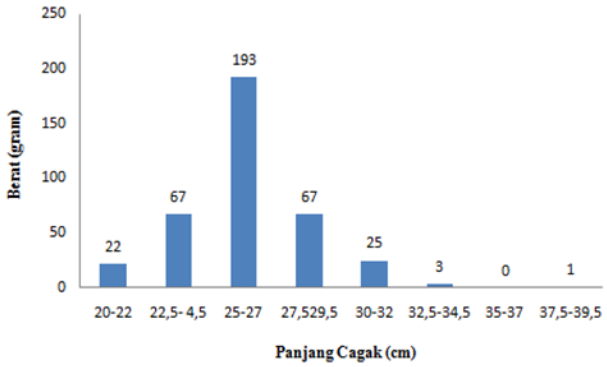

Figure 1. Depicts the distribution of the length-size frequency of landed fish in the Bengkalis Regency

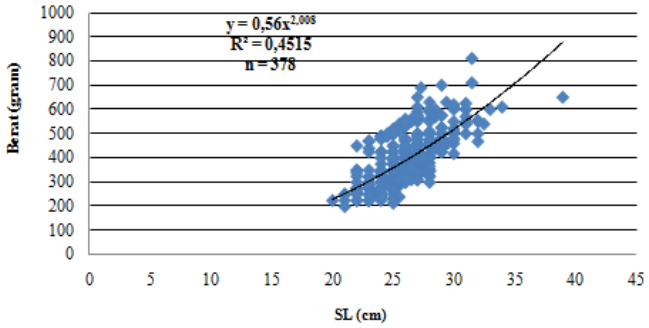

Figure 2. Calculation of the length and weight of the terubuk (*Tenualosa macrura*).

According to Figure 2, the worst fish sample contained 378 individuals. The average length and weight of the 378 terubuk fish caught with gill nets in the waters of Bengkalis Regency, which were landed at several collectors and from small river piers at each observation station location, were 26.2 cm and 404.8 g, respectively, with values of a (intercept)= 0.56, b (slope)= 2.008, and R^2=0.45. Judging from the value of b3, which is 2.008 (3=negative allometric), this means that the growth in length is faster than weight. In the operation of gillnet fishing gear by terubuk fishermen, other types of fish are usually caught. The composition of the catches of Terubuk fishermen using gill net fishing gear can be seen from the following data.

Adrianto et al. (2014) said that the purpose of determining the species composition index of the catch is to determine the composition of target and non-target fish species, or in other words, non-target (bycatch). Figure 3 shows that the composition of the target fish in their fishing operations showed good or dominant criteria, namely 60% of the direct survey data collection, indicating that all of the worst fishermen had species composition from each survey. Gill nets were used to catch the fish. The remainder is divided into four species: lomek (22%), mackerel (9%), biang (5%), and shrimp (4%). This is following several research results, including those from Rofiqo et al. (2019), which describe the proportion of catches with a mesh size of 3–4 inches obtained by other pelagic species such as mackerel and tuna, and those found in a research journal from

Pakpahan (2019), which revealed the composition of catches using gillnets with a mesh size of 3–4 inches contained lomek fish and fish master. Furthermore, 79% of respondents in interviews with 33 terubuk fishermen said the composition of fish caught using gill nets was the target fish species, namely terubuk fish, while the remaining 21% said the composition of fish caught using gill nets still found non-target fish. From this, it can be concluded that the proportion of target fish caught is higher compared to non-target fish.

(a) (b)

Figure 3. (a) Field survey observation of catch composition with terubuk fishermen; (b) Observation of catch composition from interviews with Terubuk fishermen in Bengkalis Regency.

3.2. Domain Habitat and Ecosystem

Water quality indicators are evaluated to determine the quality and health of the aquatic environment, as well as the level of water pollution, as shown in Table 2.

