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Fishermen Adherence on Source Utilization in Southeast Aru Conservation Area

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Abstract
Southeast Aru Conservation Area is stipulated in the decree of Ministry of Forestry of the Republic of Indonesia No. 27/Kpts-II/1991, as Marine Sanctuary which is fully managed by Department of Forestry Affairs, henceforth it is returned to the Ministry of Marine and Fisheries in 2009 through the decree of the Ministry of Marine and Fisheries No. 63/Men/2009 under the status of Water Nature Reserve (IN: Suaka Alam Perairan/SAP). Purpose of the establishment is to preserve endemic source which should be retained altogether with its ecosystem diversity. Decreasing of this existence along with the utilization rate by society which is predicted as simultaneity of society's social, economic and culture variables becomes the aim of this study to understand some factors. These factors affect the decision of society in adhering or violating formal regulation about conservation to formulate continuous management plan. Data collection method was performed by structured interview supported with list of questions, while analysis was performed by using basic model of adherence and renewable adherence model. Based on the analysis result, it is concluded that some factors affecting society's decision in adhering or violating formal regulation about conservation include economic profit frequency if the society catches fishes in conservation region, law enforcement capacity by *Jagawana* (EN: Rangers), productive age level and experienced men to access the sources as well as the background of society.

Keywords: Adherence, Source Utilization, Conservation Area**.**

1. Introduction

Southeast Aru Conservation Area is one of the conservation areas which is stipulated as conservation area by the central government based on the decree of Ministry of Forestry of the Republic of Indonesia No. 27/Kpts-II/1991 under the status of Southeast Aru Marine Sanctuary (MS). Southeast Aru MS area was appointed as conservation area based on the survey result of biophysical and socio-economical that this area must be retained because it had potentials endemic resources which should be protected, including turtle, dugong, and crocodile, supported with its ecosystem diversity and complexity.

Besides the consideration of biophysical parameter as explained above, another reckoned

consideration in appointing this region as conservation area are that:

a. This is an area with 7 islands, from which 3 islands of them are the outermost border islands between the government of Indonesia and Australia. The three intended islands are Enu, Coral, and Kultubai Selatan Island.
b. A region with its 7 islands consists of very small and uninhabited islands.
c. Among these seven islands, the two of them called as Enu and Coral Island are historical islands for all people in Aru because they were the place of origin away back (historical stories of Aru people), while the other 5 islands are historical islands for several surrounding villages, that are village of Longgar, Apara and Bemun.
d. Southeast Aru Conservation Areas are opposite directly to fishing ground in Arafura Sea.

In the time of appointment as Marine Sanctuary (MS), southeast Aru conservation area is fully managed by Department of Forestry Affairs under province based management called as Natural Resources Conservation Service/NRCS (IN: *Badan Konservasi Sumber Daya Alam*/BKSDA). Furthermore, it is returned to Ministry of Marine and Fisheries in 2009 through the decree of the Ministry of Marine and Fisheries No 63/Men/2009 under status changing of Southeast Aru Water Nature Reserve (WNR), with geographic coordinates at Table 1 and Figure 1.

Table 1 Frontier coordinate (degrees-minutes-seconds) of Southeast Aru Conservation Area

Point	Latitude			Longitude		
	Degrees (^{0})	Minutes (‘)	Seconds (“)	Degrees (^{0})	Minutes (‘)	Seconds (“)
1	6	49	4	134	41	24
2	6	51	32	134	46	9
3	6	58	13	134	49	18
4	7	2	18	134	44	14
5	7	8	15	134	29	15
6	7	7	2	134	23	31
7	6	56	5	134	27	13
8	6	54	5	134	29	26

Southeast Aru conservation area with 114,000 Ha width is dominated by open water zones by 85.06% while the lowest position is at mangrove forest ecosystem zones with percentage by 1.69% (Table 2). The existing ecosystem condition in Southeast Aru conservation area gives a strong contribution to the habitat, hunting and breeding sites for various resources inside of it.

