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Gonad Maturity Level of Mackerel from Fishing Ground of Pandeglang Area

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Abstract. Mackerel belongs to highly demanded fish nationally and internationally. Since this fish is favored, many of catchment activities also increase. This research was aimed to investigate the biological aspects of mackerel (*Rastrelliger* sp), based on their length, weight, and gonad maturity level (TKG), related to the condition of the waters/fishing ground as an effort to manage sustainable mackerel in Pandeglang regency. The study area was situated at the fishing ground of mackerel in Pandeglang, Banten. Mackerel were observed from catchment of local fishermen. Mackerel found were then measured for its length and weight. The maturity of gonad was divided into four levels which are I for immature, II for intermediate, III for mature, and IV for over mature. The result showed that mackerel found was 17.40 - 19.28 cm in length and 57.63 - 101.47 g in weight. Based on gender ratio, 55.17% of total caught were male mackerel. According to maturity level, level III and level II were mostly caught followed by level IV and level I. It was indicated that mackerel caught were mating ready and active for growing. Based on this research, should there be management and wise policy from fishermen. This is because if many mackerel of level II and III were caught, it might cause few changes to regenerate new population. Good and sustainable fisheries always include some catchment management. Furthermore any good recommendation on mackerel catchment in related area there should be practiced and applied based on sustainable fisheries principle.

Keywords: mackerel, maturity gonad level, weight, length, gender

INTRODUCTION

The sea area of Pandeglang regency is included in the fishery management area (WPP) 572 [1]. It is located in Sunda Strait between the island of Sumatra and Java bordered with the Indian Ocean in the west. This condition causes the strait performed dynamic and unique as the water from the Java Sea mixed with water coming from the Indian Ocean [2]. This area belongs to an important migration path for fish which make the opportunity for exploitation of fisheries development especially fishing field sounds very promising [3].

The potential of small pelagic fish in WPP 572 in 2016 reached 412,945 tons/year with a permissible amount of catch (JTB) of 330,356 tons. Small pelagic fish in the Java Sea and the Sunda Strait have been exploited by 87.31% [4]. One type of small pelagic fish that experience a decline in the population is the mackerels. This fish is found in almost Indonesian's waters with high economic value, as highly demanded both in local and international market. This lead to the consequence which fishermen often hunted for consumption purposes and trading [5].

In 2014, fisheries statistic of Pandeglang regency showed that small pelagic fish species with economic value and dominant captured were namely mackerel (*Rastrelliger* spp), tembang (*Sardinella fimbriata*), selar (*Atule mate*), and layang (*Decapterus ruselli*). The production from this activity has decreased over the last two years, from 1,754 tons in 2014 to 1,390 tons in 2015. The decline is suspected of excessive exploitation due to economic factors, fluctuations in water conditions, inappropriate use of fishing gear, absence of regulation and supervision of related

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agencies, and no minimum size limitations of catching fish. As by far, the presence of mackerel will be difficult to obtain.

Efforts to manage and utilize the potential of mackerel need to be done so that the existence of this fish is sustainable. Several research on the management and utilization of sustainable mackerel potency refers to long and reproductive long-term relationships [6, 7], bioeconomics [5], oceanography [2] and suitability of fishing gear. The study of biological aspects related to the long relationship of fish weight, the maturity level of gonad (TKG) and fishing season has not been done yet, as well as the correlation of water chemistry physics parameters relation with water fertility as an indicator of plankton existence as a main feed source for mackerel. The above indicators are most likely to be used as a reference for sustainable management in Pandeglang regency.

This study is aimed to investigate the biological aspects of mackerel (*Rastrelliger* sp), based on their length, weight, and gonad maturity level (TKG), related to the condition of the waters/fishing ground as an effort to manage sustainable mackerel in Pandeglang regency.

METHODS

Area and Sampling Time

The research was carried out in the Pandeglang sea area with coordinates 31'S 060 - 1050 36 'E (Water Panaitan, wells and the Black Stone) as shown in Fig. 1. Sampling was conducted on December 2016, February to April 2017.

Determination of fishing ground as a sampling station based on fishing location information from some fishermen and fishing area map from DGPT. The fishing ground area was divided into three stations namely Panaitan (red circle - 06031'15.9 "S-105025'42,6" E), Well (yellow circle - 06035'53 "S-105037'00" E) and Batu Hideung (blue circle - 06031'00 " S-105034'00 "E).

