Factors affecting Implementation of *sasi* in the management of mangrove ecosystem at Rutong and Leahari village, South Leitimur Sub-district, Ambon City, Indonesia

H Nanlohy¹,* W Talakua¹, L M. Soukotta¹ and E G. Talakua¹

¹Faculty Fisheries and Marine Science of Pattimura University, Ambon, Maluku, Indonesia
*Corresponding author: nanlohy_hellen@yahoo.com

Abstract. Most of the coastal community depend heavily on the natural resources found in the coastal area, but at the same time, the way they used the resources also deteriorate those resources. In some area in Maluku Province, *sasi* as indigenous knowledge has been used for hundreds of years as a tool in the management of natural resources like fish, molluscs, crustacean, etc. This study was conducted at Rutong and Leahari village of South-Leitimur Sub-district, Ambon city to find out the implementation of *sasi* in the management of mangrove ecosystem. The result shows that there is a positive relationship between community attitude towards the implementation of *sasi* in the management of mangrove ecosystem with strong correlation (r = 0.815). More than 60% of the community support the implementation of sasi in the management of the mangrove ecosystem to maintain the sustainability of that ecosystem.

1. Introduction
The local community in the Province of Maluku generally have local wisdom they inherit from their ancestor and passed down from generation to next generation. Local customary is one of the essential indigenous values or norm which is embedded exist and practicing in some part in Maluku and *kewang* as an example of it. Values embedded in the local wisdom are gloriously and highly exalted in some of the community from this province [1]. One of famous local wisdom which still exists within some of the local community and is used in managing natural resources, either marine, coastal or terrestrial in sustainable ways is *sasi*, and *kewang* as a traditional institution responsible to undertake the sasi [2, 3, 4].

In the village which is managed (governed) based on the customary way (adat), the institution of kewang is working under village chief, and the member of kewang is a group of people receives it as a heredity position from generation to generation [5]. Kewang was employed as an overseer in the implementation of *sasi* regulations in the village where sasi is conducted. In general *Kewang* function is to manage, supervise, control the harvested of natural resources in marine, coastal and terrestrial area [4, 6, 7]. *Kewang* in its function is divided into the marine *kewang* response in the management of marine/coastal natural resources and terrestrial *kewang* responsible in the management of terrestrial natural resources [8].

Sasi is one of the natural resources management instrument practices by the local community in Maluku province and can be seen as natural resources conservation [9]. It meant to keep the quality of natural or the biodiversity of natural resources in the good condition. *Sasi* can be in term of a zone (area under sasi) or natural resources (plants, fish etc.). When *sasi* is implemented, the zone or natural resources under *sasi* is regulated by sasi regulation [10]. For a certain period of time, area or natural resources under *sasi* cannot be harvested (tutup sasi) until the ban is lifted (buka sasi). Sasi has an
important meaning in the development and sustainability of natural resources. Kewang is the institute that decided the time of sasi to be implemented, lifted, and monitor the sasi. Regulation on sasi is constructed in an equal way through customary council in the village called saniri [7].

Fisheries and other natural resources management through sasi and kewang approach can be considered as community-based resources management (CBRM) [3], and has been practices for hundreds of year by local community in Maluku [11, 12]. The values or cultural norm embedded in sasi and kewang has deeply rooted in the community and become a customary natural resources management instrument. The practice of sasi and kewang in several parts of Ambon Island has been conducted for long time, but in recent years this local wisdom (indigenous knowledge) has decline, even disappear in some villages of Central Maluku [13, 14]. Some of factors affecting the decline of sasi namely: a) economy; b) quality of village leader; c) rapid change in society as a result of technology information and openness; d) internal conflict within the village especially between kewang and community [4, 11, 13]. Weaken of this indigenous knowledge in natural resources management will lead to unsustainable use of the resources and the ecosystem as well.

One of productive ecosystem found to distribute in Ambon area is mangrove with the condition tend to decline from years to years mostly caused by anthropogenic stressor [15, 16, 17]. Threaten to this ecosystem should be lessened in order to retain its contribution in term of ecology, physics, and socio-economy. Community-based to natural resources management through sasi approach can be used as a sustainable management strategy for mangrove ecosystem. Sasi and kewang can be used since this local wisdom in natural resources management previously rooted in the local community. The objective of this study was to analyze the behavior of the community in the South Leitimur Sub-district in supporting the development of sasi and kewang as well as to analyze factors allegedly affecting the existence of sasi and kewang.

2. Research Method and Data Analysis
2.1. Research method
The adaptive research method was used in this study and was conducted in a participatory way. A comprehensive analysis was conducted in accordance with these aspects of natural resources and environment, human resources, socio-economic and institutional [18].

