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## Biology Population And Exploitation Rate Of Coral Trout (*Plectropomus Leopardus*) Spermonde Island South Sulawesi

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### ABSTRACT

Coral trout (*Plectropomus leopardus*) was one of the export commodity especially alive coral grouper. Coral grouper fishing in Spermonde Island had been carried out by fishermen continuously that could interfere sustainable potential and led to excess fishing. The research aimed to find out population parameters and exploitation rate of coral grouper. The result of the research would provide information in sustainable resource management in Spermonde Island. The research method was total length and weight measurement of coral grouper from fishermen and trader's fish catches in each fishing area. Population parameters analysis was conducted by using ELEFAN program in Pizat II. Analysis result of size structure in Sarappo and LumuLumu Island was dominated by 22,5 cm, while in Langkai Island was 37,5 cm. Age group in Sarappo Island consisted of 3 and LumuLumu and Langkai Island was 4 age groups. Growth rate coefficient (K) of coral grouper was 0,34 per year (Sarappo Island), 0,30 per year (LumuLumu Island) and 0,28 per year (Langkai Island). Total mortality rate, natural and large fishing in Sarappo Island, then LumuLumu and Langkai Island. Exploitation rate in the third island > 50%, showed that utilization of coral grouper in the condition over exploitation.

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## INTRODUCTION

Coral trout (*Plectropomus leopardus*) was one of reef fish group which played important role in coral reef ecosystem, both ecology and economy. In terms of ecology, it was main predator in the food chain and it was export commodity especially live coral grouper.

Some coral grouper (grouper or trout) had high economical value which was popular in the international market such as Coral grouper (*Plectropomus leopardus*), tiger grouper (*Epinephelus fuscoguttatus*), Lodi grouper, grouper (*Epinephelus lanceolatus* dan *Epinephelus coioides*), and Mouse grouper (*Cromileptes altivelis*) (Murtidjo, 2002). Price of live coral grouper in Bonetambung and Barrangcaddi Island was Rp 180.000/kg and selling price to exporter was Rp 350.000 – 500.000/kg. (Firman, 2012)

*The International Union for The Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species* tahun 2006 dalam Prasetya, 2010), included several types of grouper such as, mouse grouper (*Cromileptes altivelis*), grouper (*Epinephelus lanceolatus* and *Epinephelus coioides*) and Coral grouper (*Plectropomus leopardus*) as endangered species. High value of grouper in the international trade, caused the demand of this fish increased, made Grouper experienced high pressure and in some areas had been overfished (Sadovy, 2005). Overfishing had caused the decreasing of reproduction capacity, habitual damage, food chain problem in the aquatic ecosystems. (Pauly *et al*, 1999).

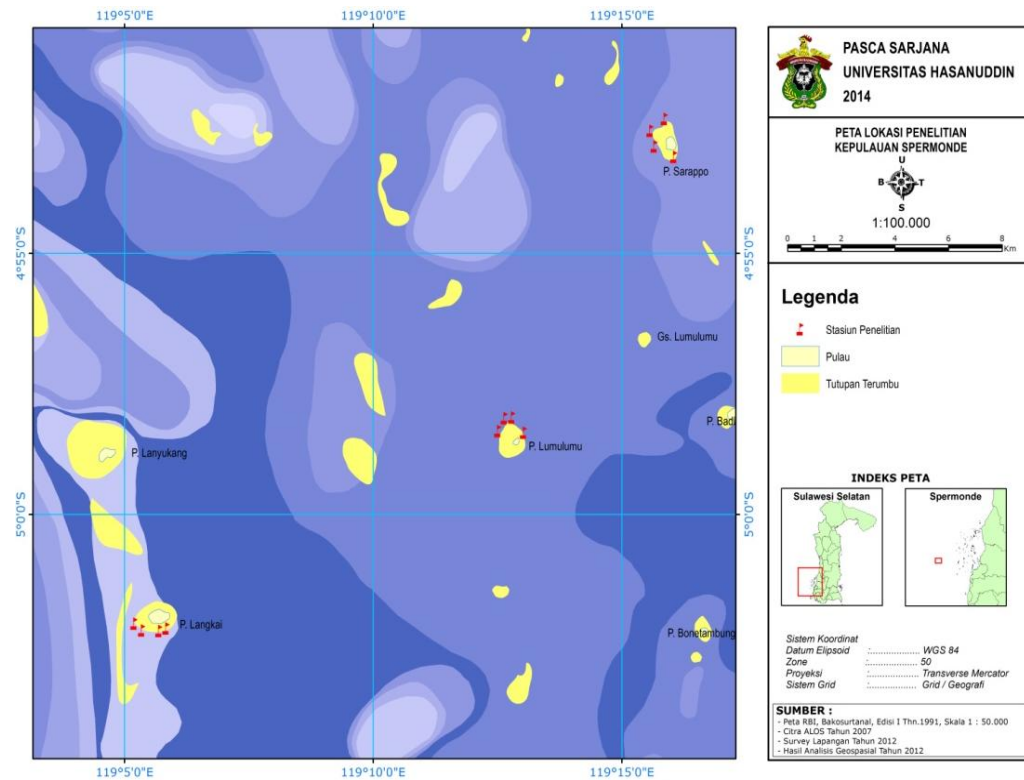
Coral grouper fishing had become fishermen life source in Spermonde, especially to the coast area with high intensity of fishing. Sarappo, Lumulumu and Langkai Island was fishing area for coral trout (*P. Leopardus*) in Spermonde Island. The increasing demand of coral grouper caused the fishing activity increased and it caused the production decreased because the number of fishing beyond the limit of maximum coral grouper. Information about Biology population and exploitation rate of coral trout (*P. leopardus*) was one of important study in the resource management so its sustainability can be maintained.

