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DIVERSITY OF LAND AND FRESHWATER SNAIL (MOLLUSCA: GASTROPODA) OF LAIWANGI WANGGAMETI NATIONAL PARK, SUMBA ISLAND, INDONESIA

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Abstract. *A study on the malacofauna of Laiwangi Wanggameti National Park (LWNP) in Sumba Island has been conducted. This study aims were to reveal the diversity of malacofauna in Sumba and compare it with those in the Lesser Sunda Islands. Observations were made on 20 stations using plots (10 x 10 m) in Wanggameti and Laiwangi. Specimens were collected for two hours in each plot. Twenty families and 44 species have been identified. The overall number of species from Sumba increased from 126 to 143 species. The LWNP represents 31% diversity of malacofauna in Sumba Island. Seventeen species are considered as new records for the island. Five endemic land snail species are still observed inside the park. The diversity and population density tend to be higher in Laiwangi area with lower altitudes than in Wanggameti area with higher altitudes. Two dominant species are Asperitas bimaensis cochlostyloides and Tarebia granifera. Species composition in Sumba is more similar to Bali compared with the other six neighboring islands.*

Keywords: *diversity, endemic species, new record, Snail, Sumba Island.*

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INTRODUCTION

Sumba Island lies in the Lesser Sunda Islands along with Bali, Lombok, Sumbawa, Flores, Timor, and many smaller islands. Administratively, Sumba consists of four districts namely West Sumba, Southwest Sumba, Central Sumba, and East Sumba that belong to the province of East Nusa Tenggara. The island extends around 10.854 km^2. About 521 km^2 (4.81%) are savannahs and grasslands, and 3.433 km^2 (31.70%) are shrubs (Monk et al., 2000). The highest peak of the island is Mount Wanggameti (1225 m a.s.l.). The Laiwangi-Wanggameti forest complex in East Sumba is the largest and most important rainforest area in Sumba because they have a great contribution as the major water catchment area. To keep the function running, then the area needs to be conserved.

The floristic biodiversity in Laiwangi Wanggameti National Park (LWNP) has been long studied. The Park has 10 bamboo species (Widjaja & Karsono, 2005), 70 fern species (Darma & Peneng, 2007), and 33 moss species (Windadri & Rosalina, 2020). Several faunistic studies also have been carried out in this area. At present, there are 40 dragonflies

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including six endemic species (Onggo, 2015), 18 mammal species (Maharadatunkamsi & Onggo, 2016), 17 reptiles including four endemic species, and five amphibian species (Tim Peneliti, 2015; Hamidy & Dermawan, 2016), 21 bird including three endemic species (Royyani & Onggo, 2016). The Sumba Cockatoo is endemic to Sumba and it has become the mascot of the park (Hidayat, 2012).

The study on molluscs inside the LWNP area has never been conducted. However, the history of molluscan studies on Sumba began in 1892. MM Schepman, a Dutch scientist, found 18 molluscs species including five new species (Schepman, 1892). EA Smith (1899) added one more species of land snail from Sumba. Shortly afterward, their studies were continued by Benthem Jutting in 1928. She recorded 28 land snails, 14 freshwater snails, and two freshwater bivalve species. Bernhard Rensch (1931a, 1931b, 1932) and Benthem Jutting (1955 & 1958) continued the study more comprehensively. Their result was then compiled by Monk et al., (2000) in the book entitled The Ecology of Nusa Tenggara and Maluku. In the last decade, studies on Sumbanese molluscs mostly focused on the land snail of the genus *Amphidromus* (Chan & Tan, 2008 & 2010; Cilia, 2013). Although there have been many studies on molluscs from Sumba Island, the opportunity for discovery is still widely open. This study aimed to reveal the diversity of malacofauna in Sumba and compare it with those in the Lesser Sunda Islands.

