Singapore Journal of Tropical Geography

doi:10.1111/sjtg.70015

Local preferences and factors determining priorities for mangrove ecosystem services provided by the Sembilang National Park, Indonesia

Fitri Agustriani,[1,2] Iskhaq Iskandar,[3] Muhammad Yazid[4] and Fauziyah[2]

[1]Doctoral Study Program of Environmental Sciences, Sriwijaya University, Palembang, South Sumatera, Indonesia
[2]Department of Marine Science, Faculty of Mathematics and Natural Sciences, Sriwijaya University, Indralaya, Ogan Ilir, South Sumatra, Indonesia
[3]Department of Physics, Faculty of Mathematics and Natural Sciences, Sriwijaya University, Indralaya, Ogan Ilir, South Sumatra, Indonesia
[4]Department of Agribusiness, Faculty of Agriculture, Sriwijaya University, Indralaya, Ogan Ilir, South Sumatra, Indonesia

Correspondence: Fauziyah (email: fauziyah@unsri.ac.id)

Effective policymaking for mangrove conservation requires a clear understanding of the value that local communities attribute to mangrove ecosystems as well as their impact on community livelihoods and overall well-being. This study aims to (i) explore local perceptions regarding the mangroves in Sembilang National Park (SNP) and (ii) examine the factors influencing those perceptions. Drawing on a Mangrove Ecosystems Services (MES) approach, survey fieldwork was conducted in three coastal communities within and around SNP. A total of six services were identified by respondents as very important for material well-being and livelihoods, including habitat for fish, biodiversity, mangrove supporting services, fisheries and coastal protection (provisioning services), and cultural services. Furthermore, multinomial logistic regression results showed that the socio-demographic attributes of the respondents, including age, education, household size, experience, occupation, and income, significantly influenced preferences for MES. This indicates the importance of considering such factors in mangrove ecosystem management strategies. A clearer understanding of locally recognized and appreciated MES, is essential for effective community-based mangrove management. Conversely, underappreciated services require greater attention to ensure sustainable utilization. These preferences are context-specific and may vary depending on the community's socio-economic and cultural conditions. In conclusion, the results provide an initial framework for integrating local perceptions into policy and management initiatives, with specific focus on sustainable management of MES at the community level.

Keywords: fish habitat services, importance level, perception, socio-demographic factors, supporting services

Accepted: 25 March 2025

Introduction

Mangrove ecosystems play a crucial role in providing valuable services with significant ecological and economic contributions globally. The benefits provided include important provisioning, regulating, cultural, and supporting services for millions of people living along the shore in tropical and subtropical latitudes worldwide (Polidoro *et al.*, 2010; Atkinson *et al.*, 2016). Mangrove ecosystem services (MES) are also available at the Sembilang National Park (SNP) located in South Sumatra, Indonesia. A previous study by Agustriani *et al.* (2023) identified 19 MES in this area, categorized into supporting, provisioning, regulating, and cultural services based on the Millennium

Ecosystem Assessment (MEA) framework. Several studies (Mukherjee *et al.*, 2014; Himes-Cornell *et al.*, 2018) have shown that MES are important for sustaining people's livelihoods and well-being, including coastal communities in developing countries (Espinoza *et al.*, 2018; Sannigrahi *et al.*, 2020). Accordingly, assessing MES to capture community preferences and priorities regarding the benefits of mangroves are crucial for informing and guiding policy decisions (Rivera-Monroy *et al.*, 2017). Nyangoko *et al.* (2022) mentioned that exploring preferences is important in elaborating and integrating benefits and priorities into decision-making processes for mangrove conservation.

Although local communities have well-identified the benefits of MES, mangroves remain under the threat of degradation and loss as they struggle to support the massive demands of community livelihoods and overall well-being (Islam *et al.*, 2018; Nyangoko *et al.*, 2020). Such degradation stems from land conversion to agriculture and aquaculture, infrastructure development, overharvesting, pollution, and anthropogenic climate change (UNEP, 2014; Islam *et al.*, 2018). Recently, mangroves in SNP have also been threatened by anthropogenic pressures including land conversion for coconut and oil palm plantations, agricultural land, ponds, ports, and settlements, illegal logging, and forest fires, which have a significant impact on degradation. These issues are consistent with previous studies (Eddy *et al.*, 2017, 2021) and SNP management strategic issues listed in the 'Long-Term Management Plan for Sembilang National Park 2020-2029' document (BSNPA, 2020). The management capacity of the SNP area is also weak due to limited staffing and logistical constraints. Moreover, the management centre (Berbak Sembilang National Park Agency or BSNPA) is not located in South Sumatra Province, where the park is situated, but rather in Jambi Province, which further hampers effective coordination and site-level management. Conflicts with local community practices also occur due to differing objectives and management approaches (Ratmoko *et al.*, 2021; Febrianto *et al.*, 2022). In other words, the local community's dependence on mangrove resources for livelihoods often clashes with park conservation-focused policies. This indicates the need to engage the local community for sustainable management plans and policies. In this context, the sustainability concept is based on the residents' perspectives (Al-Assaf *et al.*, 2014), where mutually beneficial relationships between interests and different MES should be guaranteed in management planning and development. However, there is a lack of information regarding the local community's preference towards MES in this Park.

Among different people/social groups, there are possible differences regarding the perceived benefits of certain services (Costanza *et al.*, 2017; Fedele *et al.*, 2017; Nyangoko *et al.*, 2020). Perceptions toward preferences/priorities in MES are context-specific and depend on the socio-economic identities of the community, geographical settings, and local management institutions (Costanza *et al.*, 2017; Owuor *et al.*, 2017). Therefore, it is crucial to explore the relationship between the socio-economic characteristics of the local community and preferences for MES.

Capturing the preferences of local communities for MES can help policymakers recognize the impacts of losses and benefits resulting from changes in the ecosystem and/or management. Lau *et al.* (2019) mentioned that this knowledge is essential for making brief and equitable decisions without harming society. Therefore, this study aims to explore local perceptions regarding the importance of MES in SNP and the factors affecting those perceptions. The results are expected to provide insights into the perceptions of MES complexities in developing coastal areas in SNP and surrounding regions.

Material and methods

Study sites

The fieldwork was conducted in three coastal communities within SNP and its surroundings (see Figure 1) namely, Sembilang Hamlet, Sungsung IV Village, and Terusan Dalam Hamlet. These sites were selected based on accessibility and the presence of residents around the mangrove ecosystem. Administratively, these sites are located in the Banyuasin II Subdistrict, Banyuasin Regency of South Sumatra Province (Indonesia), approximately 105 km from Palembang City. Sembilang Hamlet is located in the administrative area of Sungsung IV Village, while Terusan Dalam is a hamlet located in Tanah Dalam Village. According to BSNPA (2020), the total population in the Terusan Dalam Hamlet comprised 18 households, the majority of whom were Bugis and whose livelihoods consisted of fishing, swiftlet farming, and marine product distribution. Meanwhile, the population in the Sungsang Hamlet comprised approximately 650 households. Their livelihoods included fishing, trading (entrepreneurship), marine product distribution, and labour. The population in Sungsung IV Village (not including Sembilang hamlet) was estimated at 821 households, with fishing as the main livelihood.

