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Banua Anyar Floating Net Cages, Is It Suitable or Not – A Study of Geospatial Aspects

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Abstract

Floating Net Cages is a fishery business developed in Banua Anyar, Banjarmasin City. A total of 544 cages are managed by the Banua Anyar community. The majority of cages in Banua Anyar are used to cultivate Bawal fish. In 2019 there was a sudden death of all the fish in Floating Net Cages. This case was happened because low value of dissolved oxygen and high water salinity. So the study must be done to find out whether the location of the Floating Net Cages is suitable based on the physical and chemical parameters of fresh waters. This study is to ensure the sustainability of the Floating Net Cages and environmental carrying capacity. This study has used spatial analysis to perform scoring, spatial join and overlay in Inverse Distance Weighting (IDW) to obtained some information on physical and chemical parameters. The results indicated that of the 25 Floating Net Cages sample points, a total of 19 sample points were declared potential for Floating Net Cage and 6 sample points indicate quite suitable for Floating Net Cages. If examined based on physical and chemical parameters, it is indicated that several parameters do not meet the optimal value for aquaculture. Physical parameters that indicate sample points are not optimal for cultivation include water depth, brightness and current speed. Chemical parameters indicating not optimal for cultivation include dissolved oxygen and salinity. Physical parameters that indicate sample points are not optimal for cultivation include water depth, brightness and current speed. Chemical parameters indicating not optimal for cultivation include dissolved oxygen and salinity. Physical parameters that indicate sample points are not optimal for cultivation include water depth, brightness and current speed. Chemical parameters indicating not optimal for cultivation include dissolved oxygen and salinity.

Keywords: Floating Net Cage, Freshwater Chemical Parameters, Freshwater Physics Parameters, Spatial Analysis

1 Introduction

Floating Net Cages is a simple aquaculture business that is arranged using net cages in rivers, lakes and seas [1]. This method is able to increase the economic level of people who are close to water sources [2], [3]. The city of Banjarmasin, which is crossed by the Martapura River, provides an opportunity for the community to develop Floating Net Cages. One of the sub-districts that is developing intensively is Banua Anyar Sub-District. Floating Net Cages in this sub-district cultivate Bawal fish in local language because it is easier to cultivate than other

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types of freshwater fish [2]. Floating Net Cages cultivation does not always provide benefits to the community. Certain conditions cause crop failure which is detrimental to farmers [4]–[6].

Harvest failure occurred in 2019 due to the mass death of bawal [5], [6]. Losses reach billions of rupiah or the equivalent of tens of tons of fish [5]. This incident is a recurring incident after previously occurring in mid-2016 [5]. The occurrence of these events needs to be sought for the main causes of mass death of cultivated fish. Some hypotheses say that the root of the problem is due to the low value of dissolved oxygen [5], [6]. Harvest failure did not occur again after the 2019 incident. However, it is necessary to carry out an analysis of the suitability of the physical and chemical parameters in the Floating Net Cages. This is to ensure the carrying capacity of the environment and the sustainability of the Floating Net Cages in Banua Anyar.

This article aims to present the suitability results of the Banua Anyar Floating Net Cages location using physical and chemical parameters. The analysis uses scoring, spatial join and overlay. The analysis is coupled with the interpolation process using Inverse Distance Weighting (IDW). Inverse Distance Weighting (IDW) is an interpolation technique that assumes that the closer a point is to a point whose value is unknown, the greater the effect. IDW uses values measured at points around the place, to estimate the value of variables at that place. The assumption in the IDW method is that points that are closer to the predicted location have a greater influence than points that are farther away. So, points that are closer together weigh more This article discusses sustainability and factors that might cause crop failure in the future.

2 Methodology

Location, Data, and Scoring

The study location is in Banua Anyar Village, East Banjarmasin District, Banjarmasin City. There are 554 cages in Banua Anyar which cultivate Bawal fish. Each cage was not measured for physical and chemical parameter data. The sample used in this study was 25 cages. The sample used represents the distribution of 554 cages in Banua Anyar. The data used in this study is primary data consisting of physical and chemical parameter data. The final results of the study are based on these parameters after scoring or weighting.