Table 2. Data on water quality from previous research

Parameter	Efizon et al. (2011)	Putra et al. (2016)	Seygita et al. (2019)
Temperature (^{0}C)	29,6 - 30,6	28 - 28.6	26.7 - 30.3
Plankton (Ind/L)	23.731 – 67.493	-	16.842 - 596.688
Dissolved Oxygen / DO (mg/L)	1.48 - 3.40	-	5.9 - 7.9
pH	7 - 8.5	-	-
Brightness(m)	-	0.35 - 0.39	0.27 - 0.83
Turbidity (NTU)	10.47 - 54.38	-	-
Nitrates (mg/L)	-	-	0.617 - 2.196
Phosphate(mg/L)	-	-	0.006 - 1.666
Pb (mg/L)	-	-	0.002 - 0.094
Bod (mg/L)	13.10 - 17.66	-	0.80 - 11
Salinity (‰)	8.21 - 30.31	27. 3 - 29	25 - 30

Source: Recap of results of previous research on water quality in Bengkalis Regency

Based on previous studies on water quality in the Bengkalis Strait area, it can be concluded that several parameters such as temperature and salinity from year to year are still stable and in the good category, while for dissolved oxygen it can be seen that based on research by Efizon et al. (2011), the condition of dissolved oxygen is below the quality standard threshold in which the condition is in a polluted condition, whereas in 2019, the condition is getting better and based on the results of research by Seygita et al. (2019), it is already above the KEPMEN-LH quality standard No. 51 of 2004. Meanwhile, the brightness value of conditions in the field has not improved from year to year; this is reinforced by Putra et al. (2016), which state that the brightness value ranges from 0.35–0.39 m, and the research of Seygita et al. (2019), which stated that the brightness of the waters in the study area ranged from 0.27–0.83 m.

Based on data from previous research results, it can be concluded that the cover values and densities of mangroves in Bengkalis Regency are represented in each village and sub-district in Bengkalis Regency, as can be seen in Table 3.

Table 3. Mangrove cover and density data in Bengkalis Regency

No	Observation Area		Achieved Indicators			Source
	Village	Subdistrict	Analysis Method	Cover (%)	Density (Tree/Ha)	
1	Sungai Alam	Bengkalis	Survey Methods in Research Locations	< 50	244	Hasugian et al. (2014)
2	Kelapa Pati	Bengkalis	Survey Methods in Research Locations	≥ 75	6436	Hidayah et al. (2020)
3	Kelemantan	Bengkalis	Survey Methods in Research Locations	≥50 - < 75	1056,8	Zulkarnaini et al. (2016)
4	Bukit Batu	Bukit Batu	Survey Methods in Research Locations	≥ 75	3765	Efendi et al. (2018)
5	Teluk Pambang	Bantan	Survey Methods in Research Locations	≥ 75	13433	Ambarita et al. (2014)

Furthermore, for indicators of unique or special habitats, the waters of the Bengkalis Strait are known to have become one of the areas included as unique or special habitat areas for the worst fish species. Unique or

special habitats are defined as special habitats or species that have very high ecological and economic values, so they need special attention in their monitoring.

The existence of the mangrove ecosystem in the coastal area of the Bengkalis Strait is indirectly used by the terubuk fish to carry out the spawning process and becomes an area for developing and finding food for the juvenile terubuk fish. Ecologically, mangroves function as a nursery ground, a feeding ground, and a spawning ground for various marine biota. The waters of the Bengkalis Strait serve as a migration route for adult terubuk fish and a nursery for juvenile hatchlings. This is still going on and is continuing to this day, with evidence that the terubuk fish are still migrating to the waters of the Bengkalis Strait when they enter the spawning period. Stakeholders and the local community must work together to ensure that these waters remain a unique or special habitat for the worst fish. Therefore, regarding the alleged migration of hatchlings and spawning and laying eggs whose location points are flanked by three continents, it is necessary to pay attention so that the hatchlings do not disappear, in the sense of choosing another location as a spawning location, which of course can have an impact on aquatic productivity and the composition of the catch sector. fisheries in the Bengkalis Strait, and ultimately, the impact is also felt by local fishermen

3.3. Domain of Fishing Techniques

The category of terubuk fish that are worth catching is seen from their size, namely at sizes above 20 cm. This is because, at this size, it is suspected that the fish have matured due to a sex change from male (pias) to female (terubuk). From the results of the survey, it was determined that various sizes of net meshes were determined and used for catching terubuk fish. Observations from field observations can be seen in the following Table 4.

