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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 crustaseaae 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 sculptilis, Penaeus 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 sculptilis 63,641.7 tons/zone, Penaeus 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

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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 sustainability 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).

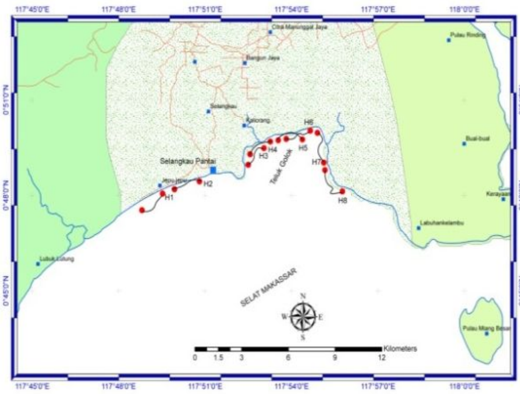
Villages of East Kutai in East Kalimantan province particularly located in Kaliorang, Sangkulirang and Sandaran sub-district have fisheries resources that can be utilized and managed by local community as the main livelihood and sideline to improve their prosperity and economy. However, fishing catchment 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).



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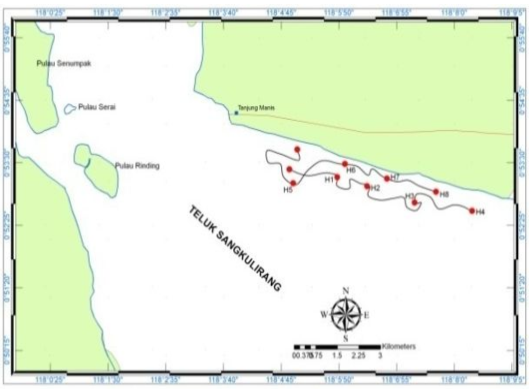

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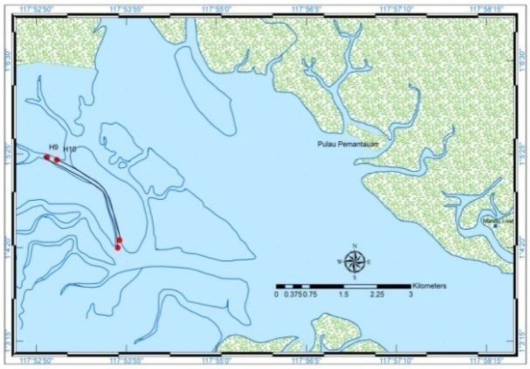
Fig 2.Map of Fish Catch and Water Quality Sampling Location in the Coastal of (a) Kaliorang sub-District and (b) Tanjung Manis Village, Sangkulirang sub-district



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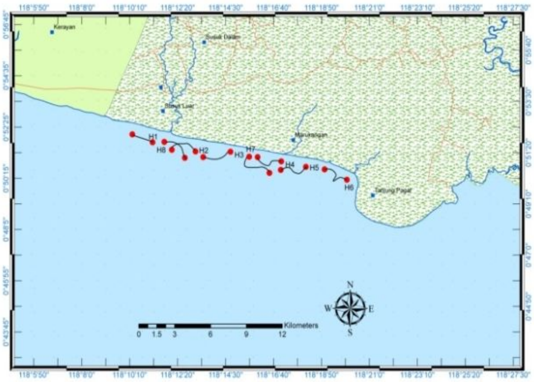

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Fig 4.Map of Fish Catch and Water Quality Sampling Location in the Coastal of (a) Seribu island, Sangkulirang Bay, Sangkulirang sub-District and (b) Susuk Luar Village and Marukangan, Sandaran sub-District