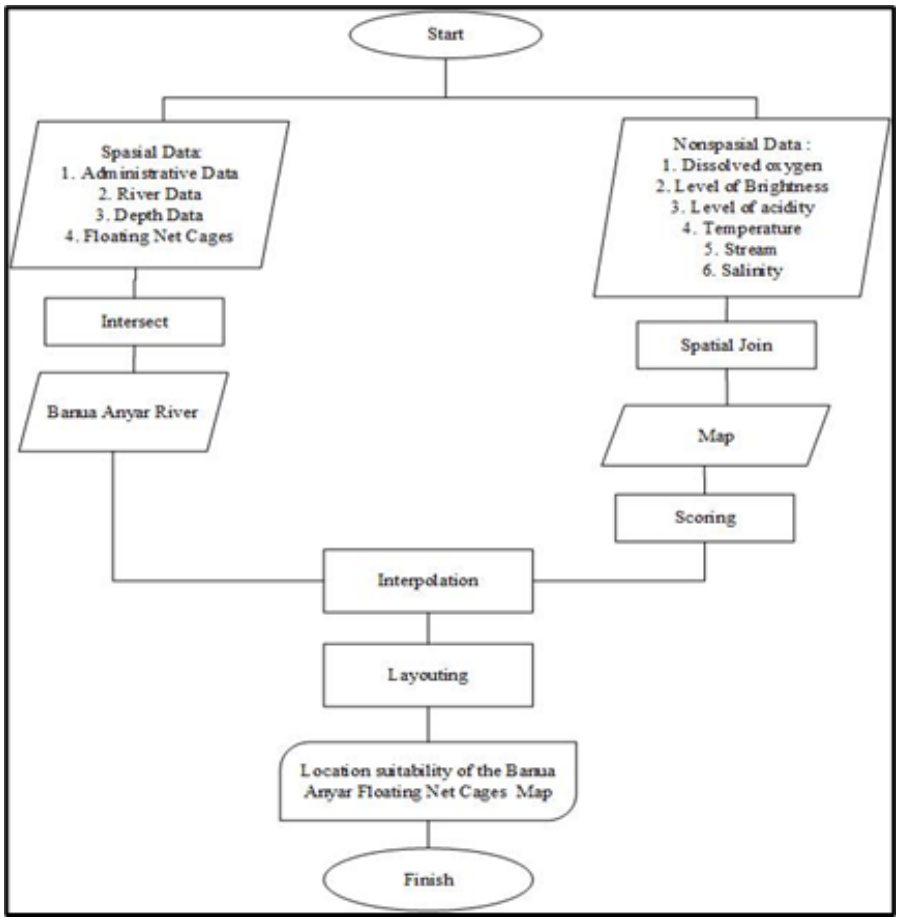

Figure 1: Flowchart

Table 1: Parameters Used in The Study

Physical Parameters	Chemical Parameters
Temperature	Dissolved oxygen (DO)
Current speed	Degree of acidity (pH)
Brightness	Salinity
Water depth	

The final results of the study were obtained by scoring based on the scores or weights shown in Tables 2 and 3 [7]–[10].

Table 2: Physics Parameter Scoring

Physical Parame-ters	Size Result Range	Mark (N)	Weight (B)	Final Score (N x B)
Temperature (ºC)	29	5	7	35

Physical Parameters	Size Result Range	Mark (N)	Weight (B)	Final Score (N x B)
	28 to 30	4		28
	27 to 31	3		21
	26 to 32	2		14
	> 32 or < 26	1		7
Current speed (cm/s)	50 to 60	5	5	25
	20 to 30	4		20
	30 to 40	3		15
	10 to <20	2		10
	<10 or >60	1		5
Brightness (cm)	35 to 40	5	1	5
	20 to 25	4		4
	30	3		3
	>40	2		2
	<20	1		1
Water depth (m)	80 to 120	5	2	10
	70 to 80	4		8
	30 to 70	3		6
	>120	2		4
	<30	1		2

Table 3: Chemical Parameter Scoring

Chemical Parameters	Size Result Range	Mark (N)	Weight (B)	Final Score (N x B)
Dissolved Oxygen (ppm)	>5	5	6	30
	4-6	4		24
	3-7	3		18
	>8	2		12
	<3	1		6
Degree of Acidity (pH)	7.5 to 8.5	5	3	15
	8.5 to 10 & 6 to 7.4	4		12
	10 to 11 or 4 to 6	3		9

Chemical Parameters	Size Result Range	Mark (N)	Weight (B)	Final Score (N x B)
	>11	2		6
	<4	1		3
Salinity (ppt)	35 to 40	5	3	15
	20 to 25	4		12
	30	3		9
	>40	2		6
	<20	1		3

The division of the final scoring class is shown in Table 4[11].

Table 4: Final Scoring Classes

Final Total Score	Conformity Class	Water Quality
81 to 100	(S1) Very suitable	Potential, has no inhibiting factors
65 to 80	(S2) Fairly Appropriate	Meet the minimum requirements
41 to 64	(S3) Almost Match	Has a limiting factor, need special treatment
21 to 40	(N1) Not suitable at this time	A fee is required to meet the minimum requirements
<20	(N2) Not suitable forever	It is very difficult to strive to meet the minimum requirements

3 Results

A. Physical Parameters

The physical parameters in this study consist of 4 (four) types such as temperature, current speed, water brightness and depth. The results of field size data collection and weighting are presented as follows.

1) Temperature

Temperature is one of the parameters that affect the growth of cultivated fish [12]. Increasing temperature affects viscosity, chemical reactions, evaporation and volatilization. Another effect is reducing the solubility of gases in water such as O2, CO2, N2, CH2[12]. The optimum temperature recommended for cultivation in the tropics ranges from 25 to 32 °C [12]. The water temperature in the Floating Net Cages area based on the samples determined ranges from 28.6 to 31 °C. The results are in the recommended optimum water temperature range. The water temperature in the Floating Net Cages area after interpolation is shown in Figure 2.

