International Journal of
Emerging Research in Management &Technology
ISSN: 2278-9359 (Volume-5, Issue-5)

Research Article | **May 2016**

Analysis of Environmental Conditions in Operation Area of Bottom Longlineat Kao Bay, Halmahera, North Maluku Province

[1]Imran Taeran, [1]Irwan Abdul Kadir, [2]Jefry Bemba
[1]Fisheries Resource Utilization Study Program, Fisheries and Marine Science, Khairun University, Indonesia
[2]Marine Science Study Program, Fisheries and Marine Science, Khairun University, Indonesia

Abstract:

The factors that influence the success bottom longline operation include seabed topography, substrate bottom, and physico-chemical conditions of waters. Until now there has been available information about these factors in the study area.The aim of this study is to create a profile and compare the environmental conditions between guyot habitat, reef habitat, and river estuary habitat. The results showed that the characteristic of the topography on third habitats varies with different depths. The substrate on guyot and reef habitat are not significant differences, but on a river estuary is significantly different. The mean values of temperature, chlorophyll-a, and salinity in front of coral reef habitat is not different from theriver estuary habitat. The average value of pH and DO on coral reef habitats and other habitats were not significantly different.

Keywords: Bottom Longline, Environmental Condition, Halmahera Island

I. INTRODUCTION

One of thefishing gearused byfishermeninthe bayKao, is bottom longline. This gearwas operated in potentialfishing areas. Based on observations, there are severalaquatic habitatsaspotentialfor fishing areassuch as guyot (table mount),coral reefhabitat; andriverestuaries.Factorsthat influence thesuccess ofbottom longline operation is the designof fishing gear, seabed topography,substratecharacteristic,and physic-chemical condition. The design offishing gearwill affect theperformancewhen interactingwithlonglinefishing, while theotherfactors thatwill affect toavailability of resourcesof fishon their habitats.

Several studies related to the performance of bottom longline gear has been done. For example; Observation of some basic aspects of bottom longline operations in Juana, Central Java by Harifin and Wijopriono (1993); The rate of fishing (hook rate) with bottom longline in kalipo, Binuangen, West Java by Nasution (1993); The influence of mesh size of bottom longline on fish catches by Wudianto et al (1995); and the trial of bottom longline using hook no 4, 6, and 8 in the Gulf Watermelon, South Lampung by Hufiadi and Nurdin (2006). But the information about seabed topography, substrate characteristic, and physico-chemical condition are not available.

Data and information on the topography of seabed condition in demersal fishing activities are needed, especially to recognize the characters and conditions of the waters. Depth has a majorfactor that influences on the distribution, abundance and diversity of fish species (Thistle, 2003; Bianchi, 1992; Fujita et al, 1995).Characteristic of bottom waters has an important role in controlling the distribution of demersal fish, because the type of substrate affects the lives of organisms such invertebrates as food fish (Lowe and McConnell, 1987). Distribution of a fish species was influenced by several factors;include physico-chemical condition, relationships with other organisms and behavior organism in selecting habitat (Krebs 1989).

The purpose ofthis research isto create a profileandcompare theenvironmental conditionson three habitats; guyot habitat, reefhabitat, andriver estuary habitat. Weexpected that the result can be valuable informationtoimprove the performance ofbottom longlineoperation.

II. MATERIALS AND METHODS

A. Study Area

Location of the study is on Kao Bay, Halmahera Island - North Maluku Province (Fig.1). This location is the bottom longlineoperation area. Data Collection was started from April 2015.

B. Sampling Method

Water depth measurement using Fishfinder type Garmin 350C (77 Hz and 200 Hz). Substrate sediment samplinguse*Ekman Grab Sampler*. Measurement of physical-chemical parameters using water quality checker Horiba U50. Measurements were taken at the surface andten meters. Chlorophyll-a data obtained through image digitization.

