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Land Suitability Analysis for Patin Siam Cultivation (*Pangasianodon hypophthalmus*) in East Tanjung Jabung Regency Jambi Province

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Abstract : Patin Siam (*Pangasianodon hypophthalmus*) in Jambi Province is one of preferred food commodity. It is indicated by demand for patin siam (*Pangasianodon hypophthalmus*) fish fry which continues to increase annually. Fisheries potential in East Tanjung Jabung have not been utilized optimally. Potential of public fisheries / river is 24 000 hectares but only about 41.5% is utilized with production rate of 679 tons. Freshwater fish cultivation potential approximately reached 14,000 hectares and only around 1120 hectares (8%) is utilized. The absence of information regarding patin fish cultivation or known suitable cultivation location for the cultivation becomes the hurdle of development in the region. Patin Siam research was conducted from July to September 2016 in East Tanjung Jabung Jambi province. The method used in this research is survey method (descriptive) utilizing Geographic Information Systems (GIS). The results exhibits inhibiting factor on the research parameters including water and soil pH. Some of the supporting parameters are dissolved oxygen, ammonia, salinity and additional parameters. Suitable land for patin siam cultivation in East Tanjung Jabung is categorized as 'very appropriate' (S1), in the following sample points: A1, A2, A3, B2, C1 and C2 with scoring value range (78-88). Suitable category (S2), is located at sample points B1, B3, D1, D2, E1, E2 and E3 with the range scoring value (62-72).

Keyword : land suitability analysis; Patin Siam cultivation.

Introduction

Patin Siam cultivation is currently considered as promising business for the community, because Patin Siam is a type of freshwater fish which is easily cultivated and possess high economic value. According to Roesfitawati¹, fresh Patin Siam's value in international market reached about 1 USD, filleted Patin Siam on the other hand reached 3.4 USD.

Patin Siam (*Pangasianodon hypophthalmus*) is one of preferred food commodity in Jambi Province, Indonesia. It is characterized by demand for Patin Siam fry or seedling (*Pangasianodon hypophthalmus*) which continues to increase annually. Based on Marine and Fishery Ministry data, in 2011 the Patin Siam fish domestic production reached 229.267 tons, while in 2012 Patin Siam production increased to 347.000 tons and in 2013 the production value reached 410.883,20 tons.

East Tanjung Jabung regency is located in Jambi Province which possesses strategic position for promoting Patin Siam cultivation. Said regency is located on the east coast of Sumatra Island which is directly adjacent to the Riau Islands Province as well as hinterland triangular economic growth of Singapore-Batam-Johor (SIBAJO). In addition, East Tanjung Jabung regency is adjacent to Muaro which is the only producer of

abon (shredded) Patin Siam in Jambi. According to Ciputra² abon Patin Siam continued to increase, up to 200kg of abon weekly in 2016. Jambi produces 10000-13000 tons of Patin per day in average, valued at Rp 12,000 per kilogram. After deducting local consumption and markets outside the region (South Sumatra and Riau). Only in Muaro, Jambi province, produces large amount of patin products up to 11.143,98 tons annually. Public waters produces 859,18 tons and cultivation produces 10.283.80 tons which are mainly sold to satisfy the local market demand, Jambi City, Tebo Regency, South Sumatra and Bengkulu, etc.. Cultivation as vast as 125 Ha consisting of 2400 plots which possess 125 Ha developments potential, the production of fish produced amounts to 6000-8000 kg/day. East Tanjung Jabung is surrounded by two major rivers: Batang Hari and Berbak River utilized as irrigation which simplifies cultivation activities implementation. Fish fry or seedling can be easily obtained by the people of East Tanjung Jabung at Freshwater Cultivation Center or Balai Budidaya Air Tawar (BBAT) Jambi which continue providing Patin Siam fish fry throughout the year.

