

# An Environmentally Friendly Fisheries Resource Use Pattern in Pangandaran Based on Its Bioecoregional Conditions (A Case Study in Pangandaran, West Java Province, Indonesia)

Atikah Nurhayati<sup>1,\*</sup>, Agus Heri Purnomo<sup>2</sup>

<sup>1</sup>Faculty of Fisheries and Marine Science, Padjadjaran University

<sup>2</sup>Ministry of Marine and Fisheries of Republic Indonesia

\*Corresponding author: nurhayati\_atikah@yahoo.com

Received December 10, 2018; Revised January 13, 2019; Accepted April 10, 2019

**Abstract** Coastal development in Pangandaran West Java Province can be carried out through optimization of the fisheries resources potential and is expected to bring about prosperity to the local communities. The potential can be associated with the premise of unique favorable bioecoregional condition, where fisheries industry may grow side by side with the marine tourism. This research aims to determine an environmentally friendly fisheries use pattern for Pangandaran, considering the bioecoregional condition and factors influencing the economic value that can be generated through fisheries exploitation. The research follows a case study methodological framework supported by data collected through a cluster random sampling technique. Primary data were collected through interviews with respondents which included 20 fishermen and 15 traders; secondary data in the meantime were gathered from documented information available at relevant institutions. The primary analytical tools are quantitative descriptive and multiple linear regression. Based on the research, it can be concluded that considering the bioecoregional condition, fisheries development can be done by focusing on a number of economic species including *Colossoma macropomum*, *Metapenaeus monoceros*, *Trichiurus lepturus*, *Scomberomorini*, *Katsuwonus pelamis*, *Thunnus Albacares*. In line with this, important factors that should be taken care of these are fishing season, types of fishing gear, type of vessel size, operational production time, fishing experience, amount crew, resources of capital and zoning distance fishing.

**Keywords:** bioecoregional, environmentally friendly, fisheries, resources, use pattern

**Cite This Article:** Atikah Nurhayati, and Agus Heri Purnomo, "An Environmentally Friendly Fisheries Resource Use Pattern in Pangandaran Based on Its Bioecoregional Conditions (A Case Study in Pangandaran, West Java Province, Indonesia)." *Journal of Ocean Research*, vol. 4, no. 1 (2019): 1-5. doi: 10.12691/jor-4-1-1.

## 1. Introduction

Pangandaran coastal development by optimizing the potential of fisheries resources is expected to have economic value to local communities. Bioecoregions in Pangandaran has unique characteristics that are owned by natural resources, especially in the fisheries sector. Management of fisheries resources is an integrated process ranging from information gathering, analysis, planning, consultation, decision-making, resource allocation and implementation, in order to ensure sustainability of productivity and achievement of management objectives [1].

Management of coastal areas and small islands is a coordination of planning, utilization, monitoring, and controlling of coastal resources and small islands of the central government and local government, between

terrestrial and marine ecosystems, as well as science and management to improving community welfare [2]. Coastal resources and small islands is the biological resources, non-biological resources artificial resources, and environmental services. Biological resources include fish, coral reefs, seagrass meadows, mangroves and other marine life. Non biological resources include sea sand, seabed minerals. Artificial resources include marine infrastructure associated with marine and fisheries and environmental services the beauty of natural resources, for marine tourism. Bioecoregion are landscapes that are within a stretch of ecological entity established by natural boundaries, such as watersheds, bays, and currents [2]. Bioecoregion conditions in Pangandaran have specific functions that are determined based on physical, biological, social, and economic characteristics based on the spatial layout of coastal areas [1,2,3,4].

The importance of the spatial layout of the coastal area based on bioecoregion, the Pangandaran, West Java

Province area has developed spatial planning that focuses on two sectors of marine-based economy, namely capture fisheries and marine tourism [3,4]. Pangandaran coastal area management must involve stakeholders, including local governments, local communities, and investors to optimize capture fisheries resources and marine tourism for sustainability. One thing to note about the use of environmentally friendly fishing gear, so as not to damage the environment and coastal resources, this is the basis of synergy in the management of fisheries resources based on sustainable economic value [5].

Sustainability of fisheries resources involves stakeholders in diversifications employment in the fisheries and marine sector, especially fishermen with a scale of subsistence fisheries that shifts towards the commercial direction, by modifying the use of fishing gear. In the maritime tourism sector with the type of recreational tourism fishing there has been a trend for current conditions [6,7].