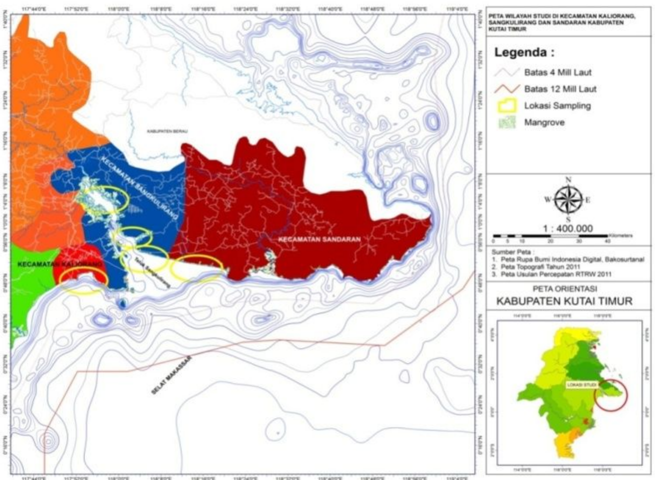

Fig 1.Map of Sampling Location in Kaliorang, Sangkulirang and Sandaran sub-district

According to Ricker (1967), Swept Zone Analysis and Total Biomass are two frequently-used procedures to identify fish types. Theoretically, CPUE is written as: Cw/a (Cw = weight of the catch; a = swept zone or effective path swept of each hauling so that a = D. h. X (D = length of the path and h is the length of the upper head-rope or width of the path swept by the trawl, X = varies from 0.4 to 0.66. Generally, X value is 0.4.D or Di could be specifically written as:

$$D_i = 60x\sqrt{(Lat_1 - Lat_2)^2 + (Lon_1 + lon_2)^2 \cos 0.5^2 (Lat_1 + Lat_2)}$$

Lat1= latitude at the start of haul (degree), Lat2 = latitude at the end of haul (degree); andLon1 = 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.

Table 1. Total Biomass of Demersal Fish Resource from Each Species in Kaliorang Sub-district Aquatic Zone (tons/zone)

No	Local Name	Scientific Name	Weight	Swept Zone (Dhx)	Stock Density	Total Biomass
			Total (kg)	(km^2)	kg/km^2	(Tons/Zone)
1	Pepetek	*Leiognathus sp*	16	0.00844	1,896.3	39,793.8
2	Gerot-Gerot/Kapas	*Pomadasys kaakan*	2.15	0.00844	254.8	5,347.3
3	Kerong-Kerong	*Terapon theraps*	0.81	0.00844	96.0	2,014.6
4	Gulamah	*Johnius amblycephalus*	0.61	0.00844	72.3	1,517.1
5	Tembang	*Sardinella fimbriata*	0.5	0.00844	59.3	1,243.6
6	Swangi Mata Besar	*Priacanthus tayenus*	0.5	0.00844	59.3	1,243.6
7	Trakulu	*Carangoides ferdau*	0.2	0.00844	23.7	497.4.
8	Beloso	*Saurida tumbil*	0.5	0.00844	59.3	1,243.6
9	Nico-Nico	*Upeneus sulphureus*	0.3	0.00844	35.6	746.1
10	Tampar Betik	*Drepane punctata*	0.31	0.00844	36.7	771.0
11	Kuwe	*Caranx sexfasciatus*	0.21	0.00844	24.9	522.3
12	Como-Como	*Rastrelliger sp*	0.1	0.00844	11.9	248.7
13	Teri	*Stolephorus indicus*	0.11	0.00844	13.0	273.6
14	Buntal Pipih	*Pseudotriacanthus strigilifer*	0.1	0.00844	11.9	248.7
15	Sarden	*Sardinella sirm*	0.1	0.00844	11.9	248.7
16	Buntal	*Lagocephalus sp*	0.2	0.00844	23.7	497.4
17	Senangin	*Polydactylus sp*	0.05	0.00844	5.9	124.4
18	Sebelah	*Grammatobothus polypthalmus*	0.05	0.00844	5.9	124.4
19	Talang	*Chorinemustala*	0.05	0.00844	5.9	124.4
20	Kaca-Kaca	*Gerres oyena*	0.05	0.00844	5.9	124.4
21	Udang Bintik	*Metapenaeus monoceros*	0.02	0.00844	2.4	49.7
22	Hiu Bodo	*Squalus mitsukurii*	0.05	0.00844	5.9	124.4
23	Kepiting Roda	*Scylla sp*	0,3	0.00844	35.6	746.1
24	Rajungan	*Portunus oceanica*	0.05	0.00844	5.9	124.4
25	Selangat	*Anodontostoma sp*	0.01	0.00844	1.2	24.9
26	Udang Putih	*Penaeus merguensis*	0.025	0.00844	3.0	62.2
	Total				2,768.0	58,086.5

