

STUDY OF TOURISM SUITABILITY AND CARRYING CAPACITY FOR FISHERIES-BASED ECOTOURISM DEVELOPMENT IN JATIGEDE RESERVOIR, WEST JAVA, INDONESIA

SULASTRI PRIHANDINI^{1*}, ZAHIDAH², M. CANDRA W. ARIEF², HETI HERAWATI², CAROLYN M. PAYUS³ AND SITI IRBAH ANUAR³

¹Fisheries Study Program, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Jalan Raya Bandung-Sumedang KM. 21, 45363 Sumedang, West Java, Indonesia. ²Department of Fisheries, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Jalan Raya Bandung-Sumedang KM. 21, 45363 Sumedang, West Java, Indonesia. ³Department of Environmental Science, Faculty of Science and Natural Resources, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia.

*Corresponding author: sulastri19001@mail.unpad.ac.id

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Abstract: A reservoir is a multipurpose dam. The Jatigede reservoir in Sumedang Regency, West Java Province, Indonesia has excellent potential as a Fisheries-based Ecotourism (FbE) development due to its sufficiently wide inundation area, the availability of fish and marine resources, wealth of natural scenery and strategic location. Currently, Jatigede Reservoir is a well-known natural tourism destination and research study area; however, minimal studies have been conducted on the environmental aspects of tourism. This study aims to determine the ecological potential of Jatigede Reservoir as a Fisheries-based Ecotourism (FbE) destination and its suitability and carrying capacity. This research was conducted between 29th August 2022 and 30th June 2023 and consists of a preliminary survey and main research activity. The study area encompasses eight selected areas: (1) Tegal Jarong, (2) Naga Island, (3) Samiah Fishing Spot, (4) Sabelit Boating Spot, (5) Jemah Island, (6) Buaya Island, (7) Curug Mas, and (8) Cibunut Fishing Spot. The Tourism Suitability Index (TSI) was calculated for two tourism categories: Fishing and boating. The TSI result for the fishing category is “Conditionally Appropriate” while for boating activity is “Very Appropriate”. The total Tourism Carrying Capacity (TCC) for all study areas is about 13.818 visitors/day.

Keywords: Sustainability, management, environmental tourism, inland water.

Introduction

Reservoirs have ecological and economic significance. The ecological function of reservoirs according to Guan *et al.* (2020) is to create new habitats and conserve aquatic biodiversity, regulate the water quality, modify the hydrological cycle, control floods, and provide raw water resources to balance human needs. In addition, reservoirs have great potential to support economic development through fisheries, energy generation, and tourism (Hadjerioua *et al.*, 2015). Tourism forms that can be carried out at the reservoir include natural tourism and ecotourism with various water-based activities such as fishing and boating (Arif *et al.*, 2023).

Ecotourism can be defined as a form of tourism that takes place in natural areas with

a specific learning and conservation purpose that involves local cultures and communities (Prasetyo *et al.*, 2022). Conceptually, ecotourism operations should follow the concept of sustainable tourism (Butarbutar, 2021). Reservoirs as a water resource have a great deal of potential for development as ecotourism destinations because it has a wide water area with unique biodiversity characteristics according to their location and rivers connected to each reservoir. Thus, the natural resources available in the reservoir area can be used as a tourist attraction (Yulianda 2019). In addition, the historical and cultural assets owned by the nearby communities can enhance the benefits of implementing ecotourism activities in the reservoir area (Arida, 2017).

Indonesia is currently focused on reservoir development. According to data published by the Ministry of Public Affairs of the Republic of Indonesia, Indonesia has developed more than 205 dams as of 2021 (Ministry of Public Affairs, 2021). Located in the Sumedang Regency of West Java Province, the Jatigede Reservoir is one of Java Island's most recent completed dam projects. The process of land acquisition, construction, and inundation of this reservoir started in 2008 and was completed in 2015 (Ministry of Public Affairs, 2015). This reservoir officially began operating in 2017 with a status of a multipurpose dam with special functions as a hydroelectric powerplant, means of irrigation and fisheries development as well as a tourist attraction (Ministry of Public Affairs, 2017). This reservoir was built by damming a river in West Java, the Cimanuk River. The damming of the Cimanuk river is considered to have great potential, because the average water discharge is quite high, reaching 4.3×10^9 m³/year. This reservoir stands on land with a fairly large area of about 90,000 ha and a catchment area of 1,462 km². With this land area, this reservoir can accommodate water with a fairly high effective storage volume of around 877×10^6 m³ (Ministry of Public Affairs, 2015b).

