Applied Ecology and Environmental Sciences, 2018, Vol. 6, No. 1, 31-34
Available online at http://pubs.sciepub.com/aees/6/1/5

DOI:10.12691/aees-6-1-5

Bioecoregion and Socio-Economic Connectivity Oriented Coastal Zone Management

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Abstract The coastal zone of Garut District is a region characterized by a strong influence of marine-terrestrial ecosystem transition. This condition results in a unique bioecoregion characteristics in terms of rich fishery and marine tourism biodiversity, which is potential for the growth of economy that is characterized with a tight bioecoregion and socioeconomic connectivity. Furthermore, this will bring an implication where a uniquely designed resource management is relevant. Recognizing the economic potential, the resulting complexity, and the management implication, this research was carried out to analyze the coastal zone management that is oriented at bioecoregion and socioeconomic connectivity. A qualitative descriptive case study approach was adopted in this research. The data used are primary data which were collected through questionnaire-guided interviews and focus group discussion, and secondary data gathered through literature review. The result shows that the most important factors to accounted for in coastal zone management in this region are: (1) interdependence among sectors, capture fishery and marine tourism, and (2) integration between social and economic systems. Based on this, this research recommends a synergized networking model which covers bioecoregion and socioeconomic connectivity elements for managing the coastal region.

Keywords: *bioecoregion, connectivity, coastal economy, social, management*

Cite This Article: Atikah Nurhayati, and A.H. Purnomo, "Bioecoregion and Socio-Economic Connectivity Oriented Coastal Zone Management." *Applied Ecology and Environmental Sciences*, vol. 6, no. 1 (2018): 31-34. doi: 10.12691/aees-6-1-5.

1. Introduction

Management of Garut District coastal zone is not optimal. This fact is very unfortunate because the economic potential of this zone, especially around the area of Sentolo Beach of Cikeulet Sub District is very high. The economic potential can be associated with both in the capture fishery and marine tourism sectors. So far, resource exploitation in through economic activities in those two sectors has been able to deliver substantial benefits to the district, but there is indication that the activities also cause negative impact, which threaten the future of not only the resource but also the economic services mentioned above.

Management of fisheries resources comprises various factors which are interrelated and affect their current functions and services to human beings. Among others there are economic activities in coastal areas, which generally involve other sectors, marine tourism, agriculture and industrial sectors [1].

Another issue that challenges Garut authority in managing the coastal area is imbalanced benefit distribution among its citizens. Despite the big overall economic magnitude, fisheries and marine tourism's benefits in this area are enjoyed by a much fewer portion of market players. A bigger portion of fishers, fish farmers, fish processors, retailers as well as marine tourism operators are small players that earn small benefits. [2].

The next issue is connectivity. Nurhayati and Purnomo [1] found in their research that management of coastal resources in the region comprises various factors which are interconnected and affect resource's current functions and services to human beings. Bioecoregion setting so that existing conditions can be improved toward the set goals [3]. These include marine tourism, capture fishery, agriculture and industrial economic functions. Connectivity become relevant because economic activities often take place in a precisely same geographical points, involving the same players and / or overlapping economic network, and dealing with resources that interrelated one with another.

Based on the above, formulation of a uniquely designed coastal zone management model, i.e., which takes into account bioecoregion and socioeconomic connectivity becomes relevant for Garut. With such a management model, it is expected that economic activities, especially capture fishery and marine tourism in the area will bring equally maximum benefit to people without jeopardizing the future of the resource and its economic functions.

Following Matsuda et al [4], the management model should covers a number of strategies aimed at maintaining resources. And, considering that there are multiple local

interests in the area, a co management as suggested by Carlssona [5], where some arrangement of power sharing between the state and a community of resource users is advanced, might also be considered.

2. Methode

The methodological approach applied in this research was a quantitative descriptive case study, wherein focus was given to capture fishery and marine tourism bioecoregion. Selection of respondent was carried out purposively sampling, where a total of 30 samples were drawn from market players in the area of Santolo Beach of Cikeulet Sub District. The data used are primary and secondary data, then test the validity. Validity is a measure that indicates the level of validity or validity of an instrument. Validity test used in an attempt to maximize the quality of measuring instruments and to minimize the likelihood of error. An instrument is said to be valid if it is able to measure what you want measured. How that can be used is to calculate the correlation between each question with a total score. If $r_{calculate} > r_{table}$ then the question is valid, whereas if the $r_{calculate} < r_{table}$ then the question is not valid. To find the value of the correlation is the author using the formula Pearson Product Moment ([6]: 144) as follows:

$$rxy = \frac{n\sum xy - \sum xy}{\sqrt{\left[n\sum x^2 - (\sum x)^2\right] - [n\sum y^2 - (\sum y)^2]}}$$

