Present status of capture fisheries in West Kutai regency of East Kalimantan Province, Indonesia

Iin Solihin[1*], *Thomas* Nugroho[1], *Dudi* M Wildan[2], *Sulistiono* Sulistiono[2], *Wildan* Nurussalam[3], *Irzal* Effendi[3], *Totok* Hestiriannoto[4], *Edriyan* Edriyan[4], *Mala* Nurimala[5], *Florensius* Steven[6], and *Yulian* Yulian[6]

[1]Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, 16680, Indonesia
[2]Department of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, 16680, Indonesia
[3]Department of Aquaculture, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, 16680, Indonesia
[4]Department of Marine Science and Technology, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, 16680, Indonesia.
[5]Department of Fisheries Processing Technology, Faculty of Fisheries and Marine Sciences, IPB University, Bogor, West Java, 16680, Indonesia
[6]Board of Regional Planning and Development, Research and Development. Barong Tongkok, West Kutai Regency, East Kalimantan, 75777, Indonesia

Abstract. The Mahakam River and the Jempang Lake regions are home to the substantial capture fisheries resources in West Kutai Regency. The purpose of this study is to describe the state of the district's capture fisheries. It was carried out in May and August of 2024 in three districts:Muara Pahu, Penyinggahan, and Jempang. The research method used was a descriptive survey by conducting observations and interviews with fishermen. Observations indicate that the three districts have a substantial potential for capture fisheries, with Asian redtail catfish, Indonesian snakehead, pangas catfish, tilapia, and Philippine catfish making up most of the catch. Typically, fishermen employ traditional gear such as lift nets, long lines, net traps, bamboo traps, and gill nets. Non-motorized boats and outboard motorboats make up many fishing vessels. The number of fishermen varies between around 6,822 and 7,508 individuals. One-day fishing is the practice of fishing for a single day, and the annual production of capture fisheries ranges from 1,556 to 1,570 tons. Among the issues faced in the field include the usage of poison, fishing with forbidden gear, and the water level (particularly Jempang Lake) being drastically reduced or even drying up during the dry season.

* Corresponding author: iin_solihin@apps.ipb.ac.id

1 Introduction

With 3.85 million hectares, Indonesia has the greatest inland water resources in the world and can develop them on a sizable inland area [1]. Any water that is created, either naturally or artificially, that is located from the lowest tides toward the mainland and does not belong to any one person is one of these waterways. Rivers, lakes, reservoirs, marshes, and other puddles are therefore considered to be part of the general waters of land [2]. There are up to 840 lakes in Indonesia [3], 5,590 rivers [4], and 33,4 million [1] hectares of swamps, which make up 15% of the country's total land area [5]. Rich in biodiversity, these waterways are home to over a thousand known species of fish, while some sources suggest that as many as 2,000 species may yet exist.

West Kutai Regency is one of the regency in East Kalimantan Province which has a relatively wide land waters. The inland waters include rivers, lakes and swamps. The lake in this district is Jempang Lake which has an area of around 15,624 ha and an average depth of 3.5 meters [6]. Jempang Lake is the largest lake in East Kalimantan Province compared to other large lake funds, namely Melintang Lake and Semayang Lake in Kutai Kertanegara Regency. West Kutai Regency is crossed by the Mahakam River which is the longest river in Indonesia, which is 920 km [7].

The potential for fish resources, especially capture fisheries, in land's interior waters is comparatively high. After Kutai Kertanegara Regency, the West Kutai has the second-largest catch in East Kalimantan Province. East Kalimantan Province's capture fisheries production in 2022 was 43,579 tonnes, while Kutai Kertanegara and West Kutai Regencies were 34,318 tonnes and 1,570 tonnes[8]. Nevertheless, this regency has not made the best use of its catch fishery potential. Information about these capture fisheries is scarce. As a result, capture fisheries that are not well managed for grow.

The purpose of this study is to provide an overview of the state of the catch fisheries in West Kutai Regency. The findings of this study are expected to help the West Kutai Regency's Regional Government advance capture fisheries in the future.

2 Methods

Three areas of West Kutai Regency, East Kalimantan—Muara Pahu, Penyinggahan, and Jempang areas—were the sites of this study, which was carried out in May and August of 2024 (Figure 1). The three districts were chosen based on the observation that each district has a comparatively high potential for capture fisheries. This study is descriptive in nature, with the goal of describing traits or phenomena and focusing more on what occurs than on how and why a phenomenon occurs [9]. Desk research, field observation, and interviews with capture fisheries actors—that is, fishermen in the three districts—were used to collect data. Descriptive analysis was performed on the collected data, which included the number of catches, fishermen, fishing boats, fishing gears, and fishing regions, as well as the capture fisheries issues that were experienced.

