

Diversity of crabs to inform crab-based ecotourism in Bagek Kembar, Lombok, Indonesia

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Manuscript received: 7 July 2025. Revision accepted: 8 January 2026.

Abstract. Hadiprayitno G, Suana IW, Santoso D, Japa L, Suyantri E, Wirajagat GC, Syazali M, Ilhamdi ML, Kawirian RR. 2026. Diversity of crabs to inform crab-based ecotourism in Bagek Kembar, Lombok, Indonesia. *Biodiversitas* 27 (1): d270104. <https://doi.org/10.13057/biodiv/d270104>. Crabs in mangrove ecosystem in Bagek Kembar, Lombok, Indonesia have potential to be developed as an ecotourism. This research aims to analyze the diversity and abundance of crabs, and to assess the suitability for crab tourism in the Essential Ecosystem Area in Bagek Kembar. Data collection was conducted over three months from June to August 2024 using folding trap and quadrant plot methods. Tourism suitability index was calculated by incorporating several variables, including diversity and evenness indices, number of species, density, and economic value. Sampling conducted using complementary quadrant plots and traditional folding traps (*Bubu*) documented 16 crab species from 5 families, with all recorded taxa categorized as Not Evaluated by the IUCN. Community structure was characterized by strong dominance of fiddler crabs (Ocypodidae), particularly *Austruca annulipes* (31.69% relative density), and overall diversity and distribution were relatively stable (Shannon-Wiener $H' = 2.195$, evenness $E = 0.792$). Quadrant plots captured broader assemblage richness (13 species) including visually attractive, behaviorally distinctive fiddler crabs, whereas *Bubu* traps mainly captured three economically important edible species (*Scylla olivacea*, *Scylla serrata*, and *Thalamita crenata*), confirming a clear separation between observation-oriented and culinary-oriented tourism assets. The modified Tourism Suitability Index integrating diversity, density, species number, economic value, and evenness yielded a score of 2.6, classifying the area as highly suitable for developing crab-focused tourism.

Keywords: Conservation, crabs, diversity, ecotourism, suitability

INTRODUCTION

Mangroves are vital ecosystems that provide various socio-economic and ecological benefits, including biodiversity (Kristiningrum et al. 2019; Wintah et al. 2023). Mangrove ecosystems possess high economic value and serve as a source of income and livelihood for coastal communities through fisheries (Farida-Hanum et al. 2019). A healthy mangrove ecosystem is an important habitat for various flora and fauna species (Kristiningrum et al. 2019), serving as breeding grounds of marine organisms, including fish and crustaceans (Hutchison et al. 2014; Muzaki et al. 2019). For example, there are 389 true crab species (Brachyura) from 188 genera and 38 families found in mangrove forests across 122 countries and 10 sub-regions worldwide (Min and Kathiresan 2023). More recently, the mangrove ecosystem has become increasingly important for climate change mitigation, as it is recognized for its large carbon storage and for protecting coastal zones from sea-level rise (Alimbon and Manseguiao 2021; Alongi 2012; Arifanti et al. 2022). Despite their pivotal roles,

mangrove ecosystems worldwide are increasingly under pressure from deforestation and degradation (Alongi 2020).

Crabs are ecologically important macroinvertebrates of the mangrove ecosystem, key species that play a pivotal role in maintaining the ecosystem's balance (Irwansyah et al. 2022). They contribute to nutrient cycling and the food web, serving as the first trophic level that consume algae or moss, as predators of small fishes and invertebrates, or in some cases, they serve as prey of bigger fish or birds (Muhtadi et al. 2022; Yousefi et al. 2022; Pedrosa-Gerasmio 2024; Putri et al. 2025). Crabs are benthic organisms that obtain nutrients through a filter-feeding mechanism. They are commonly found in mud and sandy substrates and obtain nutrition from organic materials and microorganisms within the water column suspension (Ginatra et al. 2021). Crabs are highly adaptive to environmental changes and might migrate if their habitat is disturbed (Lapolo et al. 2018).