Marine tourism recreation fish fishing increases along with the economic development of the community. Fishing tourism conditions have now undergone changes in habitat and ecosystems that are affected by various impacts associated with fishing with the use of fishing equipment that is not environmentally friendly [8]. Economic activities in the capture fisheries sector and marine tourism, encourage conservation efforts to maintain the balance of the ecosystem [9].

The economic activities of capture fisheries provide an ecosystem threat to biodiversity in the sea, such as the use of non-environmentally friendly fishing gear, overfishing, that is not in accordance with the catch target. Unsustainable fishing will have an impact on the decline of ecosystems and the loss of fish or fish species that are endemic to the ecosystem [10]. In addition, climate change will affect the biophysical conditions of the ecosystem of capture fisheries resources on fish catches and prices [11]. The biodiversity of capture fisheries resources includes differences in the types of fish, the number or availability of fish stocks [12].

Over exploitation capture fisheries, the use of fishing gear that are not environmentally friendly and climate change affects, will threaten the biodiversity of the ecosystem in the sea and habitat destruction. Catching fish that does not pay attention to sustainability aspects can result in a decline in capture fisheries products [6,11,12,13]. The level of sustainability of marine tourism and capture fisheries, requires management of coastal area, in which there are value of natural resources conservation, technological and institutional development in the fisheries and marine sector, so as to be able to provide benefit to the community present and the future [15]. This research aims to analyze biocoregion-based fisheries resources and factors that influence the economic value of environmentally friendly fisheries resources in Pangandaran, West Java Province.

## 2. Material and Methods

The research method using case studies, with respondents using technique cluster random sampling. The

data used are primary and secondary data. The primary data is done with interview techniques and focus group discussion. Secondary data were obtained from the department of fisheries and marine pangandaran district. The data obtained in the field and then collected and processed using Multiple Regression Analysis Model where there are a number of independent variables associated with the dependent variable. If the independent variable in this study is the  $X_1, X_2, X_3, \dots, X_n$  and the dependent variable  $Y$ , the shape / the general formula of multiple regressions are as follows:

$X_1$ : fishing season  
 $X_2$ : types of fishing gear  
 $X_3$ : the type of vessel  
 $X_4$ : operational production time  
 $X_5$ : fishing experience  
 $X_6$ : amount crew  
 $X_7$ : resources of capital  
 $X_8$ : zoning distance fishing

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8.$$

Measures multiple linear regression analysis was conducted to test the relationship between the independent variables ( $X_1, X_2, X_3, \dots, X_8$ ) with the dependent variable ( $Y$ ) used the coefficient of determination ( $R^2$ ). To test the effect of independent variables ( $X_1, X_2, X_3, \dots, X_8$ ) simultaneously to the dependent variable ( $Y$ ).

## 3. Results and Discussion

### 3.1. Research Location

Pangandaran is one of the centers of fisheries and tourism production ranging from capture fisheries, aquaculture fisheries, processing of fishery products, and marine tourism in Pangandaran, West Java Province. Pangandaran Regency is geographically located at coordinates  $108^\circ 41' - 109^\circ$  East Longitude and  $07^\circ 41' - 07^\circ 50'$  South Latitude has an area reaching  $61 \text{ km}^2$  with the area of sea and coast with regional boundaries as follows: North: Ciamis and Banjarsari, West: Parigi, East: Cilacap, South: Indian Ocean.

Pangandaran has a tropical climate with two seasons, namely dry season or east season and rainy season or western season. The east season occurs from May to October, the sea conditions are not large and the waters are calm, so fishing operations in the sea are not disturbed. West season occurs from November to April, sea conditions with large waves and high rainfall, so that many fishermen do not carry out fishing activities at sea. Based on the method of data collection by conducting interviews with respondents using purposive sampling, the respondents were 30 respondents.

Pangandaran coastal area consists of six sub-districts which each have a coastal tourism area and capture fisheries potential, which must be able to be processed optimally by taking into account the sustainability of fisheries resources. [3,5].

