

Fishery Household (FH) database and cultivation areas in Indramayu regency to develop Shrimp and Milkfish farming based on GIS

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Abstract. With a coastline length of 114 km, the utilization of the coastline areas is potential for especially shrimp and milkfish cultivations, which have a higher economic value. However, appropriate development strategies are highly required. The purpose of this research is to examine the existing conditions and organize integrated information for fishery household as well as the areas utilized for shrimp and milkfish cultivations, especially in coastal areas. The methods used include an analysis from Landsat 8 imagery, field survey, and interviews with various sources. This research conducted in June-November 2015. Data from remote sensing were digitized and utilized as mark point to survey area of cultivation. The results show that the distributions of RTP data cover *Windu* and *Vaname* shrimp polycultures by 1,727 RTP, milkfish by 1,551 RTP, *Vaname* shrimp by 2,953 RTP, and *Windu* Shrimp by 88 RTP. The area, which may be utilized as ponds, is 9,854.1 ha. The area for milkfish ponds is 12,065.08 ha, while the digitation result is 10,801.92 ha. It shows that Indramayu coastal areas still have numerous and various potentials, which may be utilized for shrimp and milkfish cultivations.

1. Introduction

Fish becomes one of the world's strategic commodities expected to be greatly increased as the future demand increases [1,2] especially in Indonesia and local regency such as Indramayu. Freshwater aquaculture in Indonesia started with the stocking of common carp in backyard ponds in West Java and subsequently expanded to other parts of Java, Sumatra and Sulawesi in the early twentieth century [3]. Indramayu has a great potential fishery which is supported by its natural factors, with its coastline length of 114 km, both in cultivation and capture fishery. Cultivation is considered as the main economic source in coastal areas of Indramayu Regency. Aquaculture includes fish farming in freshwater, brackish and marine aquaculture in Indramayu is now sufficiently developed, it is characterized by the activity of aquaculture that have been spread in 31 districts in Indramayu [4].

The utilization of coastal areas for cultivation is highly potential to provide great opportunities for the communities in obtaining various benefits to improve their life welfare. One of them is shrimp and milkfish cultivation which has high economic value, yet requires the appropriate strategies for its development [5]. The cultivation of milkfish (*C. chanos*) in Indonesia has a very good prospect. In 2008 the production of milkfish cultivation (*C. chanos*) was 422,086 tons higher than the total production in the Philippines at 349,432 tons. The production of milkfish (*C. chanos*) in Indonesia increased again in 2012 at 482,930 tons [6].



Aquaculture has a quite significant trend increase [7]. This condition can provide competitive advantage between fish farmers in Indramayu and farmers from other regions [8]. One of them is milkfish and shrimp commodities, which ranks the first in the fishery production in Indramayu [9]. In addition, the pond areas are extended from 13,700 to 22,000 in 2014 since aquaculture system is easier to be developed and periodically monitored. However, there are still various challenges and obstacles faced in the management of aquaculture fisheries in Indramayu Regency.

The potencies of Indonesia to be the source of fish in the world are supported by the fact that its natural sources of ocean has not been optimally explored, land to be used as both production and hatcheries is available, and climate to enhance the optimal growth of fish farming throughout the year is suitable [10]. One of the challenges faced by Indramayu Regency is due to the development of cultivation areas, which should be optimally utilized. Information on the utilization of coastal areas is urgently required, particularly on the potential of coastal areas, which are integrated with the ocean. The integrated information system, which is considered as the rapid and simple data storing, processing, as well as delivery from various sectors is in the form of Geographic Information System (GIS). Utilization of Geographic Information Systems (GIS) promising resource management and modeling primarily quantitative models become easier and simpler. GIS is an efficient and effective way to determine the characteristics of an area of land and development potential [11,12]. GIS may be integrated with the Remote Sensing Technology, which has various advantages in providing the multi-temporal spatial data that the integration may have broader coverage, ability to reach the remote areas, and early information regarding to the organization of fishery household database in the coastal areas of Indramayu Regency, such as milkfish and shrimp cultivation.

Inventory and development are required in order to improve the fishery production and to support the government programs [13,14]. This research aims at identifying the existing shrimp and milkfish cultivation areas and potential which recently have become the cultivation development areas and Household Fishery (RTP) in Indramayu Regency.