Table 4. Observation results of species caught by net eyes from gill nets in Bengkalis Regency

The size of the meshes of the best fishing gear			
2.5 inches	2.8 inches	3.0 inches	3.3 inches
• Terubuk • Lomek • Senangin • Biang	• Terubuk	• Terubuk	• Terubuk • Tenggiri

From field observations, it was shown that all variations in mesh size were capable of trapping terubuk, and the dominant fish caught were adult fish. This is to the statements in the studies contained in the guideline module for the National Action Plan for Terubuk Fish Conservation (2016) and previous studies that explain the fixed size for terubuk fishing, namely gill nets with a size of 2.5 inches to 3 inches. This is reinforced by a statement from Lubis et al. (2016), which explains that terubuk fishermen in Riau Province use only one type of fishing gear, namely gill nets, where the difference is the size of the mesh (mesh size), namely the size of the net with a mesh size that varies from 2 inches, 2.25 inches, 2.5 inches, up to 3 inches. The worst fishermen from Bengkalis, Sei. Pakning uses these gill nets. Meanwhile, fishermen from Selat Baru Village use nets that are larger than 3 inches because the target catch is not only terubuk fish but other types of fish such as Chirocentrus dorab, Scomberomorus sp., pomfret (*Pampus urgenteus*), and others.

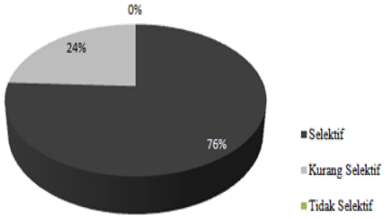

Figure 4. Percentage of interview results regarding gear selectivity for terubuk in Bengkalis Regency

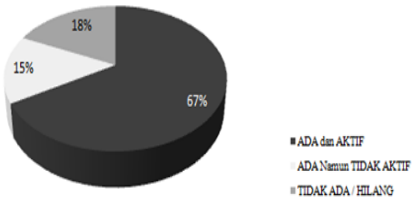

Figure 5. Percentage of terubuk fishermen in bBengkalis Regency who have fishing vessel letters or certification according to the regulations

Based on the results of the identification survey in the field and interviews with 33 respondents who represent the terubuk fishermen in Bengkalis Regency, the fishing gear used to catch the terubuk is a gill net. The meshes used by terubuk fishermen have a mesh size of 2.5–3.3 inches. Adrianto et al. (2014) explained that to determine the category of the selectivity indicator for this catch, one looks at the diversity of fish catches. Related to this, it can be explained by the species composition indicator of the catch that has been discussed, showing that the composition of fish that is the target fish is obtained with a percentage of 60%. This can be explained by the higher proportion of catches of target fish compared to non-target fish. This also indicates that in terms of fishing gear selectivity, gillnet fishing gear is selective for use in terubuk fishing operations. Furthermore, it is also explained in Figure 4, as seen from the interview results, that 76% (25 respondents) of Bengkalis teruk fishermen stated that gill nets had high selectivity for terubuk catching. Meanwhile, 24% (8

respondents) of the other worst fishermen stated that they were less selective. This was analyzed because basically, the bottom fishermen of Bengkalis Regency use a mesh size of 2.5 inches to 3.3 inches, which, from field survey observations, proves that this causes a variety of other species to become entangled in the gill nets.

Based on Figure 5, it can be seen that of the 33 respondents who represent the worst fishermen in Bengkalis Regency, as many as 67% (22 people) have ship certificates and are active, 15% (5 people) have ship certificates but are no longer active in the sense that they must be taken care of to be extended, and then there are 18% (6 people) who do not exist or are in the condition of missing ship certificates. This indicates that this indicator received a moderate rating (Score 2) because the percentage of fishermen who have certification or a shipping certificate is only around 50%–75%. This shows that there are still some fishermen who do not care about obeying this matter, which in the future can hurt cases of violations in marine fisheries supervision that are often found in marine surveillance patrol activities

3.4. Economic Domains

The income earned by fishermen from Bengkalis fluctuates very much every month. This is because the fishermen's income is also affected by the selling price of the terubuk, which is different for each village, and this commodity is also very much affected by the conditions of the regulated catch period.