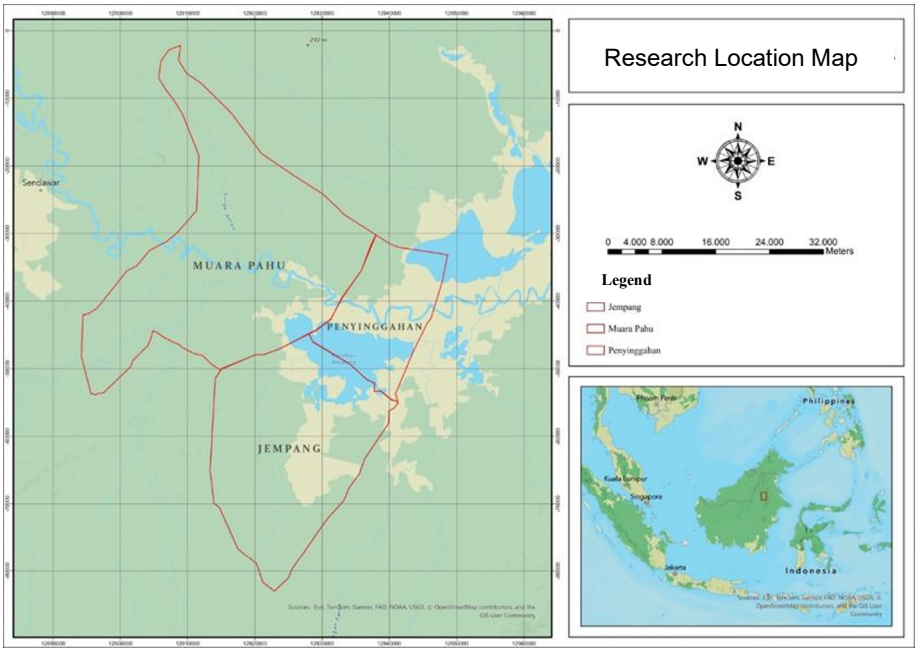

Fig. 1. Research location map of study on present status of capture fisheries in West Kutai Regency, East Kalimantan.

3 Result and discussion

3.1 Muara pahu district

3.1.1. Fisherman

There are 12 villages in the Muara Pahu District, and fishing is mostly done in a few of them. Another significant fishing hub in Muara Pahu District is Muara Beloan Village. A wide range of mainland food fish, including kissing gourami, hoven's carp, striped snakehead, catfish, snakeskin gourami, glass catfish, climbing fish, and various white fish, can be found in the village, which is encircled by numerous streams and lakes. However, given that the residents of this hamlet are entirely dependent on capture fishing enterprises, the degree of use of fisheries resources is likewise high. One of the fish-producing waters in this area is Paud Lake, a sizable lake that is connected to the Batangan River the Batang Pahu River runs through Muara Beloan Village, linking it to the Mahakam River.

Approximately 95% of the families in Muara Beloan Village, the village with the highest concentration of fishermen, make their living from fishing. Every household head owns a boat; depending on the number of male family members, a single family may own multiple boats. Table 1 shows the number of fishermen fisheries household in Muara Pahu Village.

Table 1 Number of fishermen households.

No	Year	Muara Pahu District	West Kutai Regency	Proportion (%)
1	2022	1,270	7,508	16.92
2	2023	1,270	6,822	18.62

Source : Muara Pahu District in number 2023

According to the interviews results, fishermen in Muara Pahu District ranged in age from 28 to 57 years, and the majority of them had completed elementary school (66%), followed by junior, and senior high schools (16% each). Their primary source of income is fishing, but they also work as construction workers, cage farmers, village authorities, and poultry farmers. They have ten to thirty years of fishing experience. This variation in sources of income also occurs in Konawe Regency where there are two sources of income for fishermen, namely from fishing and non-fishing[10].

3.1.2. Fishing unit

The fishing boat in Muara Pahu District is still traditional with a relatively small size. The fishing boat amounted to 2008 in 2021. Of this amount, dominated by outboard engine (1,179 units) and the others were boat without motor engine totaling 829 units. There is no inboard motor in this area. The complete data is presented in Table 2.

Table 2 Number of fishing boat per type in 2021.

