

BUKTI-BUKTI PROSES REVIEW (PENULIS KORESPONDENSI)

Title	:	Potential analysis of location, socio culture and biodiversity as ecotourism attraction in Valentine Bay on Buano Island, West Seram, Maluku, Indonesia
Author	:	Martha E. Siahaya, Paulus Matius, Marlon I. Aipassa, Yaya Rayadin, Yosep Ruslim*
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COVERING LETTER

Dear **Editor-in-Chief**,

I herewith enclosed a research article,

Title:

Potential Analysis and biodiversity of mangroves as an ecotourism attraction in Valentine Bay on Buano Island, West Seram, Moluccas, Indonesia

Author(s) name:

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2. Paulus Matius
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Sincerely yours,

Martha E. Siahaya
Yosep Ruslim

1 **Potential Analysis and biodiversity of mangroves as an ecotourism**
2 **attraction in Valentine's Bay on Buano Island, West Seram, Moluccas**
3 **Indonesia**

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12 Manuscript received: DD MM 2016 (Date of abstract/manuscript submission). Revision accepted: 2020.

13 **Abstract.** This study aims to analyze the potential of flora and fauna in the mangrove ecosystem as an attraction for ecotourism
14 development, knowing the role of stakeholders in supporting ecotourism development and determining ecotourism development
15 strategies in the mangrove area of Valentine Bay on Buano island, West Seram, Moluccas, Indonesia. This data includes the potential of
16 flora and fauna in the Valentine Bay mangrove ecosystem. Based on the results of the study, it was found that 1) The results of the
17 analysis of mangrove vegetation found 28 species of vegetation, and 19 families. For vegetation at the level of seedlings, saplings, and
18 trees, the dominant species were found, namely those were *Rhizophora apiculata*, *Bruguiera gymnorrhiza* and *Xylocarpus granatum*.
19 For animal identification, the Valentine Bay mangrove ecosystem has a diversity of animal species consisting of birds, insects, reptiles,
20 mollusks, crustaceans, echinoderms, fish, and mammals which were more diverse illustrating that the mangrove ecosystem in the
21 Valentine Bay has attracted a variety of fauna species. However, there was an endemic fauna of Buano island, namely the Kehicap
22 buano/black-chinned monarch bird (*Symposiachrus boanensis*) has started to become rare, and was declared in critical condition (CR)
23 by the International Union for Conservation of Nature and Natural Resources; 2) Stakeholder involvement in ecotourism activities were
24 very supportive; 3) development strategies were to develop ecotourism, promote ecotourism attractiveness, develop educational tourism
25 and research on the diversity of flora, fauna, culture, and traditional customs on Buano island.

26 **Key words:** biodiversity, ecotourism, mangrove, moluccas, valentine bay

27 **INTRODUCTION**

28 Mangrove is a typical forest type and grows along the coast or river estuaries which are influenced by tides and are
29 often found in coastal areas that are protected from the onslaught of waves and gently sloping areas in tropical and sub-
30 tropical areas (Hartshorn 2013; Duke & Schmitt 2014; Spencer et al. 2016).

31 Natural resources in coastal areas have a role in supporting social and economic development (Salampessy et al. 2015;
32 Neumann et al. 2017; McKinley et al. 2019). The consequence of this great potential causes coastal areas to be vulnerable
33 to damage and degradation of coastal natural resources.

34 Mangrove is a unique natural ecosystem that has high ecological and economic value (Cuenca et al. 2015) and gives
35 many benefits and services to the environment (Kristiningrum et al. 2019; Sondak et al. 2019) including providing
36 nutrients, spawning grounds, nurseries, and feeding grounds for certain marine biota and for the human coastal
37 communities. In addition to producing basic materials for family and industrial purposes such as firewood, charcoal, and
38 construction materials (Kusmana and Sukristijiono 2016), mangroves are also able to act as abrasion barriers for the land
39 area behind this ecosystem (Bengen 2004; Lee et al. 2014). Mangroves could prevent erosion (Das 2020) due to mangrove
40 trees have long tapered roots so they can protect the soil from erosion (Spalding et al. 2014; Hilmi et al. 2017), and are
41 able to hold or deposit mud to prevent seawater intrusion (Surya et al. 2020).

42 The utilization and management of natural resources on Buano island face various threats, both from ecological and
43 social aspects. Ecological aspects, namely the decline in the quality of the terrestrial and coastal environment. Terrestrial
44 environmental quality threats such as excessive felling of trees, land clearing, and mining. According to Rujehan & Matus
45 (2018), land clearing and mining activities are also issues that often occur in Bukit Soeharto, East Kalimantan. Coastal
46 threats can consist of overfishing, this also occurs in Lake Sentani which is caused by overfishing (Ohee et al. 2018),
47 damage to mangroves (Faridah-Hanum et al. 2014) and coral reefs (Wijayanti et al. 2018), declining quality of underwater
48 parks, the threat of various species of marine life such as trade in endangered species, increased abrasion, widespread

49 sedimentation, and intrusion of seawater. The coastal ecosystem faces serious threats of pollution, overexploitation,
50 conflicting use of resources, damage, and destruction of habitats, (Kumar et al. 2017). Meanwhile, threats in the social
51 aspect on Buano island include high population growth, such as the expansion of human settlements, which can lead to
52 excessive exploitation of natural resources that can damage the environment. Conservation activities are an effort to
53 maintain the balance of nature so that humans and other living things can live well.

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

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

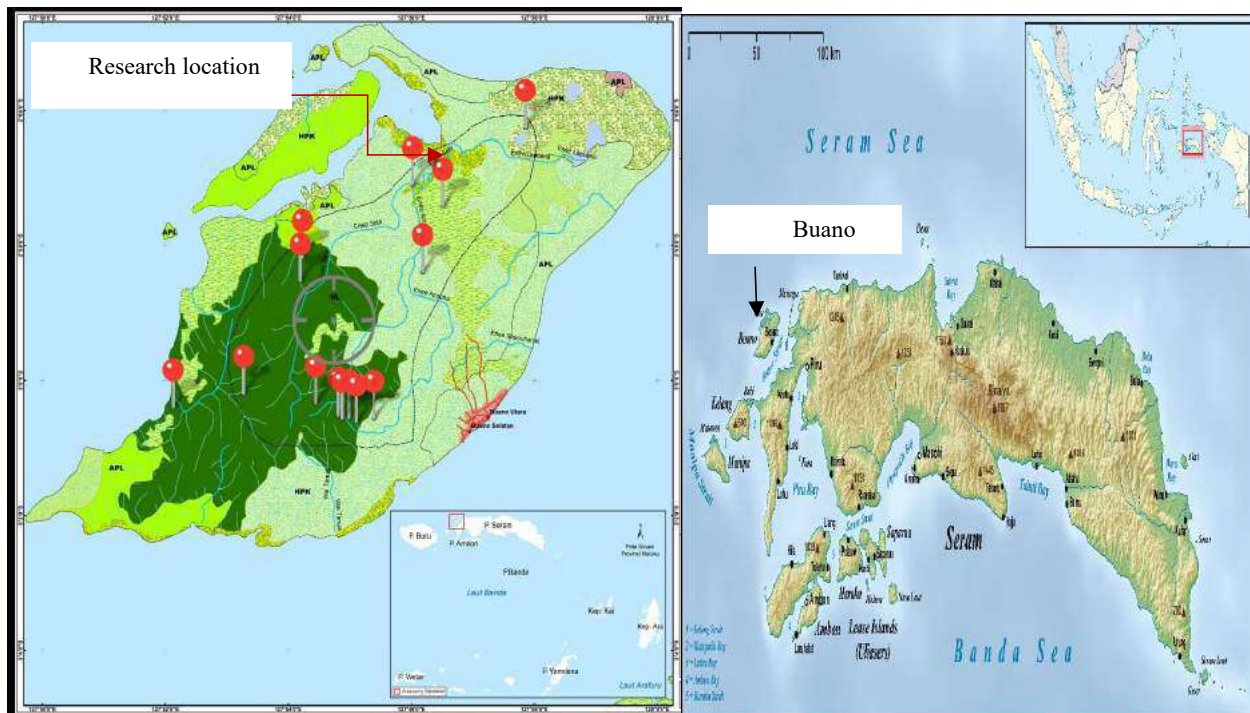
62 Based on the description above and considering the limited data and information regarding the condition of mangrove
63 forests in the coastal area of Valentine Bay, it is deemed necessary to conduct research on the potential and development
64 strategies of Valentine Bay mangrove ecotourism on Buano Island. The research objectives were (1) to analyze the
65 potential composition of mangroves including species composition, density, presence frequency, and Importance value
66 of the species; (2) to determine the role of stakeholders in supporting ecotourism development, and; (3) ecotourism
67 development strategy. This research is also expected to provide information about the potential of existing mangroves and
68 other tourism potentials around Valentine Bay so that it can provide input to related agencies in the context of managing
69 and developing mangrove areas as a supporter of ecotourism.

70

MATERIALS AND METHODS

71 Study area

72 The location of the study was in a mangrove ecosystem in the Valentine Bay area which is administratively located on
73 Buano Island, Huamual Belakang Subdistrict, West Seram District, Moluccas Province, Indonesia. The map of the
74 research location is presented in Figure 1. The research was conducted from July to September 2019.
75



76

77

78

Figure 1. Reserch location in Valentine Bay on Buano Island, West Seram District, Moluccas, Indonesia

79 Procedures

80 The data collected in this study were primary data and secondary data. Primary data were collected directly at the
81 research location. Secondary data were obtained through local community information, website searches, documents on

82 the management of natural resources on the coast of Buano Island, and key informants, consisting of the West Seram
83 District Forestry Service, West Seram Regency Tourism Office, and related NGOs.

84 The Vegetation data was collected using the combination of the path method and the compartmentalized line method.
85 Research plots were made in the line transect. The plot areas for each growth stages were as follows:

- 86 (a) Seedlings plot was up to 1.5 meters high, plot size of 5 m x 5 m,
87 (b) Poles with the height between 1.5 m – diameter <10-19 cm, plot size 10 m x 10 m
88 (c) Trees with the diameter \geq 20 cm, plot size 20 m x 20 m

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

91 **Data analysis**

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

95
96
97 Density (D) =
$$\frac{\text{Number individual of a species}}{\text{Area of the measurment plots}}$$

98
99

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

102
103

104
105 Frequency (F) =
$$\frac{\text{Number of plots found of a species}}{\text{Area of the measurement plots}}$$

106
107

108
109 Relative Frequency (RF) =
$$\frac{\text{Frequency of a species}}{\text{Frequency of all species}} \times 100\% \quad (4)$$

110
111

112
113 Dominance (SD) =
$$\frac{\text{Basal area of a species}}{\text{Area of the measurment plots}}$$

114
115

116
117 Relative Dominance (RD) =
$$\frac{\text{dominance of a species}}{\text{dominance of all species}} \times 100 \%$$

118
119

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

122 For seedlings:
$$\text{IVI} = \text{RDen} + \text{RF} \quad (7)$$

123 For poles and trees:
$$\text{IVI} = \text{RDen} + \text{RF} + \text{RD} \quad (8)$$

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

$$H' = - \sum \left[\left(\frac{n_i}{N} \right) \ln \left(\frac{n_i}{N} \right) \right] \quad (9)$$

126 Where:

127 H' = Species Diversity Index

128 N = total of Importance Value Index (IVI)

129 n_i = Importance Value Index (IVI) of a species

130 **RESULTS AND DISCUSSION**

131 **Research Review**

132 Buano Island is one of the small islands with an area of about 135.73 km², which is located to the southwest of
133 Seram Island. There were 2 villages that were located close to and parallel to the sloping coast, namely North Buano and
134 South Buano villages, both of which are only separated by mosques, and the church was located close by and is a marker

135 of the two villages. On September 29, 2014, through SK.854 / Menhut-II / 2014 concerning the Forest Area of Moluccas
 136 Province, a protected forest area of 4,287.22 Ha was established. The research locations were generally located in the
 137 mangrove area of Valentine Bay, one of the areas included in the protected forest area of Buano Island.

138 The research results showed that there were several potential tourism objects on Buano Island that could be packaged
 139 into attractive ecotourism packages, including tours in the mangrove area of Valentine Bay, the diversity of animals, and
 140 another tourism potential around Valentine bay.

141
 142 **A. Flora**

143 Valentine Bay Mangroves divided into 3 zonings; namely the front zone (Proximal), the middle zone (Middle), and the
 144 back zone (Distal). The identification results of mangroves found in Valentine Bay were 28 species and 19 families (Table
 145 1).

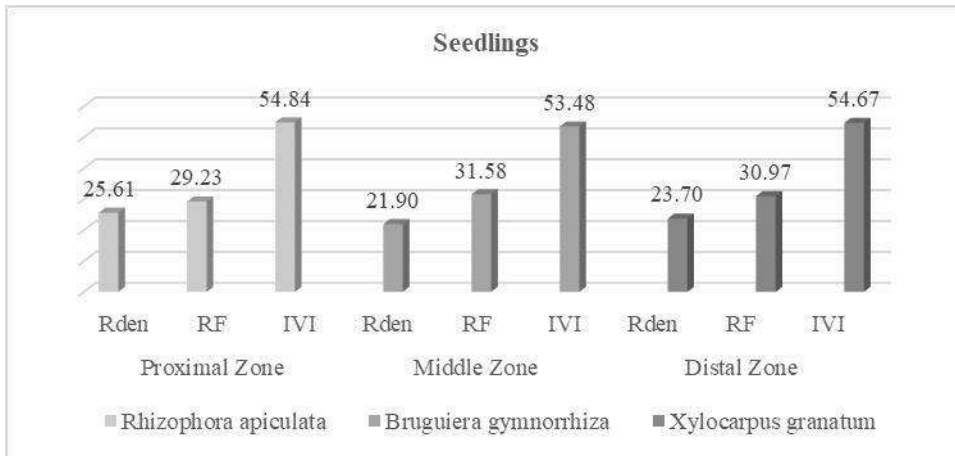
146
 147 Tabel 1. The Species of true mangroves and mangrove associates vegetation in Valentine Bay
 148

No.	Species	Family	Zone		
			Proximal	Middle	Distal
1	<i>Rhizophora apiculata</i>	Rhizophoraceae	√		
2	<i>Rhizophora stylosa</i>	Rhizophoraceae	√		
3	<i>Sonneratia alba</i>	Sonneratiaceae	√		
4	<i>Rhizophora mucronata</i>	Rhizophoraceae	√		
5	<i>Avicennia alba</i>	Verbenaceae	√	√	
6	<i>Bruguiera sexangula</i>	Rhizophoraceae	√	√	
7	<i>Bruguiera gymnorhiza</i>	Rhizophoraceae	√	√	
8	<i>Pemphis acidula</i>	Litraceae	√	√	
9	<i>Lumnitzera littorea</i>	Combretaceae	√	√	
10	<i>Acanthus ebracteatus</i>	Acanthaceae	√		
11	<i>Bruguiera cylindrica</i>	Rhizophoraceae		√	
12	<i>Ceriops tagal</i>	Rhizophoraceae		√	
13	<i>Ceriops decandra</i>	Rhizophoraceae		√	
14	<i>Xylocarpus moluccensis</i>	Meliaceae		√	√
15	<i>Xylocarpus granatum</i>	Meliaceae		√	√
16	<i>Excoecaria agallocha</i>	Euphorbiaceae		√	
17	<i>Aegiceras corniculatum</i>	Myrsinaceae		√	
18	<i>Acrostichum speciosum</i>	Pteridaceae		√	
19	<i>Nypa fruticans</i>	Arecaceae			√
20	<i>Heritiera littoralis</i>	Sterculiaceae			√
21	<i>Barringtonia asiatica</i>	Lecythidaceae			√
22	<i>Pongamia pinnata</i>	Leguminosae			√
23	<i>Pandanus tectorius</i>	Pandanaceae			√
24	<i>Terminalia catappa</i>	Combretaceae			√
25	<i>Hibiscus tiliaceus</i>	Malvaceae			√
26	<i>Acrostichum aerum</i>	Pteridaceae			√
27	<i>Scaevola taccada</i>	Goodeniaceae			√
28	<i>Intsia bijuga</i>	Fabaceae			√

149
 150 According to Ahmad (2015) in the mangrove forests of Piru bay West Seram district, Moluccas, has found 17 species
 151 of mangroves, while Poedjirahajoe et al. (2019) has found 17 species of mangroves in Kutai National Park, East
 152 Kalimantan. If compared with the research results in other regions, it could be seen that the species composition in the
 153 Valentine Bay area was higher than in other areas. The difference in the number of species composition in mangroves in
 154 several areas was thought caused by the differences in environmental conditions, the number of observations, and the level
 155 of disturbance in each research area. The species with the highest importance represent the tenure value of the species in a
 156 community. The importance value of a species could be used as an indication that the species are considered dominant by
 157 having a higher relative density, relative frequency, and dominance values compared to other species.

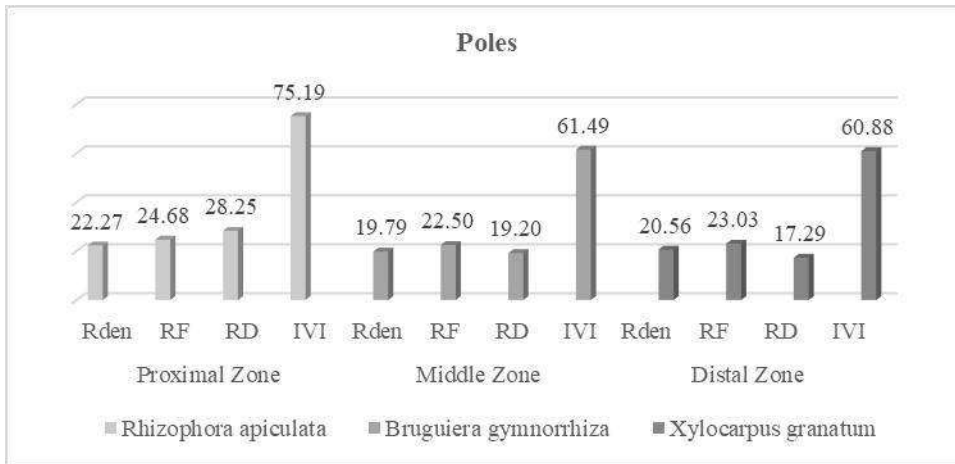
158 The results found at the seedling level there were 28 species of mangroves with different distribution patterns in
 159 relative density, relative frequency, relative dominance, importance value index, and species similarity index. For the Poles
 160 level, there were also 28 species of mangroves were found (Figure 3), meanwhile 26 species of mangroves were found at
 161 trees level.

162



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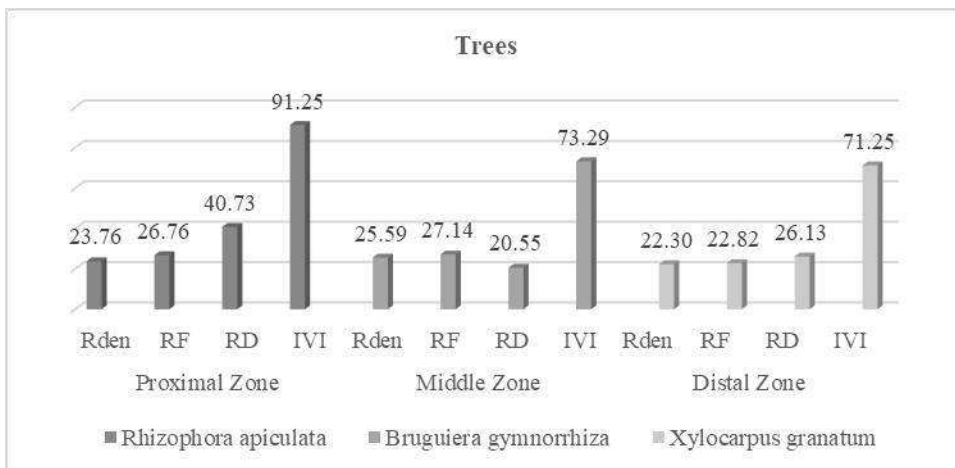
Figure 2. Mangrove species for seedling level in Valentine bay



167

168

Figure 3. Mangrove species of vegetation for poles level in Valentine bay



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170
171

Figure 4. Mangrove species of vegetation for trees level in Valentine bay

172
173
174
175

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

176 Setyawan and Ulumuddin (2012), that mangroves in Tambelan island, Natuna Sea, Indonesia, especially for *Rhizophora*
 177 *apiculata* commonly growing along the seaward and in various substrates such as fertile mud sediments, white sand, and
 178 corals. According to Shah et al. (2016) stated that the mangrove forests of Sibuti, Sarawak, Malaysia were also dominated
 179 by *Rhizophora apiculata* among the 9 species of mangroves found there

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

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

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

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

195
 196 Table 2. Species Diversity Index of Each Growth Rate in Valentine bay

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

197
 198 Based on the data in Table 2 concerning the Diversity Index, the highest was in the middle zone at the seedling
 199 level of 2.20, while the lowest was in the front zone at the tree level of 1.92. Magurran (1988) states that the range of
 200 values calculated for the diversity index (H) is as follows: (a) $H \geq 3$ means high species diversity; (b) $1 < H' < 3$ means
 201 moderate species diversity; and (c) $H' > 3$ means high species diversity. Based on the range of vegetation species diversity
 202 index proposed by Magurran, the results of the species diversity index in the mangrove forest in Valentine Bay could be
 203 categorized as moderate. Each range on the diversity index has its own benchmarks. This means that the level of diversity
 204 of mangrove forests in Valentine Bay was moderate, has sufficient vegetation productivity, ecosystem conditions were
 205 quite balanced, and ecological pressure was moderate. In line with the research of Naisumu et al. (2018) that the Tree
 206 Species Diversity Index in Lapeom Protection Forest is also in the medium category with a fairly balanced ecosystem,
 207 sufficient tree productivity levels, and moderate ecological pressure.

208



209
 210 **Figure 5.** (A) *Rhizophora apiculata* trees; (B) *R. apiculata* flowers; (C) *R. apiculata* fruits at Proximal Zone
 211



212 **Figure 6.** (A) *Bruguiera gymnorrhiza* tress; (B) *B. gymnorrhiza* flowers; (C) *B. gymnorrhiza* fruits at Middle Zone
213



214 **Figure 7.** (A) *Xylocarpus moluccensis* Trees; (B) *X. moluccensis* flowers; (C) *X. moluccensis* fruits at Distal Zone
215

216 Fandeli (2000) stated that the higher the number of species in an area, the better the quality of its diversity. Vegetation
217 observation and providing information about the various species that exist on each observation path are interesting things
218 for tourists because additional knowledge was given to get to know and learn more about vegetation species, the ecological
219 processes of existing vegetation species, and become something new for tourists. The existence of this high diversity of
220 flora will attract a lot of interest from both local and foreign tourists to come and get new experiences that were unique and
221 different.
222

223 **B. Fauna**

224
225 Apart from biodiversity, it turns out that the mangrove ecosystem also has a diversity of wildlife. Based on the results
226 of the survey and identification, it was found that the fauna species that exist in the Valentine Bay mangrove ecosystem as
227 potential for the development of objects of ecotourism attraction include 28 species of birds, 8 species of insects, 5 species
228 of reptiles, 16 species of fish, 9 species of mammals, 4 species of crustaceans, 3 species of echinoderms, and 2 species of
229 mollusks.

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

240 The species of insects in the Valentine Bay ecosystem include: kupu-kupu *Graphium sarpedon*, *Vindula sp.*, *Papilio*
241 *Memnon*, *Elymnias Vasudeva*; semut rang-rang (*Oecophylla smaragdina*), *Camponotus sp.*; dan (7) nyamuk *Anopheles sp.*,
242 *Acrophylla wuelfingi*.

243 Other species of fauna found in the Valentine Bay ecosystem were reptiles including: biawak Maluku (*Varanus*
244 *indicus*), soa-soa (*Hydrosaurus amboinensis*), kura-kura Ambon (*Cuora amboinensis*), penyu Hijau (*Chelonia mydas*),
245 penyu sisik (*Eretmochelys imbricata*), penyu ridel (*Lepidochelys olivacea*), penyu tempayang (*Caretta caretta*).

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

251 Apart from the species of fish found also types of molluscs include: kerang lola (*Trochus niloticus*), Kima (*Tridacna*
252 *sp.*), triton trompet (*Charonia tritonis*), kerang darah (*Anadara granosa*), kerang kerek (*Gafrarium tumidum*) kerang bakau
253 (*Telescopium telescopium*), kerang kepah (*polymesoda erosa*). jenis krustasea, ketam kelapa (*Birgus latro*), kepiting bakau
254 (*Scylla serrata*), udang windu (*Penaeus sp.*), udang vaname (*Vannamei sp.*), and species of Echinoderms or sea cucumbers
255 include: *Holothuria scabra*, *Holothuria atra*, *Bohadschia marmorata*.

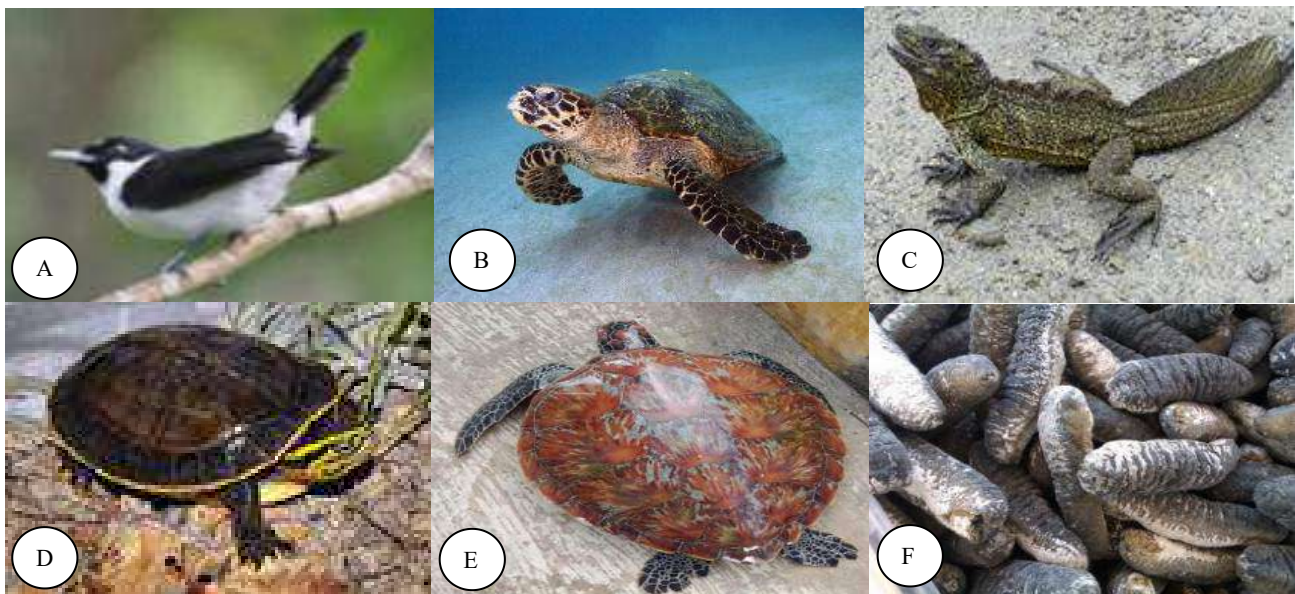
256 Likewise, there were mammal species including: Kuskus Putih (*Phalanger ursinus*), kuskus kelabu (*Phalanger*
257 *ursinus*), kuskus coklat (*Phalanger orientalis*), rusa timor (*Cervus timorensis*), dugong (*Dugong dugon*), kelelawar ekor
258 tribus kecil (*Emballonura monticola*), dan babi hutan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

259 Identification of a more diverse fauna diversity illustrates that the mangrove ecosystem in Valentine Bay has attracted a
260 variety of fauna species. This means that mangrove habitat can accommodate a variety of animals such as birds,
261 insects, reptiles, molluscs, crustaceans, echinoderms, fish and mammals. The existence of a higher diversity of fauna
262 can be caused by native habitat conditions (no disturbance), complex vegetation structure and composition,
263 availability and richness of feed resources such as fish, molluscs, crustaceans, and low predation risk (Zakaria and
264 Rajpar 2015). The structure and composition of vegetation, occurrence of silt, and richness of food sources were the
265 main driving factors affecting the distribution and diversity of fauna directly and indirectly.