MATERIALS AND METHODS

Site Location

Field sampling was carried out in Laiwangi Wanggameti National Park, Sumba Island from 15 April to 4 May 2016. The altitude ranged between 402-1.113 m a.s.l. The study sites were divided into two areas, namely the Wanggameti area (site 1, station 1-11) and the Laiwangi area (site 2, station 12-20) (Figure 1). Site 1 was divided into 3 districts, namely Matawai Lapawu District (Wanggameti, Matawai Kalimbung, and Katiku Wai Village), Pinupahar District (Ramuk Village), and Lewa District (Watumbelar Village). Site 2 was in Tabundung District (Billa, Pinduhurani, Praing Kareha, and Wudi Pandak Village). Samples were taken from 20 stations (Table 1) where six stations for land habitat, ten stations for aquatic habitat, and four stations with both habitat types.

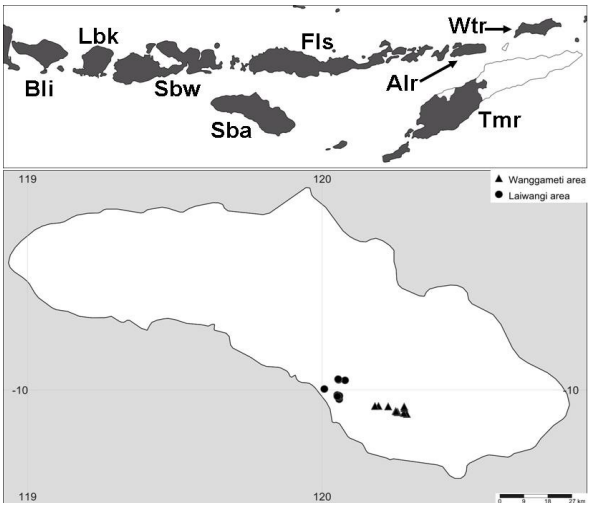

Figure 1. Sumba Island with two sites observed. Inset: Position of Sumba Island in the Lesser Sunda Islands of Indonesia. (Bli : Bali, Lbk : Lombok, Sbw : Sumbawa, Sba : Sumba, Fls : Flores, Tmr : Timor, Alr : Alor, Wtr : Wetar)

Sampling Protocol

This is exploratory research. The purposive sampling method was applied in this study. Snails were collected from plots (10 x 10 m) in 20 stations (Monde et al., 2016; Nurinsiyah et al., 2016) and each plot was observed for two hours to ensure that no species was overlooked (Marzuki et al., 2021). Living snails and dead shells were preserved in 70% alcohol in plastic bottles (Marwoto

& Shintosari, 1999). All specimens were brought, identified, and stored at the Museum Zoologicum Bogoriense (MZB). Previous studies (Schepman, 1892; Smith, 1899; Benthem Jutting, 1928, 1955, 1958; Rensch, 1931a, 1931b, 1932, 1934; Kohler, 2014; Kohler & Kessner, 2014, 2020; Kohler et al., 2016, 2018, 2020) and museum collections were examined for identification. Species distributions around the Lesser Sunda Islands were compiled from references above and Vermeullen & Whitten (1998) for Balinese land snails. If a species was not listed in the previous studies, they were considered as New Record. Species that only occurred in Sumba Island were considered endemic species.

Data Analysis

The frequency of species distribution was calculated by the number of stations where the species found was divided by the total number of observed stations. The categories were: constant species (ct : 100-76%), common species (cn : 75-50%), rare species (re : 50–25%) and accidental species (al : ≤ 25%) (Spyra, 2017; Rosales et al., 2020). Shannon-Wiener's diversity index, Pielou's evenness index, and Simpson's dominance index were used in the analysis of snail communities (Magurran, 2004). Spearman rank correlation was used to measure the degree of association between altitude and species diversity or population (significant if $p < 0.05$). Analysis of species composition was carried out using cluster analysis. Binary data (absent: 0, present: 1) were compiled from the occurrence of species between the station and between the island in the Lesser Sunda Islands (Schepman, 1892; Smith, 1899; Benthem Jutting, 1928, 1955, 1958, 1959; Rensch, 1931a, 1931b, 1934; Starmuhlner, 1974; Vermeullen & Whitten, 1998). Jaccard similarity index was used in cluster analysis (Oke & Chokor, 2011). The cophenetic correlation coefficient (r) was used to measure the pairwise distances between the original data. The categories were: very good fit ($r > 0.9$), good fit ($0.8 < r < 0.9$), poor fit ($0.7 < r < 0.8$), and very poor fit ($r < 0.7$) (Rohlf & Fisher, 1968). All statistical analysis was performed using PAST 2.17c (Hammer et al., 2001).