### Research Objective and Usability:

The research aimed to determine the parameters of population biology – structure size, age group estimation, growth rate, mortality and exploitation rate of coral trout (*P.leopardus*) in Spermonde Island, South Sulawesi. The result of research was expected to be useful for Fishery development in Indonesia, especially sustainable coral trout utilization (*P. leopardus*) in Spermonde Island, South Sulawesi.

### Research Method:

The research was conducted in July 2013 – February 2014 in Spermonde Island, South Sulawesi (Fig 1).



Sampling was conducted in three locations which directed to fishermen areas – Sarappo Island, Lumu lumu Island and Langkai Island which was also the main fishing area of coral trout (*P.leopardus*) in Spermonde Island (Fig 2)



**Fig. 2:** Coral trout (*Plectropomus leopardus*)

Measurement of population parameters was done by measuring total length (cm) and weight (gram) of coral grouper. Sampling was done in fishermen and trader level according to the fishing area in each Island.

Determining the length structure and fish length frequency distribution was done by using ELEFAN program in FiSAT II (Gayanilo et al, 2005)

Age estimation with length frequency analysis, was proper method to be applied in the tropical waters because it could divide age group components (Pauly, 1980). To divide age group, data was analyzed by Bhattacharya method. After obtained age groups, so the growth rate would be calculated. Numerical method had been developed that could convert the length frequency data to age composition was Von Bertalanffy method. (Sparre, 1992)

Math model from Bertalanffy's growth equation as follow:

$$L_t = L_{\infty}(1 - e^{-K(t-t_0)}) \quad (1)$$

To determine  $L_{\infty}$  and  $K$  value was used Gulland dan Holt's method (Sparre, 1992),

To find out  $t_0$  using Pauly's empirical equation (1989), as follow:

$$\log(-t_0) = -0,3922 - 0,2752 \log L_{\infty} - \log K$$

Mortality rate estimation ( $Z$ ) used formula that was explained by Beverton and Holt (1956 in Sparre, 1992).

$$Z = \frac{K(L_{\infty} - L_c)}{L - L_c}$$

Natural mortality rate was calculated by using Pauly's empirical formula (1980) :

$$\log M = -0,0066 - 0,279 \log L_{\infty} + 0,6543 \log K + 0,4634 \log T$$

$L_{\infty}$  was asymptotic length,  $K$  was intrinsic growth coefficient and  $T$  = annual average temperature ( $^{\circ}\text{C}$ ).