In South Sumatra Province, mangrove forests are primarily found along the eastern coast of Banyuasin and Ogan Komering Ilir regencies, particularly within SNP and protected forest areas. SNP covers approximately 88 555.56 ha of intact mangrove forest, extending landward up to 35 km, making it the largest mangrove area in western Indonesia (BSNPA, 2020). Mangroves constitute the dominant wetland ecosystem in this park, accompanied by shrub vegetation, with *Acrostichum sp.*, *Phragmites karka*, and *Cyperus esculentus* being the dominant species. Meanwhile, a designated dryland area

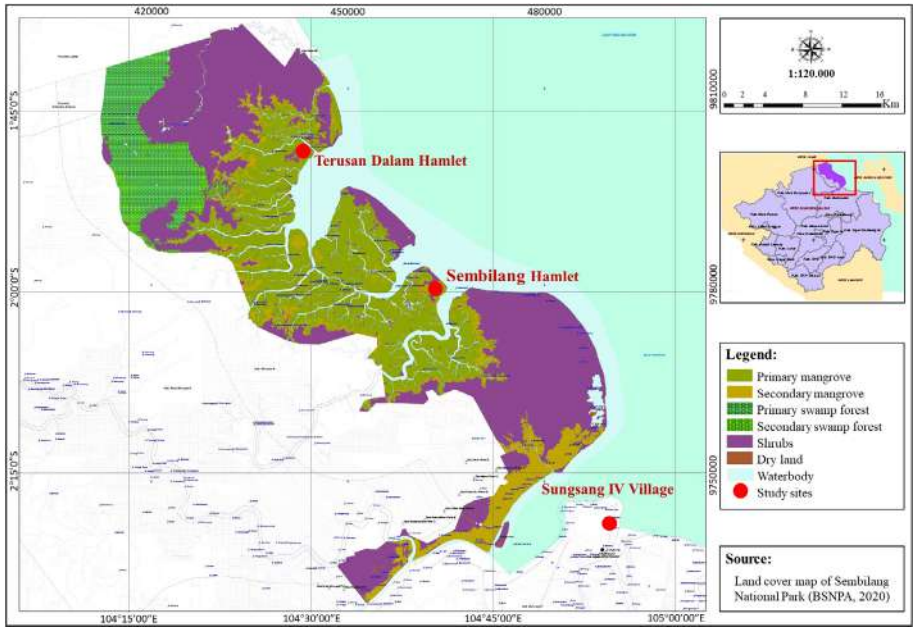

Figure 1. *Map of the study area in Banyuasin II District, Banyuasin Regency, South Sumatra, Indonesia.* *Source*: Adapted from BSNPA (2020).

within the park has been allocated for the establishment of a Mangrove Research Center (BSNPA, 2020).

According to BSNPA (2020), SNP harbours 49 mangrove species, including both true and associated species. Among these, *Sonneratia alba* and *Avicennia marina* are commonly found along the coastline, while *Rhizophora mucronata, R. apiculata, Bruguiera gymnorhiza*, and *Xylocarpus granatum* thrive further inland in low-salinity soils. The mangrove and tidal flat ecosystem in SNP serve as critical habitats for thousands of migratory birds and vital nursery grounds for fish populations. Additionally, the waters surrounding the park support several protected marine species, including the Irrawaddy dolphin (*Orcaella brevirostris*) and three Asian horseshoe crab species namely *Tachypleus tridentatus, T. gigas*, and *Carcinoscorpius rotundicauda* (Fauziyah *et al.*, 2019a, 2019b, 2021, 2022; Sari *et al.*, 2020; Fatimah *et al.*, 2023).

Despite being managed and protected by the Berbak Sembilang National Park Agency (BSNPA), these mangrove forests remain under the threat of degradation. The inadequate number of officers at the SNP site leads to weakened management capacities and limited interactions with the local community. The serious threat encountered in the management of mangrove ecosystem is rapid mangrove degradation due to human activities. During 2000–2015, mangrove areas within the SNP, especially those located in swamp forest zones, were converted for aquaculture (shrimp pond), farming and plantation activities (SSPFO, 2017). Moreover, the construction of an international port in Tanjung Api-Api directly impacted this mangrove ecosystem which had significant ecological value for the local fisheries community. Despite these activities, SSPFO (2017) claimed the mangrove change was not significant, where only a small part of the area was converted into aquaculture and farming. Febrianto *et al.* (2022) mentioned that the decline in mangrove areas during 2014–2017 reached 4.5 per cent. The use of less eco-friendly fishing gear also increases direct pressure on the SNP area. Given these challenges, efforts to foster better understanding of community awareness, preferences, and priorities for MES are essential. In the next section, this study investigates whether differences in socio-economic characteristics influence community perceptions towards the importance of MES.

Sampling

Sampling was conducted from October to November 2022 in three sites within SNP and surroundings. Stratified random sampling was performed by dividing the population into strata or smaller homogeneous groups based on residences that were close to the SNP area and characteristics of respondents. The sampling was also conducted at the level of households, village officials, and SNP managers. On the other hand, the surveyed sites were also selected based on accessibility, resident presence, and mangrove forest cover.

The survey sampling was conducted by trained enumerators under the close supervision of the research team to ensure accurate and complete data collection. Well-trained enumerators are essential for minimizing potential biases in the responses of respondents. To calculate the minimum sample size, an acceptable margin of error was set at 10 per cent with a 95 per cent confidence level. The population of each site refers to the long-term management plan for SNP spanning 2020–2029. The total population of the three sites surveyed was 1489 households, as shown in Table 1. The minimum sample size for all sites was 186 respondents adjusted to 235 to enhance reliability. The calculation was carried out using Cochran's formula modified by Bartlett *et al.*, (2001), as follows:

Table 1. Household population, and minimum sample size for study sites representative of the coastal community living inside and outside the SNP area.

Survey sites	Household Population [1]	Minimum Sample size [2]	Adjusted Sample Size [3]
Sungsang IV Village	821*	86	111
Sembilang Hamlet	650	84	104
Terusan Dalam Hamlet	20	17	20
Total	1489	186	235

Source: Compiled by the authors from various sources. *Note*: [1]Data obtained from BSNP (2020);[2]calculated using Cochran's formula as modified by Bartlett *et al*. (2001).[3]A larger sample size than the minimum sample was used to enhance reliability; *calculated without Sembilang Hamlet.

$$n = \frac{n_0}{\left(1 + \frac{n_0}{N}\right)} \tag{1}$$

$$n_0 = \frac{z^2(p(1-p))}{e^2} \tag{2}$$

where z is the critical value of the selected confidence level (the critical value for the 95 per cent confidence level was 1.96), N is the population's size, e is the acceptable margin of error (10 per cent), and p is the estimated proportion of attributes available in the population (in this context, this proportion was set at 0.5).

Data collection

Both primary and secondary data were collected for this study (Figure 2). The secondary data were obtained from related documents such as population data from the study sites, official reports, and published scientific studies, while the primary data were collected through surveys. During the survey, data were collected through household questionnaires, key respondent interviews, and field observations. In Nyangoko *et al*., (2022) a combination of these methods were performed to validate collected information.

In Zhang *et al*. (2016), key respondents were selected based on their knowledge of the local environment and its history. In this context, 11 key respondents were engaged, including the SNP manager (two persons), the village head of Sungsang IV (one person), and several influential figures in society (eight persons). The village head of Sungsang IV was selected due to their leadership role and influence in guiding community initiatives and providing insights into local issues. An influential figure in society refers to a person whose opinions are widely respected or who plays a key role in decision-making and community affairs, contributing to a better understanding of the broader socio-cultural context, particularly knowledge of the local history and environment. Furthermore, a checklist (see Appendix S1) was prepared and used during the interview process. Before starting on the detailed interviews, the key respondents were requested to share their opinions on the significant socio-economic activities of people living close to mangroves. The respondents were also asked to narrate the various benefits provided by mangroves, and how the benefits influenced livelihoods and overall well-being of the community. Subsequently, an in-depth interview was also conducted to facilitate further discussion and brainstorming on the 19 MES issues adopted from Agustriani *et al*. (2023) and their relevance to the local community. Agreement on each discussion subject was crucial to developing a deeper knowledge of the perceived benefits of MES in the study area.