Nowadays, the Jatigede Reservoir is a popular natural and cultural tourist destination in West Java Province, Indonesia. Tourist activities that are provided in the Jatigede Reservoir include sightseeing, fishing, boating, picnicking, camping, and outbound areas (Djuwendah *et al.*, 2019). This reservoir is also ideal for use as a Fisheries-based Ecotourism (FbE) destination. According to Mozumder *et al.* (2018), Fisheries-based Ecotourism (FbE) can be defined as a combination of ecotourism activities with responsible fishing practices to support local economies, preserve aquatic ecosystems, and encourage sustainable interactions between visitors and aquatic environments. Recreational fishing, diving, snorkelling, wildlife observation, and educational tours emphasising aquatic and marine biodiversity and conservation initiatives

are typical of Fisheries-based Ecotourism (FbE) activities. This strategy places a strong emphasis on the value of aquatic and marine habitat preservation, sustainable fishing methods, and the cultural legacy of fishing communities. Jatigede Reservoir has the potential for Fisheries-based Ecotourism (FbE) implementation due to its sufficiently wide inundation area, rich traditional culture, availability of fisheries resources, wealth of natural scenery, and strategic location.

The Tourism Suitability Index (TSI) is a tool used to check and assess an area's suitability to carry out a specific tourism activity based on its environmental condition and resource availability by considering various parameters (Febyanto *et al.*, 2014). Along with evaluating a specific tourism site's suitability, an additional method of evaluating the tourism area is by finding out its carrying capacity. Carrying capacity according to the United Nation-World Tourism Organisation (UNWTO) can be defined as the maximum number of visitors that may visit a tourist destination at the same time without causing a direct impact on the physical, economic, sociocultural, and environmental conditions around the tourism location that can influence the customer's satisfaction (UNWTO, 2018).

This research aims to determine the tourism suitability and assess the tourism carrying capacity of selected potential areas in the Jatigede Reservoir as a Fisheries-based Ecotourism (FbE) location. The information provided from this research can be used as a reference and recommendation for the public authorities to develop proper planning for their ecotourism sites. This article will discuss the background information of the Jatigede Reservoir, its potential area for ecotourism activity, and the analysis of the Tourism Suitability Index (TSI) and the Tourism Carrying Capacity (TCC) as well as recommendations for sustainable Fisheries-based Ecotourism (FbE) development at the Jatigede Reservoir.

Materials and Methods

Time and Location

This study was conducted between 29th August 2022 and 30th June 2023 consisted of preliminary research and main research. The preliminary research aimed to map the location for this research. The preliminary research was conducted using a survey method. The criteria used in selecting the potential research locations included the accessibility of the locations, the initial tourism activities run in the location, and the fishery resources availability.

The research took place in the water area of the Jatigede Reservoir, Sumedang Regency, West Java Province, Indonesia. Geographically, Jatigede Reservoir is located at coordinates 6°51'23"S and 108°05'41"E at an altitude of 260 m above sea level. Three of its eight locations were already managed as tourist destinations while the other five were not managed at all but have the potential for ecotourism sites. The site

locations were selected purposively based on preliminary research to find the best potential locations for tourism purposes. The research map location can be seen in Figure 1 while the detailed information of each location was listed on the Table 1.

Data Collection

The data collection was conducted between March and April of 2023. There are two types of data used in this research, i.e., primary and secondary data. Primary data was obtained by observation on-site and off-site (satellite image), survey, and interview with respondents, including visitors, local government representatives, and community members. The secondary data was obtained through related studies and literature about water quality and fisheries resources in the Jatigede Reservoir.