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 Pomadasys kaakan which was 5,347.3 tons/are, Terapon theraps was 2,014.6 tons/zone, Johnius amblycephalus 1,517.1 ton/zone and Sardinella fimbriata 1,243.6 ton/zone. For export shrimp commodity (Penaeus sp) especially Penaeus merguensis was 62.2 tons/zone and Metapenaeus monoceros was 49.7 tons/zone. Overall, total biomass in Kaliorang aquatic zone was 58,086.5 tons/zone and total density of stock was 2,768.0 kg/km2.

According to the result of potential analysis per unit zone in Sangkulirang sub-district, it was obtained that the number of Johnius amblycephalus was much larger than other species, with total biomass was about 23.617,8 tons/zone, whereas fish from 19 tax a ranged from 53.7–1,073.5 tons/zone, except for Trichiurus auriga that was about 20,497.2 tons/zone, Pellona sp was 10,198.6 tons/zone, Macrones gulio 3,220.6 tons/zone, and Plotosus canius was 2,683.8 tons/zone. For export shrimp commodity (Penaeussp) especially Penaeus monodon was 3,381.6 tons/zone, Metapenaeus monoceros was 83.199 tons/zone, Metapenaeus sp 83,199 tons/zone, Parapenaeopsis sculptilis was 24,691.3 tons/zone, Penaeus sp was 24,691.3 tons/zone, and Homarus sp was 1,073.5 ton/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.

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 167.5–1,674.8 tons/zone, except for Johnius amblycephalus which was 13,398.3 tons/zone, Thryssa sp was 10,048.7 tons/zone, layur (Trichiurus auriga) was 5,024.3 tons/zone, and Thryssa sp was 6,699.1 tons/zone. For export Penaeus sp, especially Penaeus merguensis was 33,495.7 tons/zone, and non-export commodity such as Parapenaeopsis sculptilis was 63,641.7 tons/zone, Penaeus sp was 16,747.8 tons/zone, Metapenaeus sp was 1,674.8 tons/zone, Caridina sp was 1,562,572.2 tons/zone, and Scylla serrata was 3,349.6 tons/zone. Overall, total biomass in Sandaran aquatic zone was 1,763,713.6 tons/zone and total density of stock was 13,566.5 kg/km2.

Table2. Total Biomass of Demersal Fish Resource from Each Species in Sangkulirang Sub-district Aquatic Zone (tons/zone)