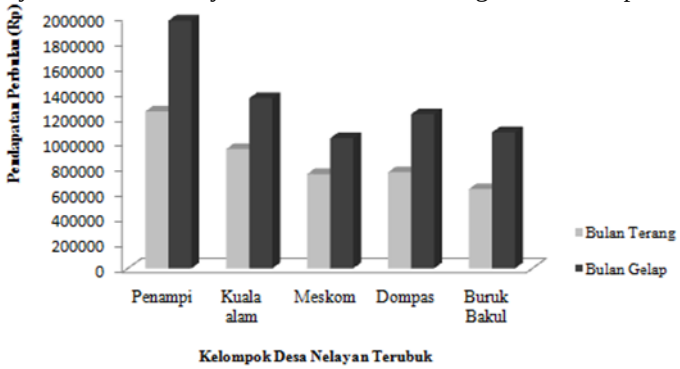

Figure 6. Income from the catch of the terubuk fishermen of Bengkalis Regency

Based on Figure 6, it can be explained that the fishermen who have the best income are the worst fishermen from Penampi Village, where the average income for their catch is IDR 1,980,000, and around IDR 1,253,333, then for Kuala Alam Village, the average income for their highest catches, namely during the dark moon, is around IDR 1,360,000, and in the brightest month, the average is around IDR 953,000, while for Meskom Village, the average income for their catch is IDR 1,040,000, and around IDR 753,000, while for Dompas Village, the average income for their catch is IDR 1,232,000, and around IDR 768,000, and for Buruk Bakul Village, the average income for their worst catches is around IDR 1,086,667, and during the bright month it averages Rp. 633,333.

Most fishing activities are carried out by fishermen, some of whom use the one-day fishing system, in which fishing trips are only carried out for one day. During fishing operations, the terubuk fishermen have to incur several costs to carry out a fishing operation, including operational costs such as fuel and food for one trip. However, to start a fishing business, investment costs are also required, in the form of the boat engines and fishing gear used, as well as the maintenance costs of the objects and tools used. The costs incurred by fishermen are as follows:

Investment costs are costs that must be incurred by the worst fishermen to start a fishing business. Among the most important are wooden boats, Dongfeng engines, fishing gear, and cool boxes or styrofoam, which are the main items that must be owned to start a fishing business at sea. In addition to investing, amortization or depreciation costs are also calculated for the goods that have been invested; this is useful information for reflecting the value of the assets of the goods when they want to be resold. The calculation of investment costs and depreciation costs for the value of the assets of the worst fishermen in Bengkalis Regency has been obtained from the results of direct interviews, and the results of the calculations are shown in Table 5.

Fixed costs are expenses that must and must be borne by the worst fishermen even if they do not conduct fishing operations. Usually, the fixed costs that must be incurred by fishermen are included in the costs of maintaining boats, engines, and individual contributions to inter-village fishing association groups if there are any. To be able to calculate fixed costs, interviews were conducted with respondents and they were asked directly about fixed costs. The results of the calculation of fixed costs can be seen in the following Table 6.

Variable costs are costs that are not incurred at any time and that are dynamic according to needs that can be adjusted. Variable costs are costs incurred by fishermen that are more oriented toward operational costs during fishing activities at sea. From the results of interviews with fishermen, it was found that Bengkalis Regency's examples of expenses in this variable cost include provisions for consumption of screens (in the form of food, drinks, ice cubes, and other side consumption) and fuel.

Table 5. Investment cost and depreciation

No	Fisherman's Village	Goods	Price (IDR)	Economic Age		Depreciation Monthly (IDR)
				Year	Month	
1	Penampi	Boat	20.611.111	15	180	114.506
		Machine	7.277.778	10	120	60.648
		Catching tool	790.000	2	24	32.917
		Cool Box / Styrofoam	50.000	2	24	2.083
						210.154
2	Kuala Alam	Boat	10.888.889	15	180	60.494
		Machine	7.722.222	10	120	64.352
		Catching tool	1.033.333	2	24	43.056
		Cool Box / Styrofoam	50.000	2	24	2.083
						169.985
3	Meskom	Boat	10.666.667	15	180	59.259
		Machine	4.500.000	10	120	37.500
		Catching tool	1.133.333	2	24	47.222
		Cool Box / Styrofoam	40.000	2	24	1.667
						145.648
4	Dompas	Boat	10.860.000	15	180	60.333
		Machine	2.160.000	10	120	18.000
		Catching tool	496.000	2	24	20.667
		Cool Box / Styrofoam	50.000	2	24	2.083
						101.083
5	Buruk Bakul	Boat	5.550.000	15	180	30.833
		Machine	2.216.667	10	120	18.472
		Catching tool	466.667	2	24	19.444
		Styrofoam	40.000	2	24	1.667
						70.417
Total						697.287