C. Analysis Method

Water depth data analysis using surfers, thenoverlay withthe basictopographicalmap of Indonesia(RBI) published by the Geospatial Information Agency,to generatebathymetry. This map hereinafterdescribedseabedmorphology. Sediment samples from eachlocation visuallyidentifiedandcategorized based on Wentworth Scale. Analysis of Physical-chemical condition usingANOVA with Tukeymeandifference test(Tukey's HSDTest)confidence intervalα= 0.05(Zar, 1984;Petersen, 1985;Tenriware, 2012).

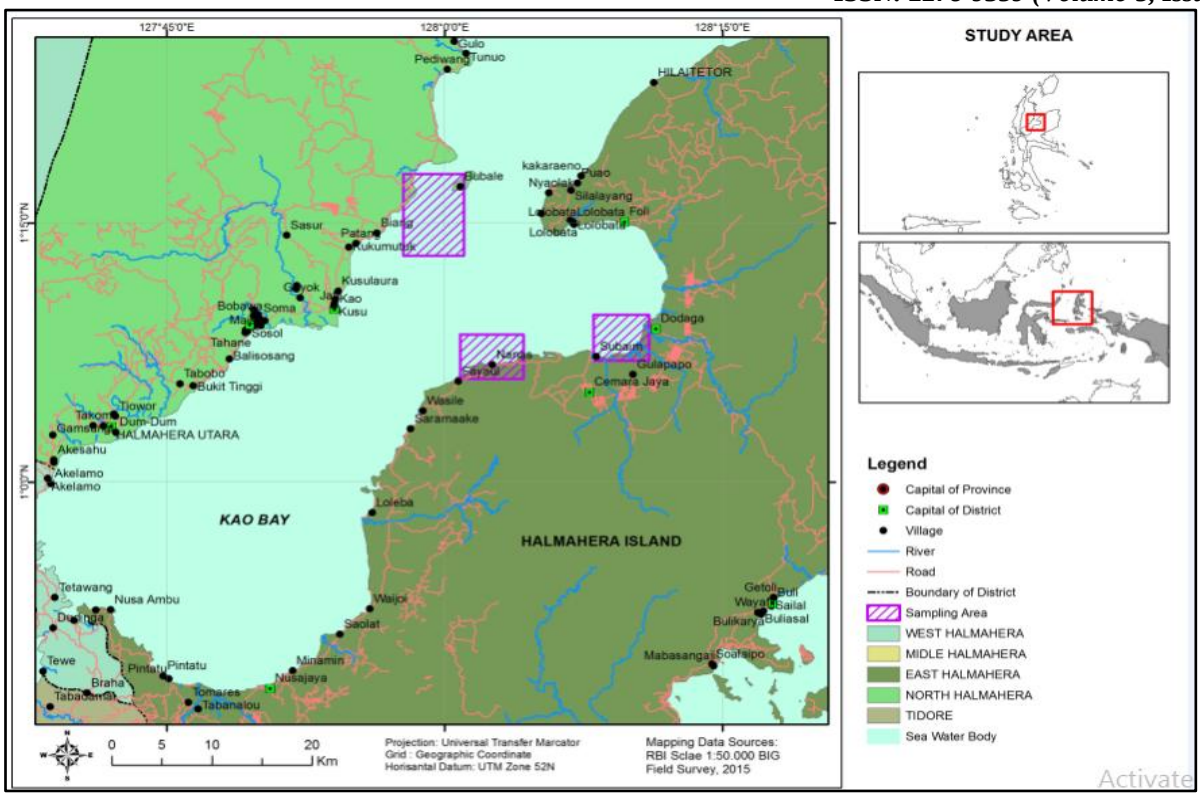


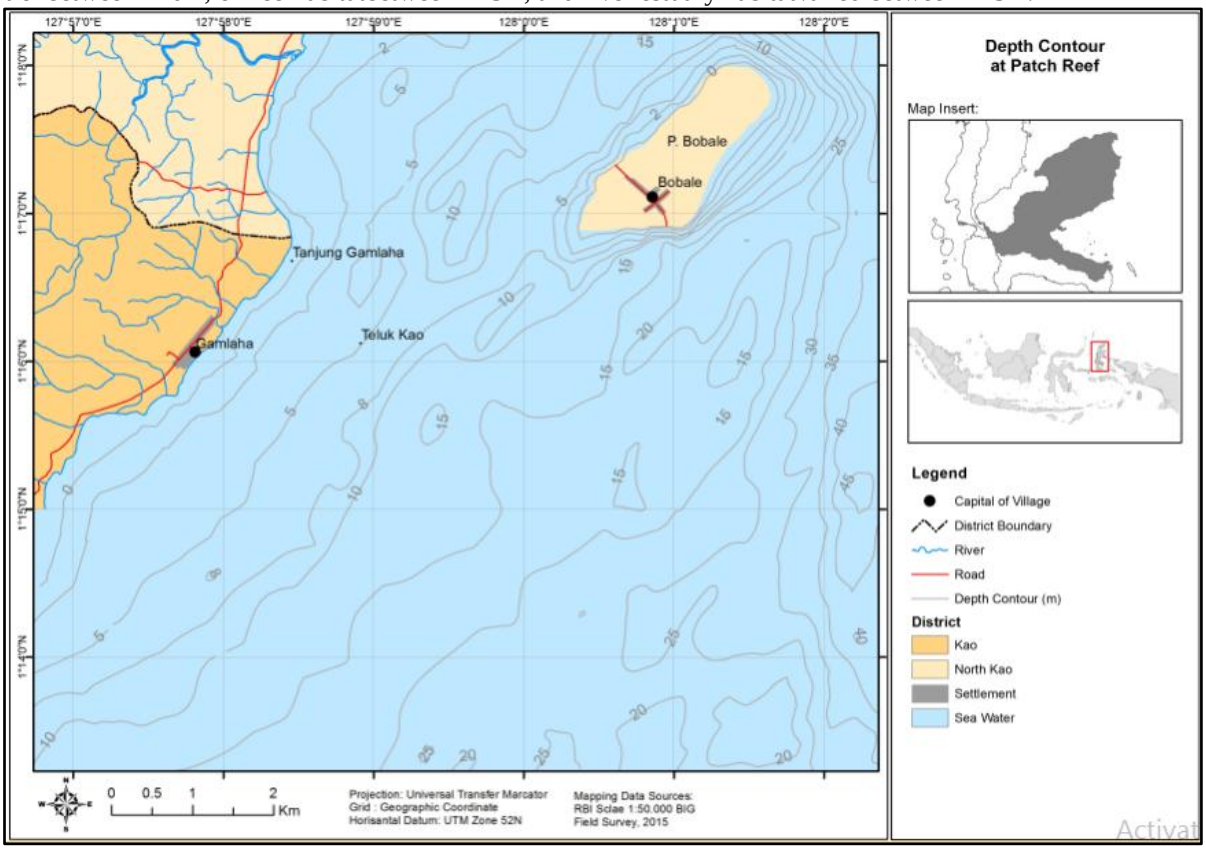
Figure 1. Study Area

III. RESULT AND DISSCUSION

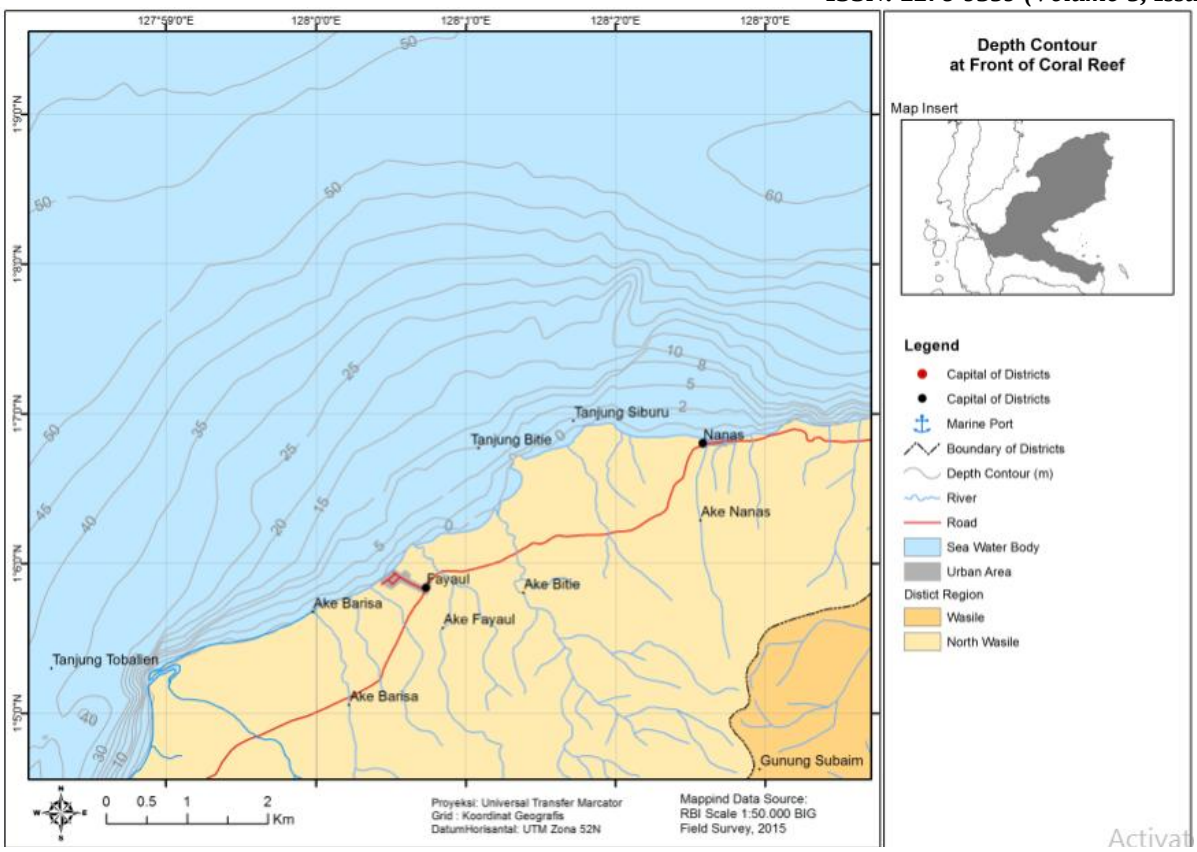
A. Topography of Study Area

The Characteristic of Seabed topography on all areas operation of bottom longline has different from one habitat to others habitat. On guyot areal shows the depth profiles is very complex and varied. Most of the area looks shallow (Fig.2a). The reef habitats tend to flat (Fig.2b). And river estuary habitat tends to shallow to depth (Fig.2c).