2. Method

The data collection was conducted through a delayed-mode image, field survey, and interviews with various informants. The primary data were obtained from fish and shrimp cultivators through interviews supported with a list of structured questions (questionnaires) to obtain the required information. Meanwhile, the secondary data were obtained from the related institutions, in this case, from the Fisheries Office, the Regional Development Planning Agency (*Badan Perencanaan Pembangunan Daerah/Bappeda*), and Central Bureau of Statistics (*Badan Pusat Statistik/BPS*) of Indramayu Regency. The sub-districts under study are Cantigi, Indramayu, Kandanghaur, Karangampel, Krangkeng, Lohbener, Losarang, and Pasekan. The first is data processing conducted with google earth (delayed data SPOT 5 and Landsat 8 TM), and further processed to determine the cultivation locations. Due to the interpretation results, the validation points are determined and then field survey was conducted using GPS handheld Garmin. In addition, field documentation and interviews with informants were eventually performed.

3. Result and Discussion

In general, all coastal districts Indramayu potential for the development of pond farming. Currently, there are business activities of shrimp and shrimp pond farming, vaname shrimp and milkfish. Traditional systems managed by the community as a monoculture and polyculture. The condition of fishpond location in Indramayu Regency is the high of pond embankment of 0.75-1 m and the embankment of the pond 0.5-1 m, the area of the pond varies 1.5-5 ha / plot with 1 door, the water depth of the pond 0, 3-0.5 m with an average of 0.4 m [15].

Determination of suitable location for the aquaculture activities should be done carefully by considering the condition of land and water (biological, physical and ecological), socio-economic condition and infrastructure support. Placement of suitable aquaculture activities will impact on the reduction of negative influence on the environment, to minimize conflicts of interests among land users,

and to maximize the production of the farm produced [16] and the cultivation of shrimp and fish in Indramayu majority still run traditionally. Cultivators are still less responsive to technology [4].

3.1. Shrimp

Windu shrimp is one of the superior commodities in Indramayu Regency because it has a relatively high selling value with bigger shrimp size. The total area for shrimp cultivation in Indramayu Regency has reached 8,594.60 ha. Tiger shrimp production target of increasing the average is 10% per year, while shrimp vaname 17% per year [17]. The sub-districts which have the largest shrimp ponds in Indramayu Regency are Cantigi, Losarang and Pasekan. Sub-district Pasekan with major commodity shrimp, designated as a development area Minapolitan Cultivation in Indramayu in 2012 [8].

Fattening segmentation is the most preferable segment selected by the Windu shrimp cultivators because the cultivation is relatively simple and appropriate with the regional pond water characteristics in Indramayu Regency. This commodity is cultivated in monoculture while the cultivation scale for Vaname shrimp is included into the simple cultivation scale. Until now, the sub-districts which cultivate Windu shrimp include Pasekan, Sindang and Patrol.

Table 1. The comparison of cultivation areas for Windu shrimp ponds.

No.	District	Land Potential (Ha)*	Result of Digitization Area (Ha)
1	Cantigi	2,171.22	2,775.00
2	Pasekan	1,507.00	1,375.00
3	Losarang	2,017.00	2,391.20
4	Indramayu	531.18	736.00
5	Sindang	716.00	698.00
6	Krangkeng	352.00	339.30
7	Arahan	714.06	755.00
8	Kandanghaur	207.00	230.00
9	Lohbener	259.70	104.50
10	Balongan	74.96	51.90
11	Juntinyuat	19.50	3.73
12	Karangampel	22.00	5.98
13	Patrol	2.00	2.17
Total		8,594.60	9,467.78

Table 1 above shows the comparison between the potential cultivation areas for windu shrimp [9] with the digitization result on pond areas in Indramayu sub-district. Simultaneously, there is an addition potential pond area by 8,594.60 hectares. However, based on the digitization results on windu pond area is equal to 9467.78 hectares. The addition of shrimp cultivation pond areas is predicted taking place due to the addition of Fishery Household (FH) in the related sub-district or the existence of other cultivators who switch into cultivating Windu shrimp. The greatest pond area increase is experienced by Cantigi sub-district. Most pond area increase takes place because the related sub-district has the Fishery Household (FH) for milkfish cultivation made utilizing poly-culture system with Windu shrimp that the number of Fishery Households (FH) increases, from 476 to 707.