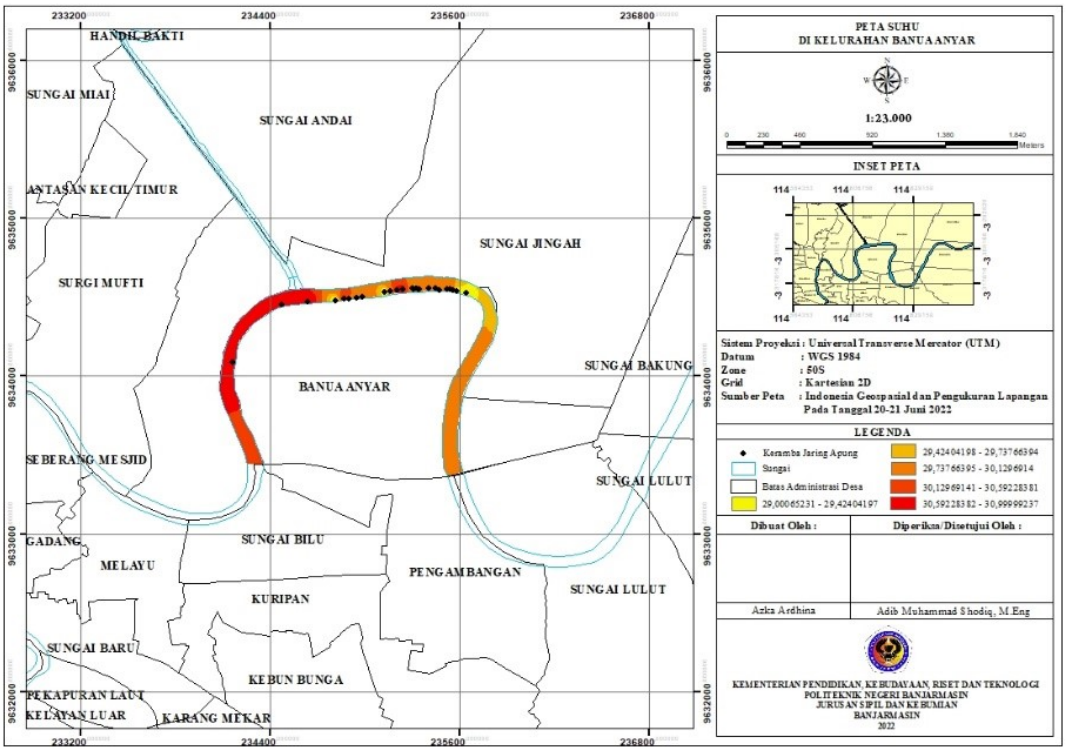

Figure 2: Water Temperature in Floating Net Cages Banua Anyar

2) Flow Speed

Currents arise when there are differences in water pressure, salinity or tides [13]. The currents that arise carry the nutrients that organisms need to develop [14]. Ideally the current speed ranges from 20 to 40 cm/s [15]. Water currents that are too strong can disrupt photosynthesis due to increased water turbidity [15].

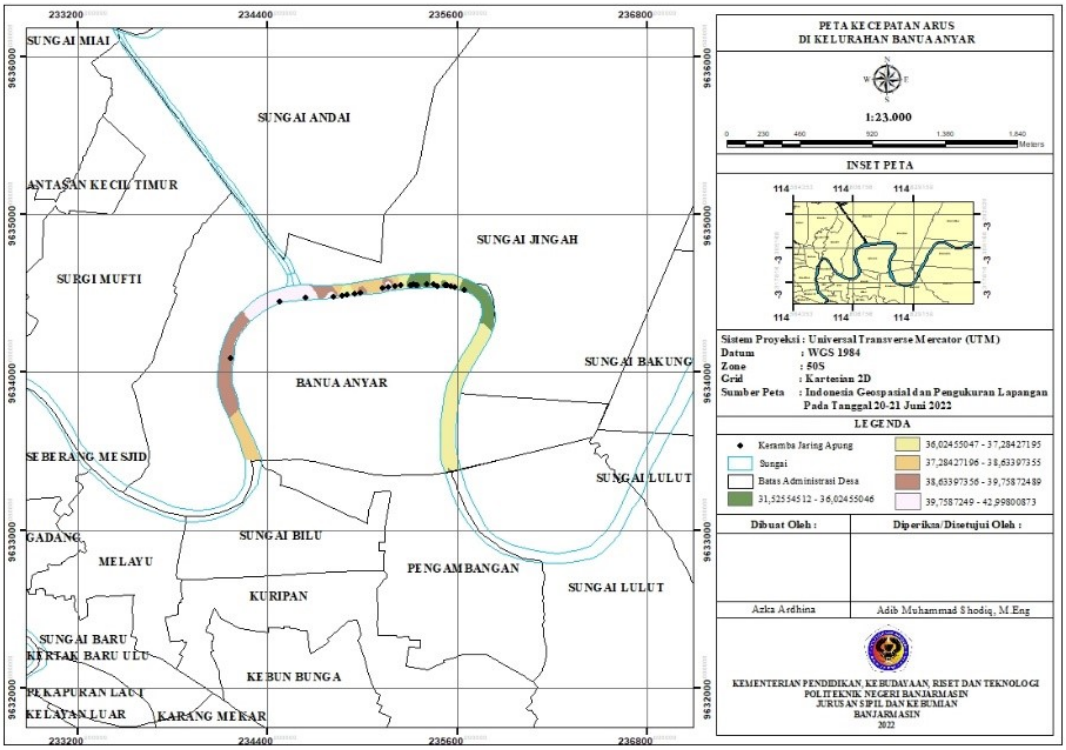

Figure 3: Flow Speed of the Banua Anyar Floating Net Cages

The current speed in the Banua Anyar Floating Net Cages is 31 to 43 cm/s. The current speed in the study area is ideal for cultivating fish. In general, in the Banua Anyar Floating Net Cages area, the current velocity is shown in Figure 3.

3) Water Brightness

The brightness of the water indicates how deep the sunlight penetrates into the body of water [16]. This has an impact on photosynthesis and other processes [16]. Another impact of turbidity is that it reduces the efficiency of eating freshwater organisms [17]. The optimum value of water brightness for fresh-water fish farming ranges from 30 to 40 cm [8], [18].