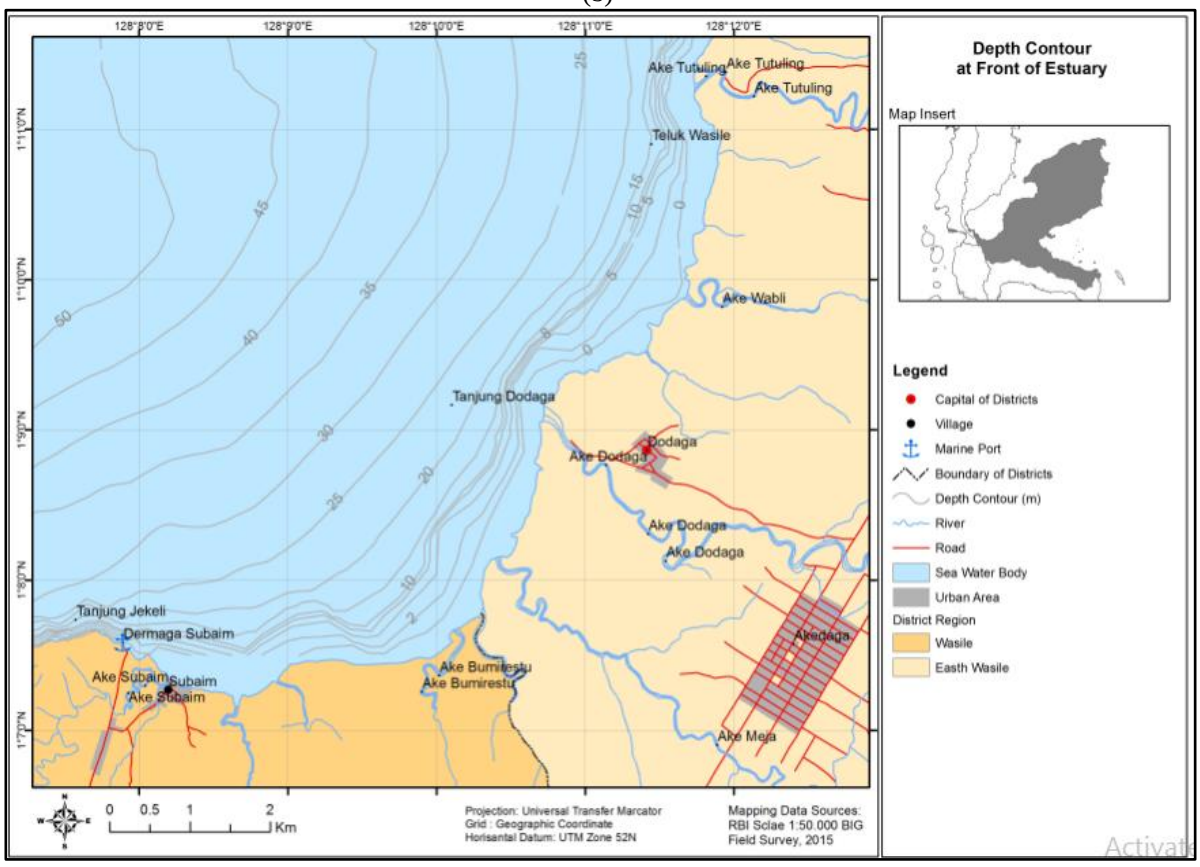
Depth interpolation result fromeachstationshows the variations indepth between all habitats.On guyot habitat, the depth variationbetween1-20m, on reefhabitatbetween2-25m, and river estuary habitatvaried between1-25m.



(a)



(b)



(c)

Figure 2. The depth characteristic at Study Areal (a) GuyotHabitat ;(b) Coral Reef Habitat; (c) River Estuary Habitat

B. Substrate Characteristic

Substrate characteristic on each station shows that the sediment varied among each. Substrate at Guyot habitat dominated by granularrocks/rubble, sand, andshells. At reef habitat, thesubstrate was dominatedbyrubble. And at river estuary habitat, the substrate was dominated by muddysand(Table 1).

Table 1. Characteristic of Substrate at Each Station

No	Habitats	Substrate Characteristic
1	Guyot	Rubble, sand and shell
2	Reef	Rubble, sand
3	River Estuary	Sand, muddy

C. Physico-Chemical Condition

Physico-Chemical condition at operations area on surface water (0m) and depth 10m are presented in Table 2 and 3.