266 According to (Kristiningrum et al. 2020), the mangrove ecosystem in the village of Mentawir Balikpapan also has a
267 diversity of mammals, reptiles, poultry, fish, and invertebrates, based on the results of the inventory it was known that the
268 potential of fauna in the Valentine's Bay was also very diverse. Referring to the ciriterias of (Fandeli 2000), state that
269 fauna with species >15 is very high, it could be categorized that the fauna found in the mangrove area of Valentine Bay
270 were very high. Based on these results it could be said that the potential object of ecotourism attraction has a high
271 competitiveness value.

272 However, there were animals such as *Symposiachrus boanensis* and *Eretmochelys imbricata* that have been declared in
273 critical condition (CR) by the International Union for Conservation of Nature and Natural Resources. Other animals such
274 as *Hydrosaurus amboinensis*, *Cuora amboinensis*, *Chelonia mydas*, *Holothuria scabra*, and *Holothuria atra*, their status
275 was threatened (EN). Meanwhile, those that were vulnerable (VU) are *Birgus latro*, *Phalanger Ursinus*, *Cervus timorensis*,
276 *Dugong dugon*, *Pteropus Ocularis*, and *Eulipoa Wallace* (IUCN 2020) (Figure 8).

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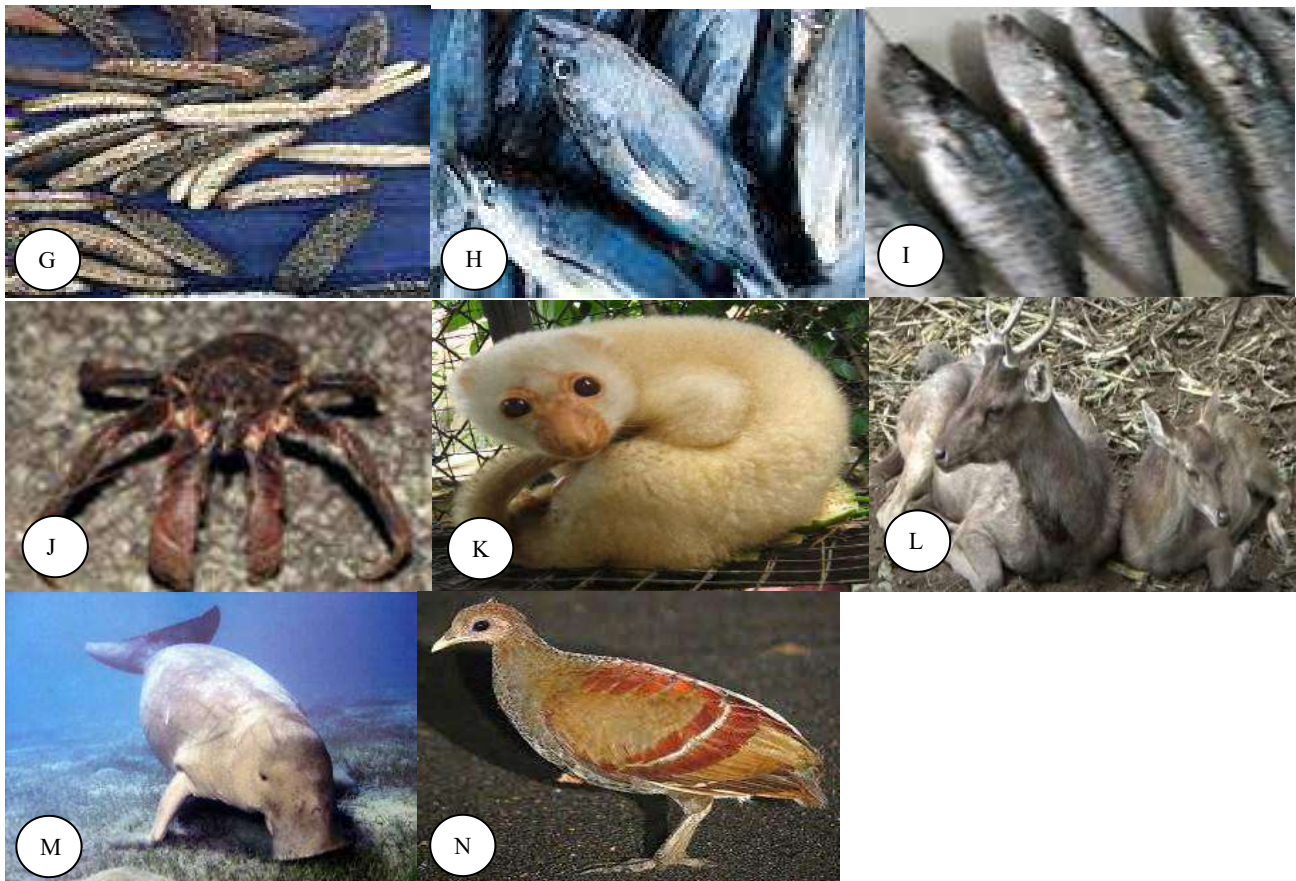


Figure 8. Fauna based on IUCN provisions (2020): (A) *Symposiachrus boanensis*; (B) *Eretmochelys imbricata*; (C) *Hydrosaurus amboinensis*; (D) *Cuora amboinensis*; (E) *Chelonia mydas*; (F) *Holothuria scabra*; (G) *Holothuria atra*; (H) *Thunnus albacares*; (I) *Scomberomorus commerson*; (J) *Birgus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

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) criterias, 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 balica*) and Javanese tigers (*Panthera Tigris 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.

C. Stakeholders

Based on interviews and direct observations 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) criterias, 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 balica*) and Javanese tigers (*Panthera Tigris 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. in the field with key informants (local community leaders, West Seram Regency Forestry Service, West Seram Regency 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) (Haroun et al. 2018), fishing, canoeing, and boating in addition to homestay owners for local, foreign tourists, and as a companion to ecotourism researchers. The form of indirect involvement is that the local community is always involved in outreach, coaching and training activities to increase

314 knowledge and understanding of the importance of preserving mangrove ecosystems in the form of management in
315 accordance with the concept of conservation and empowerment of local communities, in this case, ecotourism, training on
316 conservation cadres. In addition, the "Sasi" tradition (a prohibition on taking certain natural resources tradition) was being
317 revived to support the preservation of the existing potential of biodiversity.

318 In addition, the community must also be made aware of the ecological role and indirect economic benefits of the
319 existence of various animals in the forest around their habitat, not only as a temporary gain as the value of hunting or the
320 value of their body parts but as a source of livelihood and the economy. For example, as a pest control, pollination agent or
321 as a tourist attraction. Through this understanding, the community and government officials will jointly protect the various
322 species of flora and fauna that live in the mangrove ecosystem and around them and help prevent outsiders from engaging
323 in encroachment and hunting. Furthermore, not only stakeholders but society, educational institutions and researchers need
324 to be involved to achieve the desired goals. It is also stated by (Alves et al. 2020) that the public and scientists need to be
325 involved to achieve goals with tiered input and agree on a coordinated plan.

326 The Valentine Bay mangroves biodiversity has great potential for education, research, and ecotourism as stated by
327 (Garcia et al. 2014), that the diverse of both plants and animals in the mangrove forests and their adaptation could make
328 mangrove ecosystems an ideal destination for students and researchers. area has an attraction for mangrove tourism.

329 **D. Another tourism potential around Valentine Bay**

330 **Valentine Strait**

331 The Valentine Strait on Buano Island was included in the top 10 of the Anugerah Pesona Indonesia (The Enchantment
332 of Indonesia's Grace) 2020 for the Most Popular Hidden Heaven category. According to local people, this strait was named
333 Valentine Strait by Dutch soldiers in the colonial era because if we glimpse from a certain height on the island of Buano,
334 this strait will look like a heart. The waters of the Valentine Strait flanked by Buano Island and Pua Island with a width of
335 about 80 meters and have its own charm. It was a unique geographic The sea waves around the island of Buano usually
336 known to the public as they are frequent and wavy, but this is not the case with the water conditions in this strait. affects the
337 water conditions in the strait. The calm sea in the Valentine Strait makes this strait look like a lake. So that tourists who
338 want to swim, fish can bring along fishing rods because the sea around the island is often used as a place for fishing,
339 diving and playing water rides such as boating or jet skiing can be done comfortably (Figure 9).



341 **Figure 9.** Valentine Strait Waters

342 **Buano Coral cliff**

343 In addition, the charm of the Valentine Strait was also located in the mountain ranges, green hills and rock cliffs that
344 stand firmly separating the land from the sea along the 7.14 km of this strait. Rock climbing tourists, Buano cliffs can be
345 the main destination. Apart from having a beautiful panorama, these cliffs also have a high level of challenge.



348 **Figure 10.** Buano Cliffs

349

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351 **Buano Coral Reefs**

352 The condition of the waters of Buano island, which is on small island and the condition of the coral reef ecosystem is
 353 still good, making various reef fish live in these waters. The combination of an underwater park and marine life in the
 354 Valentine Strait has the charm of a marine park. Of particular importance are the stunning coral reefs, which act as
 355 protection mechanisms for shorelines and home to various ecosystems.



356 **Figure 11.** Buano Coral Reefs

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 358
 359 **E. Ecotourism Development Strategy**

360 Based on the existing potential and community participation, a SWOT analysis was carried out. This analysis was a
 361 technique to identify a problem which includes Strength (S), Weakness (W), Opportunity, Threat (T) so that the
 362 identification of these four factors, it could be used as a basis for ecotourism development in Valentine Bay to be more
 363 focused and able to contribute which is good for area management and improving the welfare of the community around the
 364 area (Table 3).
 365
 366

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

368
 369 Based on the weight value of Internal Factor Analysis System (IFAS) and External Factor Analysis System (EFAS) on
 370 the SWOT analysis, a more optimal and targeted ecotourism development strategy can be carried out, namely as follows:
 371 Strategies using strength to take advantage of opportunities (S-O)

- 372 • Build ecotourism based on high natural potential (flora, fauna, another tourism potential) around the Valentine Bay
 373 mangrove area by utilizing government regulations, support from the local government, local governments, NGOs
 374 (LPPM Maluku), educational and research institutions as well as tourist visits.
- 375 • The potential for cultural customs and local wisdom such as "sasi", which is currently still maintained is a power of
 376 ecotourism with government support, tourist visits, support from NGOs (LPPM Maluku), educational institutions, and
 377 mass media support.

- 378 • Making and stipulating village regulations to organize directed Village development planning, regulating
379 environmental sustainability and natural resources, and maintaining the institutions of customs and local wisdom that
380 have grown in the midst of society.
- 381 • Developing the potential of integrated agriculture through government support to help improve the welfare of local
382 communities with an ecotourism approach and simultaneously support ecotourism programs.
- 383 • Maintain local wisdom, customary sites of the Buano people to increase opportunities for integrated agricultural
384 development, ecotourism, and development of essential ecosystem areas.
- 385 • Regional database management by developing a Geographical Information System with support from educational
386 institutions and researchers.
- 387 • Increase opportunities in the development of essential ecosystem areas through the support of the government, NGOs
388 (LPPM Maluku), educational institutions, and researchers.
- 389 • Accelerate the development of ecotourism programs with the support of the community, government, and educational
390 institutions.

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

- 392 • Carrying out infrastructure development, especially the construction of roads, bridges, clean water in ecotourism areas
393 through the support of government regulations and programs.
- 394 • Build tourism support facilities and infrastructures such as accommodation, souvenir shops, restaurants, and tourist
395 information centers through the support of local and district governments.
- 396 • Increase tourism promotion efforts either through social media, online media or with the help of tourists who have
397 visited, government support and Educational Institutions.
- 398 • Cooperate with tour & travel agents to increase tourist visits.
- 399 • Improve the welfare and education of local communities around.
- 400 • Improve coordination and cooperation between institutions and support from government and educational institutions.

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

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

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

- 415 • Increase the socialization of the status and function of mangroves in the protected forest area of Buano Island to local
416 communities.
- 417 • Build infrastructure, facilities, and infrastructure continuously to increase the flow of tourist visits so that employment
418 opportunities can be opened so as to increase the low economic level of the community due to limited alternative
419 livelihoods.
- 420 • Improve the welfare and education of the local community so that they do not carry out illegal activities such as animal
421 hunting, illegal logging, forest encroachment in the mangrove ecosystem of the protected forest area of Buano Island.
- 422 • Improve coordination between institutions so as to minimize threats to the mangrove ecosystem in the protected forest
423 area of Buano Island.

424 The diversity of tourism objects in the mangrove area in Valentine Bay could be identified by identifying the potentials
425 contained in the area, both physically, biologically, and socio-culture. The potential of biodiversity around the mangrove
426 area has a competitive appeal value to be developed as an object of ecotourism attraction. Valentine Bay mangrove forest
427 is a very valuable biosphere to be preserved on Buano island. The results showed that the Valentine Bay mangrove forest
428 was still in good condition with a variety of flora and fauna species in it. The diversity of flora and fauna could be a
429 potential location for biodiversity, and a potential location for ecotourism, education, and research. The findings of this
430 study could be used as a source of information and basic data to assess the environmental parameters of the mangrove
431 ecosystem in the region. Furthermore, detailed research on the ecology of plants and wildlife as well as aspects of
432 biodiversity of these mangrove forests is needed.

433 The Efforts to conserve mangroves by increasing local communities' understanding of the function and role of
434 mangroves are expected to foster awareness of the community to preserve the mangrove ecosystem. Preservation and
435 maintenance of the mangrove ecosystem as a habitat will have an impact on the preservation of marine life which in turn
436 will support the current Buano economy and for future generations. Support from all stakeholders, namely the government,

437 the private sector, and the community around tourist objects as area managers, are expected to be able to collaborate in
438 efforts to support area conservation, open employment opportunities, diversify the business, promote culture and provide
439 increased welfare for local communities. Ecotourism potential is described as what exists and could be managed to become
440 a mainstay and marketable tour package.

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446 REFERENCES

- 447 Ahmad F. 2015. Mangrove Forest Condition in Piru Bay, West Seram, Moluccas. *Jurnal Ilmu dan Teknologi Kelautan*
448 *Tropis*, 7, No 7, 731–743.
- 449 Alves B, Angnuureng DB, Morand, Almar, R. 2020. A review on coastal erosion and flooding risks and best management
450 practices in West Africa: what has been done and should be done. *J Coastal Conserv* 24(3).
- 451 Bengen DG. 2004. Pengenalan dan Pengelolaan Ekosistem Mangrove. *Pedoman Teknis. Pusat Kajian Sumberdaya Pesisir*
452 *dan Lautan. IPB. Bogor.*
- 453 Cuenca G. C., Macusi, E. D., Abreo, N. A. S., Ranara, C. T., Andam, M. B., Cardona, L. C., & Conserva, G. G. 2015.
454 Mangrove Ecosystems and Associated Fauna with Special Reference to Mangrove Crabs in the Philippines: A Review.
455 In *IAMURE International J Ecol Conser* 15 (1).
- 456 Das S. 2020. Does mangrove plantation reduce coastal erosion? Assessment from the west coast of India. *Regional*
457 *Environmental Change*, 20(2).
- 458 Duke NC, Schmitt, K. 2014. *Tropical Forestry Handbook. Tropical Forestry Handbook*, 1–24.
- 459 Fandeli C. 2000. *Perencanaan Kepariwisata Alam. Perencanaan Kepariwisata Alam. PT. (Persero) Perhutani dan*
460 *Fakultas Kehutanan Universitas Gadjah Mada. Yogyakarta.*
- 461 Faridah-Hanum I, Latiff A, Hakeem KR., Ozturk M. 2014. Mangrove ecosystems of Asia: Status, challenges and
462 management strategies. *Mangrove Ecosystems of Asia: Status, Challenges and Management Strategies*, 1–471.
- 463 Garcia K, Malabrigo P, Gevaña D. 2014. Philippines' Mangrove Ecosystem: Status, Threats and Conservation. In:
464 Faridah-Hanum I, Latiff A., Hakeem K., Ozturk M. (eds) *Mangrove Ecosystems of Asia*. Springer, New York, NY.
- 465 Haroun R, Herrero Barrencia A, Abreu AD. 2018. Mangrove habitats in são tomé and príncipe (gulf of Guinea, Africa):
466 Conservation and management status. *Coastal Research Library*, 25, 589–605.
- 467 Hartshorn, G. S. 2013. *Tropical Forest Ecosystems. Encyclopedia of Biodiversity: Second Edition*, 7, 269–276.
- 468 Hilmi E, Kusmana C, Suhendang E, Iskandar. 2017. Correlation Analysis Between Seawater Intrusion and Mangrove
469 Greenbelt. *Indonesian J Forestry Res*, 4(2), 151–168. IUCN. 2020. *International Union for Conservation of Nature and*
470 *Natural Resources Red List of Threatened Species.*
- 471 Jiang Z, Guan W, Xiong, Y, Li, M., Che, Y, Liao B. 2019. Interactive effects of intertidal elevation and light level on
472 early growth of five mangrove species under *Sonneratia apetala* Buch. *Hamplantation canopy: Turning monocultures to*
473 *mixed forests. Forests*, 10(2).
- 474 Kristiningrum R, Lahjie AM., Masjaya, Yusuf S, Ruslim, Y. 2019. Species diversity, stand productivity, aboveground
475 biomass, and economic value of mangrove ecosystem in Mentawir village, East Kalimantan, Indonesia. *Biodiversitas*,
476 20(10), 2848–2857.
- 477 Kristiningrum R, Lahjie AM, Yusuf S. 2020. Fauna diversity, production potential and total economic value of mangrove
478 ecosystems in Mentawir Village, East Kalimantan, Indonesia. 21(5), 1940–1953.
- 479 Kumar M, Magotra R, Parikh J, Rajawat AS. 2017. Changing Landscape of Marine National Park and Sanctuary, Gulf of
480 Kachchh: Ecological Assessment of Mangroves and Coral Reefs. *Proceedings of the National Academy of Sciences*
481 *India Section A - Physical Sciences*, 87(4), 889–900.
- 482 Kusmana C, Sukristijiono, S. 2016. Mangrove Resource Uses By Local Community in Indonesia. *J Natural Resources*
483 *Environ Manag*, 6(2), 217–224.
- 484 Lee SY, Primavera JH, Dahdouh-Guebas F Mckee K, Bosire JO, Cannicci S, Diele K, Fromard F, Koedam N, Marchand C,
485 Mendelsohn I, Mukherjee N, Record S. 2014. Ecological role and services of tropical mangrove ecosystems: A
486 reassessment. *Global Ecol Biogeography*, 23(7), 726–743.
- 487 Ludwig JA, Reynolds JF. 1988. *Statistical Ecology: A Primer in Methods and Computing*. John Wiley and Sons, Inc.
- 488 Magurra AE. 2004. *Measuring Biological Diversity*. Blackwell Publishing Company.
- 489 McKinley E, Aller-Rojas O, Hattam C, Germond-Duret C, San Martín IV, Hopkins CR, Aponte H, Potts T. 2019.
490 *Charting the course for a blue economy in Peru: a research agenda. Environment, Development and Sustainability*,

491 21(5), 2253–2275.

492 Melia J, Sutriana A, Hanafiah M, Wahyu M, Lubis A, Fakhrurrozi A, Maulana TA, Sari MN. 2020. Health Status
493 Examination of Sumatran Elephant (*Elephas maximus sumatranus*) Using Ultrasonography, Cortisol Analysis and
494 Parasite Identification in Aek Nauli Elephant Conservation Camp (ANECC) and Tangkahan Conservation Response
495 Unit (CRU), North Sumatra. *E3S Web of Conferences*, 151, 1–6.

496 Mueller-Dombois D, Ellenberg H. 1974. *Aims & Methods of Vegetation Ecology*. John Wiley and Sons. The Blackburn
497 Press.

498 Naisumu YG, Seran YN, Ledheng, L. 2018. Komposisi dan Keanekaragaman Jenis Pohon Di Hutan Lindung Lapeom
499 Kabupaten Timor Tengah Utara. *J Saintek Lahan Kering*, 1(1), 4–7.

500 Neumann, B, Ott K, Kenchington R. 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14.
501 *Sustainability Science*, 12(6), 1019–1035. <https://doi.org/10.1007/s11625-017-0472-y>

502 Ohee HL, Sujarta P, Surbakti SB, Barclay, H. 2018. Rapid expansion and biodiversity impacts of the red devil cichlid
503 (*Amphilophus labiatus*, Günther 1864) in Lake Sentani, Papua, Indonesia. *Biodiversitas*, 19(6), 2096–2103.

504 Poedjirahajoe E, Sulityorini IS, Komara LL. 2019. Short communication: Species diversity of mangrove in kutai national
505 park, East Kalimantan, Indonesia. *Biodiversitas*, 20(12), 3641–3646.

506 Rujehan, Matius, P. (2018). Potential and management strategy of floral biodiversity in the coastal areas in East
507 Kalimantan, Indonesia. *Biodiversitas*, 19(3), 1130–1137.

508 Salampessy, M. L., Febryano, I. G., Martin, E., Siahaya, M. E., & Papilaya, R. 2015. Cultural Capital of the Communities
509 in the Mangrove Conservation in the Coastal areas of Ambon Dalam Bay, Moluccas, Indonesia. *Procedia
510 Environmental Sciences*, 23(Ictcred 2014), 222–229.

511 Setyawan AD, Ulumuddin, Y. I. 2012. Species diversity of *Rhizophora* in Tambelan Islands, Natuna Sea, Indonesia.
512 *Biodiversitas, J Bio Divers*, 13(4), 172–177.

513 Shah K, Mustafa Kama, AH, Rosli Z, Hakeem KR, Hoque MM. 2016. Composition and diversity of plants in Sibuti
514 mangrove forest, Sarawak, Malaysia. *Forest Scie Technology*, 12(2), 70–76.

515 Sondak CFA., Kaligis EY, Bara RA. 2019. Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia.
516 *Biodiversitas*, 20(4), 978–986.

517 Spalding M, McIvor A, Tonnejck F, Tol S, Eijk P van. 2014. Mangroves for coastal defence. *Wetlands International and
518 The Nature Conservancy*, 42.

519 Spencer T, Möller I, Reef R. 2016. Mangrove Systems and Environments☆. In Reference Module in Earth Systems and
520 Environmental Sciences.

521 Surya B, Syafri S, Sahban H, Sakti HH. 2020. Natural resource conservation based on community economic
522 empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi,
523 Indonesia. *Land*, 9(4).

524 Utina R, Katili AS, Lapolo N, Dangkoa T. 2019. The composition of mangrove species in coastal area of Banggai district,
525 central Sulawesi, Indonesia. *Biodiversitas*, 20(3), 840–846.

526 Wijayanti DP, Sabdono A, Widyananto PA, Dirgantara D, Hidaka M. 2018. Bacterial symbionts of acroporid corals:
527 Antipathogenic potency against black band disease. *Biodiversitas*, 19(4), 1235–1242.

528 Zakaria M, Rajpar MN. 2015. Assessing the fauna diversity of Marudu Bay mangrove forest, Sabah, Malaysia, for future
529 conservation. *Diversity*, 7(2), 137–148.

530 Zarghi A, Hosseini SM. 2014. Effect of ecotourism on plant biodiversity in Chelmir zone of Tandoureh national park,
531 Khorasan Razavi Province, Iran. *Biodiversitas*, 15(2), 224–228.

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

Abstract. 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, Moluccas, Indonesia. Based on the results of the study, it was found that 1) The mangrove vegetation had 28 species of plants under 19 families. Vegetation at the level of seedlings, saplings, and trees were found, the dominant species being *Rhizophora apiculata*, *Bruguiera gymnorhiza* 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; 2) Stakeholder involvement in ecotourism activities were very supportive; 3) 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.

Key words: 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 which bind the soil the vegetation is growing upon (Spalding et al. 2014; Hilmi et al. 2017; Surya et al. 2020).

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42 The utilization and management of natural resources on Buano island face various threats, both from ecological and
43 social aspects regarding ecological aspects, there has been decline in the quality of the terrestrial and coastal environment.
44 Terrestrial environmental quality threats such as excessive felling of trees, land clearing, and mining. According to
45 (Rujehan and Matus 2018), land clearing and mining activities are also issues that often occur in Bukit Soeharto, East
46 Kalimantan. Coastal threats may consist of overfishing, and similar threats are also reported in Lake Sentani due to
47 overfishing (Ohee et al. 2018), damage to mangroves (Faridah-Hanum et al. 2014) and coral reefs (Wijayanti et al. 2018),
48 declining quality of underwater parks, the threat of various species of marine life such as trade in endangered species,
49 increased abrasion, widespread sedimentation, and intrusion of seawater. The coastal ecosystem faces serious threats of
50 pollution, overexploitation, conflicting use of resources, damage, and destruction of habitats, (Kumar et al. 2017).
51 Meanwhile, threats in the social aspect on Buano island include high population growth, such as the expansion of human
52 settlements, which can lead to excessive exploitation of natural resources that can damage the environment. Conservation
53 activities are an effort to maintain the balance of nature so that humans and other living things can live well. In harmony.

