Total Economic Value of Segara Anakan Lagoon Area

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Abstract

Segara Anakan covers area of waters, mud flat and mangrove forest provide habitat for life and place of variety of flora and fauna. Segara Anakan is unique and very valuable. Segara Anakan, the coastal area of south of Java, has ecological systems associated with the event of sedimentation due to activities of watershed above as well as fisheries and system associated with the social actors, social structures and processes. Segara Anakan as a system which provides complex role is a provider of ecosystem services for the surrounding community. The total economic value Segara Anakan region with an area of 14 807 ha area, which includes District Kampung Laut consisting of 4 villages have a total economic value of IDR 106,631,702,769.80 or USD 59,615,745.27 from each ha of mangrove forest.

Keywords: Mangrove Forest; Segara Anakan Lagoon; Total Economic Value.

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1. Introduction

An economic valuation approach as a framework for analysis in decision making for resource management. Natural resources are a very important factor of production. Rothengatter [1] suggests that the natural resources in addition to functioning as a provider of raw materials for a variety of human needs is also an absorber of pollution generated by the production process. Dixon (1985) in Nurafiarini [2] argues that the growth of public welfare nature over time and continuous and depends not only on production factors but also on the desire and the choice to pay attention to environmental quality and fairness of a commodity.

Nikijuluw [3] states that consumption of resources without management will not only result in quality deterioration of resources but it’s also affects the distribution of income and welfare of the community. Therefore, without setting in a good strong construction sector it will be dominant and the weak sector will be reduced and gradually disappear.

Economic valuation is optional approach as a framework for analysis in decision making for resource management. The development of a sector depends not only on economic considerations alone but must also consider other factors such as social, cultural, and even political aspects so economic-bioecology valuation approach can be is used as a foothold in evaluating various aspects on various scenarios for development of the area. In this case the total valuation is carried out to estimate the total economic contribution of an ecosystem in which its society. The value according to Koeshendrajana and his colleagues [4] is the intrinsic value of a resource that consists of the use value and the value of the function that should calculated in policy formulation so that the allocation and management of alternative utilization can be determined correctly and on target.

Segara Anakan Lagoon is one of the natural wealth of potential in providing ecosystem factors of production resources both on the mainland and waters. In this regard, this time famous as a beacon of hope for 3388 of fisherman and 79 335 of people life in the lagoon area.

Segara Anakan region is an area of water potential in the supply of factors of production and environmental services, both mangrove forests, sea and land area. Assessment of the economy in this region using the Total Economic Value (TEV) approach to know all of the economic value of the resources that exist within the region. Total valuation carried out to estimate the total economic contribution of an ecosystems to society.

2. Material and Methods

2.1. Sampling Method

The population that participated in this study is the community, along with related parties, directly or indirectly around Segara Anakan Lagoon Area, in all manner of land use. The number of respondents is determined based on the principle of representation as well as by type of activities that the resources in this area in four villages in Kampung Laut sub district.

2.2. Data Analysis
### Table 1: Classification of Functions and Benefits Segara Anakan Lagoon

<table>
<thead>
<tr>
<th>No.</th>
<th>Study Typology</th>
<th>Classification of Functions and Benefits</th>
<th>Valuation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct use value</td>
<td>- The value of mangrove log</td>
<td>Market price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of mangrove firewood</td>
<td>Market price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of nipah leaf</td>
<td>Market price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of mangrove seed</td>
<td>Market price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of animal wildlife</td>
<td>Market price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of fisheries (shrimp, crab and clam)</td>
<td>Market price</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of the learning</td>
<td>Surrogate Market Price</td>
</tr>
<tr>
<td>2</td>
<td>Indirect use value</td>
<td>- The value of nursery ground</td>
<td>Production Function Approach [5]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of feed production</td>
<td>Benefit Transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- The value of carbon deposit</td>
<td>Benefit Transfer</td>
</tr>
<tr>
<td>3</td>
<td>Option value</td>
<td>- The value of biodiversity</td>
<td>Biodiversity value [6]</td>
</tr>
</tbody>
</table>

#### Figure 1: Total Economic Value Assessment Phase Segara Anakan Lagoon Area

The value of resources will be quantified include the value of direct benefits, the value of the indirect benefits of the mangrove. Value of direct benefit includes the value of mangrove wood logs, firewood value, the value of the fishery and the value of learning. The value of the indirect benefits of mangrove cover the value of biological functions as a habitat for spawning ground or nursery ground, litter production and the production of carbon (Table 1, Figure 1).

This calculation is based on the mangrove area, residential area, paddy field, upland area, an area of the pond. The area of the lagoon is not being calculated in the calculation of this economy because of the extent of mangrove and lagoon area of the body of water between 9-17% of the total area of mangrove and lagoon water.
bodies, as well as both are part of a close and mutually support one another. It is also based on the statement Rodwell and his colleagues [7] which gives a broad overview of conservation is optimal for 15-25% of the fishing grounds.

Indirect use value, including the value of the biological function as a habitat for spawning / nursery, ecological function, feed production and the production of carbon. Option value is done with the approach of the biodiversity value of benefits obtained from the presence of mangrove forests. Values above all based on primary data that is processed by Landsat in 2016, where there 1788.65 ha of mangrove forest area of 14 807 ha which is an area of research observations.