Pauly (1980) stated that mortality rate total was the calculation result of natural mortality and fishing mortality, so the equation was:

$$Z = F + M$$

The estimation of exploitation rate used a formula (Beverton dan Holt, 1966).

$$E = \frac{F}{Z}$$

## Findings And Discussion

### a. Size structure:

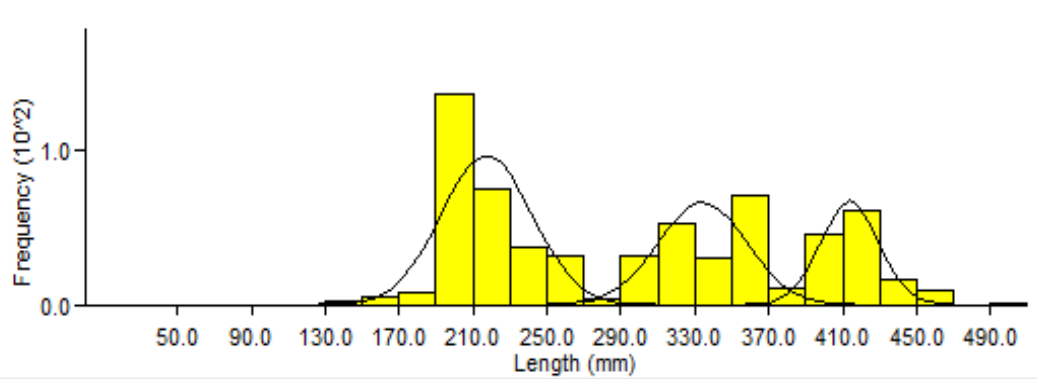
Total length size structure of coral trout (*P. leopardus*) on each location as the table below

**Table 1:** Distribution of length size of coral trout (*P. leopardus*) in the locations.

Mean	Sarappo	Lumu lumu	Langkai
17,5	8	2	0
22,5	22	66	1
27,5	58	42	40
32,5	85	55	63
37,5	110	60	68
42,5	114	58	20
47,5	24	13	16
52,5	1	2	4
57,5	0	2	2
Amount	624	291	214

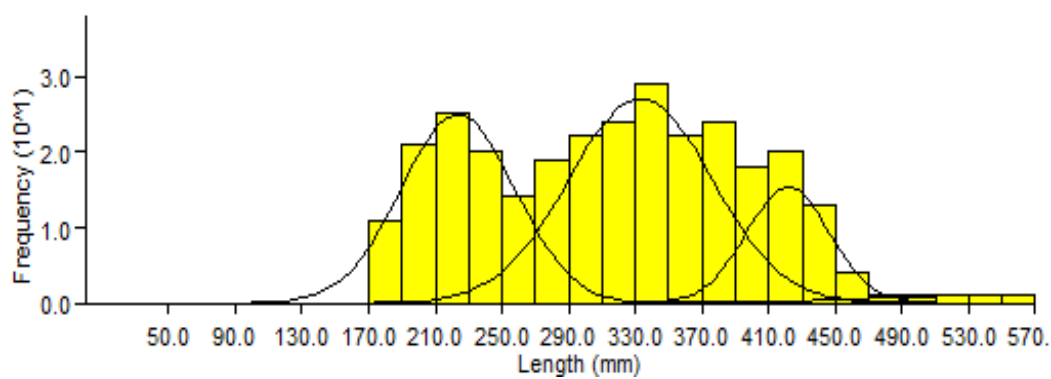
Coral trout length (*P. leopardus*) in the research location was 17,5 cm – 57,5 cm, whose the largest size caught in Langkai Island. Length distribution of coral grouper on three locations was around 22,5 cm – 42,5 cm in which 22,5 cm was mostly caught in Sarappo and Lumu lumu Island and 37,5 cm in Langkai. The difference occurred due to the fishing area which influenced the fish size. Langkai Island was farther location than Sarappo and Lumu lumu Island. Sudirman's research (1997) showed the difference of fish size according to the fishing area – fish from farther fishing zone was bigger than fish that was caught in nearer fishing area. Other factor that influenced fish length was fishing intensity, where Sarappo and LumuLumu Island had higher intensity than Langkai Island. Pet-Soede (1996) found out the average of fish length caught was bigger in the location where the fishing intensity was low by using fishing equipment in Spermonde Island.