Table 2 Zone area in Southeast Aru Conservation Area

Zone Area	1	2	3	4	5	6	7	Total (Km2)	%
Island Area	14.38	3.30	0.82	6.68	1.79	16.18	5.69	48.85	4.28
Mangrove	10.01	2.10	0.06	2.84	1.04	1.20	1.98	19.24	1.69
Seagrass	0.86	2.80	1.31	0.74	9.72	50.02	7.89	73.34	6.43
Coral	3.41	4.94	2.00	1.99	5.00	6.53	5.05	28.92	2.54
Open Waters								169.655	85.06
Total								114,000	100

Description:

1 = Enu Island
2.= Karang Island
3 = South Kultubai Island
4 = Jeh Island
5 = Mar Island
6 = Jeudin Island
7 = Marjinjin Island

Main objective of this sanctuary inauguration is to protect green sea turtle (*Chelonia mydas*) and hawksbill sea turtle (*Erelmochelys imbricala*) population which is known as the habitat and breeding sites in sandy beaches inside of conservation area's islands. Besides, it's global objective is to create main zone (sanctuary) for marine animal varieties along with its habitat such as turtle, dugong, siput mutiara and other species which can be utilized for commercial interest, thus nature reserve area can be utilized as a "reservoir" area.

Since the inauguration of this area as nature reserve, turtle hunting and egg catching still occurs by today (Sahertian and Noija, 1994; Far-Far, 2004) as well as the other natural resources exploitations in this area. This is in contradiction to the Act No. 5 of 1990. One of the exploitation causal factors in this area is that this location becomes customary land for generations for years and becomes the main income sources for them. Despite a local people, turtle hunting is also committed by fishermen from the outside of Maluku. It is estimated at about 4000 tails of maturity turtles are caught every year in Enu Island beach and commonly they are sold in Bali Island, Surabaya and Ujung Pandang.

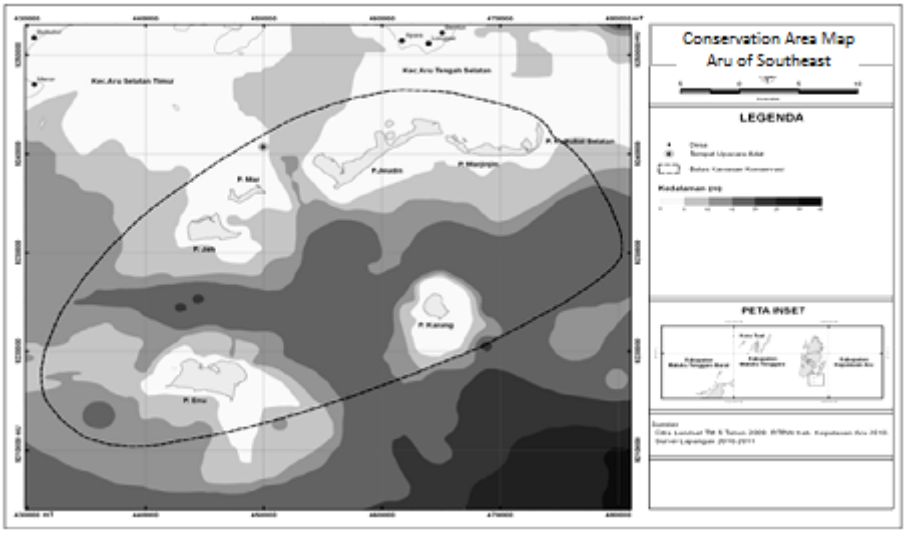

Figure 1 Map of Southeast Aru Conservation Area

90% of people in Aru Islands work as fisherman and mostly they populate coastal area and small islands. Coastal area as a region which is illustrated by (Bengen, 2005) as a small shaft where all creatures interact inside of it, is a problem complexity with a very difficult matters to be managed. Small island is a lowland characterized by having small population, less of resources, remoteness, susceptible of natural disaster, high dependent level on resources, access and infrastructure limits and also having expensive public services.

