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Megapodius reinwardt Conservation Based on Ecological Knowledge of Local People to Support Sustainable Ecotourism on Moyo Island

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Abstract. The research about distribution, species survival and conservation of *Megapodius reinwardt* based on ecological knowledge of local people to support ecotourism on Moyo island has been done. The aims are to: 1) obtain an accurate picture of the distribution of population and active nests, 2) knowledge of the ecology of the local population, 3) perception and behavior of the local population, 4) to increase population, and 5) conservation effort to prevent extinction in Moyo Island hunting park. This study consists of two stages of activities, namely the first population distribution mapping, nest study, disease, pathogens, interviews and discussions with residents regarding their perceptions and knowledge of *Megapodius reinwardt*, study documents regarding tourist visits; second, build awareness and participation of local residents to support the conservation activities of *Megapodius reinwardt*, formulate its conspiracy design and determine potential nests as tourist attractions. Perception of local residents on Moyo island to the existence of *Megapodius reinwardt* in fulfillment of the people needs directly or not directly. Local residents believe that by keeping *Megapodius reinwardt* will make the life needs can be fulfilled. In addition to that, residents of local island of Moyo assume that hunting the bird at the spawn period " *Mali* " or bring disrepute to hunters. Perception of the local residents of Moyo island to the preservation of *Megapodius reinwardt* most large 85% of the population agree to the preservation of *Megapodius reinwardt* on Moyo island, 10% are still in doubt, and 5% did not agree. The management effort of *Megapodius reinwardt* as one of the tourism attractions, should involve and be able to accommodate the needs of local people, tourists, businessmen of tourism and the government. For the success of the bird conservation efforts, it must pay attention to six things, namely: 1) agreement to recognize the minimum rights of group members; 2) clarity on the limits of the scope of mastery of each active community management group; 3) conformity between nest management costs and benefits obtained; 4) conflict resolution mechanisms; 5) firmness in applying sanctions and 6) willingness to receive knowledge / information and conservation technology and management of *Megapodius reinwardt* from outside Moyo Island.

INTRODUCTION

Moyo Island is a hunting Park, currently in the process of being proposed as a National Park and is one of the tourist destinations, especially for ecotourism. This island has a limited number of fauna (endemic). Endemic bird fauna include the Gosong bird (*Megapodius reinwardt*), cocoa koak (*Philemon buceroides*), and yellow-crested cockatoo (*Cacatua sulphurea*). The potential of biodiversity as a resource is very important in our life, in order to support the survival of all life and to meet human needs such as the need for economic, ecological, socio-cultural, aesthetic, and science[1]. All of this biodiversity is a capital that needs to be utilized optimally for development. The Gosong bird (*Megapodius reinwardt*) is very potential for the development of tourism objects, especially ecotourism, because this bird is unique in that it has an egg size of five to six times the size of the eggs of other birds that are commensurate[2], they do not incubate their eggs, their offspring are not mentored, nurtured and are considered for their survival[3]. In connection with this *Megapodius reinwardt* can potentially be used on a limited basis as a tourist attraction[4].

Megapodius reinwardt is one of the protected bird species based on RI Law No.5 of 1990 and Minister of Forestry Decree No. 301/Kpts-II /1991. Protection of birds is done because it is unique, its distribution is limited[5],

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050004-1

it has an important ecological role, information on its biological characteristics is still very small, it is difficult to breed in captivity and begin to be scarce [6]. In this connection, other researchers reported the number of *Megapodius reinwardt* on Moyo Island that was found as many as 29 individuals, preferring plantation areas over forests, grasslands and savannahs [7]. In addition, ornithologist reported that *Megapodius reinwardt* was formerly found in the Greater Sunda on Kangean Island, East Java, but is now very rare [6].

Moyo Island residents have quite a lot of knowledge related to the management of the surrounding natural resources including the existence of *Megapodius reinwardt* on the island. However, to our knowledge, this has not been scientifically explored as an instrument in environmental management. Lack of knowledge on the island that has not received attention for example, knowledge of the ecology in assessing the condition of natural resources such as the existence of *Megapodius reinwardt*. This bird is of high economic value, and many people like their meat and eggs. Not surprisingly, hunting for birds has increased, triggering a drastic decline in population. Therefore, to maintain its survival and preservation on Moyo Island, studies on life graduation, knowledge and perceptions of the population are important.

