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Culture-Based Fisheries in Rawa lebak lebung, South Sumatera, is it Applicable?

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Abstract. Rawa lebak lebung is a part of inland waters in South Sumatera which mostly used as the auction object, by granting a monopoly on fishing to Pengemin (auction winners). As an open-access resource, allowing a monopoly is considered to prevent conflicts of resource struggle and overuse. But in practice, the auction is precisely the cause of overexploitation, and the local community loses access to fishing. This study is intended to describe the suitability of Culture-Based Fisheries (CBF) implementation in the rawa lebak lebung in Ogan Komering Ilir (OKI) Regency based on practices under the auction regime, water quality, and aquatic biota communities. Increasing fish stocks and community involvement with CBF possible to develop with some adapted. This concept is carried out by spreading fish seeds to grow and harvest following fishing seasons, where local communities play an essential role. The analysis shows that the stock enhancement can be carried out in a limited way of the seed stocked. Poor swamp water quality requires the process of adaptation of seeds to be stocked. Community involvement is carried out by managing hatcheries, whose production is purchased by pengemin as an obligation to restore the environment.

Keywords: culture-based fisheries, community-based fisheries management, inland fisheries, lelang lebak lebung, rawa lebak lebung.

1. Introduction

Fish is an important food source for the community, especially those living in rural areas. This cheap and nutritious source of animal protein is obtained mainly from catches inland waters. Rawa lebak lebung is a part of inland waters known in South Sumatra for the deep floodplains where the water does not dry up throughout the year around the river flow. In the rainy season, the floodplain receives runoff. In the dry season, the water recedes, thus creating a bulkhead of land between rivers and floodplains, so fish that are carried during flooding or migrate trapped in the Rawa lebak lebung. The development of inland waters fisheries in Ogan Komering Ilir Regency is very potential, with waterlogged lowlands (perennial and non-perennial) around 1.2 million hectares or 70 percent of the OKI regency.

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Rawa lebak lebung mostly used as the auction object by granting a monopoly on fishing to auction winners (namely Pengemin in the local name). The history of the auction of lebak lebung has been started since 1850 by the clan (a customary law unit in South Sumatra at the village level. Before being abolished by the Village Government Law No. 5 of 1979)[1]. The practice of controlling natural resources by the clan rulers was inseparable from the structure of the feudal society adopted at that time and continued until now.

The practice of lebak lebung auction makes people who live around marshes and rivers cannot utilize the fish resources in the swamp. The fishing permit is limited to daily food needs with the number and type of fishing gear that is limited by the Pengemin.

In practice, controlled fishing arrangements and the use of permissible fishing gear, as the spirit of regulating common-pool resources, has proven to be very difficult to do. The practice of overfishing in the swampy, swamp waters, becomes a problem not only in reducing the number and size of fish but will affect the ecosystem and trophic chains in the waters.

This study tries to provide a win-win solution to increase the number of fish in the waters while involving the community in fisheries management efforts in the region. The alternative offered was to use Culture-based Fisheries (CBF). Increasing fish stocks and community involvement with CBF possible to develop with some adapted. This concept is carried out by spreading fish seeds to develop and harvest following fishing seasons, where local communities play an essential role. Not like aquaculture that controls strictly, CBF is a method to increase the fish production by releasing seed in natural waters to develop naturally until harvested at the specified size [2]. Also, the characteristics of implementing CBF in rural areas and with a low level of technology allows for the surrounding community to be involved in management [3]. The Community-Based Fisheries Management pattern in the CBF lesson learn in Bangladesh [4] succeeded in significantly increasing fish resources, community income, and community empowerment.

2. Methods and Materials

The CBF suitability study was carried out based on a descriptive analysis of lebak lebung auction practices in OKI Regency and water quality conditions in Rawa lebak. Also, the suitability of stocking species studies is carried out by looking at the availability of natural food in the waters and the structure of fish communities.

The determination of sampling points is divided into 4 stations. The determination of this station is based on different water characteristics, with different depths and vegetation, to represent the whole area.