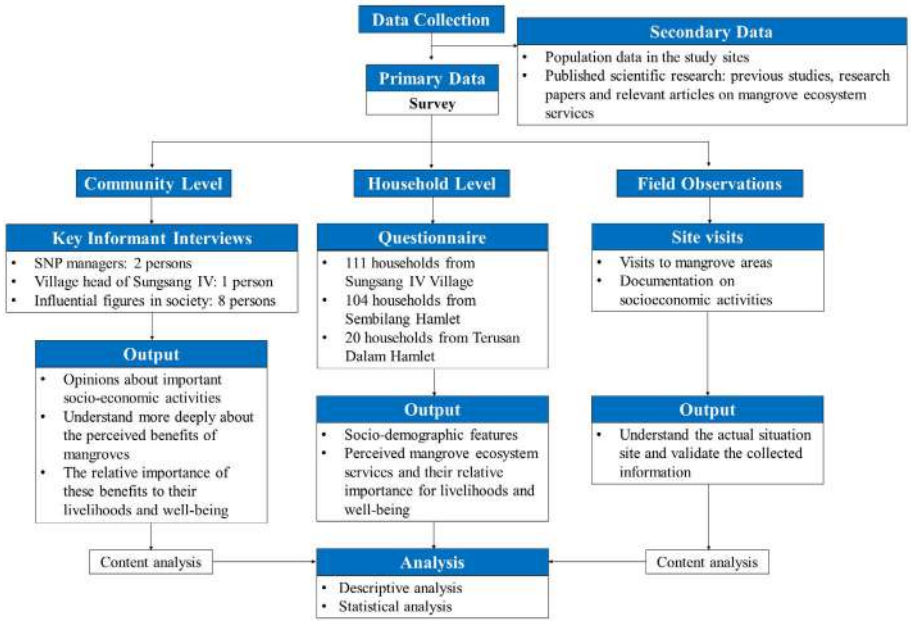

Figure 2. *Diagram illustrating the methodological scheme used for collecting and analysing data.* *Source*: **Adapted from Nyangoko *et al.* (2020).**

The household questionnaire was divided into two sections containing closed and open-ended questions. In this context, closed-ended questions required respondents to choose a predetermined answer, such as 'yes/no' or multiple choice answers. Meanwhile, open-ended questions allowed respondents to answer in open-text format according to feelings, knowledge, and understanding (Semyonov-Tal & Lewin-Epstein, 2021; Baburajan *et al.*, 2022; Hadler, 2023). The first section used open-ended questions to collect the socio-demographic characteristics of respondents including age, education level, household size, main occupation, experience, and monthly main income. The second section used closed-ended questions to compile information regarding perceptions of MES and their relative importance to the respondents' livelihoods and overall well-being. Referring to Agustriani *et al.* (2023), the 19 MES adopted in this questionnaire were grouped into four service categories namely provisioning, regulating, supporting, and cultural. Provisioning services include fisheries, timber, firewood, construction materials, food, medicine, honey, and cosmetics while regulating services comprise of coastal protection, neutralizing waste, carbon sequestration, erosion protection, and sedimentation control. Supporting services include habitat for fish, fish biodiversity, and mangrove biodiversity. Finally, cultural services include education and research, ecotourism, and spiritual amenities.

Respondents were randomly selected, but only those with sufficient knowledge and information about the mangrove ecosystem in their neighbourhood were included to minimize information bias. In this context, village leaders helped in selecting respondents who had relevant experience and knowledge concerning the study subject. Face-to-face interviews were performed and a survey questionnaire (see Appendix S2), was provided in the native language for easy understanding. Before responding to the actual survey, a few respondents were initially surveyed to ensure

that the questionnaire was appropriate and understandable. During the actual survey, respondents were asked for information regarding socio-demographic characteristics, the benefits of MES, and the importance of one's livelihood and well-being. The 19 MES in this questionnaire have been validated at the community level during interviews with key respondents. However, before valuing the benefits and relevance of the MES for livelihoods and well-being, the respondents were encouraged to explore and acknowledge the existence of the 19 MES. The specific definition of 'importance' was left to be interpreted freely to capture how respondents valued MES (Díaz *et al.*, 2018). Ranking was performed on a Likert scale, divided into four categories, namely 1 = not important, 2 = slightly important, 3 = important, and 4 = very important (Ruiz-frau *et al.*, 2013; Nyangoko *et al.*, 2020). These categories were used to prevent central tendency bias, ensuring that the tendency to choose the middle (neutral) option was avoided (Douven, 2018; Kusmaryono *et al.*, 2022).

For field observations, incidental physical observations on both mangrove areas and socio-economic activities of the coastal community were conducted to understand the actual situation of the study site and to validate collected data (Nyangoko *et al.*, 2020). Specifically, these observations were conducted three times on fishermen's activities, mangrove conditions, and community socio-economic activities.

Statistical analysis

The collected data were analysed using the XLSTAT version 2022 (Addinsoft, 2022) and SPSS software version 21 (IBM, 2012). Data obtained from interviews and direct observation was analysed using content analysis, a method used for observational and narrative data (non-numerical data).

The biplot of Principal Component Analysis (PCA) was used to depict correlations between MES and socio-demographic attributes. On the other hand, a multinomial logistic regression was used to determine factors that affected the respondents' perceptions toward the identified MES. The rationale for selecting six independent variables of respondent characteristics including age, education level, household size, main occupation, experience, and monthly main income in the model was justified by three main arguments. The arguments are as follows: (1) communities are formed from various social groups, (2) the socio-economic backgrounds of residents are closely linked to the valuation of specific MES, and (3) the selected variables represent key characteristics of the studied sites. This rationale ensured that selected respondent characteristics were based on thorough local context analysis that captured socio-economic variety, including management practices affecting perceptions of the benefits provided by mangroves (Nyangoko *et al.*, 2020; Ke *et al.*, 2022; Hamza *et al.*, 2023). Multinomial logistic regression was selected because the dependent variable had more than two nominal or ordinal categorical variables (Hamid *et al.*, 2017, 2018; Rasheed, 2021).

Results

Socio-economic activities and the respondent characteristics

The local community of the studied sites was dominated by fishermen relying on various services provided by mangroves (Table 2). Based on the results, the socio-economic conditions of Sungsang IV Village were comparatively better than those of Terusan Dalam and Sembilang Hamlet. The 19 MES were recognized as being within the SNP area.

Table 2. Summary of socio-economic conditions in the study sites obtained from key respondent interviews and incidental physical observations.

Variables	Information obtained
1. The primary socio-economic activities	• Fishing is the main livelihood for the majority of residents in the three study locations, followed by marine product distribution, trading (entrepreneurship), and labour. • Swiftlet farming is only found in the Terusan Dalam Hamlet.
2. The main source of lighting	• The primary source of lighting in Sungsang IV Village is provided by Indonesia's National Electricity Company (PLN), while in the other two study sites, lighting is generated through the use of diesel power plants (PLTD).
3. The main resource utilized for cooking fuel	• Almost all residents in Sungsang IV Village use LPG as cooking fuel. • Residents located within the SNP area (Sembilang and Terusan Dalam Hamlet) still rely on firewood alongside LPG as the preferred fuel for cooking.
4. The materials commonly used for home construction	• Wood, bricks/poles, cemented walls, and zinc sheet roofs are the characteristic construction materials in Sungsang IV Village. • Most residential buildings in Sembilang and Terusan Dalam Hamlet are constructed using wood and roofed zinc sheets.
5. Main religion	• Islam is the main religion of the local community.
6. Location of aquaculture pond	• Aquaculture ponds are only found in Sungsang IV Village and Sembilang Hamlet.
7. Nineteen MES were used in this study	• These MES are recognized as being within the SNP area, such as: • Fisheries services: providing fish, shrimp, crab and shellfish resources • Timber services: providing crucial materials for building houses and making furniture, fences, and boats • Material construction services: providing material for poles and roofing houses • Food services: Nipah fruit is used for food • Medicinal services: mangroves are used to treat wounds (*Avicennia* sp and *Rhizophora* sp) and diarrhoea (*Ceriops tagal*) • Honey is useful for increasing endurance and as an alternative livelihood, although not yet widely exploited by local community • Cosmetic services: fruit seeds of Nipah (*Xylocarpus granatum Koening*) are sometimes used by fishermen for sun protection