2.3. Direct Use Value – DUV

Direct use value are the benefits derived directly from the lagoon ecosystems such as mangrove wood and fish [8]. Further Merlo and Briales (2000) in the Vo [9] states more direct benefit is energy resources, fisheries, culture and recreation. The study is in the calculation of the value of direct benefits using the formula:

\[ DUV = \sum_{i=1}^{n} DUV_i \]

Where:

- \( DUV \): Direct Use Value
- \( DUV_i \): Value of mangrove wood logs
- \( DUV_2 \): Value of mangrove firewood
- \( DUV_3 \): Value of Nipa Palm
- \( DUV_4 \): Value of Animal Wildlife
- \( DUV_5 \): Value of Fisheries
- \( DUV_6 \): Value of Mangrove seed
- \( DUV_7 \): Value of Learning
- \( DUV_n \): Direct Use Value number-n

The value of the direct benefits of mangrove wood log is calculated based on the data stands, density and diameter of the timber, using the formula [10]:

\[ NMTKM = V_{ha} \cdot (P - C) \cdot (IDR \ m^3 \ ha^{-1} \ yr^{-1}) \]

Where,

- \( NMTKM \): Value of Mangrove logs benefit
- \( V_{ha} \): Volume Mangrove Wood ha\(^{-1}\) year\(^{-1}\) (½π d\(^2\) TK)
- \( P \): Firewood Price (IDR)
Operational Cost (IDR)

(Assuming 30% value of woods [11])

Operational Cost (IDR)

(Assuming 30% value of woods [11])

Value of direct benefit firewood is calculated from the average production of firewood made from mangrove in the research site with a formula [11]:

\[ \text{NMKB} = X_{ha} \cdot (P - C) \ (\text{IDR m}^3 \text{ha}^{-1} \text{yr}^{-1}) \]

Where,

- NMKB : Value of Mangrove logs benefit
- X_{ha} : Volume of Mangrove Wood ha\(^{-1}\) year\(^{-1}\) (\(\frac{1}{2} \pi d^2 \text{TK}\))
- P : Firewood Price (IDR)
- C : Operational Cost (IDR)

Value of direct benefit calculated lagoon fishery includes catches of fish, crabs, clams in the lagoon, and the value of the catch marine shrimp because it assumes was the result benefits of the mangrove environment, following the the formula [10]:

\[ \text{NP} = H \cdot (P - C) \]

Where:

- NP : Value of fisheries production (IDR ha\(^{-1}\) year\(^{-1}\))
- X_{ha} : Volume of Mangrove Wood ha\(^{-1}\) year\(^{-1}\) (\(\frac{1}{2} \pi d^2 \text{TK}\))
- P : Price (IDR)
- C : Operational Cost (IDR)

### 2.4. Indirect Use Value, IUV

Indirect use value are the benefits derived from ecosystems indirectly as well as retaining the abrasion or prevention of seawater intrusion, spawning areas, nursery and feeding ground [8]. Other indirect benefits are mangrove forests as a carbon deposit, water purification, biodiversity, erosion control, as well as the habitat of living creatures (Fausold and his colleagues 1996 in the Vo [9]). In this study, the value of benefits not directly approached by counting benefits biological function and physical function of the lagoon ecosystem. Biological functions as spawning habitat, feed supply capability value and place of nursery and enlargement. Value of physical function in particular emphasis mangrove forests as a carbon deposit. The total value of these benefits are Indirect Use Value (IUV) is formulated as follows:
\[ IUV = \sum_{i=1}^{n} IUV_i \]

Where:

- \( IUV \) : Indirect Use Value
- \( IUV_1 \) : Nursering or Spawning ground
- \( IUV_2 \) : Manufacturer of natural feed
- \( IUV_3 \) : Carbon deposit
- \( IUV_n \) : Indirect use value \( \text{number}-n \)

Indirect use value as spawning ground were estimated by using the formula of the relationship regression between extents mangrove fishing effort (effort) and shrimp production, referring to Barbier and Strand (1998), while the indirect benefit of mangrove forests as a carbon sink refers Marlianingrum [11] and benefits food production refers to Sukardjo [12].

2.5. Option Value

Option value of mangrove forest ecosystems in the Segara Anakan Lagoon area approximated using the value of benefits from biodiversity. Benefits of this option is the value of biodiversity which that can be captured from the existence of mangrove forests. Ruitenbeek [12] suggests the value of biodiversity of mangrove forests in Indonesia US $ 15 / ha / year. Furthermore, the Total Economy Economic Value formulated:

\[ TEV = DUV + IUV + OV \]

Where:

- \( TEV \) : Total Economic Value
- \( DUV \) : Direct Use Value
- \( IUV \) : Indirect Use Value
- \( OV \) : Option Value

3. Results and Discussion

3.1. Direct Use Value - Wood

The potential of mangrove wood as a building material needs to be taken into account in this economic assessment. Utilization of mangrove wood is used by most people around the lagoon. The value of the direct benefits of trees are calculated based on density and diameter of the timber. The assumptions used in this study is the growth characteristics of mangrove Segara Anakan Lagoon from Santos research results [13] which showed that the growth of mangroves in Segara Anakan Lagoon area ranged between 12.3 - 26.5 m³ / ha / year or an average of 19.4 m³ / ha / year. This is because the growing conditions mangrove uneven density, the number of weed plants like Warakas, gadelari and jerujon and increased sedimentation in the region. Prices of
wood logs today is USD 100,000.00 and the cost of production of 30% [11] then obtained a net price of timber logs IDR 70,000.00 per m³ of wood in order to obtain the benefits of IDR 1,358,000.00 / ha / year. Thus, in one year the region economic value of timber logs of 3890.1 ha of mangrove forest area in the region is IDR 5,282,755,800.00

3.2. Direct Use Value - Firewood

Mangrove twigs is still a source of energy for most people, especially for people who use natural resources in the lagoon region as brown sugar producers. The results of interviews with 12 respondents brown sugar producers show that they take themselves and partly sold for curing fish. Nakar timber extraction carried out 2-4 times a week primarily made during the afternoon about 2 hours while at 15:30 to 17:30 as much as 0.5 to 1.5 m³ per trip, or an average of 1.13 m³ per trip. Firewood is sold at a price of IDR 50,000.00 per m³. With a capital of cigarettes worth IDR 12,500.00 per day. With the assumed beneficiaries of mangrove wood sticks as kindling for the fuel needs of making brown sugar, then the number of takers firewood is equal to crafters brown sugar in each and every village.