Description :
r xy = coefficient of correlation between the variables x and y
x = Number certain score
y = Number of total score
n = Number of samples

If r xy value greater than or equal to r_{table} the item questionnaire / question was valid. Conversely, if the value is less than r r xy $_{table}$ then item questionnaire / question was invalid [7]. Reliability refers to a notion that an instrument is is credible as to to be used as a data collector, because the instrument is good ([6]: 154). The formula used to measure the level of reliability in this study are as follows:

$$r_{11} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum_{\sigma b}^2}{\sigma b_t^2}\right]$$

Description :
r_{11} = Reliability instruments
k = Number of granules or many questions
σb^2 = variable item
σb_t^2 = variable questions

In this analysis for multiple regresion, the dependent variable was (Y), i.e., fishers' socio-economic condition. Meanwhile, the independent variables were X_1 (fish species), X_2 setting characteristic conditions; X_3 (habitat conditions); X_4 (teritorial border), X_5 (capture fisheries), X_6 (fisheries pattern), X_7 (marine tourism).

$$Y' = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

The null and alternative hypothesis is set as follows: Ho:$b_1=b_2=b_3=b_4=b_5=b_6=b_7=b_8=0$ means that all independent variables, X_1 (fish species), X_2 setting characteristic conditions; X_3 (habitat conditions); X_4 (teritorial border), X_5 (capture fisheries), X_6 (fisheries pattern), X_7 (marine tourism), concurrently have no effect on fishers social economic connectivity. Ho:$b_1 \neq b_2 \neq b_3 \neq b_4 \neq b_5 \neq b_6 \neq b_7 \neq b_8 \neq 0$ means that all independent variables, X_1 (fish species), X_2 setting characteristic conditions; X_3 (habitat conditions); X_4 (teritorial border), X_5 (capture fisheries), X_6 (fisheries pattern), X_7 (marine tourism), concurrently affect fishers social economic connectivity with a 95% significance level.

3. Result and Discussion

Garut is geographically located at position 107°25'8"-108°7'30" East Longitude and 6°56'49"- 7°45'00" South latitude. Garut is located in the province of West Java, with the following boundaries: west bordering Cianjur and Bandung districtGarut is geographically located at position 107°25'8"-108°7'30" East Longitude and 6°56'49"- 7°45'00" South latitude. Garut is located in the province of West Java, with the following boundaries: west bordering Cianjur and Bandung district east Sumedang Tasikmalaya district north and south Indian Ocean. One of the beach in Garut is Santolo beach, Santolo Beach is a marine tourism area which administratively is under the Sub-district of Cikelet, covering a geographic area of 21.643 Ha. This beach is located between 107°37' to 107°46' West Longitude and 07°28' to 07°40' South Latitude. The administrative border of the beach are as follows: to the north is Sub-district of Cikajang, to the south is the Indian Ocean, to the east is the sub-district of Cisompet, while to the west is the Sub-district of Pakenjeng. Water need for this area is met by a number of sources including river flows, surface water and water spring. In this area, there are 5 rivers flowing to the Indian Ocean, namely Cipalebuh River, Cilauteureun River, Cipasarangan River, Cimangke River and Cimari River.

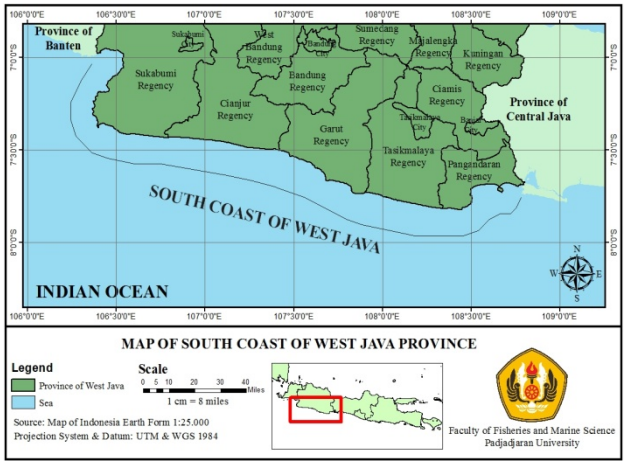

Figure 1. Bioecoregion Santolo Beach Sub District Cikelet District Garut

The bioecoregion of Garut District is characterized with coastal line as long as 80 Km stretching in the south covering a number of sub-districts including Caringin Sub-district, Mekarmukti Sub-district, Bungbulang Sub-district, Pakenjeng Sub-district, Cikelet Sub-district, Pameungpeuk Sub-district and Cibalong Sub-district. This area has a mangrove potential which lies mainly on the territorial area of Cibalong Sub-district. Meanwhile, Sea grass grows almost all along the coast line. Seaweeds grow naturally in the water area of Cikelet, Cibalong, Pakenjeng dan Caringin.