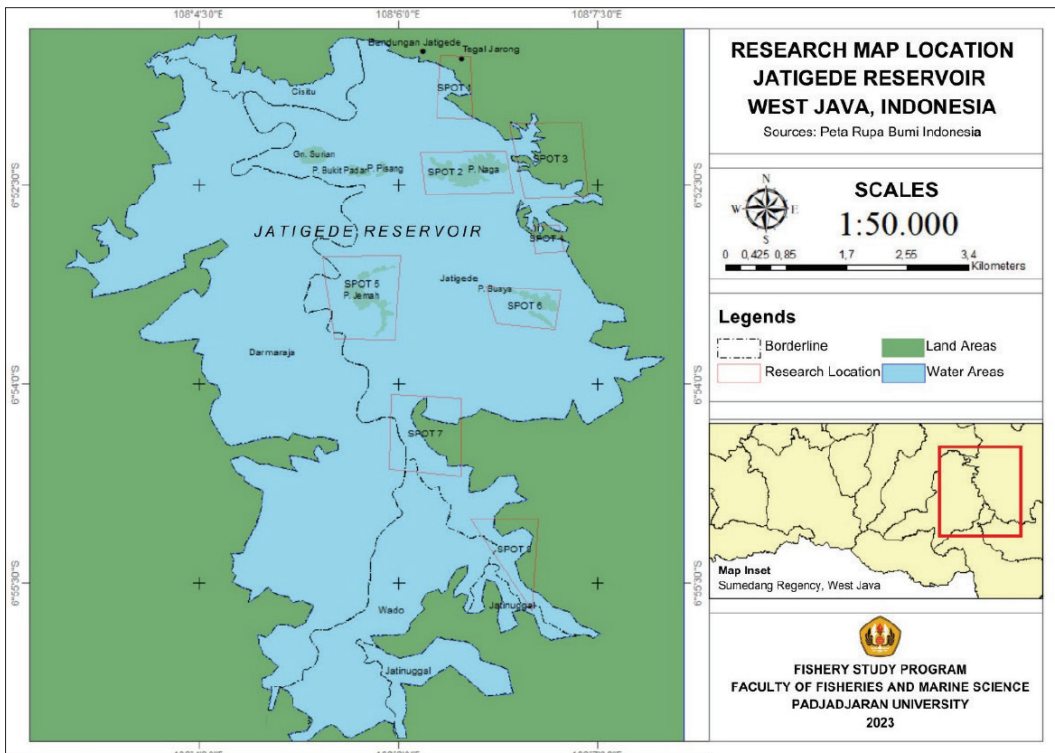

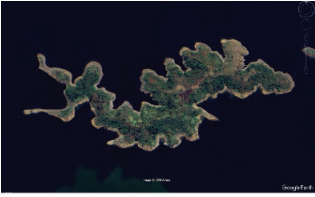

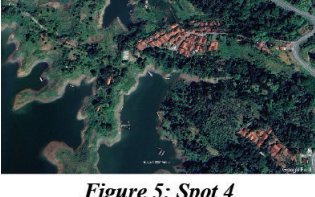

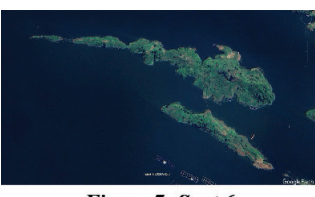


Figure 1: Research location map

Table 1: Study area location information

Spot	Location Name	Coordinates	Satellite Imagery
1	Tegal Jarong	6°51'34.59"S and 108°06'27.39"E	 <p><i>Figure 2: Spot 1</i></p>
2	Naga Island	6°52'22.20"S and 108°06'35.58"E	 <p><i>Figure 3: Spot 2</i></p>
3	Samiah Fishing Spot	6°52'18.28"S and 108°06'57.35"E	 <p><i>Figure 4: Spot 3</i></p>
4	Sabeulit Boating Spot	6°52'54.92"S and 108°07'05.60"E	 <p><i>Figure 5: Spot 4</i></p>
5	Jemah Island	6°53'23.05"S and 108°05'44.43"E	 <p><i>Figure 6: Spot 5</i></p>
6	Buaya Island	6°53'23.10"S and 108°07'06.75"E	 <p><i>Figure 7: Spot 6</i></p>

7 Curug Mas 6°54'22.93"S and 108°06'05.97"E

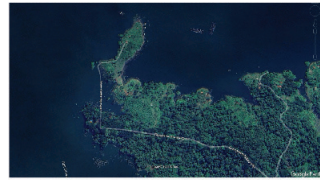


Figure 8: Spot 7

8 Cibunut Fishing Spot 6°51'27.34"S and 108°06'55.22"E



Figure 9: Spot 8

Data Analysis

Water Quality Analysis

Data on water quality parameters were taken from previous studies from 2021 to 2023. The analysis was done by comparing the data with the standard of Class II water quality, which is based on the Republic of Indonesia Government Regulation No. 22 of 2021 about the Implementation of Environmental Protection and Management, applied to lakes and reservoirs. Several parameters were considered including physical parameters (Brightness and Temperature) and chemical parameters (pH, dissolved oxygen, biochemical oxygen demand, ammonia, and phosphate).

Table 2: Tourism suitability parameters for reservoir

No.	Parameters	Fishing	Boating
1	Current speed	✓	✓
2	Water depth	✓	✓
3	Smell		✓
4	Water colour		✓
5	Abundance of fish	✓	
6	Number of fish species	✓	
7	Reservoir area		✓
8	Water quality	✓	✓

Sources: Yulianda (2019)

Tourism Suitability Index (TSI)

The Tourism Suitability Index (TSI) is a suitability matrix arranged based on the importance of each parameter to support tourism activities in a specific area (Yulianda, 2007). Fisheries-based Ecotourism (FbE) activities carried out in the reservoir or lake should consider several parameters as seen in Table 2.

The TSI assessment is calculated by a scoring system that should follow the freshwater tourism suitability matrix for each tourism category which can be seen in Table 3. The determination of TSI score and value is estimated using the following formula (Yulianda 2019):

$$TSI = \sum_{i=1}^n (Vi \times Si) \tag{1}$$

where:

n = Number of suitability parameters

Vi = Weight of the i parameter

Si = Score of the i parameter

The results of multiplying the scores and weights acquired for each parameter were used to determine whether an area is suitable for tourism activities. The total suitability score for each parameter shows the final result of the tourism suitability index. Four categories can be identified from the tourism suitability evaluation based on the TSI value that was obtained is shown in Table 4.