Threaten to extinction of *Megapodius reinwardt* is much more greater because it includes in difficult reproduction birds group in captivity. Captivity efforts to date have not yet tried to be done. The absence of the breeding efforts can be caused by various factors such as the biological information that is still very limited, especially on it nest, health, pathogen, sickness, predators and the population confounding factors. Therefore, research on the survival and conservation *Megapodius reinwardt* to support ecotourism in Moyo Island become priority.

MATERIALS AND METHODS

Research on distribution, life survival and conservation of *Megapodius reinwardt* based on ecological knowledge of local people to support eco-tourism on Moyo island, a refinement and further research regarding "Bioecological, population and survival *Megapodius reinwardt* on Moyo Island" by the year 2011 and the year 2012. Overview and results of studies that have been achieved as presented in Figure 1, Research roadmap could be seen as fishbone diagram below.

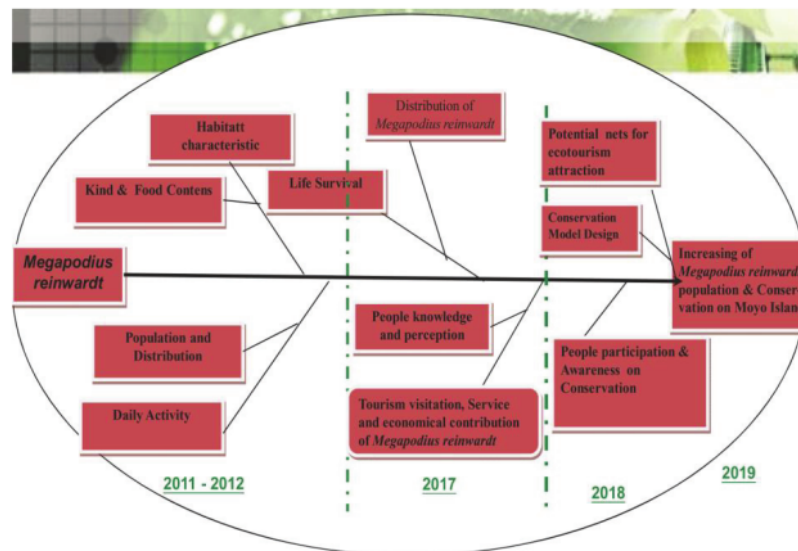


FIGURE 1. Research fishbone diagram of the first and the second year (2017-2018)

This research was conducted on Moyo Island which is geographically located at $8^{\circ} 9'.36''$ South Latitude and $117^{\circ} .27' 24''$ East Longitude. This research is a continuation of the first (first) research. This year it was carried out on Moyo Island residents. This research uses a qualitative approach as it seeks to elaborate and explain the phenomena that occur in conjunction with the ecological of *Megapodius reinwardt* on Moyo Island. Therefore, although there are quantitative data, it will only be used as the basis to explain the ecological phenomenon of *Megapodius reinwardt*. For example, to collect information about the condition of *Megapodius reinwardt* at each location in Moyo Island, it is necessary to conduct a preliminary investigation in the form of a systematic and comprehensive preliminary analysis of the condition of the bird's habitat for the past 5 years. The results obtained from this action are expected to provide an overview of *Megapodius reinwardt* conditions and perceptions of the population in Moyo Island, so that data on management locations are obtained. From this initial information, it will be explained to the next steps. Collecting and analyzing data on perceptions and knowledge of local residents following the survey and interview methods.

Data relating to the location of *Megapodius reinwardt* nests which are potentially managed for tourist attractions on a limited basis will be collected through observation, interviews and direct discussions with residents. Furthermore, the results agreed as a nest which is managed by the population group was selected as a test of economic empowerment of residents in Moyo Island based on ecological knowledge local resident for economic improvement through the development of tourism and ecosystem design based on tourism development and social potential. To get comprehensive results, this survey will be equipped with a Survey Management Information System (SIMS) to facilitate the team to carry out tasks related to information dissemination, information gathering from the field, and progress of fieldwork. The purpose of this SIMS preparation is so that this research activity can be monitored step by step to ensure the progress achieved and can provide an assessment to avoid the possibility of things related to the quality of the survey, such as completeness of the questionnaire / form and the accuracy of the data obtained. By using this SIMS technique, the surveys carried out is expected to run in an orderly, smooth, efficient and produce quality and comprehensive data, especially those related to information on *Megapodius reinwardt* conditions and perceptions of the population. In addition, this SIMS technique can facilitate the flow of data distribution, both electronic and physical data (questionnaires and SIMS forms), and facilitate the validation of Survey Information Data. The prerequisite needs related to SIMS technique, namely:

- a. KK Form (Complete Questionnaire)
- b. PKD Form (Improved Questionnaire)
- c. CAFÉ (Computer Assisted Field Editing) Form
- d. PDE Form (Data Entry Development)
- e. PKDE Form (Questionnaire Delivery in the form of Electronic Data)
- f. PKF Form (Questionnaire Delivery in Physical Form)

The sample selection is done by *stratified purposive sampling*. The population includes all residents of Moyo Island. The sample was selected with reference to the mapping of investigation based on the criteria of age of at least 40 years and have settled at least 10 consecutive years.

RESULTS AND DISCUSSION

Megapodius reinwardt Active Nest Conditions on Moyo Island

Megapodius reinwardt is a terrestrial bird that almost all of its daily activities are carried out above ground level except when taking shelter from predators and sleeping at night in the trees. Given the topography of Moyo Island, hilly, mountainous, mostly forest dense, with [accessibilities](#) still relatively difficult and expensive, in this study the data retrieval conditions of active nests and habitat *Megapodius reinwardt* only done in ten western part of the South Island of it at five locations: the areas of Labuhan Haji Hamlet, Berang Sedo Hamlet, Ai Manis, Ai Dara and Tanjung Pasir. Data condition nest *Megapodius reinwardt* obtained through observation of the colony nest in the form of a mound of earth . The following are the coordinates of the nests of the colony of the nest, the height of the site from the land surface and the type of soil where the *Megapodius reinwardt* nest colony on Moyo Island in 2018 is presented in the following table.

TABLE 1. Coordinates Tread, Altitude and Soil type nest of *Megapodius reinwardt* in Moyo Island 2018.

	Sarang Tread Coordinates		Altitude Above Sea Level (meters)	Soil Type
	Longitude	Latitude		
Ai Manis				
1	117 ° 29'58.03 "	8 ° 22'18.23 "	5	Sandy
2	117 ° 30'2.70 "	8 ° 22'20.31 "	10	Sandy
BerangSedo				
3	117 ° 30'43.51 "	8 ° 16'36.02 "	25	Humus
4	117 ° 30'45.07 "	8 ° 16'35.64 "	30	Humus
5	117 ° 30'48.50 "	8 ° 16'36.52 "	30	Humus
6	117 ° 30'50.40 "	8 ° 16'33.06 "	28	Humus
7	117 ° 30'55.05 "	8 ° 16'31.00 "	35	Humus
8	117 ° 30'57.23 "	8 ° 16'31.47 "	50	Humus
TanjungPasir				
9	117 ° 31'38.33 "	8 ° 23'15.07 "	5	Humus
10	117 ° 31'43.12 "	8 ° 23'07.76 "	5	Sandy
Labuhan Haji				
11	117 ° 29'13.32 "	08 ° 15'15.9 "	60	Chalky
12	117 ° 29'009 "	08 ° 15'41.46 "	65	Humus
13	117 ° 29'46.7 "	08 ° 15'17.3 "	50	Chalky
14	117 ° 30'58.6 "	08 ° 15'32.4 "	40	Humus
15	117 ° 30'59.3 "	08 ° 15'48.7 "	35	Humus
16	117 ° 30'09.08 "	08 ° 5'45.56 "	40	Humus
17	117 ° 31'23.2 "	08 ° 16'46,5 "	30	Humus
18	117 ° 31'48.6 "	08 ° 16 '48,5 "	10	Humus
Ai Dara				
19	117 ° 28'21.03 "	8 ° 21'31.31 "	10	Chalky
20	117 ° 28.12.36 "	8 ° 21'12.29 "	5	Chalky