The study was conducted at the village of Rutong and Leihary of South Leitimur Sub-district of Ambon City (Figure 1). The choice of study site was done deliberately with considerations of mangrove ecosystem found in these sites and the presence of sasi and kewang as well.

Figure 1. Research location in South Leitimur District
The sample for this research was taken from the population from these two villages using disproportional sampling method [19]. The group of people sampled is divided into five groups i.e. government, customary, kewang, religious, and ordinary group. Sample proportion for the test of supporting or rejecting implementation of sasi was calculated using the following formula:

\[ Z = \frac{x/n - \pi_0}{\sqrt{\pi_0 (1 - \pi_0)/n}} \]

where : 
- \( x/n \) = Sample Proportion 
- \( n \) = Sample 
- \( x \) = Sample support for sasi. 
- \( \pi_0 \) = The known value (60% or 0.60)

With Criteria :
- \( H_0 : \pi = 0.60 \)
- \( H_1 : \pi > 0.60 \)
- \( H_0 \) reject if \( Z \geq Z_{0.5-\alpha} \).
- \( H_0 \) received if \( Z < Z_{0.5-\alpha} \).

The data collection consists of primary data and secondary data. The primary data was obtained by means of interview through focus group discussions as well as field observation, while secondary data was obtained through other previous related research.

2.2. Data analysis
A multiple regression analysis was used to analyze the relationship between attitudes of community (dependent variable) towards sasi (independent variable) with the following formula [20]:

\[ y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + \varepsilon \]

where :
- \( y \) = Behavior (attitude??) about/towards sasi. 
- \( a \) = Constanta 
- \( b \) = Regression coefficient 
- \( \varepsilon \) = Residual 
- \( x_1 \) = Formal Education. 
- \( x_2 \) = Knowledge about sasi. 
- \( x_3 \) = Group relation to sasi. 
- \( x_4 \) = Communication about sasi.

3. Result and discussion
Human behavior or attitude both individually or as a community in some cases determine the use and management of natural resources and the ecosystem. Human behavior can be expressed in the form of manner or norm. Human behavior is an activity that could be observed directly or could not be observed by outsider [21]. In the case of the community in Rutong, the community behavior towards mangrove ecosystem has a big impact on this ecosystem. That behavior is influenced by several factors namely perception, motivation, emotions and experience they have in their life. These factors will affect the community in the use and management of mangrove ecosystem. The multiple regression analysis was used to analyze the relationship of the factors towards implementation of sasi in the management of the mangrove ecosystem.
Table 1. Multiple regression analysis result of Rutong community background and *sasi* on mangrove ecosystem.

| Village | Variable        | Regr. Coef. | F<sub>count</sub> | F<sub>Table (0.01)</sub> | α<sub>(0.01)</sub> | t | Count | R<sup>2</sup> | Sig. |
|---------|----------------|-------------|------------------|---------------------------|-----------------|---|-------|-----------|-----|
|         | Education      | 0.227       | 64.02            | 3.87                      | 2.02            | 2.18 | 0.866 | 0.035    |     |
|         | Knowledge      | 3.447       | 2.02             | 8.32                      | 0.000           |     |       |           |     |
| Rutong  | Group Relation | 1.022       | 2.02             | 11.43                     | 0.000           |     |       |           |     |
|         | Communication  | 0.242       | 2.02             | 6.03                      | 0.000           |     |       |           |     |

The result in Table 1 shows that as a whole there is a relationship between community behavior and the practice of *sasi* in the management of the mangrove ecosystem. The partial regression coefficient of community behavior also significant at t<sub>α<sub>(0.01) except for education which significant at t<sub>↑α<sub>(0.05) ). This analysis shows a positive strong correlation between all community behavior towards the *sasi* approach at mangrove ecosystem at Rutong village. An increase in education, knowledge, group relation and communication will, in turn, increase the behavior of community in Rutong village in the management of mangrove ecosystem through *sasi*.

Interviewed was made with the respondent of Rutong village in order to obtain their perception towards the *sasi* of mangrove. Table 2 shows the result of that interviewed which explain that 87.50% of respondent support the implementation of *sasi* in the management of mangrove ecosystem whilst 12.50% against the implementation of *sasi* in mangrove management. This suggests that majority of Rutong community prefer to implement *sasi* as a management tool in mangrove ecosystem.