In mangrove ecosystems, there are two groups of crabs usually found, namely the mud crab, specifically *Scylla* spp. and the fiddler crab, in which the male has a specific characteristic of having a larger claw. Mud crabs are

typically found in muddy substrates under mangrove vegetation, but they also occur in a wide range of habitats, from estuary to river banks and tidal areas. Fiddler crabs are easier to locate in the whole coastal area, especially in the mangroves (Barnes 2010; Peer et al. 2015). Several crab species have high economic value and are consumed as seafood at high prices. Two significant fishery resources for food consumption are mud crabs, i.e., *Scylla serrata* and *Scylla olivacea* (Muhtadi et al. 2022; Putri et al. 2022). Despite their high value, mud crabs are often exploited without regard for their conservation and sustainability (Yousefi and Naderloo 2022). For example, in Tarakan City, North Kalimantan, Indonesia, mud crabs are designated as the city's icon, yet their populations are declining due to excessive exploitation (Indarjo et al. 2020). Habitat loss, including mangrove deforestation and degradation, also significantly contributes to the decline in crab populations.

Mangrove ecotourism is promoted as a win-win approach, allowing communities to gain socio-economic benefits from mangroves while causing less ecosystem damage than activities such as timber extraction or aquaculture (Spalding and Parret 2019; Pin et al. 2021). The Essential Ecosystem Area (*Kawasan Ekosistem Esential/KEE*) in Bagek Kembar, West Lombok, West Nusa Tenggara Province, Indonesia, is increasingly popular for ecotourism. The presence of mangrove ecosystems in Bagek Kembar plays a vital role as a key asset in the further development of ecotourism grounded in ecosystem sustainability. One ecotourism activity that can improve the local economy in the mangrove area is seafood cuisine, particularly crab dishes (Karniati et al. 2015). This study was conducted to investigate crab diversity, abundance, and distribution in the mangrove ecosystem in Bagek Kembar. This study also assessed the crab Tourism Suitability Index (TSI) to determine the feasibility of developing crab-based ecotourism as well as its impacts on mangrove conservation.

MATERIALS AND METHODS

Study area

This research was conducted over three months, from June to August 2024, in the Essential Ecosystem Area of Bagek Kembar, Sekotong, West Lombok, West Nusa Tenggara, Indonesia (Table 1, Figure 1). The mangrove ecosystem in the study area covers 86.46 ha, with eight mangrove species distributed across natural and restored mangrove forest zones (Asrori 2020; Hadiprayitno et al. 2024).

Table 1. Coordinates of sampling plots in Bagek Kembar Essential Ecosystem Area of, Lombok, Indonesia

Transect	Coordinates	
	Latitudes	Longitudes
Quadrant plot		
1	-8.767025°	116.055660°
2	-8.766831°	116.055308°
3	-8.766710°	116.055157°
4	-8.766327°	116.054418°
5	-8.766358°	116.053918°
6	-8.766095°	116.053465°
7	-8.765865°	116.053253°
8	-8.766498°	116.052848°
9	-8.765864°	116.051663°
10	-8.766537°	116.051054°
Traditional folding trap (<i>Bubu</i>)		
1	-8.768018°	116.056803°
2	-8.768064°	116.057176°
3	-8.767880°	116.057565°
4	-8.767766°	116.058139°
5	-8.767182°	116.057981°
6	-8.766970°	116.057053°
7	-8.765810°	116.056747°
8	-8.765985°	116.056384°
9	-8.766269°	116.056652°
10	-8.766717°	116.056467°