Sampling was done at the first and fourth week on each sampling month. Fish sampling referred to SOP sampling which was as many as 50-100 tails taken randomly after fishes caught. Samples were counted, measured their length, weight, and observed their maturity level of gonads.

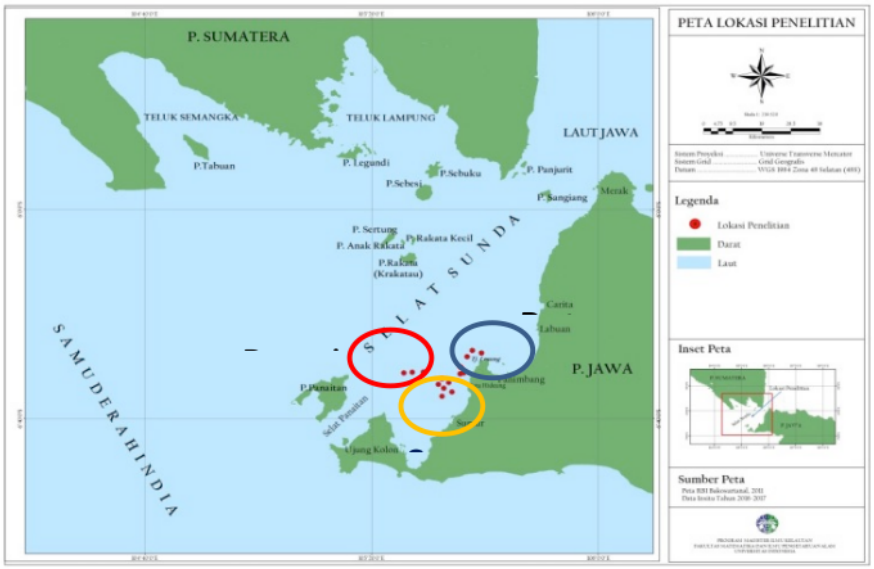


FIGURE 1. Area of sampling

The Biological Parameter of Mackerel

Measurements of length and weight were performed based on the method of Balitbang KP. Length of fish was measured from the tip of the mouth to the fork length using digital calipers. The weight of fish was measured by weighing fish/tail using digital scales. Observation of maturity level of gonad (TKG) is done by dissecting the stomach of fish and observing the morphology of gonad development based on [8]. The observation of the length of first captured fish/Lc (length of first capture) refers to the method of [9]. The First size of gonad mature (Lm) is calculated based on live history tools [10].

Water Parameter

Water parameters were measured in situ directly at each station. The parameters measured were temperature, salinity, brightness, depth and current velocity.

Data Analysis

Relationship of Weight Length based on [11] is W = a L b. If b = 3, fish growth is isometric, b <3, fish growth is negative allometric, b> 3, fish growth is positive allometric. Map of capture location using ArcGIS 10.3 application and making the profile of waters condition using Surfer 11 application.

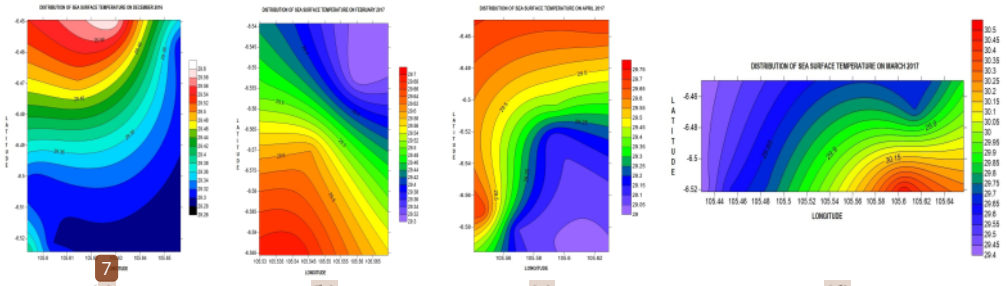
RESULTS

Environmental Condition (Water)

The research location is located where waters experienced considerable wave fluctuations between 3-4 m in the afternoon until late afternoon during a certain season. The current pattern varies greatly influenced by the west monsoon season from December to February. It moved from the west towards the east with a velocity of 30-80 cm/sec. In the east season that lasts from June to August, the current velocity was relatively slower ranging from 10-27 cm/sec. In April-May and September-November there was transition season causing current becomes relatively weak. Table 1 showed water quality parameters in research location.