Fisheries potential in Tanjung Jabung regency, according to Tanjung Jabung Government³ fisheries / river potential amounts to 24,000 hectares but only about 41.5% is utilized with production value of 679 tons. Freshwater fishery potential is approximated at 14,000 hectares and utilized for only 1,120 hectares (8%). The absence of information regarding Patin Siam fishery in East Tanjung Jabung resulted in untapped potential, therefore requiring an analysis of land suitability level.

Research Method

This research was conducted in July-September 2016 at five districts located in East Tanjung Jabung Regency Jambi Province, Indonesia. The districts selected were: Gragai, West Muarasabak, Dendang, Rantau Rasau and Berbak. The variables in this study water and soil quality. Parameters taken are related to livelihood and cultivation requirements said cultivation activity could be conducted properly. Soil quality parameters involves: soil texture, organic matter (BO), pH. While Water Quality parameters involves: temperature, pH, dissolved oxygen (DO), ammonia and salinity content as well as additional parameters: land slope, temperature and precipitation. Research method employed is survey method (descriptive) utilizing Geographic Information Systems (GIS) analysis. According to Suryabrata⁴, descriptive method is a method of describing the circumstances or events of a particular area. In this method, data collection done is not limited to collection process but also includes data analysis and discussion.

Observations or primary data collection was conducted in 13 sampling points (soil and water source), representing research sites. From each observation sites, researches obtained sampling point's geographic position by utilizing GPS. Data collection was performed in the following districts: Geragai (A), Dendang (B), West Muara Sabak (C), Berbak (D) and Rantau Rasau (E) (Figure 1).



Figure 1. Sample collection point

Findings and Discussion

Water Quality

a. pH

Based on pH level in observed sites, pH values ranged from 4.01 to 7.8. Lowest value was obtained at E3 point in Trimulyo village Rantau Rasau district. Highest value was obtained at D1 which is in Rantau Makmur village Berbak district. The overall condition of the waters in study sites tend to be acidic. The range of 'very suitable' pH value (S1) is contained in D1, D2, and E1 with pH values ranging from 6.52 to 7.87. For the 'suitable' category (S2), pH contained in A1, A2, A3, B2, B3, C1 and C2 possess range of pH values from 5.20 to 5.76. 'Not suitable' category (N) contained in the B1, E2 and E3 with pH values range 4.01 to 4.39.

b. Temperature

Water temperature values obtained from observations exhibits small range of temperature. The temperature range in East Tanjung Jabung is between 26.15 to 30.59 °C. Lowest temperature was obtained in sample point A1 in Rantau Karya village Geragai district. Highest temperature recorded in D1 Rantau Makmur village Berbak district. Based comparative analysis analysis result, using patin cultivation quality standard, there are only two categories of suitability condition: very suitable (S1) and suitable (S2). 'Very suitable' condition (S1) contained B1, C1, C2, D2 and E1. 'Suitable' condition (S2) is obtained at A1, A2, A3, B2, B3, D1, E2 and E3.

c. Dissolved Oxygen (DO)

Dissolved Oxygen (DO) obtained during observation process exhibits similar results from each sampling point. Highest value was obtained at E1 sampling point

located in Bandar Jaya village Rantau Rasau district. Lowest value was obtained in E3 sampling point at Trimulyo village in the same district. , Based on scoring result and adjusted to water quality standards for Patin Siam cultivation, DO conditions in the region as a whole is considered very suitable (S1).

d. Amonia

Ammonia value was taken from observation process which exhibits similar result obtained from sampling points. Overall value of ammonia at each sampling point is very small. Ammonia distribution value ranged between 0.01-0.03 mg / l. The highest value was obtained at E3 sampling site in Trimulyo village Rantau Rasau district. The lowest is distributed almost evenly in other sampling area. From the results of scoring and adjustments to water quality standards for Patin Siam cultivation, it is exhibited that ammonia is included in safe category parameter or very suitable (S1).

e. Salinity

Salinity observation aims to determine the extent of sea water salinity seeping into research site. The observation exhibits that that the water conditions in this region is in freshwater category or not influenced by seawater salinity. The highest salinity value obtained in sample points C2 and E2 at 0.3 ppt and lowest value in C1, D1, D2 and E1 at 0 ppt. Similar results were obtained from sample sites. Based on quality standards and scoring calculation results it is obtained that salinity distribution could be classified as 'very suitable' for cultivation (S1).

