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Potential analysis of location, socio-culture and biodiversity as ecotourism attraction in Valentine Bay on Buano Island, West Seram, Maluku, Indonesia

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Abstract. *Siahaya ME, Matius P, Aipassa MI, Rayadin Y, Ruslim Y, Aponno HSES. 2020. Potential analysis of location, socio-culture and biodiversity as ecotourism attraction in Valentine Bay on Buano Island, West Seram, Maluku, Indonesia. Biodiversitas 22: 438-448.* This study aims to analyze the potential of flora and fauna in the mangrove ecosystem as an attraction for ecotourism development, knowing the role of stakeholders in supporting ecotourism development strategies in the mangrove area of Valentine Bay in Buano island, West Seram, Maluku (Moluccas), Indonesia. Based on the results of the study, it was found that (i) The mangrove vegetation had 28 species of plants under 19 families. Vegetation at the level of seedlings, saplings, and trees was found, the dominant species being *Rhizophora apiculata*, *Bruguiera gymnorrhiza,* and *Xylocarpus granatum.* The diversity of animals in the Valentine Bay mangrove ecosystem consist of birds, insects, reptiles, mollusks, crustaceans, echinoderms, fish, and mammals. Furthermore, there was an endemic fauna of Buano island, namely the Kehicap buano/black-chinned monarch bird (*Symposiachrus boanensis*) which has started to become rare, and was declared as critically endangered (CR) by the International Union for Conservation of Nature and Natural Resources; (ii) Stakeholder involvement in ecotourism activities were very supportive; (iii) Development strategies were to develop ecotourism, promote ecotourism attractiveness, develop educational tourism and promote study on the diversity of flora, fauna, culture, and traditional customs on Buano island.

Keywords: Conservation, coral reef, diversity, fauna, flora, mangrove ecosystem

INTRODUCTION

Mangrove is a typical forest type and grows along the coast or river estuaries which are influenced by tides and are often found in coastal areas that are protected from the onslaught of waves and gently sloping areas in tropical and sub-tropical areas (Hartshorn 2013; Duke and Schmitt 2014; Spencer et al. 2016). Natural resources in coastal areas have a role in supporting social and economic development (Salampessy et al. 2015; Neumann et al. 2017; McKinley et al. 2019). The consequence of this great potential causes coastal areas to be vulnerable to damage and degradation of coastal natural resources.

Mangrove is a unique natural ecosystem that has high ecological and economic value (Cuenca et al. 2015) and gives many benefits and services to the environment (Kristiningrum et al. 2019; Sondak et al. 2019) including providing nutrients, spawning grounds, nurseries, and feeding grounds for certain marine biota and for the human coastal communities. In addition to producing basic materials for livelihood and industrial purposes such as firewood, charcoal, and construction materials (Kusmana and Sukristijiono 2016), mangroves are also able to act as abrasion barriers for the land area behind this ecosystem (Bengen 2004; Lee et al. 2014). Mangroves could prevent erosion (Das 2020) as mangrove trees have long tapered roots that bind the soil the vegetation is growing upon (Spalding et al. 2014; Hilmi et al. 2017; Surya et al. 2020).

The utilization and management of natural resources on Buano island face various threats, both from ecological and social aspects regarding ecological aspects, there has been declined in the quality of the terrestrial and coastal environment. Terrestrial environmental quality threats such as excessive felling of trees, land clearing, and mining. According to (Rujehan and Matius 2018), land clearing and mining activities are also issues that often occur in Bukit Soeharto, East Kalimantan. Coastal threats may consist of overfishing, and similar threats are also reported in Lake Sentani due to overfishing (Ohee et al. 2018), damage to mangroves (Radabaugh et al. 2019) and coral reefs (Wijayanti et al. 2018), declining quality of underwater parks, the threat of various species of marine life such as trade in endangered species, increased abrasion, widespread sedimentation, and intrusion of seawater. The coastal ecosystem faces serious threats of pollution, over-exploitation, conflicting use of resources, damage, and destruction of habitats (Kumar et al. 2017). Meanwhile, threats in the social aspect on Buano island include high

population growth, such as the expansion of human settlements, which can lead to excessive exploitation of natural resources that can damage the environment. Conservation activities are an effort to maintain the balance of nature so that humans and other living things can live well in harmony.

The cultural management of coastal communities was directed at the welfare of the community through conservation and reforestation of mangrove ecosystems in an effort to maintain the utilization of mangrove ecosystem resources for the present and future. Valentine Bay is suitable for mangrove tourism as a source of income for coastal communities. With beautiful landscapes and natural scenery, it adds value to tourism. Maluku is an Indonesian province that consists of beautiful islands and mangrove ecosystems in several areas.

Ecotourism can be defined as a form of tourism that is responsible for the preservation of unspoiled areas, provides economic benefits, and maintains the socio-cultural integrity of the local community (Zarghi and Hosseini 2014). Ecotourism is a form of travel to natural areas for a number of tourists who have insight and sensitivity to the environment.

Based on the description above and considering the limited data and information regarding the condition of mangrove forests in the coastal area of Valentine Bay, it was deemed necessary to study the potential and development strategies of Valentine Bay mangrove ecotourism on Buano island, West Seram District, Maluku (Moluccas) Province, Indonesia. The study objectives were (i) to analyze the potential composition of mangroves including species composition, density, presence frequency, and Importance value of the species; (ii) to determine the role of stakeholders in supporting ecotourism development, and; (iii) ecotourism development strategy. This study intends to provide information about the potential of existing mangroves and other tourism potentials around Valentine Bay so that it can provide input to related agencies in the context of managing and developing mangrove areas as support to ecotourism.