Table 3: Tourism suitability matrix for reservoir area

Ref.	Parameters	Categories and Scores								
		Range	S3	Score	S2	Score	S1	Score	NS	Score
Boating										
1	Aquatic plant cover (%)	0.250	$0 < x < 25$	3	2	1	$75 \leq x < 100$	0		
2	Current speed (cm/s)	0.200	$0 < x \leq 10$	3	2	1	> 50	0		
3	Odour	0.200	No odour	3	Slight odour	2	Odour	1	Strong odour	0
4	Water colour	0.150	Clear green	3	Brownish green	2	Blackish brown	1	Dark/black	0
5	Water depth (m)	0.100	$3 \leq x < 10$	3	2	1	$x \leq 1 ; > 50$	0		
6	Vegetation	0.100	Coconut, cypress, acacia	3	Trees and some bushes	2	Tall thicket	1	Non-vegetation	0
Fishing										
1	Fish abundance	0.600	A huge amount	3	Many	2	Little	1	None	0
2	Types of Fish	0.300	More than 4 species	3	2 - 3 species	2	1 species	1	None	0
3	Water depth (m)	0.100	$1 \leq x < 3$	3	$3 < x \leq 5$	2	$5 < x \leq 10$	1	$< 1 ; > 10$	0

Table 4: Adjectival interpretation of the TSI for Jatigede Reservoir

Categories	TSI Score
S3 (Very Appropriate)	$TSI \geq 2.5$
S2 (Appropriate)	$2 \leq TSI < 2.5$
S1 (Conditional Appropriate)	$1 \leq TSI < 2.0$
NA (Not Appropriate)	$TSI < 1$

Sources: Yulianda (2019)

Tourism Carrying Capacity (TCC)

The ability of an ecotourism destination to handle the volume of visitors without endangering the ecosystem is known as Tourism Carrying Capacity (TCC). According to Luna (2021), the determination of Tourism Carrying Capacity (TCC) is calculated based on the Boullon’s Carrying Capacity Mathematical Model (BCCMM), which is measured at three levels of carrying capacity assessment: Basic Carrying Capacity (BCC), Potential Carrying Capacity (PCC), and Carrying Capacity of the Area (CCA). Basic Carrying Capacity (BCC) were obtained by dividing the area open for visitors’ use in sqm (LA) and the average visitors’ standard area used (LS) while Potential Carrying Capacity (PCC) were obtained by multiply the Basic Carrying Capacity (BCC) with the Rotation Coefficient (RC). Rotation Coefficient (RC) computation is done by dividing the time provided by the tourism sites for specific tourist activities in a day (TT) by the average number of hours an area is used by visitors (TV). In conclusion, the formula used to determine the Potential Carrying Capacity (PCC) is shown below:

$$PCC = K \times \frac{LA}{LS} \times \frac{TT}{TV} \tag{2}$$

where:

PCC = Potential Carrying Capacity (visitors/day)

- K = Ecological potential (visitors)
- LA = Area or length of usable area (m²/m)
- LS = Area units for specific categories (m²/m)
- TT = Time provided by the tourism sites for tourist activities in one day (hours/day)
- TV = Time spent by tourists for each day (hours)

According to interviews with the local authorities and tourism management at the Jatigede Reservoir, the details of the time and area provided and used by the visitors for each tourism category are listed in Table 5.

In addition, to measure tourism carrying capacity the limiting factors also needed to be assessed. There are two limiting factors used in this study which are the average occurrence of cyclones in a year ($Lf1$) and the average number of hours of intense sunlight in a day ($Lf2$). According to the World Data (*Most Recent Cyclones in Indonesia, 2024*), the average of cyclones that occur in a year in Indonesia is 10 times/per year. In addition, the average number of intense sunlight received during the day in the study area is about six hours (10:00 am to 4:00 pm). The formula used to calculate the limiting factors is (Luna, 2021):

$$Lf1 = \frac{\text{Cyclones in a year}}{365} \times 100 \tag{3}$$

Table 5: Ecological potential of tourists (K), area of activity (Lt), and times (Wp and Wt)

Tourism Categories	K (people)	Lt (m ²)	Wp (hours)	Wt (hours)
Boating	6	20,000	24	24
Fishing	1	240	0.5	8

Sources: Interview result

$$Lf1 = \frac{\text{Intense sunlight in a day}}{\text{Time (hours) reservoir open in a day}} \times 100 \quad (4)$$

Lastly, the carrying capacity of the area (CCA) was calculated using the formula below:

$$CCA = PCC \times \frac{100-Lf1}{100} \times \frac{100-Lf2}{100} \quad (5)$$

Results and Discussion

Ecological Potential around the Jatigede Reservoir

Water Quality Analysis

Water quality analysis is essential to be conducted around the study area to predict the general environmental condition of the reservoir for recreation purposes. Measuring the quality of the water is crucial to ensuring that fisheries, anthropogenic, and tourism activities coexist in harmony with the environment. Table 6 shows the water quality of the Jatigede Reservoir based on secondary data used in this study.