(Continues)

Table 2. Continued

Variables	Information obtained
	• Coastal protection services: mangroves stabilize coastlines • Neutralizing waste services: mangroves as waste absorbers • Carbon sequestration services: mangroves play a key role in carbon storage, providing cooling effects through shade, light breezes, and temperature regulation in hot climates, which in turn can influence local rainfall patterns • Erosion protection services: floods, water flows, and tides are linked to the sediments that accumulate within mangroves and regulate the supply of both organic and inorganic sediments • Fish habitat services: mangroves support habitat for various types of fish, shrimp, crabs and mollusks • Fish biodiversity services: mangroves maintain the diversity of fish resources • Mangrove biodiversity services: mangroves maintain the diversity of mangrove resources • Education and research services: mangroves are useful as a source of knowledge and information • Ecotourism services: people visit the mangroves to see wildlife and migratory birds • Spiritual amenities services: mangroves offer a location for rituals when fishermen's catches are abundant

Source: Field survey, 2022.

The respondents' characteristics and preferences for MES are presented in the cross-tabulation data in Table 3, while preferences for each MES category are shown in Table 3. Among the respondents, 30.64 per cent were 'over 45 years old' with the majority ranking MES as 'very important' (14.04 per cent). This age group, along with others, showed a strong preference for supporting services, as detailed in Appendix S3. The 'very important' category was selected the most (43.4 per cent), followed by 'important' (28.94 per cent), and 'slightly important' (25.53 per cent). Only 2.13 per cent of respondents rated MES as 'not important', indicating low awareness. In general, respondents from all age groups considered MES to be 'very important' and preferred supporting services the most.

In terms of education, most respondents (40.85 per cent) had attained primary school level education. Among these respondents, a significant proportion (17.45 per cent) placed overall MES in the 'very important' category (Table 3). This was the highest percentage recorded as compared to values recorded from other groups that had different preference categories. Similarly, most respondents from the 'no education' and 'secondary school' groups viewed MES to be 'very important'. Contrastingly, respondents with senior high school education and above classified MES as 'important'

Table 3. Percentage/number distribution in the importance level of overall mangrove ecosystem services in Sembilang National Park based on respondents' characteristics and attributes (N = 235).

No	Respondents' Characteristics	Percentage distribution (%) of respondents' preferences				Overall
		1	2	3	4	
1.	Age					
	a. ≤ 25	1 (0.43)	11 (4.68)	9 (3.83)	15 (6.38)	36 (15.32)
	b. 26-35	3 (1.28)	10 (4.26)	23 (9.79)	29 (12.34)	65 (27.66)
	c. 36-45		17 (7.23)	20 (8.51)	25 (10.64)	62 (26.38)
	d. > 45	1 (0.43)	22 (9.36)	16 (6.81)	33 (14.04)	72 (30.64)
	Subtotal	5 (2.13)	60 (25.53)	68 (28.94)	102 (43.4)	235 (100)
2.	Education Level					
	a. No education	3 (1.28)	29 (12.34)	9 (3.83)	34 (14.47)	75 (31.91)
	b. Primary School	1 (0.43)	25 (10.64)	29 (12.34)	41 (17.45)	96 (40.85)
	c. Secondary School	1 (0.43)	4 (1.70)	6 (2.55)	9 (3.83)	20 (8.51)
	d. Senior High School		2 (0.85)	14 (5.96)	12 (5.11)	28 (11.91)
	e. College/university			10 (4.26)	6 (2.55)	16 (6.81)
	Subtotal	5 (2.13)	60 (25.53)	68 (28.94)	102 (43.4)	235 (100)
3.	Household size					
	a. < 4	4 (1.70)	20 (8.51)	20 (8.51)	36 (15.32)	80 (34.04)
	b. 4-6	1 (0.43)	27 (11.49)	44 (18.72)	53 (22.55)	125 (53.19)
	c. 7-9		10 (4.26)	4 (1.70)	13 (5.53)	27 (11.49)
	d. > 9		3 (1.28)			3 (1.28)
	Subtotal	5 (2.13)	60 (25.53)	68 (28.94)	102 (43.4)	235 (100)
4.	Main occupation					
	a. Fishermen	4 (1.70)	47 (20.00)	30 (12.77)	68 (28.94)	149 (63.40)
	b. Trader		9 (3.83)	12 (5.11)	17 (7.23)	38 (16.17)
	c. Government Office			8 (3.40)	3 (1.28)	11 (4.68)
	d. Teacher		1 (0.43)	7 (2.98)	3 (1.28)	11 (4.68)
	e. Others*	1 (0.43)	3 (1.28)	11 (4.68)	11 (4.68)	26 (11.06)
	Subtotal	5 (2.13)	60 (25.53)	68 (28.94)	102 (43.4)	235 (100)
5.	Experience (years)					
	a. < 10	1 (0.43)	18 (7.66)	34 (14.47)	33 (14.04)	86 (36.60)
	b. 10 - 20	3 (1.28)	25 (10.64)	21 (8.94)	30 (12.77)	79 (33.62)
	c. 21 - 30	1 (0.43)	13 (5.53)	7 (2.98)	24 (10.21)	45 (19.15)
	d. 31 - 40		4 (1.70)	5 (2.13)	11 (4.68)	20 (8.51)
	e. > 40			1 (0.43)	4 (1.70)	5 (2.13)
	Subtotal	5 (2.13)	60 (25.53)	68 (28.94)	102 (43.4)	235 (100)
6.	Monthly main income (IDR)					
	a. < 1 DMW	3 (1.28)	21 (8.94)	24 (10.21)	25 (10.64)	73 (31.06)
	b. 1-2 DMW	2 (0.85)	9 (3.83)	26 (11.06)	30 (12.77)	67 (28.51)
	c. 2-3 DMW		10 (4.26)	7 (2.98)	25 (10.64)	42 (17.87)
	d. 3-4 DMW		3 (1.28)	3 (1.28)	5 (2.13)	11 (4.68)
	e. > 4 DMW		5 (7.23)	8 (3.40)	17 (7.23)	42 (17.87)
	Subtotal	5 (2.13)	60 (25.53)	68 (28.94)	102 (43.4)	235 (100)

Source: Field survey, 2022. *Note*: * = fishermen's wives, construction workers, pedicab drivers, midwives, barbers, electric technicians, warehouse guards, mechanics, marine and air police; DMW = District's Minimum Wage for Banyuasin (IDR 3,433,489.76); 1 = not important, 2 = slightly important, 3 = important, and 4 = very important.

only. Most of the respondents in this last group rated supporting services to be 'very important' (Appendix S3).

In terms of household size, more than half of the respondents (53.19 per cent) had four to six family members. Among this group of respondents, the majority (22.55 per cent) placed MES in the 'very important' category. This was also the highest percentage recorded as compared to other groups with different preference categories. For household size groups with nine and below members, a significant proportion perceived

overall MES to be 'very important' (Table 3), especially supporting services (Appendix S3). In contrast, household size groups with over nine members perceived MES to be only 'slightly important'.