Table 1. Parameter Observation Result

No	Coordinate		District /Village/Code	Water Quality					Soil Quality			Information		
	X	Y		ph	temp (°C)	DO mg/l	Amonia mg/l	salinity (PPT)	Organic material (%)	Soil Texture	Soil pH	Slope (%)	Air temp (°C)	Precipitation mm/year
1	357070	9855760	Geraagaia/Rantau Karya/A1	5,83	26,15	4,3	0,02	0,1	3,63	sandy clay loam	6,2	3	26	2366
2	350381	9863067	Geraagaia/Rantau Karya/A2	5,72	26,87	4,5	0,01	0,1	2,56	sandy clay loam	5,7	3	26	2366
3	355277	9868865	Geraagaia/Rantau Karya/A3	5,63	27,19	4,2	0,01	0,2	3,22	sandy clay loam	5,9	3	26	2366
4	377774	9858405	Dendang/ Catur Rahayu/B1	4,39	26,56	4,6	0,01	0,2	5,45	sandy loam	5,2	2	26	910
5	383376	9866467	Dendang/Rantau Indah/B2	5,2	28,52	5,2	0,02	0,1	4,12	sandy loam	4,9	2	27	910
6	388267	9867526	Dendang/Kotakandis/B3	6,3	27,62	5,5	0,01	0,2	7,22	clay	5,1	1	27	910
7	367746	9861452	Sabak Barat/Parit culum/C1	5,76	28,89	4,3	0,01	0	1,5	sandy clay loam	6,1	3	26	2070
8	368172	9873384	Sabak Barat/Kp. Singkep/C2	5,4	29,12	6,2	0,1	0,3	2,14	sandy loam	5,8	3	26	2070
9	409845	9868199	Berbak/Rantau Makmur/D1	7,87	30,59	7,8	0,01	0	11,1	clay	5,7	1	26	1261
10	397881	9858339	Berbak/ Simpang/D2	6,52	28,67	5,2	0,01	0	3,52	clay	5,8	1	26	1261
11	399859	9869928	R. Rasau/Bandar Jaya/E1	7,12	29,64	6,5	0,01	0	14,2	clay	5,5	1	27	1846
12	404707	9875266	R. Rasau/ Rnt Rasau 1/E2	4,8	26,55	4,5	0,02	0,3	9,59	clay	4,7	1	27	1846
13	395634	9871656	R. Rasau/Tri Mulyo/E3	4,01	29,32	4,4	0,03	0,2	8,87	clay	4,8	1	27	1846

Soil Quality

a. Soil Organic Matter

Based on soil organic matter observation, lowest value of soil organic matter is 1.5% and the highest at 14.2% in percentage value. Lowest value for organic material was obtained at observation point C1 located in Paritculum village West Sabak district. While the highest value was obtained in sample point E1 located in Bandar Jaya village Rantau Rasau district. Judging from soil quality standard for Patin Siam cultivation, there are two classes of land suitability at all sampling points. 'Suitable' category (S2) was obtained in the sample point D1, E1, E2, and E3. Others are categorized as 'very suitable' (S1). Data analysis exhibits that most areas in East Tanjung Jabung's land condition possess good humus content.

b. Soil Texture

Based on soil texture observations, there are three types of soil texture which are as follows: sandy clay loam, sandy loam and clay. Most soil texture in East Tanjung Jabung possesses clay soil texture, while sandy loam soil is the least common soil texture. Some observations point possessing clay soil textures are D1, D2, E1, E2 and E3 in Berbak and Rantau Rasau districts. Sandy loam soil texture is found in B1, B2, and D2 at Dendang and Sabak district. Based on scoring value data compared with soil texture quality standard for patin cultivation, there are three categories of land suitability level. the 'Very suitable' condition is obtained from sandy clay loam textured soil in samples point A1, A2, A3 and C1. 'Suitable' condition is obtained in B1, B2 and C2. Other sample points are 'Not Suitable' (N).