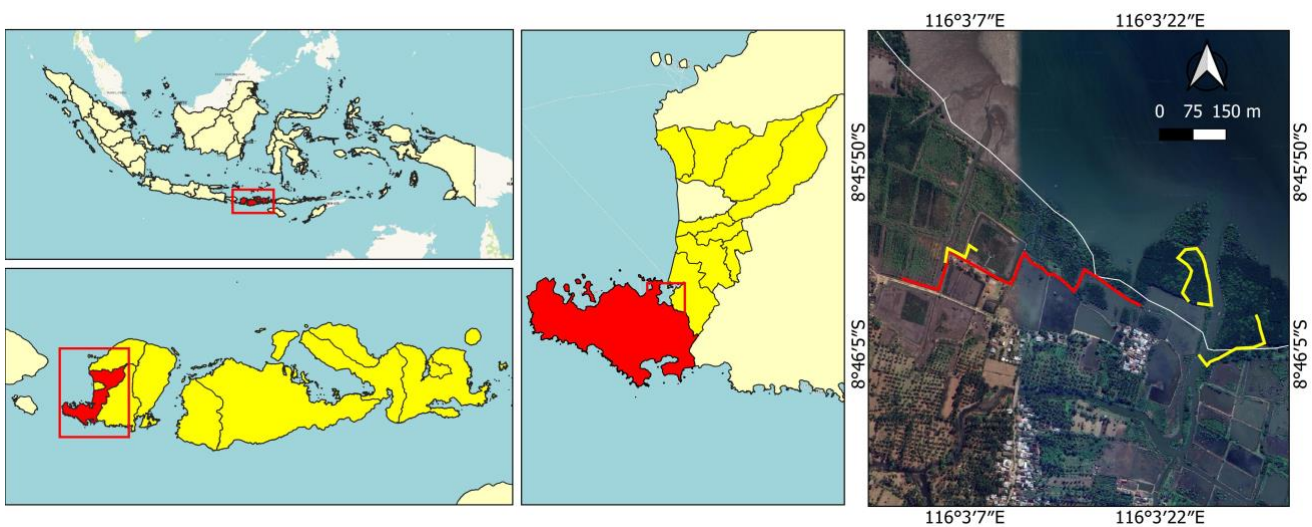


Figure 1. Map of study area in Bagek Kembar Essential Ecosystem Area, West Lombok, West Nusa Tenggara Province, Indonesia. Red line: Quadrant plot, yellow lines: Traditional folding trap

Table 2. Suitability matrix of crabs' tourism

Parameter	Weight	Category	Score
Diversity Index	0.3	$H' \geq 1.845$	3
		$0.925 < H' < 1.848$	2
		$H' \leq 0.925$	1
Density	0.2	$66 \leq D \leq 100$	3
		$34 < D < 65$	2
		$D \leq 33$	1
Species Number	0.2	$11 \leq S \leq 16$	3
		$6 \leq S < 10$	2
		$S \leq 5$	1
Economic Value	0.15	$V \geq 3$	3
		$1 > V < 3$	2
		$V \leq 1$	1
Evenness Index	0.15	$0.7 \leq E < 1$	3
		$0.4 \leq E > 0.6$	2
		$E \leq 0.3$	1

Table 3. Economic value of edible crabs

Score	Edible crab species at the study site	Price projection
3	More than or equal to three edible crab species are present	\geq IDR 80,000/kg
2	More than one and less than three edible crab species are present	IDR 40,000-80,000/kg
1	Only one edible crab species is present	$<$ IDR 40,000/kg

Data collection

Sampling was carried out according to the tidal cycle. Two sampling methods were employed: folding traps and quadrant plots (Figure 2). Each method consisted of 10 plots placed at distinct sites, with consideration given to heterogeneity and sample representativeness (Table 1). Traditional folding traps called *Bubu* were created with dimensions of 45×30×15 cm and the mesh size 2.5 cm (Figure 2.A). Each trap was baited with chicken heads. The folding traps were set up at 10 sampling sites with positions determined based on the path used by fishermen. The folding trap was set at high tide and then recollected at low tide. Quadrant plots were 1×1 m, and sampling was carried out at the lowest tide (Figure 2.B). All crabs in the traps and quadrant plots were counted and photographed for each species. The crab samples were identified morphologically using identification books, including Rahayu and Setyadi (2009), Shelley and Lovatelli (2011), Murniati and Pratiwi (2015), and Murniati et al. (2022).

Data analysis

Diversity indices

The collected data were analysed to calculate Shannon-Wiener Diversity Index (H') using the formula by Smith and Smith (2012) below:

$$H' = -\sum (p_i) (\ln p_i)$$

Where, p_i is the number of species with order $-i$.

Evenness Index (E) was calculated using the formula by Irwansyah et al. (2022):

$$E = \frac{H}{\ln(S)}$$

Where, H' : Diversity Index of Shannon-Wiener, S : total species found.

Tourism Suitability Index (TSI)

The Tourism Suitability Index (TSI) for crabs' tourism was calculated according to Yulianda (2019), with modifications that added new parameters. The evenness index is considered an additional parameter alongside crab species diversity index, crab density, number of species, and the economic value of crabs, using the formula below and scoring as described in Table 2.

$$\text{TSI of crabs' tourism} = ((0.3 \times H) + (0.2 \times D) + (0.2 \times S) + (0.15 \times V) + (0.15 \times E))$$

or

$$TSI = \sum_{i=1}^5 \left(\frac{N_i}{N_{max}} \right)$$

Where, N_i : value of parameter i (Weight \times Score); N_{max} : maximum value for each category (max; 3); H : conversion of H' ; D : conversion of species density; S : conversion value of species number; V : conversion of economic value; E : conversion of Evenness index.