No	Fleet type	Number of fleets
1	Boat without motor engine	829
2	Outboard engine	1,179
	Total	2,008

Source: Muara Pahu District in Number 2022

Their boat measures about 9 meters in length, 80 to 1 meter in width, and 80 cm in height, and it is primarily constructed of wood (Fig 1). The boat is primarily constructed from wood and fiber on its own. Nonetheless, there are four historic shipyards in this region that used to build boats for others fisherman. With a technical age of three to five years, the cost of a single boat unit varies from four to twelve million dollars. Although this kind of boat can be up to ten years old technically, it costs between IDR 9 and 30 million. The boat drive engine is an outboard motor with a power output of 6-35 PK. Yamaha, Honda, and Mitsubishi are the brands that are frequently utilized. This machine costs between IDR 4 and 40 million. They purchased it in Muara Muntai District or Samarinda City.

Fig. 2. Boat and fishing equipment in Muara Pahu District.

Muara Pahu fisherman continue to use comparatively basic fishing equipment, including lift nets, longlines, net traps, bamboo traps, gillnets.

a. Lift net fishing gear

This fishing gear includes lifting net class. This fishing gear operates on the basis of currents. Fishing gear positioned at the water's bottom. The fish will be kept in the net and then raised when the river flows.

Fig. 3. Lift net fishing gear ("Sangga").

b. Longline

The main rope and branch rope make up the longline fishing apparatus. A fishing line or hook is 1.3 meters long, whereas the main rope is 500 meters long. Nos. 14 and 12 fishing lines are utilized. Each unit has a different amount of fishing lines, typically ranging from 100 to 300. Every fisherman has between 300 and 1000 fishing hook on his line. Instead of using a buoy and buoy sign, attach them directly to the tree branches.

c. Net trap

This type of fishing gear is classified as a trap, which is used to catch fish by setting it in rivers or marshes. This fishing gear measures roughly 80 by 40 cm and is composed of wire.

Fig. 4. Net trap ("pengilar").

d. Bamboo trap

Rattan or bamboo are used to make this fishing gear. The idea of capturing is to allow the fish to get into the fishing gear and become caught there.

Fig. 5. Bamboo trap.

e. Gillnet

In essence, this type of fishing gear is classified as gillnet. But the local fishing community refers to it as a trawl. This fishing gear is 100 x 1 m in size. Usually use a net with mesh size 3.8 and 7.5 inches, a 3 ounce to 05 kg ballast, and a flip-flop float are used.

In 2023, the Fisheries Service of the West Kutai Regency Government conducted an effort to boost the production of capture fisheries by offering fishing facility assistance. This aid consists of wooden boats, cold boxes, fishing gear, and ten boat engines. The fishermen's group from Pahu Jaya received assistance. It is envisaged that this support will help fishermen capture more fish and increase their production. Government aid serves as a catalyst to support fishing organizations in their operations. The families of fishermen can fully benefit from this aid possible. It is anticipated that West Kutai's catch fisheries production will rise further with this support, benefiting both the local economy and fisherman respectively.

3.1.3. Seasons and fishing ground

Three distinct seasons make up the catching season: (i) the flood or famine season, which occurs on April and June; (ii) the peak season, also known as the dry season, which occurs from July to January; and (iii) the transition season which occurs from January to March. Both the quantity of fish caught, and the variety of fish species captured are high during the dry season. Kissing gourami, striped snakehead, Indonesian snakehead, pangas catfish, hoven's carp, glass catfish, Asian redtail catfish, and vaillanti carp are among the fish that have been captured. During the flood season, on the other hand, only kissing gourami, striped snakehead, and catfish species are caught.

There are rivers, lakes, and swamps in the fishing ground. Swamps were the most expansive fishing ground, covering 590 hectares in 2018. The acreage did, however, drastically decrease to 162 acres in 2020. An area saw a loss of about 72.54% in just two years. Table 3 displays all the information.

Table 3 The area of fishing ground in Muara Pahu District in 2018 and 2020.

No	Type of fishing ground	Square (ha)		Growth (%)
		2018	2020	
1	River	121	109	-9.91
2	Lake	182	49	-73.07
3	Swamp	287	4	-98.60
	Amount	590	162	-72.54

Source : Muara Pahu in Figures 2021

The fishing activity is done during the day and is either one-day fishing. The fishermen leave at six o'clock and return at eleven. However, they also return to the following excursion after taking a break. Except for Friday, fisherman in this area catch a fish the fishing area were the Mahakam River, Muara Gedang River, and swamp surrounding their homes. Table 4 shows the correlation between the type of fish captured and the season.

Table 4. The relationship between the fish season and the type of fish caught in Muara Beloan Village, Muara Pahu District.

