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Identification of Carp (*Cyprinus carpio L*) Fish Farming Potential in Tambrauw Regency Fef District West Papua

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Abstract : Carp (*Cyprinus carpio* L)is one of the freshwater fish farming commodities potential to be developed in Tambrauw Regencyas it has an important economic value. FEF District became one of the uplands in Tambrauw Regency, which began cultivating freshwater fish such as carp, tilapia, catfish and other freshwater fish species. Cultivation of carp is currently developing in Fef District, yet the production is not enough to meet the consumption, especially at certain times such as Christmas and Easter. Strong consumer demands from both inside and outside the district for carp creates promising economic opportunities, and such that it is necessary to study the cultivation of carp in the district of West Papua Province. There are three POKDAKAN utilized for the cultivation of carp namely Aisokoh, Aisakaw, and IOF. These three have the excellent natural resources of vast land an adequate water sources. The results of analysis of soil and water confirm that the area is suitable as land cultivation of carp.
Keywords : *Cyprinus carpio*, fish farming, water and soil analysis.

Introduction

Production of carp in the world in 2013 amounted to 4 million tonnes with an average rise of 5.38 percent per year. It turns out that carp has also been a popular production in Indonesia for its economical value[1]. Carp production in Indonesia in 2013 reached 412,703 tonnes with an average rise of 9.11 percent. For instance, carp is the most popular aquaculture species in North Sulawesi region[2]. Production of carp in Indonesia are from aquaculture activities in ponds, cages, cages and *minapadi*.

Tambrauw Regency with an area of 11,529.182 km^2 has a coastline of 1,530.036 km^2 and 552.26 ha of freshwater; it is one of the tourist districts located in the northern part of the Province of West Papua[3]. Tambrauw has a lot of potential natural resources such as freshwater fisheries spreading across 12 districts in the hinterland including Fef. The existing potential needs the readiness of local people, because even if the water source is available throughout the year, limited skilled human resources make it less managed.

According to the statistics of the Ministry of Maritime Affairs and Fisheries in 2014, the level of fish consumption is high enough for West Papuans. Average fish consumption per capita is above the national average and Papua Province. In 2013, the average consumption of fish in West Papua is > 44.02 kg / capita, Papua Province is 36.04 kg / capita, while national consumption is only 30.47 kg / capita. This proves that West Papua Province particularly Tambrauw Regency is a potential area for the development of fisheries sector both sea water and fresh water in eastern Indonesia. Fef district became one of the uplands in Tambrauw that began cultivating freshwater fish such as carp, tilapia, catfish and other freshwater fish species.

Fish culture is one of the sectors with huge potential to be developed. Uses of land and water for the cultivation areas is an alternative to empowering rural communities and thus creating jobs[4]. One type of freshwater fish of fairly good prospect for development is carp. Jacoeb *et al*.[5] states that carp is a freshwater fish that is widely cultivated in most parts of Indonesia. This is due to its rapid growth, high adaptability, high nutrient content, and a high economic value.

Cultivation of carp (*Cyprinus Carpio L*) in the pool, by utilizing the water source of the river, is now growing in the Fef District, but not enough to meet the demand of the community, especially at certain times such as Christmas and Easter. Strong consumer demands from both inside and outside the district for carp creates promising economic opportunities, and such that it is necessary to study the cultivation of carp in Tambrauw Regency of West Papua Province.

Methods

This study was conducted from March 2016 to in May 2016 in Fef District, Tambrauw Regency, West Papua Province (Figure 1). Water quality measurement was performed in the district and soil analysis was done in the laboratory of the Faculty of Fisheries and Marine Sciences University of Brawijaya. The method used is descriptive explorative method as to make a reconstruction of the past systematically and objectively by collecting, evaluating, verifying, and synthesizing evidence to rule out the facts and obtain robust conclusions.

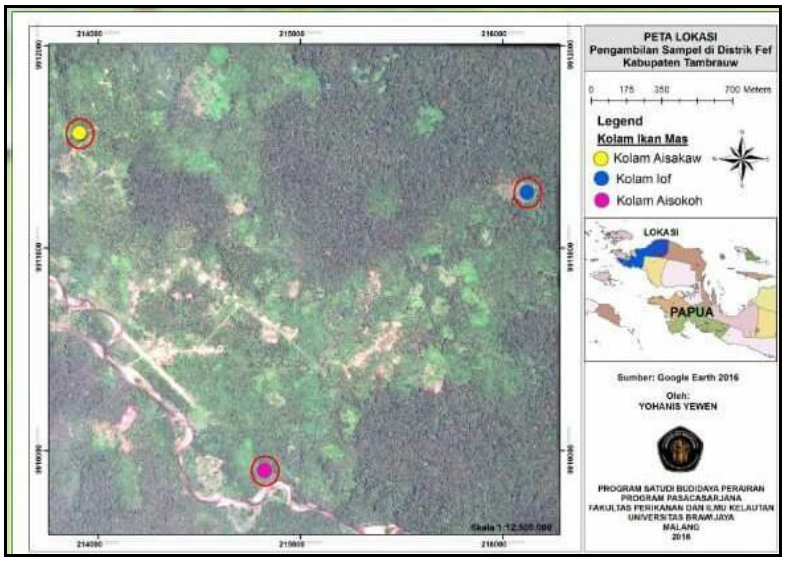

Figure 1. Research location

Based on Figure 1, the coordinates of sampling in Fef District is as follows:

1**. Aisokoh** : Latitude $0^0$45.881'S
: Longitude$132^0$26.253E
: BT 214796 mE
: LS 9909862 mS

2. **Aisakaw** : Latitude $0^0$47.974' S
: Longitude$132^0$25.740E
: BT 213844 mE
: LU 11534 mS

3. **Iof** : Latitude $0^0$48.119S
: Longitude132^0 26.984 E
: BT 216123 mE
: LU 9911267mS

Results and Discussion

Carp Cultivation Potential in Fef

There are three groups of fish farmers (*Pokdakan*) namely *Pokdakan* Aisakaw, *Pokdakan* Aisokoh, and *Pokdakan* IOF. Fef District has such bigpotential of aquaculture as natural resources are very supportive to the development of carp aquaculture. Fef is one of the largest producers of freshwater fish of carp, tilapia, *gurame*, *mujair*, *bawal*, and catfish. The area of the three fishpondscan be seen in Table 1 below:

Table 1. The Area of Fishpond of Aisakaw, Aisokoh and Iof

No	Pokdakan	Number of ponds	Area (m^2)	Average Area (m^2)
1	Aisakaw	22	1,732	50.73
2	Aisokoh	10	276	27.6
3	Iof	10	192	24

Production of Carp in Fef District

Based on Table 1, Pokdakan Aisakaw produces the highest fish production of 3,520 kg, Aisokohis the next with 2,475 kg, while IOF produces 2,118 kg. Aisakaw produces the highest compared with the others, as Aisakaw has many ponds and a large area – the more fish stocking, the higher the production will be. In addition, carp survival rate is very high is Aisakaw, in an average of 80%. Aisakaw also has concrete ponds making it easier to control fish, as compared to Iof and Aisokoh, both of which have ground-based ponds.

The community begins to see the excellent potential of natural resources for freshwater fish farming in the district. Recently, the people have begun to develop the cultivation of freshwater fish such as carp, catfish, and tilapia with an ultimate goal to improve the welfare of the family. The development objective of fisheries is not only to improve the welfare of farmers and to conserve fish resources, but also to improve the contribution of fisheries sub-sector to the national economic development, employment, foreign exchange earnings through exports and state revenues, as well as for poverty reduction[4].

Soil Analysis in Fef District

Soil and water have a very important role in fisheries as they are used as a medium of cultivation. Soil is a chain of natural system whose formation and existence is influenced strongly by natural factors, such as parent material, climate, topography or relief, vegetation or human organism and time. Water is needed by living things on earth. Therefore, the factors related to land and water deserve further attention[6]. Analysis of soil in Fef District can be seen in Table 2.

Table 2. Soil Analysis

No.	Parameter	Soil A	Soil B	Soil C
1	Ph	6,0	6,0	6,0
2	Texture	Clay Tough Sandy	Clay Sandy	Clay Tough Sandy
3	Consistency	Rather Hard	Hard	Rather Hard
4	Water Holding Capacity	50 ml	70 ml	55 ml
5	Soil Bulk Density	1.34 gr/L	1.72 gr/L	1.57 gr/L
6	Specific Gravity	2.28 g/cm^3	2.30 g/cm^3	2.67 g/cm^3
7	Pore Volume	38.55 cm^3	23.55 cm^3	38.55 cm^3
8	Total Porosity	41.2 %	21.17%	41.2 %
9	Moisture Content	0.28 gram	0.21 gr	0.23 gr

Source: Analysis at Laboratory of the Faculty of Fisheries and Marine Sciences University of Brawijaya

Based on the results of laboratory analysis, the pH value in area A, B and C tend to be equal of 6.0 in the category of weak acids as according to Kordi[8]. The soil texture in area A and C is tough sandy clay, yet it is still eligible for use in aquaculture because the texture is not too hard and smooth, as stated by Sarief[9] that the coarse-textured soils or sandy soil tends to be easily separated and processing it is easy.

Consistency of soil in area A and C is in the category of rather hard and B consistency is hard. It is good for cultivation because the soil is able to maintain its shape from outside forces, as stated by Djajadi[10] that the consistency of the soil is the strength of the soil to retain its shape from the outside forces that can affect the shape of the land. The water holding capacity in area A is 50 ml, B is 70 ml, and C is 55 ml; thus, B has the best holding capacity. According to Foth[11], lands with smooth texture has a maximum total water holding capacity, but the maximum available water retained is in soil with medium texture.