In addition, economic value (V) represents the contribution of edible crab species to local livelihoods and market demand. Economic value was determined based on the number of crab species that can be consumed and classified into three levels below (Table 3).

Tourism Suitability Index was classified into four levels: ≥ 2.50 is highly suitable, $2.0 \leq 2.5$ is suitable, $1.5 \leq 2.0$ is less suitable and < 1.5 is unsuitable.

RESULTS AND DISCUSSION

Crab species diversity and composition

In total, there are 16 crab species belonging to five families documented in the Bagek Kembar Essential Ecosystem Area. According to the International Union for Conservation of Nature (IUCN), all crab species recorded in this study are listed as Not Evaluated (Table 4). This species number is larger than other locations in Indonesia, such as Pejarakan, Bali, with 11 species (Ginantra et al. 2021), Lembongan, Bali, with 12 species (Ginantra et al. 2023), Pacitan, East Java, with 5 species (Irwansyah et al. 2022), and Mentawit village, East Kalimantan, with 3 species (Kristiningrum et al. 2020). However, this is lower than Tanjung Panjang, Gorontalo with 20 species (Lapolo et al. 2018), and the south coast of East Java with 29 species (Retnaningdyah et al. 2022).

Ocypodidae is the largest family based on relative density compared with the other families. Crabs of the family Ocypodidae are commonly found at the edge of mangrove ecosystems or in areas inclined towards the open. This family has the highest number of species according to Lapolo

et al. (2018) and Retnaningdyah et al. (2022). The Portunidae family, such as *Scylla* spp., is mostly found in habitats with a high density of mangroves. Mud crab (*Scylla serrata*) prefers to live in mangrove vegetation with a dense root system, which is able to bear the mud substrate. This crab digs tiny holes used as hiding sites and for finding food (Bagus et al. 2023). The families with the fewest species are Gecarcinidae (one species) and Grapsidae (one species). A high density of mangroves plays an important role in producing organic material, which is essential to the survival of mud crabs (Ginantra et al. 2021); however, the degradation of mangrove areas can degrade habitat, potentially reducing crab populations (Lapolo et al. 2018). Few species are rarely found, which might be due to their specific habitat niche as shelter and feeding grounds (Lapolo et al. 2018). *Austruca annulipes* is the most common species found, with a relative density of 31.69%, followed by *Tubuca arcuata* (17.70%). In contrast, *Episesarma versicolor* is the lowest, at approximately 0.41%.

Crabs recorded using the plot method had a higher number of species (13) (Table 5, Figure 3) than those recorded using *Bubu* traps (3) (Table 6, Figure 4). The crabs collected using traps are species that are consumed and have high economic value (Figure 3). On the other hand, fiddler crabs and other crab species observed using the plot method are not consumed by the community and are underutilized. Usually, fiddler crabs make holes near the roots of mangroves or open mudflats surrounding them. As the rainy season approaches, these holes will enlarge and be occupied by juvenile crabs. Later in the summer, it shrinks and is occupied by adult crabs. When soil moisture levels increase, crab burrows will get deeper and longer. There are a lot of crab burrows near *Avicennia* mangroves. Fiddler crabs are more commonly found in open, muddy areas around *Avicennia*, whereas the Sesarmidae group is typically abundant in *Rhizophora* roots. On open mudflats, the female crab population is typically more prevalent (Min and Kathiresan 2021).

Table 4. List of species, relative density, IUCN status, and diversity and evenness indices of crabs in the Bagek Kembar Essential Ecosystem Area