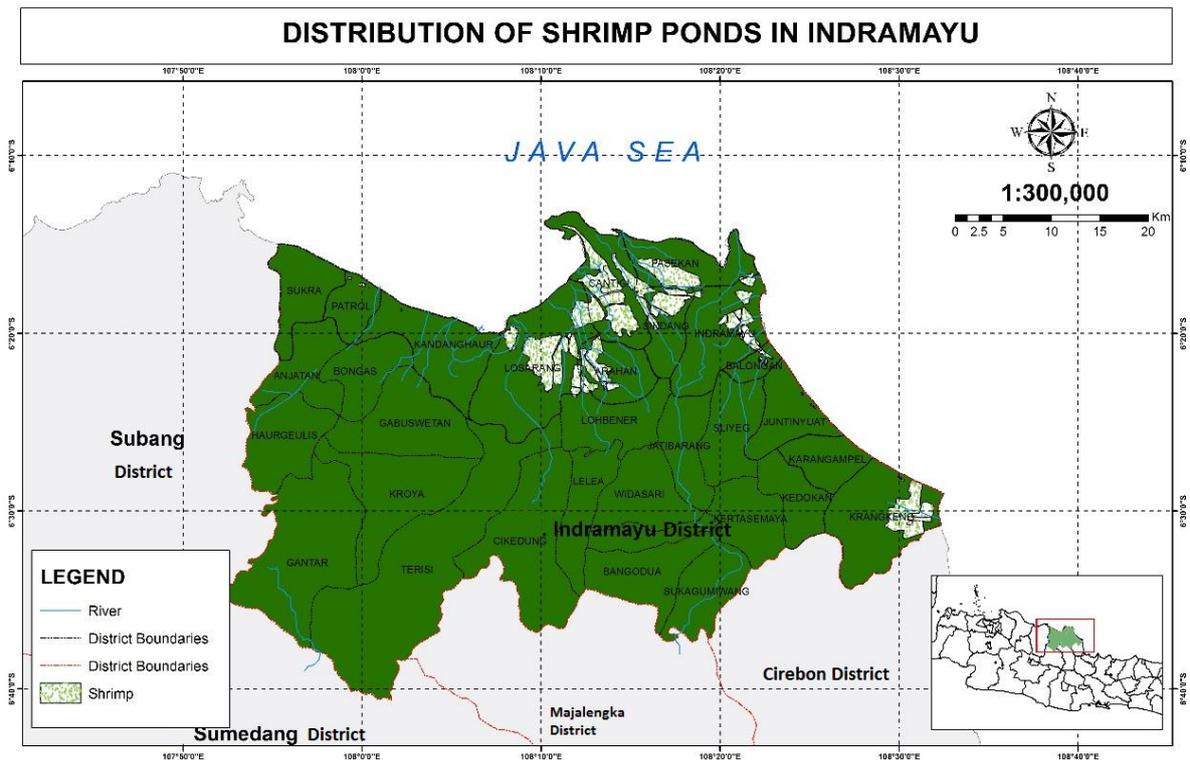


Figure 1. Distribution of Shrimp ponds.

The decreasing number of pond area takes place in most sub-districts, covering Pasekan, Sindang, Krangkeng, Lohbener, Balongan, Juntinyuat, and Karangampel (Figure 1) due to the dry season that the water sources are limited. In order to maintain the production, the cultivators made a poly-culture between Windu shrimp and milkfish to maximize the potential of pond areas and water resources. Thus, the number of Fishery Households for milkfish cultivation is more than that for Windu shrimp cultivation.

3.2. Milkfish

The milkfish cultivation area in Indramayu Regency has reached 12,063.08 hectares which is wider regarding to its good market share, cultivation which is relatively easier, and appropriateness to the pond water characteristics in Indramayu Regency when compared to the shrimp. The existing milkfish cultivation in this region belongs to the fattening segmentation with simple cultivation scale. The milkfish cultivation areas are spread in Krangkeng, Juntinyuat, Balongan, Sindang, Sukra, Patrol, Cantigi, Arahana, Losarang, and Indramayu sub-districts.

Based on table 2 which is regarding to the comparison of milkfish cultivation area, it shows that the potential of the whole pond area is 12,065.08 hectares and the result of digitization on milkfish cultivation area is 10,801.92 Ha. The difference of milkfish pond area between its potential and digitization is 1,263.16 Ha. This huge difference shows that almost all sub-districts have experienced pond area decrease, including Cantigi, Pasekan, Losarang, Indramayu, Sindang, Krangkeng, Arahana and Balongan. In addition, there is a seeding segmentation conducted in Pasekan sub-district by only 0.65 hectares.