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

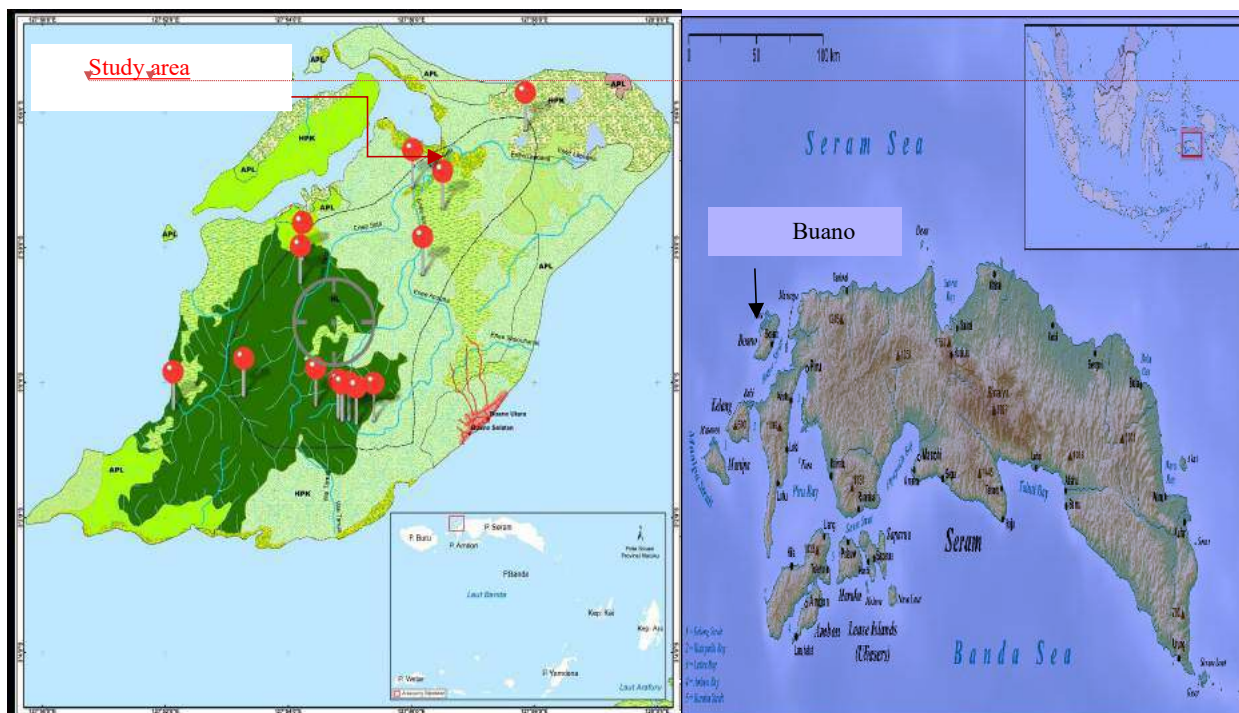
59 Ecotourism can be defined as a form of tourism that is responsible for the preservation of unspoiled areas, provides
60 economic benefits, and maintains the socio-cultural integrity of the local community (Zarghi and Hosseini 2014).
61 Ecotourism is a form of travel to natural areas for a number of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

62 Based on the description above and considering the limited data and information regarding the condition of mangrove
63 forests in the coastal area of Valentine Bay, it was deemed necessary to study the potential and development strategies of
64 Valentine Bay mangrove ecotourism on Buano Island. The study objectives were (1) to analyze the potential composition
65 of mangroves including species composition, density, presence frequency, and Importance value of the species; (2) to
66 determine the role of stakeholders in supporting ecotourism development, and; (3) ecotourism development strategy. This
67 study, intends to provide information about the potential of existing mangroves and other tourism potentials around
68 Valentine Bay so that it can provide input to related agencies in the context of managing and developing mangrove areas
69 as a supportto ecotourism.

70 MATERIALS AND METHODS

71 Study area

72 The location of the study was in a mangrove ecosystem in the Valentine Bay area which is administratively located on
73 Buano Island, Huamual Belakang Subdistrict, West Seram District, Moluccas Province, Indonesia. The map of the study
74 location is presented in Figure 1. The research was conducted from July to September 2019.
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Figure 1. Study location in Valentine Bay on Buano Island, West Seram District, Moluccas, Indonesia

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Procedures

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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 Regency Tourism Office, and related NGOs.

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The Vegetation data was collected using the combination of the path method and the compartmentalized line method.

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Study plots were made in the line transect. The plot areas for each growth stages were as follows:

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(a) Seedlings plot was up to 1.5 meters high, plot size of 5 m \times 5 m,

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(b) Poles with the height between 1.5 m – diameter at breast height <10-19 cm, plot size 10 m \times 10 m

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(c) Trees with the diameter at breast height \geq 20 cm, plot size 20 m \times 20 m

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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.

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Data analysis

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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 dan Ellenberg (1974), as follows:

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

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

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

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$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of a species}}{\text{Frequency of all species}} \times 100\% \text{ (4)}$$

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

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

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

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$$\text{For seedlings: IVI} = \text{RDen} + \text{RF} \quad (7)$$

123

$$\text{For poles and trees: IVI} = \text{RDen} + \text{RF} + \text{RD} \quad (8)$$

124

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

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$$H' = - \sum \left[\left(\frac{n_i}{N} \right) \ln \left(\frac{n_i}{N} \right) \right] \quad (9)$$

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Where:

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H' = Species Diversity Index

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N = Sum of Importance Value Index (IVI)

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n_i = Importance Value Index (IVI) of a species

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131 **Study Review**

132 Buano Island is one of the small islands with an area of about 135.73 km², which is located to the southwest of
 133 Seram Island. There were 2 villages that were located close to and parallel to the sloping coast, namely North Buano and
 134 South Buano villages, both of which are only separated by mosques, and the church was located close by and is a marker
 135 of the two villages. On September 29, 2014, through SK.854 / Menhut-II / 2014 concerning the Forest Area of Moluccas
 136 Province, a protected forest area of 4,287.22 Ha was established. The research locations were generally located in the
 137 mangrove area of Valentine Bay, one of the areas included in the protected forest area of Buano Island.

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

141 **A. Flora**

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

145 Tabel 1. The Species of true mangroves and mangrove associates vegetation in Valentine Bay
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No.	Species	Family	Zone		
			Proximal	Middle	Distal
1	<i>Rhizophora apiculata</i>	Rhizophoraceae	√		
2	<i>Rhizophora stylosa</i>	Rhizophoraceae	√		
3	<i>Sonneratia alba</i>	<u>Lythraceae</u>	√		
4	<i>Rhizophora mucronata</i>	Rhizophoraceae	√		
5	<i>Avicennia marina</i>	<u>Acanthaceae</u>	√	√	
6	<i>Bruguiera sexangula</i>	Rhizophoraceae	√	√	
7	<i>Bruguiera gymnorhiza</i>	Rhizophoraceae	√	√	
8	<i>Pemphis acidula</i>	<u>Lythraceae</u>	√	√	
9	<i>Lumnitzera littorea</i>	Combretaceae	√	√	
10	<i>Acanthus ebracteatus</i>	Acanthaceae	√		
11	<i>Bruguiera cylindrica</i>	Rhizophoraceae		√	
12	<i>Ceriops tagal</i>	Rhizophoraceae		√	
13	<i>Ceriops decandra</i>	Rhizophoraceae		√	
14	<i>Xylocarpus moluccensis</i>	Meliaceae		√	√
15	<i>Xylocarpus granatum</i>	Meliaceae		√	√
16	<i>Excoecaria agallocha</i>	Euphorbiaceae		√	
17	<i>Aegiceras corniculatum</i>	<u>Primulaceae</u>		√	
18	<i>Acrostichum speciosum</i>	Pteridaceae		√	
19	<i>Nypa fruticans</i>	Arecaceae			√
20	<i>Heritiera littoralis</i>	<u>Malvaceae</u>			√
21	<i>Barringtonia asiatica</i>	Lecythidaceae			√
22	<i>Pongamia pinnata</i>	Leguminosae			√
23	<i>Pandanus tectorius</i>	Pandanaceae			√
24	<i>Terminalia catappa</i>	Combretaceae			√
25	<i>Hibiscus tiliaceus</i>	Malvaceae			√
26	<i>Acrostichum aureum</i>	Pteridaceae			√
27	<i>Scaevola taccada</i>	Goodeniaceae			√
28	<i>Intsia bijuga</i>	<u>Leguminosae</u>			√

149 According to Ahmad (2015) in the mangrove forests of Piru bay West Seram district, Moluccas, has found 17 species
 150 of mangroves, while Poedjirahajoe et al. (2019) has found 17 species of mangroves in Kutai National Park, East
 151 Kalimantan. When compared with the results in other regions, it could be seen that the species composition in the
 152 Valentine Bay area was higher than in other areas. The difference in the number of species composition in mangroves in
 153 several areas was thought to be caused by the differences in environmental conditions, the number of observations, and the
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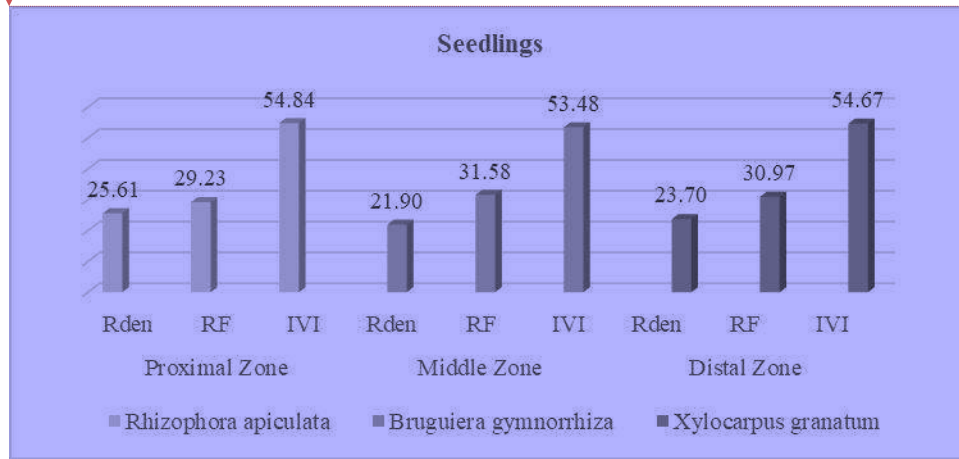
level of disturbance in each study area. The species with the highest importance represent the tenure value of the species in a community. The importance value of a species could be used as an indication that the species are considered dominant by having a higher relative density, relative frequency, 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).

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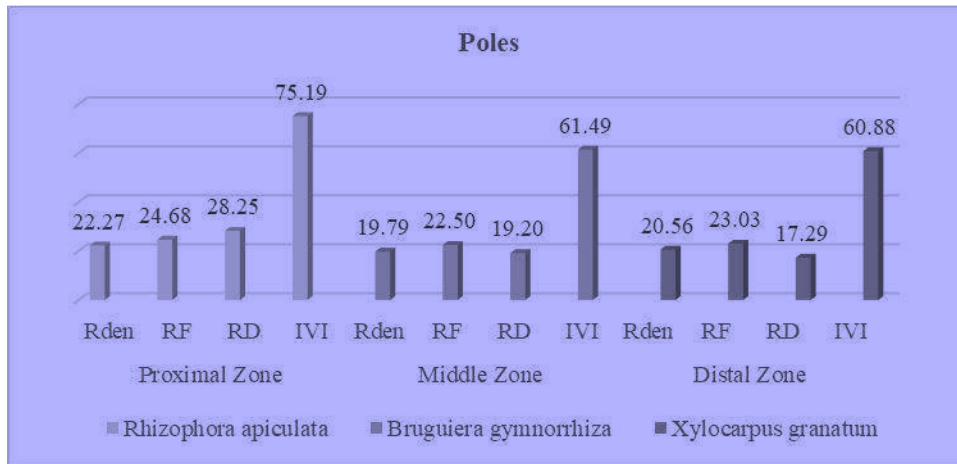
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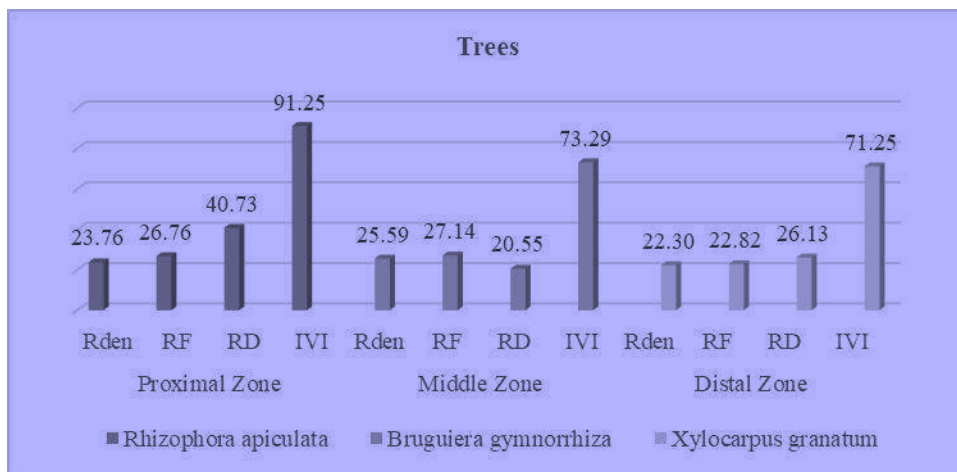
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Figure 2. Mangrove species for seedling level in Valentine bay



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166 **Figure 3.** Mangrove species of vegetation for poles level in Valentine bay



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168 **Figure 4.** Mangrove species of vegetation for trees level in Valentine bay

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170 From the results (Figure 2, 3, 4) of the vegetation analysis for the front zone, it was found that the dominant species
 171 were *R. apiculata* with the highest IVI at seedling (54.84%), poles (75.19%) and trees (91.25%). This is presumably due to
 172 the location factor which is suitable for the species *R. apiculata* (Figure 5), which generally grows along the seaward
 173 margin in various types of substrates, such as mud sediments, white sand and corals. This is in line with stated by
 174 Setyawan and Ulumuddin (2012), that mangroves in Tambelan island, Natuna Sea, Indonesia, especially for *R. apiculata*
 175 commonly growing along the seaward and in various substrates such as fertile mud sediments, white sand, and corals.
 176 According to Shah et al. (2016) the mangrove forests of Sibuti, Sarawak, Malaysia were also dominated by *R. apiculata*
 177 among the 9 species of mangroves found there

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

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

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

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

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194 Table 2. Species Diversity Index of Each Growth Rate in Valentine bay

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

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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 (1988) states that the range of values calculated for the diversity index (H) is as follows: (a) $H' \geq 3$ means high species diversity; (b) $1 < H' < 3$ means moderate species diversity; and (c) $H' > 3$ 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.

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Figure 5. *Rhizophora apiculata* (A) Trees; (B) Flowers; (C) Fruits at Proximal Zone

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Figure 6. *Bruguiera gymnorhiza* (A) Trees; (B) Flowers; (C) Fruits at Middle Zone

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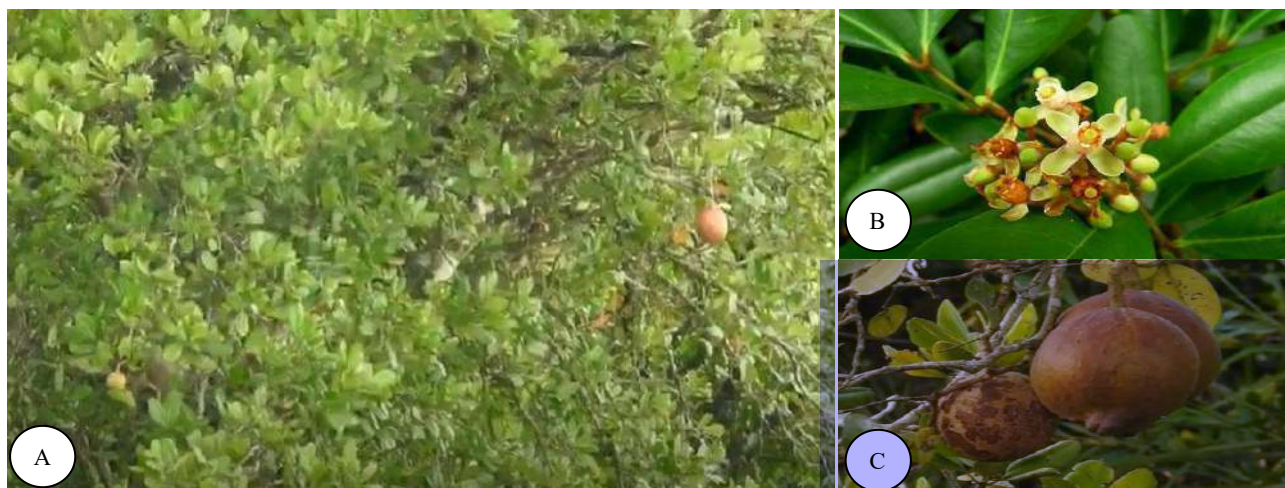


Figure 7. *Xylocarpus moluccensis* (A) Trees; (B) Flowers; (C) Fruits at Distal Zone

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 an unique experience that may attract attention of both local as well as international visitors.

B. 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: kechicap 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 (*Tanyiptera 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 yasudeva*); semut rang-rang (ants) (*Oecophylla smaragdina*, *Camponotus* sp.; and (7) 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.).

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. jenis 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 ursinus*), kuskus coklat (*Phalanger orientalis*), rusa timor (*Cervus timorensis*), dugong (*Dugong dugon*), kelelawar ekor trubus kecil (*Emballonura monticola*), dan 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).

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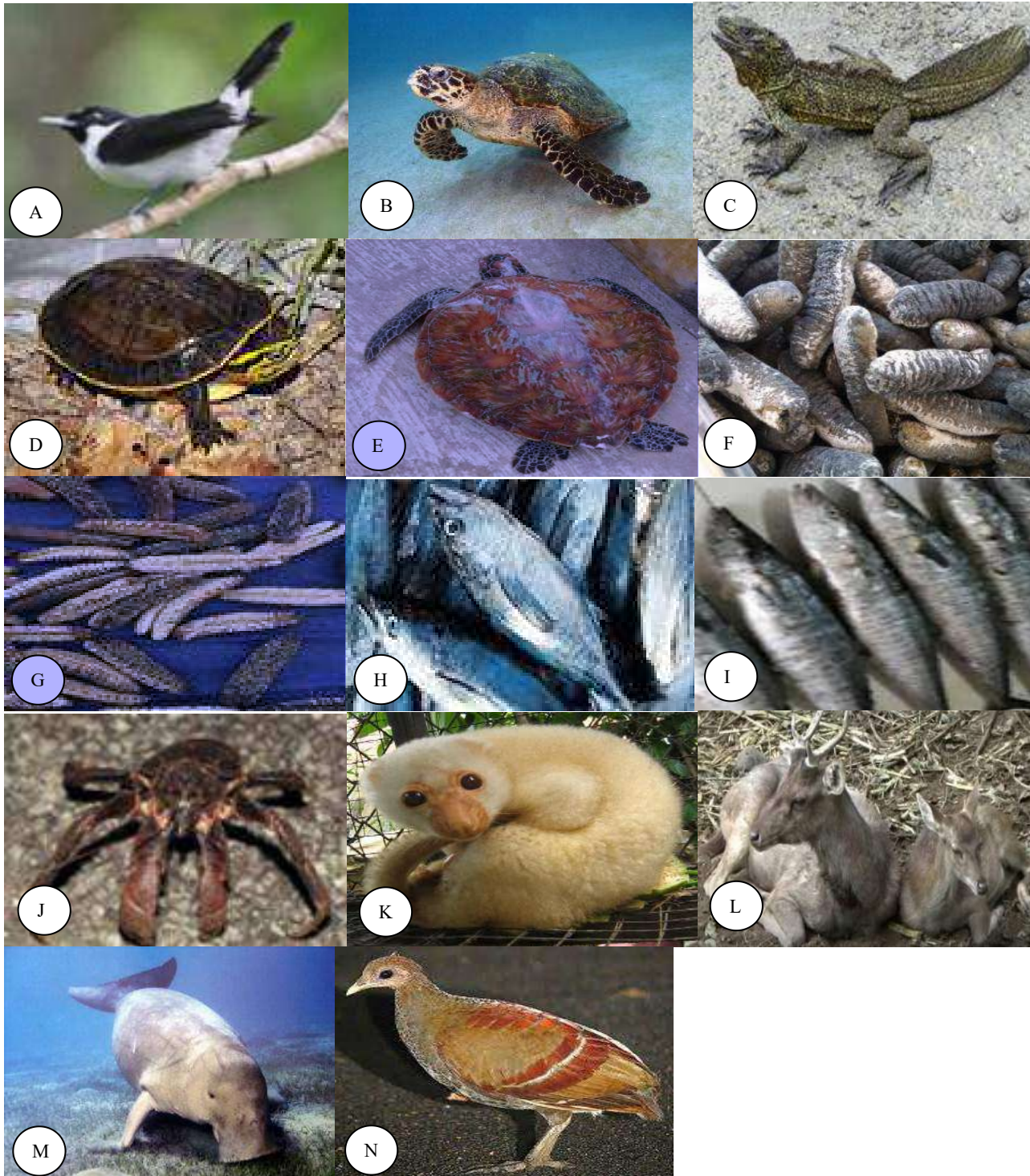
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According to Kristiningrum et al. (2020), the mangrove ecosystem in the village of Mentawir Balikpapan also has a diversity of mammals, reptiles, fish, and invertebrates, based on the results of the inventory it was known that the potential of fauna in the Valentine's Bay was also very diverse. Referring to the criterias 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*, *Pteropus aularis*, and *Eulipoa wallacei* (IUCN 2020) (Figure 8).

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

279 Likewise, in the Sumatran forests, the threat status of the Sumatran elephant (*Elephas maximus* ssp. *sumatranus*) has
280 increased dramatically (Melia et al. 2020). In the latest assessment based on (IUCN 2020) criterias, the status of Sumatran
281 elephants (*Elephas maximus* ssp. *sumatranus*) rose from endangered to critically (critically endangered) which occurred in
282 2011, even the Bali tigers (*Panthera tigris* ssp. *balica*) and Javan tigers (*Panthera tigris* ssp. *sondaica*) have become
283 extinct. Efforts to protect and utilize endangered species could be carried out with a sustainable approach, among others,
284 by maintaining its function in maintaining the balance of the ecosystem; for the benefit of ecotourism, education, and
285 research.

287 C. Stakeholders

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

301 The Valentine Bay mangroves biodiversity has great potential for education, research, and ecotourism (Garcia et al.
302 2014). In addition, the community must also be made aware of the ecological role (pest control etc.) and indirect economic
303 benefits (livelihood etc.) derived from the existing animals in the forest around their habitat, and encourage not to value
304 them only for hunting. Through this understanding, the community and government officials may jointly protect the
305 various species of flora and fauna that live in the mangrove ecosystem and around them and help prevent outsiders from
306 engaging in encroachment and hunting. Furthermore, not only stakeholders but society, educational institutions and
307 researchers need to be involved to achieve the desired goals. It is also stated by (Alves et al. 2020) that the public and
308 scientific community need to be involved together to achieve goals with tiered input and agree on a coordinated
309 conservation plan.

312 D. Another tourism potential around Valentine Bay 313 Valentine Strait

314 The waters of the Valentine Strait flanked by Buano Island and Pua Island with a width of about 80 meters have its
315 own charm. The Valentine Strait on Buano Island was included in the top 10 list of the Anugerah Pesona Indonesia (The
316 Enchantment of Indonesia's Grace) 2020 for the Most Popular Hidden Heaven category. According to local people, this
317 strait was named as Valentine Strait by Dutch soldiers in the colonial era because the aerial outlook of the strait of Buano
318 Island is shaped as heart. The sea waves around the island of Buano are popular to the public as they are frequent and
319 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
320 where swimming, fishing, diving and water ride activities could be carried out comfortably (Figure 9).



321 **Figure 9.** Valentine Strait Waters
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Buano Coral cliff

In addition to aquatic areas, the charm of the Valentine Strait also consist 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 Cliffs

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Buano Coral Reefs

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

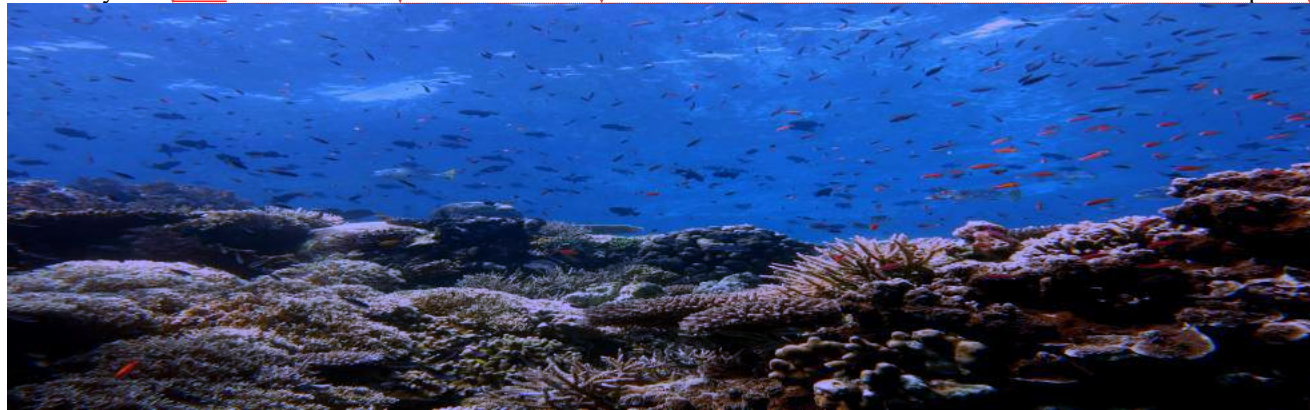


Figure 11. Buano Coral Reefs

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E. 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).

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)	

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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.	1. Lack of infra-structure. 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. The 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.
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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, other 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.

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 & 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.

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- 386 • Take advantage of the support of the local government and traditional community leaders to participate in increasing
387 the participation and awareness of local people about mangrove conservation in the protected forest area of Buano
388 Island and its surroundings as a potential for ecotourism from various kinds of disturbances

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

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

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

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

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415 analysis, and reviewers who provided suggestions to improve this research.