### b. Age Group of Coral trout (*P. leopardus*):

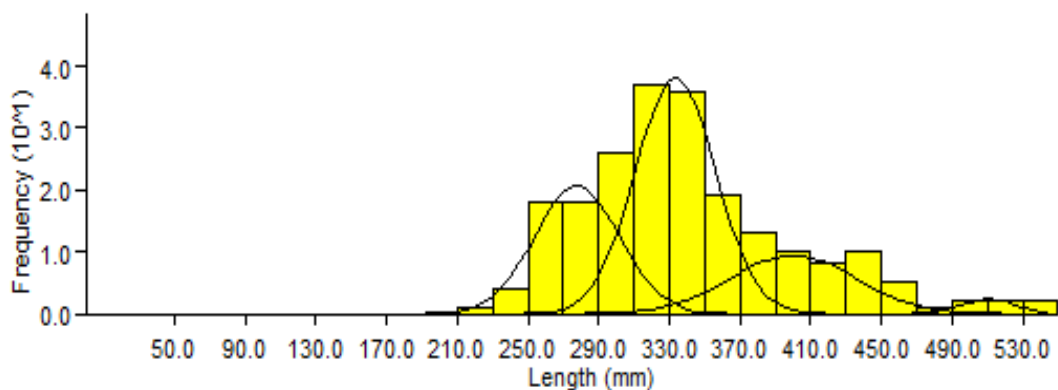


**Fig. 1:** Age group of coral trout (*P. leopardus*) in Sarappo Island

The analysis result of coral trout age group which was caught in Sarappo, LumuLumu and Langkai Island was shown in the figure 1, 2,3.



**Fig. 2:** Age group of coral trout (*P. leopardus*) in Lumu Lumu Island



**Fig. 3:** Age group of coral trout (*P. leopardus*) in Langkai Island

The analysis result of coral trout age group (*P. leopardus*) showed that in Sarappo Island, there were 3 age groups and LumuLumu and Langkai Island were 4 age groups, were each age group had different length size. Sudirman's research (1997), found out the age group of coral grouper (*P. leopardus*) in Spermonde Island were 5 age groups. The age group difference was caused by the change of sub-population due to the over fishing.

The relationship between age group with coral trout length was shown on the table below:

**Table 2:** The relationship between age group with coral trout (*P. leopardus*) at fishing location.

Location	Age group	Length rate (cm)
Sarappo Island	I	21,4
	II	34,2
	III	41,3
Lumu lumu Island	I	22,3
	II	33,3
	III	42,1
	IV	54,4
Langkai Island	I	27,7
	II	33,3
	III	40,0
	IV	51,0

**c. Growth Rate (K):**

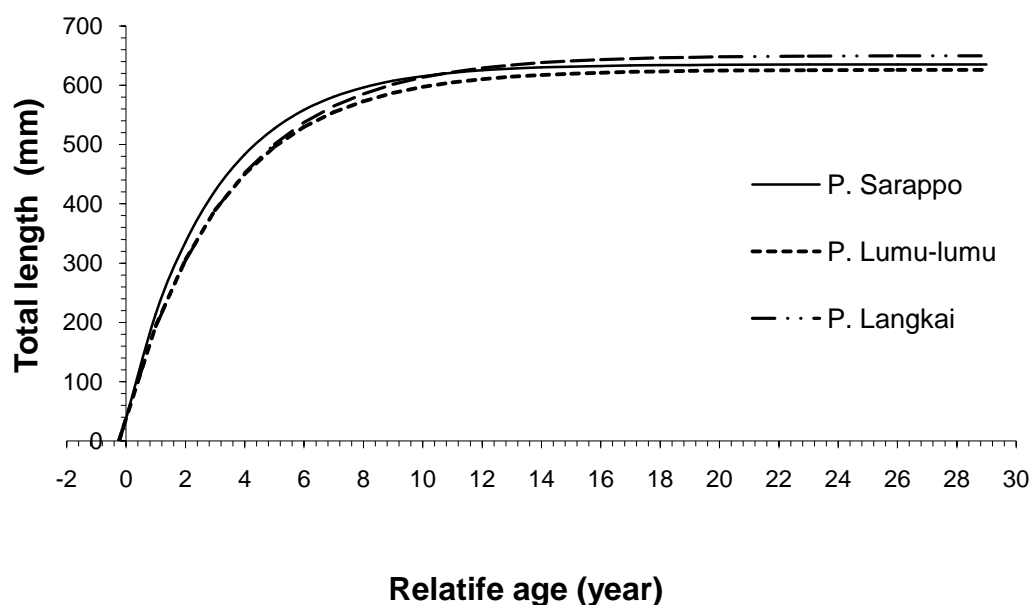
Analysis result of K and L value of Von Bertalanffy's growth function was obtained by Gulland Method. Using Pizat II was obtained growth and mortality rate in Sarappo, LumuLumu and Langkai Island as shown in the table below:

**Table 3:** Koefisien growth rate (K), maksimum length (L maks) and age with length = 0 (to) coral trout (*P. leopardus*).