Table 2. The Average of physics-chemistry conditions on surface water (0 m)

No	Parameter	Guyot Habitat	Coral reef Habitat	River estuary Habitat
1	Temperature (ºC)	28.89b±0.34	30.30a±0.25	30.75a±0.66
2	Chlorophyll- a (mg/m3)*	2,31b±0.61	0.59a±0.27	0.69a±0.34
3	Salinity (psu)	35.62b±0.13	34.11a±0.07	34.46a±0.42
4	pH	8.62a±0.26	7.29a±0.09	4.34b±2.44
5	Dissolve Oxygen (mg/l)	6.92a±0.40	5.55a±0.11	9.40b±1.93

Note: The different ofsuperscript on the same line ($\alpha = 0.05$) based on Tukey test
* Only on the surface waters

Table 3. The Average of physics-chemistry conditions on 10 m

No	Parameter	Guyot Habitat	Coral reef Habitat	River estuary Habitat
1	Temperature (ºC)	28.4b±0.19	30.18a±0.16	30.00a±0.48
2	Salinity (psu)	35.70b±0.14	34.04a±0.05	34.32a±0.83
3	pH	8.16a±0.42	7.66a±0.28	4.97b±0.39
4	Dissolve Oxygen (mg/l)	8.16a±0.51	5.51a±0.19	8.73b±1.57

Note: the different of superskrip on the same line in different real ($\alpha = 0.05$) based on Tukey test

The average values of each parameter are variationsamong all three habitats. The high temperature is relatively observed in a river estuary habitat, while a low temperature recorded in its natural guyothabitat. Comparison temperature vertically shows that surface temperature higher than the bottom temperature. The chlorophyll-a on the surface waters is relatively high founded in guyothabitat (2.31mg /m3), while in coral reef habitat and river estuary habitat have more value which is relatively loweach 0.56 and 0.69 mg/m3.Salinity on surface waters is relatively high in guyot habitat, while vertically salinity in coral reefs habitat and river estuary habitat noted high than on the surface waters. pH value in guyothabitat was higher if compared with pH value in coral reef habitat and river estuary habitat. Vertical distribution of pH shows that pH value at guyot habitat in the surface was higher than in the bottom, but in coral reef habitat and river estuary habitat, the pH valuewas lowest at surface and higher at bottom. The concentration of dissolve oxygen was high founded at river estuary habitatand lowest at coral reef habitat. While the vertical distribution of dissolve oxygen shows that at surface was high concentrations better than at the bottom.

Result of Tukey mean test shows that the parameters; temperature, chlorophyll-a, salinity, in coral reefs habitat are no different from river estuary habitat, but both of the habitat are really different with guyothabitat. On the other parameter, pH level and dissolve oxygen in guyot habitat and coral reefshabitat are not different, but they were different from river estuary habitat.

D. Discussion

The operations areas at guyot habitat have a basic complexity and variety of topography. Meanwhile, coral reef habitat has flat form and in river estuary habitat, the topography tends to decrease far from the coast. Thisdescribes specification this region in biodiversity that were in it. Demersal fish can live with both in the waters that aresubstrate mud or mud sandy with the details communities are complex (Aoyama, 1973). Types of habitat have an importance role in controlling distribution of demersal fish, as the type life of organisms substrate affected that live in the waters such as invertebrates that is also important as food fish (Lowe's Cos and McConnell, 1987).

The fish potential resources caught in the Kao bay identified as many as 22 types. One of the fish catches that dominates is a type of fish (17.35 percent) (BLH North Maluku, 2014). Substrate characteristic in this areacan support the survival of fish. Main areas of red snapper fish (*Lutjanusmalabaricus*) were uncharted waters with a substrate coral reef and rocky, a mix of sand, sand muddy, and associated with coral reefs (Allen, 1985). This species were associated with coral reef because coral gives protection from larvae till small fish and the majority of growth in this area (*nursery ground*) (Andrade, 2003).

The lowest temperature in guyot habitat was influenced by the position of this area close to each other and to deal with waters from Hatetabako where the temperature is relatively low (BLH North Maluku, 2014). The temperature that was thus found in river estuary habitat has averaged 30.75ºC. This value in river estuary habitat was influenced by the position with the Wasileguyot where the temperature is relatively high because of its semi-closed bay (BLH North

Maluku, 2014).The high temperature of seawaters between 30.0-32.0 ºC because of its semi-closed have been reported coastal waters in theLuwu Regency Bone Gulf (Andriyani, 2004), in the waters Palopo and waters Kolaka(Zainuddin, 2011).