From interviews with community groups note that taker raw sugar from each village is, 55 people taker from Ujung Alang village, 15 takers from Ujung Gagak village, 21 takers from Klaces village and 125 takers from Panikel village, then in this region there are 216 people doing this activity, with an average retrieval are 3 trips per week, then in a year there are 32,400 making the trip with an average of 1.25 m³. Assuming the costs of the provision is IDR 12.500.00 each trip and IDR 50.000.00 fixed costs as the price of a machete, then the value of firewood the region is IDR 1,609,200,000.00 per year.

<table>
<thead>
<tr>
<th>Village</th>
<th>n</th>
<th>Trip/year</th>
<th>Production (m³/year)</th>
<th>Value (IDR/year)</th>
<th>Operational Cost (IDR/year)</th>
<th>Fixed Cost (IDR/year)</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>55</td>
<td>8,250</td>
<td>10,313</td>
<td>515,625,000</td>
<td>103,125,000</td>
<td>2,750,000</td>
<td>409,750,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>15</td>
<td>2,250</td>
<td>2,813</td>
<td>140,625,000</td>
<td>28,125,000</td>
<td>750,000</td>
<td>111,750,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>21</td>
<td>3,150</td>
<td>3,938</td>
<td>196,875,000</td>
<td>39,375,000</td>
<td>1,050,000</td>
<td>156,450,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>125</td>
<td>18,750</td>
<td>23,438</td>
<td>1,171,875,000</td>
<td>234,375,000</td>
<td>6,250,000</td>
<td>931,250,000</td>
</tr>
<tr>
<td>Total</td>
<td>216</td>
<td>32,400</td>
<td>40,500</td>
<td>2,025,000,000</td>
<td>405,000,000</td>
<td>10,800,000</td>
<td>1,609,200,000</td>
</tr>
</tbody>
</table>

3.3. Direct Use Value – Nipa Palm Leaves

Until now nipa palm leaves are still used some communities for the roofing and wrapping sugar. Seeker palm leaves about 25 people from two villages in the region, namely Panikel and Ujung Alang village. With an
average of four trips per week making, as well as 25 of his belt every trip. With a selling price of IDR 7000,00 every two belts, and retrieval for 40 weeks, then obtained a revenue of IDR 328,750,000.00 per year from Segara Anakan Lagoon area.

Table 3: Economic Value of Nipa Palm on Segara Anakan Lagoon Area

<table>
<thead>
<tr>
<th>Village</th>
<th>n</th>
<th>Trip/year</th>
<th>Production (m³/year)</th>
<th>Value (IDR/year)</th>
<th>Operational Cost (IDR/year)</th>
<th>Fixed Cost (IDR/year)</th>
<th>Income (IDR/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>10</td>
<td>1,760</td>
<td>44,000</td>
<td>154,000,000</td>
<td>22,000,000</td>
<td>500,000</td>
<td>131,500,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>15</td>
<td>2,640</td>
<td>66,000</td>
<td>231,000,000</td>
<td>33,000,000</td>
<td>750,000</td>
<td>197,250,000</td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>4,400</td>
<td>110,000</td>
<td>385,000,000</td>
<td>55,000,000</td>
<td>1,250,000</td>
<td>328,750,000</td>
</tr>
</tbody>
</table>

3.4. Direct Use Value – Animal Wildlife

The animal is rare, but the precious of its animal diversity of mangrove forests will still a main favorite a hunter main wildlife birds and snakes. This activity is much needed expertise and special skills that not many people do. There are about 9 inhabitants of the village of Ujung Alang and Ujung Gagak did. This activity is performed when the dry season about 1-2 trips per week or 15 weeks for a year, in order to get 30 trips a year. Total acquisition of about 2-8 birds with an average of 3 birds / trip. Bird price varies depending on the type, buyer preferences and size, with price of IDR 75,000.00 - IDR150.000,00 per bird, the average price is IDR 100,000.00 per animal revenues are around IDR 250,000.00 / trip. Costs incurred by these hunters are net costs, supplies, capital investments boat with 1 liter of fuel every trip. Value of the benefit of wildlife this region IDR 71,775,000.00 / year.