Data Sources: Khairuddin and Yamin, 2017

Megapodius reinwardt seems to favor the location of nest colonies in the form of secondary forests compared to primary forest areas and Savanna. From the survey conducted by the research team at the five locations above, 20 active nest colonies were found. Researchers reported that 20 active nest colonies were recorded in the western part of Moyo island. There are 8 colonies with 57 nests in the secondary forest in the Labuhan Haji region at an altitude of ± 10 to 60 meters above sea level, and 6 colonies with 45 nests in the primary forest of Berang Sedo at an altitude of ± 25 to 50 meters above sea level, while in the savanna area in Ai Dara and Ai Manis each found 2 colonies with 13 nests at an altitude of ± 5 to 10 meters above sea level and Tanjung Pasir primary forest each found 2 colonies with 13 active nests at an altitude of ± 5 above sea level [8]. This can be understood because *Megapodius reinwardt* is a terrestrial eater of insects, insects, seeds, worms and fruit flesh [6]. Subsequently reported that the presence of *Megapodius reinwardt* on a habitat type is not associated with the profile, the number of individuals, and the diversity of species [9], but rather is determined by the availability of feed ingredients, the high density of trees and above sea level [10]. *Megapodius reinwardt* prefers plantation areas to forests and grass savanna fields [11].

The highest number of *Megapodius reinwardt* colonies nest found in areas Labuhan Haji because the area is an agricultural area that provide more food, tree density is less and its location is relatively higher above sea level than the region Berang Sedo, Ai Dara, Ai Manis and Tanjung Pasir are an average of 45 meters above sea level, while altitudes at Ai Manis and Tanjung Pasir average 5 meters above sea level. Secondary forest and shrubby areas around agricultural areas in addition to providing more food in the form of insects, termites, insects and worms than primary forest or savannah is also very well be used for shelter from predators. Habitat that is too tight limits *Megapodius reinwardt* hunting because it is blocked by tree branches when hunting insects. Conversely, locations that are too open are also less favored, because *Megapodius reinwardt* gainless security from predators when hunting [12]. If there are no trees, there is no shelter when being chased by predators. Therefore savanna habitats around the Ai Manis and Ai Dara regions are also less favored compared to secondary forests in the Labuhan Haji and BerangSedo areas. In this connection the presence of birds in a place is influenced by several factors such as the abundance of epiphytic plants, fruits, floor openness, and composition of plant species [4]. Most insectivorous birds, such as the Dicruridae and Oriolidae tribes, like open forest areas, forest fringes, plantations and parks [7]. In line

with other experts said that each species of animal is very dependent on environmental factors that exist in its habitat, such as vegetation, water, and climate [13]. Following are the results of the calculation of Diversity Index (H'), Uniformity Index (E), Density (D), Frequency, (F) Type of Dominant Vegetation at each *Megapodius reinwardt* nest colony location on Moyo Island in 2018.

9 **TABLE 2.** Diversity Index (H'), Uniformity Index (E), Density (D), Frequency (F),Vegetation Dominant at each *Megapodius reinwardt* nest colony location in July 2018

Location	H'	E	D	F	Community
Primary forest	2.24	0.72	302	7	<i>Merremiasp.</i> , <i>S. oblongata</i> , <i>S. oleosa</i> .
Secondary forest	2.53	.89	136	9	<i>C. pentandra</i> , <i>P.javanicum</i> , <i>Bauhinia sp</i>
Savana	2.50	0.95	58	5	<i>Merremiasp.</i> , <i>T. indica</i> , <i>A.angusteloba</i>

Information :

H = Diversity index, E = Uniformity index

D = Density of trees / hectare, F = Frequency of the presence of *Megapodius reinwardt*

From the results of observations on the condition of the active nest *Megapodius reinwardt* on Moyo Island, the research team obtained an overview as presented in the Figure below.



FIGURE 2. Overview of *Megapodius reinwardt* Active nets on Moyo Island, 2018

The picture above shows the condition of the *Megapodius reinwardt* nest on Moyo Island is relatively awake. This was confirmed by [14], who reported that the disturbance of *Megapodius reinwardt* population on Moyo Island was still within tolerance. This can be understood because Moyo Island is a conservation area which is about 75% of its area is a protected area.