Species	Family	Number of individuals	DR (%)	IUCN Status
<i>Cardisoma carnifex</i> (Herbst, 1796)	Gecarcinidae	6	2.47	Not evaluated
<i>Metopograpsus quadridentatus</i> Stimpson, 1858	Grapsidae	10	4.12	Not evaluated
<i>Austruca annulipes</i> (H. Milne Edwards, 1837)	Ocypodidae	77	31.69	Not evaluated
<i>Austruca perplexa</i> (H. Milne Edwards, 1852)	Ocypodidae	3	1.23	Not evaluated
<i>Austruca triangularis</i> (A. Milne-Edwards, 1873)	Ocypodidae	6	2.47	Not evaluated
<i>Gelasimus vocans</i> (Linnaeus, 1758)	Ocypodidae	23	9.47	Not evaluated
<i>Tubuca arcuata</i> (De Haan, 1835)	Ocypodidae	43	17.70	Not evaluated
<i>Tubuca bellator</i> (White, 1847)	Ocypodidae	3	1.23	Not evaluated
<i>Tubuca dussumieri</i> (H. Milne Edwards, 1852)	Ocypodidae	10	4.12	Not evaluated
<i>Tubuca rosea</i> (Tweedie, 1937)	Ocypodidae	6	2.47	Not evaluated
<i>Scylla olivacea</i> (Herbst, 1796)	Portunidae	23	9.47	Not evaluated
<i>Scylla serrata</i> (Forskål, 1775)	Portunidae	6	2.47	Not evaluated
<i>Thalamita crenata</i> Rüppell, 1830	Portunidae	19	7.82	Not evaluated
<i>Episesarma versicolor</i> (Tweedie, 1940)	Sesarmidae	1	0.41	Not evaluated
<i>Parasesarma eumolpe</i> (De Man, 1895)	Sesarmidae	5	2.06	Not evaluated
<i>Episesarma mederi</i> (H. Milne Edwards, 1853)	Sesarmidae	2	0.82	Not evaluated
Total		243	100.00	
Diversity Index (H')		2.195		
Evenness Index (E)		0.792		

Table 5. Distribution of crab species recorded using the quadrant plot method in the Bagek Kembar Essential Ecosystem Area

Species	Family	Sampling sites									
		1	2	3	4	5	6	7	8	9	10
<i>Cardisoma carnifex</i> (Herbst, 1796)	Gecarcinidae	-	-	-	-	-	-	+	-	-	-
<i>Metopograpsus quadridentatus</i> Stimpson, 1858	Grapsidae	+	+	-	+	-	-	-	-	-	-
<i>Austruca annulipes</i> (H. Milne Edwards, 1837)	Ocypodidae	+	-	+	+	+	+	-	+	+	+
<i>Austruca perplexa</i> (H. Milne Edwards, 1852)	Ocypodidae	-	-	-	-	-	-	-	-	+	-
<i>Austruca triangularis</i> (A. Milne-Edwards, 1873)	Ocypodidae	-	-	-	-	-	+	-	-	-	-
<i>Gelasimus vocans</i> (Linnaeus, 1758)	Ocypodidae	-	-	-	-	+	+	-	-	-	-
<i>Tubuca arcuata</i> (De Haan, 1835)	Ocypodidae	-	-	-	-	-	-	-	+	+	+
<i>Tubuca bellator</i> (White, 1847)	Ocypodidae	-	-	-	-	-	-	-	-	+	-
<i>Tubuca dussumieri</i> (H. Milne Edwards, 1852)	Ocypodidae	-	-	+	-	+	+	-	+	+	-
<i>Tubuca rosea</i> (Tweedie, 1937)	Ocypodidae	+	-	-	-	-	+	-	+	+	-
<i>Episesarma versicolor</i> (Tweedie, 1940)	Sesarmidae	+	-	-	-	-	-	-	-	-	-
<i>Parasesarma eumolpe</i> (De Man, 1895)	Sesarmidae	+	-	+	-	-	-	-	-	-	-
<i>Episesarma mederi</i> (H. Milne Edwards, 1853)	Sesarmidae	+	-	-	-	-	-	-	-	-	-

Note: +: present; -: absent

Table 6. Distribution of crab species recorded using folding traps (*Bubu*) in the Bagek Kembar Essential Ecosystem Area

Species	Family	Sampling sites									
		1	2	3	4	5	6	7	8	9	10
<i>Scylla olivacea</i> (Herbst, 1796)	Portunidae	+	+	+	+	+	+	+	-	+	+
<i>Scylla serrata</i> (Forskål, 1775)	Portunidae	+	-	-	-	-	-	+	-	-	-
<i>Thalamita crenata</i> Rüppell, 1830	Portunidae	+	-	+	+	+	+	-	+	+	+

Note: +: present; -: absent



Figure 3. Crab species recorded from quadrant plot: A. *Austruca annulipes*, B. *Austruca perplexa*, C. *Austruca triangularis*, D. *Gelasimus vocans*, E. *Episesarma mederi*, F. *Episesarma versicolor*, G. *Parasesarma eumolpe*, H. *Metopograpsus quadridentatus*, I. *Tubuca dussumieri*, J. *Tubuca bellator*, K. *Tubuca arcuata*, L. *Tubuca rosea*. Photograph of *Cardisoma carnifex* is not displayed