Soil bulk density in A is 1.34 g/l, B is 1.72 g/l, and C 1.57 gr/l. According to Sunarmi[12], specific gravity is a dry weight of a unit volume of land in a whole (0.5/cm3). A specific gravity is 2.28 g/cm3, B is 2.30 g/cm3, and C 2.67 gr/cm3. This shows that specific gravity of soil must be utilized, as stated by Hanafiah[13] that the specific gravity of a soil particle indicates the density of the solid particles as a whole.

Porosity of the soil in area A and C is 41.2% and in B is 21.17%. This shows that B has the lowest porosity level. Porosity is the number of pores within the structure of the soil; the more stable the soil structure the higher porosity it has. According to Wiskandar[14], the effect of organic matter on soil physical properties is increasing soil porosity.

Water Quality Analysis

Availability of good water is very important in aquaculture. Water quality needs of each species differ even within each stage in the life cycle within a species. Therefore, the condition of water should be tested first before making a decision and take further action[12]. Water quality data such as pH, temperature, dissolvedoxygen, and transparency in Fef District can be seen in Table 3.

Table 3. Water Quality in Fef District

No	Parameter	Results
1	pH	8.5
2	DO (mg/L)	12
3	Temperature (^{0}C)	30
4	Transparency (cm)	20

Based on analysis, the pH value of aquaculture observed is still within the limits of tolerance for the optimal pH. According to Kordi[8], aquaculture will work well in water with a pH of 6.5-9.0, and the optimum range is at pH 7.5-8.7. Dissolved oxygen is 12 mg/l. Water dissolved oxygen within the range is tolerated. This is according to Salmin[16] confirming that the levels of dissolved oxygen in waters ideal for the growth of fish is> 5 mg/L.

Based on the measurement results, the temperature is within tolerances for cultivation. This is according to Budiharjo[17] stating that generally freshwater fish such as carp and tilapia require optimum water temperature ranging from 26-300C. Water transparency is 20 cm. Water transparency is a reflection of the amount of phytoplankton present in the media and the amount of suspended solids accumulating in pond media. Transparency for media cultivation in ponds is best between 25-35 cm[16].

Identification of Internal and External Factor

IFAS identification results in 10 factors composed of five strengths and five weaknesses of carp cultivation in Fef District. The strength among others are potential land, local government support, and information on development plans. Implementation of PB PUMP of PNPM Mandiri program and the number of the high number of *Pokdakan* receiving PUMP PB and the enthusiasm of the community are the other strengths.

The weaknesses are the lack of basic information and technology on carp cultivation, limited facilities for fish farming, limitated number of extension workers (Diskanla), limited infrastructure for the cultivation of carp, and the absence of spatial utilization of potential areas for cultivation of fish.

Internal strategic factor as the main force is the PUMP PB program and the presence of potential lands with the highest value of 0.116, while the major weakness with the highest value is limited infrastructure and lack of spatial utilization of potential areas for cultivation of fish at 0.116. Total weighted score of IFAS is 3,841 and the difference between IFAS scoring is equal to 0.289. Matricesof IFAS and EFAS can be seen in Table 5.

Table 4. **Matrices of IFAS and EFAS**

Total Score for Internal Factors	**Total Score for External Factors**
(S-W = x)	**(O-T = y)**
1.935+0.502 = 2.437 (S)	1.622+0.52 = 2.142 (O)
1.906+0.498 = 1.902 (W)	1,738+0.532 = 2.271 (T)
X=0.034	Y=-0.129

Source: Processed data

Alternative Strategies

The strategy needs to be done, using the strengths, to be able to deal with the existing threats are:

a. Utilization of potential land for the cultivation of carp must be done with the appropriate and environmentally friendly technology to increase the production of carp. The potential of marine resources in FefDistrict must be able to create integrated aquaculture fish producer in Tambrauw Regency.
b. Local Government support to the development of infrastructure supporting freshwater aquaculture activities must be given, such as the construction of the main road connecting Tambrauw with other areas to optimize the procurement of food, seeds, and the cultivation of carp. Improvement of telecommunications infrastructure to facilitate communication must also be done.
c. Encourages the government to immediately realize the construction of BBI in Fef to regulate procurement of seeds and training for the people, especially freshwater fish farmers as to realize continuous production of quality seed.
d. Direct Community Assistance (BLM) PUMP PB must be done in the next year to the group of fish farmers for assistance and improvement of infrastructures of carpaqua culture.
e. There is a need for diversification of business groups to develop carp fish farming such as the establishment of group of fish farmers, fish processing, tourism, and business development where other partnerships to support the business continuity.

Conclusions

This study can be concluded that carp cultivation in accordance with Indonesian National Standard (SNI) can be applied in Tambrauw. Strategy for the development of sustainable carpaquaculture can be implemented by utilizing the existing natural resources. Natural resources in Tambrauw covers 1,1529.182 $km^2$of the Province of West Papua. The districts that can be utilized for the cultivation of carp are Aisokoh, Aisakaw, and IOF.

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