As a region consisting of small islands, it has a unique fishery resource characteristics and endemic species such as turtle, dugong and dolphin as well as complex and vary resource ecosystem. Characteristic of fishery resource in this area indicates that;

First; fishery resources of the area have decreased either for its island ecosystem, mangrove ecosystem, seagrass ecosystem, coral reefs ecosystem or its open waters ecosystem. *Second*; cause of fishery resources decrease in this area is a consequence of inhabitant raising number, thus it raises the number of utilization activities legally or illegally. *Third*; the occurrence of various utilization activities in the area is an accumulation of utilization area limitation which is intended to be used as Marine Sanctuary areas.

> Main role of protected area is being species diversity conservation, biodiversity conservation, along with ongoing resources management which can and should bring utilization for surrounding society (Brodziak *et al.*, 2005; Worm *at al.*, 2009). The Convention on Biological Diversity (The Secretariat of the Convention on Biological Diversity, 2008) states that protected area is an important tool for ecosystem and biological conservation as the supplier of resources and environment's service, thus it will form continuous development strategy basis. However, this effort often experiences obstacle in achieving the intended objective because the society is more isolated. It occurs because in the same time, people are trying to survive, especially in developing nations (Straede and Treue, 2006).

High utilization activities in this area are predicted as simultaneity of social, economic and cultural variables occurring in society's region, thus an analysis is needed to reveal

social-economic and cultural factors leading to fishery resource decrease in this area. This study aims to determine some factors affecting society's decision in adhering or violating formal regulation about conservation and to formulate and to recommend alternative policy in order to execute participative and continuous utilization areas.

2. Methodology of the Research

Data sampling method on society's perception in conservation areas is conducted on structural interview approach supported by question lists. Collective data related to biological resource utilization patterns of coastal area and beaches is collected by using approach of Participatory Rural Appraisal (PRA) methods.

Data analysis is conducted using adherence analysis based on adherence basis model I, adherence basis model II and expanded adherence model.

Adherence basis model I

Adherence analysis using Adherence Basis Model I as follows:

$$V = f(k, Gv, Gc, P_1)$$

Information:

V = Violation against formal regulation

Variable V is binary variables having 2 values, they are:

1. V value = 1; if the violation rate is above the average
2. V value = 0; if the violation rate is under the average

k = Constant

Gv = Economic profit if regulation is violated which is measured by the average value of haul per trip if the fishes is caught surrounding Enu Island

Gc = Economic profit if regulation is adhered, which is measured by the average value of haul per trip if the fishes is caught outside of Enu Island conservation areas

P1 = Admonished, arrested and prosecuted by *Jagawana* (Rangers) if regulation is violated

Information:

P1 = 1; if they had admonished by Jagawana

P1 = 0; If they had never admonished by Jagawana

Adherence basis model II

$$V = f(k, Gv, Gc, P_2)$$

Description:

P_2 = Determinant of various factors affecting the chances of being known, arrested and punished, then P2 is proxy by

X_1 = Patrol frequency

X_2 = Fisherman's marine motor capacity (HP or GT)

Hence, the formula is:

$V = f(k, Gv, Gc, X_1, X_2)$

Extended Adherence Model

$$V = (k, Gv, Gc, Z_1, Z_2, Z_3, Z_4, Z_5, Z_6)$$

Information:

Z_1 = Education, quantified by the total years of attending formal education activities

Z_2 = Size of Family, quantified by the number of family members.

Z_3 = Age, quantified by the respondent age level

Z_4 = Experience, measured by the number of respondent in attending education or training.

Z_5 = Background, measured by the status of respondent as indigenous person or migrant.

- If $Z_5 = 1$; this man is a migrant
- If $Z_5 = 0$; this man is an indigenous person

Z_6 = Religion, measured by the status of respondent for being a Christian or a Moslem.

- If $Z_6 = 1$; this man is a Moslem
- If $Z_6 = 0$; this man is a Christian

3. Result and Discussion

3.1. The Analysis of Adherence Basis Model I

Probit analysis result using adherence basis model I, considering violation as independent variable from which the independent variables are economic profit frequency if regulation is violated (Gv), economic profit frequency if regulation is adhered (Gc) and if they had admonished or had never admonished by *Jagawana* (P1), can be seen clearly in Table 1.