c. Soil pH

In addition to water pH observations, this study also observed soil pH. Obtained soil pH values were in the range of 4.7 to 6.2. Lowest soil pH was obtained at sampling points E2 in Rantau Rasau 1 village Rantau Rasau district. Highest soil pH were obtained from sample point A1 in the Rantau Karya village Geragi district. Based on soil suitability quality standard for Patin Siam cultivation, there two land suitability levels which are: 'Suitable' (S2) and 'Not Suitable' (N). 'Suitable' condition (S2) is only found in sample points A1 and B1 while other sample points are 'Not Suitable' (N).

Additional Parameter

a. Land Slope

Based on observation data, East Tanjung Jabung land slope tends to be flat. Observed slope in this region ranges between 1-3%. Slope can be seen from a height of sample points in comparison with the extent of the area. There are two types of land suitability based on scoring calculation and Patin Siam cultivation quality standards. 'Very suitable' slope (S1) was obtained in sample points A1, A2, A3, B1, B2, D1 and D2. 'Suitable' conditions were obtained in B3, C1, C2, E1, E2 and E3. Differences in land slope value is affected by geographical conditions, such as lower land slope in seaward lands.

b. Temperature

Air temperature observations were done as it is an important parameter in supporting Patin Fish cultivation. Air temperature affects water temperature. Air temperature conditions in East Tanjung Jabung on average are similar throughout the region. The range of air temperature is in 26-27 °C. Based on scoring and quality standard, the regions are considered 'Very Suitable' (S1). The absence of air temperature difference affected the observation result as it obtained similar value and land suitability category.

c. Precipitation

Precipitation data was obtained from Meteorology, Climatology and Geophysics Department (BMKG) in Jambi Province. Based on observation data, precipitation in the last 2 years amounts to 910-2366 mm / year. Observation station is calculated based on the districts. The highest precipitation recorded was in Geragai district. Lowest precipitation rate is in Dendang district. There are two categories of land suitability based on precipitation observation. 'Suitable' condition (S2) located in Geragai (A1, A2, A2), West Sabak (C1, C2,) and Rantau Rasau (E1, E2, E3). 'Not suitable' (N) are recorded in Dendang (B1, B2, B3) and Berbak (D1.D2).

Water, Soil, and Additional Parameter Quality Analysis

East Tanjung Jabung district's soil contain peat. According to *Tanjabtimkab* or Tanjung Jabung government³, land distribution in East Tanjung Jabung macro-wise in general is influenced by ground water, young soil such as: organic or peat soil. Some soil types found in East Tanjung Jabung according to the Land Research Center (PPT) Bogor (1983), are as follows: Alluvial Tionik, Gleik Alluvial, alluvial Humic, Organosol fibric, Organosol Sapric, Organosol Humic and Gleisol Humic. In addition, East Tanjung Jabung is located in adjacent to South China Sea, which causes river condition in the region to be affected by tide. Field observations exhibits East Tanjung Jabung possessing rivers irrigation linking two major rivers, Batang Hari and Berbak Rivers. Those rivers possess tidal phase due to the influence of the tide.

Peaty soil conditions causes low pH value in East Tanjung Jabung region. The results exhibits pH value ranges from 4-6 in the region, which is below required value according to soil quality standard and included in 'Not Suitable' (N) category. According to Supartno and Kasnadi⁵ pH value which supports cultivation is in the range of 7-8. In addition to peat, soil pH conditions also influenced by slope and rainfall. Research results exhibits slope values ranging from 1-3%. At the observation point with a slope of 1% (B3, D1, D2, E1, E2 and E3) soil pH values obtained ranged between 4.7 to 5.1. Smaller slopes are often flooded during rainy season. Sloped land condition proved to be less suitable for Patin Fish. According to Pramudiyanti and Ankiq⁶, land slope suitable for cultivation is in the range of 2-5%.