Table 1. Localities and habitat types of sampling station

Stations	Locality and Habitat (F: freshwater, L: land)	Latitude	Longitude	Altitude (m.a.s.l.)
1	Lukularing River, Matawai Kalimbung Village (F)	-10.0578056	120.2242500	508
2	Laironja River, Wanggameti Village (F)	-10.0843167	120.2873417	932
3	Waimuru River, Wanggameti Village (F)	-10.0808889	120.2771611	962
4	Roadside of Wanggameti Forest, Wanggameti Village (L)	-10.0741889	120.2494194	1033
5	Laimuduk River, Katiku Wai Village (L , F)	-10.0561278	120.1913389	402
6	Ramuk River, Ramuk Village (F)	-10.0564417	120.1793389	447
7	Wanggameti Forest (hiking trails), Wanggameti Village (L)	-10.0764944	120.2560250	1083
8	Wanggameti Forest (ecology plot), Wanggameti Village (L)	-10.0781611	120.2557778	1113
9	Kanjilu River, Wanggameti Village (F)	-10.0636611	120.2789944	928
10	Front side of Kapumbung Cave, Wanggameti Village (L)	-10.0582000	120.2784083	993
11	Watumbelar riverside, Watumbelar Village (L)	-09.8052710	119.7652960	1043
12	Forest, Billa Village (L , F)	-09.9659528	120.0778167	277
13	Downstream of Pinduhurani River, Pinduhurani Village (L , F)	-09.9964167	120.0074722	34
14	Laputi Forest, Praing Kareha Village (L , F)	-10.0323500	120.0578750	482
15	Laputi Lake, Praing Kareha Village (F)	-10.0248750	120.0576694	488
16	Lameta River, Praing Kareha Village (F)	-10.0175556	120.0515611	330
17	Lamondu River, Praing Kareha Village (F)	-10.0202611	120.0583778	368
18	Limestone cave, Praing Kareha Village (L)	-10.0222889	120.0520139	412
19	Waturara River, Wudi Pandak Village (F)	-09.9641472	120.0555917	273
20	Katikataru River, Wudi Pandak Village (F)	-09.9618778	120.0544806	274

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RESULTS AND DISCUSSION

Snail Communities

Overall, 1.301 snail specimens were collected from two observed sites. It comprises 21 families and 44 species. Five families and nine species belong to freshwater snails, whereas 16 families and 35 species are land snails (Table 2). The number of specimens varied from nine to 239 individuals per station (average 65.05), while species richness varied from one to 28 (average 6.1). The molluscs community indices are presented in Table 3.

According to their location, 416 specimens representing 14 families and 26 species were observed from the Wanggameti area, and 885 specimens representing 16 families and 36 species were observed from the Laiwangi area. Only 15 species which observed in both sites. Snail populations are greatly varied in each station. In Wanggameti 11-91 individuals (average 38) were found, whereas 18-239 individuals were found from Laiwangi (average 98). That is two and a half times higher than in Wanggameti. (Figure 2. a and b)

Table 2. Composition and snail assemblages in Laiwangi Wanggameti National Park.