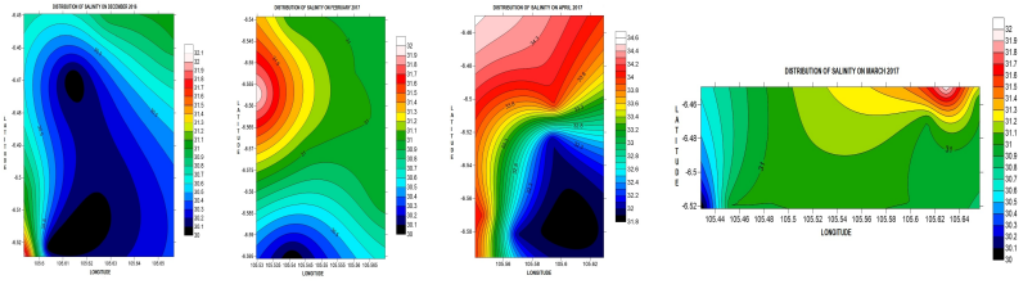
TABLE 1. Water quality parameter in the research area

Parameter	Unit	Range	Average	S.Dev
Temperature	°C	29.10-30.00	29.40	29.5±0.11
Salinity	ppt	30-32	31.5	31.4±1.18
Brightness	m	6-9	8	8.0±0.84
Current velocity	cm/sec	30-80	60	60.3±1.62
Depth	m	40-70	55	



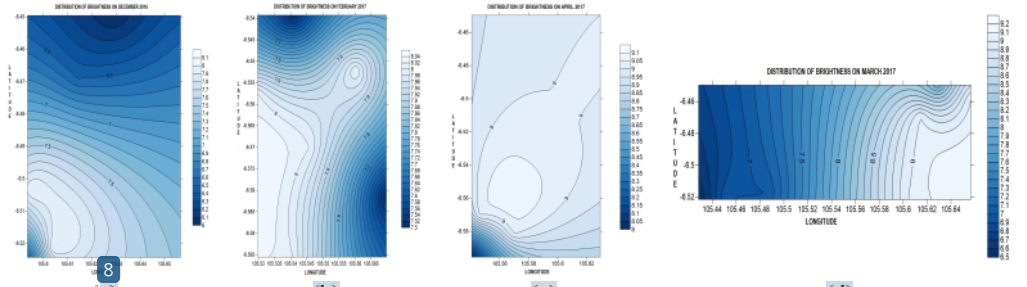
(a) (b) (c) (d)

FIGURE 2. Profile of sea surface temperature during sampling month
(a) Desember 2016, (b) February 2017, (c) April 2017, dan March 2017



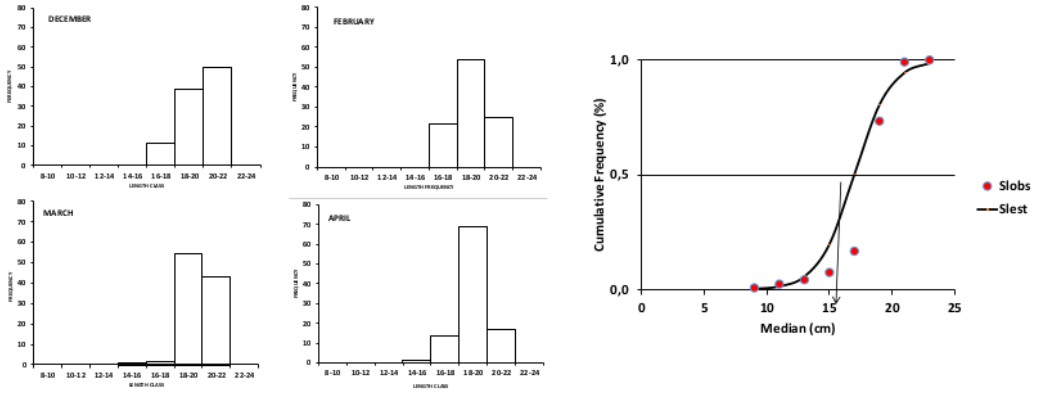
(a) (b) (c) (d)

FIGURE 3. Profile of salinity in research location during sampling month
(a) Desember 2016, (b) February 2017, (c) April 2017, dan March 2017



(a) (b) (c) (d)

FIGURE 4. Profile of brightness in research location during sampling month
(a) Desember 2016, (b) February 2017, (c) April 2017, dan March 2017



(a) (b)

FIGURE 5. (a) Length frequency of mackerel and (b) its Lc

The results of sea surface temperature measurements show that the distribution of temperatures in the waters of Pandeglang district range in December ranged from 29.20-29.45 °C, in February ranged from 29.40-29.60 °C, March between 29.40-29.60 °C and April ranged from 29.10-29.70 °C. Distribution of water temperature can be seen in Fig. 2.