Low soil pH in every observation site affects water pH conditions. Research analysis exhibits most pH value contained in East Tanjung Jabung are under 6 and does not meet the requirements Patin Siam cultivation. According to Minggawati and Saptono⁷, suitable pH level for Patin Siam ranged from 6.5 to 9.0. Unsuitable water pH level (N) is obtained at B1, E2, and E3. However, some of the sample points tend to possess normal pH conditions ranged from 6.5 to 7.8 in S1 category found in D1, D2 and E3. This phenomenon occurs in observation sites near Batang Hari and Berbak rivers.

River tide affects the value of temperature distribution. During low tide, water temperature increases and temperature value decreases during high tide. The average value of the temperature at observation sites is relatively low in the range of 26-29 °C. This is supported by air temperature observations which affect water

temperature. Temperatures in East Tanjung Jabung ranged between 26-27 °C, which is suitable for Patin Fish cultivation. According to Mahyudin⁸, suitable water temperature for Patin Siam cultivation is in the range of 28-30 °C, and suitable air temperature ranges between 25 to 30 °C.

In addition to water temperature, river tides affects DO and ammonia level. Tidal streams resulting river flows in both directions. During low tides, river flows downstream and during high tide it flows upstream. River flowing in both directions in East Tanjung Jabung makes good water circulation. Water circulation in research areas maintain DO quality in normal conditions. Field observations also exhibits DO value in normal conditioned observation point, which is in the range of 4-7 mg / l. According to Minggawati and Saptono⁷, suitable DO level for Patin Siam cultivation is in the range of 3-7 mg / l. It also affects the levels of ammonia in the water. Good water circulation affects ammonia level at all observation points in the safe category in the range 0.01-0.03 mg / l. According to Firdaus⁹, suitable ammonia level for Patin Siam cultivation is less than 0.1 mg / l.

Tidal phase affecting river tide is feared to affect fresh water quality, therefore rising the need for this study to observe salinity parameter. Based on salinity observation at research area, water salinity is not affected by seawater. Salinity value in East Tanjung Jabung is below 0.3 ppt. A considerable distance from the shore does not affect an increase in salinity in the region. This condition is still very feasible for Patin Fish cultivation. According to Nirmala *et al.*¹⁰, patin can survive in salinity level of 18-27 ppt.

Based on soil quality observation, the region's condition supports Patin Fish cultivation in general. Research result exhibits soil organic matter ranged between 1.5 to 14.2%. According to Mahyudin⁸, suitable level of soil organic matter for Patin Siam cultivation is less than 8%. Based on observations, soil texture in the region supports Patin Fish cultivation because mostly contain sandy loam and sandy clay loam texture. According to Mahyudin⁸, suitable soil texture for patin siam cultivation is sandy clay loam.

Land Suitability Analysis for Patin Siam Cultivation

To determine the level of land suitability for patin fish cultivation, it is needed to know suitability level based on each observation parameter. Parameter observation results are then merged (overlay) to obtain land suitability map overview for patin fish cultivation. Value and weight calculation of all the parameters were also conducted to obtain scoring range in each sampling point. The scoring value obtained from all parameter ranged between 64-88. The highest scoring value obtained was at C1 and the lowest point at sample point E3. Land suitability for patin fish cultivation could be seen in Figure 2.

Figure 2 exhibits that there are two categories of land suitability levels: very suitable (S1) and suitable (S2). Land suitability was determined by class interval as follows: S1 (80-108), S2 (51-79) and N (22-50). Based on the scoring result that has been adapted to class interval obtained in sample point, areas possessing 'Very Suitable' category (S1) are A1, A2, A3, C1, C2, D2 and E1 with scoring value of 80-92. 'Suitable' (S2) lands included B1, B2, B3, D1, E2 and E3 with scoring value 64-78. Based on this result, East Tanjung Jabung is considered suitable for Patin Siam cultivation supported by 'Very Suitable' and 'Suitable' land suitability available in the region.