No	Local Name	Scientific Name	Weight Total (kg)	Swept Zone (Dhx) (km²)	Stock Density kg/km²	Total Biomass (Tons/Zone)
1	Udang Ambaring Hitam	*Caridina sp*	1.5	0.00743	202.02	8,051.5
2	Udang Bintik Kuning	*Metapenaeus sp*	0.6	0.00743	80.81	3,220.6
3	Udang Ambaring Putih	*Caridina sp*	0.3	0.00743	40.40	1,610.3
4	Bawal	*Pampus argenteus*	0.15	0.00743	20.20	805.2
5	Udang Bintik	*Metapenaeus monoceros*	15.5	0.00743	2,087.54	83,199.0
6	Udang Bintik Kuning	*Metapenaeus sp*	2.7	0.00743	363.64	14,492.7
7	Udang Brown	*Penaeus sp*	7.7	0.00743	1,037.04	41,331.1
8	Bulu Ayam	*Thryssa satirostris*	0.2	0.00743	26.94	1,073.5
9	Bulu Ayam Panjang	*Thryssa sp*	0.1	0.00743	13.47	536.8
10	Buntal	*Lagocephalus sp*	0.025	0.00743	3.37	134.2
11	Cumi	*Loligo sp*	0.2	0.00743	26.94	1,073.5
12	Gulamah	*Johnius amblycephalus*	4.4	0.00743	592.59	23,617.8
13	Hiu Bodo	*Squalus mitsukurii*	0.16	0.00743	21.55	858.8
14	Hiu Putih	*Carcharhinus sp*	0.4	0.00743	53.87	2,147.1
15	Kepiting Bakau	*Scylla serrata*	0.5	0.00743	67.34	2,683.8
16	Lampa-Lampa	*Thryssa sp*	0.2	0.00743	26.94	1,073.5
17	Lampa-Lampa (Bulu Ayam Pendek)	*Thryssa sp*	0.2	0.00743	26.94	1,073.5
18	Layur	*Trichiurus auriga*	3.8	0.00743	511.78	20,397.2
19	Lidah	*Paraplagusia sp*	0.4	0.00743	53.87	2,147.1
20	Udang Lobster	*Homarus sp*	0.2	0.00743	26.94	1,073.5
21	Udang Loreng	*Parapenaeopsis sculptilis*	4.6	0.00743	619.53	24,691.3
22	Mantis	*Oratosquilla sp*	0.2	0.00743	26.94	1,073.5
23	Menangin	*Polydactylus sp*	0.3	0.00743	40.40	1,610.3
24	Nico-Nico	*Upeneus sulphureus*	0.03	0.00743	4.04	161.0
25	Otek	*Macrones gulio*	0.6	0.00743	80.81	3,220.6
26	Puput	*Pellona sp*	1.9	0.00743	255.89	10,198.6
27	Rajungan	*Portunus oceanica*	0.95	0.00743	127.95	5,099.3
28	Sembilang	*Plotosus canius*	0.5	0.00743	67.34	2,683.8
29	Senangin	*Polydactylussp*	0.05	0.00743	6.73	268.4
30	Teri	*Stolephorus indicus*	0.01	0.00743	1.35	53.7
31	Udang Windu	*Penaeus monodon*	0.63	0.00743	84.85	3,381.6
32	Trakulu	*Carangoides ferdau*	0.1	0.00743	13.47	536.8
33	Udang Putih	*Penaeus merguensis*	0.2	0.00743	26.94	1,073.5
	Total				6,640.40	264,653.3

Source: Primary Data, Processed, 2014.

Table3. Total Biomass of Demersal Fish Resource from Each Species in Sandaran Sub-district Aquatic Zone (tons/zone)

No	Local Name	Scientific Name	Weight Total (kg)	Swept Zone (Dhx) (km²)	Stock Density kg/km²	Total Biomass (Tons/Zone)
1	Udang Brown	*Penaeus sp*	1	0,00776	128,8	16.747,8
2	Udang Putih	*Penaeus merguensis*	2	0,00776	257,6	33.495,7
3	Udang Loreng	*Parapenaeopsis sculptilis*	3,8	0,00776	489,5	63.641,7
4	Udang Bintik Kuning	*Metapenaeus sp*	0,1	0,00776	12,9	1.674,8
5	Udang Ambaring Hitam	*Caridina sp*	93,3	0,00776	12.019,3	1.562.572,2
6	Gulamah	*Johnius amblycephalus*	0,8	0,00776	103,1	13.398,3
7	Layur	*Trichiurus auriga*	0,3	0,00776	38,6	5.024,3
8	Puput	*Pellona sp*	2,1	0,00776	270,5	35.170,4
9	Menangin	*Eletheronema tetradactylum*		0,00776	12,9	1.674,8
10	Lampa-Lampa	*Thryssa sp*	0,6	0,00776	77,3	10.048,7
11	BuluAyam	*Thryssa sp*	0,1	0,00776	12,9	1.674,8
12	Lidah	*Paraplagusia sp*	0,01	0,00776	1,3	167,5
13	Teri	*Stolephorus indicus*	0,1	0,00776	12,9	1.674,8
14	Otek	*Macrones gulio*	0,3	0,00776	38,6	5.024,3
15	Kepiting Bakau	*Scylla serrata*	0,2	0,00776	25,8	3.349,6
16	Bulu Ayam Pendek	*Thryssa satirostris*	0,4	0,00776	51,5	6.699,1
17	Bulu Ayam Panjang	*Thryssa sp*	0,1	0,00776	12,9	1.674,8
	Total				13.566,5	1.763.713,6

Sumber : Data Primer Diolah, 2014.