Table 4: The Economic Value of Animal Wildlife in Segara Anakan Lagoon Area

<table>
<thead>
<tr>
<th>Village</th>
<th>n</th>
<th>Trip/yr</th>
<th>Production animal wildlife/year</th>
<th>Value IDR/year</th>
<th>Operational cost IDR/year</th>
<th>Fixed cost IDR/year</th>
<th>Boat cost IDR/year</th>
<th>Gas cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>5</td>
<td>150</td>
<td>450</td>
<td>45,000,000</td>
<td>1,875,000</td>
<td>500,000</td>
<td>1,250,000</td>
<td>1,500,000</td>
<td>39,875,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>4</td>
<td>120</td>
<td>360</td>
<td>36,000,000</td>
<td>1,500,000</td>
<td>400,000</td>
<td>1,000,000</td>
<td>1,200,000</td>
<td>31,900,000</td>
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<tr>
<td>Total</td>
<td>9</td>
<td>270</td>
<td>810</td>
<td>81,000,000</td>
<td>3,375,000</td>
<td>900,000</td>
<td>2,250,000</td>
<td>2,700,000</td>
<td>71,775,000</td>
</tr>
</tbody>
</table>

3.5. Direct Use Value of Fisheries – Crab

The average daily production of crab is 3 kg / trip by the number of fishermen wadong and pintur in Segara Anakan ranges from 265 fishermen who do wadong, the term of arrest by using wadong. There is also the use of pintur to catch crabs, but it is not a done deal. The average fisherman exerting 30-40 wadong in each operation,
and 10 to 15 will be filled with crab wadong. Operation wadong depending on the tide. Thus every fisherman wadong arresting about 270 trips annually. Likewise, pintur, only three villagers who did it with catches of about 2 kg per day with an average trip together with wadong, 270 trip. With revenues of about 3 kg and 2.5 kg per trip with a selling price of IDR 35,000.00 per kilogram, so every fisherman on average to get the IDR 70000.00 to 105,000.00 per day, before deducting provisions and fuel as much as 1 liter each of his trip, as well as price and pintur wadong IDR 20,000.00 each fruit and the life of 1 year. The economic value of this fishery - the crab is IDR 5,949,675,000.00

Table 5: The Economic Value of Fisheries – Crab on Segara Anakan Lagoon Area

<table>
<thead>
<tr>
<th>Village</th>
<th>n Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 35,000/kg)</th>
<th>Boat Cost IDR/year</th>
<th>Operational Cost IDR/year</th>
<th>Gas cost IDR/year</th>
<th>Wadong IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>68</td>
<td>18,360</td>
<td>55,080</td>
<td>1,927,800,000</td>
<td>153,000,000</td>
<td>229,500,000</td>
<td>183,600,000</td>
<td>40,800,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>59</td>
<td>15,930</td>
<td>47,790</td>
<td>1,672,650,000</td>
<td>177,000,000</td>
<td>199,125,000</td>
<td>159,300,000</td>
<td>35,400,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>12</td>
<td>3,240</td>
<td>9,720</td>
<td>340,200,000</td>
<td>36,000,000</td>
<td>40,500,000</td>
<td>32,400,000</td>
<td>7,200,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>58</td>
<td>15,660</td>
<td>46,980</td>
<td>1,644,300,000</td>
<td>174,000,000</td>
<td>197,750,000</td>
<td>158,600,000</td>
<td>34,800,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Village</th>
<th>n Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 35,000/kg)</th>
<th>Boat Cost IDR/year</th>
<th>Operational Cost IDR/year</th>
<th>Gas cost IDR/year</th>
<th>Wadong IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>67</td>
<td>18,090</td>
<td>45,225</td>
<td>1,582,875,000</td>
<td>150,750,000</td>
<td>226,125,000</td>
<td>180,900,000</td>
<td>40,200,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>9</td>
<td>2,430</td>
<td>6,075</td>
<td>212,625,000</td>
<td>20,250,000</td>
<td>30,375,000</td>
<td>24,300,000</td>
<td>5,400,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>75</td>
<td>20,250</td>
<td>50,625</td>
<td>1,771,875,000</td>
<td>168,750,000</td>
<td>253,125,000</td>
<td>202,500,000</td>
<td>45,000,000</td>
</tr>
</tbody>
</table>

3.6. Direct Use Value of Fisheries – Clam

Fishery - clams are sideline activities by the majority of clam gatherers, although there are some people who look at it as the main activity, so it is assumed based on apong gear there are 131 trips per year and children can do after school interrupted 2-4 times a week.

With the price of IDR 2000.00 per kilogram obtained average acquisition shells is 7-10 bucket or a price IDR 7000.00 per bucket, so that in each trip the fishermen receive IDR 49000.00 / trip.
Thus each year the economic value of clams from this area is IDR 2,220,650.00

Table 6: The Economic Value of Clam on Segara Anakan Lagoon Area

<table>
<thead>
<tr>
<th>Village</th>
<th>n Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 7,000/bucket)</th>
<th>Operational Cost IDR/year</th>
<th>Fixed cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>80</td>
<td>21,600</td>
<td>151,200</td>
<td>1,058,400,000</td>
<td>270,000,000</td>
<td>16,000,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>772,400,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>70</td>
<td>18,900</td>
<td>132,300</td>
<td>926,100,000</td>
<td>236,250,000</td>
<td>14,000,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>675,850,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>30</td>
<td>8,100</td>
<td>56,700</td>
<td>396,900,000</td>
<td>101,250,000</td>
<td>6,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td>289,650,000</td>
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<td>50</td>
<td>13,500</td>
<td>94,500</td>
<td>661,500,000</td>
<td>168,750,000</td>
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<td>482,750,000</td>
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<td>230,621,000</td>
<td>434,700</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>46,000,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,220,650,000</td>
</tr>
</tbody>
</table>

