The Stock Potency of Demersal Fish Resource at The Coastal Zone, East Kutai District in East Kalimantan

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Abstract- The objective of this research was to estimate the potency of demersal fish resource spread over three sub-districts i.e. Sangkulirang, Sandaran and Kaliorang in Kutai district, East Kalimantan province. The result showed that the highest total biomass was produced by aquatic zone of Sandaran sub-district with 1,763,713.6 ton/zone and the density stock was 13,566.5 kg/km². It was followed by Sangkulirang sub-district with 264,653.3 ton/zone and 6,640.4 kg/km², respectively and then by Kaliorang sub-district with 58,086.5 ton/zone and 2,768.0 kg/km², respectively. In term of species particularly from crustaceae family, the most economic aquatic zone was found in Sangkulirang sub-district. The export product species Penaeus sp was obtained from Penaeus monodon, Metapenaeus monoceros, Metapenaeus sp, Parapenaeopsis sculpitilis, Peneaus sp, and lobster which was accounted by 3,381.6 tons/zone, 83,199 tons/zone, 14,492.7 tons/zone, 24,691.3 tons/zone, 41,331.1 tons/zone, and 1,073.5 tons/zone, respectively. It was followed by Sandaran sub-district with export product species was Penaeus merguensis 33,495.7 tons/zone and non-export products were Parapenaeopsis sculpitilis 63,641.7 tons/zone, Peneaus sp 16,747.8 tons/zone, Metapenaeus sp 1,674.8 tons/zone, Caridina sp 1,562,572.2 tons/zone, and Scylla serrata 3,349.6 tons/zone. Next was Kaliorang sub-district which accounted by Penaeus merguensis 62.2 tons/zone and Metapenaeus monoceros 49.7 tons/zone. In situ measurement on seven physical-chemical quality parameters of water which compared to the standardized of sea water showed that water quality found in coastal zone of Kaliorang, Sangkulirang and Sandaran sub-district, East Kutai province was suitable and feasible for the aquatic and living of marine habitats.

Keywords: potency; stock; coastal; fish; demersal

I. INTRODUCTION

Coastal zone has abundant potency of fishery resource, but somehow hasn’t reached the optimum exploration (Charles, 2001). Thus, appropriate effort should be addressed in order to manage and explore those resources. Coastal zone is the transition or interface between land and ocean ecosystem (Blankenship and Leber, 1995). Biologically, this zone is very productive and potential for Demersal fish catchment (Blanchard, 2001).

Fishing can be carried out in coastal zone and off-shore zone. Fishing catchment in coastal zone is carried out by small fishermen using simple technology. They catch different kinds of skinny fish, mollusk and plant protein such as mangrove vegetation, algae, sea weed and so on (Sorensen et al., 1984). While fishing catchment in off shore zone, besides of small fishers, capital-intensive fishers play the most significant role (Soede, 2000).

Local community highly depend their livelihoods on the sustainibility of coastal zone in East Kalimantan. It has been known from a long time ago that coastal zone with its all potency has been utilized by local community especially for economic reason (Suyatna et al., 2010). Villages of East Kutai in East Kalimantan province particularly located in Kaliorang, Sangkulirang and Sandaran sub-district have fisheries resources that can be utilized and managed by local community as the main livelihood and sideline to improve their prosperity and economy. However, fishing catchment activity has not yet given significant yield for East Kutai district. Mean while, abundance coastal potency spreading over seven sub-districts is very potential for further fishing exploration by utilizing fishing device such as hand line, tonda, purse seine, guidding barrier, gillnet, trammel net and trawl (East Kalimantan Statistical Bureau, 2012).

The biophysical characteristic of coastal zone located in East Kutai depicts viable fisheries condition for the
development of fishing catchment activity of Demersal fish. The slope profile of coast is very practicable for utilization of fishing device including dogol, trawl, trammel net, belat, jermal and rawai dasar. However, it has limitation on the geographically aspect in which the zone is freely exposed to stream and wave of north and south season. Technical modifications on the catchment technology system and uses of stable ship/boats used for fishing are some efforts that could be done to minimizing the limitation (Purwaka and Sunoto, 1999). In spite of this, the limiting factor that cannot be avoided is regulation concerning on the spatial planning excluding fisheries sector (Stobutzki et al., 2006).