Transition Season			Famine Season		Peak Season					
Jan	Feb	Mar	Apr	Jun	Jul	Ags	Sep	Oct	Nov	Dec
			Kissing gourami, striped snakehead and phillipine catfish		Kissing gourami, striped snakehead, Indonesian snakehead, pangas catfish, hoven's carp, glass catfish, Asian redtail catfish, vaillanti carp					

3.1.4. Catch production

Muara Pahu District has a comparatively higher catch yield. The catch production climbed by 9.85%, from 245.94 tons in 2022 to 270.17 tons. In comparison to West Kutai Regency's catch fisheries production, Muara Pahu District made up 15.66% in 2022 and 17.36% in 2023. Table 5 displays all the data.

Table 5 Production of catches in Muara Pahu District in 2022-2023.

Year	Muara Pahu		West Kutai Regency		Proportion (%)
	Production (ton)	Growth (%)	Production (ton)	Growth (%)	
2022	245.94		1,570.00		15.66
2023	270.17	9.85	1,556.00	- 0.88	17.36

Source : West Kutai Regency in number 2023

According to the findings of fisherman interviews, kissing gourami is the most common catch, reaching up to 1,000 tons per fishing trip during the busiest time of year, but only reaching 50 kg during the off-peak period. This fish costs between 5,000 and 15,000 rupiah/kg.

3.1.5. Fishing problems

One of the issues Muara Pahu District's fishermen face is (i) the government's policy of granting permits to coal mining businesses. This company's operations have an effect on environmental harm, specifically the habitat of fish that are targeted for fishing. (ii) granting permits to open oil palm plantations that harm fisheries areas; (iii) granting permits for hauling roads or mine production routes from the pit location to the coal loading and

unloading jetty to the pontoon on the Mahakam River; (iv) illegal fishing on the Mahakam River, which results in fishing with chemical/poison and electric fishing. (v) The distribution of fishing facilities aid is still ineffective, and fishermen themselves sell fishing gear, which is poorly handled. (vi) The lack of infrastructure for fish landing and marketing locations prevents activity from being concentrated in one area; (vii) the number of catches has decreased.

3.2 Penyinggahan District

3.3 Fisherman

Penyinggahan Ulu, Penyinggahan Ilir, Tanjung Haur, Minta, Bakung, and Loa Deras Villages are the six villages that make up Penyinggahan District. Tanjung Haur Village is home to most fishermen. Ninety percent of the people living in this village are fisherman. In contrast, only about 10% of people in other villages are employed as fishermen.

Table 6 Number of fishermen households in Penyinggahan District.

No.	Year	Number of fisherman household		
		Penyinggahan District	**West Kutai Regency**	**Proportion (%)**
1	2022	1,280	7,508	17.05
2	2023	1,280	6,822	18.76

Source : West Kutai Regency in number 2023

3.2.1 Catching units

The number of fishing boats in the Penyinggahan District is 2,372 units dominated by boat without motor engine that reached 2,365 units, outboard motor engine and motor boats each of 4 and 3 units (Penyinggahan in number 2022).

Table 7. Number of fishing boat in Penyinggahan District 2021.

No	Type of mode	Number (unit)
1	Boat without a motor engine	2,365
2	Outboard motor engine	4
3	Motor boat	3

In Penyinggahan District, fishermen utilize gill net, net trap, bamboo trap, lift net and longline as their fishing gear. Gillnet are typically used in the Mahakam River and Jempang Lake. Asian redtail catfish, striped snakehead, and catfish, which are often fished in the Mahakam River, are caught in Jempang Lake. In this district, gillnet is used by the majority of fisherman. About four persons own the net trap fishing gear, which is used extensively in the Jempang Lake. The snakeskin gourami, kissing gourami, and tilapia are the catch. Three fishermen own the bamboo traps, with each having twenty units. Both the Mahakam River and a smaller river that circles the Penyinggahan are used for fishing. Glass catfish and Asian redtail catfish are among the fish caught using bamboo traps. Ten fishermen are equipped with lift net fishing gear. A vaillanti carp is the type of catch. It is possible to catch up to one ton of vaillanti carp per person per day during the busiest time of year. Four fishermen own the remaining fishing gear, which has been around for a while. This fishing gear catch striped

snakeheads and red tail catfish. Vaillanti carp are used as bait in the operation to collect catfish, while small snakeskin gourami fish are used to catch striped snakehead.

3.2.2 Season and fishing ground

The Mahakam River and Jempang Lake are the two fishing grounds in Penyinggahan District. It takes around two hours to drive by boat the roughly 20 miles from where they live to Jempang Lake. In 2021, this district's fishing ground will include 570 ha of lakes and 435 ha of rivers.

