Size structure, age groups and growth of squid *Loligo pealeii* in the waters of Barru Regency, South Sulawesi

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Abstarct. Squid is an economically important resource. Currently, squid populations, especially in the District Barru, were intensive exploited, that is feared to affect the population biology parameters. The study was conducted from February to April 2011. The sampling period was three times a week. The Samples were obtained using random collection from the fishermen catch using Rambo left net. Squid mantle length was measured to the nearest one mm. The parameters analyzed were age group, gonad maturity stage, growth, mortality, and exploitation rate. Squid population in Barru district consists of three age groups with the length of each mode of 51 mm, 98 mm, 133 mm for males, and 51 mm, 96 mm, 127 mm for females. The gonad maturity stage ranging from TKG I to IV for males and females, with the largest percentage of TKG TKG III (47.82% in males and 50.06% in females). The squid first maturity is reached at 94.3827 mm in long coat for males, and 59.6735 mm for females. Growth equation for males was Lt = 227 {1 - e $^{-0.31}$ (t + 0.30)} and females are Lt = 196 {1-e-0, 37 (t +0.26)}. The total mortality rate (Z) is 1.59 for males and 1.63 for females. The natural mortality rate (M) is 0.20 for males and 0.57 for females. The capture mortality rate (F) is 1.39 for males and 1.06 for females. The highest CPUE values reached in 1999 was 0.0022 ton per trip, while the smallest CPUE values reached in 2001 was 0.0001 tons per year. The greatest catches could be reached with fishing effort of 50 000 trips with catches of 50 tonnes.
Keywords: Squid, CPUE, gonado matuity stage

Introduction

Squid (*Loligo* sp) is one of important economically valuable fishery commodities, and an export commodity worldwide. Due to significant economic value and very popular, the demand for squid increased. This trend will urge fishermen to conduct intensive arrest, while it is known that the production of squid still hanging on the stock in the wild so feared arrest intensification will somehow threaten the sustainability of resource commodity. The squid in Indonesia are almost all surface waters, such as waters of the west coast of Sumatra (Aceh and North Sumatra), Strait Java (West Java and Central Java), Bali, NTB, NTT, South and West Kalimantan, South Sulawesi, Southeast Sulawesi, Northern Sulawesi, Maluku and Irian Jaya (Pratiwi and Ward, 1996 in Nurcahaya, 2004).

Waters in Barru Ragency that include in Makassar strait in South Sulawesi are included in the scope of a potential Indonesian waters will capture squid, cuttlefish whereabouts has long been used by the surrounding community as income and food ingredients. According to statistics of the Department of Fisheries and Marine Resources of South Sulawesi, the production of squid in Barru increase since 2002 amounted to 25.7 tons to 127.1 tonnes in 2008.

If the arrest was made on a continuous basis to meet consumer demand in the absence of a business setting, the biological resources of squid in a certain period can have excess catch and result in disruption of resource sustainability. The results Sriwana (2007) in the waters of Polewali Mandar, West Sulawesi using large liftnet (*bagan rambo*) scored exploitation rate of 0.70 per year. Syriac (2007) in the waters of the North Galesong District, Takalar get the value of exploitation rate of 0.79 per month. The data indicate that the level of exploitation of the squid is very high.

Statistical data of 1999 - 2008 obtained the catch per trip on the amount of fishing gear decreased at the end of the year, 0.0013 on purse seine and 0.0853 on the large liftnet (bagan rambo), while the longline had increase of 0.3556 (Departemen Kelautan dan Perikanan Sulawesi Selatan, 2009). A realistic view of the stock in the sustainable management of fishery resources, is included to take advantage of the existing stock in the optimal, for example squid stocks. For this purpose it is necessary to analyze the impact of squid fishing technology, and biological characteristics must be understood as the dynamic nature of fish resources. Hence the objective of the present study was to evaluate the size stricture and age group of Squid *Loligo pealeii* in the Waters of Barru Regency, South Sulawesi

Materials and Methods

The study was conducted in February-April 2011 in the waters of Barru Regency, South Sulawesi. The sampling period was three times a week. There are 2090 squids used in this study, which number of males are 1307 individu and females are 783 individu. Each squid mantle length is measured with a ruler and expressed in millimeters and then calculate the rate of gonadal maturation, maturation, growth, mortality, MSY, and the exploitation rate.