Figure 4. Crab species collected using folding traps (*Bubu*) from the genus *Scylla*, which have high economic value

Almost every sampling site has fiddler crabs *Austruca annulipes*. This kind of crab, however, is extremely sensitive to human presence and will typically retreat into its hiding place as human approaches. Other species include *Tubuca arcuata*, *Tubuca bellator*, *Tubuca rosea*, *Austruca perplexa*, and *Austruca triangularis*. On the other hand, when faced with adverse conditions or threatened, *Gelasimus vocans* and *Tubuca dussumieri* sometimes submerge in the mud if they are unable to reach their hiding place in time. Fiddler crabs, like *A. annulipes*, can draw visitors by moving their claws like a violin and dancing when they are above the ground (Irwansyah et al. 2022). Adjacent niches are discovered in several fiddler crab (Ocypodidae) species. *T. arcuata* and *T. rosea* are frequently seen together and occasionally face off. Conversely, *G. vocans* is frequently seen living and gathering at the same location as *A. perplexa* and *T. dussumieri*. Tourists may be attracted to observe fiddler crabs and other crabs because of their eye-catching colors and patterns (Figure 3).

Crabs in the family Portunidae are commonly consumed, and the genus *Scylla* spp. is of high economic value, including *Scylla olivacea* and *Scylla serrata* (Figure 4). The species composition obtained in this study is the same as that found by Karniati et al. (2021) in North Sumatra. *S. olivacea* has a wider distribution than other species in the Bagek Kembar mangrove forest. This species has a higher relative density than the other two consumable crab species (Table 4). There is also evidence that this species is prevalent in the mangrove ecosystem of the Setiu Wetland in Trengganu, Malaysia, with a relative density of 54.2% (Fazhan et al. 2022). Our study is in contrast to Karniati et al. (2021), who found that of the two species of *Scylla* obtained, *S. serrata* had a higher number (478.6 ind/ha) compared to *S. olivacea* (205.13 ind/ha), and Bagus et al. (2023), who found that *S. serrata* is more abundant than *S. olivacea*, which were 47.8% and 30.4%, respectively, and the rest was *Scylla tranquebarica* (21.8%). In Bagek Kembar, the local community typically uses the terms "red crab" for *S. olivacea* and "green crab" for *S. serrata*. In the meantime, the stone crab, *Thalamita crenata*, is also widely recognized.

Suitability index of crab tourism

The suitability index for crab tourism in the Bagek Kembar Essential Ecosystem Area is categorized as highly suitable with a score of 2.6 (Table 7). Crab observation tourism might utilize the unique morphologies and attractive colors of the violin crab group. Activities and habitat utilization by crabs that can be observed include clinging to the mangrove root system, clinging to rocks, walking on the surface of sand or gravel, walking, going in and out of their hiding burrows, submerging themselves in the mud, and looking for food which are interesting attractions to observe in the mangrove ecotourism area (Ginantra et al. 2021).

Crabs in the Bagek Kembar Essential Ecosystem area can also be developed as culinary tourism destinations, given the presence of consumable crabs of high economic value in the genus *Scylla* spp. The mangrove habitat in the Bagek

Kembar Essential Ecosystem Area is dominated by the presence of fiddler crabs (Ocypodidae), especially at the edge of the mangrove forest or open land with young mangroves. Rosenberg (2020) states that fiddler crabs (Ocypodidae) can be found along most tropical and subtropical coastlines worldwide, acting as key species and ecosystem engineers. In addition, the fiddler crabs can be used as an indicator in new mangrove plantings or open mangrove forest habitats, while the Sesamididae family can be used as an indicator of ecological function in old plantings or in thick mangrove forests (Ashton and Macintosh 2024). Crab pits can generally be found on the forest floor between mangrove root systems. Fiddler crab holes in this study site are very easy to find for crab observations. The function and construction of the holes varied between species and sexes (Pardo et al. 2020). Fiddler crab burrowing activity impacts important biogeochemical processes in mangrove forests (Agusto et al. 2021). Bioturbation resulting from the crab's excavation to the substrates is directly correlated with substrate oxygenation and carbon and nitrogen cycling within an ecosystem (Al-Khayat and Giraldez 2020). Fiddler crabs usually appear around their burrows to find food and interact with individuals of the same or different species.