Fishermen carry out one day fishing operation home. They usually leave at 07.00 and return at 12.00 noon. In addition to Friday, fishermen of this region make fishing operation every day for one week and twelve months for a year. There is no special place to land the boat. They put the boat near their house or on the edge of the Mahakam River. Engine and fishing gear are brought home when finished from the operation of the fishing. they carried out the fishing activities themselves.

3.2.3 Catch production

Penyinggahan District's capture fisheries production will reach 311.28 tonnes in 2022. This amount is 15.18% of West Kutai Regency's capture fisheries production in the same year. In 2023, the production of capture fisheries in Penyinggahan District will decrease to 238.27 tons or a decrease of 23.43% compared to the previous year. However, its contribution to the production of West Kutai Regency has relatively increased, namely 15.31%. West Kutai Regency's catch production itself decreased by 0.88% in the same year.

Table 8. Capture fisheries production in the Panyinggahan District and West Kutai Regency in 2022-2023.

Year	Penyinggahan District		West Kutai Regency		Proportion (%)
	Production (ton)	Growth (%)	Production (ton)	Growth (%)	
2022	311.28		1,570.00		15.18
2023	238.27	- 23.45	1,556.11	- 0.88	15.31

The distribution of fish types caught by village in Penyinggahan District is presented in Table 9.

Table 9. Distribution of fish types by village in Penyinggahan District.

No	Village	Fish species				
		Hoven's carp	Indonesian snakehead	Asian redtail catfish	Common carp	Tilapia
1	Loa Deras	(1)	(1)	(2)	(1)	(2)
2	Minta	(2)	(1)	(2)	(1)	(1)
3	Penyinggahan Ilir	(1)	(2)	(2)	(1)	(2)
4	Tanjung Haur	(1)	(2)	(2)	(1)	(3)
5	Penyinggahan Ulu	(1)	…	…	(1)	…
6	Bakung	…	(1)	(1)	…	(1)

Description: 1 = production <10 ton/year; 2 = production 10-20 ton/year; 3 = > 20 ton/year

Besides making catch, fishermen also have a fish culture business in cages. The cage they placed along the edge of the Mahakam River near to their house. Each fisherman usually has about two cages. Fish culture in this cage usually takes one year. Fish that are cultivated varies such as tilapia, Asian redtail catfish, Indonesian snakehead and Philippine catfish. One harvest can reach 500 kg/cage. The income earned varies depending on the type of fish being cultivated. For example, a fisherman has income reaching 65 million from his cage business

for one year. Income from this cage is very helpful for the economy of fishermen, especially to support incidental expenses such as children's tuition fees, marriages and others. This happens because the income from fishing is relatively low and sometimes even minus when compared to operational costs that must be incurred.

The businesses made by fishermen are mostly their own efforts. The capital for fishing business and daily needs can come from bank loans, loans to village company and loans to collecting traders. The amount of loan to the bank is around 30 million with an interest of 1.5 million. They paid the debt shortly after harvesting cages.

3.2.4 Fishing problems

The problem faced by fishermen in the Penyinggahan District is the first, there are fishermen from outside the area (Kutai Kartanegara) who uses the fishing gear (fixed trap net). This fishing gear is considered to reduce their catch because the mesh size is relatively small so that all fish can be caught. There are around 200 units fixed trap net fishing gear that are operated at Jempa Lake. On the other hand, the fishing gear used by Penyinggahan fishermen is lift net. The agricultural extension center, the village representative, the local administration, and the community are working together to regulate the usage of mosquito nets and electric shocks on Jempang Lake. The use of fishing gear that is not environmentally friendly has numerous detrimental effects. Fishermen's catches decline when they utilize fixed trap net and electronic fishing gear. Furthermore, the fishing region is monopolized. This is due to the fact that fixed trap net fishing gear needs a lot of space. Additionally, using fixed trap net is extremely risky for nighttime fishers. The rope holding the mosquito net stretches above the water's surface, causing the boat to sink or putting fishermen in risk. Second, there are fish species experiencing extinction. In the past, there were shrimp in the Mahakam River and Jempang Lake. However, currently the shrimp is seldom relatively found/captured. Third, there are fishermen who use electric fishing gear to catch fish. Their target is striped snakehead, especially during the dry season.