Family	Species	Wa	La	N	D	C	Bli	Lbk	Sbw	Fls	Tmr	Alr	Wtr
i. Achatinidae	1. *Lissachatina fulica* *	+	-	31	1	al	+	-	-	-	-	-	-
	2. *Paropeas acutissimum*	+	+	3	2	al	+	-	-	-	-	-	-
	3. *Subulina octona* *	-	+	1	1	al	+	-	-	-	-	-	-
ii. Alycaeidae	4. *Chamalycaeus kessneri*	-	+	1	1	al	+	-	-	-	-	-	-
iii. Ampullariidae	5. *Pomacea canaliculata* *	+	-	1	1	al	-	-	-	-	-	-	-
iv. Ariophantidae	6. *Macrochlamys robsoni*	+	+	7	2	al	+	-	-	+	+	-	-
	7. *Macrochlamys spiralifer*	+	+	16	5	re	+	-	-	-	-	-	-
v. Assimineidae	8. *Anaglyphula tiluana*	-	+	1	1	al	-	-	-	-	-	-	-
vi. Camaenidae	9. *Amphidromus latestrigatus*	-	+	49	3	al	+	-	-	-	-	-	-
	10. *Landouria montana*	+	+	26	4	al	+	+	+	+	+	-	-
	11. *Landouria winteriana*	-	+	1	1	al	+	-	-	+	+	-	-
	12. *Parachloritis argillacea*	+	+	6	6	re	-	-	-	+	+	+	-
vii. Chronidae	13. *Vitrinopsis fruhstorferi*	-	+	1	1	al	+	+	+	+	-	-	-
viii. Cyclophoridae	14. *Cyclotus politus sumbaensis* “	-	+	11	3	al	-	-	-	-	-	-	-
	15. *Cyclotus reticulatus*	-	+	8	3	al	+	-	-	+	+	-	-
	16. *Cyclotus sp*	+	+	14	4	al	-	-	-	-	-	-	-
	17. *Japonia ciliocincta*	+	-	2	2	al	+	-	-	-	-	-	-
	18. *Leptopoma helicoides*	+	-	11	3	al	-	-	-	-	-	-	-
	19. *Leptopoma perlucidum*	+	+	44	4	al	+	-	+	+	+	+	-
ix. Diplommatinidae	20. *Arinia crassiventris* “	+	+	19	2	al	-	-	-	-	-	-	-
	21. *Arinia tjendanae* “	+	-	1	1	al	-	-	-	-	-	-	-
	22. *Diplommatina fluminis*	+	+	9	3	al	+	-	-	-	+	-	-
	23. *Palaina gedeana*	+	-	28	3	al	+	-	-	-	-	-	-
	24. *Palaina vulcanicola*	-	+	4	1	al	+	-	-	-	-	-	-
x. Dyakiidae	25. *Asperitas bimaensis cochlostyloides* “	+	+	103	7	re	-	-	-	-	-	-	-
	26. *Asperitas sp*	-	+	9	1	al	-	-	-	-	-	-	-
	27. *Asperitas sparsa*	+	+	10	2	al	+	+	+	+	-	-	-
	28. *Sasakina oxyconus*	+	+	21	4	al	-	+	+	-	-	-	-

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xi. Euconulidae	29. *Kaliella barrakporensis*	-	+	1	1	al	+	-	+	+	-	-	-
xii. Helicarionidae	30. *Helicarion albellus*	+	-	3	1	al	+	+	-	-	-	-	-
	31. *Helicarion sumbaensis*	-	+	11	2	al	-	-	+	+	-	-	-
xiii. Helicinidae	32. *Geophorus agglutinans* "	-	+	6	2	al	-	-	-	-	-	-	-
xiv. Lymnaeidae	33. *Radix rubiginosa*	+	-	45	6	re	-	-	-	-	-	-	-
xv. Neritidae	34. *Clithon bicolor*	-	+	1	1	al	-	-	-	-	-	-	-
	35. *Clithon squarrosus*	-	+	29	1	al	-	-	-	-	-	-	-
	36. *Neritina pulligera*	-	+	3	1	al	-	-	-	-	-	-	-
xvi. Physidae	37. *Glyptophysa albertisi*	+	-	34	1	al	-	-	-	-	-	-	-
xvii. Punctidae	38. *Paralaoma servilis* *	+	-	2	2	al	+	-	-	-	-	-	-
xviii. Pupinidae	39. *Moulinsia floresiana*	+	+	4	3	al	+	+	+	+	-	-	-
xix. Thiaridae	40. *Melanoides tuberculata*	+	+	290	12	cn	+	+	+	+	+	-	-
	41. *Mieniplotia scabra*	+	+	41	4	al	+	+	+	+	+	-	-
	42. *Tarebia granifera*	+	+	353	10	re	+	+	+	+	+	+	+
xx. Trochomorphidae	43. *Trochomorpha planorbis*	+	-	3	2	al	-	-	-	-	-	-	-
xxi. Veronicellidae	44. *Filicaulis bleekeri*	+	-	1	1	al	-	-	-	-	-	-	-