II. RESEARCH METHOD

Research was carried out in two months covered three sub-districts i.e.: Kaliorang, Sangkulirang, and Sandaran. According to English et al. (1985), there are at least five fishing gears for sampling fish species living surround mangrove forest, one of them is trawl. Fish sampling technique was performed by lowering fish net called setting. When the net already reached the bottom, the ship was operated to capture all the existing biota in the bottom for 30 minutes. Then, the net was hauled using the method of Line tracking.

Fish sampling was conducted out in two months period. A period of sampling consisted of one week for two trips so the total sampling was 32 times (with towing period by 30 minutes).
Lat1 = latitude at the start of haul (degree), Lat2 = latitude at the end of haul (degree); and Lon1 = longitude at the start of haul (degree), Lon2 = longitude at the end of haul (degree) (Spare and Veneme, 1992 in Can et al., 2005).

III. RESULT AND DISCUSSION

The result of swept analysis was about the species of demersal fish, a potential resource for coastal fishery in East Kutai District. The analyzed fish were from the commonly-consumed species.

| Local Name | Scientific Name | Weight Total (kg) | Swept Zone (Dhx) | Stock Density kg/km² | Total Biomass (Tons/Zone) |
|------------|----------------|------------------|------------------|----------------------|--------------------------|
| Pepetek    | Leiognathus sp  | 16               | 0.00844          | 1,896.3              | 39,793.8                 |
| Gerot-Gerot/Kapas | Pomadasys kaakan | 2.15             | 0.00844          | 254.8                | 5,347.3                  |
| Kerong-Kerong | Terapon theraps | 0.81             | 0.00844          | 96.0                 | 2,014.6                  |
| Gulamah    | Johnius ambycheopus | 0.61            | 0.00844          | 72.3                 | 1,517.1                  |
| Tembang    | Sardinella fimbriata | 0.5             | 0.00844          | 59.3                 | 1,243.6                  |
| Swangi Mata Besar | Pricancus tayenus | 0.5             | 0.00844          | 59.3                 | 1,243.6                  |
| Trakulu    | Carangoides ferdau | 0.2             | 0.00844          | 23.7                 | 497.4                    |
| Beloso     | Saurida tumbil   | 0.5              | 0.00844          | 59.3                 | 1,243.6                  |
| Nico-Nico  | Upeineus sulphureus | 0.3            | 0.00844          | 35.6                 | 746.1                    |
| Tampar Betik | Drepone punctata | 0.31             | 0.00844          | 36.7                 | 774.0                    |
| Kuwe       | Caranx sexfasciatus | 0.21          | 0.00844          | 24.9                 | 522.3                    |
| Como-Como  | Rastrelliger sp   | 0.1              | 0.00844          | 11.9                 | 248.7                    |
| Teri       | Stolephorus indicus | 0.11           | 0.00844          | 13.0                 | 273.6                    |
| Buntal Pipih | Pseudotrancanthus strigilifer | 0.1 | 0.00844 | 11.9 | 248.7 |
| Sarden     | Sardinella sirn | 0.1              | 0.00844          | 11.9                 | 248.7                    |
| Buntal     | Lagoceps sp     | 0.2              | 0.00844          | 23.7                 | 497.4                    |
| Senangin   | Polydactylus sp  | 0.05             | 0.00844          | 5.9                  | 124.4                    |
| Sebelah    | Grammatobothys polyphthalmus | 0.05 | 0.00844 | 5.9 | 124.4 |
| Talang     | Chorinemustata  | 0.05             | 0.00844          | 5.9                  | 124.4                    |
| Kaca-Kaca  | Gerres otyena   | 0.05             | 0.00844          | 5.9                  | 124.4                    |
| Udang Bintik | Metapeneus monoceros | 0.02 | 0.00844 | 2.4 | 49.7 |
| Huo Bodo   | Squilos mitsukuri | 0.05           | 0.00844          | 5.9                  | 124.4                    |
| Kepting Roda | Sylla sp        | 0.3              | 0.00844          | 35.6                 | 746.1                    |
| Rajungan   | Portunus oceanica | 0.05           | 0.00844          | 5.9                  | 124.4                    |
| Selangst   | Anodontostoma sp | 0.01            | 0.00844          | 1.2                  | 24.9                     |
| Udang Putih | Peneaus merquisens | 0.025         | 0.00844          | 3.0                  | 62.2                     |