Lokasi	K (pertahun)	L maks (cm)	to (thn)
Sarappo Island	0,34	63,5	-0,210
Lumu lumu Island	0,30	62,6	-0,240
Langkai Island	0,28	65,0	-0,379
Spermonde Archipelago (Sudirman, 1997)	0,40	70,0	-0,33
Australia (1978)	0,25	64,7	
Kaledonia Baru (Loubens, 1980)	0,16	50,0	

The analysis result showed the coefficient value of growth rate (K) of coral trout (*P.leopardus*), the lowest was in Langkai (0,28), LumuLumu (0,30) and Sarappo Island (0,34). K value showed the growth speed of fish – the lower K made the longer period needed by fish to reach its maximum length. Sudirman's research (1997) found out coral grouper (*P.leopardus*). In Spermonde Archipelago had K value (0,40) and L maximum. *Mycteroperca fusca* (Serranidae) in Northwest Africa waters had K value 0,062 per year and L maximum 898 mm (Bustos, 2009). Then, Mehanna (2013) reported that coral (*Epinephelus diacanthus*) in Arabia Oman waters had K value 0,22 per year and L max 61 cm.

According to Bertalanffy's growth equation, coral grouper in Sarappo Island reached maximum length at 48 years, in LumuLumu Island at 55 years and in Langkai Island at 59 years (Figure 4 and Table 4).

**Fig. 4:** Von Bertalanffy growth curve coral trout (*P.leopardus*) at fishing location.

**d. Total Mortality (Z), Natural mortality (M) and Fishing Mortality(F):**

Analysis result of mortality rate (Pauly, 1980) showed that total mortality (Z) in Sarappo was 3,26 (M= 0,38 and F= 2,88), in LumuLumu was 2,51 (M=0,35 and F=2,16), in Langkai Island total mortality (Z) was 1,08 (M=0,32 and F=0,76).

Natural mortality value (M), could be related with its growth coefficient value (K) where the fish which grow faster probably had high natural mortality and fish which grow slower had low natural mortality (Sparre and Venema, 1992). Similar with Sparre's opinion (1992) it shown that lower K value (0,18) in Langkai Island was followed by lower M and K value in Sarappo Island (0,34), was followed by higher M.

**e. Exploitation Rate:**

Analysis result of exploitation rate (Pauly,1980), obtained E value in Sarappo Island 0,88, 0,86 in LumuLumu Island, and 0,70 in Langkai Island (Table). The exploitation rate in the third Island was influenced by bigger fishing rate (F). Exploitation rate of Coral trout (*P.leopardus*) in Spermonde Island which was obtained by Sudirman (1997) was 0,42. The value difference of exploitation rate 0,70 – 0,80 showed that the resource usability in the third Island had shown the over fishing. Results of interviews local fishermen that the arrest of *P. leopardus* grouper particular, very high intensity where fishermen catch daily basis using a variety of fishing gear. Furthermore Spermonde Islands is an area that is prone to various activities fishing gears are not environmentally friendly as the use of explosives, toxic materials and catching the fish anesthetic (*Destructif Fishing Watch*, 2003).

**Conclusion And Suggestion:**

1. Length distribution of coral trout on three locations was 22,5 – 57,5 cm where 22,5 cm was caught in Sarappo Island and LumuLumu Island, while the Langkai Island was mostly around 37,5 cm.
2. Age group of coral trout (*P.leopardus*) in Sarappo Island consisted of 3 age groups, while LumuLumu and Langkai Island were 4 age groups, where each age group had different length average.
3. Growth rate coefficient (K) of coral trout, in Sarappo Island was 0,34, LumuLumu 0,30 and Langkai Island 0,28. Lower K value in the third Island showed that coral grouper needs longer time to reach its maximum length.
4. Total mortality rate (Z), natural mortality (M) and Fishing mortality (F) were higher in Sarappo Island than in LumuLumu and Langkai Island.
5. Coral trout (*P.leopardus*) in Sarappo Island, LumuLumu and Langkai Island showed that in those places, over fishing occurred.

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