The main occupation of most respondents was fishing (63.40 per cent). Among these respondents, the majority (28.94 per cent) regarded MES as 'very important' (Table 3). Compared to other occupation categories, this group recorded the highest percentage in the 'very important' category. Similarly, a larger proportion of traders identified all MES to be 'very important'. Government officers and teacher groups ranked all MES as 'important'. Furthermore, most of the fishermen (115 of 149 responses) also identified supporting services as 'very important' (Table 4). All occupation groups also expressed the same preferences, stating that supporting services were the most important.

With regards to experience, most respondents (36.60 per cent) had experience below 10 years and predominantly classified MES as 'important' (Table 3). In comparison, respondents who had 10–20 years of experience (33.62 per cent) mostly categorized MES as 'very important'. Respondents with over 10 years of experience showed a similar pattern in their MES preferences/perceptions, while a different pattern was observed among those who had below 10 years of experience. Referring to Appendix S3, each experience group expressed that supporting services were most important.

In terms of monthly main income, most of the respondents (31.06 per cent) had income below the District's Minimum Wage (DMW) for Banyuasin (IDR 3 433 489.76). Within this group, most respondents classified MES as 'very important' (Table 3). Similarly, the majority of respondents earning 1–2 times the DMW (28.51 per cent) classified MES as 'very important'. Most of the respondents (regardless of whether their monthly income was below or above the DMW) classified MES as 'very important'. Referring to Appendix S3, each income group also regarded supporting services as the most important MES.

In general, respondents expressed different importance levels for each MES. The majority stated that all MES were 'very important' (43.40 per cent), followed by 'important' (28.94 per cent), 'slightly important' (25.53 per cent), and 'not important' (2.13 per cent). Supporting services were the most frequently selected MES in both 'important' and 'very important' categories, accounting for 97.4 per cent of overall respondents, followed by regulating services (70.2 per cent), cultural services (67.7 per cent), and supporting services (55.7 per cent). These differences are consistent with the variation in the socio-demographic characteristics of the respondents.

In this study, 19 MES and their importance were identified as shown in Figure 3. Among the 'very important' service categories, fish biodiversity (3.85) had the highest average score obtained from respondents in Terusan Dalam Hamlet. Meanwhile, habitat for fish had the highest score in Sembilang and Sungsang IV Village, with average scores of 3.84 and 3.65 respectively. Honey was among the provisioning services included in the 'slightly important' category.

In general, the results showed that habitat for fish, fish biodiversity, fisheries, mangrove biodiversity, as well as education and research services were perceived as highly important MES for the local community's livelihoods, although preferences differed between the surveyed sites. For example, respondents from Sungsang IV Village only ranked habitat for fish, fish biodiversity, fisheries, education and research, and mangrove biodiversity as the most important services. In addition to these five services, respondents from Sembilang Hamlet revealed coastal protection as the most important service. Meanwhile, most of the respondents from Terusan Dalam Hamlet ranked nine services as 'very important'. These include fish biodiversity, habitat for fish, coastal

Table 4. The multinomial logistic regression for respondents' perceptions towards the identified mangrove ecosystem services in Sembilang National Park, South Sumatra, Indonesia.

Variables and Statistics test	Coefficient (β) and Likelihood Ratio Tests (sig.) by MES categories									
	Provisioning		Regulating		Supporting		Cultural		Overall	
	β	Sig.	β	Sig.	β	Sig.	β	Sig.	β	Sig.
A. Independent variables										
Intercept	-3.22*	0.046	376.04*	<0.001	-16.23	0.111	135.08*	0.001	130.26	0.845
Age	-2.25*	<0.001	12.36*	0.002	-2.03	0.439	13.08	0.880	10.3*	0.018
Education	0.522	0.481	35.81*	0.001	-0.12*	0.009	7.84*	<0.001	75.41*	<0.001
Household	-2.76*	0.003	-49.73*	<0.001	-5.12*	<0.001	-32.96*	<0.001	-22.02*	<0.001
Occupation	-0.729	0.068	-48.80*	0.002	-1.25*	0.013	-28.07*	0.004	-48.36*	0.025
Experience	7.85*	<0.001	12.50	0.410	19.81*	<0.001	24.2*	<0.001	19.81*	<0.001
Income	1.18*	0.003	-24.13*	<0.001	18.99*	0.001	4.95*	0.047	9.47*	0.014
B. Statistics test										
Model fitting (sig.)	<0.001		<0.001		<0.001		<0.001		<0.001	
Goodness-of-Fit (sig.)	1.00		1.00		1.00		1.00		1.00	
Pseudo R^2	62.6		61.8		68.7		61.8		62.2	

Source: Produced by authors. *Note*: Significant differences were observed at p-value <0.05. The Goodness-of-Fit is based on the Pearson chi-square statistic. This summary only presents the coefficients for the 'very important' preference model, with the 'not important' rating levels as the reference category.

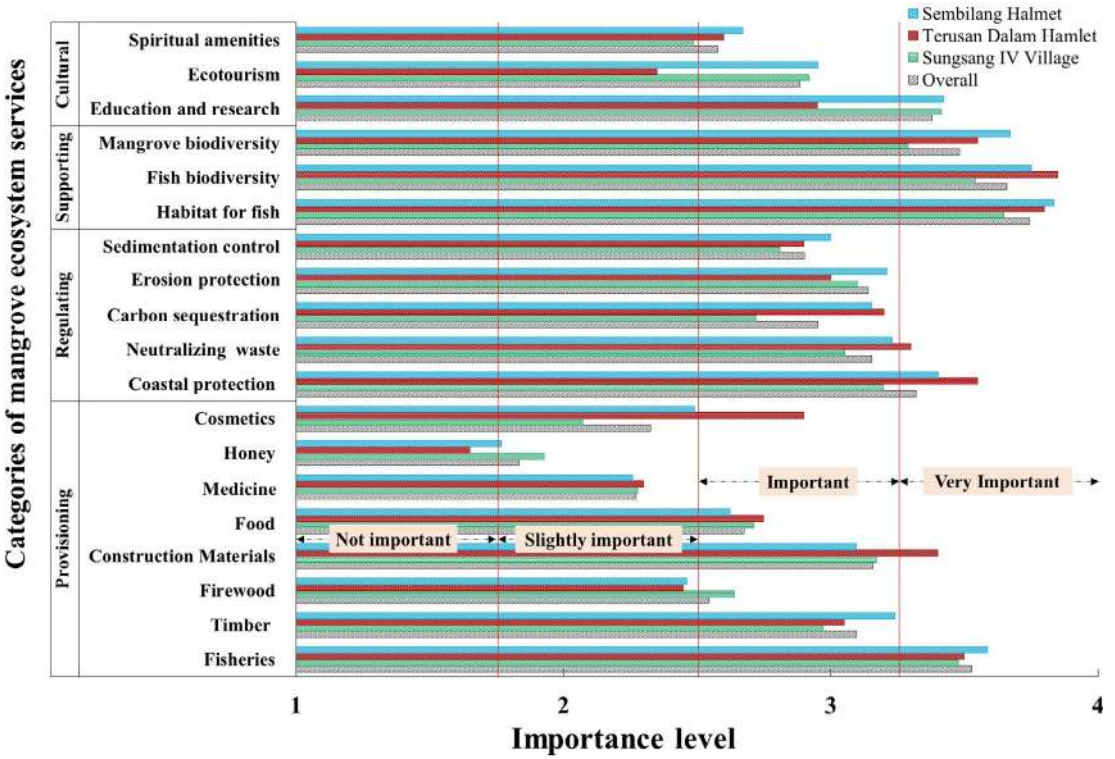

Figure 3. *Variations in the mean rating values for each identified mangrove ecosystem service across different locations.*
Source: Produced by authors.
Note: The ratings (1–4) represent the perceived importance levels assigned by individual respondents, where 1 = not important and 4 = very important. The average rating values are categorized into four importance levels: not important (1.00–1.75), slightly important (1.76–2.50), important (2.51–3.25), and very important (3.26–4.00).

protection, mangrove biodiversity, fisheries, construction materials, neutralizing waste, and carbon sequestration.