416 REFERENCES

- 417 Ahmad F. 2015. Mangrove Forest Condition in Piru Bay, West Seram, Moluccas. *Jurnal Ilmu dan Teknologi Kelautan*
418 *Tropis* 7: 731–743.
- 419 Alves B, Angnuureng DB, Morand P, Almar R. 2020. A review on coastal erosion and flooding risks and best
420 management practices in West Africa: what has been done and should be done. *J Coast Conserv* 24: 38.
421 <https://doi.org/10.1007/s11852-020-00755-7>
- 422 Bengen DG. 2004. Pengenalan dan Pengelolaan Ekosistem Mangrove. Pedoman Teknis. Pusat Kajian Sumberdaya Pesisir
423 dan Lautan. IPB. Bogor. [Indonesian]
- 424 Cuenca GC, Macusi ED, Abreo NAS, Ranara CTB, Andam MB, Cardona LC, et al. 2015. Mangrove Ecosystems and
425 Associated Fauna with Special Reference to Mangrove Crabs in the Philippines: A Review. *JAMURE Int J Ecol*
426 *Conser* 15: 60-110.
- 427 Das S. 2020. Does mangrove plantation reduce coastal erosion? Assessment from the west coast of India. *Reg Environ*
428 *Change* 20: 58. <https://doi.org/10.1007/s10113-020-01637-2>
- 429 Duke NC, Schmitt K. 2014. *Mangroves: Unusual Forests at the Seas' Edge*. In: Pancel L, Köhl M, Tropical Forestry
430 Handbook. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-54601-3_129
- 431 Fandeli C. 2000. Perencanaan Kepariwisata Alam. Perencanaan Kepariwisata Alam. PT. (Persero) Perhutani dan
432 Fakultas Kehutanan Universitas Gadjah Mada. Yogyakarta.
- 433 Faridah-Hanum I, Latiff A, Hakeem KR., Ozturk M. 2014. Mangrove ecosystems of Asia: Status, challenges and
434 management strategies. Springer, New York.
- 435 Garcia K, Malabrigo P, Gevaña D. 2014. Philippines' Mangrove Ecosystem: Status, Threats and Conservation. In:
436 Faridah-Hanum I, Latiff A, Hakeem K, Ozturk M. (eds) *Mangrove Ecosystems of Asia*. Springer, New York,
437 https://doi.org/10.1007/978-1-4614-8582-7_5
- 438 Haroun R, Herrero Barrencia A, Abreu AD. 2018. Mangrove habitats in são tomé and príncipe (gulf of Guinea, Africa):
439 Conservation and management status. In: Makowski C, Finkl C. (eds) *Threats to Mangrove Forests. Coastal Research*

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Library, vol 25. Springer, Cham. https://doi.org/10.1007/978-3-319-73016-5_27,

Hartshorn GS. 2013. Tropical Forest Ecosystems. In: Levin SA (ed) Encyclopedia of Biodiversity, Second Edition. Elsevier Inc., 269–276. <https://doi.org/10.1016/B978-0-12-384719-5.00146-5>

Hilmi E, Kusmana C, Suhendang E, Iskandar. 2017. Correlation Analysis Between Seawater Intrusion and Mangrove Greenbelt. Indonesian J Forestry Res 4: 151–168. <http://doi.org/10.20886/ijfr.2017.4.2.151-168>

IUCN. 2020. International Union for Conservation of Nature and Natural Resources Red List of Threatened Species.

Jiang Z, Guan W, Xiong Y, Li M, Chen Y, Liao B. 2019. Interactive effects of intertidal elevation and light level on early growth of five mangrove species under *Sonneratia apetala* Buch. Hamplantation canopy: Turning monocultures to mixed forests. Forests 10: 83. <https://doi.org/10.3390/f10020083>

Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y. 2019. Species diversity, stand productivity, aboveground biomass, and economic value of mangrove ecosystem in Mentawir village, East Kalimantan, Indonesia. Biodiversitas J Biol Divers 20: 2848–2857. <https://doi.org/10.13057/biodiv/d201010>

Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y, Ma'Ruf A. 2020. Fauna diversity, production potential and total economic value of mangrove ecosystems in Mentawir Village, East Kalimantan, Indonesia. Biodiversitas J Biol Divers 21: 1940–1953. <https://doi.org/10.13057/biodiv/d210522>

Kumar M, Magotra R, Parikh J, Rajawat AS. 2017. Changing Landscape of Marine National Park and Sanctuary, Gulf of Kachchh: Ecological Assessment of Mangroves and Coral Reefs. Proc Natl Acad Sci India Sect A - Phys Sci 87: 889–900. <https://doi.org/10.1007/s40010-017-0457-3>

Kusmana C, Sukristijiono, S. 2016. Mangrove Resource Uses By Local Community in Indonesia. J Natural Resources Environ Manag 6: 217–224. <https://journal.ipb.ac.id/index.php/jpsl/article/view/15307/11213>

Lee SY, Primavera JH, Dahdouh-Guebas F, Mckee K, Bosire JO, Cannicci S, et al. 2014. Ecological role and services of tropical mangrove ecosystems: A reassessment. Global Ecol Biogeogr 23: 726–743. <https://doi.org/10.1111/geb.12155>

Ludwig JA, Reynolds JF. 1988. Statistical Ecology: A Primer in Methods and Computing. John Wiley and Sons, Inc.

Magurran AE. 2004. Measuring Biological Diversity. Blackwell Publishing Company.

McKinley E, Aller-Rojas O, Hattam C, Germond-Duret C, San Martín IV, Hopkins CR, Aponte H, Potts T. 2019. Charting the course for a blue economy in Peru: a research agenda. Environ Dev Sustain 21: 2253–2275. <https://doi.org/10.1007/s10668-018-0133-z>

Melia J, Sutriana A, Hanafiah M, Wahyu M, Lubis A, Fakhurrozi A, Maulana TA, Sari MN. 2020. Health Status Examination of Sumatran Elephant (*Elephas maximus sumatranus*) Using Ultrasonography, Cortisol Analysis and Parasite Identification in Aek Nauli Elephant Conservation Camp (ANECC) and Tangkahan Conservation Response Unit (CRU), North Sumatra. E3S Web of Conferences, 151: 01053. 1–6. <https://doi.org/10.1051/e3sconf/202015101053>

Mueller-Dombois D, Ellenberg H. 1974. Aims & Methods of Vegetation Ecology. John Wiley and Sons. The Blackburn Press.

Naisumu YG, Seran YN, Ledheng L. 2018. Komposisi dan Keanekaragaman Jenis Pohon di Hutan Lindung Lapeom Kabupaten Timor Tengah Utara. J Saintek Lahan Kering 1: 4–7. [Indonesian]

Neumann B, Ott K, Kenchington R. 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14. Sustain Sci 12: 1019–1035. <https://doi.org/10.1007/s11625-017-0472-y>

Ohee HL, Sujarta P, Surbakti SB, Barclay H. 2018. Rapid expansion and biodiversity impacts of the red devil cichlid (*Amphilophus labiatus*, Günther 1864) in Lake Sentani, Papua, Indonesia. Biodiversitas J Biol Divers 19: 2096–2103. <https://doi.org/10.13057/biodiv/d190615>

Poedjirahajoe E, Sulityorini IS, Komara LL. 2019. Species diversity of mangrove in kutai national park, East Kalimantan, Indonesia. Biodiversitas J Biol Divers 20: 3641–3646. <https://doi.org/10.13057/biodiv/d201224>

Rujehan, Matius P. 2018. Potential and management strategy of floral biodiversity in the coastal areas in East Kalimantan, Indonesia. Biodiversitas J Biol Divers 19: 1130–1137. <https://doi.org/10.13057/biodiv/d190348>

Salampessy MI, Febryano IG, Martin E, Siahaya ME, Papilaya R. 2015. Cultural Capital of the Communities in the Mangrove Conservation in the Coastal areas of Ambon Dalam Bay, Moluccas, Indonesia. Procedia Environmental Sciences 23: 222–229. <https://doi.org/10.1016/j.proenv.2015.01.034>

Setyawan AD, Ulumuddin YI. 2012. Species diversity of *Rhizophora* in Tambelan Islands, Natuna Sea, Indonesia. Biodiversitas J Biol Divers 13: 172–177. <https://doi.org/10.13057/biodiv/d130402>

Shah K, Kama AHM, Rosli Z, Hakeem KR, Hoque MM. 2016. Composition and diversity of plants in Sibuti mangrove forest, Sarawak, Malaysia. For Sci Tech 12: 70–76. <https://doi.org/10.1080/21580103.2015.1057619>

Sondak CFA, Kaligis EY, Bara RA. 2019. Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia. Biodiversitas J Biol Divers 20: 978–986. <https://doi.org/10.13057/biodiv/d200407>

Spalding M, McIvor A, Tonnejck FH, Tol S, van Eijk P. 2014. Mangroves for coastal defence. Guidelines for coastal managers & policy makers. Wetlands International and The Nature Conservancy, 42p. <https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefenceDecisionmakersGuideWebVersion.pdf> (Accessed 12.12.2020).

Spencer T, Möller I, Reef R. 2016. Mangrove Systems and Environments. In: Reference Module in Earth Systems and

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Environmental Sciences. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-409548-9.10262-3>
Surya B, Syafri S, Sahban H, Sakti HH. 2020. Natural resource conservation based on community economic empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi, Indonesia. *Land* 9: 104. <https://doi.org/10.3390/land9040104>
Utina R, Katili AS, Lapolo N, Dangkoa T. 2019. The composition of mangrove species in coastal area of Banggai district, central Sulawesi, Indonesia. *Biodiversitas J Biol Divers* 20: 840–846. <https://doi.org/10.13057/biodiv/d200330>
Wijayanti DP, Sabdono A, Widyananto PA, Dirgantara D, Hidaka M. 2018. Bacterial symbionts of acroporid corals: Antipathogenic potency against black band disease. *Biodiversitas J Biol Divers* 19: 1235–1242. <https://doi.org/10.13057/biodiv/d190408>
Zakaria M, Rajpar MN. 2015. Assessing the fauna diversity of Marudu Bay mangrove forest, Sabah, Malaysia, for future conservation. *Divers* 7(2): 137–148. <https://doi.org/10.3390/d7020137>
Zarghi A, Hosseini SM. 2014. Effect of ecotourism on plant biodiversity in Chelmir zone of Tandoureh National Park, Khorasan Razavi Province, Iran. *Biodiversitas J Biol Divers* 15: 224–228. <https://doi.org/10.13057/biodiv/d150215>

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1 **Potential analysis of location, socio-culture and biodiversity as**
2 **ecotourism attraction in Valentine's Bay on Buano Island, West Seram,**
3 **Moluccas Indonesia**

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15 **Abstract.** This study aims to analyze the potential of flora and fauna in the mangrove ecosystem as an attraction for ecotourism
16 development, knowing the role of stakeholders in supporting ecotourism development strategies in the mangrove area of Valentine Bay
17 in Buano island, West Seram, Moluccas, Indonesia. Based on the results of the study, it was found that 1) The mangrove vegetation had
18 28 species of plants under 19 families. Vegetation at the level of seedlings, saplings, and trees were found, the dominant species being
19 *Rhizophora apiculata*, *Bruguiera gymnorhiza* and *Xylocarpus granatum*. The diversity of animals in the Valentine Bay mangrove
20 ecosystem consist of birds, insects, reptiles, mollusks, crustaceans, echinoderms, fish, and mammals. Furthermore, there was an endemic
21 fauna of Buano island, namely the Kehicap buano/black-chinned monarch bird (*Symposiachrus boanensis*) which has started to become
22 rare, and was declared as critically endangered (CR) by the International Union for Conservation of Nature and Natural Resources; 2)
23 Stakeholder involvement in ecotourism activities were very supportive; 3) development strategies were to develop ecotourism, promote
24 ecotourism attractiveness, develop educational tourism and promote study on the diversity of flora, fauna, culture, and traditional
25 customs on Buano island.

26 **Key words:** conservation, coral reef, diversity, fauna, flora, mangrove ecosystem

27 **INTRODUCTION**

28 Mangrove is a typical forest type and grows along the coast or river estuaries which are influenced by tides and are
29 often found in coastal areas that are protected from the onslaught of waves and gently sloping areas in tropical and sub-
30 tropical areas (Hartshorn 2013; Duke and Schmitt 2014; Spencer et al. 2016).

31 Natural resources in coastal areas have a role in supporting social and economic development (Salampessy et al. 2015;
32 Neumann et al. 2017; McKinley et al. 2019). The consequence of this great potential causes coastal areas to be vulnerable
33 to damage and degradation of coastal natural resources.

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

42 The utilization and management of natural resources on Buano island face various threats, both from ecological and
43 social aspects regarding ecological aspects, there has been decline in the quality of the terrestrial and coastal environment.
44 Terrestrial environmental quality threats such as excessive felling of trees, land clearing, and mining. According to
45 (Rujehan and Matus 2018), land clearing and mining activities are also issues that often occur in Bukit Soeharto, East
46 Kalimantan. Coastal threats may consist of overfishing, and similar threats are also reported in Lake Sentani due to
47 overfishing (Ohee et al. 2018), damage to mangroves (Radabaugh et al. 2019) and coral reefs (Wijayanti et al. 2018),
48 declining quality of underwater parks, the threat of various species of marine life such as trade in endangered species,
49 increased abrasion, widespread sedimentation, and intrusion of seawater. The coastal ecosystem faces serious threats of
50 pollution, overexploitation, conflicting use of resources, damage, and destruction of habitats (Kumar et al. 2017).
51 Meanwhile, threats in the social aspect on Buano island include high population growth, such as the expansion of human
52 settlements, which can lead to excessive exploitation of natural resources that can damage the environment. Conservation
53 activities are an effort to maintain the balance of nature so that humans and other living things can live well In harmony.

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

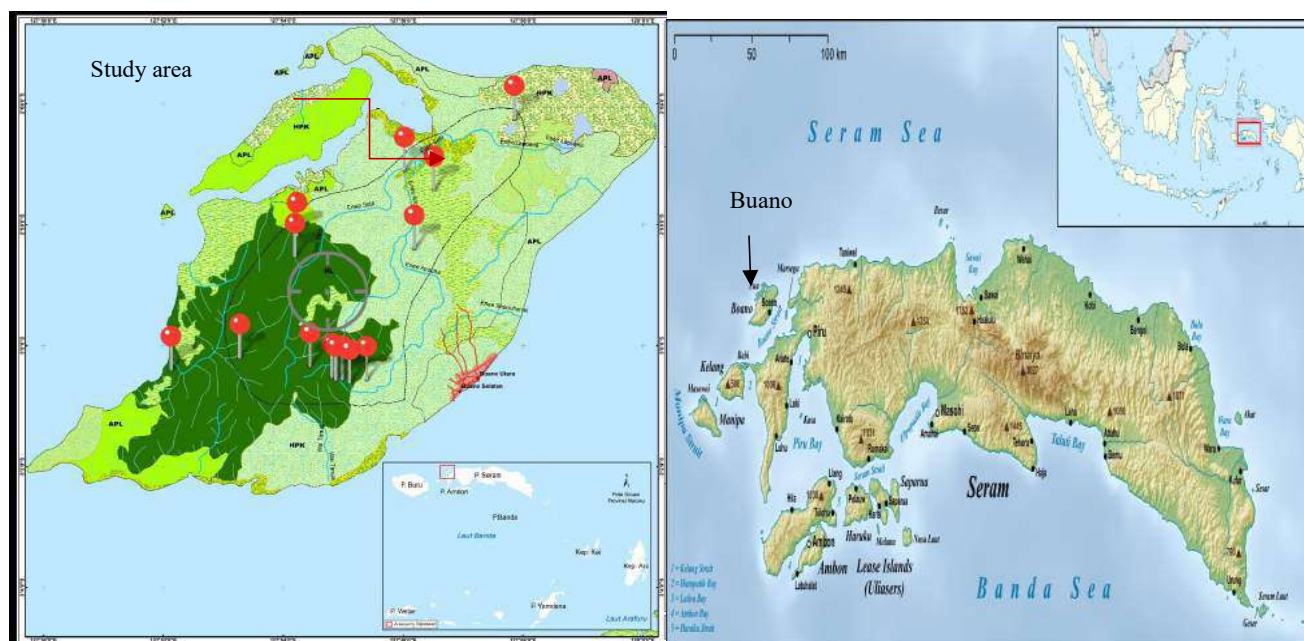
59 Ecotourism can be defined as a form of tourism that is responsible for the preservation of unspoiled areas, provides
60 economic benefits, and maintains the socio-cultural integrity of the local community (Zarghi and Hosseini 2014).
61 Ecotourism is a form of travel to natural areas for a number of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

62 Based on the description above and considering the limited data and information regarding the condition of mangrove
63 forests in the coastal area of Valentine Bay, it was deemed necessary to study the potential and development strategies of
64 Valentine Bay mangrove ecotourism on Buano Island. The study objectives were (1) to analyze the potential composition
65 of mangroves including species composition, density, presence frequency, and Importance value of the species; (2) to
66 determine the role of stakeholders in supporting ecotourism development, and; (3) ecotourism development strategy. This
67 study intends to provide information about the potential of existing mangroves and other tourism potentials around
68 Valentine Bay so that it can provide input to related agencies in the context of managing and developing mangrove areas
69 as a support to ecotourism.

70 MATERIALS AND METHODS

71 Study area

72 The location of the study was in a mangrove ecosystem in the Valentine Bay area which is administratively located on
73 Buano Island, Huamual Belakang Subdistrict, West Seram District, Moluccas Province, Indonesia. The map of the study
74 location is presented in Figure 1. The research was conducted from July to September 2019.
75



76
77 **Figure 1.** Study location in Valentine Bay on Buano Island, West Seram District, Moluccas, Indonesia

78 **Procedures**

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

83 The Vegetation data was collected using the combination of the path method and the compartmentalized line method.
84 Study plots were made in the line transect. The plot areas for each growth stages were as follows:

- 85 (a) Seedlings with ranging from sprouts to 1.5 m high – diameter at < 2 cm, plot size of 5 m × 5 m,
86 (b) Poles with the height between 1.5 m – diameter at breast height <10-19 cm, plot size 10 m ×10 m
87 (c) Trees with the diameter at breast height ≥ 20 cm, plot size 20 m × 20 m

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

90 **Data analysis**

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

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

97
98
99
100 Relative Density (Rden) =
$$\frac{\text{density of a species}}{\text{density of all species}} \times 100\%$$

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102
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104 Frequency (F) =
$$\frac{\text{Number of plots found of a species}}{\text{Area of the measurement plots}}$$

105
106
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108 Relative Frequency (RF) =
$$\frac{\text{Frequency of a species}}{\text{Frequency of all species}} \times 100\%$$

109
110
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112 Dominance (SD) =
$$\frac{\text{Basal area of a species}}{\text{Area of the measurement plots}}$$

113
114
115
116 Relative Dominance (RD) =
$$\frac{\text{dominance of a species}}{\text{dominance of all species}} \times 100 \%$$

117
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119 Then the Importance Value Index (IVI) value was calculated to determine the dominant plant species and levels with
120 the following formula:

121 For seedlings: IVI = RDen + RF

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

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

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

125 Where:

126 H' = Species Diversity Index

127 N = Sum of Importance Value Index (IVI)

128 n_i = Importance Value Index (IVI) of a species

130 **Study Review**

131 Buano Island is one of the small islands with an area of about 135.73 km², which is located to the southwest of
 132 Seram Island. There were 2 villages that were located close to and parallel to the sloping coast, namely North Buano and
 133 South Buano villages, both of which are only separated by mosques, and the church was located close by and is a marker
 134 of the two villages. On September 29, 2014, through SK.854/Menhut-II/2014 concerning the Forest Area of Moluccas
 135 Province, a protected forest area of 4,287.22 ha was established. The research locations were generally located in the
 136 mangrove area of Valentine Bay, one of the areas included in the protected forest area of Buano Island.

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

141 **A. Flora**

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

145 Tabel 1. The Species of true mangroves and mangrove associates vegetation in Valentine Bay
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No.	Species	Family	Zone		
			Proximal	Middle	Distal
1	<i>Rhizophora apiculata</i>	Rhizophoraceae	√		
2	<i>Rhizophora stylosa</i>	Rhizophoraceae	√		
3	<i>Sonneratia alba</i>	Lythraceae	√		
4	<i>Rhizophora mucronata</i>	Rhizophoraceae	√		
5	<i>Avicennia marina</i>	Acanthaceae	√	√	
6	<i>Bruguiera sexangula</i>	Rhizophoraceae	√	√	
7	<i>Bruguiera gymnorhiza</i>	Rhizophoraceae	√	√	
8	<i>Pemphis acidula</i>	Lythraceae	√	√	
9	<i>Lumnitzera littorea</i>	Combretaceae	√	√	
10	<i>Acanthus ebracteatus</i>	Acanthaceae	√		
11	<i>Bruguiera cylindrica</i>	Rhizophoraceae		√	
12	<i>Ceriops tagal</i>	Rhizophoraceae		√	
13	<i>Cerriops decandra</i>	Rhizophoraceae		√	
14	<i>Xylocarpus moluccensis</i>	Meliaceae		√	√
15	<i>Xylocarpus granatum</i>	Meliaceae		√	√
16	<i>Excoecaria agallocha</i>	Euphorbiaceae		√	
17	<i>Aegiceras corniculatum</i>	Primulaceae		√	
18	<i>Acrostichum speciosum</i>	Pteridaceae		√	
19	<i>Nypa fruticans</i>	Arecaceae			√
20	<i>Heritiera littoralis</i>	Malvaceae			√
21	<i>Barringtonia asiatica</i>	Lecythidaceae			√
22	<i>Pongamia pinnata</i>	Leguminosae			√
23	<i>Pandanus tectorius</i>	Pandanaceae			√
24	<i>Terminalia catappa</i>	Combretaceae			√
25	<i>Hibiscus tiliaceus</i>	Malvaceae			√
26	<i>Acrostichum aureum</i>	Pteridaceae			√
27	<i>Scaevola taccada</i>	Goodeniaceae			√
28	<i>Intsia bijuga</i>	Leguminosae			√

148 According to Ahmad (2015) in the mangrove forests of Piru bay West Seram district, Moluccas, has found 17 species
 149 of mangroves, while Poedjirahajoe et al. (2019) has found 17 species of mangroves in Kutai National Park, East
 150 Kalimantan. When compared with the results in other regions, it could be seen that the species composition in the
 151 Valentine Bay area was higher than in Piru Bay and Kutai National park. The difference in the number of species
 152 composition in mangroves in several areas was thought to be caused by the differences in environmental conditions, the
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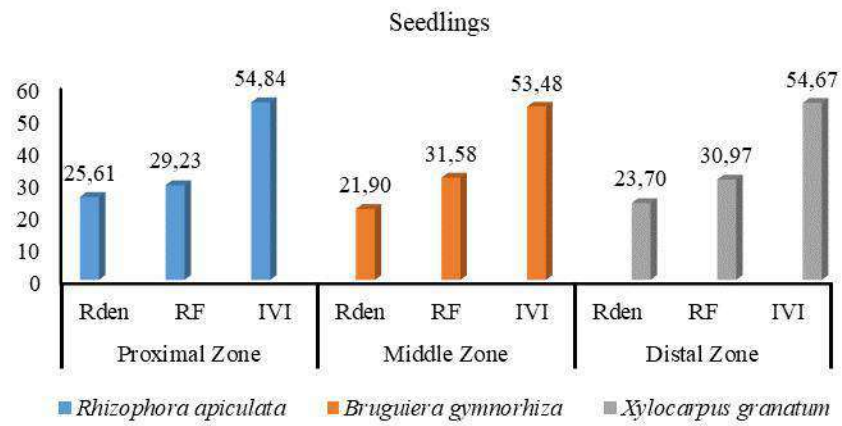
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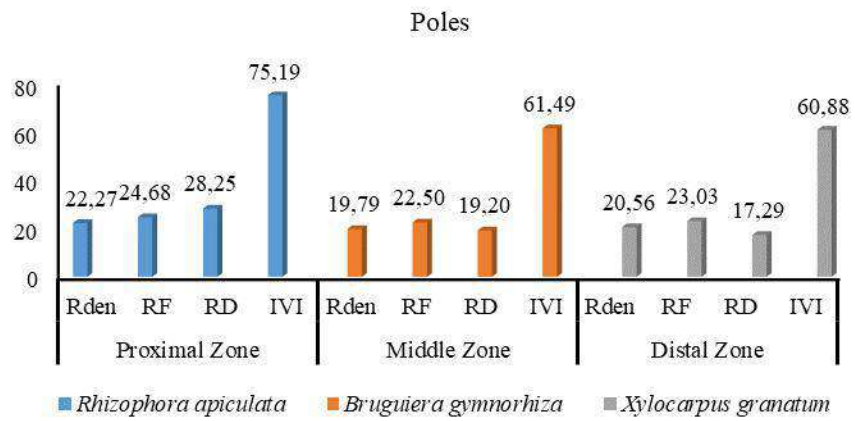
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154 number of observations, and the level of disturbance in each study area. The species with the highest importance represent
 155 the tenure value of the species in a community. The importance value of a species could be used as an indication that the
 156 species are considered dominant by having a higher relative density, relative frequency, and dominance values compared
 157 to other species. It was found that 28 species at both seedling and pole levels were found, while at the tree level 26 species
 158 of mangroves were found (Table 1).
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 166 **Figure 2.** Mangrove species for seedling level in Valentine bay
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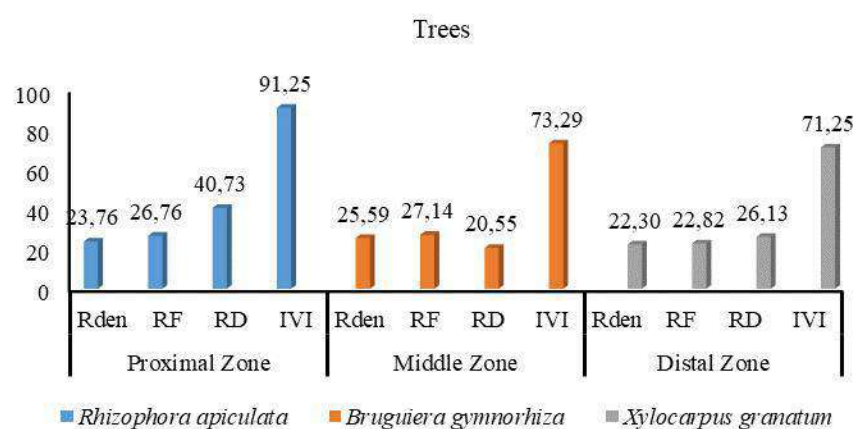


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176 **Figure 3.** Mangrove species of vegetation for poles level in Valentine bay

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179 **Figure 4.** Mangrove species of vegetation for trees level in Valentine bay

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181 From the results (Figure 2, 3, 4) of the vegetation analysis for the front zone, it was found that the dominant species
182 were *R. apiculata* with the highest IVI at seedling (54.84%), poles (75.19%) and trees (91.25%). This is presumably due to
183 the location factor which is suitable for the species *R. apiculata* (Figure 5), which generally grows along the seaward
184 margin in various types of substrates, such as mud sediments, white sand and corals. This is in line with stated by
185 Setyawan and Ulumuddin (2012), that mangroves in Tambelan island, Natuna Sea, Indonesia, especially for *R. apiculata*
186 commonly growing along the seaward and in various substrates such as fertile mud sediments, white sand, and corals.
187 According to Shah et al. (2016) the mangrove forests of Sibuti, Sarawak, Malaysia were also dominated by *R. apiculata*
188 among the 9 species of mangroves found there

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

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

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

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

204 Table 2. Species diversity index of each growth rate in Valentine bay

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

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207 Based on the data in Table 2 concerning the Diversity Index, the highest was in the middle zone at the seedling level of
208 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
209 calculated for the diversity index (H) is as follows: (a) $H \geq 3$ means low species diversity; (b) $1 < H < 3$ means moderate
210 species diversity; and (c) $H > 3$ means high species diversity. Based on the range of vegetation species diversity index
211 proposed by Magurran, the results of the species diversity index in the mangrove forest in Valentine Bay could be
212 categorized as moderate. Each range on the diversity index has its own benchmarks. This means that the level of diversity

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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.