The location of Station 1 is a place that is close to residential areas and close to where fishing boats drop in when anchored, this location is very minimal in vegetation. There are only woods or driftwood that flow by the current. The station has a depth ranging from 80-130 cm. slow currents depend on the strength of the wind. Station 2 is located in the mid-melt where there is no vegetation around it. only hydrilla's are carried by currents and have depths ranging from 170-220 cm, having moderate currents depending on wind speed. Station 3 is located on the outskirts of the island and the island is planted with rubber and palm plantations. This station has a depth ranging from 30-200 cm and has vegetation in the form of grass, hydrilla, *purun* (*Lepironia articulata*), and other plants. This station also often has buffalo looking for food, and there are also birds looking for food. This station has currents when only strong winds. Station 4 is located at a water depth ranging from 150-200 cm and has vegetation in the form of grass, hydrilla, purun, and other plants. This location has very slow currents, and these currents depend on the speed of the wind.

Catching fish is done by installing fishing gear at each station. The fishing gear used is gill nets with a density of 1-5 inches. The net will be installed in the afternoon and removed in the morning. Fish caught will be identified using an identification key from Saanin [5] and Kottelat et al. [6].

To determine the abundance and diversity of plankton and macrozoobenthos, identification was done using a plankton identification key using Bold and Wynne [7]. Then do the calculations using the Shannon index formula and Evenness index [8].

3. Result and Discussion

3.1. *Lebak Lebung Auction Practices*

The auction is regulated with the spirit of avoiding the tragedy of the commons, where open-access resources exploit, and no party feels responsible for the preservation and sustainability of these resources [9]. Based on the results of research conducted by Oktaviani (2016) [10]; Muthmainnah & Prisantoso (2016) [11]; Jubaedah, et al (2015) [12]; Valbo-Jorgensen & Thomson (2007) [13]; De Silva et al. (2006) [14], the practice of leasing and auctions water bodies makes owned tend to be overexploited so that many reports in several water bodies, fish catches are getting smaller and some types of fish are hard to find.

The people, who for generations have lived around floodplains have a dependency on the rawa lebak ecosystem. Getting the needs of family meals, work opportunities, transportation routes, and family income sources come from environmental services provided by the surrounding floodplains. Community access to fisheries resources in the Rawa lebak lebung is limited to permits granted at a price determined unilaterally by the pengemin.

The practice of auctioning was briefly stopped after reforms began due to resistance from the community. After no longer being auctioned, the management of lebak lebung is given to villages and fishing groups. However, this practice only lasted a few years because there was a sporadic conflict between communities due to the struggle for resources. Finally, the local government again held an auction.

The auction applied makes the pengemin spend capital to obtain management rights and take fish from the auction object. The capital expended makes pengemin tend to exploit massively (in many cases, the use of illegal fishing tools such as stun is used), resulting in overexploitation. On the other hand, people who live and depend on swamp ecosystems with auction are eventually eliminated and do not have the benefits of fisheries resources in their area.

The intention to manage shared resources to avoid conflicts and overuse, on the contrary, happens. Efforts to avoid the tragedy of the commons instead became a tragedy. Natural resources are exploited massively, with the potential for open conflict due to the accumulation of injustice for the community. Placing most people like spectators and not benefiting from the management of shared resources, is a market perspective management, in which the capital owner can utilize the resources. Excitement control of resources by the state for the welfare of the people fails and land (read: rawa lebak lebung) sociologically social functioning, even a potential source of social conflict.

3.2. *Agrarian Reform*

There are two types of models that are set by the pengemin if the communities want to catch fish. First, people are required to pay a sum of money if they want to catch fish. In some lebak lebung, the money ranges from hundreds of thousands to millions for the location and type and number of fishing gear that has been determined by the pengemin. The second way, the community is allowed to catch fish, but the fish they catch must be sold to the pengemin at a meager price. People who cannot afford to pay usually catch fish and sell their catch to the pengemin with a price range of 25 percent of the market price.

The pattern of resource management that places capital as the power of access to resources creates a patron-client relationship between fellow villagers with different capital capabilities. People who have capital can have access to the auction and then get the right to manage resources while people who do not have the capital must work for leaders with rules that are made unilaterally and do not heed the wisdom of resource management. Conflict does not occur more because of patron-client relations that are perpetuated and the social ties of rural community capital.

3.3. *Suitability of waters for CBF*

Based on the results of water quality measurements carried out for five months (March to June) shows that the quality of swamp water is very distinctive and tends to be bad (table 1). Water conditions that tend to be acidic (low pH) and low dissolved oxygen content make choices in the type of species to be

developed very limitedly and have a tolerance to these water quality conditions. Fish that can be developed must be species that have additional breathing apparatus to enable them to take oxygen directly into the air.