Supporting services including fish habitat, fish biodiversity, and mangrove biodiversity were ranked 'very important' by most of the respondents in each study site. On the contrary, provisioning services were ranked at the lowest level of importance despite these services being classified in the 'important' services category. Cultural and regulating services were also ranked as 'important'.

The PCA biplot (Figure 4) explained 58.77 per cent of the total variation, with F1 (34.79 per cent) primarily capturing the variation in the MES categories and F2 (23.97 per cent) reflecting respondent characteristics. The MES categories, including provisioning, regulating, supporting, cultural, and overall services categories were positively associated with F1. Respondent characteristics including age, income, experience, occupation, education, and household size showed inverse relationships with F1 but positive associations with F2. In general, MES were strongly correlated with experience, age, and education, and negatively correlated with household size and occupation. Provisioning services were linked to experience, age, income, and education. Regulating and cultural services were positively associated with education and age but inversely related to household size, income, and occupation.

Socio-demographic factors influencing MES perceptions

The multinomial logistic regression model was employed to determine the influence of socio-demographic attributes on the level of importance respondents' placed on MES,

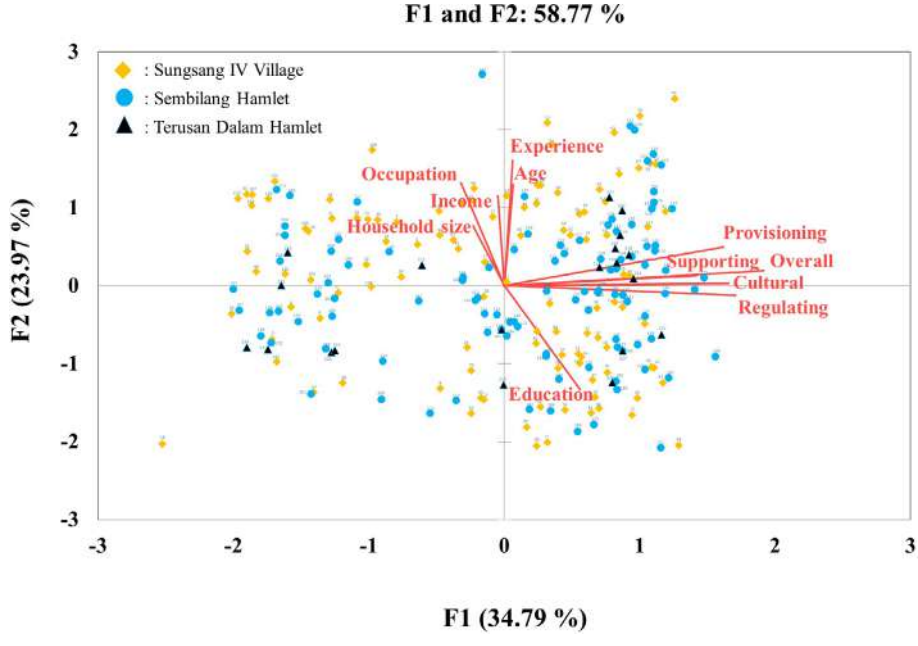

Figure 4. *PCA biplot showing the correlation between socio-demographic attributes and the perceived importance of mangrove ecosystem services in Sembilang National Park, South Sumatra, Indonesia*.
Source: Generated by authors based on field survey data.
Note: The arrow's length represents the variance of the attributes, while the angles between them indicate their correlations.

as shown in Table 4. Regarding the fitted model information, the Likelihood ratio test yielded a small p-value ($p < 0.001$), indicating a good model fit. Meanwhile, the Chi-Square Goodness-of-Fit tests (p-value >0.05) indicated that all models adequately fitted the data. Pseudo R^2 (Nagelkerke's R^2) values were greater than 60 per cent, indicating that more than 60 per cent of variations in the level of importance respondents' placed on MES could be explained by the full logistic model. In other words, the predictions proposed can be considered reliable.

The Likelihood Ratio Tests showed that age, education, household size, experience, occupation, and income influenced the perceived importance level of overall MES, although the results were distinct for each category. For example, the perceived importance level of cultural services was not influenced by age attributes, while provisioning services were affected by age attributes. Almost all respondent attributes influenced regulating services except for experience. The preferences for provisioning services were not significantly influenced by occupation type and level of education.

Discussion

This study explored how the local community ranked various MES categories in the SNP and the factors that influenced such preferences. Most respondents considered overall MES in this Park very important, with preferences varying across different categories. The highest priority was given to supporting services, which are crucial for livelihoods and the overall well-being of the community. Other services, including fisheries (provisioning service) and coastal protection (regulating service), were also perceived as highly important. Many of the 19 types of MES identified were provisioning services, which are highly valued by the local community due to their direct contribution to livelihoods (Owuor *et al.*, 2017). Among these, fisheries services were considered the most important, likely due to the high proportion of respondents engaged in fishing activities and dependence on fisheries resources. In contrast, the provision of honey and medicine, while important, were perceived to be less critical, as both products are not widely exploited by the coastal community at the study sites (Nyangoko *et al.*, 2022).

Despite having varying levels of importance, provisioning services were generally considered as very important by local community. This strong preference can be attributed to the direct benefits that supporting services, such as fish biodiversity and habitat, provide to the local population, particularly those engaged in fishing activities. Local fishermen, for instance, highly value mangroves as vital nurseries and feeding grounds for fish, which directly contribute to the sustainability of livelihoods. Observations confirmed that areas close to mangroves, such as mudflats, are prime fishing grounds, especially for traditional fishing methods. This underscores the integral role of mangrove ecosystems in enhancing fisheries yields.

Nyangoko *et al.* (2020) similarly emphasized the significance of these habitats in supporting local livelihoods. Carrasquilla-Henao *et al.* (2019) mentioned that mangroves provide essential habitats for fish populations, functioning as nurseries, reproduction, and food source areas, critical for local fisheries. However, the increasing use of destructive fishing gear and rising sea levels pose significant threats to these essential habitats, potentially diminishing their role in supporting fish populations (Yanda *et al.*, 2018). This disruption may force local communities to adopt alternative livelihoods, such as charcoal production or illegal logging, further worsening the degradation of mangrove ecosystems (Quinn *et al.*, 2017). Therefore, the value placed on

supporting services by local communities stem from direct and long-term benefits to fisheries, which are crucial for economic survival and community well-being.

In general, differences in perceptions of MES were influenced by the socio-demographic characteristics of the respondents such as age, education, household, occupation, experience, and income. These results are consistent with previous studies (Quevedo *et al.*, 2022) that outlined the role of respondents' profiles in determining their level of engagement with mangroves. Variation in preferences underscores the context-specific nature of these perceptions, with factors such as occupation and income influencing services considered most important (Nyangoko *et al.*, 2020). The results suggest that understanding local socio-demographic profiles can help tailor conservation strategies and interventions to the needs and values of different community groups.

The characteristics of respondents explained only about 60 per cent of the importance level of MES, indicating that around 40 per cent of external factors were not analysed in the regression model. These external factors could potentially influence the perceptions of the respondents. Factors such as access to local and regional markets likely play a role in shaping the perceptions. For example, market access often determines the economic benefits derived from mangrove resources. Therefore, communities with better market access may prioritize certain services, such as provisioning services, more than those with limited access. Alternative livelihoods, regional development initiatives, and national economic conditions may also affect how communities value and utilize MES. These factors, which were not directly explored, could provide further insights into the broader context of local perceptions of mangrove services.