Table 6. Fixed cost

No	Fisherman's Village	Information	Unit	Price (Rp)
1	Penampi	Maintenance	12 months	256.019
		Group Dues	1x per trip	10.000
				266.019
2	Kuala Alam	Maintenance	12 months	239.815
		Group Dues	1x per trip	0
				239.815
3	Meskom	Maintenance	12 months	133.333
		Group Dues	1x per trip	0
				133.333
4	Dompas	Maintenance	12 months	295.000
		Group Dues	1x per trip	0
				295.000
5	Buruk Bakul	Maintenance	12 months	327.778
		Group Dues	1x per trip	0
				327.778
Total				1.261.944

These costs are only incurred when fishermen carry out the worst fishing operations. From conducting interviews with the respondents of the worst fishermen's RTP and asking directly about matters related to variable costs, the results of calculating the costs are as follows in the following Table 7.

Revenue from per-trip and per-month catches. Income is the catch of fishermen from the worst fishing operations. According to field data, the worst fishermen can complete 8 fishing trips in a month. The catches have been recapitulated and analyzed, with the lowest fish prices per village obtained from the results of the interviews. Based on this, the details can be seen in the following Table 8.

Table 7. Variable cost

No	Fisherman's Village	Information	Unit	Price (IDR)
1	Penampi	Provision of Screen Consumption	per trip	105.556
		Solar	25-30 L	191.389
				296.945
2	Kuala Alam	Provision of Screen Consumption	per trip	85.556
		Solar	25-30 L	66.444

				152.000
3	Meskom	Provision of Screen Consumption	per trip	53.333
		Solar	25-30 L	58.500
				111.833
4	Dompas	Provision of Screen Consumption	per trip	73.600
		Solar	25-30 L	31.200
				104.800
5	Buruk Bakul	Provision of Screen Consumption	per trip	73.333
		Solar	25-30 L	31.500
				104.833
Total				770.412

Table 8. Average income of fishermen's catch (per trip)

No	Fisherman's Village	Information	Unit	Price (IR)
1	Penampi	Gross Income	per head	495.000
		Aside	total	40.000
		Net income	per trip	228.055
		Profit Sharing (1/4)	0,25	-
				268.055
2	Kuala Alam	Gross Income	per head	340.000
		Aside	total	30.000
		Net income	per trip	188.000
		Profit Sharing (1/3)	0.3	-
				218.000
3	Meskom	Gross Income	per head	260.000
		Aside	total	25.000
		Net income	per trip	148.167
				173.167
4	Dompas	Gross Income	per head	308.000
		Aside	total	20.000
		Net income	per trip	203.200
				223.200
5	Buruk Bakul	Gross Income	per head	271.667
		Aside	total	20.000
		Net income	per trip	166.833
				186.833

Furthermore, after calculating per-trip income, proceed with calculating monthly catch income to obtain the average income range of the worst fishermen per month. Detailed calculations can be seen in the following Table 9.

Table 9. Average income of the best fishermen monthly (per month)

No	Fisherman's Village	Information	Unit	Price (IDR)
1	Penampi	Income	per month	2.144.444
		Total cost	per month	266.019
		Shrinkage	per month	210.154
		Average Income		1.668.271
2	Kuala Alam	Income	per month	1.743.999
		Total cost	per month	239.815
		Shrinkage	per month	169.985
		Average Income		1.334.199
3	Meskom	Income	per month	1.385.333
		Total cost	per month	133.333
		Shrinkage	per month	145.648
		Average Income		1.106.352
4	Dompas	Income	per month	1.785.600
		Total cost	per month	295.000
		Shrinkage	per month	101.083
		Average Income		1.389.517
5	Buruk Bakul	Income	per month	1.494.667
		Total cost	per month	327.778
		Shrinkage	per month	70.417
		Average Income		1.096.472

Based on the calculations made in Table 9, it can be seen that the monthly income of the fishermen in Bengkalis varies greatly and varies from village to village. So it can be concluded that the income of Bengkalis residents is below the average regional minimum wage (UMR) for Bengkalis Regency, which has been stipulated through Riau PERGUB Decree Number: Kpts.1198/XI/2019, which is around Rp. 3,261,357.42 per month. Based on the economic analysis of fishing efforts conducted by fishermen in Bengkalis, this indicator is given a criterion score of 1 because the income is lower than the regional minimum wage for the Bengkalis Regency, which has been set.