Table 1. Water Quality in Rawa Lebak

Parameters	Range Value
Temperature (°C)	28.1 – 32.2
Depth (m)	0.7-5
Brightness (cm)	20 - 50
TDS (ppm)	13 - 35
pH	4.1 - 5
DO (mgL ⁻¹)	1.7 - 4.1
Phosphate (mgL ⁻¹)	<0.060-<0.090
Total Nitrogen (mgL ⁻¹)	12.70 – 38.90
Ammonia (mgL ⁻¹)	0.68- 0.95

Plankton abundance in rawa lebak has low fertility rates or oligotrophic fertility because it has an abundance of around 174 - 219 ind/l at all observation stations (table 2).

Table 2. Total Individual of Phytoplankton

Phytoplankton Class	Total Individual	Percentage (%)
Chlorophyceae	132	18.00
Bacillariophyceae	386	53.70
Cyanophyceae	202	28.00
Euglenophyceae	1	0.13
Jumlah	718	100.00

The type of phytoplankton that commonly found is in the Bacillariophyceae class. Bacillariophyceae is a group of phytoplankton that found in many water body, especially in lousy water quality. Bacillariophyceae resistant in extreme conditions, adaptable and has a very high reproductive power. This type of plankton, even with low abundance, can sustain aquatic life in the waters. Phytoplankton is the beginning of life in waters because of its role as a primary producer, which is the source of life in aquatic ecosystems and the beginning of the formation of food chains in waters (table 3).

Table 3. Results of Plankton Observations Per Month during March-July

Parameter	Observation Station				
	Station 1	Station 2	Station 3	Station 4	Average
Number of Species	10	11	10	11	11
Total Individuals	55	51	44	49	50
Plankton Abundance (Ind / l)	219	198	172	194	196
Diversity Index	1,88	1,93	1,79	1,77	1,84
Uniformity Index	0,64	0,61	0,58	0,55	0,60
Domination Index	0,79	0,79	0,75	0,73	0,77

Based on fish catches obtained, 14 species identified and dominated by carnivorous fish (figure 2). In contrast to CBF practices in common, which stock species are plankton-eating, in the rawa lebak with low abundance of plankton and predatory fish found, fish stocking can be used with mixed-species that do have tolerance with water quality. In order to guarantee that the fish seeds stocked have better endurance, stocking of large seeds is highly recommended.