MATERIALS AND METHODS

Study area

The location of the study was in a mangrove ecosystem in the Valentine Bay area which is administratively located on Buano island, Huamual Belakang Sub-district, West Seram District, Maluku (Moluccas) Province, Indonesia. The map of the study location is presented in Figure 1. The research was conducted from July to September 2019.

Procedures

The data collected in this study were primary data and secondary data. Primary data were collected directly at the study location. Secondary data were obtained through local community information, various website, documents on the management of natural resources on the coast of Buano island, and key informants, consisting of the West Seram District Forestry Service, West Seram District Tourism Office, and related NGOs.

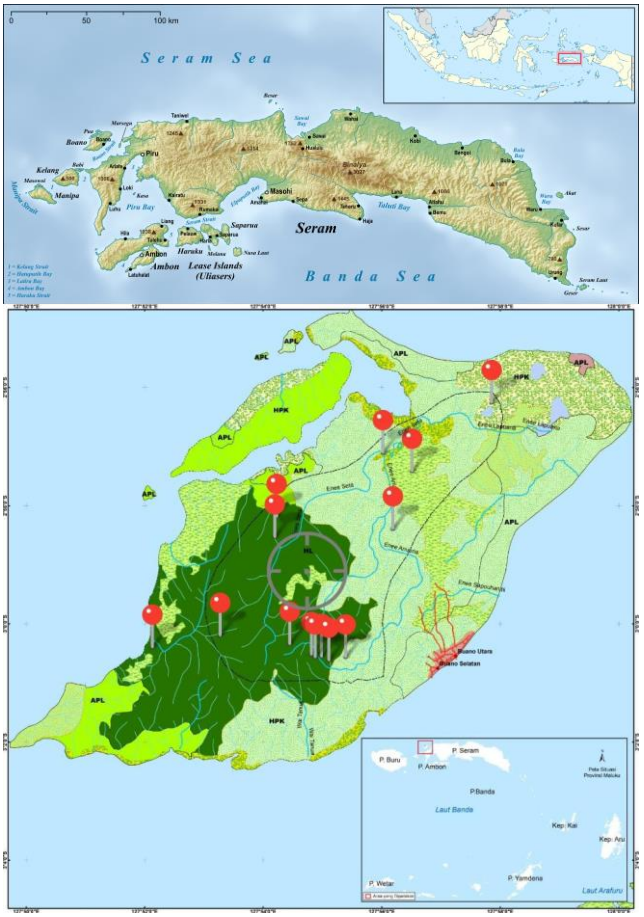

Figure 1. Study location in Valentine Bay on Buano Island, West Seram District, Maluku, Indonesia

The Vegetation data were collected using the combination of the path method and the compartmentalized line method. Study plots were made in the line transect. The plot areas for each growth stages were as follows: (i) Seedlings with ranging from sprouts to 1.5 m high - diameter at < 2 cm, plot size of 5 m × 5 m, (ii) Poles with a height between 1.5 m - diameter at breast height <10-19 cm, plot size 10 m ×10 m, (iii) Trees with the diameter at breast height ≥ 20 cm, plot size 20 m × 20 m.

The wildlife data collection was carried out through direct and indirect observations, through footprints, scat, sounds, and information from local communities who accompanied researchers while at the research location.

Data analysis

The collected vegetation data was then analyzed to determine species density, relative density, species dominance, relative dominance, species frequency and relative frequency as well as the Importance Value Index using the Mueller-Dombois and Ellenberg (1974), as follows:

$$\text{Density (D)} = \frac{\text{Number individual of a species}}{\text{Area of the measurement plots}}$$

$$\text{Relative Density (Rden)} = \frac{\text{Density of a species}}{\text{Density of all species}} \times 100\%$$

Frequency (F) = $\frac{\text{Number of plots found of a species}}{\text{Area of the measurement plots}}$

Relative Frequency (RF) = $\frac{\text{Frequency of a species}}{\text{Frequency of all species}} \times 100\%$

Dominance (SD) = $\frac{\text{Basal area of a species}}{\text{Area of the measurement plots}}$

Relative Dominance (RD) = $\frac{\text{Dominance of a species}}{\text{Dominance of all species}} \times 100\%$

Then the Importance Value Index (IVI) value was calculated to determine the dominant plant species and levels with the following formula:

For seedlings: IVI = RDen + RF

For poles and trees: IVI = RDen + RF + RD

The formula to determine the index of diversity in vegetation species using Shannon index equation (Magurran 2004) was as follows:

$$H' = -\sum\left[\left(\frac{n_i}{N}\right)\ln\left(\frac{n_i}{N}\right)\right]$$

Where:
H' = Species Diversity Index
N = Sum of Importance Value Index (IVI)
n_i = Importance Value Index (IVI) of a species

RESULTS AND DISCUSSION

Study area

Buano island is one of the small islands with an area of about 135.73 km^2, which is located to the southwest of Seram Island. There were 2 villages that were located close to and parallel to the sloping coast, namely North Buano and South Buano villages, both of which are only separated by mosques, and the church was located close by and is a marker of the two villages. On September 29, 2014, through SK.854/Menhut-II/2014 concerning the Forest Area of Maluku Province, a protected forest area of 4,287.22 ha was established. The research locations were generally located in the mangrove area of Valentine Bay, one of the areas included in the protected forest area of Buano island.