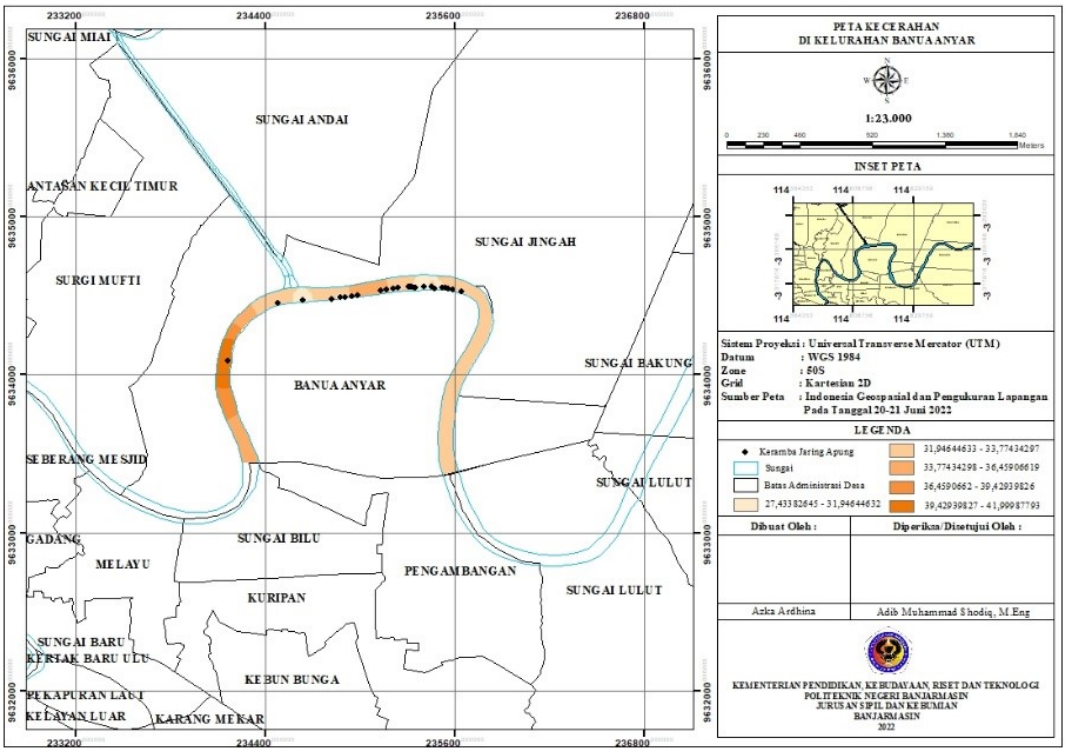

Figure 4: Flow Speed of the Banua Anyar Floating Net Cages

Based on 25 sample points, the Banua Anyar Floating Net Cages has a water brightness between 27 to 42 cm. The sample point P25 is indicated to experience turbidity with a water brightness value of 42 cm. Figure 4 shows the brightness of the water in the Banua Anyar Floating Net Cages.

4) Water Depth

The depth of the water affects the speed of the current and can increase the turbidity of the water [19]. An area that is shallow and affected by tides has high turbidity [19]. Water depth affects the penetration of sunlight and the spread of water microorganisms [20]. The minimum water depth for Floating Net Cages is between 2 to 3 m. The optimum is in the range of 5 to 7 m [19].

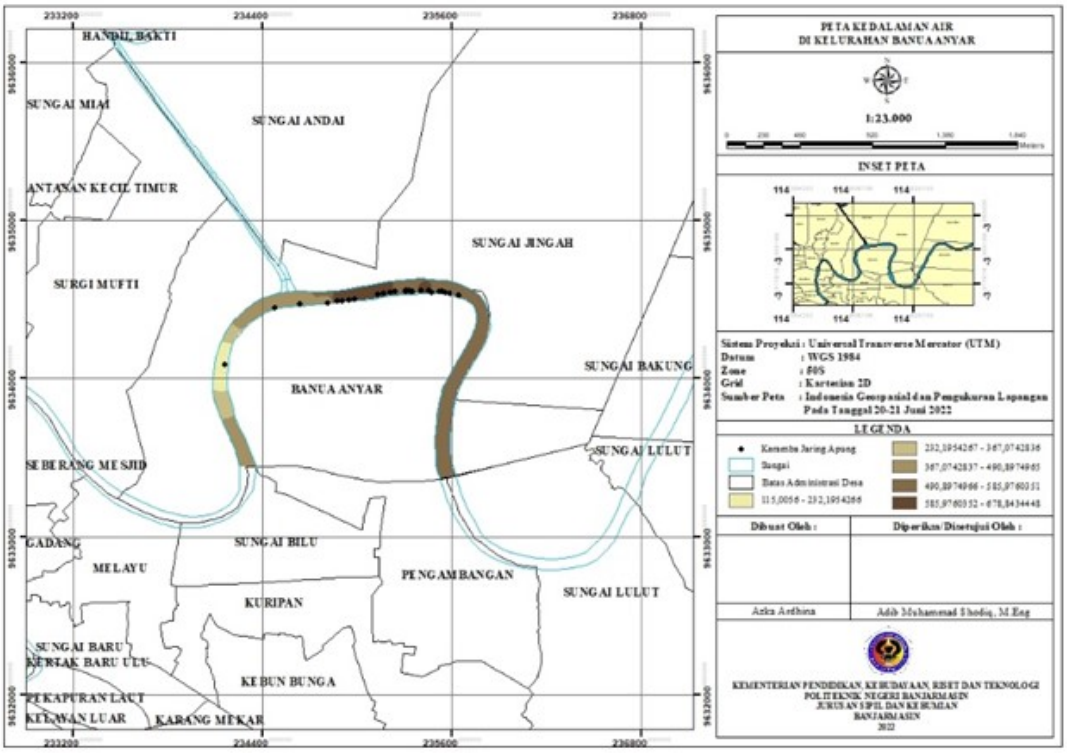

Figure 5: Water Depth in Banua Anyar Floating Net Cages

The Banua Anyar Floating Net Cages area has a water depth between 1.15 to 6.79 m. One shallow sample point is point P25 with a depth of 1.15 m. In general, the water depth in the Banua Anyar Floating Net Cages is optimal for freshwater fish farming. The water depth in the Banua Anyar Floating Net Cages is shown in Figure 5.

B. Chemical Parameters

The chemical parameters in this study consist of 3 (three) types such as dissolved oxygen, degree of acidity and salinity. The results of field size data collection and weighting are presented as follows.