Source: Primary Data, Processed, 2014.

Based on the result of potential analysis per unit zone in Kaliorang sub-district, it was obtained that the number of pepetek fish (Leiognathus sp) was much larger than other species, with total biomass 39,793.8 tons/zone, whereas fish from around 26 tax a ranged from 24.9 – 746.1 tons/zone, except for family Pomadasyas kaakan which was 5,347.3 tons/are, Terapon theraps was 2,014.6 tons/zone, Johnius ambycheopus 1,517.1 tons/zone, and Sardinella fimbriata 0.61 tons/zone. For export shrimp commodity (Penaeus sp) especially Penaeus monodon was 3,381.6 tons/zone, Metapeneus monoceros was 83.199 tons/zone, Parapeneaopus sculpilis was 24,691.3 tons/zone, Peneaus sp was 24,691.3 tons/zone, and Homarus sp was 1,073.5 tons/zone. Overall, total biomass in Sandaran aquatic zone was 264,653.3 tons/zone and total density of stock was 6,640.4 kg/km².

Potential analysis result per unit zone in Sandaran sub-district showed that Pellona sp species was much larger than other species, with total biomass was 35,170.4 tons/zone, whereas fish from 11 tax a ranged from 167.5 – 1,073.5 tons/zone, except for Johnius ambycheopus which was 13,398.3 tons/zone, Thryssa sp was 10,048.7 tons/zone, and Metapeneus monoceros was 83.199 tons/zone. Overall, total biomass in Sangkulirang aquatic zone was 264,653.3 tons/zone and total density of stock was 6,640.4 kg/km². For export Peneaus sp, especially Peneaus merquisens was 33,495.7 tons/zone, and non-export commodity such as Parapeneaopus sculpilis was 63,641.7 tons/zone, Peneaus sp was 16,741.3 tons/zone, and Homarus sp was 1,073.5 tons/zone. Overall, total biomass in Sangkulirang aquatic zone was 264,653.3 tons/zone and total density of stock was 6,640.4 kg/km².

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Rapid development shave brought negative impacts on the quality of the environment. One of the attempts to save the environment is to minimize the effect of an activity that will cause water quality degradation. Review of water quality parameters requires an adequate knowledge and understanding of the definition (terminology) of water quality parameters, the relationship between parameters, the causative relationship between parameters and the role of these parameters in the balance of aquatic environments.

Given the importance of the presence of water resources quality, the quality should be preserved and maintained, so that the utilization could be sustained. Due to many activities occur in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district, possible impacts that occur on water quality also need to be considered in order to avoid changes in water quality and pollution of sea water.

Measurement of sea water quality in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district, was carried out at nine observation stations. The measurements were performed at Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district, possible impacts that occur on water quality also need to be considered in order to avoid changes in water quality and pollution of sea water. Measurement of sea water quality in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district, was carried out at nine observation stations.
stations which were marine zone that were ecologically functioning as recipient impact of various activities conducted in the mainland and in the coastal waters. All nine of the observation stations namely: Muara Selangkau observation station (station 1), Hilir Teluk Golok (station 2), Muara Sangkulirang (station 3), Tanjung Manis-1 (station 4), Tanjung Manis-2 (station 5), Pulau Seribu-1 (station 6), Pulau Seribu-2 (station 7), Pulau Seribu-3 (station 8), and Muara Susuk Luar (station 9).