Protecting aquatic resources is very important so that fish and their environment can be preserved. This is to ensure the sustainability of the fishing business. The Fisheries Service has made several efforts to encourage the community to be involved in protecting these aquatic resources through activities to determine protected water areas (Reservaat), restocking fish, forming a Fisheries Community Monitoring Group (POKMASWAS), installing warning signs about the dangers of Illegal Fishing, as well as socializing several regulations related to fisheries.

In general, fishing activities in the waters of the Republic of Indonesia have been regulated by several fishing gear that are not allowed include the prohibition of the use of trawls with its derivatives in the Minister of Maritime Affairs and Fisheries Regulation of the Republic of Indonesia Number 2/Permen-KP/2015 concerning the Prohibition of Use of Trawls and seine nets in the fisheries management area.

3.4 Jempang District

3.3.1 Fisherman

The largest number of fishermen in Jempang District is in several villages, namely Lanting Island, Tanjung Jone and Muara Ohong. Data on the number of fisheries family household in Jempang District is presented in Table 10.

Table 10 Number of fisheries family household of Jempang District 2022-2023.

No.	Year	Number of fisheries family household		
		Jempang District	West Kutai Regency	Proportion (%)
1	2022	1,360	7,508.00	18.11
2	2023	1,360	6,822	19.94

Source: Jempang District in number 2023

In Pulau Lanting Village, 170 of the 366 family heads are employed as fishermen, accounting for 46% of the total. Furthermore, 104 of the 229 family heads in Tanjung Jone Village are employed as fishermen. In addition to fishing, they are also fish farmers. Fishermen activities face obstacles, especially during the dry season. Jempang Lake as a main fishing ground has decreased its water level even to drought. As a result, many fishermen switch professions from fishermen to laborers in oil palm plantations, becoming oil palm farmers by utilizing they land, go to the city as taxi driver, trader or laborer. These conditions can be permanent, meaning that fishermen who switch the profession do not return to their profession as fishermen. This is due to their greater income when they don't become fishermen.

3.3.2 Fishing units

The fishing boat in Jempang District in 2021 will number 1,445 units. Most of the fishing boat are outboard motor engine, reaching 1,060 units or around 73%. Meanwhile, the rest of the fishermen use boats without motor engine as a catch property.

Table 11. Number of Jempang District fishing boat in 2021.

No	Fleet type	Amount
1	Boat without motor engine	385
2	Outboard motor engine	1,060
Amount		1,445

Source: Jempang District in number 2022

The fishing gear used is relatively the same as in Muara Pahu and Penyinggahan Districts. But fishing gear which relatively dominant is gillnet. There are three types of hooks used, which are 7.5, 9, and 11. The fishing gear that is widely used by fishermen in Jempang District is fixed trap net. This fishing gear is included in the setnet fishing gear category. The operation of this fishing gear has caused polemics in the fishing community. Fishermen from Penyinggahan District refused to operate this fishing gear. This is because the fishing gear is thought to be able of capturing all kinds of fish, regardless of size. Their ability to continue fishing is threatened by this ailment. Their fishing activities' sustainability is impacted by these circumstances. However, fisherman in the Jempang District believe that this gear is quite effective and doesn't take a lot of money or work. Fishermen who operate this fishing gear, especially from Tanjung Ohong Village and Kutai Kartanegara Regency. The majority of the fisherman using this gear are from Kutai Kartanegara District and Tanjung Ohong Village. The fish that are captured by this fixed trap net will be fed to fish kept in cages. This is to replace artificial feed, which is comparatively more costly and scarcer. On Jempang Lake, an estimated 150 fixed trap net fishing gear units are in operation each day. Each fishing excursion, they receive their haul, which can be worth up to one million rupiah.

Beside that there are other fishing gear that disturb the thumb community, namely the operation of trawl and “bundre” fishing gear. In deep water season, it is estimated that there

are around 50 trawl units from Tanjung Ohong and Jantur Villages. Their catch can reach 1,500 kg per fishing trip. While the "bundre" is operated when it is about one meter water until the lake condition is dry.

3.3.3 Season and Fishing Ground

There are three types of potential fishing areas in Jempang District, namely rivers, lakes and swamps. The biggest potential of fish resources is found in the lake, Jempang Lake with an area of around 11,810 ha. While the river and swamps were 132 ha and 555 ha, respectively.

Table 12 The area of fishing ground based on its type in 2022.