According to the findings of 33 Bengkalis fishermen respondents' interviews, 76% (25 respondents) could not save and the remaining 24% (8 respondents) could. This shows that the fishermen's management of the difference between their expenditure and income is still relatively poor; from the calculations in the processing and analysis of the data, it shows that the SR value of Bengkalis fishermen is smaller than the value of the interest rate provisions set by BI in October 2020, namely 0.4%. The results of the analysis of the saving ratio indicator are in line with the explanation of the results of the previous indicator, namely the indicator of household income for fishermen in Bengkalis Regency. This explains how the saving ratio is related to economic income and expenditure in Bengkalis fishermen's households, where the RTP's income is less than the regional minimum wage for Bengkalis Regency and survey data from interviews show the value of SR = the loan interest rate (minus income). It is assumed that this causes a minus in income so the majority of the selected respondents stated that it was not possible to save from the results of the worst fishing income.

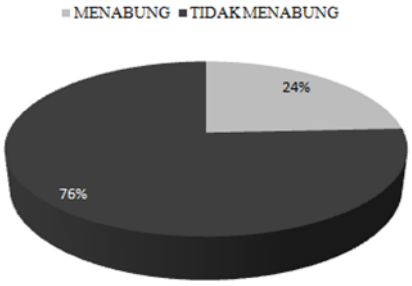

Figure 7. Percentage of savings ratio of the RTP of the best fishermen

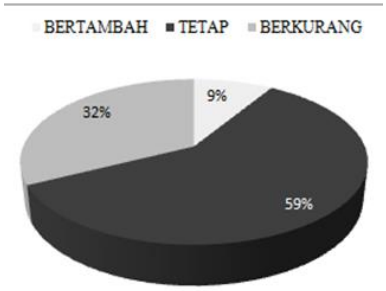

Figure 8. Percentage of fishery household asset ownership

Regarding the ownership of assets in the Bengkalis fishing household, it was published based on the results of interviews that obtained a percentage of 59% (20 respondents) RTP stating that their assets were constant, 9% (3 respondents) stating their assets had increased, and finally 32% (11 respondents) stating their assets had been reduced or decreased. The percentage diagram of fishery household asset ownership can be seen in the following Figure 8.

Fixed assets are divided into two categories: productive assets such as ships, machinery, fishing gear, and the like, and non-productive assets such as motorcycles, televisions, furniture, and others. The reduced assets of Bengkalis fishermen are classified into two categories: productive assets, in the form of boats or machines that are traded, and fishing gear, in the form of nets and other equipment that, if damaged, needs to be repaired. As for non-productive assets, for example, in a fishing household, fishermen used to own electronic goods or even other assets that had to be sold to make ends meet during the famine season. This shows that in terms of dominant asset ownership, it does not have continuity to minimal income because, seen from the minimum income of fishermen, the majority of fishermen have fixed assets. This means that there is no urgency to reduce the assets owned by fishermen to meet their needs or to balance the economic balance in the household affairs of fishermen, especially those in Bengkalis Regency.

3.5. Social Domains

Based on the results of the interviews in Figure 9, it can be seen that from the fisheries extension participation activities, as much as 94% (31 respondents) stated that they had been held and participated in fisheries extension activities 1–5 times held by stakeholders, while as many as 6% (2 respondents) stated they did not participate and never even knew there was a fisheries counseling activity held by stakeholders.

Furthermore, as many as 91% (30 respondents) said they had held and participated in capture fisheries training activities, while as many as 9% (3 respondents) said they had never participated in capture fisheries training activities by stakeholders. Meanwhile, regarding participation in fisheries sector assistance, as much as 27% (9 respondents) stated that they had experienced or received assistance from the fisheries sector in the form of fishing gear, boat engines, or funds for the management of fishing groups if active, while 73% (24 respondents) stated that they had never even experienced or received participation in fisheries sector assistance in any form, either from stakeholders in the regions or from stakeholders in the center.

For this social aspect, interesting events often occur that can be discussed and become indicators in this study, namely fisheries conflict indicators. Fishery conflict itself can be caused by fighting over fishing grounds

(resources conflict), fishing gear conflict, policy conflict in the same area, or activity conflict between conflict sectors. For the waters of the Bengkalis Strait as a terubuk fishing area, the results of interviews with the respondents, terubuk fishermen, regarding the frequency of conflicts over the utilization of terubuk fish resources can be seen in the following Figure 10.