3.7. Direct Use Value of Fisheries – Shrimp

Table 7: The Economic Value of Shrimp on Segara Anakan Lagoon Area

a. Gear: Apong

<table>
<thead>
<tr>
<th>Village</th>
<th>n Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 30,000/kg)</th>
<th>Operational Cost IDR/year</th>
<th>Gas Cost IDR/year</th>
<th>Boat cost IDR/year</th>
<th>Fixed Cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>116</td>
<td>15,312</td>
<td>37,514</td>
<td>1,125,432,000</td>
<td>191,400,000</td>
<td>153,120,000</td>
<td>127,600,000</td>
<td>648,672,000</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>312</td>
<td>41,184</td>
<td>100,901</td>
<td>3,027,024,000</td>
<td>514,800,000</td>
<td>411,840,000</td>
<td>343,200,000</td>
<td>1,744,704,000</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klaces</td>
<td>13</td>
<td>1,716</td>
<td>4,204</td>
<td>126,126,000</td>
<td>21,450,000</td>
<td>17,160,000</td>
<td>14,300,000</td>
<td>72,696,000</td>
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<td></td>
<td></td>
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<td>Panikel</td>
<td>45</td>
<td>5,940</td>
<td>14,553</td>
<td>436,590,000</td>
<td>74,250,000</td>
<td>59,400,000</td>
<td>49,500,000</td>
<td>251,640,000</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>486</td>
<td>64,152</td>
<td>157,172</td>
<td>4,715,172,000</td>
<td>801,900,000</td>
<td>534,600,000</td>
<td>2,717,712,000</td>
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<td></td>
</tr>
</tbody>
</table>
b. Gear: Jala

<table>
<thead>
<tr>
<th>Village</th>
<th>n Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 30,000/kg)</th>
<th>Operational Cost IDR/year</th>
<th>Gas Cost IDR/year</th>
<th>Boat cost IDR/year</th>
<th>Fixed Cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>42</td>
<td>10,080</td>
<td>27,720</td>
<td>831,600,000</td>
<td>126,000,000</td>
<td>100,800,000</td>
<td>84,000,000</td>
<td>517,440,000</td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>20</td>
<td>4,800</td>
<td>13,200</td>
<td>396,000,000</td>
<td>60,000,000</td>
<td>48,000,000</td>
<td>40,000,000</td>
<td>246,400,000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Klaces</td>
<td>4</td>
<td>960</td>
<td>2,640</td>
<td>79,200,000</td>
<td>12,000,000</td>
<td>9,600,000</td>
<td>8,000,000</td>
<td>49,280,000</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panikel</td>
<td>23</td>
<td>5,520</td>
<td>15,180</td>
<td>455,400,000</td>
<td>69,000,000</td>
<td>55,200,000</td>
<td>46,000,000</td>
<td>283,360,000</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>89</td>
<td>21,360</td>
<td>58,740</td>
<td>2,055,900,000</td>
<td>267,000,000</td>
<td>213,600,000</td>
<td>1,096,480,000</td>
</tr>
</tbody>
</table>
c. **Gear: Jaring**

<table>
<thead>
<tr>
<th>Village</th>
<th>Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 30,000/kg)</th>
<th>Operational Cost IDR/year</th>
<th>Gas Cost IDR/year</th>
<th>Boat cost IDR/year</th>
<th>Fixed Cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>108</td>
<td>15,552</td>
<td>33,437</td>
<td>1,003,104,000</td>
<td>194,400,000</td>
<td>155,520,000</td>
<td>129,600,000</td>
<td>8,640,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>207</td>
<td>29,808</td>
<td>64,087</td>
<td>2,243,052,000</td>
<td>372,600,000</td>
<td>298,080,000</td>
<td>248,400,000</td>
<td>16,560,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>13</td>
<td>1,872</td>
<td>4,025</td>
<td>140,868,000</td>
<td>23,400,000</td>
<td>18,720,000</td>
<td>15,600,000</td>
<td>1,040,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>69</td>
<td>9,936</td>
<td>21,362</td>
<td>747,684,000</td>
<td>124,200,000</td>
<td>99,360,000</td>
<td>82,800,000</td>
<td>5,520,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Village</th>
<th>Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 30,000/kg)</th>
<th>Operational Cost IDR/year</th>
<th>Gas Cost IDR/year</th>
<th>Boat cost IDR/year</th>
<th>Fixed Cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>108</td>
<td>15,552</td>
<td>33,437</td>
<td>1,003,104,000</td>
<td>194,400,000</td>
<td>155,520,000</td>
<td>129,600,000</td>
<td>8,640,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>207</td>
<td>29,808</td>
<td>64,087</td>
<td>2,243,052,000</td>
<td>372,600,000</td>
<td>298,080,000</td>
<td>248,400,000</td>
<td>16,560,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>13</td>
<td>1,872</td>
<td>4,025</td>
<td>140,868,000</td>
<td>23,400,000</td>
<td>18,720,000</td>
<td>15,600,000</td>
<td>1,040,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>69</td>
<td>9,936</td>
<td>21,362</td>
<td>747,684,000</td>
<td>124,200,000</td>
<td>99,360,000</td>
<td>82,800,000</td>
<td>5,520,000</td>
</tr>
</tbody>
</table>

The economic value of shrimp on this area is IDR 6,154,640,000.

The fishermen Segara Anakan perform shrimp fishing using nets *Apong*, othek nets and nets. *Apong* nets is similar trawl nets bag fitted with a settled somewhere overlooking the water flow receded. Othek is a small mesh nets operated in shallow waters. Within a year, netting *Apong* operated approximately 132 trip with production of about 2.45 kg per trip, nets 240 trip with production of 2.75 kg per trip, and the trip to the 144 net production of 2.15 kg per trip, with an average price of IDR 30,000.00 per kg. Each number of fishermen in each of the activities listed in Table 7. The results of each gear in the lagoon.