The concentration of chlorophyll-a was relatively high in guyot habitat (2.31 mg/m3), while in coral reef habitat and river estuary habitat was relatively low each 0.56-0.69 mg/m3. The chlorophyll-a in this research was high compared with an average of chlorophyll-a in Indonesian waters of 0.19 mg/m3 (Nontji, 2002). The highest concentration of chlorophyll-a caused by the location of areal study was very close to land, so that the nutrients that comes from the land influences the habitat.

Salinity was relatively high measured in guyot habitat, which on the surface waters was 35.62 and the 10 meters was 35.70. The salinity has been recorded by several researchers in the range between 33.63 - 34.15 psu (BLH North Maluku, 2014), range between 33.09-34.19 psu (Tarigan and Edward, 2003), ranged between 28.6 %)-over 32.3 psu(Sediadi and Sidabutar, 1995). Furthermore, pH levels in guyot habitat and coral reef habitat noted between 7.29 and 8.62. This value was not different from previous research results: between 7.97-8.35 (BLH North Maluku, 2014), in the range 7.01-8.05 (Sediadi and Sidabutar, 1995), between 6.95-7.01 (Tarigan and Edward, 2003). pH levels in river estuary habitat were relatively low (4.23). The low of pH value in this habitat because of the influence of fresh water mass form river, but it is not permanent (Tenriware, 2012). The pH value obtained during the research was still able to support of phytoplanktonand other organism life (Prescod, 1973). The concentration of dissolved oxygen in the surface water (0 m) on the three habitats between 5.55-9.40 mg/l, less than the depth water (10 m) between 5.51-8.73 mg/l. the lower of the dissolved oxygen has been reported in the range 5.05-5.26 mg/l (Tarigan and Edward, 2003).

IV. CONCLUSION

Topography profile at guyot habitat were complex with the depth of 20 meters, at coral reef habitat, structured are flat, tends to be at a depth of about 25 m, while river estuary habitat, the topography tend to increase into the far from the coast, with the depth 25 m. The substrate at guyot and coral reef habitats dominated by rubble and sand, but at river estuary habitat dominated by sand and mud. Tukey test with $\alpha = 0.05$ shows that temperature, chlorophyll-a, and salinity in guyot habitat was different with coral reef habitat and river estuary habitat, while coral reef habitat was not significant difference with river estuary habitat. pH value and concentration of DO at guyot habitat and river estuary habitat was not different but both of habitat were different with coral reef habitat.

ACKNOWLEDGEMENTS

Thank you to Directorate General of Higher Education, the Ministry Research, Technology and Education, Republic of Indonesia for the research grant. An also to Fisheries and Marine Science Faculty Khairun University and to all colleagueswho participate in this research.

REFERENCE

[1] Allen, G.R., 1985. FAO species catalogue. *Snapper of the world*. An annotated and illustrated catalogue of Lutjanidae spesies known to date. FAO Fish. Synop. 125 (6), 1-208,

[2] Andrade, F.M., 2003. AComparison of Life Histories and Ecological Aspects Among Snappers (*pisces Lutjanidae*) [dissertation] Lousiana (US): Lousiana State University.

[3] Andriyani, 2004. Analisis Hubungan Parameter Fisika-Kimia dan Klorofil-a dengan Produktivitas Primer Fitoplankton di Perairan Pantai Kabupaten Luwu (tesis). Bogor. Sekolah Pascasarjana. Institut Pertanian Bogor. Bogor, 81pp.

[4] Aoyama, T., 1973. The Demersal Stock and Fisheries of the South Chines. Sea.SCS/DEV/T3/3.FAO.Rome.

[5] Bianchi, G., 1992. Study of the demersal assemblages of the continental shelf and upper slope off Congo and Gabon, Based on the trawl surveys of the RV: Dr. Fridjoft Nansen. Mar. ecol Prog Ser85, 9-23.