The research results showed that there were several potential tourism attractions on Buano island that could be defined into attractive ecotourism packages, including tours in the mangrove area of Valentine Bay, showcasing the diversity of flora and fauna, and other potential tourism deliverables around Valentine bay.

Flora

Valentine Bay Mangroves was divided into 3 zones; namely the front zone (Proximal), the middle zone (Middle), and the back zone (Distal). The identification results of mangroves found in Valentine Bay were 28 species and 19 families (Table 1).

Tabel 1. The Species of true mangroves and mangrove associates vegetation in Valentine Bay, West Seram District, Maluku, Indonesia

Species	Family	Zone		
		Proximal	Middle	Distal
Rhizophora apiculata	Rhizophoraceae	√		
Rhizophora stylosa	Rhizophoraceae	√		
Sonneratia alba	Lythraceae	√		
Rhizophora mucronata	Rhizophoraceae	√		
Avicennia marina	Acanthaceae	√	√	
Bruguiera sexangula	Rhizophoraceae	√	√	
Bruguiera gymnorrhiza	Rhizophoraceae	√	√	
Pemphis acidula	Lythraceae	√	√	
Lumnitzera littorea	Combretaceae	√	√	
Acanthus ebracteatus	Acanthaceae	√		
Bruguiera cylindrica	Rhizophoraceae		√	
Ceriops tagal	Rhizophoraceae		√	
Ceriops decandra	Rhizophoraceae		√	
Xylocarpus moluccensis	Meliaceae		√	√
Xylocarpus granatum	Meliaceae		√	√
Excoecaria agallocha	Euphorbiaceae		√	
Aegiceras corniculatum	Primulaceae		√	
Acrostichum speciosum	Pteridaceae		√	
Nypa fruticans	Arecaceae			√
Heritiera littoralis	Malvaceae			√
Barringtonia asiatica	Lecythidaceae			√
Pongamia pinnata	Leguminosae			√
Pandanus tectorius	Pandanaceae			√
Terminalia catappa	Combretaceae			√
Hibiscus tiliaceus	Malvaceae			√
Acrostichum aureum	Pteridaceae			√
Scaevola taccada	Goodeniaceae			√
Intsia bijuga	Leguminosae			√

According to Ahmad (2015) in the mangrove forests of Piru bay West Seram district, Maluku, has found 17 species of mangroves, while Poedjirahajoe et al. (2019) has found 17 species of mangroves in Kutai National Park, East Kalimantan. When compared with the results in other regions, it could be seen that the species composition in the Valentine Bay area was higher than in Piru Bay and Kutai National park. The difference in the number of species composition in mangroves in several areas was thought to be caused by the differences in environmental conditions, the number of observations, and the level of disturbance in each study area. The species with the highest importance represent the tenure value of the species in a community. The importance value of a species could be used as an indication that the species are considered dominant by having a higher relative density, relative frequency, and dominance values compared to other species. It was found that 28 species at both seedling and pole levels were found, while at the tree level 26 species of mangroves were found (Table 1).

From the results (Figure 2, 3, 4) of the vegetation analysis for the front zone, it was found that the dominant species were *R. apiculata* with the highest IVI at seedling

(54.84%), poles (75.19%), and trees (91.25%). This is presumably due to the location factor which is suitable for the species *R. apiculata* (Figure 5), which generally grows along the seaward margin in various types of substrates, such as mud sediments, white sand, and corals. This is in line with stated by Setyawan and Ulumuddin (2012), that mangroves in Tambelan island, Natuna Sea, Indonesia, especially for *R. apiculata* commonly growing along the seaward and in various substrates such as fertile mud sediments, white sand, and corals. According to Shah et al. (2016) the mangrove forests of Sibuti, Sarawak, Malaysia were also dominated by *R. apiculata* among the 9 species of mangroves found there

Meanwhile, the middle zone for the three dominant species growth rates was *B. gymnorrhiza* (Figure 6), respectively, the largest IVI for seedlings (53.48%), poles (61.49%), and trees (73.29%) grows from the coastline with high tidal areas of the mainland. Jiang et al. (2019) stated that *B. gymnorrhiza* in the Qi'ao-Dangan Province Nature Reserve, on Qi'ao Island in Zhuhai, China, could grow best in the tidal area.

The back zone was dominated by *X. granatum* (Figure 7) with the highest IVI at seedling (54.67%), poles (60.88%), and trees (71.25%) where this area was the closest to dry plain. Utina et al. (2019) also stated that *X. granatum* was found growing in the back zone where the substrate is a dry plain and has a wide distribution in mangrove forests in Banggai district, Central of Sulawesi, Indonesia.

Likewise, the value of relative density, relative frequency, and the highest relative dominance for seedlings, poles, and trees in the front zone was *R. apiculata* and the middle zone was *B. gymnorrhiza*, while in the back zone was *X. granatum*. Based on the results, the three species had a wider distribution, greater dominance, and more abundance when compared to other mangrove plant species in Valentine Bay.