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 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	2	3	4	5	6	7	8	9	Lamp. I	Lamp. III
1	DO	mg/l	4.33	4.24	4.28	4.16	4.29	4.30	4.52	4.49	4.48	-	> 5
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	67	63	983	-	< 5
4	pH	-	8.36	8.37	8.22	8.27	8.04	8.21	7.75	7.79	7.97	6,5 - 8,5	7 - 8,5
5	Salinity	°/₀₀	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	47	56	32	48	80	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)
Description of Station /Location:

1. Muara Selangkau
2. Teluk Golok
3. Muara Sangkulirang
4. Tanjung Manis 1
5. Tanjung Manis 2
6. Pulau Seribu-1
7. Pulau Seribu-2
8. Pulau Seribu-3
9. Muara Susuk Luar

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 on Sea Water Quality Standard 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:

1. Muara Selangkau (Station 1st)
   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. In Muara Selangkau there were 2 water quality parameters beyond the approved limit of quality standard, i.e.: Turbidity and Dissolved Oxygen. Measured turbidity was about 15 NTU and measured Dissolved Oxygen was 4.33 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.

2. Teluk Golok (Station 2nd)
   The analysis of water samples from Teluk Golokshowed 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 Sangkulirangshowed 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

Decree No. 51 in 2004 Appendix I for Ports Water and Appendix III for Marine Life.

4. Tanjung Manis-1 (Station 4th)
   The analysis of water samples from Tanjung Manis-1showed 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-2showed 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-1showed 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-3showed 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-districtshowed 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. However, in general, there were wo parameters beyond the approved limit, such as: Turbidity and Dissolved Oxygen. According to Yosiaki *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-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.

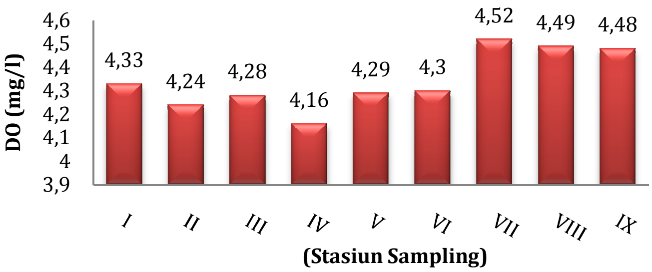

Figure 1.Dissolved Oxygen Parameter (DO) at Nine Sampling Stations

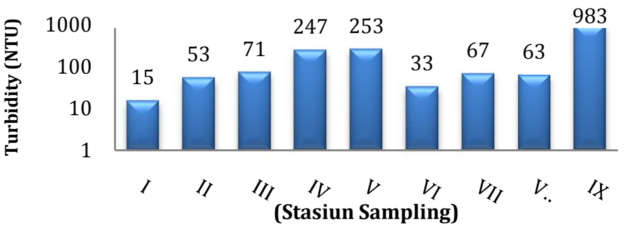

Figure 2.Turbidity Parameter at Nine Sampling Stations

Turbidity is caused by both organic and inorganic materials suspended or dissolved such as mud, silt, organic and inorganic materials such as plankton and other microorganisms. High turbidity value does not mean as the indication of high pollution rate, it just affects light penetration that might reduce the level of primary productivity in marine life. Coastal aquatic ecosystems are still heavily influenced by the land and the rivers that flow into the sea, in addition to other influences such as the stirring waters by waves and currents, they are also influenced by microorganisms such as planktons.