[6] BLH (Badan Lingkungan Hidup) Maluku Utara,2014. Studi Kualitas dan Sumberdaya Perairan Teluk Kao, Teluk Buli, dan Teluk Weda di Provinsi Maluku Utara. Ternate, 251 pp.

[7] Fujita, T., Inada, T., Ishito, Y., 1995. Depth gradient structure of the demersal fish community on the continental shelf and upper slope off Sendai Bay.“ Japan Mar. Eco. Prog. Ser 118, 13-23.

[8] Harifin, L., Wijopriono, 1993. Pengamatan terhadap beberapa aspek operasional rawai dasar di Juana, Jawa Tengah. Jurnal Penelitian Perikanan Laut 81, 29-39.

[9] Hufiadi, E., Nurdin, 2006. Uji coba rawai dasar menggunakan mata pancing nomor 4, 6, dan 8 di Teluk Semangka, Lampung Selatan. Di dalam: M.F.A.Sondita, M.P. Sobari, D. Simbolon, G. Puspito, A.B. Pane. Prosiding, Seminar Nasional Perikanan Tangkap, 119-127.

[10] Krebs, C. J., 1989. Ecological Methodology. New York: Harper Collins Publisher, (cocokan tahun) ref. D. Maturutty.

[11] Lowe, R.H., McConnel, 1987. Ecological Studies in Tropical Fish Communities. Cambridge University Press. Cambridge.

[12] Nasution, C., 1993. Laju pancing (*hook rate*) rawai dasar kalipo di Perairan Binuangen, Jawa Barat. Jurnal Penelitian Perikanan Laut 81, 40-53.

[13] Nontji, A., 2002. Laut Nusantara. Penerbit Djambatan, Jakarta.

[14] Petersen,G. R., 1985. Design and Analysis of Experiments. Marcel Dekker, Inc. New York.

[15] Prescod, M.B., 1973. Investigation of National Effluent and Streams Standars for Tropical Countries. Bangkok.

[16] Sediadi, A., Sidabutar, T., 1995. Pengamatan Trichodesmium erythraeum di perairan Teluk Kao, Maluku Utara. Prosiding, Semiar Kelautan Nasional-1995. Pemantapan Keterpaduan dan Pendayagunaan Potensi Sumberdaya Manusia, Ilmu Pengetahuan dan Teknologi dan Kelembagaan Kelautan Nasional Menuju Kemandirian.Jakarta.

[17] Tarigan, M.S., Edward, 2003. Kondisi hidrologi perairan teluk Kao, Pulau Hamahera Maluku Utara. Pusat Penelitian Oseanografi. Lembaga Ilmu Pengetahuan Indonesia. Jakarta, 19-23.

[18] Tenriware, 2012. *P*erikanan Sero di Perairan Pantai Pitumpanua Kabupaten Wajo-Teluk Bone. Ringkasan [disertasi]. Sekolah Pascasarjana. Institut Pertanian Bogor. Bogor, 45 pp.

[19] Thistle, D., 2003. The deep-sea Floor: An Over view.in : Tyler PA, editor Ecosystem of The world 28 Ecosystem of the deep OceanSchool of ocean and earth science UK. Elsevier 2, 5-37.

[20] Wudianto, Mahiswara, M. Linting, 1995. Pengaruh ukuran mata pancing rawai dasar terhadap hasil tangkapan. Jurnal Penelitian Perikanan Laut, 1, 58-67.

[21] Zainuddin, M., 2011. Skipjack tuna in relation to surface temperature and clorophyll-a concentration of Bone Bay using remotely sensed satellite data. Jurnal Ilmu dan Teknologi Kelautan Tropis 3 (1), 82-90.

[22] Zar, J. H., 1984. Biostatistical Analysis. 2nd Edition. Prentice-Hal International, Inc., Englewood Cliffs, New Jersey.