This result shows that those three mentioned factors affect to the waywardness of society in conservation areas. Among those three variables, economic profit frequency if regulation is violated become the most dominant variable or have the greatest effect into waywardness, this is shown by T value by 3.988. Usually, conservation activities have a tight relation with utilization level conducted by human being (Jackson and Sala, 2001; Stachowitsch, 2003; Halpern *et al*, 2008). Human resources having a great effect on coastal ecosystem, by which this case is in contradiction to human activities, gives various pressures which are simultaneously exploiting the coastal natural resources incorrectly (Crain *et al.*, 2008; Darling and Côté, 2008; Doak *et al.*, 2008; Halpern *et al.*, 2008).

Table 1. Probit Analysis Result on Adherence Basis Model I

PROBIT // Dependent Variable is VIOL
Date: 4-18-2005 / Time: 10:14
SMPL range: 1 - 119
Number of observations: 119
Convergence achieved after 4 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-2.4524552	0.5512766	-4.4486834	0.141
GV	6.153D-06	1.543D-06	3.9875744	0.156
GC	1.513D-07	1.590D-06	0.0951307	0.940
P1	0.0613029	0.3857607	0.1589142	0.900

Log likelihood -37.691485
Cases with VIOL = 1 20
Cases with VIOL = 0 99

VARIABLE	MEAN ALL	MEAN D=1	MEAN D=0
C	1.0000000	1.0000000	1.0000000
GV	191974.79	380000.00	153989.90
GC	244327.73	303750.00	232323.23
X1	0.3277311	0.4500000	0.3030303
X2	15.126050	15.750000	15.000000

Covariance Matrix

C,C	0.303906	C,GV	-5.50D-07
C,GC	-5.78D-07	C,P1	-0.050863
GV,GV	2.38D-12	GV,GC	-9.59D-14
GV,P1	-7.66D-09	GC,GC	2.53D-12
GC,P1	7.78D-08	P1,P1	0.148811

Magnitude of economic profit frequency effect if regulation is violated is triggered by dependence of society economically on the existing resources in conservation areas. Some factors affecting this dependence are that most of the petuanan territorial of local people are rented to entrepreneurs, thus conservation area become an alternative choice of resource utilization for economic interest in addition to existing resources kinds in this area. Number of this resource is reasonably available and it has high economic value such as siput mutiara, lola, sea cucumber, shark, abalone and turtle as well as another various biological resources. Conservation areas is an alternative choice considering that the history of this area is common property, thus it can be utilized by all people in Aru Islands.

Based on partially variable relationship as shown in covariance matrix, relationship between economic profit frequency if regulation is violated and the duty of Jagawana gives an indication that Jagawana has no supervision function in the area. To meet this challenge, it needs a carefully planned management which is truly and well performed and continues effort in monitoring and evaluating in order to better the existing management model.

3.2. Analysis Result of Adherence Basis Model II

Probit analysis result using adherence basis model II, considering violation (viol) as independent variable from which the independent variables are economic profit frequency if regulation is violated (Gv), economic profit frequency if regulation is adhered (Gc), patrol frequency (X_1) and fisherman's marine motor (X_2) is presented in Table 2.

Based on Table 2, it is known that it is only economic profit factor if regulation is violated (Gv) affect to waywardness or violation. This is shown by T value by 4.225. Magnitude of economic profit frequency effect if regulation is violated is triggered by dependence of society economically on the existing resources in conservation areas. This case is in line with some research stating that worldwide coastal ecosystem interact potentially with human activities, thus there are no coastal areas and small islands which are still pure or untouched by human being (Jackson and Sala, 2001; Stachowitsch, 2003;. Halpern et al, 2008). Human gives a huge effect on coastal areas (Vitousek *et al*, 1997; Halpern et al., 2008). Contradiction of human activities give a various pressures which are standing simultaneously in delivering pressing response to the ecosystem (Halpern at al, 2008).