Water quality samplings were conducted on sunny days, each sampling started from 7:30 am until 1:10 pm (Indonesia Central Time). Water quality parameters were measured and observed in situ consists of seven parameters of water quality, which were: DO (Dissolved Oxygen), conductivity, turbidity, pH, temperature, salinity and TSS (suspended solids). The results of the sea water quality measurement at nine observation stations around the coastal waters of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district, East Kutai district, are presented in Table 4.

Table 4. The measurement results of sea water quality in coastal waters around Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district, East Kutai district

| No | Station | Unit | Location/Observation Station | Quality Standard*) |
|----|---------|------|------------------------------|-------------------|
| 1  | DO      | mg/l | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | Lamp. I | Lamp. III |
| 2  | Conductivity | - | 50.1 | 50.2 | 47 | 46.8 | 48.2 | 47.1 | 32.3 | 36.5 | 18.3 | - | - |
| 3  | Turbidity | NTU | 15 | 53 | 71 | 247 | 253 | 33 | 6.7 | 63 | 98.5 | - | < 5 |
| 4  | pH      | - | 8.56 | 8.37 | 8.22 | 8.27 | 8.04 | 8.21 | 7.75 | 7.79 | 7.9 | 6.5-8.5 | 7-8.5 |
| 5  | Salinity | /w | 33 | 33 | 30.8 | 30.6 | 31.5 | 30.7 | 20.2 | 23.2 | 11.6 | Alami | s/d 34 |
| 6  | Temperature | °C | 29 | 29.7 | 29.8 | 30.8 | 29.7 | 29.7 | 29.8 | 29.5 | 31.8 | Alami | Alami |
| 7  | TSS     | mg/l | 28 | 57 | 35 | 41 | 44 | 44 | 47 | 56 | 32 | 48 | 80 |

* Minister of Environment Decree No 51 in 2004 on Sea Water Quality Standard Appendix I for Ports Water and Appendix III for Sea Organisms (around Mangrove)

The quality of the aquatic environment is an aquatic environmental feasibility for sustaining life and growth of aquatic organisms whose value is expressed in a certain range. Meanwhile, an ideal aquatic zone is an zone that supports the life of organisms in completing their life cycles (Boyd, 1982).

The measurement results of sea water quality in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district were then compared to the quality standard from Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. Based on the measurement and analysis of water quality, the results obtained for each observation station are as follow:

1. **Muara Selangkau (Station 1**

The analysis of water samples from Muara Selangkau showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life (around Mangrove). Based on the measurement and analysis of water quality, the results obtained for each observation station are as follow:

2. **Teluk Golok (Station 2nd)**

The analysis of water samples from Teluk Golok showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Teluk Golok there were two water quality parameters beyond the approved limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 53 NTU and measured Dissolved Oxygen was 4.24 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

3. **Muara Sangkulirang (Station 3rd)**

The analysis of water samples from Muara Sangkulirang showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Muara Sangkulirang there were two water quality parameters beyond the permitted limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 71 NTU and measured Dissolved Oxygen was 4.28 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment
4. Tanjung Manis-1 (Station 4th)

The analysis of water samples from Tanjung Manis-1 showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Tanjung Manis-1 there were two water quality parameters beyond the approved limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 247 NTU and measured Dissolved Oxygen was 4.16 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

5. Tanjung Manis-2 (Station 5th)

The analysis of water samples from Tanjung Manis-2 showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Tanjung Manis-2 there were two water quality parameters beyond the permitted limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 253 NTU and measured Dissolved Oxygen was 4.29 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

6. Pulau Seribu-1 (Station 6th)

The analysis of water samples from Pulau Seribu-1 showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Pulau Seribu-1 there were two water quality parameters beyond the permitted limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 33 NTU and measured Dissolved Oxygen was 4.30 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