Determination of the age group using the method of Bhattacharya (1967) which divides the squid in batches mantle lenght. To get good results, the observed frequency is converted into a frequency count (Fc) using the normal distribution equation (Hassel Blad *in* Sparre *et al*. 1989) : $Fc = \frac{n.dl}{sd\sqrt{2\pi}} \exp\left[\frac{-(X-\overline{X})^2}{2s^2}\right]$ wherein Fc is frequency calculated, n is number of squid, dl is interval of class, sd is standard deviation, x is mean of squid's mantle length, π = 3,1415. Estimation of growth parameters using the Von Bertalanffy growth formula (Sparre *et al*. 1999) : $Lt = L_\infty(I-e^{-K(t-to)})$, wherein Lt is total mantle length (mm), L_∞ is asymptotic mantle length (mm), K is growth coefficient, t_0 is age theoretical squid at zero length (years) and t is age (years).

Results and Discussion

The catch of squid for this research in the waters of Barru regency was 2090 individu. The squid males were 1307 individu and females 783 individu. The male squid that many caught in the class midpoints size 104 mm is 136 individu and the female on the size of the class midpoints of 100 mm is 139 individu. Catches gained at least 164 mm size of the class midpoints is 10 individu in males and the female on the size of the class midpoints of 154 mm is 7 individu (Fig.1 and 2).

The number of samples of squid (*Loligo chinensis*) obtained during the study in Barru waters is 2090 individu. Based on the analysis of the results of the mapping method Bhattacharya class midpoint values by accounting for the difference in the natural logarithm of the frequency obtained three age groups for males and females with modus of length 50 mm, 105 mm, 145 mm for males and 47 mm, 92 mm, 124 mm for females (Figures 3 and 4). Both image mapping (Figures 3 and 4) showed the presence of three straight lines indicating that squid caught in the waters of Barru use Large lift net for each study consisted of three age groups. While the relationship between mantle length range, the relative age and mode of mantle length of squid (*Loligo chinensis*) in waters of Barru Regency can be seen in Table 1.
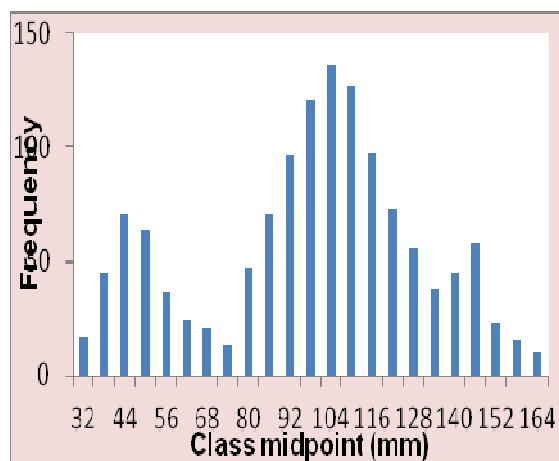

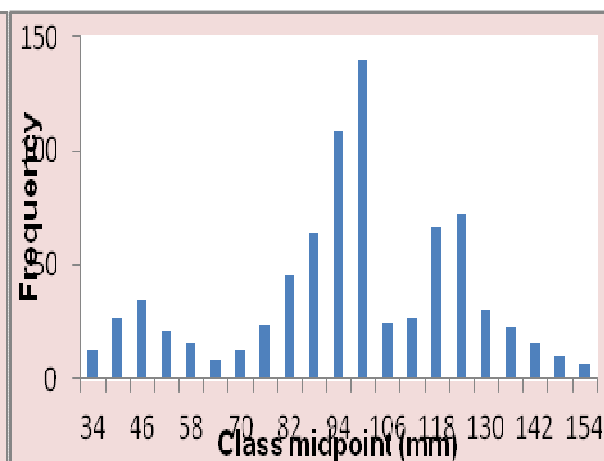Figure 1. Relation between the Class Midpoint (mm) and the Frequency of Males Squid (individu)