### 3.8. Direct Use Value of Fisheries – Fish

Fishers use several types of gears, such as bag nets, nets and fishing rods. When the fishing line is rarely used except for recreation. Fishing with a net bag or *Apong* made about 132 trips per year and mesh with 240 trips per year per fisherman, with calculations at high tide with the production of fish caught by an average of 4.5 kg using *Apong* and the average catch of 3 kg using nets and nets an average of 2:15 kg obtained mullet and other fish like bloso with an average price of IDR 20,000.00. Fishermen fishing is the same as the population of the shrimp fishermen who use the same gear.

**Table 8: Value Benefits of Fish in Segara Anakan Lagoon Area**

### a. Gear: *Apong*

<table>
<thead>
<tr>
<th>Village</th>
<th>Trip/yr</th>
<th>Result kg/year</th>
<th>Value IDR/year (IDR 30,000/kg)</th>
<th>Operational Cost IDR/year</th>
<th>Gas Cost IDR/year</th>
<th>Boat cost IDR/year</th>
<th>Fixed Cost IDR/year</th>
<th>Income IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ujung Alang</td>
<td>116</td>
<td>15,312</td>
<td>69,904</td>
<td>1,378,085,000</td>
<td>191,400,000</td>
<td>153,120,000</td>
<td>127,600,000</td>
<td>4,640,000</td>
</tr>
<tr>
<td>Ujung Gagak</td>
<td>312</td>
<td>41,184</td>
<td>185,328</td>
<td>3,705,560,000</td>
<td>514,800,000</td>
<td>431,840,000</td>
<td>343,200,000</td>
<td>12,480,000</td>
</tr>
<tr>
<td>Klaces</td>
<td>13</td>
<td>1,716</td>
<td>7,722</td>
<td>154,480,000</td>
<td>21,450,000</td>
<td>17,160,000</td>
<td>14,350,000</td>
<td>520,000</td>
</tr>
<tr>
<td>Panikel</td>
<td>45</td>
<td>5,740</td>
<td>26,710</td>
<td>534,630,000</td>
<td>74,250,000</td>
<td>59,400,000</td>
<td>49,500,000</td>
<td>1,800,000</td>
</tr>
</tbody>
</table>

### b. Gear: *Jala*

118
Economic Value of fisheries this area is IDR 5,055,844,000,00 each year.

3.9. Direct Use Value of Fisheries – Mangrove Seed

The next direct benefit is the availability of mangrove seedlings. The value of the benefits of the availability of mangrove seeds sold to projects or activities to rehabilitate mangrove, mangrove seedlings obtained from the value produced by society Kampung Laut. At this time needs around the mangrove seedlings and also for education and research as well as improvement of coastal land around 1 million trees, with the price of IDR leaves ready for planting 6,100.00 per tree. Nursery costs around IDR 340.00 / seed covering media, bamboo, rope, plastic, labor costs IDR 620.00 / seed for the preparation bedengan, mangrove fruit collection, filling soil in the polybag, planting and maintenance, as well as equipment costs USD 10.00 / seed and the cost of building supplies seedlings IDR 30.00 / seed.

Adopting this approach, if the community Kampung Laut can produce 350,000 seeds per year, then the benefits gained IDR 350,000,000.00 / year. With costs reduced by 50%, assuming a nursery near, mangrove fruit available, labor is a part-time job and does not rent land and property of the masses in their own yard, then obtained a net benefit value 350,000 seedlings x IDR 500.00 = IDR 175,000,000.00 / year. The value of these benefits requires labor costs IDR 108,500,000.00 (350,000 seedlings labor costs 50% x IDR 620.00), so that the value of the net benefits of this region of mangrove seed is IDR 66,500,000.00 per year.

3.10. Direct Use Value – Value of Learning

Value of learning which includes travel, where the function of this lagoon as a system that is unique so interesting to learn, as well the activities of the current sea will enter harvest fish period. Value learning with regard to education and research in this area is IDR 10201.00 / ha / year. It is based on the calculation in 2014, there are 12 research and three field visits. The research activities involving 1-7 people in each team, an average of 5 persons in each team with a range of about 5 days. Field trips, such as students doing practical work, have
an average of 30-40 participants with a range of 2 days. These visitors usually rent a boat or vessel IDR 250,000.00 to 500,000.00 / trip and the accommodation costs IDR 50,000.00 per day per person.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Freq</th>
<th>Participant (person)</th>
<th>Resident day</th>
<th>Accommodation cost (IDR)</th>
<th>Boat rent (IDR)</th>
<th>Boat cost (IDR)</th>
<th>Accommodation (IDR)</th>
<th>Nett value (IDR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>250</td>
<td>12,500,000</td>
<td>25,000,000</td>
<td>12,500,000</td>
<td>17,500,000</td>
</tr>
<tr>
<td>Field trip</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td>450,000</td>
<td>1,500,000</td>
<td>750,000</td>
<td>270,000</td>
</tr>
<tr>
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<td>2</td>
<td>280</td>
<td>14,000,000</td>
<td>4,000,000</td>
<td>2,000,000</td>
<td>8,400,000</td>
</tr>
<tr>
<td>Tourism</td>
<td>52</td>
<td>20</td>
<td>1</td>
<td>1040</td>
<td>52,000,000</td>
<td>13,000,000</td>
<td>13,000,000</td>
<td>31,200,000</td>
</tr>
</tbody>
</table>

Table 9: Benefits of Learning on Segara Anakan Lagoon Area

3.11. Indirect Use Value – Spawning Ground

The value of benefits lagoons and mangrove forests as a habitat for spawning calculated through modeling approaches regression relationship between the extent of mangrove, fishing effort and the production of shrimp. Shrimp production is determined based on production of shrimp dominant namely *P. Merguensis* (jerbung / cap / white), *M. Ensis* (dogol), *P Monodon* (Tiger shrimp) landed on the 11 TPI in Cilacap. All three are in the life cycle of shrimp, juvenile and pre-adult phase grow in the lagoon. The growth of production of marine shrimp catches, fishing effort and extensive mangrove for 14 years (1999-2012) is presented in Table 11 below.