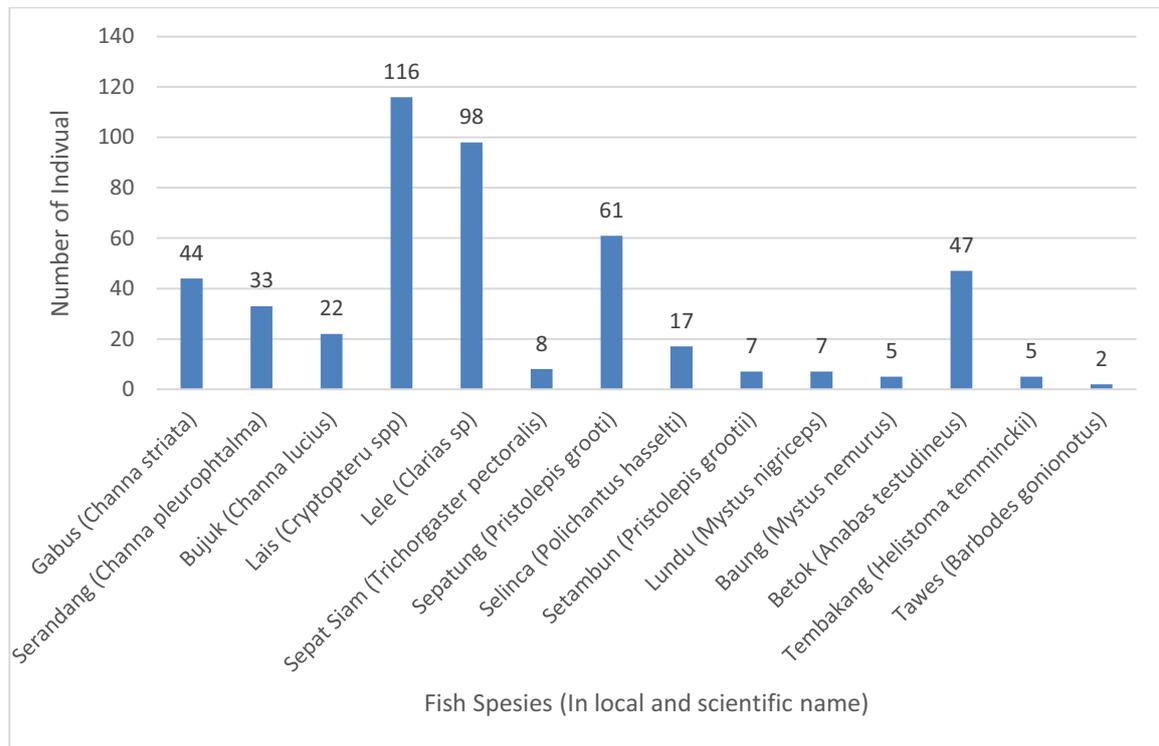


Figure 1. The abundance of fish caught

Seeds to be sown are produced by the public hatchery unit on land-based installations. After the seeds are produced, nurseries are carried out in the swamp using floating net cages. In addition to the use of space, the use of floating net cages in the swamps is also a means of adaptation for the seeds that will be stocked. Conceptually, the chart of seed production flow through UPR until harvesting can be seen in figure 2. The nursery activities will be carried out using the cage net in the rawa lebak that is suitable for the placement of a cage net.

Community involvement with a UPR pattern is considered to be possible by facilitating by the local fisheries department. The pattern of cooperation that can be established is the obligation of the owner to carry out restocking as stated in Chapter VII Obligations and Prohibitions, article 28 for Pengemin paragraph 7 which reads "Every pengemin is obliged to sow fish seeds in the period leading up to the management of 5% of the auction price [15].

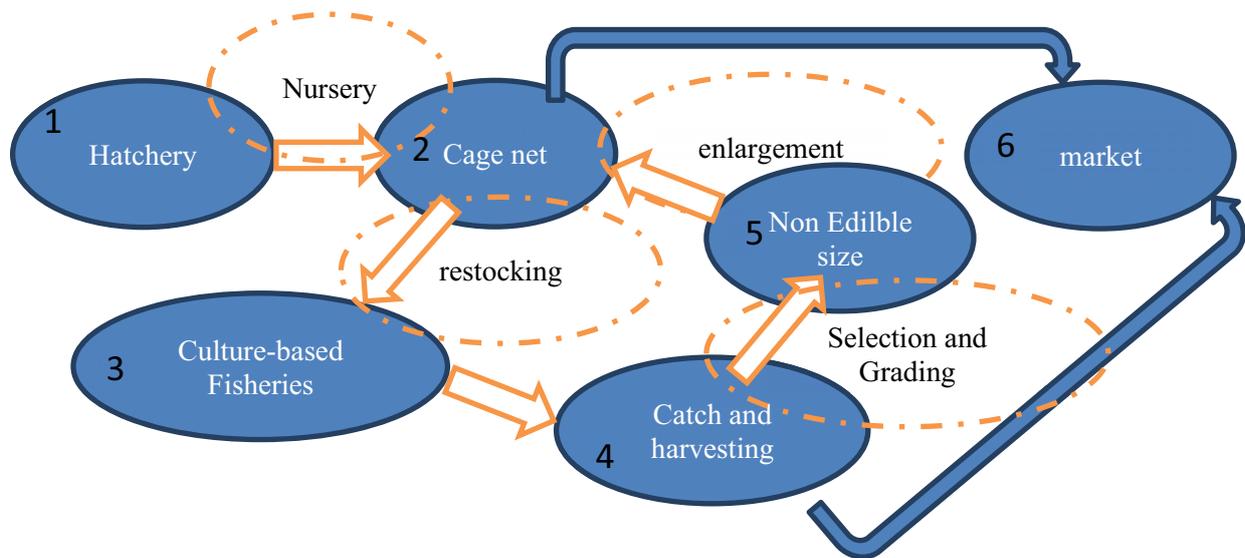


Figure 2. Culture-Based Fisheries and Cage Net System

4. Conclusion

Community-based management or through collaboration through the CBF model can increase community income directly from supplying seedlings and increasing the catches of pengemin. Also, indirectly, the bargaining position of seed supply communities will increase in order to balance the hegemony of fisheries management in the village.

These models are believed to be acceptable to all actors so that it tends to be more applicable than eradicating the auction system that has been fought for by many farmer and fisheries organizations for decades but has always been vehemently opposed by local governments and holders of hegemony in the village (read: pengemin).

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