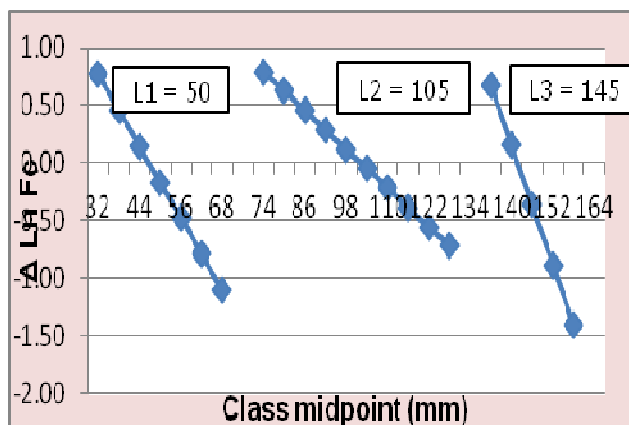Figure 2. Relation between the Class Midpoint (mm) and the Frequency of Females Squid (individu)

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Figure 3. Mapping Between Class Midpoint and the Difference Frequency Effective Natural logarithm (ln Δ Fc) Males squid (*Loligo chinensis*) in waters of Barru Regency.

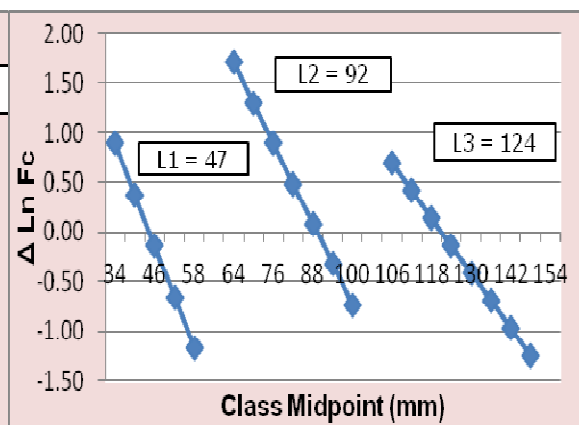Figure 4. Mapping Between Class Midpoint and the Difference Frequency Effective Natural logarithm (ln Δ Fc) Females squid (*Loligo chinensis*) in waters of Barru Regency.

Table 1.   Relation between Range of Mantle Length (mm), Age Group and Mean Length of Squid *(Loligo chinensis)* Male and Female in the waters of Barru Regency

Sex	Range of Length (mm)	Age Group	Mean Length (mm)	Frequency (individu)
Male	29 – 77	1	50	292
	71 – 137	2	105	877
	131 – 167	3	145	189
Female	31 – 67	1	47	117
	61 – 109	2	92	424
	103 – 157	3	124	274

Table 1 shows that at the same relative age, male squid has a mantle length of the mode is larger than the female squid. Compared with the results of the study Sriwana (2007) in the waters of Polewali Mandar, West Sulawesi on *S. lessosiana* use large lift net, obtained three age groups with a length mantle is 11.761 cm, 18.603 cm and 23.962 cm as well as research Nurcahaya (2004) in the waters of Bali on *Loligo* sp, using purse seine earned four age groups with length mantle is 66.07 mm, 85.88 mm, 100.03 mm and 115.15 mm. The difference in results is caused by the differences in fishing gear and species of squid were caught.

Conclusions

Based on the results of research on the impact of fishing technology on squid (*Loligo chinensis*) in Barru waters, it can be concluded that: (1)Large liftnet impact on squid populations, characterized by the size of squid caught that small and generally not spawn yet (phase I and II), (2) Squid population dynamics in waters of Barru Regency tend to be similar to other places, where the growth of females larger than males and fishing mortality is greater than natural mortality.
3. The utilization rate of squid in the waters Barru has exceeded the ability of the population to recover.

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