Based on the results of the regression of the data 1999-2012, the results of the biological parameter estimates following the combination of α determination, r, and q is the result of constant comparison of the model. The regression analysis correlation between the production of shrimp, fishing effort, and extensive mangrove so obtained equation [2]:

\[ h = 0.01051EM - (-0.00029E^2) = 0.01051EM + 0.00029E^2 \]

Table 10: Recapitulation Analysis of Benefits and Costs on Segara Anakan Lagoon Area

<table>
<thead>
<tr>
<th>Type of benefits</th>
<th>Benefit value IDR/year</th>
<th>Cost IDR/year</th>
<th>Nett Benefit IDR/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mangrove</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Log</td>
<td>7,546,794,000</td>
<td>2,264,038,200</td>
<td>5,282,755,800</td>
</tr>
<tr>
<td>2 Firewood</td>
<td>2,025,000,000</td>
<td>415,800,000</td>
<td>1,609,200,000</td>
</tr>
<tr>
<td>3 Nipa palm leaf</td>
<td>385,000,000</td>
<td>56,250,000</td>
<td>328,750,000</td>
</tr>
<tr>
<td>4 Biota</td>
<td>81,000,000</td>
<td>9,225,000</td>
<td>71,775,000</td>
</tr>
</tbody>
</table>
### Mangrove seed

|      | 175,000,000 | 108,500,000 | 66,500,000 |

### Fisheries

#### Crab

<table>
<thead>
<tr>
<th></th>
<th>5,584,950,000</th>
<th>1,854,975,000</th>
<th>3,729,975,000</th>
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</thead>
<tbody>
<tr>
<td>Wadong</td>
<td>3,567,375,000</td>
<td>1,347,675,000</td>
<td>2,219,700,000</td>
</tr>
<tr>
<td>Total</td>
<td>9,152,325,000</td>
<td>3,202,650,000</td>
<td>5,949,675,000</td>
</tr>
</tbody>
</table>

#### Clam

|      | 3,042,900,000 | 822,250,000 | 2,220,650,000 |

#### Shrimp

<table>
<thead>
<tr>
<th></th>
<th>4,715,172,000</th>
<th>1,997,460,000</th>
<th>2,717,712,000</th>
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</thead>
<tbody>
<tr>
<td>Apong</td>
<td>1,762,200,000</td>
<td>665,720,000</td>
<td>1,096,480,000</td>
</tr>
<tr>
<td>Jala</td>
<td>4,134,708,000</td>
<td>1,794,440,000</td>
<td>2,340,268,000</td>
</tr>
<tr>
<td>Total</td>
<td>10,612,080,000</td>
<td>4,457,620,000</td>
<td>6,154,460,000</td>
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</table>

#### Fish

<table>
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<tr>
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<th>5,773,680,000</th>
<th>1,997,460,000</th>
<th>3,776,220,000</th>
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<td>1,281,600,000</td>
<td>665,720,000</td>
<td>615,880,000</td>
</tr>
<tr>
<td>Jala</td>
<td>2,458,224,000</td>
<td>1,794,440,000</td>
<td>663,784,000</td>
</tr>
<tr>
<td>Total</td>
<td>9,513,504,000</td>
<td>4,457,620,000</td>
<td>5,055,884,000</td>
</tr>
</tbody>
</table>

### Value of study

|      | 122,450,000 | 75,620,000 | 46,830,000 |

Value of economy =

|      | 42,656,053,000 | 15,869,573,200 | 26,786,479,800 |

Source: Primary Data Processing

Where,

- \( h \) : Shrimp productions
- \( E \) : Catch effort
- \( M \) : Mangrove area

With an average price of shrimp in the Cilacap region of each shrimp *jerbung* IDR 70,000.00 - IDR 100,000.00 / kg with an average IDR 85,000.00, shrimp cap IDR 40,000.00 / kg, shrimp *dogol* IDR 30,000.00 - IDR 40,000.00 / kg and tiger shrimp / *Tepus* IDR 110,000.00, with the percentage composition of the shrimp fishing in 2013 was 37%, 34%, 18% and 11%, are used to determine the economic value as the breeding habitat is IDR 324,456,473,718.92 with an area of research Nurfiarini [2] is 8,234 ha, or IDR 39,402,277.98 / ha. Thus, in this study, with an area of 1788.65 ha of mangrove forest is the value of his benefits IDR 70,476,884,509.00.

#### 3.12. Indirect Use Value – Carbon Deposit

Based on research Martianingrum [11] who is doing research mangroves in the island Belakang Padang, which
has similarities with mangrove in the area Segara Anakan dominated by Rhizophora and Nipa Palm, capable of carbon storage reached 1.81 tons / ha. Based on that estimate the value of the benefits of carbon storage in the Segara Anakan can refer to the value of the benefits of carbon storage in the island Belakang Padang ie 1.81 tonnes / ha. When considered 1 US $ currently is USD 1337.00, based Fankhauser and his colleagues [14] stating carbon exchange rate is US $ 20 per ton of carbon, then the value of the benefits of carbon storage in the region's Segara Anakan research sites 1788.65 ha is IDR 860,913,018.00 per year or IDR 481,320.00 per ha.