1) Dissolved Oxygen (DO)

Dissolved oxygen (DO) is the main chemical parameter for freshwater environments [21]. Dissolved oxygen shows the amount of oxygen in a water [21]. Oxygen plays an important role in the process of respiration and metabolism of aquatic creatures [21]. The DO value in waters should not be less than 3 mg/L with a minimum value of 2 mg/L [22]. The optimal DO value for freshwater waters is more than 5 mg/L [22]. The results obtained at the 25 points of the Banua Anyar Floating Net Cages showed DO levels ranging from 2.7 to 3.5 mg/L.

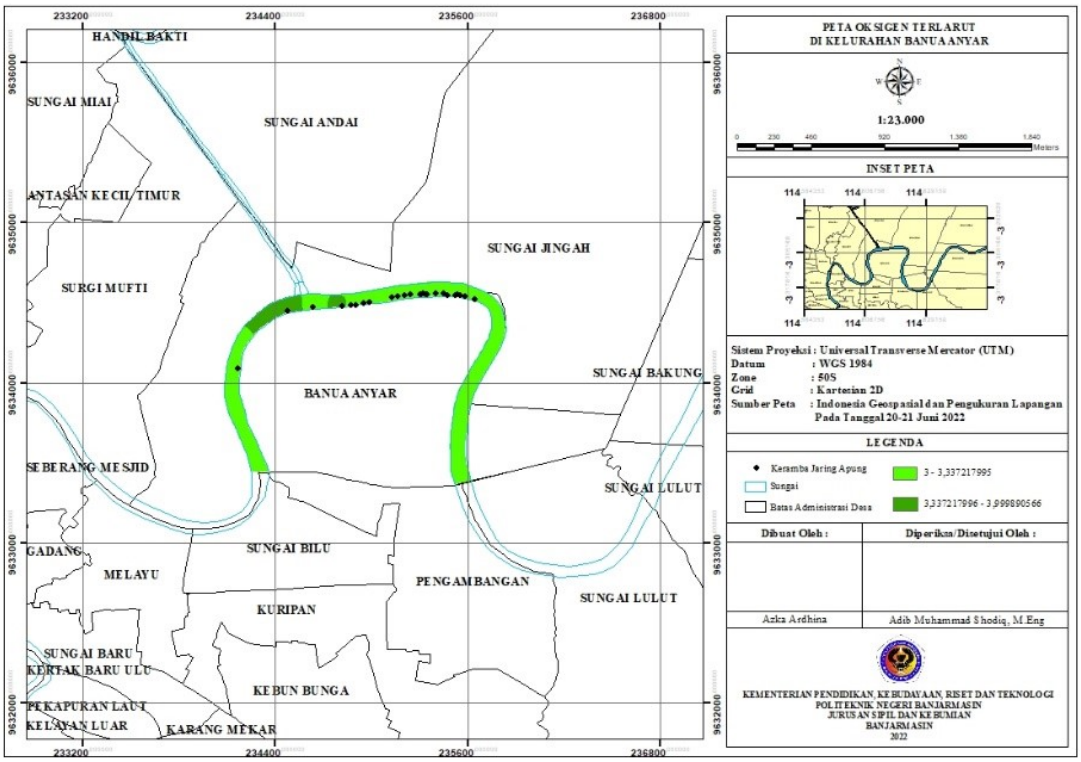

Figure 6: Dissolved Oxygen in Banua Anyar Floating Net Cages

The results obtained at the 25 points of the Banua Anyar Floating Net Cages showed DO levels ranging from 2.7 to 3.5 mg/L. The results in the field showed that DO in the Banua Anyar Floating Net Cages area did not meet the optimal DO value for fresh water waters. The DO value in the Banua Anyar Floating Net Cages is shown in Figure 6.

2) Acidity

The degree of acidity or pH indicates the acidity or alkalinity of a liquid [7]. pH shows the amount of hydrogen ion content in the liquid. The pH value that indicates acid is less than 7. Alkaline liquids give a pH value of more than 7. The pH value of 7 is the neutral value of a liquid [7]. The pH of the water that is too acidic affects the fertility of the waters which results in a decrease in dissolved oxygen content [23]. The same thing also happens when the pH in the waters is too alkaline [23]. The optimal water pH value for fish farming ranges from 6 to 9 [24].