The presence of species in a forest community could be measured from the Species Diversity Index. Species diversity is influenced by the number of species and species distribution (Ludwig and Reynolds 1988). The results of the analysis using Shannon's Species Diversity Index are presented in Table 2.

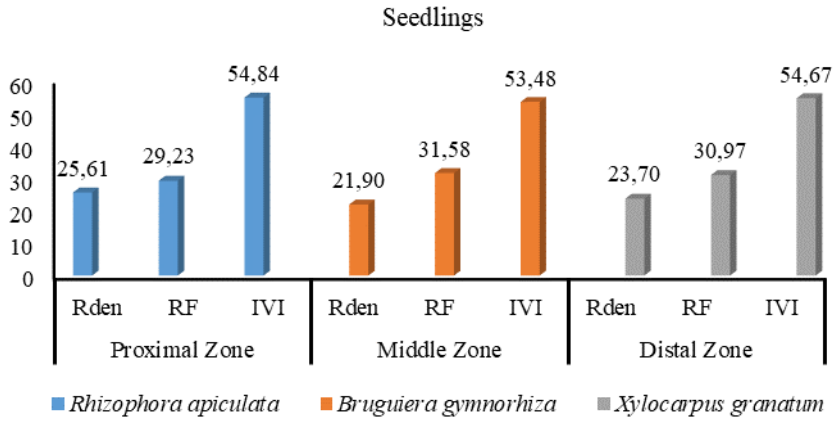

Figure 2. Mangrove species for seedling level in Valentine bay, West Seram District, Maluku, Indonesia

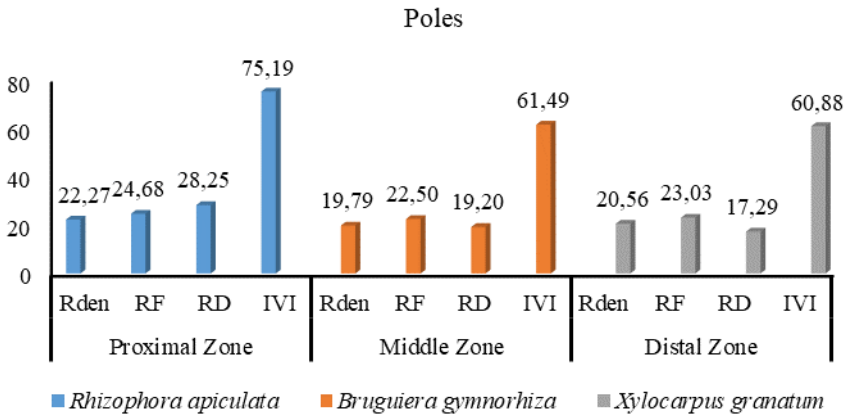

Figure 3. Mangrove species of vegetation for poles level in Valentine bay, West Seram District, Maluku, Indonesia

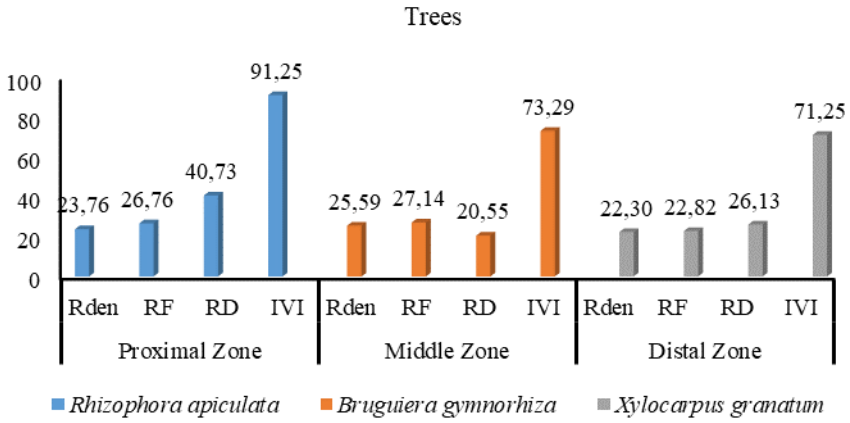

Figure 4. Mangrove species of vegetation for trees level in Valentine bay, West Seram District, Maluku, Indonesia

Table 2. Species diversity index of each growth rate in Valentine bay, West Seram District, Maluku, Indonesia

Zone	Seedlings	Poles	Trees
Proximal	2.00	2.00	1.92
Middle	2.20	2.16	2.10
Distal	2.02	2.11	2.04

Based on the data in Table 2 concerning the Diversity Index, the highest was in the middle zone at the seedling level of 2.20, while the lowest was in the proximal zone at the tree level of 1.92. (Magurran, 2004) states that the range of values calculated for the diversity index (H) is as follows: (i) H'≥3 means low species diversity; (ii) 1<H'<3 means moderate species diversity; and (iii) H'>3 means high species diversity. Based on the range of vegetation species diversity index proposed by Magurran, the results of the species diversity index in the mangrove forest in Valentine Bay could be categorized as moderate. Each range on the diversity index has its own benchmarks. This means that the level of diversity of mangrove forests in Valentine Bay was moderate, has sufficient vegetation productivity, ecosystem conditions were quite balanced, and ecological pressure was moderate. In line with the study of Naisumu et al. (2018) that the Tree Species Diversity Index in Lapeom Protection Forest is also in the medium category with a fairly balanced ecosystem, sufficient tree productivity levels, and moderate ecological pressure.