Although this study is limited to examining the influence of respondents' characteristics on their MES preferences, recognizing broader economic and market contexts is essential for comprehensive understanding of dynamics. Future studies could integrate contextual factors to provide a more holistic view of the socio-economic influences on MES prioritization in SNP. This approach would help in designing more effective and context-sensitive conservation strategies consistent with both local livelihoods and national economic goals.

Finally, understanding the trends in the level of importance placed by communities towards MES in SNP and the factors influencing preferences is crucial for developing policies that match the needs of the local community. According to Gouwakinnou *et al.* (2019), enhancing synergies and minimizing trade-offs between ecosystem services requires a deep understanding of social values and integration into decision-making processes. This study underscores the need to consider local preferences when designing policies related to mangrove management. Policymakers and conservation practitioners can use these insights as baseline data to create policies that better reflect community priorities, ensuring both ecological sustainability and local livelihoods are addressed. By incorporating local knowledge and values into conservation planning, including prioritizing certain ecosystem services such as fisheries and coastal protection, policies will be more effective in fostering community engagement and achieving long-term conservation success.

Conclusion

In conclusion, MES provide many benefits to the local community in SNP by supporting their livelihoods and overall well-being. Based on the results, six services were rated as very important, including (1) habitat for fish, (2) fish biodiversity,

(3) mangrove biodiversity, (4) fisheries, (5) coastal protection, as well as (6) education and research. Supporting services were considered the most important for the community, followed by provisioning, regulating, and cultural services. This ranking emphasizes the need for targeted awareness campaigns to prevent over-exploitation and ensure sustainable use of these critical services. Furthermore, socio-demographic factors such as age, education, household size, occupation, experience, and income played a significant role in shaping community preferences for MES. Other external factors not analyzed in this study may also influence perceptions. The results provide valuable insights for policymakers to incorporate local preferences into the management and conservation of mangroves in SNP. In particular, management strategies should focus on balancing the preservation of highly valued services with sustainable resource use, ensuring that local perspectives on MES are central to conservation, restoration, and stakeholder engagement efforts. Future studies on MES are needed, especially in other areas where people depend on mangrove resources for livelihoods. Additional factors including biophysical, ecological, and economic indicators as well as the influence of local and regional market access on community perceptions should be further investigated. The outcome of such further investigations will help inform management practices in SNP and similar mangrove ecosystems.

Acknowledgements

The authors are grateful to the Public Service Agency of Universitas Sriwijaya [Grant SP DIPA-023.17.2.677515/2022 under the Rector's Decree Number: 0109/UN9.3.1/SK/2022 and SP DIPA-023.17.2.677515/2023 under the Rector's Decree Number: 0188/UN9.3.1/SK/2023] for the financial assistance provided. The authors are also grateful to the Interview Team for their assistance, as well as to the editor and reviewers for their valuable comments and suggestions to improve the manuscript.

References

Addinsoft (2022) XLSTAT 2022 [online] Addinsoft SARL Paris, France. Available at: https://cdn.xlstat.com/helpcentersfdc/XLSTAT_Help.pdf.

Agustriani F, Iskandar I, Yazid M, Fauziyah (2023) Economic valuation of mangrove ecosystem services in Sembilang National Park of South Sumatra, Indonesia. *Journal of Hunan University (Natural Sciences)* **50** (1), 156–66.

Al-Assaf A, Nawash O, Omari M (2014) Identifying forest ecosystem services through socio-ecological bundles: a case study from northern Jordan. *International Journal of Sustainable Development & World Ecology* **21** (4), 314–21.

Atkinson SC, Jupiter SD, Adams VM, Ingram JC, Narayan S, Klein CJ, Possingham HP (2016) Prioritising mangrove ecosystem services results in spatially variable management priorities. *PLoS ONE* **11** (3), e0151992. Available at: https://doi.org/10.1371/journal.pone.0151992.

Baburajan V, de Abreu de Silva J, Pereira FC (2022) Open vs closed-ended questions in attitudinal surveys - Comparing, combining, and interpreting using natural language processing. *Transportation Research Part C: Emerging Technologies* **137**, 103589. Available at: https://doi.org/10.1016/j.trc.2022.103589.

Bartlett JE, Kotrlik JW, Higgins CC (2001) Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal* **19** (1), 43–50.

Berbak Sembilang National Park Agency (BSNPA) (2020) *A Long-Term Management Plan for Sembilang National Park 2020-2029*. Berbak Sembilang National Park Agency, Palembang.

Carrasquilla-Henao M, Ban N, Rueda M, Juanes F (2019) The mangrove-fishery relationship: a local ecological knowledge perspective. *Marine Policy* **108**, 103656. Available at: https://doi.org/10.1016/j.marpol.2019.103656.

Costanza R, Groot R De, Braat L *et al.* (2017) Twenty years of ecosystem services: how far have we come and how far do we still need to go? *Ecosystem Services* **28**, 1–16.

Díaz BS, Pascual U, Stenseke M *et al.* (2018) Assessing nature's contributions to people. *Science* **359** (6373), 270–2.

Douven I (2018) A Bayesian perspective on Likert scales and central tendency. *Psychonomic Bulletin and Review* **25** (3), 1203–11.

Eddy S, Iskandar I, Ridho MR, Mulyana A (2017) Land cover changes in the Air Telang Protected Forest, South Sumatra, Indonesia (1989-2013). *Biodiversitas* **18** (4), 1538–45.

Eddy S, Milantara N, Sasmito SD, Kajita T, Basyuni M (2021) Anthropogenic drivers of mangrove loss and associated carbon emissions in South Sumatra, Indonesia. *Forests* **12**, 187. Available at: https://doi.org/10.3390/f12020187.

Espinoza M, Díaz E, Angulo A, Hernández S, Clarke TM (2018) Chondrichthyan diversity, conservation status, and management challenges in Costa. *Frontiers in Marine Science* **5** (85), 1–15.

Fatimah F, Mustopa AZ, Purwiyanto AIS *et al.* (2023) COI gene analysis of Asian horseshoe crab in Banyuasin estuarine waters, Sumatra, Indonesia. *HAYATI Journal of Biosciences* **30** (3), 567–75.

Fauziyah, Agustriani F, Mustopa AZ, Gozali IC, Iqbal M, Ningsih EN (2022) Historical and new records of the Irrawaddy Dolphins, Orcaella brevirostris (Owen in Gray, 1866) (Cetacea, Delphinidae) from the east coast of South Sumatra, Indonesia. *Check List* **18** (1), 219–25.

Fauziyah, Mustopa AZ, Fatimah *et al.* (2021) Morphometric variation of the horseshoe crab Tachypleus gigas (Xiphosura: Limulidae) from the Banyuasin estuarine of South Sumatra, Indonesia. *Biodiversitas Journal of Biological Diversity* **22** (11), 5061–70.

Fauziyah, Purwiyanto AIS, Putri WAE, Agustriani F, Mustopa AZ, Fatimah (2019a) The first investigation record of threatened horseshoe crabs in the Banyuasin Estuarine, South Sumatra, Indonesia. *Ecologica Montenegrina* **24**, 17–22.

Fauziyah, Putri WAE, Purwiyanto AIS, Agustriani F, Mustopa AZ, Fatimah (2019b) The morphometric variability of the mangrove horseshoe crab (Carcinoscorpius rotundicauda) from Banyuasin estuarine of South Sumatra, Indonesia. *Ecologica Montenegrina* **46**, 38–46.

Febrianto S, Syafina HA, Latifah N, Muskananfola MR (2022) Dynamics of changes in the area and density of mangrove ecosystem in the Sembilang National Park using Landsat 8 Satellite Imagery. *Jurnal Kelautan Tropis* **25** (3), 369–77.