The measurement results of the degree of acidity (pH) at all observation stations in coastal waters of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-district ranged between 7.75 and 8:37. The results of pH measurements 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 which is around 6.5-8.5.

Every organism has an optimum pH for its life, the ideal pH for phytoplankton is 6.5–8.0. In waters with pH less than six, phytoplankton cannot live well. While in waters with pH 9.5 can cause the death of marine organisms and reduce productivity (Weber, 1991).

The measurement results of salinity at all observation stations in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-distric tranged 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‰

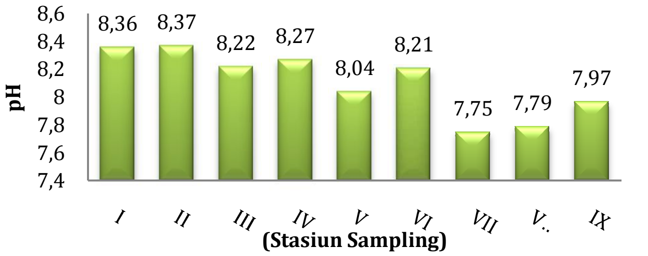

Figure 3. Degree of Acidity Parameter (pH) at Nine Sampling Stations

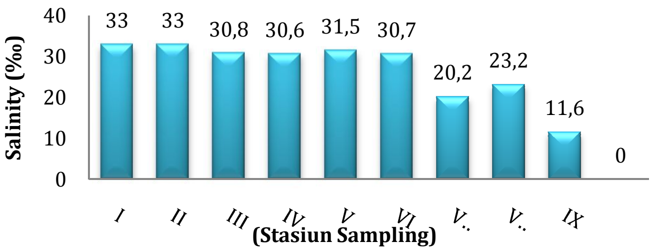

Figure 4.Salinity Parameter at Nine Sampling Stations

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 organism sliving 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).

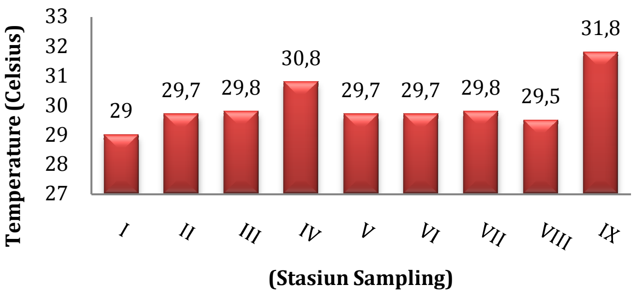

Figure 5.Temperature Parameter at Nine Sampling Stations

According to the measurement results of quality of physic-chemical parameters of measured and observed sea water and compared to quality standard showed that sea water quality in coastal zones of Kaliorang sub-district, Sangkulirang sub-district, and Sandaran sub-districtwere quite well in general and able to support the feasibility of the waters and marine life, 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.

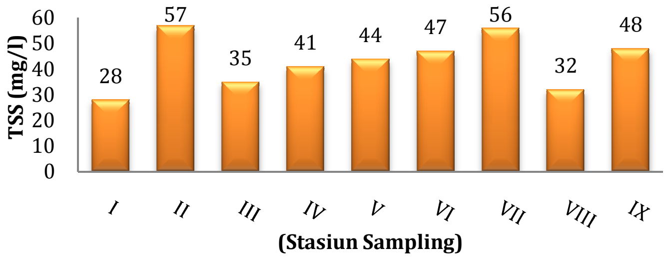

Figure 6.Total Suspended Solid (TSS) Parameter at Nine Sampling Station

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-districtranged from 18.3 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.

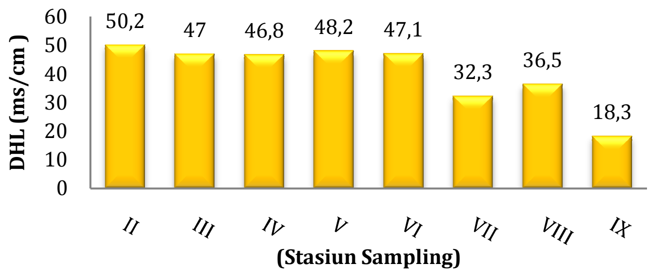

Figure 7.EC Parameter at Nine Sampling Stations

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.