7. Pulau Seribu-2 (Station 7th)

The analysis of water samples from Pulau Seribu-2 showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Pulau Seribu-2 there were two water quality parameters beyond the permitted limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 67 NTU and measured Dissolved Oxygen was 4.52 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

8. Pulau Seribu-3 (Station 8th)

The analysis of water samples from Pulau Seribu-3 showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Pulau Seribu-3 there were two water quality parameters beyond the permitted limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 63 NTU and measured Dissolved Oxygen was 4.49 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

9. Muara Susuk Luar (Station 9th)

The analysis of water samples from Muara Susuk Luar showed that most of water quality parameters were still in approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In Muara Susuk Luar there were two water quality parameters beyond the permitted limit of quality standard, such as: Turbidity and Dissolved Oxygen. Measured turbidity was about 983 NTU and measured Dissolved Oxygen was 4.48 mg/l, while the other parameters remained within limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

The measurement results at all observation stations in coastal waters of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district showed that most measured sea water quality were still in the approved limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. In general, there were two parameters beyond the approved limit, such as: Turbidity and Dissolved Oxygen. According to Yosiaik et al. (1988), the process of photosynthesis caused an increase in dissolved oxygen during the day and reached its maximum in the afternoon, and then the concentration of dissolved oxygen decreased from evening until the next morning due to the respiration activity of organisms and decomposition of organic matter.

Dissolved oxygen is an important parameter of water quality for marine life because it is closely related to respiration process in the water. In general, the quality of sea water in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district contained DO ranged from 4.16–4.52 mg/l. If we compare to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life, measured DO level in all zones were under the required range, more than 5 mg/l.

The results of turbidity measurements showed that turbidity parameter as an indicator of sea water quality at all observation stations in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-

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district had exceeded the limit of Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life. Measured sea water turbidity at all zones ranged from 15-983 NTU and had exceeded the permitted quality standard which is 5 NTU. Odum (1971) suggested that turbidity was caused mainly by siltation and sediment particles. Turbidity is often important as a limiting factor. On the contrary, if the turbidity is caused by organisms (plankton) or organic materials, the value of turbidity is an indication of water productivity.

The measurement results of salinity at all observation stations in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district ranged from 11.6-33‰. The results in all zones generally were still in the limit required by Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life for salinity with natural range up to 34‰.

![Figure 1. Dissolved Oxygen Parameter (DO) at Nine Sampling Stations](Image)

![Figure 2. Turbidity Parameter at Nine Sampling Stations](Image)

![Figure 3. Degree of Acidity Parameter (pH) at Nine Sampling Stations](Image)

![Figure 4. Salinity Parameter at Nine Sampling Stations](Image)

The measurement results of water temperature at all observation stations in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district ranged from 29 - 30.8 °C. The results in all zones were still in the limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life which required Water Temperature in natural range with variation less than 3°C. Any changes in temperature are likely to affect many chemical processes which occur simultaneously in plant and animal tissues, thus also affecting the biota as a whole. The higher the temperature, the higher metabolism of organisms living in the waters will occur. It will increase oxygen requirement, but the ability of hemoglobin to bind oxygen decreases. Walk et al., (2000) stated that high temperature will directly affect the metabolic processes of aquatic biota.

The measurement results of total suspended solids at all stations in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district ranged from 28 mg/l to 57 mg/l. In general, the value of TSS or suspended solids measured at all observation stations were still in the limit according to Sea Water Quality Standard in Minister of Environment Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life which required total suspended solids (TSS) or dissolved residues less than 80 mg/l. High content of TSS generally is influenced by water movement from coastal and sea water which are open system waters and lotic water resulting in water movement that could stir the silt contained in the bottom and sediment.
particles to move towards the surface through erosion process and abrasion (soil erosion on the shore).

According to the measurement results of quality of physic-chemical parameters of measured and observed water has not been included in quality standards (PP. No. 82 in 2001, and East Kalimantan Province Local Regulation No. 02 in 2011 Class II), so the feasibility of waters for fishing activities cannot yet be compared.