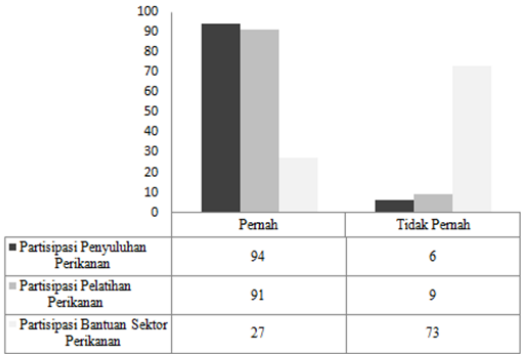

Figure 9. Frequency of Terubuk fishermen (respondents) in stakeholder participation for terubuk fisheries management, Bengkalis Regency

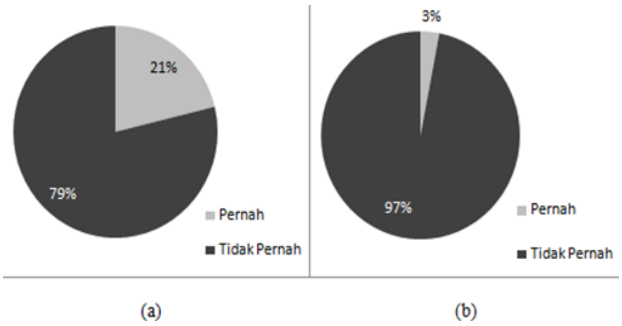

Figure 10. (a) The percentage that has experienced conflict with fishermen outside the area; (b) the percentage that has experienced conflict with fishermen in one area

Based on Figure 10 above, it can be explained that the worst conflicts between fishermen, both in one region and in different regions, have occurred in the last 5 years. The only difference is the frequency and type of conflict. From the results of the interviews, the percentage of conflicts with fishermen outside the area was 21% (7 respondents), and they explained that the conflicts that occurred were with fishermen outside the majority area from Meranti Regency who caught demersal fisheries leading to the Bengkalis Strait using stone nets. Stone nets, if they overlap or drift, will damage the gill net fishing gear and can tear it, men outside the majority are from Meranti Regency caught demersal fisheries leading to the Bengkalis Strait using stone nets. Stone nets, if they overlap or drift, will damage the gill net fishing gear and can tear it, which then cannot be reused by terubuk fishermen. This has reportedly been the case for a long time. As for fishing conflicts between regions.

3.6. Institutional Domains

The data needed for this compliance indicator is the frequency of occurrence of violations of the law within a year of the detected fisheries control operation. second, conducted by interview or questionnaire (key person) on non-formal violations, including compliance with the rules themselves and the regulations above them. This matter can be seen in the following Figure 11.

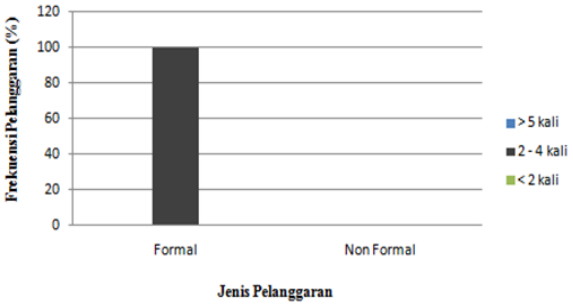

Figure 11. Percentage of violations that occurred in the worst fisheries in Bengkalis Regency

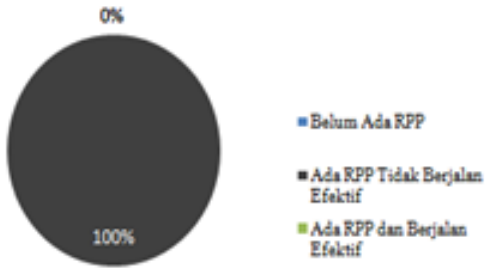

Figure 12. Percentage of implementation of RPP in terubuk fishery management

Figure 11, based on the joint patrol monitoring activities carried out by the PSDKP Satwas Rohil with the BPSPL Padang Satker Pekanbaru and the Technical Implementation Unit (UPT) for Control of Marine Resources and Fisheries Region II Marine and Fisheries Service of Riau Province, From the notes and results of observations in the field, it can be seen that formal violations occur on a 100% scale for the types of formal violations. In particular, the number of violations occurring 2-4 times was discovered with the captain's name, fleet group, and inspection location recorded in the 2020 protected fisheries surveillance report. Meanwhile, the frequency of non-formal violations was not found because there were no rules of custom or cultural rules that bind the management of terubuk fisheries. As a result, there are no rules, no frequency of violations,