Code : Wa (Wanggameti), La (Laiwangi), N (number of individual), D (distribution), C (category), al (accidental), re (rare), cn (common), Bli (Bali), Lbk (Lombok), Sbw (Sumbawa), Fls (Flores), Tmr (Timor), Alr (Alor), Wtr (Wetar), * (introduced), " (endemic to Sumba), + (present), - (absent), **family names** writtenn in **bold** (freshwater snail)

Table 3. Three indices of molluscan community from 20 observed stations.

Station	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Species	3	2	3	4	3	1	7	11	2	3	16
Individuals	19	38	91	9	34	30	17	50	33	11	84
Dominance_D	0.38	0.73	0.49	0.33	0.79	1.00	0.16	0.15	0.89	0.69	0.13
Shannon_H	1.02	0.44	0.79	1.22	0.43	0.00	1.91	2.08	0.23	0.60	2.30
Evenness_e^H/S	0.92	0.77	0.73	0.84	0.51	1.00	0.96	0.73	0.63	0.61	0.62
Station	**Wa**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**La**
Species	26	9	4	28	1	4	4	10	4	3	36
Individuals	416	132	72	239	18	93	74	80	123	54	885
Dominance_D	0.15	0.26	0.46	0.11	1.00	0.41	0.26	0.23	0.59	0.56	0.13
Shannon_H	2.39	1.66	0.89	2.60	0.00	1.02	1.37	1.75	0.76	0.75	2.45
Evenness_e^H/S	0.42	0.59	0.61	0.48	1.00	0.69	0.99	0.58	0.53	0.71	0.32

Code : Wa (Wanggameti), La (Laiwangi)

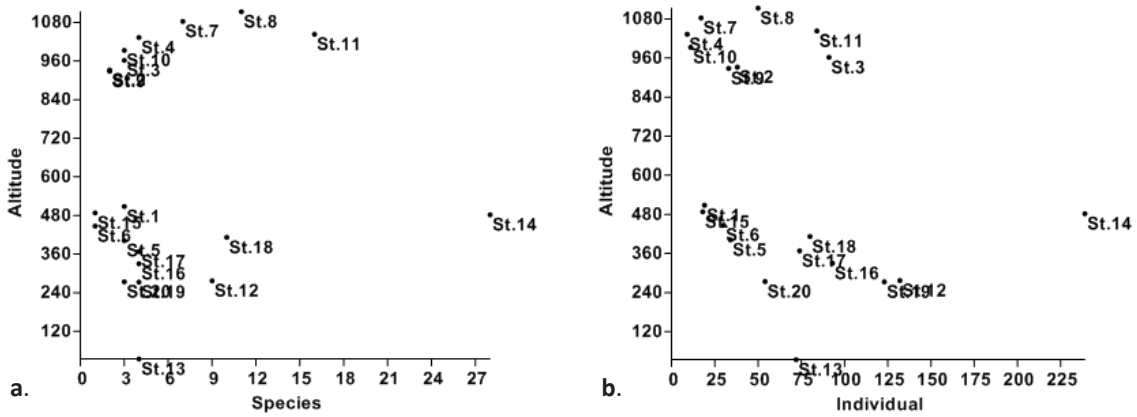

Figure 2. a) Number of species at different altitudes, b) Number of individuals at different altitudes

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Species Composition

Based on the cluster analysis, two different groups of the station were formed (Figure 3. a). The first group consists of 12 stations with 10 snail species (nine freshwater and one land snail). There are eight stations in the second group, consist of 34 land snail species. This grouping is merely based on their habitat, i.e. freshwater and land snail, because almost all of the land snail species were formed the first group and all of the freshwater snail species were formed the second group (except *Filicaulis bleeekeri* which was observed attached to the stone in the riverside of Laimuduk River, station 5). However, three freshwater snails (*Melanoides tuberculata*, *Tarebia granifera*, *Radix rubiginosa*) were found in St.12 (Forest, Billa Village). *Melanoides tuberculata* was also observed in St.14 (Laputi Forest). The occurrences of freshwater snails in the forest were because there were two rivers flowing inside those forests. The plot was just located near the river bank.