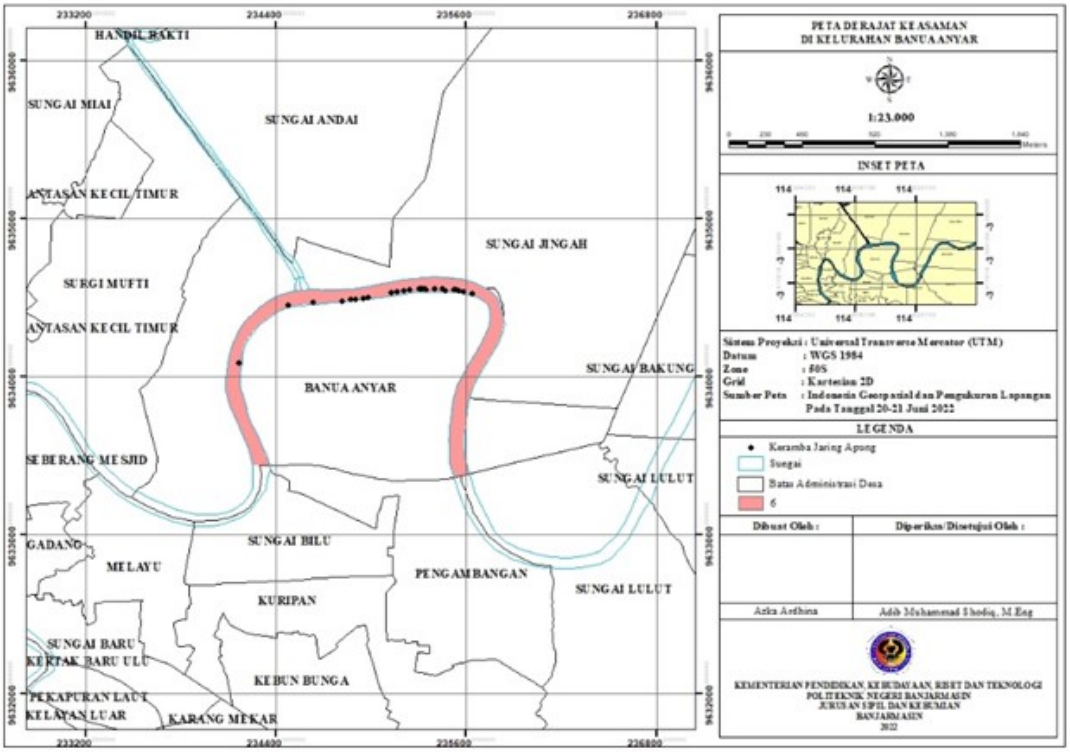

Figure 7: Degree of Acidity of Banua Anyar Floating Net Cages

The pH (acidity) of the water in the Banua Anyar Floating Net Cages ranges from 6.07 to 6.43. This amount is quite optimal for freshwater fish farming. In general, the pH of the water in the Banua Anyar Floating Net Cages is shown in Figure 7.

3) Salinity

Salinity is a chemical parameter that shows the value of dissolved salt content in a liquid [25]. In general, fresh waters have a salinity of 0% or range from 0 to 5 ppt [26]. Brackish waters have a salinity between 1 to 30% or around 6 to 29 ppt [26]. Sea water has a salinity value of more than 30% or more than 30 ppt [26].

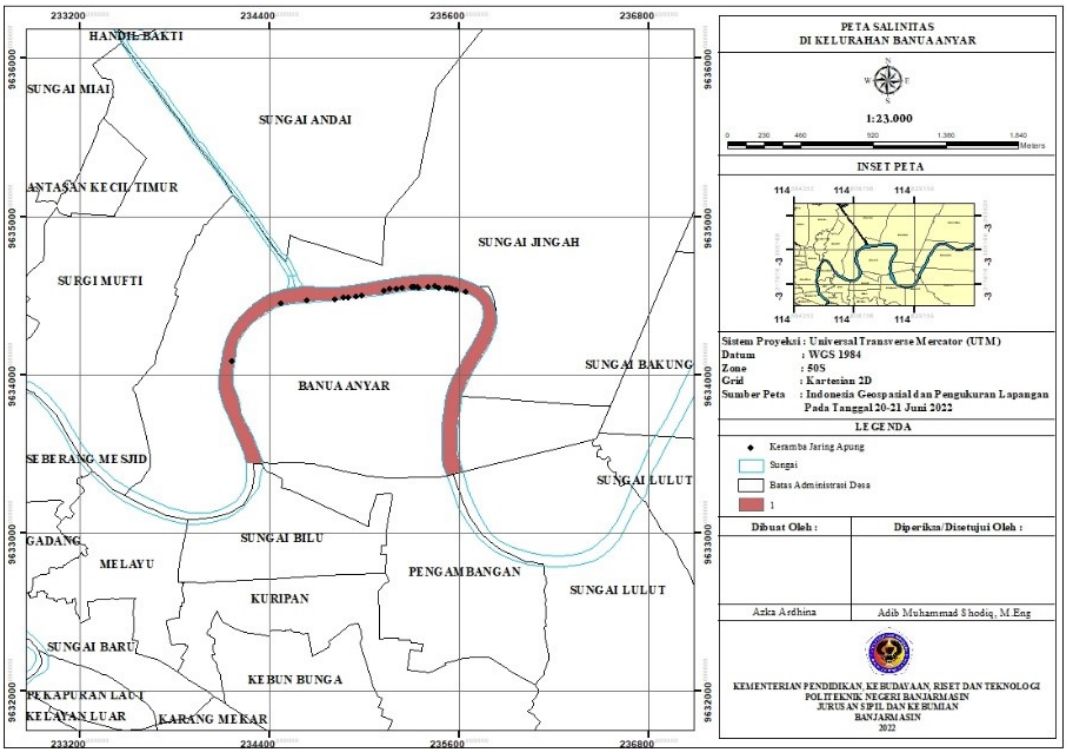

Figure 8: Salinity of Banua Anyar Floating Net Cages

Salinity in the Banua Anyar Floating Net Cages area is 0.5 ppt. This magnitude indicates that the waters of the Banua Anyar Floating Net Cages are fresh waters but tend to be brackish when tides occur. The salinity level of the Banua Anyar Floating Net Cages is shown in Figure 8.

4 Final Classification and Discussion

A. Final Classification

The results of the initial analysis of the primary data are then carried out by the final weighting. The results of the final analysis provide a spatial overview of the Banua Anyar Floating Net Cages. Based on this analysis, it can be determined whether spatially the Banua Anyar Floating Net Cages is appropriate or not.

The final score in Table 3 is the basis for determining whether the Banua Anyar Floating Net Cages location is appropriate based on the existing parameters. The final scoring results for all sample points are shown in Table 5.