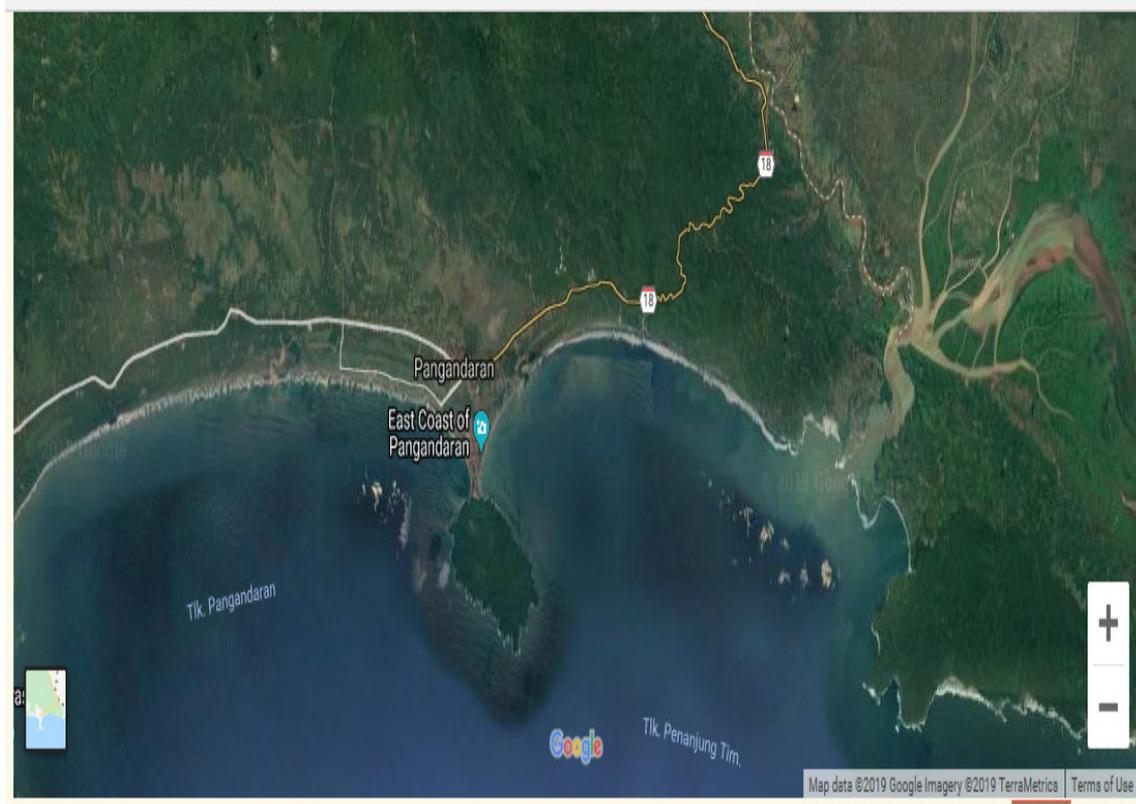


Figure 1. Research Location Pangandaran, West Java Province, Indonesia

Table 1. Number, Type and Size as well as Long Beach Coastal Village, District Pangandaran 2016

No	Sub District	Total Number of Village	The Type of Village		Area (km <sup>2</sup> )	Long Beach (Km)
			Swadaya	Swakarsa		
1	Cimerak	11	10	1	118	17.93
2	Cijulang	7	7	-	93	11.04
3	Parigi	10	0	10	98	7.40
4	Sidamulih	7	4	3	78	6.29
5	Pangandaran	8	0	8	61	13.32
6	Kalipucang	9	9	0	137	1110
	Jumlah	52	30	22	585	67.08

Sumber : BPS Pangandaran, 2016 (be processed).

### 3.2. Bioecoregion Based On Fisheries Resources

Bioekoregion are landscapes that are within a stretch of ecological entity established by natural boundaries, such as watersheds, bays, and currents. The area is part of Coastal Areas and Small Islands which has a specific function that is determined based on the criteria of physical characteristics, biological, social, and economic to be protected. [5] Zoning is a form of engineering utilization of space through the establishment of functional boundaries in accordance with the resource potential and carrying capacity and ecological processes that take place as a single unit in the coastal ecosystem [14].

The importance of coastal area management in bioecoregional arrangements, Pangandaran has developed an economy that focuses on two sectors of marine-based economy, namely capture fisheries and marine tourism. Challenges that are increasingly developing in the coastal area of Pangandaran should not only rely on the potential

of natural resources, but must consider the potential sources of other regions, such as human resource development, easy access to capital and transfer of information technology in processing fishery products, this will increase competitiveness Pangandaran coastal area. [4]

Bioecoregion conditions in Pangandaran have the physical characteristics of two different beaches, namely white sand beaches located on the West Coast of Pangandaran and rocky beaches located on the East Coast of Pangandaran. Pangandaran Beach is flanked by Parigi bay and Pananjung bay and the eastern part is bordered by the Ciputrapinggan river which empties into Pangandaran bay and the western part is bordered by the Cikembulan river.