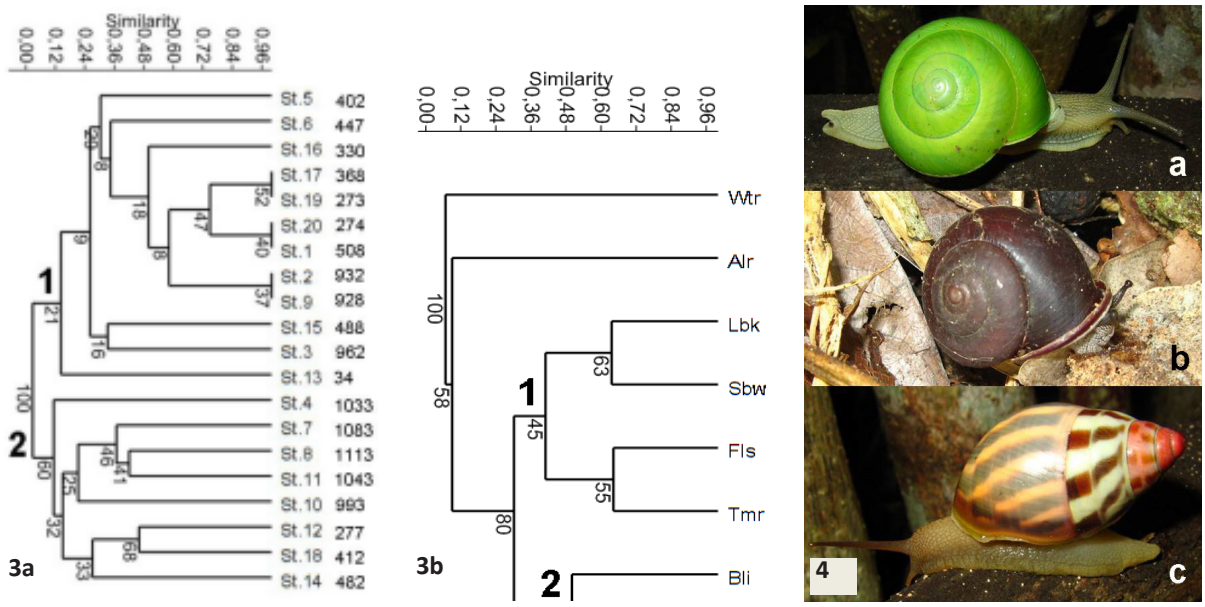

Figure 3. Dendrograms based on the similarity of species composition. a) Between stations, with altitude (r : 0.93, very good), b) Between islands (r : 0.91, very good). (Sba : Sumba, Bli : Bali, Tmr : Timor, Fls : Flores, Sbw : Sumbawa, Lbk : Lombok, Alr : Alor, Wtr : Wetar).

Figure 4. Three land snails that frequently found and with striking shell color. a. *A. bimaensis cochlostyloides*, b. *C. argillacea*, c. *A. latestrigatus*

The most diverse and dense station in LNWP was St.14 with 28 species from 239 individuals snail, while the most diverse family found was Cyclophoridae with seven species. *Asperitas bimaensis cochlostyloides* was the dominant land snail species (103 individuals or 7.9%), while *T. granifera* was the dominant freshwater snail (353 individuals or 27.1%). The molluscan community index varies greatly between stations. These indexes reflect the condition of the molluscs population in their habitat. The diversity index ranges from 0-2.6 with 10 stations each for the medium and low categories. The dominance index ranges from 0.11-1 with four stations each for high and medium categories and 12 stations with low

categories. Evenness index range from 0.48-1 with 15 stations in the high category and five stations in the medium category. Based on the value of the diversity index, it means that the ecosystem pressure occurs at a medium and high level. Domination is only observed from eight stations and most species are evenly distributed as observed from 15 stations (Magguran, 2004). Between all stations, station 14 can be considered to have the most stable ecological conditions for having the highest diversity index and lowest dominance index value.