Class II water quality standards, which are based on Republic of Indonesia Government Regulation No. 22 of 2021, which is about the

Implementation of Environmental Protection and Management are applied to lakes and reservoirs. Water that meets class two water quality standards is meant to be used for freshwater farming and aquatic recreation facilities and infrastructure, making it appropriate for determining whether the water quality is suitable for the growth of fisheries-based ecotourism.

Generally speaking, Jatigede Reservoir’s water quality still satisfies class II lake water quality requirements, allowing it to facilitate ecotourism initiatives. Nonetheless, it is known that several parameters, including brightness, BOD, ammonia, and total phosphate, at several sites did not match the necessary quality standards. While the high levels of BOD, ammonia, and total phosphate indicate an increase in pollutants entering the water body (Hamuna *et al.*, 2018), the low brightness of the waters despite the sunny weather indicates the presence of sedimentation particles in the waters (Minggawati & Saptono, 2012). Domestic waste, soap, detergent, and human or animal waste are some sources of these pollutants (Syawal *et al.*, 2016).

Table 6: Water quality of Jatigede Reservoir

Parameters	Standard*	Reservoir’s Zone		
		Riverine	Transition	Lacustrine
Physic				
Temperature	dev 3	29.7 ± 0.9	29.1 ± 1.0	28.5 ± 0.5
Brightness (m)	4	0.95 ± 0.10**	1.05 ± 0.18**	1.14 ± 0.19**
Chemical				
Acidity (pH)	6-9	9.2 ± 0.2	8.5 ± 0.3	8.5 ± 0.4
DO (mg/L)	4	6.8 ± 0.8	5.3 ± 0.8	4.8 ± 0.9*
BOD (mg/L)	3	7.88 ± 4.53**	12.51 ± 3.59**	6.95 ± 2.24**
Ammonia (mg/L)	0.2	0.17 ± 0.171	0.26 ± 0.237**	0.336 ± 0.229**
Phosphate total (mg/L)	0.03	0.13 ± 0.082**	0.075 ± 0.01**	0.082 ± 0.029**

Source: Sami *et al.* (2021); Wulandari *et al.* (2023)

* Class II national lake/reservoir water quality standards based on the Republic of Indonesia Government Regulation No. 22 of 2021 About the Implementation of Environmental Protection and Management.

** Parameter values that exceeded the minimum/maximum standard value.

Fisheries Resources

There are two type of fishery resources in the Jatigede Reservoir area: Fish and non-fish. According to the survey results, several species of freshwater fish are included in the category of fish resources in the Jatigede Reservoir, Jatigede District while the Mollusca group (freshwater mussels and rice snails) and Crustacean (freshwater lobster) were included in the category of non-fish resources.

According to the previous research, there are 17 species spread across eight families that make up the fish community structure in Jatigede Reservoir which are: Cichlidae (Nile Tilapia/*Oreochromis niloticus* and Mozambique tilapia/*Oreochromis mossambicus*), Osphronemidae (Snakeskin Gourami/*Trichogaster pectoralis*), Channidae (Stripped Snakehead/*Channa striata*), Loricariidae (Common Pleco/*Liposarcus pardalis*), Pangasiidae (Iridescent shark/*Pangasius hypophthalmus*), Bagridae (Asian Red-tail Catfish/*Mystus nemurus*), Chanidae (Milkfish/*Chanos chanos*), and Mastacembelidae (Fire Eel/*Mastacembelus erythrotaenia*) (Warsa *et al.*, 2016; Andina *et al.*, 2017). The most frequently caught fish species are lalawak (*Barbodes balleroides*) and hampal (*Hampala macrolepidota*), endemic fish of the Cimanuk River.

Tourism Suitability Index (TSI) of Selected Potential Tourism Area in Jatigede Reservoir

Tourism suitability was calculated to evaluate the parameters for the tourism sites under the study's potential. A criterion of resources and environmental requirements for tourism development is the tourism suitability index (Lelloltery *et al.*, 2018; Yanti *et al.*, 2021). Table 8 displays the findings of the Tourism Suitability Index (TSI) score for boat tourism. All eight study locations—spot 1 (Tegal Jarong), spot 2 (Naga Island), spot 3 (Samiah Fishing Spot), spot 4 (Sabeulit Boating Spot), spot 5 (Jemah Island), spot 6 (Buaya Island), spot 7 (Curug Mas), and spot 8 (Cibunut Fishing Spot)—were chosen for this category because, according to the preliminary research, all of the study

locations had the potential for boat activities. The Tourism Suitability Index (TSI) for this category was highest at spot 7, which received a perfect score of 3.00. Other spots that scored highly were spots 4, 6, and 8 (TSI score 2.9), spot 1 (TSI score 2.8), spots 5 and 7 (TSI score 2.7), and spot 3 (TSI score 2.55). The aforementioned result indicates that the Tourism Suitability Index (TSI) for the boat tourism category is “Very Appropriate” for the study locations as a whole.