Fandeli (2000) stated that the higher the number of species in an area, the better its diversity. From the tourism point of view, observation of up-close diversity of vegetation with tagged information, exploration of underlying ecological processes is a unique experience that may attract attention of both local as well as international visitors.

Fauna

Apart from plant diversity, it turns out that the mangrove ecosystem is also rich in faunal diversity. Based on the survey, presence of 28 species of birds, 8 species of insects, 5 species of reptiles, 16 species of fish, 9 species of mammals, 4 species of crustaceans, 3 species of echinoderms, and 2 species of mollusks were recorded.

Bird species in the Valentine Bay mangrove ecosystem on Buano Island include: kehicap buano (*Symposiachrus boanensis*), gagak hutan (*Corvus enca*), isap madu seram (*Lichmera monticola*), pergam tarut (*Ducula concinna*), cikukua seram (*Philemon subcorniculatus*), cekakak suci (*Todiramphus sanctus*), walet Maluku (*Aerodramus infuscatus*), dara laut kecil (*Sternula albifrons*), kuntul besar (*Ardea alba*), kuntul Kecil (*Egretta garzetta*), gosong Maluku (*Eulipoa wallacei*), mandar besar (*Porphyrio porphyrio*), trinil semak (*Tringa glareola*), trinil pantai (*Actitis hypoleucos*), kareo padi (*Amaurornis phoenicurus*), Elang Bondol (*Haliastur indus*), elang-laut perut-putih (*Haliaeetus leucogaster*), cangak abu (*Ardea cinerea*), perling Maluku (*Aplonis mysolensis*), cekakak-pita biasa (*Tanysiptera galatea*), cekakak pantai (*Todiramphus saurophagus*), raja-udang biasa (*Alcedo atthis*), raja-udang kecil (*Alcedo pusilla*), burung madu sriganti (*Cinnyris jugularis*), burung madu hitam (*Leptocoma sericea*), layang-layang Batu (*Hirundo tahitica*), kapinis laut (*Apus pacificus*), dan merpati kenanga (*Ptilinopus viridis*) etc.

The species of insects in the Valentine Bay ecosystem include: kupu-kupu (butterflies) (*Graphium sarpedon, Vindula* sp., *Papilio memnon, Elymnias vasudeva*); semut rang-rang (ants) (*Oecophylla smaragdina*), *Camponotus* sp.; and nyamuk (mosquitoes) belonging to genus *Anopheles*, and also the stick insect *Acrophylla wuelfingi*.

Among other animals found in the Valentine Bay ecosystem, the reptiles include: biawak Maluku (*Varanus indicus*), soa-soa (*Hydrosaurus amboinensis*), kura-kura Ambon (*Cuora amboinensis*), penyu Hijau (*Chelonia mydas*), penyu sisik (*Eretmochelys imbricata*), penyu ridel (*Lepidochelys olivacea*), penyu tempayang (*Caretta caretta*), etc.

The species of fish found to include: kerapu (*Epinephelus* sp.), (*Plectropomus* sp.), (*Plectorhinchus* sp.), kakap (*Lutjanus* sp.), leuncam (*Lethrinus* sp.), tuna (*Thunnus albacares*), cakalang (*Katsuwonus pelamis*), tongkol (*Euthynnus affinis*), ekor kuning (*Caesio* sp.), Pisang-pisang (*Pterocaesio* sp.), tenggiri (*Scomberomorus commerson*), baronang (*Siganus* sp.), layang (*Decapterus* sp.), caroang (*Tylosurus crocodilus*), kembung (*Rastrelliger kanagurta*), julung-julung (*Hemiramphus* sp.).

A **B** **C**

Figure 5. *Rhizophora apiculata.* A. Trees; B. Flowers; C. Fruits at proximal zone

A **B** **C**

Figure 6. *Bruguiera gymnorrhiza.* A. Trees; B. Flowers: C. Fruits at middle zone

A **B** **C**

Figure 7. *Xylocarpus granatum.* A. Trees; B. Flowers; C. Fruits at distal zone

The molluscs include: kerang lola (*Trochus niloticus*), Kima (*Tridacna* sp.), triton trompet (*Charonia tritonis*), kerang darah (*Anadara granosa*), kerang kerek (*Gafrarium tumidum*) kerang bakau (*Telescopium telescopium*), kerang kepah (*Polymesoda erosa*), etc. Krustasea (Crustaceans) ketam kelapa (*Birgus latro*), kepiting bakau (*Scylla serrata*), udang windu (*Penaeus* sp.), udang vaname (*Litopenaeus vannamei* sp.), and species of Echinoderms or sea cucumbers include: *Holothuria scabra*, *Holothuria atra*, *Bohadschia marmorata*, *etc*.

Likewise, there were mammal species including: Kuskus Putih (*Phalanger ursinus*), kuskus kelabu (*Phalanger vestitus*), kuskus coklat (*Phalanger orientalis*), rusa timor (*Cervus timorensis*), dugong (*Dugong dugon*), kelelawar ekor trubus kecil (*Emballonura monticola*), and babi hutan (*Sus scrofa*), etc.