Table 5: Final Scoring of the Banua Anyar Floating Net Cages Sample Point

Point	Final Score	Conformity Class
P1	92	(S1) Very suitable
P2	92	(S1) Very suitable
P3	85	(S1) Very suitable
P4	85	(S1) Very suitable

Point	Final Score	Conformity Class
P5	85	(S1) Very suitable
P6	85	(S1) Very suitable
Q7	85	(S1) Very suitable
Q8	85	(S1) Very suitable
Q9	85	(S1) Very suitable
P10	85	(S1) Very suitable
P11	94	(S1) Very suitable
Q12	94	(S1) Very suitable
Q13	92	(S1) Very suitable
P14	78	(S2) Fairly Appropriate
P15	78	(S2) Fairly Appropriate
Q16	85	(S1) Very suitable
Q17	94	(S1) Very suitable
P18	87	(S1) Very suitable
P19	85	(S1) Very suitable
P20	85	(S1) Very suitable
P21	78	(S2) Fairly Appropriate
P22	92	(S1) Very suitable
P23	78	(S2) Fairly Appropriate
P24	78	(S2) Fairly Appropriate
P25	73	(S2) Fairly Appropriate

Table 5 shows the final score ranges at the sample points. The final score has a value range of 73 to 94. A total of 19 sample points were declared very suitable for the Banua Anyar Floating Net Cages. The 19 sample points were expressed in terms of potential water quality to be developed as Floating Net Cages locations. 6 (six) sample points were declared fairly appropriate for the Banua Anyar Floating Net Cages. This indicates that the water quality at the sample point meets the minimum requirements for use as an aquaculture area. An overview of the spatial location of the Floating Net Cages based on the final score is shown in Figure 9.

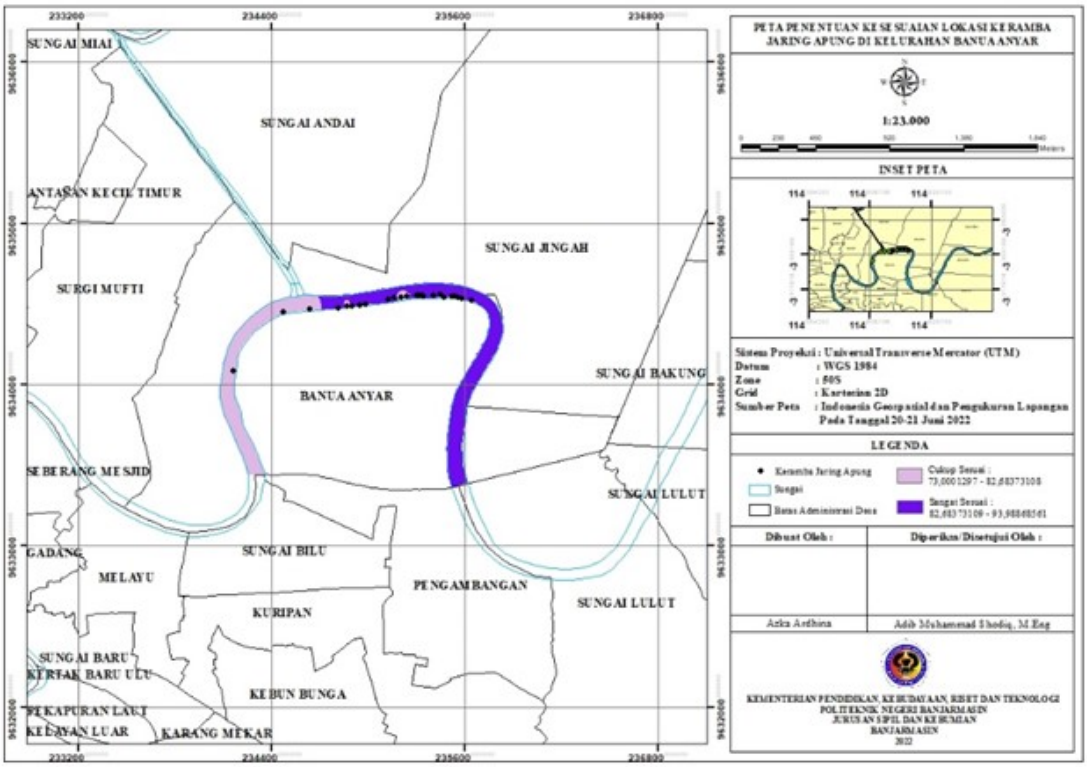

Figure 9: Location suitability of Banua Anyar Floating Net Cages

B. Discussion

The primary data used in this study were obtained at the beginning of the dry season. Data collection was carried out around May to June 2022. The mass mortality of cultivated fish in the Banua Anyar Floating Net Cages in 2019 occurred during the dry season. There is a suitability of seasonal conditions between the events and the data obtained. The results indicated that several physical and chemical parameters in several samples of the Banua Anyar Floating Net Cages indicated that they were not optimal for use as cultivation areas.

Physical parameters whose values are not optimal include water depth, brightness and current speed. Chemical parameters that indicate not optimal include dissolved oxygen and salinity. The relationship between the density of the number of cages and chemical and physical parameters cannot be explained in this article. Based on the final results it is known that the Banua Anyar Floating Net Cages area has good potential for freshwater fish farming. The local government needs to issue a good and sustainable freshwater fish farming policy to reduce the negative impact of community activities.

5 Conclusion

The Banua Anyar Floating Net Cages area using 25 sample points obtained information that a total of 19 samples were declared potential for freshwater fish farming. A total of 6 sample points were declared sufficiently suitable to be used as freshwater fish farming areas. However, it is necessary to pay attention to the effect of floating net cage density

on physical and chemical parameters in order to avoid negative impacts on the community.

Acknowledgement

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Reference

[1] S. D. Atmojo, "PENENTUAN KRITERIA LOKASI KERAMBA JARING APUNG (KJA) OFFSHORE DI PERAIRAN PROVINSI JAWA TIMUR," *Repos. ITS*, 2018.

[2] Banjarhits, "Cerita Nasib Pembudidaya Ikan Keramba Apung di Sungai Martapura," *Kumparan*, 2019. https://kumparan.com/banjarhits/cerita-nasib-pembudidaya-ikan-keramba-apung-di-sungai-martapura-1rN7IAr92Gf/full.