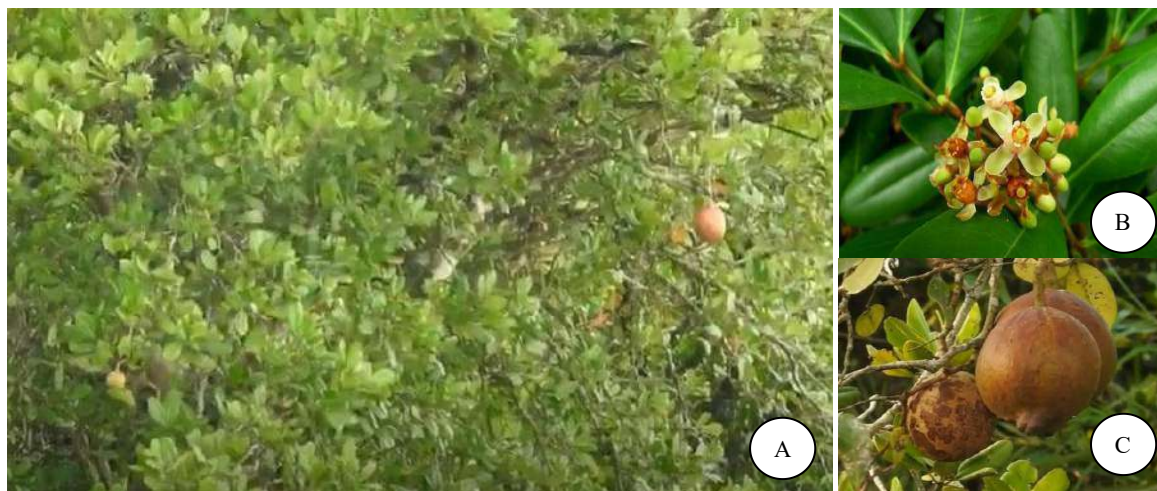
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Figure 5. *Rhizophora apiculata* (A) Trees; (B) Flowers; (C) Fruits at Proximal Zone



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Figure 6. *Bruguiera gymnorhiza* (A) Trees; (B) Flowers; (C) Fruits at Middle Zone



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Figure 7. *Xylocarpus moluccensis* (A) Trees; (B) Flowers; (C) Fruits at Distal Zone

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 an unique experience that may attract attention of both local as well as international visitors.

B. 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 (7) nyamuk (mosquitoes) belonging to genus *Anopheles*, and also the stick insect *Acrophylla wuefingii*.

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.).

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's Bay was also very diverse. Referring to the criterias 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).

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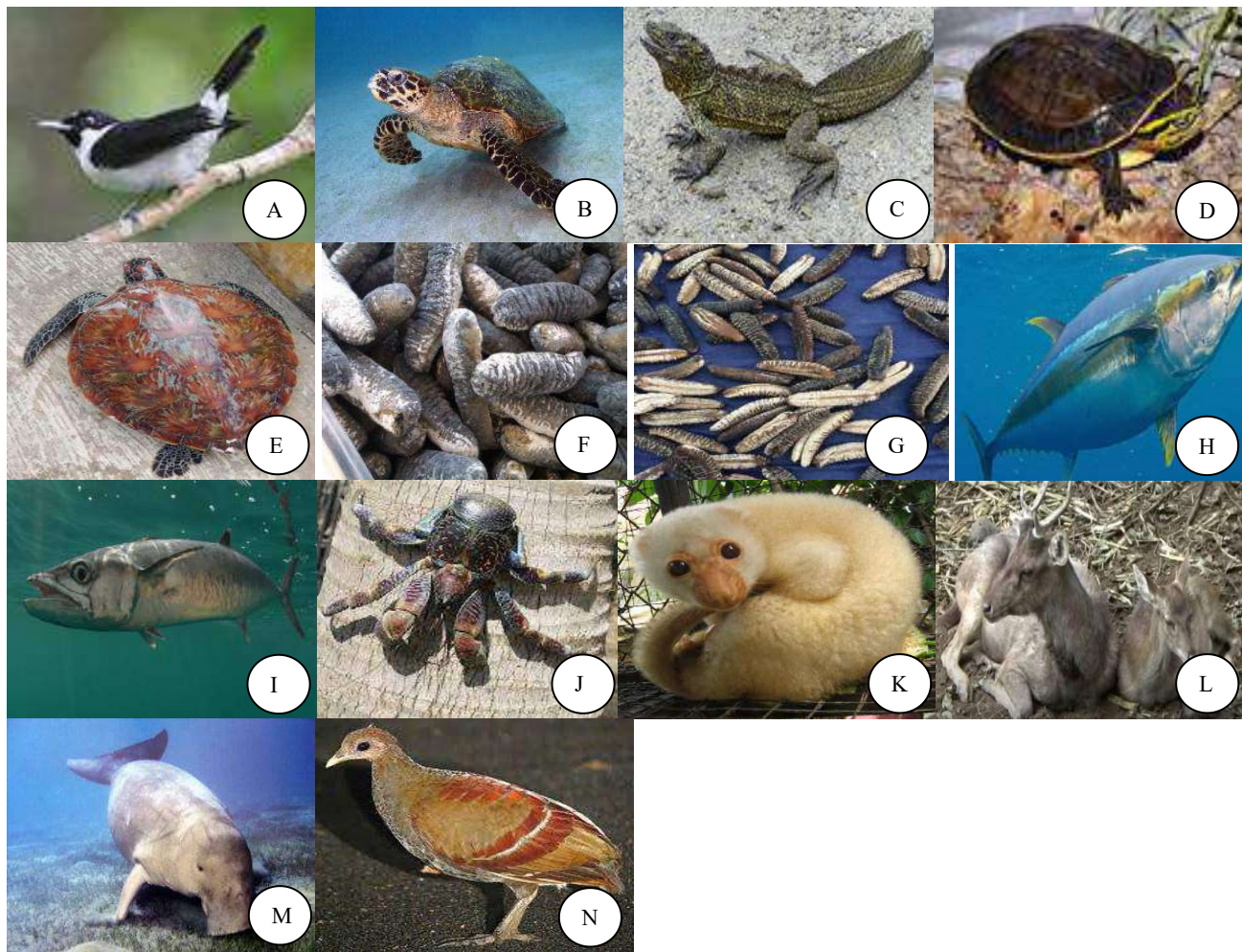


Figure 8. Fauna based on IUCN provisions (2020): (A) *Symposiachrus boanensis*; (B) *Eretmochelys imbricata*; (C) *Hydrosaurus amboinensis*; (D) *Cuora amboinensis*; (E) *Chelonia mydas*; (F) *Holothuria scabra*; (G) *Holothuria atra*; (H) *Thunnus albacares*; (I) *Scomberomorus commerson*; (J) *Birgus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

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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) criterias, 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.

C. Stakeholders

Based on interviews and direct observations in the field with key informants (local community leaders, West Seram Regency Forestry Service, West Seram Regency 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.

319 The Valentine Bay mangroves biodiversity has great potential for education, research, and ecotourism (Garcia et al.
320 2014). In addition, the community must also be made aware of the ecological role (pest control etc.) and indirect economic
321 benefits (livelihood etc.) derived from the existing animals in the forest around their habitat, and encourage not to value
322 them only for hunting. Through this understanding, the community and government officials may jointly protect the
323 various species of flora and fauna that live in the mangrove ecosystem and around them and help prevent outsiders from
324 engaging in encroachment and hunting. Furthermore, not only stakeholders but society, educational institutions and
325 researchers need to be involved to achieve the desired goals. It is also stated by (Alves et al. 2020) that the public and
326 scientific community need to be involved together to achieve goals with tiered input and agree on a coordinated
327 conservation plan.
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329 **D. Another tourism potential around Valentine Bay**

330 **Valentine Strait**

331 The waters of the Valentine Strait flanked by Buano Island and Pua Island with a width of about 80 meters have its
332 own charm. The Valentine Strait on Buano Island was included in the top 10 list of the Anugerah Pesona Indonesia (The
333 Enchantment of Indonesia's Grace) 2020 for the Most Popular Hidden Heaven category. According to local people, this
334 strait was named as Valentine Strait by Dutch soldiers in the colonial era because the aerial outlook of the strait of Buano
335 Island is shaped as heart. The sea waves around the island of Buano are popular to the public as they are frequent and
336 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
337 where swimming, fishing, diving and water ride activities could be carried out comfortably (Figure 9).
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339 **Figure 9.** Valentine strait waters

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342 **Buano Coral cliff**

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

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353 **Buano Coral Reefs**

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



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 359 **Figure 11.** Buano coral reefs

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 362 **E. Ecotourism Development Strategy**

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 364 Based on the existing potential and community participation, a SWOT analysis was carried out. This analysis was a
 365 technique to identify Strength (S), Weakness (W), Opportunity, Threat (T) which could be used as a basis for ecotourism
 366 development in Valentine Bay to be more focused and able to contribute which is good for area management and
 367 improving the welfare of the community around the area (Table 3).
 368

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

370
 371 Based on the weight value of Internal Factor Analysis System (IFAS) and External Factor Analysis System (EFAS) on
 372 the SWOT analysis, a more optimal and targeted ecotourism development strategy can be carried out, namely as follows:

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

- 374 • Building ecotourism based on high natural potential (flora, fauna, other 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.
- 375 • Promoting the potential for cultural customs and local wisdom such as "sasi", which is still maintained.
- 376 • 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.
- 377 • 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.

- 383 • Maintaining local wisdom, customary sites etc. of the Buano people to increase opportunities for integrated agricultural
384 development, ecotourism, and development of essential ecosystem areas.
385 • Managing regional database by developing a Geographical Information System with support from educational
386 institutions and researchers.
387 • Increasing opportunities in the development of essential ecosystem areas through the support of the government, NGOs
388 (LPPM Maluku), educational institutions, and researchers.
389 • Accelerating the development of ecotourism programs with the support of the community, government, and
390 educational institutions.

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

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

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

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

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

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

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

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

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441 **REFERENCES**

442 Ahmad F. 2015. Mangrove Forest Condition in Piru Bay, West Seram, Moluccas. *Jurnal Ilmu dan Teknologi Kelautan*
443 *Tropis* 7(2): 731–743.

444 Alves B, Angnuureng DB, Morand P, Almar R. 2020. A review on coastal erosion and flooding risks and best
445 management practices in West Africa: what has been done and should be done. *J Coast Conserv* 24: 38.
446 <https://doi.org/10.1007/s11852-020-00755-7>

447 Bengen DG. 2004. Pengenalan dan pengelolaan ekosistem mangrove. Pedoman Teknis. Pusat Kajian Sumberdaya Pesisir
448 dan Lautan. IPB. Bogor. [Indonesian]

449 Cuenca GC, Macusi ED, Abreo NAS, Ranara CTB, Andam MB, Cardona LC, et al. 2015. Mangrove Ecosystems and
450 Associated Fauna with Special Reference to Mangrove Crabs in the Philippines: A Review. *IAMURE Int J Ecol*
451 *Conser* 15: 60-110.

452 Das S. 2020. Does mangrove plantation reduce coastal erosion? Assessment from the west coast of India. *Reg Environ*
453 *Change* 20: 58. <https://doi.org/10.1007/s10113-020-01637-2>

454 Duke NC, Schmitt K. 2014. Mangroves: Unusual Forests at the Seas' Edge. In: Pancel L, Köhl M, *Tropical Forestry*
455 *Handbook*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-54601-3_129

456 Fandeli C. 2000. Perencanaan Kepariwisata Alam. Perencanaan Kepariwisata Alam. PT. (Persero) Perhutani dan
457 Fakultas Kehutanan Universitas Gadjah Mada. Yogyakarta. [Indonesian]

458 Garcia K, Malabrigo P, Gevaña D. 2014. Philippines' Mangrove Ecosystem: Status, Threats and Conservation. In:
459 Faridah-Hanum I, Latiff A, Hakeem K, Ozturk M. (eds) *Mangrove Ecosystems of Asia*. Springer, New York.
460 https://doi.org/10.1007/978-1-4614-8582-7_5

461 Haroun R, Herrero Barrencia A, Abreu AD. 2018. Mangrove habitats in são tomé and príncipe (gulf of Guinea, Africa):
462 Conservation and management status. In: Makowski C, Finkl C. (eds) *Threats to Mangrove Forests*. Coastal Research
463 *Library*, vol 25. Springer, Cham. https://doi.org/10.1007/978-3-319-73016-5_27.

464 Hartshorn GS. 2013. Tropical Forest Ecosystems. In: Levin SA (ed) *Encyclopedia of biodiversity*, Second Edition.
465 Elsevier Inc. 269–276. <https://doi.org/10.1016/B978-0-12-384719-5.00146-5>

466 Hilmi E, Kusmana C, Suhendang E, Iskandar. 2017. Correlation analysis between seawater intrusion and mangrove
467 greenbelt. *Indonesian J Forestry Res* 4: 151–168. <http://doi.org/10.20886/ijfr.2017.4.2.151-168>

468 IUCN. 2020. International Union for conservation of nature and natural resources red list of threatened species.

469 Jiang Z, Guan W, Xiong Y, Li M, Chen Y, Liao B. 2019. Interactive effects of intertidal elevation and light level on early
470 growth of five mangrove species under *Sonneratia apetala* Buch. Hamplantation canopy: Turning monocultures to
471 mixed forests. *Forests* 10: 83. <https://doi.org/10.3390/f10020083>

472 Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y. 2019. Species diversity, stand productivity, aboveground
473 biomass, and economic value of mangrove ecosystem in Mentawir village, East Kalimantan, Indonesia. *Biodiversitas*
474 20(10): 2848–2857. <https://doi.org/10.13057/biodiv/d201010> [Indonesian]

475 Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y, Ma'Ruf A. 2020. Fauna diversity, production potential and
476 total economic value of mangrove ecosystems in Mentawir Village, East Kalimantan, Indonesia. *Biodiversitas* 21(5):
477 1940–1953. <https://doi.org/10.13057/biodiv/d210522> [Indonesian]

478 Kumar M, Magotra R, Parikh J, Rajawat AS. 2017. Changing landscape of marine national park and Sanctuary, Gulf of
479 Kachchh: Ecological Assessment of Mangroves and Coral Reefs. *Proc Natl Acad Sci India Sect A - Phys Sci* 87:889–
480 900. <https://doi.org/10.1007/s40010-017-0457-3>

481 Kusmana C, Sukristijiono, S. 2016. Mangrove resource uses by local community in Indonesia. *J Natural Resources*
482 *Environ Manag* 6: 217–224. <https://journal.ipb.ac.id/index.php/jpsl/article/view/15307/11213>

483 Lee SY, Primavera JH, Dahdouh-Guebas F, Mckee K, Bosire JO, Cannicci S, et al. 2014. Ecological role and services of
484 tropical mangrove ecosystems: A reassessment. *Global Ecol Biogeogr* 23z: 726–743.
485 <https://doi.org/10.1111/geb.12155>

486 Ludwig JA, Reynolds JF. 1988. *Statistical ecology: A Primer in Methods and Computing*. John Wiley and Sons, Inc.

487 Magurran AE. 2004. *Measuring Biological Diversity*. Blackwell Publishing Company.

488 McKinley E, Aller-Rojas O, Hattam C, Germond-Duret C, San Martín IV, Hopkins CR, Aponte H, Potts T. 2019. Charting
489 the course for a blue economy in Peru: a research agenda. *Environ Dev Sustain* 21: 2253–2275.
490 <https://doi.org/10.1007/s10668-018-0133-z>

491 Melia J, Sutriana A, Hanafiah M, Wahyu M, Lubis A, Fakhurrozi A, Maulana TA, Sari MN. 2020. Health status E
492 examination of Sumatran Elephant (*Elephas maximus sumatranus*) Using Ultrasonography, Cortisol Analysis and Parasite
493 Identification in Aek Nauli Elephant Conservation Camp (ANECC) and Tangkahan Conservation Response Unit
494 (CRU), North Sumatra. *E3S Web of Conferences* 151: 01053. 1–6. <https://doi.org/10.1051/e3sconf/202015101053>

495 Mueller-Dombois D, Ellenberg H. 1974. *Aims & Methods of vegetation ecology*. John Wiley and Sons. The Blackburn

Deleted[Yosep Ruslim]: P

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Deleted[Yosep Ruslim]: M

Deleted[Yosep Ruslim]: B

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Deleted[Yosep Ruslim]: L

Deleted[Yosep Ruslim]: C

Deleted[Yosep Ruslim]: E

Deleted[Yosep Ruslim]: S

Deleted[Yosep Ruslim]: V

496 Press.

497 Naisumu YG, Seran YN, Ledheng L. 2018. Komposisi dan keanekaragaman jenis pohon di hutan lindung Lapeom

498 Kabupaten Timor Tengah Utara. J Saintek Lahan Kering 1: 4–7. [Indonesian]

499 Neumann B, Ott K, Kenchington R. 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14.

500 Sustain Sci 12: 1019–1035. <https://doi.org/10.1007/s11625-017-0472-y>

501 Ohee HL, Sujarta P, Surbakti SB, Barclay H. 2018. Rapid expansion and biodiversity impacts of the red devil cichlid

502 (*Amphilophus labiatus*, Günther 1864) in Lake Sentani, Papua, Indonesia. Biodiversitas 19(6): 2096–2103.

503 <https://doi.org/10.13057/biodiv/d190615> [Indonesian]

504 Poedjirahajoe E, Sulityorini IS, Komara LL. 2019. Species diversity of mangrove in Kutai National Park, East Kalimantan,

505 Indonesia. Biodiversitas 20(12): 3641–3646. <https://doi.org/10.13057/biodiv/d201224>

506 Radabaugh KR, Moyer RP, Chappel AR, Dontis EE, Russo CE, Joyse KM, Bownik MW, Goeckner A, H, Khan NS. 2019.

507 Mangrove damage, delayed mortality, and early recovery following hurricane Irma at two landfall sites in Southwest

508 Florida, USA. <https://doi.org/https://doi.org/10.1007/s12237-019-00564-8>

509 Rujehan, Matus P. 2018. Potential and management strategy of floral biodiversity in the coastal areas in East Kalimantan,

510 Indonesia. Biodiversitas 19(3): 1130–1137. <https://doi.org/10.13057/biodiv/d190348> [Indonesian]

511 Salampessy ML, Febryano IG, Martin E, Siahaya ME, Papilaya R. 2015. Cultural Capital of the Communities in the

512 Mangrove Conservation in the Coastal areas of Ambon Dalam Bay, Moluccas, Indonesia. Procedia Environmental

513 Sciences 23: 222–229. <https://doi.org/10.1016/j.proenv.2015.01.034>

514 Setyawan AD, Ulumuddin YI. 2012. Species diversity of *Rhizophora* in Tambelan Islands, Natuna Sea, Indonesia.

515 Biodiversitas 13(4): 172–177. <https://doi.org/10.13057/biodiv/d130402> [Indonesian]

516 Shah K, Kamal AHM, Rosli Z, Hakeem KR, Hoque MM. 2016. Composition and diversity of plants in Sibuti mangrove

517 forest, Sarawak, Malaysia. For Sci Tech 12: 70–76. <https://doi.org/10.1080/21580103.2015.1057619>

518 Sondak CFA, Kaligis EY, Bara RA. 2019. Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia.

519 Biodiversitas 20(4): 978–986. <https://doi.org/10.13057/biodiv/d200407> [Indonesian]

520 Spalding M, McIvor A, Tonnejck FH, Tol S, van Eijk P. 2014. Mangroves for coastal defence. Guidelines for coastal

521 managers and policy makers. Wetlands International and The Nature Conservancy, 42p.

522 [https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence](https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence_Decision_makers_Guide_WebVersion.pdf)

523 [nce_Decision_makers_Guide_WebVersion.pdf](https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence_Decision_makers_Guide_WebVersion.pdf) (Accessed 12.12.2020)

524 Spencer T, Möller I, Reef R. 2016. Mangrove systems and environments. In: Reference module in earth systems and

525 environmental sciences. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-409548-9.10262-3>

526 Surya B, Syafri S, Sahban H, Sakti HH. 2020. Natural resource conservation based on community economic

527 empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi,

528 Indonesia. Land 9: 104. <https://doi.org/10.3390/land9040104>

529 Utina R, Katili AS, Lapolo N, Dangkoa T. 2019. The composition of mangrove species in coastal area of Banggai district,

530 central Sulawesi, Indonesia. Biodiversitas 20(3): 840–846. <https://doi.org/10.13057/biodiv/d200330> [Indonesian]

531 Wijayanti DP, Sabdon A, Widyananto PA, Dirgantara D, Hidaka M. 2018. Bacterial symbionts of acroporid corals:

532 Antipathogenic potency against black band disease. Biodiversitas 19(4): 1235–1242.

533 <https://doi.org/10.13057/biodiv/d190408> [Indonesian]

534 Zakaria M, Rajpar MN. 2015. Assessing the fauna diversity of Marudu Bay mangrove forest, Sabah, Malaysia, for future

535 conservation. Divers 7(2): 137–148. <https://doi.org/10.3390/d7020137>

536 Zarghi A, Hosseini SM. 2014. Effect of ecotourism on plant biodiversity in Chelmir zone of Tandoureh National Park,

537 Khorasan Razavi Province, Iran. Biodiversitas 15(2): 224–228. <https://doi.org/10.13057/biodiv/d150215> [Indonesian]

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Managing Editor	2020-12-30 06:49
Biodiversitas,	AM
I send you back the revised of our journal. I hear soon your information.	
Best regards,	
Corresponding author,	
Yosep Ruslim	

1 **Potential analysis of location, socio-culture and biodiversity as**
2 **ecotourism attraction in Valentine's Bay on Buano Island, West Seram,**
3 **Moluccas Indonesia**

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15 **Abstract.** This study aims to analyze the potential of flora and fauna in the mangrove ecosystem as an attraction for ecotourism
16 development, knowing the role of stakeholders in supporting ecotourism development strategies in the mangrove area of Valentine Bay
17 in Buano island, West Seram, Moluccas, Indonesia. Based on the results of the study, it was found that 1) The mangrove vegetation had
18 28 species of plants under 19 families. Vegetation at the level of seedlings, saplings, and trees were found, the dominant species being
19 *Rhizophora apiculata*, *Bruguiera gymnorhiza* and *Xylocarpus granatum*. The diversity of animals in the Valentine Bay mangrove
20 ecosystem consist of birds, insects, reptiles, mollusks, crustaceans, echinoderms, fish, and mammals. Furthermore, there was an endemic
21 fauna of Buano island, namely the Kehicap buano/black-chinned monarch bird (*Symposiachrus boanensis*) which has started to become
22 rare, and was declared as critically endangered (CR) by the International Union for Conservation of Nature and Natural Resources; 2)
23 Stakeholder involvement in ecotourism activities were very supportive; 3) development strategies were to develop ecotourism, promote
24 ecotourism attractiveness, develop educational tourism and promote study on the diversity of flora, fauna, culture, and traditional
25 customs on Buano island.

26 **Key words:** conservation, coral reef, diversity, fauna, flora, mangrove ecosystem

27 **INTRODUCTION**

28 Mangrove is a typical forest type and grows along the coast or river estuaries which are influenced by tides and are
29 often found in coastal areas that are protected from the onslaught of waves and gently sloping areas in tropical and sub-
30 tropical areas (Hartshorn 2013; Duke and Schmitt 2014; Spencer et al. 2016).

31 Natural resources in coastal areas have a role in supporting social and economic development (Salampessy et al. 2015;
32 Neumann et al. 2017; McKinley et al. 2019). The consequence of this great potential causes coastal areas to be vulnerable
33 to damage and degradation of coastal natural resources.

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

42 The utilization and management of natural resources on Buano island face various threats, both from ecological and
43 social aspects regarding ecological aspects, there has been decline in the quality of the terrestrial and coastal environment.
44 Terrestrial environmental quality threats such as excessive felling of trees, land clearing, and mining. According to
45 (Rujehan and Matus 2018), land clearing and mining activities are also issues that often occur in Bukit Soeharto, East
46 Kalimantan. Coastal threats may consist of overfishing, and similar threats are also reported in Lake Sentani due to
47 overfishing (Ohee et al. 2018), damage to mangroves (Radabaugh et al. 2019) and coral reefs (Wijayanti et al. 2018),
48 declining quality of underwater parks, the threat of various species of marine life such as trade in endangered species,
49 increased abrasion, widespread sedimentation, and intrusion of seawater. The coastal ecosystem faces serious threats of
50 pollution, overexploitation, conflicting use of resources, damage, and destruction of habitats (Kumar et al. 2017).
51 Meanwhile, threats in the social aspect on Buano island include high population growth, such as the expansion of human
52 settlements, which can lead to excessive exploitation of natural resources that can damage the environment. Conservation
53 activities are an effort to maintain the balance of nature so that humans and other living things can live well In harmony.