Crabs are the dominant macrofauna in the mangrove ecosystem and play an important role in protecting its ecological functions (Rahim et al. 2021). Crabs are a potential indicator of mangrove ecosystem recovery. The existence of mangrove ecosystems is one of the factors supporting the presence of crabs because of their role as natural habitat and food providers. Mangrove leaves are the main carbon source for crab diets in mangrove forest edge areas, and organic sediments and mangrove leaves are the main carbon sources for crabs in low and medium tidal zones. However, mangrove leaves contribute little to the diet of crabs in the high tidal zone (Lu et al. 2024). The sustainability of mangrove ecotourism is determined not only by the existence of mangrove vegetation, but also the diversity of living things in it, including crabs. The existence of crab species in mangrove ecosystems can be utilized as tourist destinations. Information on where the species is found and its status (protected or not; common or rare), is important for ecotourism activities. The morphological appearance, activities carried out by crabs, and the number and distribution of each species have unique features that can attract more tourists to visit the mangrove area (Ginantra et al. 2021; Irwansyah et al. 2022).

Table 7. Crab tourism suitability index in the Bagek Kembar Essential Ecosystem Area

Parameter	Weight	Score	TSI
Diversity index (H')	0.3	3	0.9
Density (D)	0.2	1	0.2
Species number (S)	0.2	3	0.6
Economic value (V)	0.15	3	0.45
Evenness index (E)	0.15	3	0.45
Sum (Σ)			2.6 (Highly suitable)

The diversity of fiddler crabs has the potential to support ecotourism through crab-observation activities, thereby avoiding culinary tourism focused solely on consumable crabs. However, tour guides with knowledge and skills in behavioral ecology and crab identification are needed. The existence of crabs with important economic value in the mangrove ecosystem is also an ecotourism attraction. A variety of products and mud crab ecotourism initiatives, including food services, snacks, souvenirs, educational tours, and tracking; encouraging activities, including processing mud crabs; and setting up resources, like mud crab galleries (Mahbubi et al. 2025). Crabs and mangroves both support sustainable development and have a beneficial effect on ecosystems and local communities (Hartanti and Fithor 2024). However, crab populations in the wild are decreasing due to anthropogenic activities, for example, deforestation of mangrove forests (Putri et al. 2022). To protect crabs, the mangrove ecosystem must be maintained. In addition, we recommend that a zoning system can developed in the Bagek Kembar area. Crabs must be managed in this manner to ensure their sustainability. For example, edible crabs and fiddler crabs with unique coloration or morphology are important elements of sustainable ecotourism in Bagek Kembar.

In conclusion, the mangrove ecosystem of the Bagek Kembar Essential Ecosystem Area supports a high diversity of crabs that can be directly leveraged to strengthen sustainable, crab-based ecotourism while reinforcing mangrove conservation goals. Sampling conducted using complementary quadrant plots and traditional folding traps (bubu) documented 16 crab species from 5 families, with all recorded taxa categorized as Not Evaluated by the IUCN. Community structure was characterized by strong dominance of fiddler crabs (Ocypodidae), particularly *A. annulipes* (31.69% relative density), and overall diversity and distribution were relatively stable (Shannon-Wiener $H' = 2.195$, evenness $E = 0.792$). Quadrant plots captured broader assemblage richness (13 species) including visually attractive, behaviorally distinctive fiddler crabs, whereas *Bubu* traps mainly captured three economically important edible species (*S. olivacea*, *S. serrata*, and *T. crenata*), confirming a clear separation between observation-oriented and culinary-oriented tourism assets. The modified Tourism Suitability Index integrating diversity, density, species number, economic value, and evenness yielded a score of 2.6, classifying the area as highly suitable for developing crab-focused tourism. To maximize benefits while minimizing ecological risk, tourism design should prioritize crab-observation experiences (e.g., burrowing activity and claw-display behavior) to reduce pressure on marketable mud crabs, supported by trained local guides, clear visitor management, and zoning that safeguards key habitats and maintains mangrove structure and root complexity.

ACKNOWLEDGEMENTS

We would like to thank the Rector of Universitas Mataram, Indonesia, for providing research funding through the Institute for Research and Community Service for the

professor research scheme. Thanks also go to Agus Alwi, Hendra, and the fishing community in Bagek Kembar for facilitating crab sampling.

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