The study illustrates that the mangrove ecosystem in Valentine Bay is abode to a variety of fauna, mainly birds, insects, reptiles, molluscs, crustaceans, echinoderms, fish and mammals. The existence of a higher diversity of fauna may be the result of less disturbed habitat conditions, complex vegetation structure and composition, availability and richness of feed resources such as fish, molluscs, crustaceans, and low predation risk (Zakaria and Rajpar 2015).

According to Kristiningrum et al. (2020), the mangrove ecosystem in the village of Mentawir Balikpapan also has a diversity of mammals, reptiles, fish, and invertebrates,

based on the results of the inventory it was known that the potential of fauna in the Valentine Bay was also very diverse. Referring to the criteria of (Fandeli 2000), the animal species richness >15 is very high, hence the fauna recorded in the mangrove area of Valentine Bay may be categorized as very high.

However, there were animals such as *Symposiachrus boanensis* and *Eretmochelys imbricata* that have been declared as Critically Endangered (CR) by IUCN . Other animals such as *Hydrosaurus amboinensis*, *Cuora amboinensis*, *Chelonia mydas*, *Holothuria scabra*, and *Holothuria atra* have their status under Endangered (EN) category. Meanwhile, *Thunnus albacares* and *Scomberomorus commerson* were under Near Threatened (NT) category and those under Vulnerable (VU) category were *Birgus latro*, *Caretta caretta*, *Lepidochelys olivacea*, *Phalanger ursinus*, *Cervus timorensis*, *Dugong dugon*, and *Eulipoa wallacei* (IUCN 2020) (Figure 8).

Likewise, in the Sumatran forests, the threat status of the Sumatran elephant (Elephas maximus ssp. sumatranus) has increased dramatically (Melia et al. 2020). In the latest assessment based on (IUCN 2020) criteria, the status of Sumatran elephants (Elephas maximus ssp. sumatranus) rose from endangered to critically (critically endangered) which occurred in 2011, even the Bali tigers (Panthera tigris ssp. balica) and Javan tigers (Panthera tigris ssp. sondaica) have become extinct. Efforts to protect and utilize endangered species could be carried out with a sustainable approach, among others, by maintaining its function in maintaining the balance of the ecosystem; for the benefit of ecotourism, education, and research.