In the Jatigede Reservoir water area, boat activities are highly appropriate because the water flow is relatively tranquil, ranging from 0.25 to 0.03 m/s and the aquatic plant covers just about 5% to 15% of the surface on average. The scenic elements that are available are also incredibly beautiful and organic, encompassing a variety of elements like forests, mountains, and reservoirs. In addition, the water areas in almost all study locations have the qualities of odourless and clear green waters, which makes them ideal for supporting boating tourism. Only spot 3, out of the eight selected study locations has water that is a brownish-green colour. As a result, location 3 has the lowest suitability score of any location—2.55. This is brought on by sedimentation getting into the reservoir waters as a result of nearby building construction activities. However, other parameters such as object view, vegetation, and odour continue to meet the required criteria, so, spot 3 remains in the “Very Appropriate” category.

The depth of the waters is one of the parameters that needs to be considered because it relates to safety issues in developing boat tourism in the reservoir area. The average depth of water area in the overall selected study location ranged from 8 to 20 m during the dry season. In the rainy season, the water depth would usually be deeper due to the increase in the reservoir's water volume. Thus, the weather and seasonal factors are important to be studied in boating tourism operations. According to Yulianda (2019), the ideal depth for boat tourism is about 3 to 10 m. A water depth that is more

than 30 m is not appropriate because of the risk to visitors' safety.

Next, Table 9 provides the Tourism Suitability Index (TSI) for the fishing tourism category. The main criteria in selecting the locations for the fishing tourism category was the land contour and the water depth. The preliminary survey identified five locations—spot 1 (Tegal Jarong), spot 2 (Naga Island), spot 3 (Samiah Fishing Spot), spot 6 (Buaya Island), and spot 8 (Cibunut Fishing Spot)—that have the potential to support fishing activities. Of all of the study locations that were chosen, the Tourism Suitability Index (TSI) for fishing activity was classified as “Conditional Appropriate”. Spot 8 achieved the highest index with a TSI score of 1.8, followed by spots 1 and 3 (scored 1.7), spot 2 (scored 1.5), and spot 6 (scored 1.4). The score obtained in this fishing category is the lowest suitability score compared with the other three tourism categories.

The “fish abundance” is the parameter that gives fishing activities a low suitability score. Observations showed that, despite the wide variety of fish species (between three and seven), the abundance of fish in all the locations that were chosen fell into the low or very few categories. A multitude of factors, including

declining water quality, unsustainable fishing practices, noncompliant mesh sizes, and external factors like industrial land clearance or reservoir-adjacency can contribute to the declining fish population in Jatigede Reservoir (Wulandari, 2014). One of the attempt that can be made to address this issue is to conduct integrated, routine restocking operations (Osathanunkul & Suwannapoom, 2023). Restocking is the process of adding fish of different ages to the initial population in order to boost the stock there while adhering to the general guidelines for restocking (Sadili et al., 2015).

Tourism Carrying Capacity (TCC) of Selected Potential Tourism Area in Jatigede Reservoir

The Tourism Suitability Index (TSI) of the eight study locations shows a diverse result, ranging from “Conditional Appropriate”, “Appropriate”, to “Very Appropriate”. To enhance the sustainability management of ecotourism sites in the Jatigede Reservoir, a study about the carrying capacity should be conducted. The calculation of the Carrying Capacity of the Area (CCA) of the study locations for each tourism category is presented in Table 7.

Limiting factors for boating and fishing activities:

$$Lf1 = \frac{\text{Cyclones in a year}}{365} \times 100 = \frac{10}{365} \times 100 = 2.74$$

$$Lf2 = \frac{\text{Intense sunlight in a day (hours)}}{\text{Time (hours) reservoir open in a day}} \times 100 = \frac{6}{12} \times 100 = 50.00$$

$$LFa = \frac{100-Lf1}{100} \times \frac{100-Lf2}{100} = \frac{100-2.74}{100} \times \frac{100-50.00}{100} = 0.48$$

The calculated Tourism Carrying Capacity (TCC) for the eight study locations shows different results for each spot, it depends on the number of tourism activities carried out and the size of the area of each location. The total maximum number of visitors that Jatigede Reservoir can carry for one operation day specifically for water-based ecotourism according to the calculation is about 13,813

visitors. This figure was obtained after considering seasonal and weather factors which potentially limited the visitor activities. It was computed with the assumption that the tourism sites operate for eight hours/day.