Table 2. Probit Analysis Result on Adherence Basis Model II

PROBIT // Dependent Variable is VIOL

Date: 4-18-2005 / Time: 10:19
SMPL range: 1 - 119
Number of observations: 119
Convergence achieved after 4 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-2.1700574	0.6739254	-3.2200261	0.192
GV	6.719D-06	1.590D-06	4.2247037	0.148
GC	-3.778D-07	1.816D-06	-0.2080987	0.869
X1	-0.4696763	0.4093190	-1.1474577	0.456
X2	-0.0093808	0.0413672	-0.2267682	0.858

Log likelihood -37.022777
Cases with VIOL = 1 20
Cases with VIOL = 0 99

VARIABLE	MEAN ALL	MEAN D=1	MEAN D=0
C	1.0000000	1.0000000	1.0000000
GV	191974.79	380000.00	153989.90
GC	244327.73	303750.00	232323.23
X1	0.3277311	0.4500000	0.3030303
X2	15.126050	15.750000	15.000000

Covariance Matrix

C,C	0.454175	C,GV	-4.08D-07
C,GC	-2.00D-07	C,X1	-0.090971
C,X2	-0.017981	GV,GV	2.53D-12
GV,GC	-6.49D-13	GV,X1	-2.22D-07
GV,X2	4.75D-10	GC,GC	3.30D-12
GC,X1	1.18D-07	GC,X2	-3.22D-08
X1,X1	0.167542	X1,X2	0.004736
X2,X2	0.001711		

On the contrary, economic profit frequency if regulation is adhered (Gc), patrol frequency (X1) and fisherman's marine motor capacity (X2) do not affect to waywardness or violation. (Gc) variable do not give effect because resource utilization activities are conducted outside of conservation areas. It indicates that resource utilization activities outside of conservation areas contribute in limiting people's waywardness to utilize resources in conservation areas.
X_1 variable with no effect indicates that there are problems in patrol process which should be performed by Jagawana (Rangers). These problems are caused by limited personnel number

in Jagawana (3 people only), patrol infrastructure constraints (1 speedboat only) and equivocal performance of law enforcement capacity by Jagawana. While fisherman's marine motor capacity (X_2) variable gives a very low chance for those who access this area. It can be seen from the marine motor capacity ranging from 10 – 25 HP. Low power of the existing marine motor capacity makes people feel afraid to utilize the existing resources inside the area, although the existence of marine motor capacity support their effort to reach conservation areas (positive relationship of Gv-X_2 variables).

3.3. Analysis Result of Extended Adherence Model

Probit analysis result using extended adherence basis model, considering violation as independent variable from which the independent variables are economic profit frequency if regulation is violated (Gv), economic profit frequency if regulation is adhered (Gc), education (Z_1), and Size of Family (Z_2), Age (Z_3), Experience (Z_4), Background (Z_5) and religion (Z_6) are clearly stated in Table 3.

Table 3. Probit Analysis Result against Extended Adherence Model

PROBIT // Dependent Variable is VIOL
Date: 4-18-2005 / Time: 10:22
SMPL range: 1 - 119
Number of observations: 119
Convergence achieved after 4 iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT.	2-TAIL SIG.
C	-5.5094234	1.8106655	-3.0427616	0.202
GV	7.790D-06	1.964D-06	3.9653043	0.157
GC	1.521D-06	1.748D-06	0.8705389	0.544
Z1	-0.1661646	0.1341723	-1.2384418	0.432
Z2	-0.0692764	0.1688963	-0.4101713	0.752
Z3	0.1094759	0.0459347	2.3832921	0.253
Z4	-0.0908003	0.4641122	-0.1956430	0.877
Z5	0.6705926	0.6738284	0.9951979	0.502
Z6	-0.1852323	0.5940754	-0.3117992	0.808