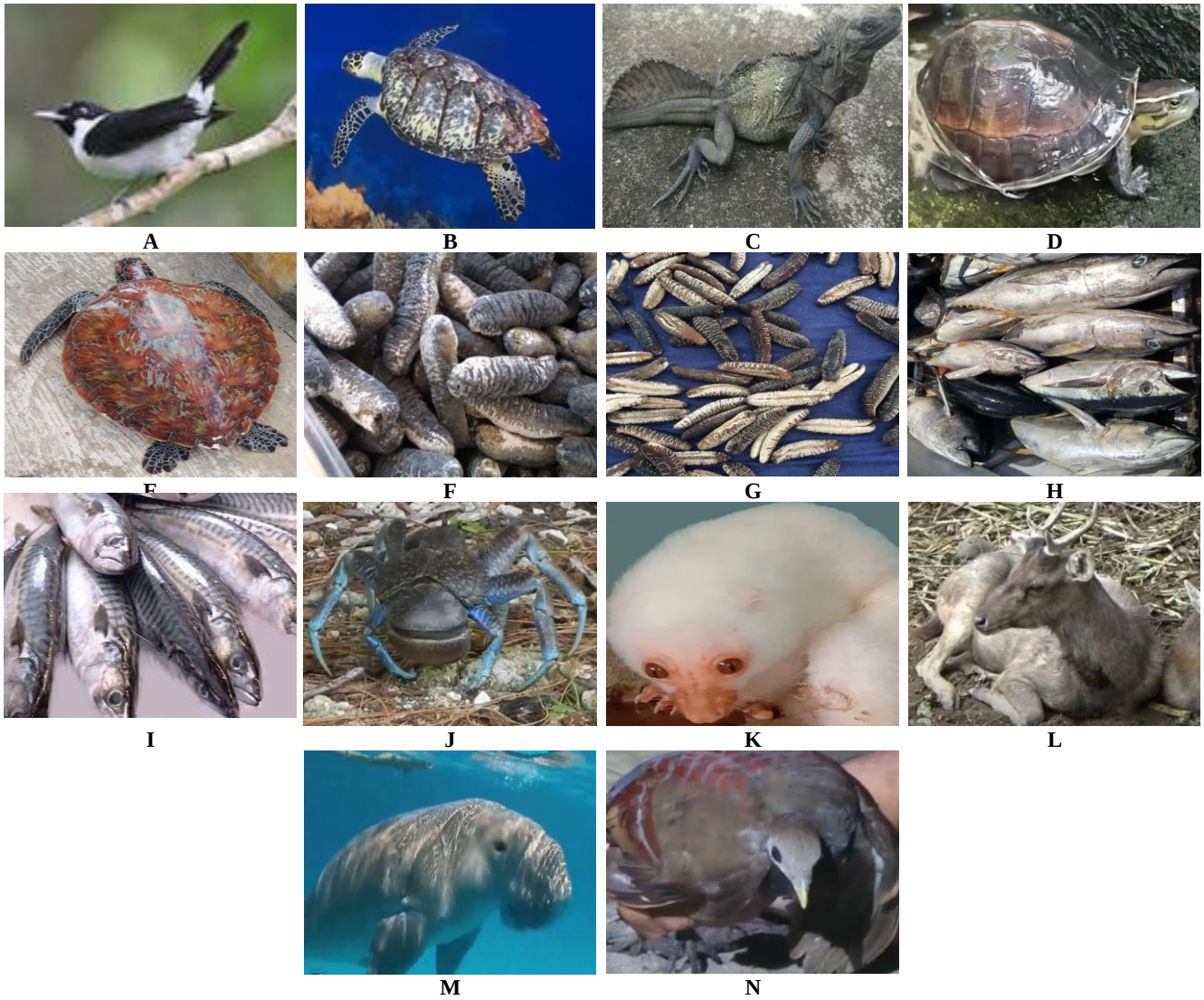

Figure 8. Fauna based on IUCN provisions (2020): A. *Symposiachrus boanensis*; B. *Eretmochelys imbricata*; C. *Hydrosaurus amboinensis*; D. *Cuora amboinensis*; E. *Chelonia mydas*; F. *Holothuria scabra*; G. *Holothuria atra*; H. *Thunnus albacares*; I. *Scomberomorus commerson*; J. *Birgus latro*; K. *Phalanger ursinus*; L. *Cervus timorensis*, M. *Dugong dugon*; and N. *Eulipoa wallacei*.

Stakeholders

Based on interviews and direct observations in the field with key informants (local community leaders, West Seram District Forestry Service, West Seram District Tourism Office, and NGOs) it shows that the Buano island community in developing the potential of mangroves as objects of ecotourism attraction can be divided into 2 categories, namely direct and indirect. Direct community involvement so far has been as ecotourism guides for flora (medicinal plants), fauna (birdwatching) similar to those already in the place at Malanza mangrove São Tomé area, Gulf of Guinea, Africa, where birdwatching activity could support community development and job opportunities (Haroun et al. 2018), fishing, canoeing, and boating in addition to homestay owners for local, foreign tourists, and as a field assistant to ecotourism researchers. The form of indirect involvement is that the local community is always involved in outreach, coaching, and training activities to increase knowledge and understanding of the importance of preserving mangrove ecosystems in the form of management in accordance with the concept of conservation and empowerment of local communities, in this case, ecotourism, training on conservation cadres. In addition, the "Sasi" tradition (a prohibition on taking certain natural resources) was being revived to support the conservation of the existing potential of biodiversity.

The Valentine Bay mangrove biodiversity has great potential for education, research, and ecotourism (Garcia et al. 2014). In addition, the community must also be made aware of the ecological role (pest control, etc.) and indirect economic benefits (livelihood, etc.) derived from the existing animals in the forest around their habitat, and encourage not to value them only for hunting. Through this understanding, the community and government officials may jointly protect the various species of flora and fauna that live in the mangrove ecosystem and around them and help prevent outsiders from engaging in encroachment and hunting. Furthermore, not only stakeholders but society, educational institutions, and researchers need to be involved to achieve the desired goals. It is also stated by (Alves et al. 2020) that the public and scientific community need to be involved together to achieve goals with tiered input and agree on a coordinated conservation plan.

Another tourism potential around Valentine Bay

Valentine Strait

The waters of the Valentine Strait flanked by Buano island and Pua island with a width of about 80 meters have their own charm. The Valentine Strait on Buano island was included in the top 10 list of the Anugerah Pesona Indonesia (The Enchantment of Indonesia's Grace) 2020 for the Most Popular Hidden Heaven category. According to local people, this strait was named Valentine Strait by Dutch soldiers in the colonial era because the aerial outlook of the strait of Buano island is shaped like heart. The sea waves around the island of Buano are popular to the public as they are frequent and wavy, but this is not the case with the strait waters. The calm sea in the Valentine Strait makes this strait look like a lake where swimming, fishing, diving, and water ride activities could be carried out comfortably (Figure 9).

Buano coral cliff

In addition to aquatic areas, the charm of the Valentine Strait also consists of the mountain ranges, green hills, and rock cliffs that stand firmly separating the land from the sea along the 7.14 km stretch of this strait. Apart from having a beautiful panorama, these Buano cliffs offer high level of challenge to rock climbers (Figure 10).

Buano coral reefs

The condition of the waters of Buano island was found to be still pristine making it ideal condition to thrive the coral reef ecosystem with various reef fish. The combination of marine life in the Valentine Strait has the charm of a marine park (Figure 11).

Figure 9. Valentine strait waters

Figure 10. Buano coral cliffs

Figure 11. Buano coral reefs

Ecotourism development strategy

Based on the existing potential and community participation, a SWOT analysis was carried out. This analysis was a technique to identify Strength (S), Weakness (W), Opportunity, Threat (T) which could be used as a basis for ecotourism development in Valentine Bay to be more focused and able to contribute which is good for area management and improving the welfare of the community around the area (Table 3).