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

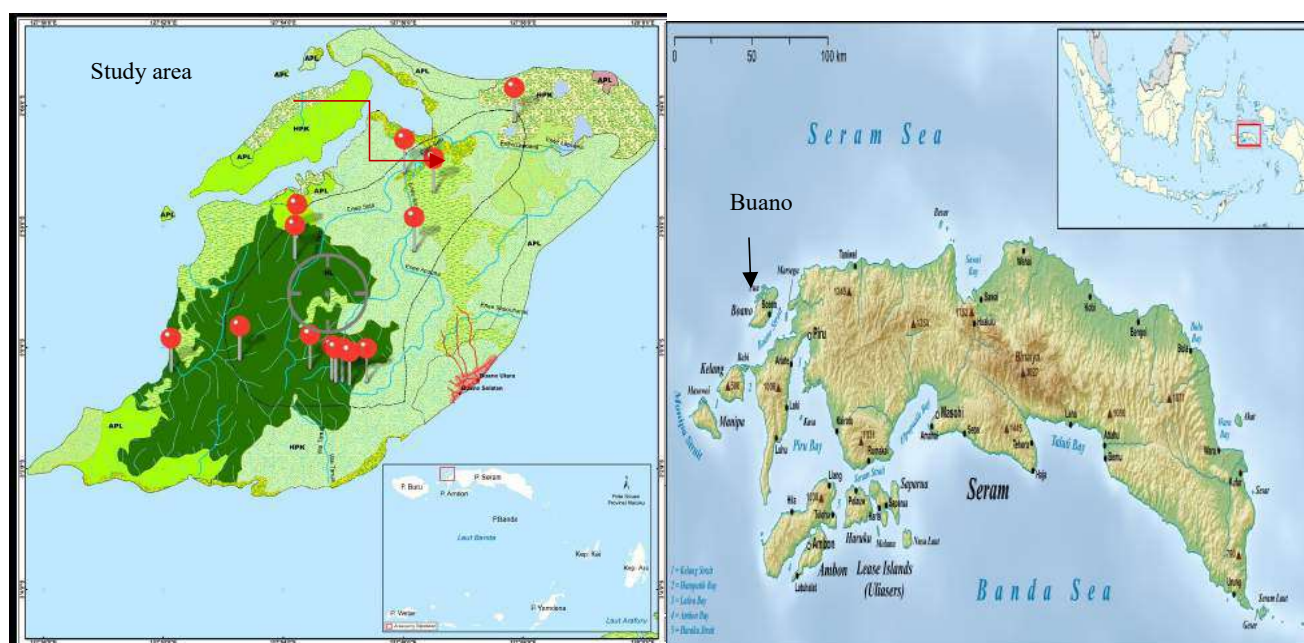
59 Ecotourism can be defined as a form of tourism that is responsible for the preservation of unspoiled areas, provides
60 economic benefits, and maintains the socio-cultural integrity of the local community (Zarghi and Hosseini 2014).
61 Ecotourism is a form of travel to natural areas for a number of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

62 Based on the description above and considering the limited data and information regarding the condition of mangrove
63 forests in the coastal area of Valentine Bay, it was deemed necessary to study the potential and development strategies of
64 Valentine Bay mangrove ecotourism on Buano Island. The study objectives were (1) to analyze the potential composition
65 of mangroves including species composition, density, presence frequency, and Importance value of the species; (2) to
66 determine the role of stakeholders in supporting ecotourism development, and; (3) ecotourism development strategy. This
67 study intends to provide information about the potential of existing mangroves and other tourism potentials around
68 Valentine Bay so that it can provide input to related agencies in the context of managing and developing mangrove areas
69 as a support to ecotourism.

70 MATERIALS AND METHODS

71 Study area

72 The location of the study was in a mangrove ecosystem in the Valentine Bay area which is administratively located on
73 Buano Island, Huamual Belakang Subdistrict, West Seram District, Moluccas Province, Indonesia. The map of the study
74 location is presented in Figure 1. The research was conducted from July to September 2019.
75



76
77 **Figure 1.** Study location in Valentine Bay on Buano Island, West Seram District, Moluccas, Indonesia

78 **Procedures**

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

83 The Vegetation data was collected using the combination of the path method and the compartmentalized line method.
84 Study plots were made in the line transect. The plot areas for each growth stages were as follows:

- 85 (a) Seedlings with ranging from sprouts to 1.5 m high – diameter at < 2 cm, plot size of 5 m × 5 m,
86 (b) Poles with the height between 1.5 m – diameter at breast height <10-19 cm, plot size 10 m ×10 m
87 (c) Trees with the diameter at breast height ≥ 20 cm, plot size 20 m × 20 m

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

90 **Data analysis**

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

94
95
96 Density (D) =
$$\frac{\text{Number individual of a species}}{\text{Area of the measurement plots}}$$

97
98
99
100 Relative Density (Rden) =
$$\frac{\text{density of a species}}{\text{density of all species}} \times 100\%$$

101
102
103
104 Frequency (F) =
$$\frac{\text{Number of plots found of a species}}{\text{Area of the measurement plots}}$$

105
106
107
108 Relative Frequency (RF) =
$$\frac{\text{Frequency of a species}}{\text{Frequency of all species}} \times 100\%$$

109
110
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112 Dominance (SD) =
$$\frac{\text{Basal area of a species}}{\text{Area of the measurement plots}}$$

113
114
115
116 Relative Dominance (RD) =
$$\frac{\text{dominance of a species}}{\text{dominance of all species}} \times 100 \%$$

117
118
119 Then the Importance Value Index (IVI) value was calculated to determine the dominant plant species and levels with
120 the following formula:

121 For seedlings: IVI = RDen + RF

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

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

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

125 Where:

126 H' = Species Diversity Index

127 N = Sum of Importance Value Index (IVI)

128 n_i = Importance Value Index (IVI) of a species

130 **Study Review**

131 Buano Island is one of the small islands with an area of about 135.73 km², which is located to the southwest of
 132 Seram Island. There were 2 villages that were located close to and parallel to the sloping coast, namely North Buano and
 133 South Buano villages, both of which are only separated by mosques, and the church was located close by and is a marker
 134 of the two villages. On September 29, 2014, through SK.854/Menhut-II/2014 concerning the Forest Area of Moluccas
 135 Province, a protected forest area of 4,287.22 ha was established. The research locations were generally located in the
 136 mangrove area of Valentine Bay, one of the areas included in the protected forest area of Buano Island.

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

141 **A. Flora**

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

145 Tabel 1. The Species of true mangroves and mangrove associates vegetation in Valentine Bay
 146
 147

No.	Species	Family	Zone		
			Proximal	Middle	Distal
1	<i>Rhizophora apiculata</i>	Rhizophoraceae	√		
2	<i>Rhizophora stylosa</i>	Rhizophoraceae	√		
3	<i>Sonneratia alba</i>	Lythraceae	√		
4	<i>Rhizophora mucronata</i>	Rhizophoraceae	√		
5	<i>Avicennia marina</i>	Acanthaceae	√	√	
6	<i>Bruguiera sexangula</i>	Rhizophoraceae	√	√	
7	<i>Bruguiera gymnorhiza</i>	Rhizophoraceae	√	√	
8	<i>Pemphis acidula</i>	Lythraceae	√	√	
9	<i>Lumnitzera littorea</i>	Combretaceae	√	√	
10	<i>Acanthus ebracteatus</i>	Acanthaceae	√		
11	<i>Bruguiera cylindrica</i>	Rhizophoraceae		√	
12	<i>Ceriops tagal</i>	Rhizophoraceae		√	
13	<i>Cerriops decandra</i>	Rhizophoraceae		√	
14	<i>Xylocarpus moluccensis</i>	Meliaceae		√	√
15	<i>Xylocarpus granatum</i>	Meliaceae		√	√
16	<i>Excoecaria agallocha</i>	Euphorbiaceae		√	
17	<i>Aegiceras corniculatum</i>	Primulaceae		√	
18	<i>Acrostichum speciosum</i>	Pteridaceae		√	
19	<i>Nypa fruticans</i>	Arecaceae			√
20	<i>Heritiera littoralis</i>	Malvaceae			√
21	<i>Barringtonia asiatica</i>	Lecythidaceae			√
22	<i>Pongamia pinnata</i>	Leguminosae			√
23	<i>Pandanus tectorius</i>	Pandanaceae			√
24	<i>Terminalia catappa</i>	Combretaceae			√
25	<i>Hibiscus tiliaceus</i>	Malvaceae			√
26	<i>Acrostichum aureum</i>	Pteridaceae			√
27	<i>Scaevola taccada</i>	Goodeniaceae			√
28	<i>Intsia bijuga</i>	Leguminosae			√

148 According to Ahmad (2015) in the mangrove forests of Piru bay West Seram district, Moluccas, has found 17 species
 149 of mangroves, while Poedjirahajoe et al. (2019) has found 17 species of mangroves in Kutai National Park, East
 150 Kalimantan. When compared with the results in other regions, it could be seen that the species composition in the
 151 Valentine Bay area was higher than in Piru Bay and Kutai National park. The difference in the number of species
 152 composition in mangroves in several areas was thought to be caused by the differences in environmental conditions, the
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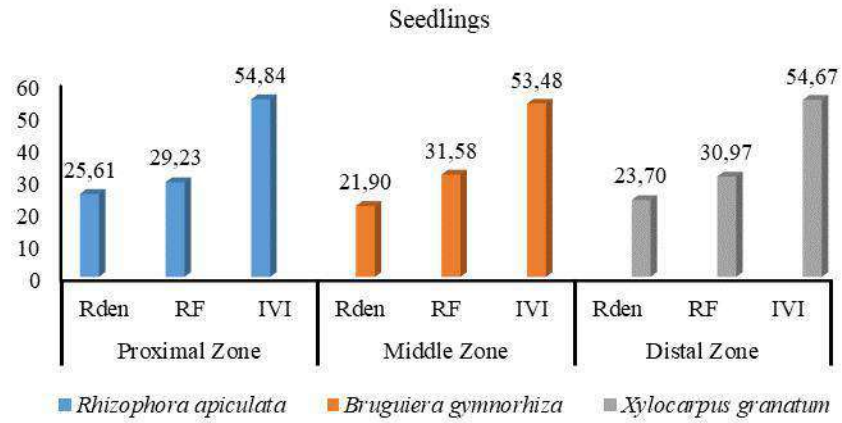
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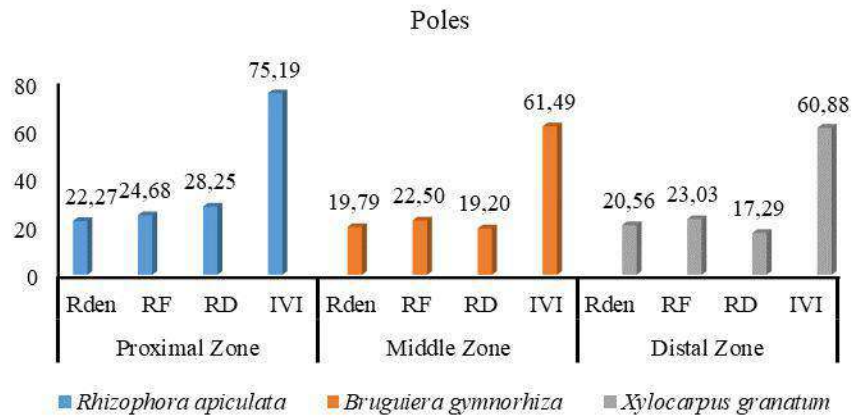
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154 number of observations, and the level of disturbance in each study area. The species with the highest importance represent
 155 the tenure value of the species in a community. The importance value of a species could be used as an indication that the
 156 species are considered dominant by having a higher relative density, relative frequency, and dominance values compared
 157 to other species. It was found that 28 species at both seedling and pole levels were found, while at the tree level 26 species
 158 of mangroves were found (Table 1).
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 166 **Figure 2.** Mangrove species for seedling level in Valentine bay
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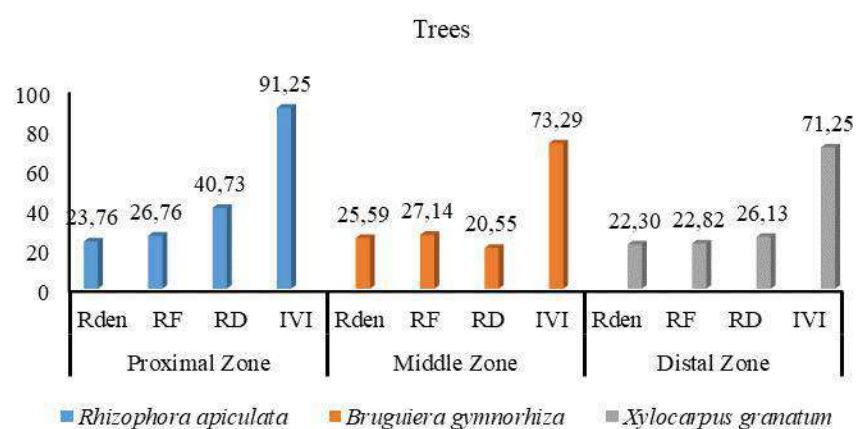


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176 **Figure 3.** Mangrove species of vegetation for poles level in Valentine bay

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179 **Figure 4.** Mangrove species of vegetation for trees level in Valentine bay

180
181 From the results (Figure 2, 3, 4) of the vegetation analysis for the front zone, it was found that the dominant species
182 were *R. apiculata* with the highest IVI at seedling (54.84%), poles (75.19%) and trees (91.25%). This is presumably due to
183 the location factor which is suitable for the species *R. apiculata* (Figure 5), which generally grows along the seaward
184 margin in various types of substrates, such as mud sediments, white sand and corals. This is in line with stated by
185 Setyawan and Ulumuddin (2012), that mangroves in Tambelan island, Natuna Sea, Indonesia, especially for *R. apiculata*
186 commonly growing along the seaward and in various substrates such as fertile mud sediments, white sand, and corals.
187 According to Shah et al. (2016) the mangrove forests of Sibuti, Sarawak, Malaysia were also dominated by *R. apiculata*
188 among the 9 species of mangroves found there

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

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

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

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

204 Table 2. Species diversity index of each growth rate in Valentine bay

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

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207 Based on the data in Table 2 concerning the Diversity Index, the highest was in the middle zone at the seedling level of
208 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
209 calculated for the diversity index (H) is as follows: (a) $H \geq 3$ means low species diversity; (b) $1 < H < 3$ means moderate
210 species diversity; and (c) $H > 3$ means high species diversity. Based on the range of vegetation species diversity index
211 proposed by Magurran, the results of the species diversity index in the mangrove forest in Valentine Bay could be
212 categorized as moderate. Each range on the diversity index has its own benchmarks. This means that the level of diversity

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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.



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Figure 5. *Rhizophora apiculata* (A) Trees; (B) Flowers; (C) Fruits at Proximal Zone



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Figure 6. *Bruguiera gymnorhiza* (A) Trees; (B) Flowers; (C) Fruits at Middle Zone



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Figure 7. *Xylocarpus moluccensis* (A) Trees; (B) Flowers; (C) Fruits at Distal Zone

226 Fandeli (2000) stated that the higher the number of species in an area, the better its diversity. From the tourism point of
227 view, observation of up-close diversity of vegetation with tagged information, exploration of underlying ecological
228 processes is an unique experience that may attract attention of both local as well as international visitors.
229

230 B. Fauna

231
232 Apart from plant diversity, it turns out that the mangrove ecosystem is also rich in faunal diversity. Based on the survey,
233 presence of 28 species of birds, 8 species of insects, 5 species of reptiles, 16 species of fish, 9 species of mammals, 4
234 species of crustaceans, 3 species of echinoderms and 2 species of mollusks were recorded.

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

245 The species of insects in the Valentine Bay ecosystem include: kupu-kupu (butterflies) (*Graphium sarpedon*, *Vindula*
246 *sp.*, *Papilio memnon*, *Elymnias vasudeva*); semut rang-rang (ants) (*Oecophylla smaragdina*), *Camponotus* sp.; and (7)
247 nyamuk (mosquitoes) belonging to genus *Anopheles*, and also the stick insect *Acrophylla wuefingii*.

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

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

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

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

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

268 According to Kristiningrum et al. (2020), the mangrove ecosystem in the village of Mentawir Balikpapan also has a
269 diversity of mammals, reptiles, fish, and invertebrates, based on the results of the inventory it was known that the potential
270 of fauna in the Valentine's Bay was also very diverse. Referring to the criterias of (Fandeli 2000), the animal species
271 richness >15 is very high, hence the fauna recorded in the mangrove area of Valentine Bay may be categorized as very
272 high.

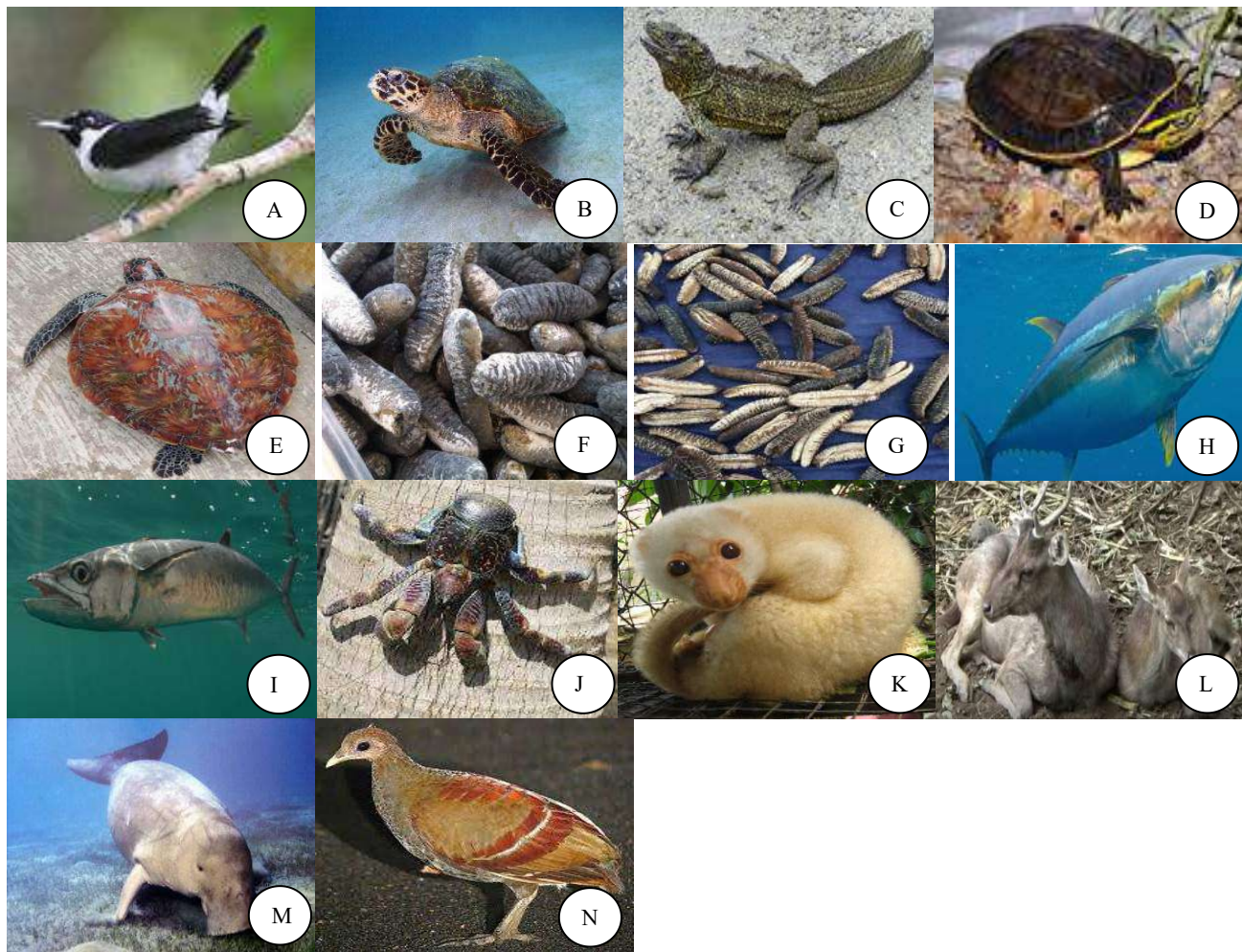
273 However, there were animals such as *Symposiachrus boanensis* and *Eretmochelys imbricata* that have been declared as
274 Critically Endangered (CR) by IUCN . Other animals such as *Hydrosaurus amboinensis*, *Cuora amboinensis*, *Chelonia*
275 *mydas*, *Holothuria scabra* and *Holothuria atra* have their status under Endangered (EN) category. Meanwhile, *Thunnus*
276 *albacares* and *Scomberomorus commerson* were under Near Threatened (NT) category and those under vulnerable (VU)
277 category were *Birgus latro*, *Caretta caretta*, *Lepidochelys olivacea*, *Phalanger ursinus*, *Cervus timorensis*, *Dugong dugon*,
278 and *Eulipoa wallacei* (IUCN 2020) (Figure 8).
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292 **Figure 8.** Fauna based on IUCN provisions (2020): (A) *Symposiachrus boanensis*; (B) *Eretmochelys imbricata*; (C) *Hydrosaurus*
 293 *amboinensis*; (D) *Cuora amboinensis*; (E) *Chelonia mydas*; (F) *Holothuria scabra*; (G) *Holothuria atra*; (H) *Thunnus albacares*; (I)
 294 *Scomberomorus commerson*; (J) *Birgus latro*; (K) *Phalanger ursinus*; (L) *Cervus timorensis*, (M) *Dugong dugon*; and (N) *Eulipoa*
 295 *wallacei*.

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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) criterias, 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.

C. Stakeholders

Based on interviews and direct observations in the field with key informants (local community leaders, West Seram Regency Forestry Service, West Seram Regency 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.

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319 The Valentine Bay mangroves biodiversity has great potential for education, research, and ecotourism (Garcia et al.
320 2014). In addition, the community must also be made aware of the ecological role (pest control etc.) and indirect economic
321 benefits (livelihood etc.) derived from the existing animals in the forest around their habitat, and encourage not to value
322 them only for hunting. Through this understanding, the community and government officials may jointly protect the
323 various species of flora and fauna that live in the mangrove ecosystem and around them and help prevent outsiders from
324 engaging in encroachment and hunting. Furthermore, not only stakeholders but society, educational institutions and
325 researchers need to be involved to achieve the desired goals. It is also stated by (Alves et al. 2020) that the public and
326 scientific community need to be involved together to achieve goals with tiered input and agree on a coordinated
327 conservation plan.
328

329 **D. Another tourism potential around Valentine Bay**

330 **Valentine Strait**

331 The waters of the Valentine Strait flanked by Buano Island and Pua Island with a width of about 80 meters have its
332 own charm. The Valentine Strait on Buano Island was included in the top 10 list of the Anugerah Pesona Indonesia (The
333 Enchantment of Indonesia's Grace) 2020 for the Most Popular Hidden Heaven category. According to local people, this
334 strait was named as Valentine Strait by Dutch soldiers in the colonial era because the aerial outlook of the strait of Buano
335 Island is shaped as heart. The sea waves around the island of Buano are popular to the public as they are frequent and
336 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
337 where swimming, fishing, diving and water ride activities could be carried out comfortably (Figure 9).
338



339 **Figure 9.** Valentine strait waters

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342 **Buano Coral cliff**

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

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353 **Buano Coral Reefs**

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



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 359 **Figure 11.** Buano coral reefs

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 362 **E. Ecotourism Development Strategy**

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 364 Based on the existing potential and community participation, a SWOT analysis was carried out. This analysis was a
 365 technique to identify Strength (S), Weakness (W), Opportunity, Threat (T) which could be used as a basis for ecotourism
 366 development in Valentine Bay to be more focused and able to contribute which is good for area management and
 367 improving the welfare of the community around the area (Table 3).
 368

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

370
 371 Based on the weight value of Internal Factor Analysis System (IFAS) and External Factor Analysis System (EFAS) on
 372 the SWOT analysis, a more optimal and targeted ecotourism development strategy can be carried out, namely as follows:

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

- 374 • Building ecotourism based on high natural potential (flora, fauna, other tourism potential) around the Valentine Bay
 375 mangrove area by utilizing government regulations, support from the local government, local governments, NGOs
 376 (LPPM Maluku), educational and research institutions as well as tourist visits.
 377 • Promoting the potential for cultural customs and local wisdom such as "sasi", which is still maintained.
 378 • Making and stipulating village regulations to organize directed Village development planning, regulating
 379 environmental sustainability and natural resources, and maintaining the institutions of customs and local wisdom that
 380 have grown in the midst of society.
 381 • Developing the potential of integrated agriculture through government support to help improve the welfare of local
 382 communities with an ecotourism approach and simultaneously supporting ecotourism programs.

- 383 • Maintaining local wisdom, customary sites etc. of the Buano people to increase opportunities for integrated agricultural
384 development, ecotourism, and development of essential ecosystem areas.
385 • Managing regional database by developing a Geographical Information System with support from educational
386 institutions and researchers.
387 • Increasing opportunities in the development of essential ecosystem areas through the support of the government, NGOs
388 (LPPM Maluku), educational institutions, and researchers.
389 • Accelerating the development of ecotourism programs with the support of the community, government, and
390 educational institutions.

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

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

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

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

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

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

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

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

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441 **REFERENCES**

442 Ahmad F. 2015. Mangrove Forest Condition in Piru Bay, West Seram, Moluccas. *Jurnal Ilmu dan Teknologi Kelautan*
443 *Tropis* 7(2): 731–743.

444 Alves B, Angnuureng DB, Morand P, Almar R. 2020. A review on coastal erosion and flooding risks and best
445 management practices in West Africa: what has been done and should be done. *J Coast Conserv* 24: 38.
446 <https://doi.org/10.1007/s11852-020-00755-7>

447 Bengen DG. 2004. Pengenalan dan pengelolaan ekosistem mangrove. Pedoman Teknis. Pusat Kajian Sumberdaya Pesisir
448 dan Lautan. IPB. Bogor. [Indonesian]

449 Cuenca GC, Macusi ED, Abreo NAS, Ranara CTB, Andam MB, Cardona LC, et al. 2015. Mangrove Ecosystems and
450 Associated Fauna with Special Reference to Mangrove Crabs in the Philippines: A Review. *IAMURE Int J Ecol*
451 *Conser* 15: 60-110.

452 Das S. 2020. Does mangrove plantation reduce coastal erosion? Assessment from the west coast of India. *Reg Environ*
453 *Change* 20: 58. <https://doi.org/10.1007/s10113-020-01637-2>

454 Duke NC, Schmitt K. 2014. Mangroves: Unusual Forests at the Seas' Edge. In: Pancel L, Köhl M, *Tropical Forestry*
455 *Handbook*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-54601-3_129

456 Fandeli C. 2000. Perencanaan Kepariwisata Alam. Perencanaan Kepariwisata Alam. PT. (Persero) Perhutani dan
457 Fakultas Kehutanan Universitas Gadjah Mada. Yogyakarta. [Indonesian]

458 Garcia K, Malabrigo P, Gevaña D. 2014. Philippines' Mangrove Ecosystem: Status, Threats and Conservation. In:
459 Faridah-Hanum I, Latiff A, Hakeem K, Ozturk M. (eds) *Mangrove Ecosystems of Asia*. Springer, New York.
460 https://doi.org/10.1007/978-1-4614-8582-7_5

461 Haroun R, Herrero Barrencia A, Abreu AD. 2018. Mangrove habitats in são tomé and príncipe (gulf of Guinea, Africa):
462 Conservation and management status. In: Makowski C, Finkl C. (eds) *Threats to Mangrove Forests*. Coastal Research
463 *Library*, vol 25. Springer, Cham. https://doi.org/10.1007/978-3-319-73016-5_27.