Log likelihood -29.446584
Cases with VIOL = 1 20
Cases with VIOL = 0 99

VARIABLE	MEAN ALL	MEAN D=1	MEAN D=0
C	1.0000000	1.0000000	1.0000000
GV	191974.79	380000.00	153989.90
GC	244327.73	303750.00	232323.23
Z1	6.7983193	6.0000000	6.9595960
Z2	3.6302521	4.2000000	3.5151515
Z3	32.285714	34.700000	31.797980
Z4	0.1764706	0.1500000	0.1818182
Z5	0.0756303	0.1000000	0.0707071
Z6	0.1428571	0.0500000	0.1616162

Covariance Matrix

C,GC	-9.52D-07	C,Z1	-0.111538
C,Z2	0.053768	C,Z3	-0.063775
C,Z4	0.299904	C,Z5	-0.200231
C,Z6	-0.063443	GV,GV	3.86D-12
GV,GC	2.75D-13	GV,Z1	-2.01D-08
GV,Z2	-8.75D-08	GV,Z3	2.97D-08
GV,Z4	1.90D-07	GV,Z5	1.61D-07
GV,Z6	1.51D-07	GC,GC	3.05D-12
GC,Z1	-3.72D-08	GC,Z2	-4.11D-08
GC,Z3	1.66D-08	GC,Z4	-1.35D-07
GC,Z5	1.74D-07	GC,Z6	3.21D-08
Z1,Z1	0.018002	Z1,Z2	0.003468
Z1,Z3	7.93D-05	Z1,Z4	-0.008640
Z1,Z5	-0.005174	Z1,Z6	-0.010009
Z2,Z2	0.028526	Z2,Z3	-0.004695
Z2,Z4	0.011146	Z2,Z5	-0.021473
Z2,Z6	0.004299	Z3,Z3	0.002110
Z3,Z4	-0.009992	Z3,Z5	0.005884
Z3,Z6	0.000448	Z4,Z4	0.215400
Z4,Z5	-0.035272	Z4,Z6	0.028728
Z5,Z5	0.454045	Z5,Z6	0.040242
Z6,Z6	0.352926		

Based on Table 3, there are four factors affecting society's waywardness in conservation areas, they are: Gv, Gc, Z_3 and Z_5. Among those four variables, economic profit frequency if regulation is violated and age variable are variables with the highest effect on waywardness

or violation. This is shown by T value of Gv by 3.965 and of Z_3 by 2.383.

Gv variable as explained above is enough to give effect because of the existing dependence economically on the existing resources in conservation areas. While age variable tends to give effect because of two main factors, they are: (1) performance of the society who often access the areas are those who are still young and (2) those who are experienced and have knowledge on the existing biological resource potential surrounding the areas. This second factor is only found from several aged respondents ranging from 40 to 50 years old. These two factors encourage society surrounding conservation areas to have resources utilization business.

Partially variable relationship in covariance matrix shows that relationship between Gv-Z_3, Gv-Z_4, Gv-Z_5, Gc-Z_3, and Gc-Z_5. is positive. Relationship between economic profit frequency if regulation is violated and age, experience, background and religion means that society's tendency to utilize biological resources in the areas is caused by productive age of society's capacity who are able to reach the areas compared with those who are non-productive. On the contrary, factor of experience also gives a chance for the society surrounding the areas to continuously utilize the existing resources because knowledge and technology mastery are grown well. Besides, migrant community tends to access these resources because they have low feeling of common property and usual low adherence level.

Another positive relationship between economic profit frequency outside of conservation areas and factor of age and background shows that society's effort capacity under productive age groups will tend to open chance for them to utilize the resources, whether those who stay inside or outside of conservation areas, even the booster factor of biological resource utilization become the reason of economic interest. While migrant community in their resource utilization pattern do not pay attention on the limitation of local community petuanan territorial (tradition), thus it opens a chance for them to continuously utilize the resources as long as their ability can do so.

4. Conclusion

Factors affecting society's decision in adhering or violating formal regulation about conservation include economic profit frequency if the society is fishing in conservation region, law enforcement capacity by *Jagawana* (EN: Rangers) against infringement in conservation area, productive age level and those who are experienced to access the sources as well as the background of the society, especially those who are migrant.

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