The salinity of Pandeglang waters fishing ground area measured shows salinity distribution in December, February, March and April ranged from 30-32 ppt. The distribution of salinity can be seen in Fig. 3.

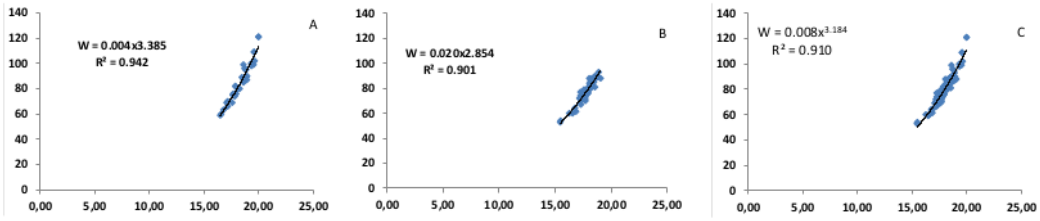


FIGURE 6. The relationship between weight and length on mackerel (a) Female, (b) Male, (c) Mixed.

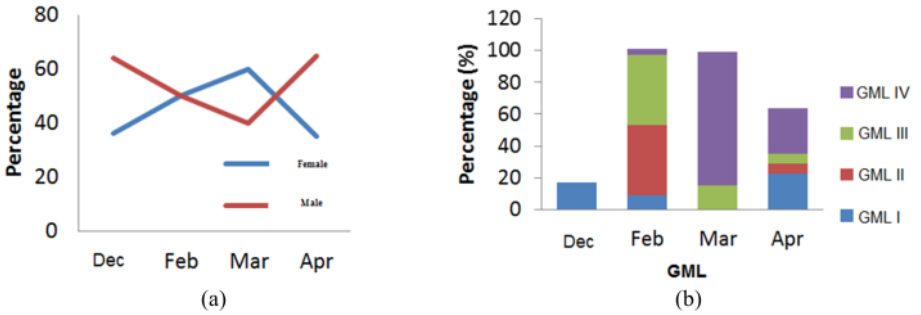


FIGURE 7. (a) Gender ratio of mackerel caught, (b) Gonad maturity level of mackerel

The brightness of the fishing ground area of Pandeglang district waters measured shows the brightness of December ranged between 6.4-8m, February ranged between 7.8-8 m, March ranged between 6-8 m and in April ranged from 8-9 m. The distribution of brightness can be seen in Fig. 4.

Current velocity of Pandeglang waters fishing ground area of measurement shows the current distribution in December ranges from 0.6-0.8 m/s, February 0.7-0.8 m/s, March 0.5-0.7 m/s and April 0.3-0.5 m/s.

Distribution of Length Frequency and Lc

Results of observation of 453 mackerel (*Rastrelliger* spp) consists of 206 female and 247 male with a frequency range of 18-20 cm long. While the results of Lc calculations of mackerel obtained results 17.17 cm. The long frequency graphs and Lc values can be seen in Fig. 5a and Fig. 5b.

Weight – Length

The results of calculating the length and weight of male and female bloated, and its simple linear regression analysis can be seen in Fig. 6. The relationship between length and weight of mackerel obtained result of sampling (A) $W = 0.004x^{3.385}$ slope value of 3.385, sampling (B) $W = 0.020x^{2.854}$ slope value of 2,854, and sampling (C) $W = 0.008x^{3.184}$ slope value of 3,184.

Fish Composition (Gonad Maturity Level)

The yield of mackerel obtained during the research activities varies depending on the western, eastern and transitional seasons. In December the ratio of male and female fish (%) was 64:36, February (50:50), March (40:60) and April (65:35). The ratio of the composition of the mackerel catch can be seen in Fig. 7a.