### Table 11: Shrimp Production development (H), Capture Effort (E) and Area of Mangrove

<table>
<thead>
<tr>
<th>Year</th>
<th>Shrimp productions (kg)</th>
<th>Catch effort (E)</th>
<th>CPUE (kg/trip)</th>
<th>Mangrove area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>2,923,913.21</td>
<td>44,600</td>
<td>65.56</td>
<td>10,520</td>
</tr>
<tr>
<td>2000</td>
<td>1,308,453.28</td>
<td>45,280</td>
<td>28.90</td>
<td>10,118</td>
</tr>
<tr>
<td>2001</td>
<td>1,355,293.50</td>
<td>45,500</td>
<td>29.79</td>
<td>9,812</td>
</tr>
<tr>
<td>2002</td>
<td>1,865,728.20</td>
<td>46,120</td>
<td>40.45</td>
<td>9,677</td>
</tr>
<tr>
<td>2003</td>
<td>2,014,639.37</td>
<td>46,680</td>
<td>43.16</td>
<td>9,544</td>
</tr>
<tr>
<td>2004</td>
<td>2,039,335.80</td>
<td>47,700</td>
<td>42.75</td>
<td>9,272</td>
</tr>
<tr>
<td>2005</td>
<td>1,849,396.01</td>
<td>48,330</td>
<td>38.27</td>
<td>9,255</td>
</tr>
<tr>
<td>2006</td>
<td>2,263,023.18</td>
<td>48,900</td>
<td>46.28</td>
<td>9,238</td>
</tr>
<tr>
<td>2007</td>
<td>1,385,638.77</td>
<td>50,240</td>
<td>27.58</td>
<td>9,032</td>
</tr>
<tr>
<td>2008</td>
<td>2,181,908.82</td>
<td>51,170</td>
<td>42.64</td>
<td>8,830</td>
</tr>
<tr>
<td>2009</td>
<td>1,263,514.95</td>
<td>55,625</td>
<td>22.71</td>
<td>8,633$^c$</td>
</tr>
<tr>
<td>2010</td>
<td>746,661.55</td>
<td>44,500</td>
<td>16.78</td>
<td>8,440$^c$</td>
</tr>
<tr>
<td>2011</td>
<td>1,701,856.70</td>
<td>69,760</td>
<td>24.40</td>
<td>8,252$^c$</td>
</tr>
<tr>
<td>2012</td>
<td>1,953,799.68</td>
<td>68,240</td>
<td>28.56</td>
<td>8,037$^c$</td>
</tr>
</tbody>
</table>

#### 3.13. Indirect Use Value – Sea Intrusion Barrier

Based on the calculation Paryono [15], the indirect benefits of mangrove forests when the measuring 12089.99 benefit IDR 38,628,739,140.00 or USD 3,277,814.00 / ha. The current exchange rate is US $ 9780.00 per US dollar, then the value of the seawater intrusion barrier today is USD 4,481,019.83 / ha or IDR 8,014,976,113.52 in the lagoon area immediately these seedlings.

#### 3.14. Indirect Use Value – Feed Production

Sukardjo [12] in his research in the area of Kapuk Muara Angke mangrove states that overlay produce litter fall
as much as 13.08 tons / ha / year or around 4.85 tons dry weight / ha / year. Biomass contains nutrients N 10.5 kg / ha or the equivalent of 23.33 kg of urea, of P or Phosphor 4.72 kg / ha / year, equivalent to 13.11 kg of fertilizer SP-36. If the price of urea IDR 1800.00 / kg and SP-36 fertilizer IDR 2,500.00 / kg of the obtained benefits of mangrove litter as a feed source is IDR 74769.00 / ha / year, so that the economic value of the feed production the region IDR 133,735,572.00

3.15. Indirect Use Value – Biodiversity

Value biodiversity refers to Ruitenbeek [6] that the value of mangrove forest biodiversity Indonesia US $ 1,500 / km2 / year or US $ 15 / ha / year. The calculation delivers the existence of regional biodiversity value of IDR 358,713,757.50

3.16. Total Economic Value of Mangrove Forest Ecosystem Benefits on Segara Anakan Lagoon Area

The total economic value to the region Segara Anakan covering 14 807 ha of IDR106.631.702.769.80, both now and in the natural state in case of sedimentation that meet the water body as a result of the dynamics of land change Segara Anakan Region through the valuation of ecosystem services approach with various scenarios relating to land use change and designation.

**Table 12:** Economic Value of Total Benefits Mangrove Forest Ecosystems in Central Segara Anakan covering 14 807 ha in 2016

<table>
<thead>
<tr>
<th>No</th>
<th>Benefit value</th>
<th>Value (IDR/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct benefit</td>
<td>26,786,479,800.00</td>
</tr>
<tr>
<td>2</td>
<td>Indirect benefit</td>
<td>79,486,509,212.30</td>
</tr>
<tr>
<td>3</td>
<td>Option value benefit</td>
<td>358,713,757.50</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>106,631,702,769.80</td>
</tr>
</tbody>
</table>

Source: Primary and Secondary Data Processing

4. Conclusion

The total economic value Segara Anakan region with an area of 14 807 ha area, which includes District Kampung Laut consisting of 4 villages have a total economic value of IDR 106,631,702,769.80 or USD 59,615,745.27 from each ha of mangrove forest.

References


at Segara Anakan, Cilacap.” Disertation, Bogor Agricultural University, Indonesia, 2015.