Bioekoregion of aspects of the mangrove ecosystem at the scene Kalipucang District. The potential of ecosystems, flora and fauna, both land and sea in Pangandaran is very diverse. There are lowland ecosystems, beaches, seagrasses and coral reefs, which consist of six coral species, four seagrass species and six species of seaweed

and various species of reef fish. Zoning of the coastal area in Pangandaran which is formed by steep hills and mountains, and coastal plains that can be used for tourism, fisheries, forestry, agriculture, residential and industrial environments by considering biophysical balance.

In addition to the coastal and estuary ecosystems, in Pangandaran there are also mangrove ecosystems, seagrass beds, algae and coral reefs. The largest mangrove forest is in Kalipucang. The types of vegetation around the estuary are Api-api (*Avicenia*, *SP*), mangroves (*Rhizophora*, *SPP*), Nipah (*Nypa fruticans*), and Jeruju (*Acanthus illicifolius*). In general, around 50% of the condition of the ecosystem is in a critical condition.

Geomorphologically, the coastal area of Pangandaran is similar to the geomorphology of the south coast of West Java in general. Geomorphology is a sloping unit of coastal land stretching from west to east. The coast slope is relatively flat with a slope of 0-3% with an altitude of 0-3 m above sea level. The coastal plain unit is formed by weathering bedrock and is clay and gravel.

Based on the results of interviews with respondents from the Fisheries and Maritime Affairs Office of Pangandaran, information was obtained that there were biophysical indicators that showed living coral conditions at a depth of 4 m which tended to decrease, and a depth of 6 m had a tendency to stable live coral cover. The condition of the coral reefs at the research location is in the status of bad to good. The condition of the coral reefs in Pangandaran is influenced by natural environmental conditions such as waves and currents as well as by tourism activities and capture fisheries [15].

Based on this research coastal areas in Pangandaran through bioecoregion approaches with biophysical conditions that have the potential of capture fisheries and marine tourism. The potential of capture fisheries resources that have economic value include the type of bawal (*Colossoma macropomum*), dogol shrimp (*Metapenaeus monoceros*), layur (*Trichiurus lepturus*), mackerel (*Scomberomorini*), cakalang (*Katsuwonus pelamis*), tuna (*Thunnus Albacares*).

Based on the results of interviews with respondents and secondary data from the Fisheries and Maritime Affairs Office of Pangandaran, seagrass bioecoregion conditions in Pangandaran are at Ujung Pananjung, which is on the east coast of Pangandaran with a relative area of between 40-150 m<sup>2</sup>. The species is *Thalassia*, *Hemprichii* [16]. Management of the Pangandaran coastal area must involve several stakeholders, including the central government, local government, local communities, and investors to optimize natural resources, especially capture fisheries and marine tourism resources.

### 3.3. Factors Influence the Economic Value of Environmentally Friendly Fisheries Resources in Pangandaran, West Java Province

Factors that influence the economic value of bioecoregion based on environmentally friendly fisheries resources in Pangandaran, include: fishing season, types of fishing gear, type of vesse sizer, operational production time, fishing experience, amount crew, resources of capital and zoning distance fishing.

Fishing season in Pangandaran the long dry season, sea products tend to be abundant, especially large fish. Seasonal cycles are very decisive for the sustainability of fishing businesses that are cultivated by fishermen [16]. Based on this research in the field, fishermen can use indicators in nature such as stellar positions certain conditions of the wind, sea currents and others for predict changes in west wind and east wind, which suitable for catching fish in the sea. In the current conditions fishermen are very difficult and even cannot predict another good season to catch fish. That matter because of climate changes.

Types of fishing gear in Pangandaran are arad net. Arad nets can be found in almost all of them Indonesian territory, especially in less locations make it possible to use more high technology. Arad nets or commonly called trawls (beach seine) is a trawl bag that is carried out by looping the arad net on a certain area and pulling it towards the beach through its two wings [17]. Type of vesse sizer used is less than 5 GT in size, and can using paddle power, screen, or outboard motor. The size of arad nets varies from 20 to 40 meters calculated from the tip of the wing to the end of the bag. Towing rope each wing reaches 400 meters.