The result of analysis using live history tools application obtained by mackerel reach maturity gonad (Lm) at 17.9 cmFL. Observation of gonad maturity level in female fish shows that most of the caught in December, 17% in maturity level of gonad (TKG) I (immature), February 44% TKG II (developing virgin) and 44% TKG III

(maturing), and March as much as 84% TKG IV, (late maturing) and 16% TKG III. Observations in April were dominant in TKG I and IV. In January no sampling was done because the appeal did not go to sea from the relevant agencies, because the water conditions are very extreme. Percentage of TKG in mackerel can be seen in Fig. 7b.

DISCUSSION

Pandeglang waters parameter condition as a fishing ground area has almost the same characteristics seen from physical and chemical parameters of waters. The characteristics of these waters are ideal as mackerel habitat [12]. The pattern of water temperature distribution in the study sites did not experience extreme value difference and still support for the activity of aquatic organisms. Heat received from sunlight evenly in the waters, so the water temperature tends to warm. The intensity of light received more and caused the water temperature to increase, the temperature of the sea water is affected by weather, water depth, wave, measurement time, convection movement, altitude, upwelling, season, convergence, divergence, and human activities Around the waters and the intensity of light received by the waters. That the temperature ranges between 27 °C-32 °C for the life of aquatic organisms [13]. Fluctuations and distribution of aquatic salinity are strongly influenced by season and freshwater supply from both settlements and streams. Factors influencing the causes of these fluctuations are shown by the presence of a strong relationship between changes in velocity of waters currents and waters brightness to salinity concentration in the waters. The western season occurring causes the water's brightness to be low, the evaporation of water into the air is very low, whereas high rainfall causes the water salinity level in certain range of values especially in the waters near the mouth of the river.

Results of observation of mackerel caught with rampus net obtained fork length values between 14-22 cm (18.3 cm mode). [6] conducted a study, obtained the size of mackerel in the waters of Jakarta Bay between 11-14 cm (12.5 cm mode) and in the smaller Blanakan waters (10 cmFL) allegedly the size that began to enter the fish stock (recruitment). Flatulent fish caught in Kendal waters between 17-18 cmFL [14]. Differences in the size of fish in different waters, allegedly influenced the environmental conditions of the waters, especially the temperature and availability of feed for fish.

The size of the mackerel caught in the Java Sea varies with time (month) and fishing ground. Results of cumulative frequency analysis of each class length, at 50% position obtained the average size of the first fish caught (L50) measuring 15.8 cm [6]. The observation of the size of the first mackerel caught (Lc) from the waters of the Sunda Strait is 17.1 cmFL. The possibility of this condition influenced the quality of the aquatic environment especially the availability of plankton as fish feed.

The analysis of the long-term relationship obtained by the value of slope (b) male bloat 2.854 is classified in negative allometric category and female fish 3,385 including allometrik positive and b-male and female fish value 3,184 (Fig. 7a). Positive allometrics in female and female female females were caused during the period of arrest in February-April, fish under TKG I-IV conditions. [15] stated that gonad weight increase in female fish is 10-25% of body weight. The results of the research in Jakarta bay conducted by [16] that mackerel caught had b value of 2,322, while [17] research at the same location value (b) male kembung 2,739 and female fish 2,6001 that including allometrik Negative, this shows long growth faster than growth weight.

Decreased fish catches in December dominated by male fish by 64 %, while in February-March the composition of catch more female fish in TKG I-IV condition. This condition is most likely due to warm water temperatures, high brightness, availability of aquatic feed that is needed in the process of fish metabolism especially to support the development of gonads. The first long-term size of gonad mature fish (Lm) is 17.9 cmFL. This Lm size is different from Lm size (length-at-first-maturity) result of [18] done in Java Sea obtained Lm value 16,4 cmFL.

The results of the first long mackerel caught (Lc) analysis were 17.1 cmFL, lower than the Lm size (17.9 cm). These results indicate that most of the mackerel are caught in a mature gonad condition and have not had time to spawning. If this condition is ignored then the population of mackerel decreases because the productive parent is exploited without regard to sustainability rules.

Efforts are needed to arrange fishing patterns based on the biological properties of fish in spawning and adjusting the recommended use of tagging measures, so that the presence of puffed fish in Pandeglang waters remains sustainable.

CONCLUSIONS

Pandeglang regency possessed good condition form mackerel habitat. Mackerel caught were mostly male which had gonad maturity level II and III. Selective tool for catching mackerel is needed as part of sustainable fisheries. Availability of such tool can reduced mackerel population who will grow and reproduce from fishing.

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