No	Type of fishing ground	Area (ha)
1	River	132
2	Lake	11,810
3	Swamp	555
	Amount	12,497

Source: Jempang District in Figures 2023

The characteristics of fishing ground in Jempang are relatively unique where the fishing ground, especially swamps and lakes, can experience drought. The remaining water during the dry season is only 30% of the normal volume of the water. This has implications for the availability of fish in fishing ground is relatively reduced to only 30%. Fish from Jempang Lake or swamp migrated to the Mahakam River area. These conditions cause the catch obtained also to decrease. The catch of fishermen during the dry season only ranges from 20 kg/trip, decreases very significantly when compared to the during the water season which can reach 50 kg/capture trip.

Some fishermen take advantage of the dry Jempang Lake by planting rice on the lake land. This is possible because the dry season can take place relatively long time, which is about three months or more. This rice harvest can reach 50-500 cans where one can of about 17 kg of grain or between 850 kg -1850 kg of grain. This grain is relatively easy to sell because there are buyers from Banjarmasin City who will buy the grain.

However, this rice cultivation is not without risk. The uncertainty of the season causes the harvest to be unpredictable. That is, it could have happened that rice cannot be harvested because the rainy season or deep water comes before the estimated time. As a result, the stretch of rice that was not ready to be harvested was submerged in water. The condition of the Jempang Lake when dry can be seen in Figure 6.

Fig. 6. Conditions of drought Jempang Lake (Source of Photo: Pulau Village Officials Lanting).

Fig. 7. Expanse of rice that is ready to harvest and submerged in water in Jempang Lake 9 Source of Photo: Village Officials Pulau Lanting, 2024).

3.3.4 CatchpProduction

Capture fisheries production made the biggest contribution to production at the district level. In 2022 capture fisheries production of Jempang District reached 366.02 tons with a contribution of 23.31 %. However, it decreased in 2023 where production was only 290 tons and its contribution declined to 18.64 %. More information is presented in Table 13.

Table 13. Capture fisheries production of Jempang District in 2022-2023.

Year	Jempang District		West Kutai Regency		Proportion (%)
	Production (ton)	Growth (%)	Production (ton)	Growth (%)	
2022	366,02		1,570.00		23.31
2023	290,00	- 20.77	1,556.11	- 0.88	18.64

Catch production was concentrated in several villages, namely on Lanting Island, Tanjung Isuy, Tanjung Jone and Muara Ohong Village. Types of fish that are relatively large in the location of the village are spotted barb (around 65%), vaillanti carp (30%) and the rest are pangas catfish, Indonesian snakehead, striped snakehead and Phillipine catfish. The catch obtained is around 20 kg/trip trip during the dry season and 50kg/trip during the deep water

season. The fishing trip was carried out for 4-5 days per week and 12 months a year. The most dominant types of fish caught are vaillanti carp, spotted barb, tilapia, kissing gourami, striped snakehead and Indonesian snakehead. Catch based on fish species is as presented in Table 14.

Table 14. Number of catching results in Jempang District by fish type.

No	Village	Production per type of fish (kg)						Amount (ton)
		spotted barb	Vaillanti carp	Kissing gourami	Tilapia	Gabus	Indonesian snakehead	
1	Lanting Island	35,088	140,352	87,720	70,176	10,526	7,018	350,880
2	Tanjung Jan	2,040	8,160	5,100	4,080	612	408	20,400
3	Tanjung Isuy	32,640	130,560	81,600	65,280	9,792	6,528	326,400
4	Mancong	816	3,264	2,040	1,632	245	163	8,160
5	Perigiq	4,080	16,320	10,200	8,160	1,224	816	40,800
6	Tanjung Jone	32,701	130,805	81,753	65,402	9,810	6,540	327,012
7	Muara Ohong	31,987	127,949	79,968	63,974	9,596	6,397	319,872
Total number		139,352	557,410	348,381	278,705	41,806	27,870	1,393,524

Source: Interview, 2024

3.3.5 Problems

Some of the problems faced by fishermen in the Jempang District are (i) there is a decrease in the catch where the fish is relatively fixed or even reduced but the sophisticated fishing gear (ii) there is pollution in the form of fertilizer from oil palm plantations (iii) operation of fishing gear is not environmentally friendly (fixed net and trawl) and (iv) fishing ground that experience drought.

3.4 Discussion

Inland waters in West Kutai Regency as well as other public waters have certain characteristics that are different from marine waters. General waters of land are not only used for the use of fish resources through catching but also for other purposes, namely fish farming. In addition to the use of fisheries, these waters are also used for other uses such as forestry, agriculture, transportation, power plants, household and industrial needs [11]. The main public waters in West Kutai Regency are the Mahakam River and Jempang Lake. There is a strong interaction between the two waters. Mahakam River water is very abundant during the rainy season. Therefore the water moves and fills the Jempang Lake and swamp around it. This condition caused the peak season of the capture in Jempang Lake. The fishermen who are around Jempang Lake (Tanjung Isui, Tanjung Joni, Lanting Island Village and its surroundings get relatively large catches. But the conditions are relatively reversed with the conditions in Muara Pahu District (Muara Beloan Village and Surrounding Villages) which get relative catches a little.