The Altitudinal Gradient on Diversity

Snail populations were greatly varied in each station. Laiwangi area is more diverse and dense than the Wanggameti area even with fewer stations observed. Stations in Wanggameti were ranged from 402-1.113 m a.s.l. with an average of 858.5 m a.s.l., while stations in Laiwangi were ranged from 34-488 m a.s.l. with an average of 326.4 m a.s.l. Twelve stations were located between 34 to 508 m a.s.l. Nine hundred and sixty-eight individuals (range from 18-236) belonging to 37 species (range from 1-28) species were observed from this lower altitude. The other eight stations were located between 928 to 1,113 m a.s.l. Three hundred and thirty-three individuals (range from 9-91) belonging to 25 species (range from 2-16) were observed from this higher altitude (Figure 2. a, b). Spearman's rank correlation coefficient showed no significant correlation between altitude and number of species ($R = 0.5$, $p = 0.45$) and between altitude and number of individuals ($R = 0$, $p = 1$). Based on Spearman's value, no strong correlation between altitude and number of species nor individuals.

Previous studies on land snails from the sub-tropic region, Italy (Aubry et al., 2005) showed a strong correlation between altitude and the number of species or individuals. However, a similar study in the tropical region, Malaysian Borneo (Liew et al., 2010) did not show the same trend. Previous studies on aquatic snails only show decreasing in species richness with increasing altitude, whether in the sub-tropic region, Bulgaria (Georgiev & Hubenov, 2013) or the tropical region, Brazil (Maltchik et al., 2010). Snail is a sessile animal with low dispersal abilities, each species has its preferred niche (Liew et al., 2010). On the other hand, niche type tends to be less diverse in the higher altitude (Aubry et al., 2005). Both reasons explain why higher altitude is less diverse than the lower one.

Species Distribution

As seen inFigure 2. a, b, both species distribution and population of snails are greatly varied. Seventeen species are only found from one station, even 10 of them only found as singleton. These are accidental species (al). Twenty-one species that occur between 2-4 stations are also accidental species (al). Five rare (re) species occur in 5-10 stations. Only *M. tuberculata* that occur in 12 stations are classified as common species (cn). The occurrence of species depends on their adaptation ability (Rosales et al., 2020). Only a small number of species can adapt to different habitats (here equal to the station and its altitude). They found that snails which are classified as common and constant species occur in the wide range of altitude (0-700 m. a. s. l.). Our data showed that *A. b. cochlostyloides* occur in seven stations (277-1113 m. a. s. l.) and *M. tuberculata* occur in 12 stations (34-962 m. a. s. l.). While less diverse niche types are found in the higher altitude (Aubry et al., 2005), snails have to adapt to their surrounding environment.

Figure 3. a showed the species composition between 20 observed stations.

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Group 1 mostly consists of stations below 900 m. a. s. l., except for three stations (2, 3, 9) that are located at a higher altitude. Only *M. tuberculata* occur in all 12 stations in group 1. Group 2 consists of species that occur above 900 m. asl (*A. b. cochlostyloides*) and below 500 m. asl (*Amphidromus latestrigatus*, *Chloritis argillacea*, *Cyclotus politus sumbensis*, *C. reticulatus*, *Leptopoma vitreum*, *A. b. cochlostyloides*).

There were 126 species known reported from Sumba (Schepman, 1892; Smith, 1899; Benthem Jutting, 1928, 1955, 1958, 1959; Rensch, 1931a, 1931b, 1934; Starmuhlner, 1974; Vermeullen & Whitten, 1998). Species occurrence data in the Lesser Sunda Islands have been compiled from previous studies and museum collections. From 44 species observed in the present study, 24 species occur in Bali, 15 species occur in Flores, 11 species occur in Sumbawa, nine species occur in both Lombok and Timor, two species occur in Alor, and only one species occur in Wetar (Figure 3. b).