Next is the indicator for the fishery management plan. Adrianto et al. (2014) explained that this indicator provides an assessment of the success of implementing an ecosystem approach in fisheries management. If the

regional government has a complete RPP for each fishery management implementation, then the fishery management can be considered successful; conversely, if the fishery management is not supported by an RPP, then the fishery management is considered unsuccessful or has the potential to threaten sustainability.

Based on Figure 12, the results of interviews with the three core stakeholders, namely BPSPL Padang Satker Pekanbaru, Maritime Affairs and Fisheries Service of Riau Province, and PSDKP Belawan Satwas Rohil, all agree that the Fisheries Management Plan used for the management of the worst fisheries in Bengkalis Regency refers to the program "The 2016 National Action Plan (RAN) for the Conservation of Worm Fish," which has the objective of being a reference for relevant stakeholders to determine priorities for conservation activities, as well as designing programs that are in line with the need to maintain the sustainability of the worst fish populations and their habitat, and following KEPMEN KP No. 59 Years (2011), where the fish was classified as a restricted catch. This is following the data presented, which shows that the RPP exists.

3.7. Evaluation of Management Status with Assessment of EAFM Indicators

EAFM implementation requires a set of indicators that can be used as a monitoring and evaluation tool regarding the extent to which fisheries management has applied the principles of ecosystem-based management. Simultaneously, each indicator for the aspect of the ecosystem approach in fisheries management covers five (five) domains, namely: the domain of fish resources, fishing techniques, social, economic, and institutional.

Based on the analysis of each indicator from the five domains that have been mentioned, the status of the score of each indicator in the management of terubuk fisheries shows that the economic domain is in the poor category, while the social and institutional domains are in the medium category, and the fish resources and fishing techniques are in the good category. Therefore, priority for improvement is given to the economic domain, as well as attention to the social and institutional domains. As for the overall assessment of the EAFM domain, it is presented in Table 10.

Table 10. Overall assessment of the EAFM domain for the best fisheries in Bengkalis Regency

No	Domain	Composite Value	Description
1	Fish Resources	97	Very well
2	Habitat or Ecosystem	52	Currently
3	Fishing Techniques	98	Very well
4	Economy	44	Currently
5	Social	67	Good
6	Institutional	67	Good
	Aggregate	71	Good

Based on the results of the overall assessment of each domain by giving a score based on predetermined criteria, the current performance of fisheries management in Bengkalis Regency shows that there are three groupings based on composite values, namely, domains that qualify as "moderate," namely, the economy; domains that qualify for stage "good," namely, the institutional domain; and finally, domains that qualify for stage "excellent," namely, the fish resources domain, the fishing technique domain, and the social domain. Therefore, the priority for improvement as well as the spotlight are given to the economic domain.

In this study, the aggregate values obtained tend to be influenced by the connectivity between indicators, which means that the influence of parameters in the area is also felt to be related. In this context, the value of connectivity will also show its effect on the overall calculation. The simple logic is that any indicator that has a high linkage to other indicators will be classified as an indicator that has a big role in the ecosystem of a region

4. Conclusions

The status of the best fisheries management in Bengkalis Regency as a whole is considered to be in good criterion condition (aggregate score: 71). However, specifically based on the values between domains, three groupings based on composite values can be obtained, namely, domains that qualify as "moderate," namely the economic domain and habitat and ecosystem. Domains that qualify as "good" are institutional domains and social domains. The domains that qualify as "very good" are the domain of fish resources and the domain of fishing techniques.

5. Suggestion

The status of the best fisheries management in Bengkalis Regency as a whole is considered to be in good criterion condition (aggregate score: 71). However, specifically based on the values between domains, three groupings based on composite values can be obtained, namely, domains that qualify as "moderate," namely the economic domain and habitat and ecosystem. Domains that qualify as "good" are institutional domains and social domains. The domains that qualify as "very good" are the domain of fish resources and the domain of fishing techniques.

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