The largest pond area decrease is in Cantigi sub-district due to its transition from monoculture to poly-culture cultivation. The milkfish Fishery Households make the poly-culture between milkfish and shrimp that the number of poly-culture fishery households is 707, while the milkfish fishery households is only 435. Similarly, the other sub-districts also experience pond area decrease. Meanwhile, the milkfish cultivation area experiences increase, such as in Kandanghaur, Juntinyuat, Sukra, and Patrol

sub-districts with the greatest milkfish pond area addition is in Kandanghaur sub-district (Figure 2). It is proven that the number of fishery households for milkfish cultivation is more dominating than that for the shrimp which is only equal to 176 fishery households.

Table 2. The Comparison of Milkfish Cultivation Area.

No	Distirct	Land Potential (Ha)	Result of Digitation Area (Ha)
1	Cantigi	4,092.00	3,505.00
2	Pasekan	3,223.00	2,892.00
3	Losarang	2,519.00	2,320.00
4	Indramayu	977.79	908.50
5	Sindang	444.00	377.00
6	Krangkeng	12.00	11.92
7	Arahan	309.84	274.00
8	Kandanghaur	346.00	454.30
9	Balongan	123.50	49.60
10	Juntinyuat	4.00	6.00
11	Sukra	11.00	11.50
12	Patrol	2.00	2.10
Total		12,065.08	10,801.92

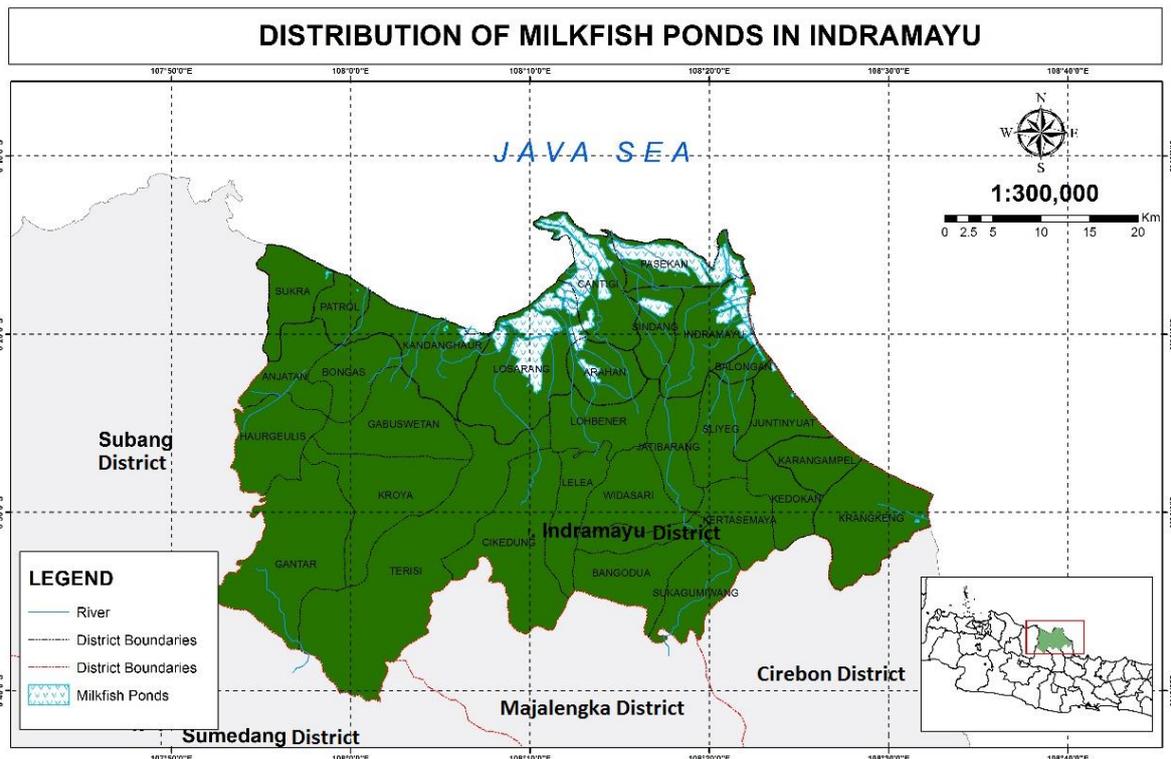


Figure 2. Distribution of Milkfish Ponds.

4. Conclusion

The results show that the data distribution of fishery households consists of 1727 fishery households for Windu shrimp polyculture, 1,551 milkfish fishery households, and 88 Windu shrimp fishery households. The pond area which may be utilized is 9,854.1 hectares. The milkfish pond area is 12,065.08 hectares, while the digitization result is 10,801.92 hectares.

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