Conversely, the famine season in Jempang Lake occurs in the dry season. The amount of water in this lake has experienced a very significant reduction and even experiencing drought. Only one third of this lake is submerged in water, and even then with a depth of only about half a meter. Water flows from the Jempang Lake to the Mahakam River. This condition causes the catch on Jempang Lake to decrease (famine) but in the watershed and swamps the catch has increased. This condition is relatively the same as the condition of the waters of Tempe Lake [12].

Such water conditions have implications for the use of multifunctional land. During the rainy season, fishermen use Jempang Lake for fishing activities and fish farming. While during the dry season, the lake is used as land for rice farming (Figure 7). This happens in several locations with the same characteristics [13]. However, the use is at risk of crop failure. This is because the change of seasons is difficult to predict, so that rice that is not yet time to be harvested has been submerged in water first.

Inland public waters have an important role as a source of nutrition and employment opportunities for the surrounding community through fishing activities and related activities [14]. This can be seen from the majority of the people around the Mahakam River and Jempang Lake living as fishermen. Muara Beloan Village (Muara Pahu District), Tanjung Haur Village (Penyinggahan District), Lanting Island, Tanjung Jan, Tanjung Isuy, Mancong, Perigiq, Tanjung Jone and Muara Ohong (Jempang District) are villages with a large population of fishermen. They are traditional fishermen who catch fish with traditional fishing gear as well. However, with dynamic environmental conditions, fishermen adapt in the form of business diversification outside of fishing such as fish farming. This fish farming is carried out to increase income and is also used as savings whose results will be obtained when they harvest. Catch fish that have high economic potential such as Indonesian snakehead, Asian redtail catfish, Philippine catfish and striped snakehead are not all sold but some of them (especially small ones) are cultivated. The need for feed for aquaculture is also obtained by utilizing trash fish which is relatively low in economic value.

Changed environmental conditions cause a shift in the livelihoods of fishermen to also occur to other work. For some fishermen who have plantation land, they turn into oil palm farmers. While for fishermen who do not have land, they turn into laborers/employees in oil palm plantation companies and go to the city to become informal traders, laborers and taxi drivers.

Fishing facilities used by fishermen in West Kutai Regency are still relatively simple. The fishing boat used are dominated by outboard motor boat followed by boats without motor engine. The characteristics of fishing boats in inland waters are relatively different from fishing boats in the sea. In general, the boat is relatively small in size, boat construction is emphasized on stability for calm waters and is able to maneuver in waters with many trees and twigs. Therefore, the boat can still be operated at a relatively minimal waters.

Inland fisheries are complex in aspects of multigears and multispesies, inter -annual variability driven by abiotic factors, and in social and economic contexts. The challenge in managing capture fisheries in inland waters is that most fishing devices used, both passive and active have a negative impact on the environment, unavailability of data and information, environmental pressures caused by human activity, and the absence of management systems [15]. Considering these various complexities, some of the strategies that can be done are related to improving environmental quality, are improvements to water fertility, water level manipulation, increasing access to waters where boats are fixed, for example with the construction of footpaths and other technical interventions such as river dam construction, flood control responsibility, flood control responsibility which is able to be a fish barrier to migrate [16].

4 Conclusions

The three districts have a large capture fisheries potential, with the main catches consisting of Asian redtail catfish, Indonesian snakehead, pangas catfish, tilapia, and Philippine catfish. Generally, fishermen use traditional equipment including gill nets, bamboo trap, trap net, hand line, and lift nets. Fishermen boats generally consist of outboard motor engine and non -motorized boats. The number of fishermen fluctuates around 6,822 to 7,508 people. Fishing activities are carried out for one day (one day fishing), and the results of capture fisheries production vary around 1,556-1,570 tons/year. Some of the problems encountered in the field include fishing activities using illegal fishing gear, the use of poisons, and the volume of water (especially Jempang Lake) to significantly decrease and even dry in the dry season. Strategies that can be carried out for the sustainability of the capture business in West Kutai Regency related to improving the quality of the environment are the improvement of water fertility, manipulation of water levels, increasing access to waters where boats are fixed, for example with the construction of footpaths and other technical interventions such as making river dams, controlling responsibilities floods that can be a fish barrier to migrate.

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