Table 2. The Behavior of the people against mangrove *Sasi* in Rutong

| No. | Community attitude | Res | Percentage (%) |
|-----|--------------------|-----|----------------|
| 1.  | Support (Score : 30-50) | 35  | 87.50          |
| 2.  | No Support (Score : 10-29) | 5   | 12.50          |
|     | Total              | 40  | 100.00         |

The results of Z analysis concerning proportion of community in Rutong supporting *sasi* on mangrove ecosystem shows that more than 60% of the community support implementation of *sasi* on mangrove ecosystem (Table 3). Several studies have shown that the use of *sasi* on the management of marine natural resources in some Central Maluku has declined in recent years [13, 14]. On the other hand study on the management of mangrove ecosystem in several villages at Western Seram, District has shown that *sasi* is not implemented in that area but the local people eager to implement *sasi* on mangrove ecosystem [22].

Tabel 3. The result of Z analysis on the proportion population in Rutong village supporting or against mangrove *sasi*

| Village | Z<sub>value</sub> | Decesion | Explanation |
|---------|-----------------|----------|-------------|
| Rutong  | 3.50            | Reject H0, because | More than 60% of poeple in Rutong support implementation of *sasi* |

Table 4 shows result summary of the analysis of variance of multiple regression relationship between Leahari village community backgrounds towards *sasi* on mangrove ecosystem. This result shows there is a strong relationship between community background towards implementation of *sasi* with coefficient correlation r = 0.9005 (R<sup>2</sup> = 0.811). This table also shows that from four community
background, only education which has not significantly related with *sasi* implementation on mangrove ecosystem, whilst the rest (knowledge, group, and experience) has high significant ($t_{0.01}$. As a whole, the people of Leahary positively support the use of *sasi* in the management of the mangrove ecosystem.

**Table 4.** Table 1. Multiple regression analysis result of Leahary community background and *sasi* implementation on mangrove ecosystem

| Village | Variable    | Coef. regesi | Fcount | F Table (0.01) | $t$ | $R^2$ | Sig. |
|---------|-------------|--------------|--------|----------------|-----|-------|------|
| Leahari | Education   | 0.0755       | 42.83  | 3.89           | 2.02| 0.68  | 0.811| 0.498|
|         | Knowledge   | 2.5856       |        |                | 2.02| 8.12  | 0.000|
|         | Group       | 0.4479       |        |                | 2.02| 4.0   | 0.000|
|         | Communication| 0.3795      |        |                | 2.02| 3.91  | 0.000|

Table 5 shows the result of an interview with respondents from Leahary village in relation to an issue of supporting and not supporting the implementation of *sasi* in the management of the mangrove ecosystem. The result shows that majority (95%) of respondent support the implementation of *sasi* on the management of mangrove ecosystem whilst only small proportion (5%) did not support it. In other words, the majority of local people of Leahary village agree to implement the use of *sasi* in the management of mangrove ecosystem in their village.

**Table 5.** Distribution about people behavior for mangrove *sasi* in Leahari

| No. | Behavior Category      | Number of Resp. | Percentage (%) |
|-----|------------------------|-----------------|----------------|
| 1.  | Support (Score : 30-50)| 38              | 95.00          |
| 2.  | No Support (Score : 10-29)| 2            | 5.00           |
| Total|                        | 40              | 100.00         |

The result of $Z$ analysis concerning the proportion of the population in Leahari village supporting and against the implementation of *sasi* on the management of mangrove ecosystem shows that more than 60% of the people support the implementation of *sasi* in the management of mangrove ecosystem (Table 6). This result is in accordance with the result of an interview shown in Table 5 which shows that 95% of the people of Leahari village support the use of *sasi* in the management of the mangrove ecosystem.

**Table 6.** The result of $Z$ analysis on the proportion population in Leahari village supporting or against mangrove *sasi*

| Village | $Z_{Count}$ | $Z_{Table}$ | Decision          | Explanation                              |
|---------|-------------|-------------|-------------------|------------------------------------------|
| Leahari | 4.518       | 2.33        | Reject $H_0$, because $Z_{count} > Z_{table}$ | More than 60% of people in Leahari village support implementation of *Sasi* |

Multiple regression analysis from this study shows that there is a relationship between people attitude and management of mangrove ecosystem through *sasi* approach. When the interview with people from Rutong village, 87.5% support implementation of *sasi* in the management of mangrove, whilst 95% of people from Leahari village also support the same approach. The $Z$ test also shows that more than 60% of people from these two villages support the implementation of *sasi* in mangrove management. All these analyses summarize that *sasi* and *kewang* as an institution responsible for
implementation of sasi still embedded as indigenous knowledge within the community of Rutong and Leahari village.

4. Conclusion
From this study, it can be concluded that community of Rutong and Leahari have a positive attitude towards the management of mangrove ecosystem through sasi approach and more the 60% of the community from these two villages support the implementation of sasi as a way in the sustainable management of mangrove ecosystem.