Perception of Local Residents of Moyo Island towards *Megapodius reinwardt*

Moyo Island is divided into two areas, namely protected areas and cultivation areas. Both of these areas were used by the local residents to support their daily life. They know that Moyo island is a protected area from counseling officers and Forest Guard Communities (stated as :MPH) in their respective hamlets. Their perception of the existence of a resource in the area where it belongs to the community in the area, the community has the freedom to use and manage it for their living needs. Local people of Moyo island know and feel the benefits of in supporting their needs. The perceived benefits are primarily as a source of protein for increased income from the sale of the bird's eggs. Thus it can be said that local people's perception of *Megapodius reinwardt* is to be able to support the fulfillment of their needs.

In this study, perception as a process of interpreting the local population on Moyo island towards *Megapodius reinwardt* which they have felt is beneficial. Local residents utilize *Megapodius reinwardt* to support the fulfillment

of the needs of life of its day-to-day as a source of protein. In addition, sometimes as additional income from the sale of eggs and tourist visits services. These ways were included in natural resources management in a sustainable manner. Currently they believe in preserving nature will make their needs can be fulfilled. The attitude of the local population of Moyo island towards the preservation of *Megapodius reinwardt* is grouped into three forms, namely agree, disagree and doubt.

TABLE 3. Attitudes of Moyo Island Population towards *Megapodius reinwardt* conservation

Attitudes of Residents / Respondents							
Agree		not Agree		Doubtful		Number of Respondents	
Person	%	Person	%	Person	%	Person	%
17	85	1	5	2	10	20	100

Data source : Field observations

From the data above, it appears that most (17 people) or 85% of the population agreed to the preservation of *Megapodius reinwardt* on Moyo island. Two people or 10% still doubt and one person or 5% who disagree. This illustrates the positive value of *Megapodius reinwardt* as a provider of benefits for local residents. This means local residents largely have felt or get benefits from *Megapodius reinwardt*. In other words, local residents do not get disadvantaged for the preservation of *Megapodius reinwardt*. In this case the community consciously wants to preserve *Megapodius reinwardt* on Moyo island to support the fulfillment of his life in a sustainable manner. The purpose of using *Megapodius reinwardt* by residents on Moyo island is presented in the following table.

TABLE 4. Purpose of Utilizing by residents on Moyo Island

Purpose of Utilization	Life fulfilment	Additional income	On sale	Used alone
Person	17	12	11	19
Percentage (%)	85	60	55	95

From Table 4. above it can be concluded that the local population of Moyo island in utilizing *Megapodius reinwardt* for three kinds of needs namely life fulfilment, additional income and self-use. Most (95%) of the local people of Moyo island utilize *Megapodius reinwardt* for their own use. Local residents utilize sustainably by avoiding catching / hunting at the time of laying eggs. Almost all residents / respondents assume that the presence of *Megapodius reinwardt* nests will fertilize the soil, if captured or labored while laying eggs hunters going to **Mali (getting bad)**. The bird lays eggs around 11am to 12 o'clock at Friday noon, most of its activities are around soil surface, active in the morning until around 11 o'clock and evening until 16 o'clock. Taking rest and sleep in the same tree (fixed). Predators of population on Moyo Island are monitor lizards (*Varanus* sp), wild boar (*Sus barbatus*), ferrets (*Prinodon linsang*), eagles (*Haliasturindus*), aloof (*Microhierax fringillarius*), and humans^[15].

TABLE 5. Behavior of local Population from *Megapodius reinwardt* Utilization

No	Behavior	Using		Never Using	
		Person	%	Person	%
1	Meat	15	75	5	25
2	Egg	18	90	2	10

Data source : Field observations

***Megapodius reinwardt* Conservation Models on Moyo Island**

Broadly speaking, the development and management of tourism on Moyo island is influenced by four community groups namely a) tourists, b) local residents, c) tourism entrepreneurs and d) Government. The four groups have their own needs :

- 1) Travelers, needs a) feel the comfort, b) environmental cleanliness at tourist spots, c) accessibility to Moyo island, d) be able to utilize the facilities and a complete tourist infrastructure; e) get good service; f) getting secure and during the tour.