464 Hartshorn GS. 2013. Tropical Forest Ecosystems. In: Levin SA (ed) *Encyclopedia of biodiversity*, Second Edition.
465 Elsevier Inc. 269–276. <https://doi.org/10.1016/B978-0-12-384719-5.00146-5>

466 Hilmi E, Kusmana C, Suhendang E, Iskandar. 2017. Correlation analysis between seawater intrusion and mangrove
467 greenbelt. *Indonesian J Forestry Res* 4: 151–168. <http://doi.org/10.20886/ijfr.2017.4.2.151-168>

468 IUCN. 2020. International Union for conservation of nature and natural resources red list of threatened species.

469 Jiang Z, Guan W, Xiong Y, Li M, Chen Y, Liao B. 2019. Interactive effects of intertidal elevation and light level on early
470 growth of five mangrove species under *Sonneratia apetala* Buch. Hamplantation canopy: Turning monocultures to
471 mixed forests. *Forests* 10: 83. <https://doi.org/10.3390/f10020083>

472 Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y. 2019. Species diversity, stand productivity, aboveground
473 biomass, and economic value of mangrove ecosystem in Mentawir village, East Kalimantan, Indonesia. *Biodiversitas*
474 20(10): 2848–2857. <https://doi.org/10.13057/biodiv/d201010> [Indonesian]

475 Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y, Ma'Ruf A. 2020. Fauna diversity, production potential and
476 total economic value of mangrove ecosystems in Mentawir Village, East Kalimantan, Indonesia. *Biodiversitas* 21(5):
477 1940–1953. <https://doi.org/10.13057/biodiv/d210522> [Indonesian]

478 Kumar M, Magotra R, Parikh J, Rajawat AS. 2017. Changing landscape of marine national park and Sanctuary, Gulf of
479 Kachchh: Ecological Assessment of Mangroves and Coral Reefs. *Proc Natl Acad Sci India Sect A - Phys Sci* 87:889–
480 900. <https://doi.org/10.1007/s40010-017-0457-3>

481 Kusmana C, Sukristijiono, S. 2016. Mangrove resource uses by local community in Indonesia. *J Natural Resources*
482 *Environ Manag* 6: 217–224. <https://journal.ipb.ac.id/index.php/jpsl/article/view/15307/11213>

483 Lee SY, Primavera JH, Dahdouh-Guebas F, Mckee K, Bosire JO, Cannicci S, et al. 2014. Ecological role and services of
484 tropical mangrove ecosystems: A reassessment. *Global Ecol Biogeogr* 23z: 726–743.
485 <https://doi.org/10.1111/geb.12155>

486 Ludwig JA, Reynolds JF. 1988. *Statistical ecology: A Primer in Methods and Computing*. John Wiley and Sons, Inc.

487 Magurran AE. 2004. *Measuring Biological Diversity*. Blackwell Publishing Company.

488 McKinley E, Aller-Rojas O, Hattam C, Germond-Duret C, San Martín IV, Hopkins CR, Aponte H, Potts T. 2019. Charting
489 the course for a blue economy in Peru: a research agenda. *Environ Dev Sustain* 21: 2253–2275.
490 <https://doi.org/10.1007/s10668-018-0133-z>

491 Melia J, Sutriana A, Hanafiah M, Wahyu M, Lubis A, Fakhurrozi A, Maulana TA, Sari MN. 2020. Health status E
492 examination of Sumatran Elephant (*Elephas maximus sumatranus*) Using Ultrasonography, Cortisol Analysis and Parasite
493 Identification in Aek Nauli Elephant Conservation Camp (ANECC) and Tangkahan Conservation Response Unit
494 (CRU), North Sumatra. *E3S Web of Conferences* 151: 01053. 1–6. <https://doi.org/10.1051/e3sconf/202015101053>

495 Mueller-Dombois D, Ellenberg H. 1974. *Aims & Methods of vegetation ecology*. John Wiley and Sons. The Blackburn

Deleted[Yosep Ruslim]: P

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Deleted[Yosep Ruslim]: M

Deleted[Yosep Ruslim]: B

Deleted[Yosep Ruslim]: A

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Deleted[Yosep Ruslim]: L

Deleted[Yosep Ruslim]: C

Deleted[Yosep Ruslim]: E

Deleted[Yosep Ruslim]: S

Deleted[Yosep Ruslim]: V

496 Press.

497 Naisumu YG, Seran YN, Ledheng L. 2018. Komposisi dan keanekaragaman jenis pohon di hutan lindung Lapeom

498 Kabupaten Timor Tengah Utara. J Saintek Lahan Kering 1: 4–7. [Indonesian]

499 Neumann B, Ott K, Kenchington R. 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14.

500 Sustain Sci 12: 1019–1035. <https://doi.org/10.1007/s11625-017-0472-y>

501 Ohee HL, Sujarta P, Surbakti SB, Barclay H. 2018. Rapid expansion and biodiversity impacts of the red devil cichlid

502 (*Amphilophus labiatus*, Günther 1864) in Lake Sentani, Papua, Indonesia. Biodiversitas 19(6): 2096–2103.

503 <https://doi.org/10.13057/biodiv/d190615> [Indonesian]

504 Poedjirahajoe E, Sulityorini IS, Komara LL. 2019. Species diversity of mangrove in Kutai National Park, East Kalimantan,

505 Indonesia. Biodiversitas 20(12): 3641–3646. <https://doi.org/10.13057/biodiv/d201224>

506 Radabaugh KR, Moyer RP, Chappel AR, Dontis EE, Russo CE, Joyse KM, Bownik MW, Goeckner A, H, Khan NS. 2019.

507 Mangrove damage, delayed mortality, and early recovery following hurricane Irma at two landfall sites in Southwest

508 Florida, USA. <https://doi.org/https://doi.org/10.1007/s12237-019-00564-8>

509 Rujehan, Matus P. 2018. Potential and management strategy of floral biodiversity in the coastal areas in East Kalimantan,

510 Indonesia. Biodiversitas 19(3): 1130–1137. <https://doi.org/10.13057/biodiv/d190348> [Indonesian]

511 Salampessy ML, Febryano IG, Martin E, Siahaya ME, Pampilaya R. 2015. Cultural Capital of the Communities in the

512 Mangrove Conservation in the Coastal areas of Ambon Dalam Bay, Moluccas, Indonesia. Procedia Environmental

513 Sciences 23: 222–229. <https://doi.org/10.1016/j.proenv.2015.01.034>

514 Setyawan AD, Ulumuddin YI. 2012. Species diversity of *Rhizophora* in Tambelan Islands, Natuna Sea, Indonesia.

515 Biodiversitas 13(4): 172–177. <https://doi.org/10.13057/biodiv/d130402> [Indonesian]

516 Shah K, Kamal AHM, Rosli Z, Hakeem KR, Hoque MM. 2016. Composition and diversity of plants in Sibuti mangrove

517 forest, Sarawak, Malaysia. For Sci Tech 12: 70–76. <https://doi.org/10.1080/21580103.2015.1057619>

518 Sondak CFA, Kaligis EY, Bara RA. 2019. Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia.

519 Biodiversitas 20(4): 978–986. <https://doi.org/10.13057/biodiv/d200407> [Indonesian]

520 Spalding M, McIvor A, Tonneijck FH, Tol S, van Eijk P. 2014. Mangroves for coastal defence. Guidelines for coastal

521 managers and policy makers. Wetlands International and The Nature Conservancy, 42p.

522 [https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence](https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence_Decision_makers_Guide_WebVersion.pdf)

523 [Decision_makers_Guide_WebVersion.pdf](https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence_Decision_makers_Guide_WebVersion.pdf) (Accessed 12.12.2020)

524 Spencer T, Möller I, Reef R. 2016. Mangrove systems and environments. In: Reference module in earth systems and

525 environmental sciences. Elsevier Inc. <https://doi.org/10.1016/B978-0-12-409548-9.10262-3>

526 Surya B, Syafri S, Sahban H, Sakti HH. 2020. Natural resource conservation based on community economic

527 empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi,

528 Indonesia. Land 9: 104. <https://doi.org/10.3390/land9040104>

529 Utina R, Katili AS, Lapolo N, Dangkoa T. 2019. The composition of mangrove species in coastal area of Banggai district,

530 central Sulawesi, Indonesia. Biodiversitas 20(3): 840–846. <https://doi.org/10.13057/biodiv/d200330> [Indonesian]

531 Wijayanti DP, Sabdon A, Widyananto PA, Dirgantara D, Hidaka M. 2018. Bacterial symbionts of acroporid corals:

532 Antipathogenic potency against black band disease. Biodiversitas 19(4): 1235–1242.

533 <https://doi.org/10.13057/biodiv/d190408> [Indonesian]

534 Zakaria M, Rajpar MN. 2015. Assessing the fauna diversity of Marudu Bay mangrove forest, Sabah, Malaysia, for future

535 conservation. Divers 7(2): 137–148. <https://doi.org/10.3390/d7020137>

536 Zarghi A, Hosseini SM. 2014. Effect of ecotourism on plant biodiversity in Chelmir zone of Tandoureh National Park,

537 Khorasan Razavi Province, Iran. Biodiversitas 15(2): 224–228. <https://doi.org/10.13057/biodiv/d150215> [Indonesian]

Deleted[Yosep Ruslim]: K

Deleted[Yosep Ruslim]: J

Deleted[Yosep Ruslim]: P

Deleted[Yosep Ruslim]: H

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

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Abstract. *Siahaya ME, Matus P, Ivanhoe MI, Rayadin Y, Ruslim Y, Aponno HSES. 2020. Potential analysis of location, socio-culture and biodiversity as ecotourism attraction in Valentine's Bay on Buano Island, West Seram, Moluccas Indonesia. Biodiversitas 22: xxxx.* 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, Moluccas, Indonesia. Based on the results of the study, it was found that 1) The mangrove vegetation had 28 species of plants under 19 families. Vegetation at the level of seedlings, saplings, and trees were found, the dominant species being *Rhizophora apiculata*, *Bruguiera gymnorhiza* 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; 2) Stakeholder involvement in ecotourism activities were very supportive; 3) 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.

Key words: 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 which 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 decline 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 Matus 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, overexploitation, 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. The Moluccas is a 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. The study objectives were (1) to analyze the potential composition of mangroves including species composition, density, presence frequency, and Importance value of the species; (2) to determine the role of stakeholders in supporting ecotourism development, and; (3) 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 a 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 Subdistrict, West Seram District, 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 Regency Tourism Office, and related NGOs.

The Vegetation data was 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:

- Seedlings with ranging from sprouts to 1.5 m high – diameter at < 2 cm, plot size of $5 \text{ m} \times 5 \text{ m}$,
- Poles with the height between 1.5 m – diameter at breast height $< 10\text{-}19$ cm, plot size $10 \text{ m} \times 10 \text{ m}$
- Trees with the diameter at breast height ≥ 20 cm, plot size $20 \text{ m} \times 20 \text{ m}$

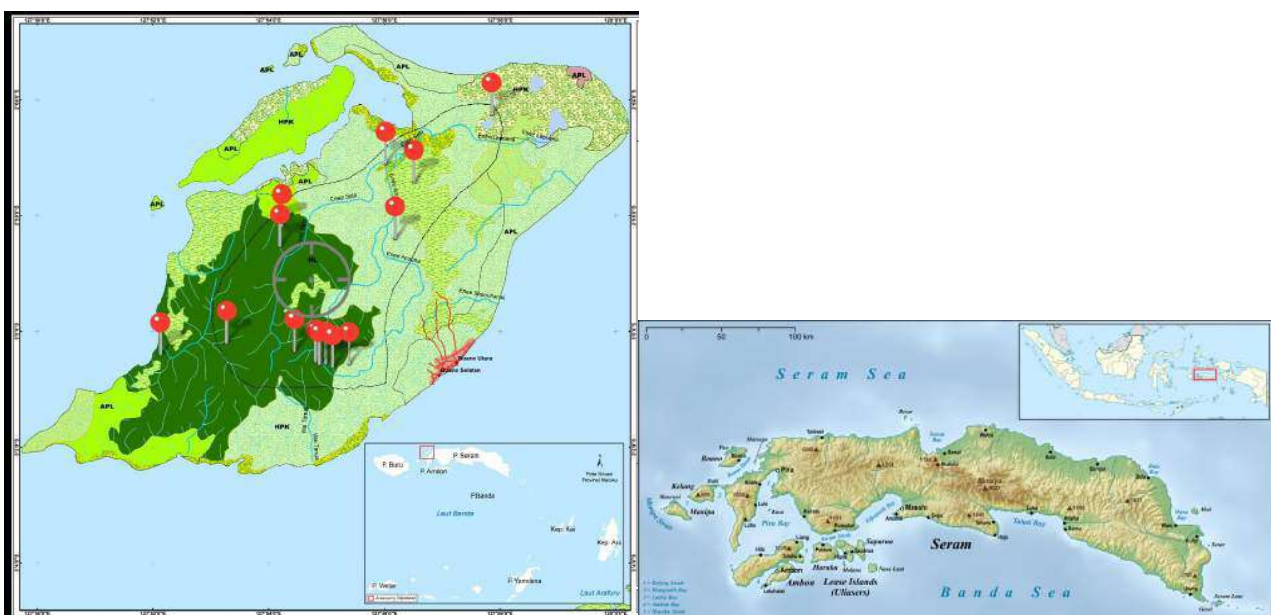


Figure 1. Study location in Valentine Bay on Buano Island, West Seram District, Moluccas, Indonesia

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:

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

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

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

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

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

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

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 Review

Buano Island is one of the small islands with an area of about 135.73 km², 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 Moluccas 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

No.	Species	Family	Zone		
			Proximal	Middle	Distal
1	<i>Rhizophora apiculata</i>	Rhizophoraceae	√		
2	<i>Rhizophora stylosa</i>	Rhizophoraceae	√		
3	<i>Sonneratia alba</i>	Lythraceae	√		
4	<i>Rhizophora mucronata</i>	Rhizophoraceae	√		
5	<i>Avicennia marina</i>	Acanthaceae	√	√	
6	<i>Bruguiera sexangula</i>	Rhizophoraceae	√	√	
7	<i>Bruguiera gymnorhiza</i>	Rhizophoraceae	√	√	
8	<i>Pemphis acidula</i>	Lythraceae	√	√	
9	<i>Lumnitzera littorea</i>	Combretaceae	√	√	
10	<i>Acanthus ebracteatus</i>	Acanthaceae	√		
11	<i>Bruguiera cylindrica</i>	Rhizophoraceae		√	
12	<i>Ceriops tagal</i>	Rhizophoraceae		√	

No.	Species	Family	Zone		
			Proximal	Middle	Distal
13	<i>Ceriops decandra</i>	Rhizophoraceae		√	
14	<i>Xylocarpus moluccensis</i>	Meliaceae		√	√
15	<i>Xylocarpus granatum</i>	Meliaceae		√	√
16	<i>Excoecaria agallocha</i>	Euphorbiaceae		√	
17	<i>Aegiceras corniculatum</i>	Primulaceae		√	
18	<i>Acrostichum speciosum</i>	Pteridaceae		√	
19	<i>Nypa fruticans</i>	Arecaceae			√
20	<i>Heritiera littoralis</i>	Malvaceae			√
21	<i>Barringtonia asiatica</i>	Lecythidaceae			√
22	<i>Pongamia pinnata</i>	Leguminosae			√
23	<i>Pandanus tectorius</i>	Pandanaceae			√
24	<i>Terminalia catappa</i>	Combretaceae			√
25	<i>Hibiscus tiliaceus</i>	Malvaceae			√
26	<i>Acrostichum aureum</i>	Pteridaceae			√
27	<i>Scaevola taccada</i>	Goodeniaceae			√
28	<i>Intsia bijuga</i>	Leguminosae			√

According to Ahmad (2015) in the mangrove forests of Piru bay West Seram district, Moluccas, 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. gymnorhiza* (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. gymnorhiza* 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. gymnorhiza*, 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 be seen in Table 2.

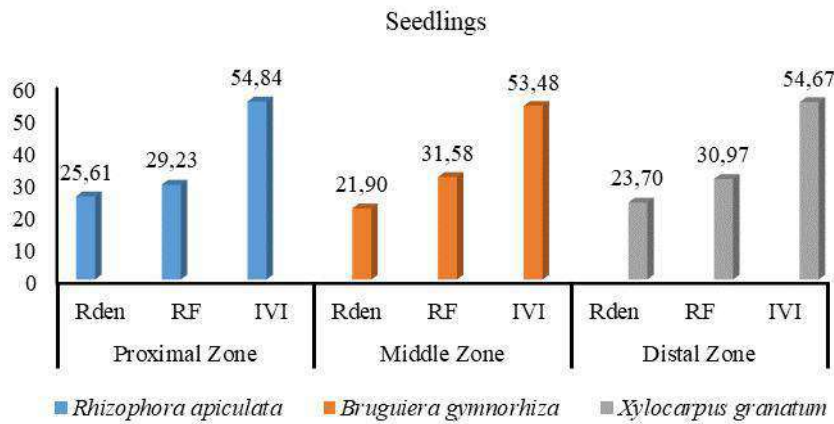


Figure 2. Mangrove species for seedling level in Valentine bay

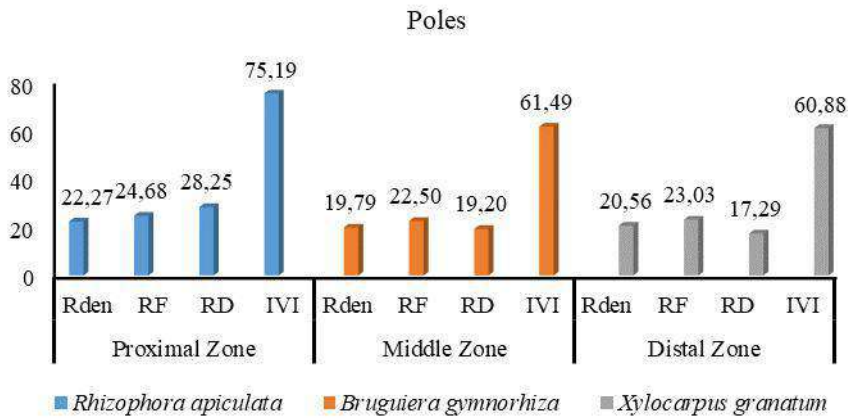


Figure 3. Mangrove species of vegetation for poles level in Valentine bay

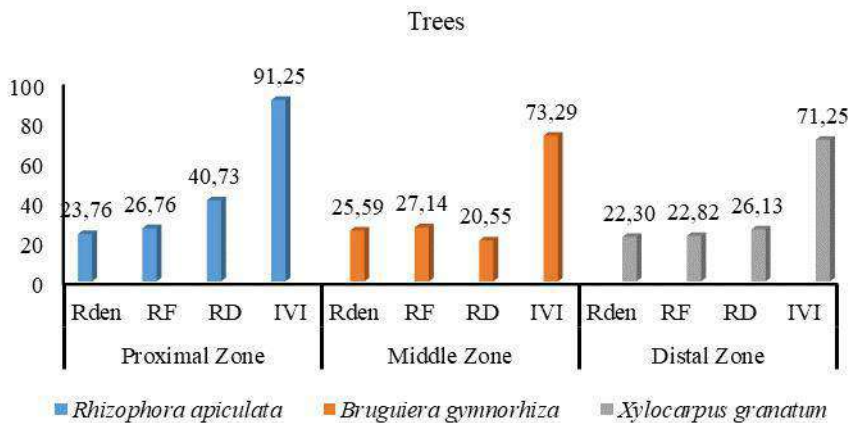


Figure 4. Mangrove species of vegetation for trees level in Valentine bay

Table 2. Species diversity index of each growth rate in Valentine bay

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: (a) $H' \geq 3$ means low species diversity; (b) $1 < H' < 3$ means moderate species diversity; and (c) $H' > 3$ 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: kechicap 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 (*Tanyiptera 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.



Figure 5. *Rhizophora apiculata* (A) Trees; (B) Flowers; (C) Fruits at Proximal Zone



Figure 6. *Bruguiera gymnorhiza* (A) Trees; (B) Flowers; (C) Fruits at Middle Zone



Figure 7. *Xylocarpus moluccensis* (A) Trees; (B) Flowers; (C) Fruits at Distal Zone

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 (7) 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.).

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's Bay was also very diverse. Referring to the criterias 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) criterias, 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 Regency Forestry Service, West Seram Regency 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 mangroves 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 its 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 as Valentine Strait by

Dutch soldiers in the colonial era because the aerial outlook of the strait of Buano Island is shaped as 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 consist 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).



Figure 9. Valentine strait waters



Figure 10. Buano cliffs



Figure 11. Buano coral reefs

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

Buano Coral Reefs

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

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, other 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.
- 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)

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 & 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.

- 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 to 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 towards 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 are 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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REFERENCES

- Ahmad F. 2015. Mangrove Forest Condition in Piru Bay, West Seram, Moluccas. *Jurnal Ilmu dan Teknologi Kelautan Tropis* 7(2): 731–743.
- Alves B, Angnuureng DB, Morand P, Almar R. 2020. A review on coastal erosion and flooding risks and best management practices in West Africa: what has been done and should be done. *J Coast Conserv* 24: 38. DOI: 10.1007/s11852-020-00755-7
- Bengen DG. 2004. Pengenalan dan pengelolaan ekosistem mangrove. Pedoman Teknis. Pusat Kajian Sumberdaya Pesisir dan Lautan. IPB. Bogor. [Indonesian]
- Cuenca GC, Macusi ED, Abreu NAS, Ranara CTB, Andam MB, Cardona LC, et al. 2015. Mangrove Ecosystems and Associated Fauna with Special Reference to Mangrove Crabs in the Philippines: A Review. *IAMURE Int J Ecol Conser* 15: 60–110.
- Das S. 2020. Does mangrove plantation reduce coastal erosion? Assessment from the west coast of India. *Reg Environ Change* 20: 58. DOI: 10.1007/s10113-020-01637-2
- Duke NC, Schmitt K. 2014. Mangroves: Unusual Forests at the Seas' Edge. In: Pancel L, Köhl M, Tropical Forestry Handbook. Springer, Berlin, Heidelberg. DOI: 10.1007/978-3-642-54601-3_129
- Fandeli C. 2000. Perencanaan Kepariwisata Alam. Perencanaan Kepariwisata Alam. PT. (Persero) Perhutani dan Fakultas Kehutanan Universitas Gadjah Mada. Yogyakarta. [Indonesian]
- Garcia K, Malabrigo P, Gevaña D. 2014. Philippines' Mangrove Ecosystem: Status, Threats and Conservation. In: Faridah-Hanum I, Latiff A, Hakeem K, Ozturk M. (eds) *Mangrove Ecosystems of Asia*. Springer, New York. DOI: 10.1007/978-1-4614-8582-7_5
- Haroun R, Herrero Barrencia A, Abreu AD. 2018. Mangrove habitats in são tomé and príncipe (gulf of Guinea, Africa): Conservation and management status. In: Makowski C, Finkl C. (eds) *Threats to Mangrove Forests*. Coastal Research Library, vol 25. Springer, Cham. DOI: 10.1007/978-3-319-73016-5_27.
- Hartshorn GS. 2013. Tropical Forest Ecosystems. In: Levin SA (ed) *Encyclopedia of biodiversity*, Second Edition. Elsevier Inc. 269–276. DOI: 10.1016/B978-0-12-384719-5.00146-5
- Hilmi E, Kusmana C, Suhendang E, Iskandar. 2017. Correlation analysis between seawater intrusion and mangrove greenbelt. *Indonesian J Forestry Res* 4: 151–168. DOI: 10.20886/ijfr.2017.4.2.151-168
- IUCN. 2020. International Union for conservation of nature and natural resources red list of threatened species.
- Jiang Z, Guan W, Xiong Y, Li M, Chen Y, Liao B. 2019. Interactive effects of intertidal elevation and light level on early growth of five mangrove species under *Sonneratia apetala* Buch. Hamplantation canopy: Turning monocultures to mixed forests. *Forests* 10: 83. DOI: 10.3390/f10020083
- Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y. 2019. Species diversity, stand productivity, aboveground biomass, and economic value of mangrove ecosystem in Mentawir village, East Kalimantan, Indonesia. *Biodiversitas* 20 (10): 2848–2857. DOI: 10.13057/biodiv/d201010 [Indonesian]
- Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y, Ma'Ruf A. 2020. Fauna diversity, production potential and total economic value of mangrove ecosystems in Mentawir Village, East Kalimantan, Indonesia. *Biodiversitas* 21 (5): 1940–1953. DOI: 10.13057/biodiv/d210522 [Indonesian]
- Kumar M, Magotra R, Parikh J, Rajawat AS. 2017. Changing landscape of marine national park and Sanctuary, Gulf of Kachchh: Ecological Assessment of Mangroves and Coral Reefs. *Proc Natl Acad Sci India Sect A - Phys Sci* 87:889–900. DOI: 10.1007/s40010-017-0457-3
- Kusmana C, Sukristijono, S. 2016. Mangrove resource uses by local community in Indonesia. *J Natural Resources Environ Manag* 6 (2): 217–224. DOI: 10.29244/jpsl.6.2.217
- Lee SY, Primavera JH, Dahdouh-Guebas F, Mckee K, Bosire JO, Cannicci S, et al. 2014. Ecological role and services of tropical mangrove ecosystems: A reassessment. *Global Ecol Biogeogr* 23z: 726–743. DOI: 10.1111/geb.12155
- Ludwig JA, Reynolds JF. 1988. *Statistical ecology: A Primer in Methods and Computing*. John Wiley and Sons, Inc.
- Magurran AE. 2004. *Measuring Biological Diversity*. Blackwell Publishing Company.
- McKinley E, Aller-Rojas O, Hattam C, Germond-Duret C, San Martín IV, Hopkins CR, Aponte H, Potts T. 2019. Charting the course for a blue economy in Peru: a research agenda. *Environ Dev Sustain* 21: 2253–2275. DOI: 10.1007/s10668-018-0133-z
- Melia J, Sutriana A, Hanafiah M, Wahyu M, Lubis A, Fakhurrozi A, Maulana TA, Sari MN. 2020. Health status E examination of Sumatran Elephant (*Elephas maximus sumatranus*) Using Ultrasonography, Cortisol Analysis and Parasite Identification in Aek Nauli Elephant Conservation Camp (ANECC) and Tangkahan Conservation Response Unit (CRU), North Sumatra. *E3S Web of Conferences* 151: 01053. 1–6. DOI: 10.1051/e3sconf/202015101053
- Mueller-Dombois D, Ellenberg H. 1974. *Aims & Methods of vegetation ecology*. John Wiley and Sons. The Blackburn Press.
- Naisumu YG, Seran YN, Ledheng L. 2018. Komposisi dan keanekaragaman jenis pohon di hutan lindung Lapeom Kabupaten Timor Tengah Utara. *J Saintek Lahan Kering* 1: 4–7. [Indonesian]
- Neumann B, Ott K, Kenchington R. 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14. *Sustain Sci* 12: 1019–1035. DOI: 10.1007/s11625-017-0472-y
- Ohee HL, Sujarta P, Surbakti SB, Barclay H. 2018. Rapid expansion and biodiversity impacts of the red devil cichlid (*Amphilophus labiatus*, Günther 1864) in Lake Sentani, Papua, Indonesia. *Biodiversitas* 19 (6): 2096–2103. DOI: 10.13057/biodiv/d190615 [Indonesian]
- Poedjirahajoe E, Sulityorini IS, Komara LL. 2019. Species diversity of mangrove in Kutai National Park, East Kalimantan, Indonesia. *Biodiversitas* 20(12): 3641–3646. DOI: 10.13057/biodiv/d201224
- Radabaugh KR, Moyer RP, Chappel AR, Dontis EE, Russo CE, Joyse KM, Bownik MW, Goeckner A. H, Khan NS. 2019. Mangrove damage, delayed mortality, and early recovery following hurricane Irma at two landfall sites in Southwest Florida, USA. DOI: DOI: 10.1007/s12237-019-00564-8
- Rujehan, Matius P. 2018. Potential and management strategy of floral biodiversity in the coastal areas in East Kalimantan, Indonesia. *Biodiversitas* 19 (3): 1130–1137. DOI: 10.13057/biodiv/d190348 [Indonesian]
- Salampessy ML, Febryano IG, Martin E, Siahaya ME, Papiyaya R. 2015. Cultural Capital of the Communities in the Mangrove Conservation in the Coastal areas of Ambon Dalam Bay, Moluccas, Indonesia. *Procedia Environ Sci* 23: 222–229. DOI: 10.1016/j.proenv.2015.01.034
- Setyawan AD, Ulumuddin YI. 2012. Species diversity of *Rhizophora* in Tambelan Islands, Natuna Sea, Indonesia. *Biodiversitas* 13(4): 172–177. DOI: 10.13057/biodiv/d130402 [Indonesian]
- Shah K, Kamal AHM, Rosli Z, Hakeem KR, Hoque MM. 2016. Composition and diversity of plants in Sibuti mangrove forest, Sarawak, Malaysia. *For Sci Tech* 12: 70–76. DOI: 10.1080/21580103.2015.1057619
- Sondak CFA, Kaligis EY, Bara RA. 2019. Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia. *Biodiversitas* 20(4): 978–986. DOI: 10.13057/biodiv/d200407 [Indonesian]
- Spalding M, McIvor A, Tonneijck FH, Tol S, van Eijk P. 2014. Mangroves for coastal defence. Guidelines for coastal managers and policy makers. Wetlands International and The Nature Conservancy. https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence_Decision_makers_Guide_WebVersion.pdf
- Spencer T, Möller I, Reef R. 2016. Mangrove systems and environments. In: Reference module in earth systems and environmental sciences. Elsevier Inc. DOI: 10.1016/B978-0-12-409548-9.10262-3
- Surya B, Syafri S, Sahban H, Sakti HH. 2020. Natural resource conservation based on community economic empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi, Indonesia. *Land* 9: 104. DOI: 10.3390/land9040104

- Utina R, Katili AS, Lapolo N, Dangkua T. 2019. The composition of mangrove species in coastal area of Banggai district, central Sulawesi, Indonesia. *Biodiversitas* 20(3): 840–846. DOI: 10.13057/biodiv/d200330 [Indonesian]
- Wijayanti DP, Sabdono A, Widyananto PA, Dirgantara D, Hidaka M. 2018. Bacterial symbionts of acroporid corals: Antipathogenic potency against black band disease. *Biodiversitas* 19 (4): 1235–1242. DOI: 10.13057/biodiv/d190408 [Indonesian]
- Zakaria M, Rajpar MN. 2015. Assessing the fauna diversity of Marudu Bay mangrove forest, Sabah, Malaysia, for future conservation. *Divers* 7(2): 137–148. DOI: 10.3390/d7020137
- Zarghi A, Hosseini SM. 2014. Effect of ecotourism on plant biodiversity in Chelmir zone of Tandoureh National Park, Khorasan Razavi Province, Iran. *Biodiversitas* 15(2): 224–228. DOI: 10.13057/biodiv/d150215 [Indonesian]



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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, Matus 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 Matus 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.