Recommendation
1. Regulation about sasi and kewang is needed in the management of mangrove in order to sustain that ecosystem;
2. The institution of kewang and its member capacity building should be empowered through workshop or education concerning sustainable management of marine natural resources.

References
[1] The Maritime and Fishery Departement 2011. Mangrove Management Guidelines. The Directorate General Maritime, Coastal and Small Islands (Jakarta-Indonesia: The Directorate KP3K) p 133.
[2] Karepesina S S, Susilo E and Indrayani E 2013 J. Ecsofim 1 (1) 25 – 41
[3] Nikijuluw V P H 1995 Community-based fisheries management (sasi) in Central Maluku. IARD Journal. 17(2), 33-39
[4] Adhuri D S 2004 How Can Traditional Marine Resources Management Support Responsible Fishery? Lessons learn from Maluku. IFFET 2004 Japan Proc. pp 1-13.
[5] Anonymous 2015. Sasi: Antara Kebanggan, Penghargaan, dan Keprihatinan. Policy Brief. http://kedesa.id/wp-content/uploads/2017/02/Policy-Brief%e2%80%9cSasi%e2%80%9d-Antara-Kebanggan-Penghargaan-dan-Keprihatinan.pdf p 4
[6] Nanlohy H, Asis N B, Ambariyanto, and Sahala H 2014 J. Regional and Environmental 2 89
[7] Nendissa R H 2010 J. Sasi 16 (4) 1 - 6
[8] Adam F P, Limba S, and Kasim M 2015. Modal sosial: kekuatan dalam hidup bermasyarakat disekitar Taman nasional Manusela Maluku Tengah. Policy Brief JIKTI 2015.p 8 https://www.batukarinfo.com/system/files/8_policy%20brief%20(felicia-sembuel-maaruf-kasim).pdf
[9] Satria A 2002 Introduction of Coastal Community Sosiology (Jakarta-Indonesia: PT Pustaka Cidesindo) p 155.
[10] Nanlohy H, Asis N B, Ambariyanto, and Sahala H 2013 Conf Proc, Departement of Urban Planning and Regional 23 Faculty of Engineering (Semarang-Indonesia: Diponegoro University).
[11] von Benda-Beckmann F, von Benda-Beckmann K and Brouwer A 1995 Changing “indigenous environmental law” in the Central Moluccas: Communal regulation and privatization of sasi’, Ekonlesia 2 1-38.
[12] Nikijuluw F P H 1994 Sasi sebagai satu pengelolaan sumberdaya berdasarkan komunitas (PSBK) di Pulau Saparua, Maluku. Jurnal Penelitian Perikanan Laut 93 79-92
[13] Novaczek I H T, Harkes J, Sopacula M D D Tatuhey 2001 An Institutional Analysis of Sasi Laut in Maluku, Indonesia, http://www.worldfishcenter.org/Naga/Naga24-3&4/pdf.
[14] Harkes I 2003 An Institutional Analysis of Sasi Laut, a Fisheries Management System in Indonesia. Proc of the Int Workshop on Fisheries Co-Management p 9
[15] Suyadi 2009 Kondisi Hutan Mangrove di Teluk Ambon: Prospek danTantangan. Berita Biologi. 9(5) 481-490.
[16] Suyadi. 2012. Satu dekade kondisi hutan mangrove di Teluk Ambon, Maluku. TulisanPendek. Jurnal Biologi Indonesia 8(1) 197-203
[17] Saptono M., Muryanidan C, and Santoso S. 2016. Kajian perubahan luas dan pemanfaatan serta persepsi masyarakat terhadap pelestarian hutan mangrove di KecamatanTeluk Ambon Baguala. *Jurnal GeoEco*. 2(2). 170-183

[18] Mikkelsen B 1999. *The Methodology Participatory and Empowerment* (Jakarta-Indonesia: The Foundation Torch) p 178

[19] Anonymous 2019. Disproportional sampling. [https://explorable.com/disproportional-sampling](https://explorable.com/disproportional-sampling)

[20] Zar J H 1999. *Biostatistical Analysis*. 4th Edition. (New Jersey, USA: Prentice Hall International, Inc) p 663

[21] Notoatmodjo S 2012. *Community Recources Development*. Revision Edition (Jakarta-Indonesia: Rineka Cipta Publisher) p 122.

[22] Nanlohy H, Asis N B, Ambariyanto, and Hutabarat S 2015. Coastal Communities Knowledge Level on Climate Change As a Consideration in Mangrove Ecosystems Management in the Kotania Bay, West Seram Regency. *Procedia Environmental Sciences* 23 157 – 163