[3] D. Triomarsidi, "Melihat Budidaya Keramba Banua Anyar, Sekali Panen Raup Rp 20 Juta," *Banjarmasin Post*, 2017. https://banjarmasin.tribunnews.com/2017/04/19/melihat-budidaya-keramba-banua-anyar-sekali-panen-raup-rp-20-juta.

[4] adminwartaniaga, "Keramba Menjamur di Banua Anyar Langgar UU Sungai," *wartaniaga*, 2019. https://wartaniaga.com/2019/10/keramba-menjamur-di-banua-anyar-langgar-uu-sungai/.

[5] L. K. Waela, "Intrusi Air Laut di Banjarmasin Kembali Sebabkan Kematian Puluhan Ton Ikan," *Kompasiana*, 2019. https://www.kompasiana.com/kaekaha.4277/5d9eaedf097f3635b0766352/pencemaran-air-sungai-martapura-banjarmasin-kembali-meminta-korban%0A.

[6] suarindonesia, "DKP3 dan DLH Cek Lokasi Keramba yang Ikannya Mati," *suarindonesia*, 2019. https://suarindonesia.com/dkp3-dan-dlh-cek-lokasi-keramba-yang-ikannya-mati/.

[7] B. Hardjojo dan Djokosetiono, "Pengukuran dan Analisis Kualitas Air. Edisi Kesatu," in *Modul 1 - 6*, Jakatrta: Universitas Terbuka, 2005.

[8] M. G. . Kordi dan A. B. Tancung, *Pengelolaan Kualitas Air dalam Perikanan Budidaya*. Jakarta: Penerbit Rineka Cipta, 2005.

[9] M. Syahid, A. Subhan, dan R. Armando, *Budidaya Bandeng Organik secara Polikultur*. Jakarta: Penebar Swadaya, 2006.

[10] Direktorat Jenderal Perikanan, *Pembenihan Ikan Bandeng*. Jakarta: Departemen Pertanian, 1998.

[11] L. L. Widowati, "Analisis Kesesuaian Perairan Tambak di Kabupaten Demak ditinjau dari Aspek Produktivitas Primer Menggunakan Penginderaan Jauh," Universitas

Diponegoro, 2004.

[12] H. Effendi, "Telaah Kualitas Air bagi Pengelolaan Sumber Daya Lingkungan Perairan," Institut Pertanian Bogor, 2003.

[13] Firdaus, A. Mahfudz, dan T. Kusumastanto, "Analisis Kelayakan Teknis dan Finansial Pengembangan Energi Arus Laut di Selat Madura," Institut Pertanian Bogor, 2014.

[14] J. D. Mudeng, M. E. F. Kolopita, dan A. Rahman, "Kondisi Lingkungan Perairan Pada Lahan Budidaya Rumput Laut Kappaphycus alvarezii Di Desa Jayakarsa Kabupaten Minahasa Utara," *J. Budid. Perair.*, vol. 3, no. 1, hal. 172–186, 2015.

[15] P. N. I. Kalangi, K. W. A. Masengi, M. Iwata, F. P. T. Pangalila, dan I. F. Mandagi, "Profil salinitas dan suhu di Teluk Manado pada hari-hari hujan dan tidak hujan," *J. Perikan. dan Kelaut. Trop.*, vol. VIII, no. 3, hal. 90–93, 2012.

[16] P. Pujiastuti, I. Bagus, dan Pranoto, "Kualitas Dan Beban Pencemaran Perairan Waduk Gajah Mungkur," *JurnalEkosains*, vol. 5, no. 1, 2013.

[17] R. R. Tarigan, "Faktor Fisika Perairan : Oseanografi," UNIVERSITAS BRAWIJAYA, 2012.

[18] F. O. Tatangindatu, Kalesaran, dan S. Rompas, "Studi parameter fisika kimia air pada areal budidaya ikan di Danau Tondano, Desa Paleloan, Kabupaten Minahasa," *J. Budid. Perair.*, vol. 1, no. 2, hal. 8–19, 2013.

[19] M. S. Wibisono, *Pengantar Ilmu Kalautan*. Jakarta: PT. Gramedia Widiasarana Indonesia, 2005.

[20] E. P. Odum, *Dasar-Dasar Ekologi*, Edisi Keti. Yogyakarta: Gadjah Mada University Press, 1979.

[21] Salmin, "Kadar Oksigen Terlarut di Perairan Sungai Dadap, Goba, Muara Karang dan Teluk Banten. Dalam : Foraminifera Sebagai Bioindikator Pencemaran, Hasil Studi di Perairan Estuarin Sungai Dadap, Tangerang," Jakarta, 2000.

[22] M. B. Pescod, *Investigation of Rational Effluent Stream Standards for Tropical Countries*. Bangkok: AIT, 1973.

[23] L. Amanda, "Evaluasi Kesesuaian Lahan Tambak Untuk Budidaya Udang Windu Dan Bandeng (Chanos chanos) Di Sekitar Desa Tambak Kalisogo Dan Desa Permisan Kecamatan Jabon Kabupaten Sidoarjo," *J. Geogr. Swara Bhumi*, vol. 02, no. 01, 2016.

[24] Pemerintah Republik Indonesia, *Peraturan Pemerintah Republik Indonesia Nomor 22 Tahun 2021 tentang Penyelenggaraan Perlindungan dan Pengelolaan Lingkungan Hidup*. Indonesia, 2021.

[25] J. H. Ambardhy, *Physical and Chemical Properties Water. Pegangan Training Budidaya*. Jakarta: PT. Central Pertiwi Bahari, 2004.

[26] D. Fardiansyah, "Budidaya Udang Vannamei di Air Tawar," *Artik. Ilm. Dirjen Perikan. Budid. KKP RI*, 2011.