The potential of marine biota includes a variety of pelagic fishes such as skipjack (*Katsuwonus pelamis*), Layaran (*Istiophorus iroantalis*), Tembang (*Sardinella gibbosa*), Tongkol (*Euthynnus affinis*), and demarsal fishes such as Kakap (*Lutjanus campechanus*), shark fish (*Charcharinus* sp.), Grouper (*Chromileptes altivelis*), crustacea (shrimps and crabs), mollusks (sea cucumbers/*Holothuroidea*, sea urchins *Echinoidea*, starfishes /*Asteroidea*) and other marine biotas [2].

The sustainable resource potential (MSY) of Garut including the EEZ waters which covers a water area or approximately 28,560 Km^2 is estimated as much as 10,000 Tons. Among others, the most important are tuna, tongkol, skipjack (*Katsuwonus pelamis*), squids, layur, kakap (*Lutjanus campechanus)*, bawal hitam, grouper (*Chromileptes altivelis*), baronang, bottle shark (*Charcharinus* sp.), and lobster. In additions to those species, sea weeds are very potential [2].

In addition to capture fishery potential, Garut also is potential for brackish water aquaculture, which is supported by 1,000 Ha aquaculture area. A number underutilized potential marine ecosystem are also available. These include estuary (24 Ha), coral (525 Ha), sea grass (75 Ha) and mangrove (50.9 Ha) (Fisheries and Veternirary Service Garut 2015). Other resource potentials of Garut are tidal energy, especially in the bay and estuary waters. A number of mineral resource potentials are also available, namely tin ores, iron ores, beach sand, rocks, cobalt, mangan and others.

Garut District also has a very good potential for marine tourism. Charming beaches are among those that attract tourists (Fisheries and Veternirary Service Garut 2015). With respect to aquaculture fishery, the potential of Garut Regency includes 1,000 Ha shrimp ponds, lakes and swamps (258 Ha), river (774.17 Km), running water ponds (74 units), still water ponds (4,000 Ha), paddy fields (21,000 Ha) and marine culture (1,660 Ha) [2].

Based on the results of the data in the field list of questions given to respondents about the research variables correlation values are (X_1) fish species 0.41, (X_2) setting characteristic conditions 0.39; (X_3) habitat conditions 0.42; (X_4), teritorial border 0.47, (X_5) capture fisheries 0.35, (X_6) fisheries pattren enviromental 0.38, (X_7) marine tourism 0.30, all variables have a correlation coefficient > 0.300, so it can be said that the data used has validity value.

Reliability test is used to measure the level of consistency of respondents to the questionnaire statement item based on an understanding of respondents to the questions in the questionnaire. Reliability tests conducted by the Alpha method. The result of the calculation of the reliability coefficient obtained for 0.87 shows the number ≥ 0.60 based on tables of significance r = 5%. Overall the variables that have been tested showed reliable results and can be used as a base to conduct research. The minimum limit of reliability using Cronbach Alpha is 0.6 [8].

The coefficient of determination (R^2) of 0.78 means that 78% of the variables used in this study can interpret the value of connectivity biophysical and socio economic connectifity oriented coastal zone management while the remaining 22% of variables not included in the study variables.

It was found that F_{calc} was 2.334, which is greater than F_{tabel} which was 1.352 and therefore the null hypothesis is rejected. Given this, it can be concluded that all independent variables, X_1 (fish species), X_2 setting characteristic conditions; X_3 (habitat conditions); X_4 (teritorial border), X_5 (capture fisheries), X_6 (fisheries pattern), X_7 (marine tourism), concurrently affect on fishers social economic connectivity.

From the t-test analyses, however, it was found that some variables significantly affect the connectivity while others do not. The critical t value is 2.042; therefore the independent variables that give partial influence are X_1 (fish species) with a t value of 3.594, X_3 (habitat conditions) with a t value of 3.609, X_5 (capture fisheries) with a t value of 3.256, X_7 (enviromental) with a t value of 3.507, and X_8 (marine tourism) with a t value of 3.898. Meanwhile, dependent variables that do not give partial influence are X_2 (setting characteristic conditions) with a t value of -1.520, X_4 (teritorial border) with a t value of -1.425, X_6 (fisheries pattern enviromental) with a t value of-0.431.

This statistic finding provide value informations that can be used to improved the coatal zona management developed by Nurhayati, 2012 [9]. Nurhayati' model outlined sinergized link betwen policy, markets player behavior, and the management goals. There for the result present research, if combained with Nurhayati's model will result in a model such as depicted in Figure 2.

Bioecoregion conectivity in South Coast of Garut including economic resources of fisheries and maritime the indicator is production of fisheries, the energy sea, fisheries industry, export fisheries product, participation of fishermen in development and marine tourism. Bioecoregion conectivity need maritime facilities and infrastructure the indicator is improvement of port facilities, increasing capacity of fishing vessels, environmentally friendly fishing gear, information systems to improve connectivity inter-regions. Bioecoregion conectivity have challenge is competitiveness and maritime & productivity that is regional defense and security system, marine culture, monitoring of utilization fishery resources, local wisdom, development of fisheries and marine science .