Based on the measurement results of the electrical conductivity value (EC) at nine sampling stations in Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district varied from 8.3 to 50.2 ms/cm. The lowest value of DHL was found in Muara Susuk Luar station which was 18.3 ms/cm. Its value was much lower than in Muara Selangkau which was 91 ms/cm.

Electric conductivity (EC) describes the electrical charge contained in a water body due to the presence of dissolved ions in the waters, thus the DHL value will be proportional to the concentration of dissolved substances which form ions in the water. The higher concentration of ions contained in the water, the higher electric conductivity will be gained (Boyd, 1982). Commonly used public waters for supporting people's life have electrical conductivity between 50–1500 mhos/cm (5–150 mS/m) (APHA, 1998).

Nevertheless, DHL permissible value contained in the water has not been included in quality standards (PP. No. 82 in 2001, and East Kalimantan Province Local Regulation No. 02 in 2011 Class II), so the feasibility of waters for fishing activities cannot yet be compared.

Due to the distribution of coastal ecosystem such as lamun, coral reefs, and mangroves as well as the ecosystem based on the types such as estuaries (brackish water) and sea water, the management of fish resources in East Kutai especially in three observed sub-districts, namely Kaliorang, Sangkulirang, and Sandaran, will give wide variation.

Related to the type and fish size as well as the types of ecosystems, the three groups interacted each other, especially the interaction between fish and the coastal ecosystem (Lamun, Mangroves and Coral Reefs). Generally, small fish congregated in the estuary waters where mangrove is found, even only with mangroves, small form of groups was found. In this zone, they could find food easily as feeding ground and even as the nursery ground, and therefore the estuarine fish productivity was the highest, while the diversity of types was found in the coral reef ecosystem. For recommendations, zones in the river mouths should be prohibited from using dogol as it would reduce the amount of larvae and small fish. Small fishing net should be also prohibited. For fisheries management (sustainable management), prohibitions in fish and shrimp fishing in some places are very necessary as MPAs (Marine Protected Zones), but this needs further study to determine the locations. The results of the study showed that Sangkulirang sub-district and Sandaran sub-district had the highest potential and diversity compared to Kaliorang sub-district. Therefore, those sub-districts need attention to be used as a marine protected zone. Above 5 km from the coastline must be served as pelagic fishing zone and it is necessary to study the most economical fishing gear.

CONCLUSION

The highest total biomass of demersal fish resource was found at Sandaran sub-district aquatic zone by 1,763,713.6 ton/zone and density stock by 13,566.5 kg/km2, followed by Sangkulirang aquatic zone by 264,653.3 ton/zone and density stock by 6,640.4 kg/km2, respectively and Kaliorang aquatic zone by 58,086.5 ton/zone and density stock by 2,768.0 kg/km2, respectively.

According to the biomass production of crustaceae family, the most economic aquatic zone occurred at...
Sangkulirang sub-district which consisted of export species (Penaeus sp) including Penaeus monodon 3,381.6 tons/zone, Metapenaeus monoceros 83,199 tons/zone, Parapeneaopsis sculptilis 24,691.3 tons/zone, Peneaus sp 41,331.1 tons/zone, and Homarus sp 1,073.5 ton/zone. Followed by Sandaran sub-district which consisted of export species including Penaeus merguensis 33,495.7 tons/zone, and non-export including Parapeneaopsis sculptilis by 63,641.7 tons/zone, Peneaus sp 16,747.8 tons/zone, Metapenaeus sp1,674.8 tons/zone, udang Caridina sp 1,562,572.2 tons/zone, and Scylla serrata 3,349.6 tons/zone. Next was Kaliorang sub-district which consisted of Penaeus merguensis 62.2 tons/zone and Metapenaeus monoceros 49.7 tons/zone.

According to the in situ measurement on seven physico-chemical quality parameters of water which compared to the standardized of sea water showed that water quality found in coastal zone of Kaliorang, Sangkulirang and Sandaran sub-district, East Kutai province was suitable and feasible for the aquatic and living of marine habitats.

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