Based on the results of fishing using bottom mini trawl, fish and shrimp with economically significant size (fish size is big enough) were caught within the sea zone from coastline between two and three km. While fish and shrimp caught in the zone less than 2 km commonly have smaller size. Therefore, this zone can be recommended as a fishing zone (fishing ground) for local fishers.

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 Kaliorangsub-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 6,640.4 kg/km2, respectively and Kaliorang aquatic zone by 58,086.5 ton/zone and 2,768.0 kg/km^2, respectively.

According to the biomass production of crustaseaae 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, Metapenaeus sp 14,492.7 tons/zone, Parapenaeopsis sculptilis 24.691,3 tons/zone, Penaeus 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 Parapenaeopsis sculptilis by 63,641.7 tons/zone, Penaeus 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

REFERENCES

[1] APHA, 1998. Standard Methods for The Examination of Water and Wastewater. American Public Health Assoc. Washington

[2] Blanchard, F. 2001. The effect of fishing on demersal fish community dynamics: an hypothesis. ICES Journal of Marine Science 58: 711-718.

[3] Blankenship, H. L., Leber, K.M., 1995. A responsible approach to marine stock enhancement. Am. Fish. Soc. Symp. 15: 167–175.

[4] Boyd, C.E. 1982. Water Quality Management for Pond Fish Culture. Elsevier. Scientific Publishing Company. Amsterdam, pp.41

[5] Charles A. Sustainable Fisheries System. Oxford: Blackwell Science. London. 2001.

[6] English, S; C. Wilkinson and V. Baker. 1985. Survey manual for tropical marine resources. Asean Australia Marine Science Project : Living coastal resources. Living Coastal Resources by the Autralian Institute of Marine Science P.M.B. No. 3 Townsville Mail Center, Australia 4810.309 p.

[7] Odum, E.P. 1971. Fundamental of Ecology. W.B. Sounders Company. Philadelphia – London – Toronto.576 p.

[8] Purwaka T and Sunoto M. 1999. Coastal and Marine Resources in Indonesia.Legal and Institutional Aspect. PRIAP-ICLARM, Working Paper No.2, Manila, Philipines.

[9] Soede, C. P. 2000. Co-management of an Indonesian coastal fishery. Jurnal Pesisir dan Lautan 3 (1) : 24-35.

[10] Sorensen J. C, S. T., McCreary and M. J. Hersman. 1984. Institutional Arrengement for management of Coastal Resources Research Planning Institute. Inc Colombia, South California.

[11] Sparre P, Venema SC. 1999. Introduksi Pengkajian Stok Ikan Tropis (Introduction: Study of Tropical Fish Stock). Food and Agricultural Organization of The United Nations. 438 p

[12] Stobutzki, G. T. Silvestre, A. Abu Talib, A. Krongpromc, M. Supongpan, P. Khemakorn, N. Armada and L.R. Garces. 2006. Decline of demersal coastal fisheries resources in three developing Asian countries. Fisheries Research. 78: 130–142

[12] Stumn, W. and Morgan. S. J., 1981. Aquatic Chemistry Emphazing Chemical Equilibra In Natural Water. 2nd Edition. John Willey And Son, New York.

[13] Suyatna I, A.A. Baratawinata, A S Sidik and A Ruchaemi. 2010. Demersal fishes and their distribution in estuarine water of Mahakam Delta, East Kalimantan. Biodiversitas, 11 (4); 204-210.

[14] Weber, C. I. 1991. Methods for Measuring the Acute Toxicity of Effluent and Recieving Water to Freshwater and Marine Organisms.Fourth edition. US EPA, Ohio.

[15] Yosiaki D, Haruo S and Sho K. 1988.Aquatic Environment Research guide (in Japenese). Koseisha Koseikaku. Tokyo. 106 pages.