- 2) Population , the needs of the local population are: (a) income increased; (b) get the opportunity to work and do business on Moyo island ; (c) tourism activities do not have a negative impact on the culture of local residents ; (d) the environment is maintained; and (e) the health of the population is maintained, and (f) the transportation to and from the island of Moyo is fast and cheaper.
- 3) Tourism Entrepreneurs, their needs are: (a) profits increased; (b) high number of tourist visits; (c) smooth transportation facilities to and from Moyo island ; (d) availability of infrastructure networks such as electricity, telephone, clean water; (e) easy travel licensing; (f) satisfaction of tourists; (g) maintaining security and environmental order; (h) It's easy to get skilled local workers.
- 4) Government, the needs are: (a) increasing regional income; (b) reduced unemployment and poverty; (c) increasing the image of Moyo island tourist destinations ; (d) environmental cleanliness; (e) traveling comfort; (f) increasing number of tourist visits; (g) absence of socio-cultural conflicts between tourists and local residents ; and (i) there is no environmental pollution.

Based on the needs of the four groups mentioned above (tourists, local residents, tourism entrepreneurs and the Government), the *Megapodius reinwardt* nest management model as a tourist attraction on Moyo Island is illustrated as follows.

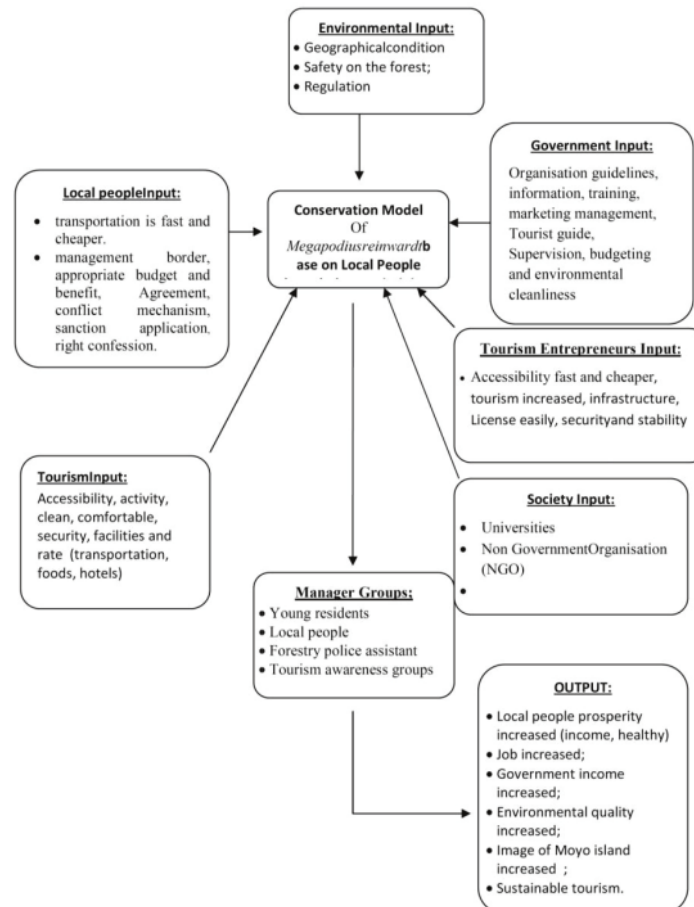


FIGURE 3. Conservation Model Of *Megapodius reinwardt* base on Local People Knowledge on Moyo Island

From the picture above, it can be said that the model of conservation and management of *Megapodius reinwardt* as one of the tourist attractions on Moyo island based on local people ecological knowledge have an important role. The important role of the local people is related to the security and ownership of the site of a number of active nests, employment and welfare. For the success of the conservation and management of *Megapodius reinwardt* as one of

the tourist attractions on the Moyo Island attention to 6 (six) things are necessary, namely: 1) agreement on the recognition of the minimum rights of group members; 2) clarity of the scope of control of each active nest management community group ; 3) compatibility between nest management costs and benefits gained; 4) conflict resolution mechanism ; 5) firmness in the application of sanctions and 6) willingness to receive knowledge/information and conservation technology and management of *Megapodius reinwardt* from outside the Moyo Island area.