For the case of the South Coast of Garut, given the exixting of bioecoregion condition, the implementation sosioeconomic conectivity with costal zona management is improvement in public educations regarding the connectivity fisheries and other resource potentials, infrastructure development of fisheries and marine tourism and market driven marine product.

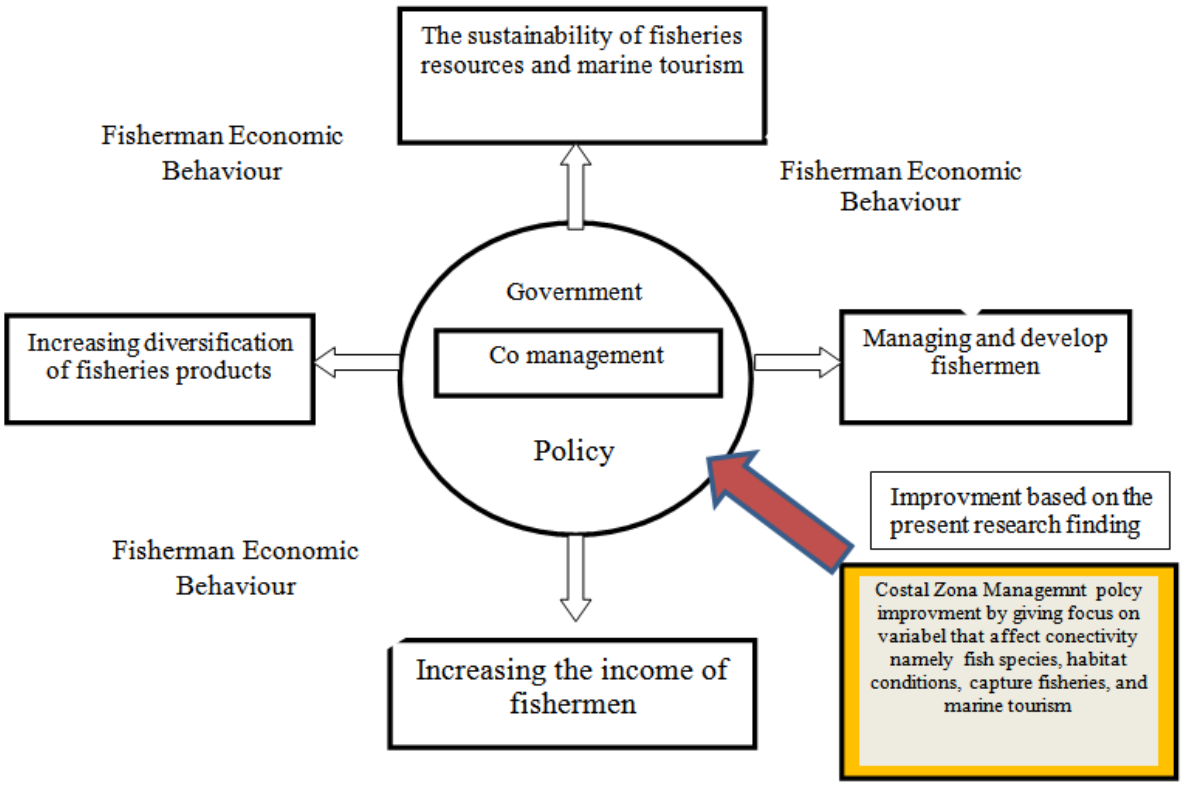

Figure 2. Models Bioecoregion and Socio Economic Conectivity Oriented Coastal Zona Management

Bioecoregional conditions of Garut can be described as: (1) A landscape covering interlinked habitat: magrove, fishing ground, seagrass, seaweed: (2) Each habitat as the pontential for economic development: fisheries production and marine tourism: (3) Each habitat has different ecological function: protections from abrasion, nursery ground. Socioeconomic connectivity of Garut can be described as: (1) Socioeconomic conditions are influnce simultaneously by a number of factors associated with the existing bioecoregional conditions; (2) Those factors are: fishing gear, fish species, habitat conditions; teritorial border, marine tourism visit; (3) Disturbances that happend to any of these factors will affect another factors.

4. Conclusion

This research recommends a synergized networking model which covers bioecoregion and socioeconomic connectivity elements for managing the coastal region. The improving the bioecological conditions should be done. The Following are actions that can be: Optimizing the connectivity, e.g mainly through development of better infrastructure, Improving the people understanding about the implication of bioecoregional setting, e.g throuh advancement of people" educations, distributing weight of develoopment focus following the bioecoregional.

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