Based on the weight value of Internal Factor Analysis System (IFAS) and External Factor Analysis System (EFAS) on the SWOT analysis, a more optimal and targeted ecotourism development strategy can be carried out, namely as follows:

Strategies using strength to take advantage of opportunities (S-O)

- Building ecotourism based on high natural potential (flora, fauna, and another tourism potential) around the Valentine Bay mangrove area by utilizing government regulations, support from the local government, local governments, NGOs (LPPM Maluku), educational and research institutions as well as tourist visits.
- Promoting the potential for cultural customs and local wisdom such as "sasi", which is still maintained.
- Making and stipulating village regulations to organize directed Village development planning, regulating environmental sustainability and natural resources, and maintaining the institutions of customs and local wisdom that have grown in the midst of society.
- Developing the potential of integrated agriculture through government support to help improve the welfare of local communities with an ecotourism approach and simultaneously supporting ecotourism programs.
- Maintaining local wisdom, customary sites, etc. of the Buano people to increase opportunities for integrated agricultural development, ecotourism, and development of essential ecosystem areas.
- Managing regional database by developing a Geographical Information System with support from educational institutions and researchers.
- Increasing opportunities in the development of essential ecosystem areas through the support of the government, NGOs (LPPM Maluku), educational institutions, and researchers.
- Accelerating the development of ecotourism programs with the support of the community, government, and educational institutions.

Table 3. Matrix of problems and supporting factors for ecotourism development in Buano Island

Problems		Supporting factors	
Threat (T)	**Weakness (W)**	**Strength (S)**	**Opportunity (O)**
1. The high dependence of the local communities on natural resources in the area so that illegal activity such as hunting and illegal logging is rampant. 2. The economic level of the local communities around the area is still relatively low due to limited alternative livelihoods. 3. Low understanding of local communities about biodiversity conservation. 4. Security situation.	1. Lack of infrastructure. 2. Lack of coordination with stakeholders. 3. Facilities and infrastructure to support tourism such as accommodation, tourist information centers are inadequate, there are no banks, souvenir shops and restaurants. 4. The quantity and quality of human resources are still limited due to the low level of education of the local communities. 5. Lack of promotion of ecotourism.	1. The Potential of natural resources (flora, fauna, another tourism potential on Buano island). 2. Cultural customs and local wisdom are still maintained. 3. The potential of marine fisheries, plantations, and agriculture. 4. The existing potentials have uniqueness, scarcity and diversity values. 5. High support from the district, sub-district, village governments, communities, and NGOs in the development of Buano island area.	1. Government regulations on tourism, forestry, and related sectors and village regulations. 2. Support from governments, regencies, and local communities for the ecotourism sector on Buano island. 3. Support from educational institutions for technological advances and researchers, NGOs, and mass media 4. Interest in visits from tourists (local and foreign). 5. The existence of the development of essential ecosystem areas.

Strategies for overcoming weaknesses by taking advantage of opportunities (W-O)

- Carrying out infrastructure development, especially the construction of roads, bridges, clean water in ecotourism areas through the support of government regulations and programs.
- Building tourism support facilities and infrastructures such as accommodation, souvenir shops, restaurants, and tourist information centers through the support of local and district governments.
- Increasing tourism promotion efforts either through social media, online media or with the help of tourists who have visited; here support of government and Educational Institutions may be required.
- Cooperation with tour and travel agents to increase tourist visits.
- Improve the social welfare and education of local communities around.
- Improve coordination and cooperation between institutions and support from government and educational institutions.

Strategies to use strength to face threats (S-T)

- Take advantage of the high support of local communities, especially traditional institutions in protecting and maintaining mangroves in the protected forest area of Buano island and its surroundings.
- Utilizing the support of the government and NGOs (LPPM Maluku) to provide guidance for environmental conservation and inculcating of love for nature for the surrounding community to conserve the environment.
- Take advantage of government and community support to open business opportunities that support the tourism sector for the surrounding community.
- Encouraging integrated agricultural development programs to increase the income and welfare of local communities so that people no longer depend only on forest products, especially wood.
- Maintain the conservation and biodiversity of mangroves in the protected forest area of Buano island.
- Take advantage of the support of the local government and traditional community leaders to participate in increasing the participation and awareness of local people about mangrove conservation in the protected forest area of Buano island and its surroundings as a potential for ecotourism from various kinds of disturbances

Strategies to minimize weaknesses and overcome threats (W-T)

- Increasing dissemination of knowledge about the status and function of mangroves in the protected forest area of Buano island to local communities.
- Building infrastructure and facilities to increase the flow of tourist visits as a means to sustain alternative livelihood opportunities for the locals.
- Improving the social welfare and education of the local community as a means to dissuade them from animal hunting, illegal logging, forest encroachment in the mangrove ecosystem of the protected forest area of Buano island.
- Improving coordination between institutions so as to minimize threats to the mangrove ecosystem in the protected forest area of Buano island.

The diversity of avenues of ecotourism in the mangrove area in Valentine Bay could be identified from both locational, biological, and socio-cultural potential. To keep the locational sanctity of the place, focus should be also be made towards management of waste and minimizing impact of tourism on environment. The potential of biologically rich mangrove forest, bay waters, waters around island and cliffs in Valentine Bay may be sustainably showcased as attractions of ecotourism and further study must be promoted for its conservation and new additions to list of local flora and fauna. Socio-cultural aspects may be incorporated under ecotourism which may not only add to conservation of local traditions but also help the local economy.

The Efforts to conserve mangroves by increasing local communities' understanding of the function and role of mangroves are expected to foster awareness of the community to conserve the mangrove ecosystem. Conservation and maintenance of the mangrove ecosystem as a habitat will have an impact on the conservation of marine life which in turn will support the current Buano economy and its sustenance for future generations. Support from all stakeholders is expected for collaborating in efforts to support conservation, open employment opportunities, promote local culture, and provide increased welfare for local communities.

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