Spot 1 (Tegal Jarong) is a tourist destination in the Jatigede Reservoir that is run by the local community and government working together. These tourism sites currently oversee several

Table 7: Carrying capacity of study locations

Spot	Location	Tourism Categories	K (people)	LA (m ²)	LS (m ²)	TT (hours)	TV (hours)	PCC	CCA
1	Tegal Jarong	Boating	6	20,000	236,100	0.5	8	1,133	827
		Fishing	1	240	66,293	8	8	276	201
								Sub-total	1,028
2	Pulau Naga	Boating	6	20,000	703,507	0.5	8	3,377	2,463
		Fishing	1	240	152,969	8	8	637	465
								Sub-total	2,928
3	Samiah Fishing Spot	Boating	6	20,000	345,900	0.5	8	1,660	1,211
		Fishing	1	240	50,031	8	8	208	152
								Sub-total	1,363
4	Sabeulit	Boating	6	20,000	15,700	0.5	8	75	55
								Sub-total	55
5	Jemah Island	Boating	6	20,000	962,600	0.5	8	4,620	3,370
								Sub-total	3,370
6	Buaya Island	Boating	6	20,000	384,000	0.5	8	1,843	1,345
		Fishing	1	240	52,881	8	8	220	161
								Sub-total	1,505
7	Curug Mas	Boating	6	20,000	718,200	0.5	8	3,447	2,515
								Sub-total	2,515
8	Cibunut	Boating	6	20,000	261,600	0.5	8	1,256	916
		Fishing	1	240	43,417	8	8	181	132
								Sub-total	1,048
								TOTAL	13,813

Notes: PCC (Potential Carrying Capacity), CCA (Carrying Capacity of the Area), K (Ecological potential), LA (Area or length of usable area), LS (Area units for specific categories), TT (Time provided), TV (Time used)

tourism activities, including boating, fishing, and lounging. With a TCC result of 827 visitors/day, the boating tourism category had the highest carrying capacity, followed by fishing with a TCC result of 201 visitors/day.

Spot 2 or Naga Island is a small island in the Jatigede Reservoir with the potential to host several ecotourism destinations. This island has a sizable unmanaged area that is made up of 44.5 ha of water area. There is potential for the development of fishing and boating activities in this location. This location can accommodate up to 2,928 tourists per day overall, with specific

allocations for each tourism category: 2,463 visitors for boating and 465 visitors for fishing.

In the Jatigede Reservoir, Spot 3—also called Samiah Fishing Spot—is a run-of tourist destination. The entire potential tourism area in this location was calculated to be 39.8 hectares based on the size of the area but only 15% of that area was used for tourism. According to the study’s findings, this site has the capacity to host a maximum of 1,363 visitors per day across two tourism categories (1,211 for boating and 152 for fishing).

Table 8: Tourism Suitability Index (TSI) for boating

Ref.	Parameters	V	Location and Scores																			
			Spot 1		Spot 2		Spot 3		Spot 4		Spot 5		Spot 6		Spot 7		Spot 8		Spot 9			
			a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c		
1	Aquatic plant cover (%)	0.250	10%	3	0.75	10%	3	0.75	10%	3	0.75	20%	3	0.75	20%	3	0.75	3	0.75			
2	Current speed (cm/s)	0.200	2.5	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6			
3	Odour	0.200	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6		
4	Water colour	0.150	Clear green	3	0.45	Clear green	3	0.45	Brownish green	2	0.3	Clear green	3	0.45	Clear green	3	0.45	Clear green	3	0.45		
5	Water depth (m)	0.100	13-23	2	0.2	20-30	1	0.1	20-30	1	0.1	11-21.5	2	0.2	11-21.5	2	0.2	11-21.5	2	0.2		
6	Vegetation	0.100	Trees and bushes	2	0.2	Trees and bushes	2	0.2	Trees and bushes	2	0.2	Coconut Acacia	3	0.3	Coconut Acacia	3	0.3	Coconut Acacia	3	0.3		
Tourism Suitability Index (TSI)			2.8						2.7						2.55						2.9	
Category			VA						VA						VA						VA	

Ref.	Parameters	V	Location and Scores																			
			Spot 5		Spot 6		Spot 7		Spot 8		Spot 9		Spot 10		Spot 11		Spot 12		Spot 13			
			a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c		
1	Aquatic plant cover (%)	0.250	10%	3	0.75	15%	3	0.75	20%	3	0.75	15%	3	0.75	15%	3	0.75	3	0.75			
2	Current speed (cm/s)	0.200	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6		
3	Odour	0.200	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6	No odour	3	0.6		
4	Water colour	0.150	Clear green	3	0.45	Clear green	3	0.45	Clear green	3	0.45	Clear green	3	0.45	Clear green	3	0.45	Clear green	3	0.45		
5	Water depth (m)	0.100	17-27	2	0.15	10-20.1	3	0.3	10	3	0.3	-2-8	3	0.3	-2-8	3	0.3	-2-8	3	0.3		
6	Vegetation	0.100	Trees and bushes	2	0.2	Trees and bushes	2	0.2	Coconut trees	3	0.3	Trees and bushes	2	0.2	Trees and bushes	2	0.2	Trees and bushes	2	0.2		
Tourism Suitability Index (TSI)			2.75						2.9						3						2.9	
Category			VA						VA						VA						VA	