Fedele G, Locatelli B, Djoudi H (2017) Mechanisms mediating the contribution of ecosystem services to human well-being and resilience. *Ecosystem Services* **28**, 43–54.

Gouwakinnou GN, Biaou S, Vodouhe FG, Tovihessi MS, Awessou BK, Biaou HSS (2019) Local perceptions and factors determining ecosystem services identification around two forest reserves in Northern Benin. *Journal of Ethnobiology and Ethnomedicine* **15** (1), 61. Available at: https://doi.org/10.1186/s13002-019-0343-y.

Hadler P (2023) The effects of open-ended probes on closed survey questions in web surveys. *Sociological Methods and Research* **0** (0), 1–34. Available at: https://doi.org/10.1177/00491241231176846.

Hamid HA, Hassan A, Wah YB, Amin NAM (2018) Investigating the power of goodness-of-fit test for multinomial logistic regression using K-Means clustering technique. In *Proceedings of the International Conference on Mathematics, Engineering and Industrial Applications 2018 (ICoMEIA 2018)*. AIP Publishing, Kuala Lumpur. Available at: https://doi.org/10.1063/1.5054203.

Hamid HA, Yap BW, Xian-jin X, Ong SH (2017) Investigating the power of goodness-of-fit tests for multinomial logistic regression. *Communications in Statistics - Simulation and Computation* **47** (4), 1039–55.

Hamza AJ, Esteves LS, Cvitanović M, Kairo JG (2023) Sustainable natural resource management must recognise community diversity. *International Journal of Sustainable Development & World Ecology* **30** (7), 727–44.

Himes-Cornell A, Grose SO, Pendleton L (2018) Mangrove ecosystem service values and methodological approaches to valuation: where do we stand? *Frontiers in Marine Science* **5**, 376. Available at: https://doi.org/10.3389/fmars.2018.00376.

IBM (2012) *IBM SPSS Statistics 21 Brief Guide*. IBM Corporation, Armonk, New York.

Islam MM, Sunny AR, Hossain MM, Friess DA (2018) Drivers of mangrove ecosystem service change in the Sundarbans of Bangladesh. *Singapore Journal of Tropical Geography* **39**, 244–65.

Ke G, Aria IK, Utama P *et al*. (2022) Influence of mangrove forests on subjective and psychological wellbeing of coastal community: case studies in Malaysia and Indonesia. *Frontiers in Public Health* **10**, 898276. Available at: https://doi.org/10.3389/fpubh.2022.898276.

Kusmaryono I, Wijayanti D, Maharani HR (2022) Number of response options, reliability, validity, and potential bias in the use of the Likert scale education and social science research: a literature review. *International Journal of Educational Methodology* **8** (4), 625–37.

Lau JD, Hicks CC, Gurney GG, Cinner JE (2019) What matters to whom and why? Understanding the importance of coastal ecosystem services in developing coastal community. *Ecosystem Services* **35**, 219–30.

Mukherjee N, Sutherland WJ, Dicks L, Hugé J, Koedam N, Dahdouh-Guebas F (2014) Ecosystem service valuations of mangrove ecosystem to inform decision making and future valuation exercises. *PLoS ONE* **9** (9), e107706. Available at: https://doi.org/10.1371/journal.pone.0107706.

Nyangoko BP, Berg H, Mangora MM, Gullström M, Shalli MS (2020) Community perceptions of mangrove ecosystem services and their determinants in the Rufiji Delta, Tanzania. *Sustainability* **13** (63), 1–23. Available at: https://doi.org/10.3390/su13010063.

Nyangoko BP, Berg H, Mangora MM, Shalli MS, Gullstrom M (2022) Local perceptions of changes in mangrove ecosystem services and their implications for livelihoods and management in the Rufiji Delta, Tanzania. *Ocean and Coastal Management* **219**, 106065. Available at: https://doi.org/10.1016/j.ocecoaman.2022.106065.

Owuor MA, Icely J, Newton A *et al*. (2017) Mapping of ecosystem services flow in Mida Creek, Kenya. *Ocean and Coastal Management* **140**, 11–21.

Polidoro BA, Carpenter KE, Collins L *et al*. (2010) The loss of species: mangrove extinction risk and geographic areas of global concern. *PLoS ONE* **5** (4), e10095. Available at: https://doi.org/10.1371/journal.pone.0010095.

Quevedo JMD, Uchiyama Y, Kohsaka R (2022) Community perceptions of long-term mangrove cover changes and its drivers from a typhoon-prone province in the Philippines. *Ambio* **51** (4), 972–89.

Quinn CH, Stringer LC, Berman RJ *et al*. (2017) Unpacking changes in mangrove social-ecological systems: lessons from Brazil, Zanzibar, and Vietnam. *Resources* **6** (14), 1–14.

Rasheed NM (2021) Diagnosis in the ordinal logistic regression model. *Turkish Journal of Computer and Mathematics Education Diagnosis* **12** (10), 5524–32.

Ratmoko IA, Budianta D, Ridho R, Wildayana E, Idrus Z, Nuryamsasni N (2021) Analytic hierarchy process for zonation review of Sembilang National Park, Banyuasin Regency, South Sumatera Province, Indonesia. *IOP Conference Series: Earth and Environmental Science* **737**, 012019. Available at: https://doi.org/10.1088/1755-1315/737/1/012019.

Rivera-Monroy VH, Kristensen E, Lee SY, Twilley RR (2017) *Mangrove Ecosystem: A Global Biogeographic Perspective: Structure, Function, and Services*. Springer Nature, Cham.

Ruiz-frau A, Hinz H, Edwards-jones G, Kaiser MJ (2013) Spatially explicit economic assessment of cultural ecosystem services: non-extractive recreational uses of the coastal environment related to marine biodiversity. *Marine Policy* **38**, 90–8.

Sannigrahi S, Zhang Q, Pilla F *et al*. (2020) Responses of ecosystem services to natural and anthropogenic forcings: a spatial regression based assessment in the world's largest mangrove ecosystem. *Science of the Total Environment* **715**, 137004. Available at: https://doi.org/10.1016/j.scitotenv.2020.137004.

Sari NP, Gulo N, Najah M, Fauziyah (2020) Influence of environmental variability on the body condition of the mangrove horseshoe crab Carcinoscorpius rotundicauda from Banyuasin Estuarine, South Sumatra, Indonesia. *Ecologica Montenegrina* **30**, 37–46.

Semyonov-Tal K, Lewin-Epstein N (2021) The importance of combining open-ended and closed-ended questions when conducting patient satisfaction surveys in hospitals. *Health Policy OPEN* **2**, 100033. Available at: https://doi.org/10.1016/j.hpopen.2021.100033.

South Sumatra Provincial Forestry Office (SSPFO) (2017) *Executive Summary - South Sumatra Biodiversity Strategy and Action Plan (SSBSAP) for 2017-2021*. SSPFO, Palembang.

United Nations Environment Programme (UNEP) (2014) *The Importance of Mangroves to People: A Call to Action*. van Bochove, J., Sullivan, E., Nakamura, T. (eds). UNEP World Conservation Monitoring Centre, Cambridge.

Yanda PZ, Mabhuye E, Johnson N, Mwajombe A (2018) Nexus between coastal resources and community livelihoods in a changing climate. *Journal of Coastal Conservation* **23**, 173–83.

Zhang W, Kato E, Bhandary P *et al.* (2016) Awareness and perceptions of ecosystem services in relation to land use types: evidence from rural community in Nigeria. *Ecosystem Services* **22**, 150–60.

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1: Checklist for key informant interviews in Sembilang National Park.
Appendix S2: Household questionnaire survey in Sembilang National Park, Banyuasin Regency, South Sumatra Province.
Appendix S3: Percentage/number distribution of the socio-demographic attributes of the respondents and their linkages to the level of importance in each mangrove ecosystem service.