Based on this research, the determination coefficient value ( $R^2$ ) of 0.764 means fishing season, types of fishing gear, type of vesse sizer, operational production time, fishing experience, amount crew, resources of capital and zoning distance fishing of 76.4% affect the economic value of environmentally friendly fishery resources while 23.6% are other variable factors outside the research variable.

Based on the results of the F test on the 90 percent confidence level, it shows that the calculated  $F_{\text{value}}$  is 49.55 and  $F_{\text{table}}$  value is 2.35, which means that the calculated  $F_{\text{value}}$  is greater than  $F_{\text{table}}$  value. This showed that together these factors have an influence on the economic value of fisheries resources that are environmentally friendly.

## 4. Conclusion

Bioecoregional condition, fisheries development can be done by focusing on a number of economic species including *Colossoma macropomum*, *Metapenaeus monoceros*, *Trichiurus lepturus*, *Scomberomorini*, *Katsuwonus pelamis*, *Thunnus Albacares*. In line with this, important factors that should be taken care of; these are fishing season, type of fishing vessels, environmentally friendly fishing gears, on-board fish handling, and fish price.

## References

- [1] Nurhayati. A., (2012). Analysis of Local Government Policy Through the Synergy Models of Economic Behavior Fisherman. (Case Study in Pangandaran Region, Ciamis Regency). Journal of Maritime and Fisheries Socio-Economic Policy Vol. 2 No. 2.
- [2] The Law of Republic Indonesia. No 1 in 2014. On Management of Coastal Areas and Small Island.
- [3] Nurhayati., A & Purnomo, A.H.(2017). Developing the Marine and Fisheries Industry in Pangandaran using a Bioecoregion-Based Technopark Framework. Journal of STI Policy and Management, 2(1), 43-52.

- [4] Nurhayati, A., & Purnomo, A. H. (2014). A Case study on sustainability analysis of fisheries in Pangandaran, West Java Province. *Journal of Agricultural Science and Technology B*, 321
- [5] Nurhayati, A. & Purnomo, A.H. (2018). Bioecoregion and Socio-Economic Connectivity Oriented Coastal Zone Management. *Applied Ecology and Environmental Sciences*, 2018, Vol. 6, No. 1, 31-34.
- [6] Mike, A. & Cowx, I.G.(1986). A preliminary appraisal of the contribution of recreational fishing to the fisheries sector in north-west Trinidad. *Fisheries Management and Ecology*, 3: 219-228.
- [7] Everard, M. & Kataria, G.(2011). Recreational angling markets to advance the conservation of a reach of the Western Ramganga River, India. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 21: 101-108.
- [8] Arlinghaus, R., Cooke, S.J., Schwab, A. & Cowx, I.G. (2009). Contrasting pragmatic and suffering-centred approaches to fish welfare in recreational fishing. *Journal of Fish Biology*, 75: 2448-2463.
- [9] Rees SE, Rodwell LD, Attrill MJ, Austen MC, Mangi SC. (2010). The value of marine biodiversity to the leisure and recreation industry and its application to marine spatial planning. *Mar Policy* 2010; 34: 868-875.
- [10] USAID. (2013). Sustainable Fisheries and Responsible Aquaculture. Agency for International Development 1300 Pennsylvania Avenue, NW. Washington, DC 20523
- [11] M. Ruckelshaus. (2013). Securing ocean benefits for society in the face of climate change. *Marine Policy* 40 (2013) 154-159.
- [12] Nurhayati, A & Herawati, T. (2018). Bio-physical and social environments and their potential effect on fisheries biodiversity (Case study in Palabuhan Ratu, Sukabumi West Java Province), Indonesia. *Journal Eco. Env. & Cons.* 24 (1): 2018; pp. (140-144).
- [13] Welcomme, R.L. (2001). *Inland fisheries: ecology and management*. Oxford, UK, Blackwell Science, Fishing News Books.
- [14] Law of The Republic of Indonesia. No 1 / 2014. On Management of Coastal Areas and Small Island
- [15] Agency Marine and Fisheries Pangandaran. 2016. Profile of Pangandaran Coastal Area. Annual report.
- [16] Gunawan A. 2004. Analysis of fishing season patterns and levels utilization of anchovy in Tuban Regency, East Java. Institute Bogor Agriculture. Bogor.
- [17] Monintja RD. 1989. An Introduction to Fishing Technology in Indonesia. Director General of Higher Education, Fisheries and Marine Affairs. Bogor.



© The Author(s) 2019. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).