The similarity of species between Sumba and seven other islands is presented in Figure 3. b. Bali is grouped with Sumba based on 24 similar species. Timor and Flores share nine similar species, while eight species occur between Sumbawa and Lombok. Alor and Wetar can be considered as the out-group. The geological evidence reveals that Bali is part of the Asian plate and separated from the other islands in Lesser Sunda. In the other hand, Lombok, Sumbawa, Flores, Sumba, and Timor are part of the Wallacea region. During the Pleistocene, Bali, Java, and Sumatra were interconnected in one land together with the mainland of Asia and share the same Asian fauna (Satyana, 2012; Minarwan, 2012). The higher similarity in mollusc diversity between Sumba and Bali which is irrelevant with geology data, maybe due to the study of Vermeullen & Whitten (1998) was more recent and comprehensive compared with the other studies. More species were identified from Bali, then the chance to find a similar species with Sumba is increase.

Five endemic land snail species were found in the present study. They only occur in Sumba Island and have never been reported from the neighboring islands. *Cyclotus politus sumbaensis*, *Arinia crassiventris*, and *A. tjendanae* were described based on specimens from Waingapu. *Geophorus agglutinans* was described from Langgaliru, while *A. b. cochlostyloides* was described from Katikuwai (Schepman, 1892; Rensch, 1932; Benthem Jutting, 1958).

Of 44 species found in this study, 17 of them have never been reported from Sumba and are considered as a new record for this island. Within the Lesser Sunda Islands, nine species were previously recorded from Bali (*Pomacea canaliculata*, *Macrochlamys spiralifer*, *Chamalycaeus kessneri*, *Lagochilus ciliocinctum*, *Palaina gedeana*, *P. vulcanicola*, *P. caputspinulae*, *P. acutissimum*, and *Subulina octona*). *Helicarion albellus* recorded from Bali and Lombok (Vermeullen & Whitten, 1998; Suarmustika et al., 2018). *Helicarion sumbaensis* was recorded from Sumbawa and Flores (Rensch, 1932). Two species were never recorded from the Lesser Sunda Islands (*Pupisoma tiluanum* and *Clithon bicolor*) but they are present in Java (Benthem Jutting, 1952 & 1956). The presence of *C. bicolor* in the Lesser Sunda Islands is already predicted because it also occurs in Moluccas (Benthem Jutting, 1959). *Glyptophysa albertisi* was previously recorded from Papua New Guinea (Starmuhlner, 1976). *Lissachatina fulica* and *P. canaliculata* are two introduced species that originated from Africa and South America. The previous record of *Lissachatina fulica* from Timor was in 1980 (Bruggen, 1981).

The identities of two Cyclophorid species are questionable. Shell morphology of *Cyclotus* sp. in this study is different from the four *Cyclotus* (*C. pseudoreticulatus*, *C. succinctus*, *C. politus sumbaensis*, *C. reticulatus*) previously known in Sumba. It also happens with *Leptopoma*. The shell is different from *L. vitreum* or *L. moussoni* that known to occur in Sumba, but is rather similar to *L. bourguignat* that known from Borneo. It is not surprising, because the other species, *C. politus*, also occur in both Borneo and Sumba (Rensch, 1932).

The result from the present study is still incomplete because it only documents 44 species of aquatic and land snail. However, 17 species of them have never been reported from Sumba. If the number accumulated with the previously known species from Sumba (126 species), then the overall number will be 143 species. The LWNP represents 31% diversity of malacofauna in Sumba Island. In the future, a more comprehensive study is needed to uncover the diversity of malacofauna from Sumba.

This present study is the first faunistic study of malacofauna in the Laiwangi Wanggameti National Park (LWNP). Twenty families and 44 species have been identified. Two dominant species are *A. b. cochlostyloides* and *T. granifera*, while *T. granifera* and *M. tuberculata* are two constant species that occur between 10-12 stations. The diversity and population density tend to be higher in Laiwangi area with lower altitudes than in Wanggameti area with higher altitudes. Species composition in Sumba is more similar to Bali compared with the other six neighboringislands. Seventeen species are considered as new records for Sumba and four species for the Lesser Sunda Islands. Five endemic species with a low population are still can be found inside the park.

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