Determination of the *Megapodius reinwardt* Nest that Manage as a Tourist Attraction on Moyo Island

Determination of the location and number of *Megapodius reinwardt* active nest managed in this activity based on three considerations, namely the number of active nests, the affordability of the location and the status of the nest location / ownership of the nest site. Based on these considerations, four point of *Megapodius reinwardt* conservation and management were determined as one of the tourist attractions on Moyo Island, namely Labuhan Haji Hamlet, Berang Sedo Hamlet, Ai Manis and Tanjung Pasir. Nest run as a tourist attraction, was 18 pieces of each of the eight nests in Labuhan Haji Hamlet, 6 nests in Hamlet Berang Sedo and two each of the nests in Ai Manis and Tanjung Pasir.

Megapodius reinwardt nests in Labuhan Haji and Berang Sedo Hamlets are in the area of people's land and it managed by them, tourism entrepreneurs and environmentalists from the local hamlet. The nests in Ai Manis and Tanjung Pasir are in protected areas managed by the Forest Police Assistance Community (called: MPPH) of the Labuhan Haji and Berang Sedo hamlets. They were 20 persons as members of the conservation and management of *Megapodius reinwardt* model group on Moyo island. The following is a picture of the location of the conservation and management of *Megapodius reinwardt* nests as one of the tourist attractions.

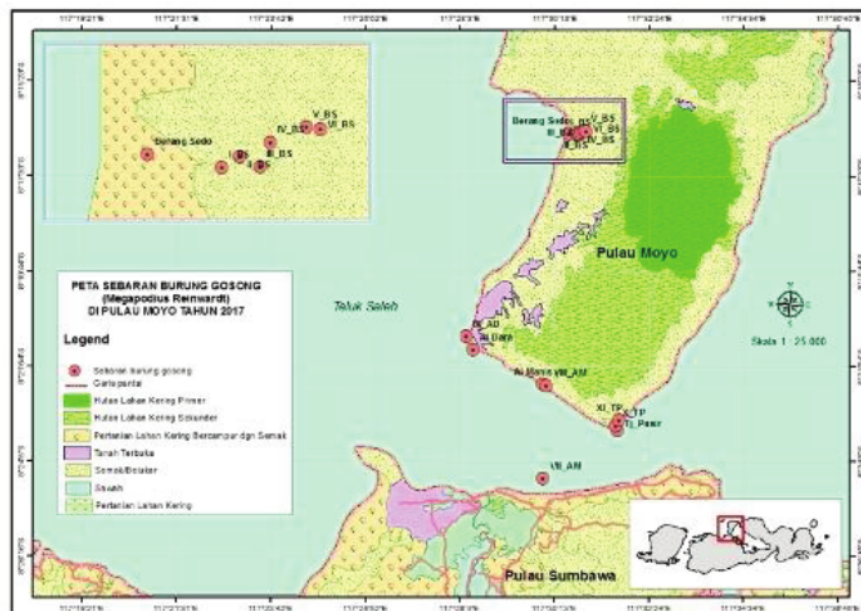


FIGURE 4. Conservation and Management Location of *Megapodius reinwardt* nest Based on Ecological Knowledge of Local people as Tourist Attraction on Moyo Island

From the picture above shows the existence of a nest *Megapodius reinwardt* on Moyo Island which highest amount and closest to the settlement that is in Labuhan Haji and Berang Sedo hamlet. The Ai Manis area and Tanjung Pasir are far from residential areas. The easiest accessibility the nests are to the Labuan Haji port. The three other locations have rather difficult accessibility. On Moyo Island there is no land or sea transportation for the public.

CONCLUSION

From the description and the above discussion can be concluded: Conservation and management of resources, especially *Megapodius reinwardt* on Moyo island by the government have ongoing problems, especially problems of safety and high cost; The local inhabitants of Moyo island consider the existence of *Megapodius reinwardt* on Moyo island to be useful in enriching agricultural land and to help the economy of the population; Local people of Moyo island belief where *Megapodius reinwardt* on Moyo Island supports the fulfillment of their life, and hunting *Megapodius reinwardt* when laying eggs will be "Mali" or get bad / calamity ; it is important that local residents are involved in *Megapodius reinwardt* conservation efforts on Moyo island for security and avoiding conflict, because of the presence of a number of bird's nest sites (*Megapodius reinwardt*) location are in the area of land owned by residents. Therefore, the conservation and management *Megapodius reinwardt* n-situ on Moyo island effort needs attention and support as well as the target of the government to alleviate the welfare of mainly to the locals and sustainable resource used.

3

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