Figure 2. Land Suitability Map

Factors that allows East Tanjung Jabung to possess S2 type of land suitability (suitable) is the limiting factor on observation parameter. Based on the results of every parameter observation analysis, researchers found inhibiting parameters for Patin Siam, including the soil and water quality. Soil and water quality parameters that acts as limiting factor is pH. Regions in East Tanjung Jabung possess low water in most region and low soil pH in every region. However, there are supporting parameters for Patin Siam cultivation which ensure the region possessing S1 type for land suitability (very appropriate) including DO, ammonia and salinity. Every additional parameters parameter supports Patin Siam cultivation activities.

Conclusion and Suggestion

Conclusion

Based on the results of research in East Tanjung Jabung, it could be concluded that:

1. Inhibiting parameter for Patin Siam cultivation in East Tanjung Jabung is water pH and soil, while contributing factor involves: temperature, DO, ammonia and salinity.
2. Land suitability level for Patin Siam cultivation in East Tanjung Jabung is 'very suitable' (S1), exhibited in A1, A2, A3, B2, C1 and C2 with scoring value range of 78-88. 'Suitable' category (S2) exhibited in B1, B3, D1, D2, E1, E2 and E3 with scoring value range of 62-72.

Suggestion

This study is a conducted to determine cultivation area. Future researchers would benefit in pursuing further studies to determine region's fish production capacity.

References

1. Roesfitawati. Ikan Patin Siam Hasil Alam Benilai Ekonomi dan Berpotensi Ekspor Tinggi. 2013. STT: Ditjen PEN/MJL/81/X/2013.
2. Ciputra. Ciputra Entrepreneurship. 2016. www.Ciputra-entrepreneurship. com. Accessed in 17 Maret 2016.

3. Pemkab Tanjung Jabung Timur. 2012. <http://www.TanjungJabungTimurkab.go.id>. Accessed in 17 Maret 2016.
4. Suryabrata, Sumadi. Metodologi Penelitian. 2003. Raja Grafindo Persada. Jakarta.
5. Supratno, K.P.T., Kasnadi. Peluang usaha Budidaya Alternatif dengan Pembesaran Kerapu di Tambak Melalui Sistem Modular. 2003. Pelatihan Budidaya Udang Windu Sistem Tertutup bagi Petani Kab. Tegal dan Jepara- Jateng 19 Mei - 8 Juni 2003, di BBPBAP. Jepara.
6. Pramudiyanti, R., T.S. Ankiq. Penentuan Kawasan Jenis Usaha Budidaya Perikanan di Kabupaten Bandung Dengan Menggunakan Data Spasial. Jurnal Akuatik. 2011, 2 (2): 15-20.
7. Minggawati, Saptono. Water Quality Parameters for Cage Culture of Patin Fish (*Pangasius pangasius*) In the Kahayan River, Palangka Raya City. Tropical Animal Science journal. 2012, Vol. 1 No. 1.
8. Mahyudin, K. Panduan Lengkap Agribisni Patin Siam. 2010. Penebar Swadaya. Jakarta.
9. Firdaus. Kesesuaian Air Sungai Kampar Untuk Budidaya Ikan Patin Siam Sistem Keramba Di Desa Kuala Panduk Kecamatan Teluk Meranti Kabupaten Pelalawan. 2014. STKIP Sumatra Barat. Padang.
10. Nirmala, K., D.P. Lesmono, D. Djokosetiyanto. Pengaruh teknik adaptasi salinitas terhadap kelangsungan hidup dan pertumbuhan benih ikan patin *Pangasius sp.* Jurnal Akuakultur Indonesia. 2005, 4: 25–30.