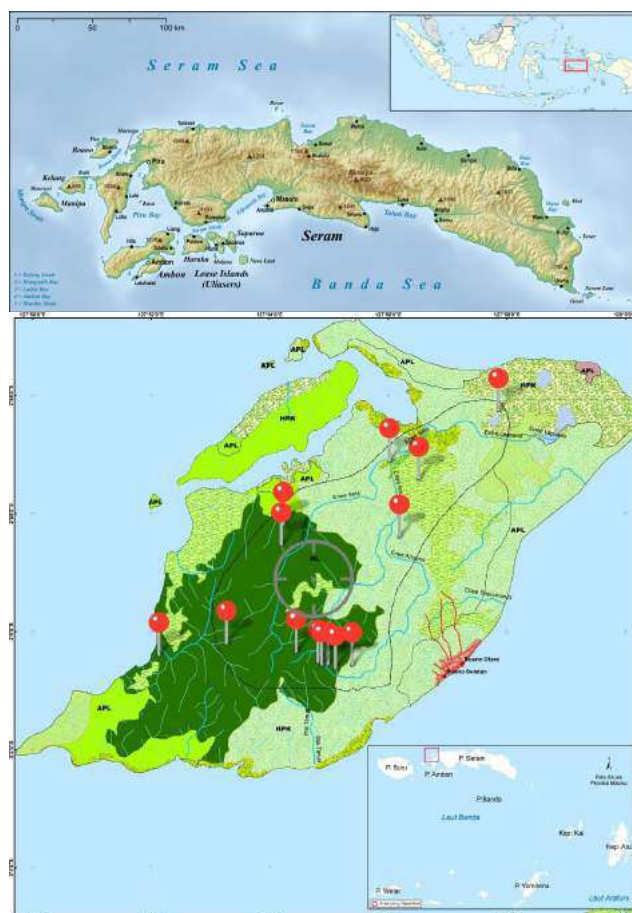


Figure 1. Study location in Valentine Bay on Buano Island, West Seram District, Maluku, Indonesia

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:

$$\text{Density (SD)} = \frac{\text{Number individual of species}}{\text{Area of the measurements plots}}$$

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

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

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

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

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

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 km², 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).

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

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

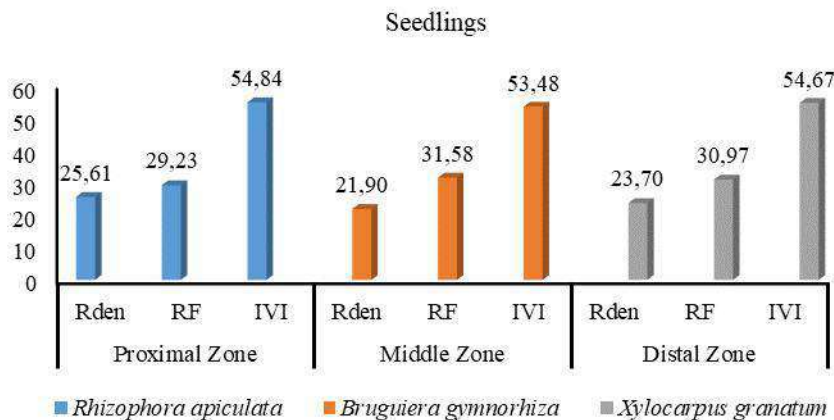


Figure 2. Mangrove species for seedling level in Valentine bay, West Seram District, Maluku, Indonesia

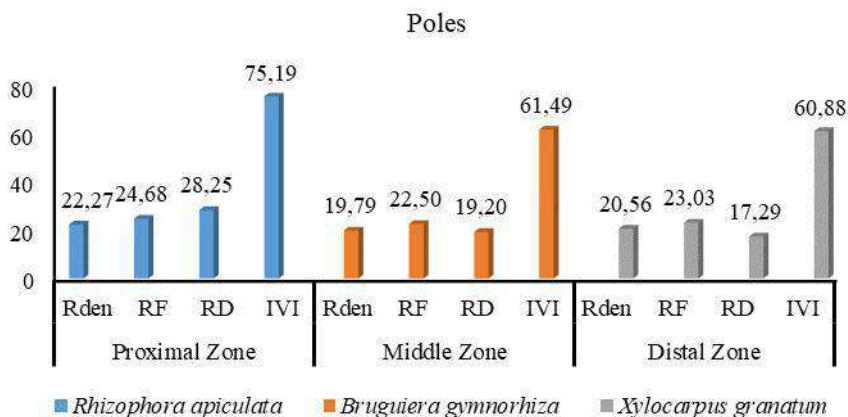


Figure 3. Mangrove species of vegetation for poles level in Valentine bay, West Seram District, Maluku, Indonesia

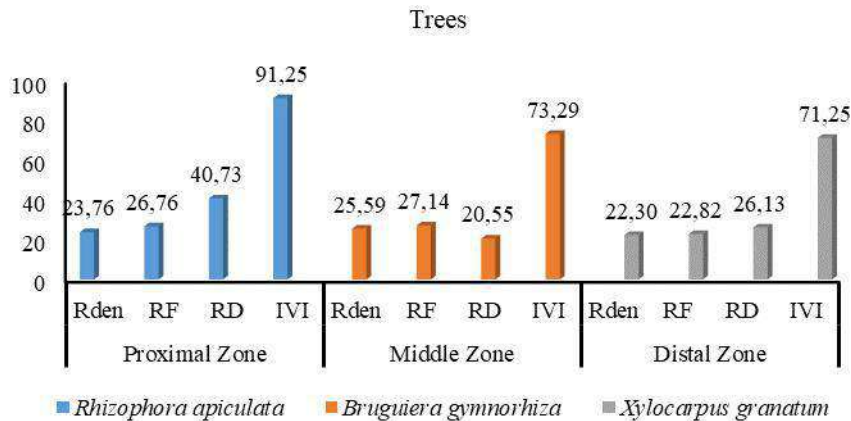


Figure 4. Mangrove species of vegetation for trees level in Valentine bay, West Seram District, Maluku, Indonesia

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) $H' \geq 3$ 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.).



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



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



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.

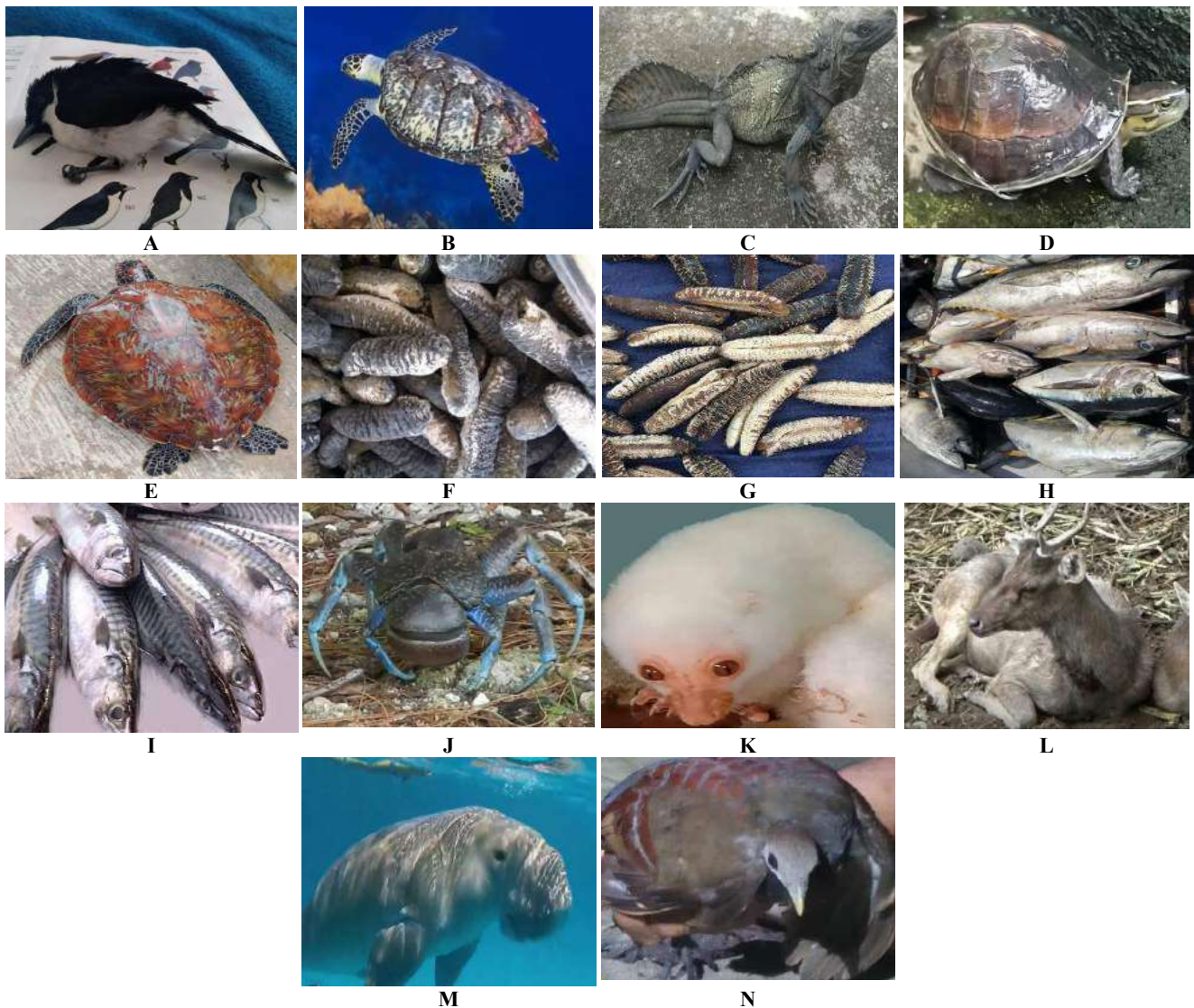


Figure 8. Fauna based on IUCN provisions (2020): A. *Symposiachrus boanensis*; B. *Eretmochelys imbricata*; C. *Hydrosaurus amboinensis*; D. *Cuora amboinensis*; E. *Chelonia mydas*; F. *Holothuria scabra*; G. *Holothuria atra*; H. *Thunnus albacares*; I. *Scomberomorus commerson*; J. *Birgus latro*; 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 (García 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

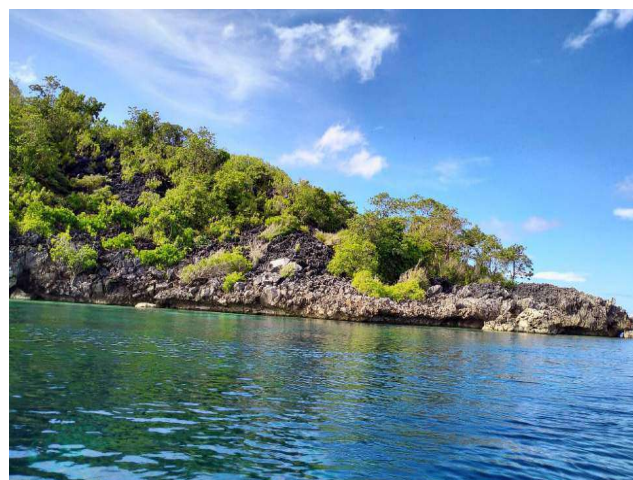


Figure 10. Buano coral cliffs



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

Threat (T)	Problems	Weakness (W)	Supporting factors	
			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.	1. Lack of infrastructure.	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).	1. Government regulations on tourism, forestry, and related sectors and village regulations.
2. The economic level of the local communities around the area is still relatively low due to limited alternative livelihoods.	2. Lack of coordination with stakeholders.		2. Cultural customs and local wisdom are still maintained.	2. Support from governments, regencies, and local communities for the ecotourism sector on Buano island.
3. Low understanding of local communities about biodiversity conservation.	3. Lack of coordination with stakeholders.		3. The potential of marine fisheries, plantations, and agriculture.	3. Support from educational institutions for technological advances and researchers, NGOs, and mass media
4. Security situation.	4. The quantity and quality of human resources are still limited due to the low level of education of the local communities.		4. The existing potentials have uniqueness, scarcity and diversity values.	4. Interest in visits from tourists (local and foreign).
	5. Lack of promotion of ecotourism.		5. High support from the district, sub-district, village governments, communities, and NGOs in the development of Buano island area.	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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REFERENCES

- Ahmad F. 2015. Mangrove Forest Condition in Piru Bay, West Seram, Moluccas. *Jurnal Ilmu dan Teknologi Kelautan Tropis* 7 (2): 731-743.
- Alves B, Angnuureng DB, Morand P, Almar R. 2020. A review on coastal erosion and flooding risks and best management practices in West Africa: what has been done and should be done. *J Coast Conserv* 24: 38. DOI: 10.1007/s11852-020-00755-7.
- Bengen DG. 2004. *Pengenalan dan pengelolaan ekosistem mangrove*. Pedoman Teknis. Pusat Kajian Sumberdaya Pesisir dan Lautan. IPB, Bogor. [Indonesian]
- Cuenca GC, Macusi ED, Abreo NAS, Ranara CTB, Andam MB, Cardona LC, et al. 2015. Mangrove ecosystems and associated fauna with special reference to mangrove crabs in the Philippines: A review. *IAMURE Intl J Ecol Conser* 15: 60-110.

- Das S. 2020. Does mangrove plantation reduce coastal erosion? Assessment from the west coast of India. *Reg Environ Change* 20: 58. DOI: 10.1007/s10113-020-01637-2.
- Duke NC, Schmitt K. 2014. Mangroves: Unusual forests at the seas' edge. In: Pancel L, Köhl M (eds.). *Tropical Forestry Handbook*. Springer, Berlin. DOI: 10.1007/978-3-642-54601-3_129.
- Fandeli C. 2000. Perencanaan Kepariwisata Alam. Perencanaan Kepariwisata Alam. PT. (Persero) Perhutani dan Fakultas Kehutanan Universitas Gadjah Mada, Yogyakarta. [Indonesian]
- Garcia K, Malabrigo P, Gevaña D. 2014. Philippines' mangrove ecosystem: status, threats and conservation. In: Faridah-Hanum I, Latiff A, Hakeem K, Ozturk M (eds.). *Mangrove Ecosystems of Asia*. Springer, New York. DOI: 10.1007/978-1-4614-8582-7_5.
- Haroun R, Herrero Barrencia A, Abreu AD. 2018. Mangrove habitats in são tomé and príncipe (Gulf of Guinea, Africa): Conservation and management status. In: Makowski C, Finkl C. (eds.) *Threats to Mangrove Forests*. Coastal Research Library, Vol 25. Springer, Cham. DOI: 10.1007/978-3-319-73016-5_27.
- Hartshorn GS. 2013. Tropical Forest Ecosystems. In: Levin SA (ed) *Encyclopedia of biodiversity*, 2nd ed. Elsevier Inc., Nederland. DOI: 10.1016/B978-0-12-384719-5.00146-5.
- Hilmi E, Kusmana C, Suhendang E, Iskandar. 2017. Correlation analysis between seawater intrusion and mangrove greenbelt. *Indon J For Res* 4: 151-168. DOI: 10.20886/ijfr.2017.4.2.151-168.
- IUCN. 2020. International Union for conservation of nature and natural resources red list of threatened species. <https://www.iucnredlist.org/>
- Jiang Z, Guan W, Xiong Y, Li M, Chen Y, Liao B. 2019. Interactive effects of intertidal elevation and light level on early growth of five mangrove species under *Sonneratia apetala* Buch. Hamplantation canopy: Turning monocultures to mixed forests. *Forests* 10: 83. DOI: 10.3390/f10020083.
- Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y. 2019. Species diversity, stand productivity, aboveground biomass, and economic value of mangrove ecosystem in Mentawir village, East Kalimantan, Indonesia. *Biodiversitas* 20 (10): 2848-2857. DOI: 10.13057/biodiv/d201010. [Indonesian]
- Kristiningrum R, Lahjie AM, Masjaya, Yusuf S, Ruslim Y, Ma'ruf A. 2020. Fauna diversity, production potential and total economic value of mangrove ecosystems in Mentawir Village, East Kalimantan, Indonesia. *Biodiversitas* 21 (5): 1940-1953. DOI: 10.13057/biodiv/d210522. [Indonesian]
- Kumar M, Magotra R, Parikh J, Rajawat AS. 2017. Changing landscape of marine national park and Sanctuary, Gulf of Kachchh: Ecological Assessment of Mangroves and Coral Reefs. *Proc Natl Acad Sci India Sect A - Phys Sci* 87: 889-900. DOI: 10.1007/s40010-017-0457-3.
- Kusmana C, Sukristijiono, S. 2016. Mangrove resource uses by local community in Indonesia. *J Nat Resour Environ Manag* 6 (2): 217-224. DOI: 10.29244/jpsl.6.2.217.
- Lee SY, Primavera JH, Dahdouh-Guebas F, Mckee K, Bosire JO, Cannicci S, et al. 2014. Ecological role and services of tropical mangrove ecosystems: A reassessment. *Global Ecol Biogeogr* 23: 726-743. DOI: 10.1111/geb.12155.
- Ludwig JA, Reynolds JF. 1988. *Statistical ecology: A Primer in Methods and Computing*. John Wiley and Sons, Inc., New York.
- Magurran AE. 2004. *Measuring Biological Diversity*. Blackwell Publishing Company, UK.
- McKinley E, Aller-Rojas O, Hattam C, Germond-Duret C, San Martín IV, Hopkins CR, Aponte H, Potts T. 2019. Charting the course for a blue economy in Peru: a research agenda. *Environ Dev Sustain* 21: 2253-2275. DOI: 10.1007/s10668-018-0133-z.
- Melia J, Sutriana A, Hanafiah M, Wahyu M, Lubis A, Fakhurrozi A, Maulana TA, Sari MN. 2020. Health status examination of Sumatran Elephant (*Elephas maximus sumatranus*) using ultrasonography, cortisol analysis and parasite identification in Aek Nauli Elephant Conservation Camp (ANECC) and Tangkahan Conservation Response Unit (CRU), North Sumatra. *E3S Web Conf* 151: 01053. DOI: 10.1051/e3sconf/202015101053.
- Mueller-Dombois D, Ellenberg H. 1974. *Aims & Methods of Vegetation Ecology*. John Wiley and Sons, New York.
- Naisumu YG, Seran YN, Ledheng L. 2018. Komposisi dan keanekaragaman jenis pohon di hutan lindung Lapeom Kabupaten Timor Tengah Utara. *J Saintek Lahan Kering* 1: 4-7. [Indonesian]
- Neumann B, Ott K, Kenchington R. 2017. Strong sustainability in coastal areas: a conceptual interpretation of SDG 14. *Sustain Sci* 12: 1019-1035. DOI: 10.1007/s11625-017-0472-y.
- Ohee HL, Sujarta P, Surbakti SB, Barclay H. 2018. Rapid expansion and biodiversity impacts of the red devil cichlid (*Amphilophus labiatus*, Günther 1864) in Lake Sentani, Papua, Indonesia. *Biodiversitas* 19 (6): 2096-2103. DOI: 10.13057/biodiv/d190615. [Indonesian]
- Poedjirahajoe E, Sulityorini IS, Komara LL. 2019. Species diversity of mangrove in Kutai National Park, East Kalimantan, Indonesia. *Biodiversitas* 20 (12): 3641-3646. DOI: 10.13057/biodiv/d201224.
- Radabaugh KR, Moyer RP, Chappel AR, Dontis EE, Russo CE, Joyse KM, Bownik MW, Goeckner AH, Khan NS. 2019. Mangrove damage, delayed mortality, and early recovery following hurricane Irma at two landfall sites in Southwest Florida, USA. *Estuaries and Coasts*. DOI: 10.1007/s12237-019-00564-8.
- Rujehan, Matius P. 2018. Potential and management strategy of floral biodiversity in the coastal areas in East Kalimantan, Indonesia. *Biodiversitas* 19 (3): 1130-1137. DOI: 10.13057/biodiv/d190348. [Indonesian]
- Salampessy ML, Febryano IG, Martin E, Siahaya ME, Papilaya R. 2015. Cultural Capital of the Communities in the Mangrove Conservation in the Coastal areas of Ambon Dalam Bay, Moluccas, Indonesia. *Procedia Environ Sci* 23: 222-229. DOI: 10.1016/j.proenv.2015.01.034.
- Setyawan AD, Ulumuddin YI. 2012. Species diversity of *Rhizophora* in Tambelan Islands, Natuna Sea, Indonesia. *Biodiversitas* 13 (4): 172-177. DOI: 10.13057/biodiv/d130402. [Indonesian]
- Shah K, Kamal AHM, Rosli Z, Hakeem KR, Hoque MM. 2016. Composition and diversity of plants in Sibutu mangrove forest, Sarawak, Malaysia. *For Sci Tech* 12: 70-76. DOI: 10.1080/21580103.2015.1057619.
- Sondak CFA, Kaligis EY, Bara RA. 2019. Economic valuation of Lansia Mangrove forest, north Sulawesi, Indonesia. *Biodiversitas* 20 (4): 978-986. DOI: 10.13057/biodiv/d200407. [Indonesian]
- Spalding M, McIvor A, Tonneijck FH, Tol S, van Eijk P. 2014. *Mangroves for coastal defense. Guidelines for coastal managers and policymakers*. Wetlands International and The Nature Conservancy. https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/MangrovesforCoastalDefence_Decision_makers_Guide_WebVersion.pdf
- Spencer T, Möller I, Reef R. 2016. *Mangrove systems and environments*. In: Reference module in earth systems and environmental sciences. Elsevier Inc., Nederland. DOI: 10.1016/B978-0-12-409548-9.10262-3.
- Surya B, Syafri S, Sahban H, Sakti HH. 2020. Natural resource conservation based on community economic empowerment: Perspectives on watershed management and slum settlements in Makassar City, South Sulawesi, Indonesia. *Land* 9: 104. DOI: 10.3390/land9040104.
- Utina R, Katili AS, Lapolo N, Dangkoa T. 2019. The composition of mangrove species in coastal area of Banggai district, central Sulawesi, Indonesia. *Biodiversitas* 20 (3): 840-846. DOI: 10.13057/biodiv/d200330. [Indonesian]
- Wijayanti DP, Sabdono A, Widyananto PA, Dirgantara D, Hidaka M. 2018. Bacterial symbionts of Acroporid Corals: Antipathogenic potency against black band disease. *Biodiversitas* 19 (4): 1235-1242. DOI: 10.13057/biodiv/d190408. [Indonesian]
- Zakaria M, Rajpar MN. 2015. Assessing the fauna diversity of Marudu Bay mangrove forest, Sabah, Malaysia, for future conservation. *Diversity* 7 (2): 137-148. DOI: 10.3390/d7020137.
- Zarghi A, Hosseini SM. 2014. Effect of ecotourism on plant biodiversity in Chelmir zone of Tandoureh National Park, Khorasan Razavi Province, Iran. *Biodiversitas* 15 (2): 224-228. DOI: 10.13057/biodiv/d150215. [Indonesian]

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Potential analysis of location, socio-culture and biodiversity as ecotourism attraction in Valentine Bay on

Abstract

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Abstract. Siahaya ME, Matius P, Aipassa MI, Rayadin Y, Ruslim Y, Aponno HSES. 2021. 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.