Table 9: Tourism Suitability Index (TSI) for fishing

Ref.	Parameters	Location and Scores																							
		V		Spot 1		Spot 2		Spot 3		Spot 6		Spot 8		S		N									
		a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c			
1	Fish abundance	0.600	Little	1	0.6	Little	1	0.6	Little	1	0.6	Little	1	0.6	Little	1	0.6	Little	1	0.6	Little	1	0.6		
2	Types of fish (species)	0.300	>4	3	0.9	3	2	0.6	>4	3	0.9	3	2	0.6	4	3	0.9	3	2	0.6	4	3	0.9		
3	Water depth (m)	0.100	4	2	0.2	2	3	0.3	3-5	2	0.2	10	2	0.2	1-8	3	0.3	1-8	3	0.2	1-8	3	0.3		
Tourism Suitability Index (TSI)				1.7		CA		1.5		CA		1.7		CA		1.4		CA		1.8		CA			
Category				CA		CA		CA		CA		CA		CA		CA		CA		CA		CA			

Spot 4 (Sabeulit) is a small area close to the settlement areas with a perfect suitability score for boating activities, making it a great candidate to be developed as a tourist attraction. This area is only appropriate for boating tourism activities because of its small known water area (1.57 ha). There was a daily maximum of roughly 55 visitors permitted at this location to preserve its uniqueness and sustainability. Given that this study location had the smallest area of any other study location, its number was the lowest. Spot 5, Jemah Island, is surrounded by 96.26 ha of water area. This location only can accommodate boating activities for its water area. The analysis for its tourism carrying capacity shows a result of 3,370 visitors/day for boating activities.

Another small island in the Jatigede Reservoir is Spot 6, Buaya Island. During one operating day, the TCC result for this area is approximately 1,505 visitors. The boating capacity is 1,345 visitors/day while fishing is about 161 visitors/day. Spot 7 named Curug Mas is known as a local tourism destination in Jatigede Reservoir. The maximum number of visitors that this location can carry is about 2,515 visitors/day which is allocated for boating activities.

Last, but not least, Spot 8 was located in Cibunut. This location could accommodate the following activities: Fishing, which has a daily Tourism Carrying Capacity (TCC) of 132 visitors and boating, which can accommodate 916 visitors. Therefore, the area’s maximum capacity is roughly 1,048 visitors. This number is relatively low because it only covers a small portion of the area— roughly 30.50 ha.

Conclusions

Jatigede Reservoir has great potential for ecotourism development based on its water quality and fisheries resources. Generally speaking, the water quality of Jatigede Reservoir shows a suitable result for class II Indonesian water quality standard which can support recreation and fisheries activity, although several parameters do not match the required criteria

such as brightness, BOD, ammonia, and total phosphate at several study location. Fisheries resources found in Jatigede Reservoir consisted of fish and non-fish resources. The fish resources consisted of 17 species and eight families of fish while non-fish resources consisted of freshwater lobster, freshwater mussels, and rice snails.

The Tourism Suitability Index (TSI) result ranged between 1.4 and 3.0, which was categorised as “Conditional Appropriate” for the fishing category, and “Very Appropriate” for boating categories. The total Tourism Carrying Capacity (TCC) is about 13,813 visitors/day with details for each spot are 1,028 visitors for spot 1, 2,928 visitors for spot 2, 1,363 visitors for spot 3, 55 visitors for spot 4, 3,370 visitors for spot 5, 1,505 visitors for spot 6, 2,515 visitors for spot 7, and 1,048 visitors for spot 8.

Recommendations

The general recommendations for implementing Fisheries-based Ecotourism (FbE) in the Jatigede Reservoir include:

a. Management of Water Quality

Although the general water quality in the Jatigede Reservoir meets the criteria of the class II water standards according to the Indonesian Government regulation, several parameters including brightness, BOD, ammonia, and phosphate still need attention. It is advised that mitigation strategies, water quality monitoring, and the identification of pollution sources be considered.

b. Fisheries Resources Enhancement

To apply the Fisheries-based Ecotourism (FbE) concept, the primary ecological issue in the Jatigede Reservoir is the notable decline in its fishery resources. Researching the root cause of the issue, developing a program for biodiversity management, and restocking are several recommended strategies to lessen it.

c. Ecotourism Management Initiatives

From a tourism perspective, the primary tactics that can assist in the implementation

of Fisheries-based Ecotourism in Jatigede Reservoir are ecotourism management initiatives. There are various suggested measures to consider such as the creation of infrastructure, visitor management, and spot-specific development plans (zoning).

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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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