Identification of Decapterus sp. potential fishing grounds in Java and Western Kalimantan Seas

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Abstract. Decapterus sp. is one of the main targeted species for small pelagic fish in Java and western Kalimantan Seas (Karimata Strait and South China Sea). Decapterus sp. mainly catch at around 40-70 meters depth. They live in warm waters (more than 26°C) with salinity greater than 30 ppt, pH greater than 7.75, and concentration of dissolved oxygen (DO) greater than 4.2 ml/l. Datas were obtained from World Ocean Atlas 2013, NCEP, and result of numerical model. The aim of the research was to investigate the seasonal variation of decapterus sp. potential fishing ground. The results show that variation of seasonal oceanographic conditions has an impact to the potential fishing ground pattern of decapterus sp. The catching prediction area was at 20 m depth, except when second transition season which was at 40 meters depth. Fishing period should be done during the rainy season according to the widest area of potential fishing ground.

1. Introduction

Decapterus sp. (scad fish) is the main catch fish in Karimata Strait and Java Sea for small pelagic fishes. Based on fishery statistics of Ministry of Marine Affairs and Fisheries Indonesia, over ten years (2004-2014), scad fish has accounted for almost 23% (346,645.9 tons / year) from total capture of small pelagic fish or about 7.75% of the total Indonesian catch [1]. Growth of scad capture itself reached 1.81% per year within that period. In terms of production value, this species contributed almost Rp 2,356,000,000,000 per year or 5.1% of the total value of fish production in 2004-2014 [1]. This suggests that scad fish is one of the national major catch and has a play important role in the coastal economy enhancement.

There are several species of scad fishes in Indonesia, such as Decapterus russelli, D. macrosoma, D. macarellus, and D. kurroides. Decapterus russelli and Decapterus macrosoma are commonly found in the exposed waters of Sunda Sea (South China Sea, Java Sea) and Arafura Sea, as well as in coastal waters [2]. Based on Pastoral et al, Decapterus sp. lives in warm waters (greater than 26°C) with salinity greater than 30 ppt, pH value greater than 7.75, and concentration of dissolved oxygen (DO) greater than 4.2 ml/l [3].

Oceanography characteristic plays an important role in Indonesia Sea, which is influenced by the seasons. Therefore, the characteristic of potential fishing ground will also affected by seasonal changes. The objective of the research was to investigate the seasonal variation of Decapterus sp. potential fishing ground.
2. Methods
The study area was located at Fisheries Management Areas (FMA) 711 and 712 (Figure 1) which was covered western Kalimantan Seas and Java Sea. Several sources of data were used in this study including oceanography and climatology data. Dissolve oxygen (ml/l), temperature (°C), and salinity (ppt) data were obtained from World Ocean Atlas 2013 with 1°x1° resolution. Those data is average condition from 2005-2012 whose calculated by World Ocean Atlas 2013 (WOA 13) [4].

Results of numerical model was used to extract pH value [5]. We assumed the value of pH is considered equal from the surface to the seabed, adjusting to the numerical model we referred. The month grouping refers to the seasonal groupings used by WOA 13 where rainy season (boreal winter) consist of January-February-March, first transition season (boreal spring) consist April-May-June, dry season (boreal summer) consist July-August-September, and second transition season (boreal autumn) consist October-November-December. The rainfall data from NCEP was also used in this study as supporting data analysis [6]. The average rainfall calculated from 2005-2012 in accordance with average year used by WOA 13.

Fishing ground map was depicted using Ocean Data View at 20 m, 40 m, and 70 m depth. This approach was based on Pastoral et al. [3]: whereas the highest catch of Decapterus sp. in Sulu Sea predicted about 40-70 m depth, while in the South China Sea found in shallow water about 20 m depth.

![Figure 1. Zoning of Fisheries Management Area in Indonesia](image)

3. Results and Discussion
3.1. Characteristic of study area
Java Sea and western Kalimantan seas have shallow bathimetry with varying depths. The depth in the eastern waters of Kalimantan reaches 70 m around the bay of Thailand and is shallower to the south. While in the Java sea has a depth of 20 m off the coast of south Sumatra to more than 60 m in its eastern part [8]. This shallow bathimetry causes the sea to tend homogeneous. The study area also affected by monsoon so the oceanography parameters will have seasonal variation. During rainy season, the wind blows northwest and the current will move southward. This current will bring freshwater from study area penetrated eastern part of Indonesian waters and affected another parameter, such as salinity and chlorophyll [8][9].
Vertical distribution of several parameters we used can be seen in Figure 2 along with its seasonal variation. The data were obtained from WOA 13 which is the average condition in 2005-2012. During rainy season, the temperature reach its lowest value and tend to high value of DO. High precipitation during the rainy season (figure 3) will also decrease the salinity. But, as shown in figure 2 and 3, the highest precipitation occur in second transition season. It makes the salinity in second transition season has lowest value among all season. The pH value also has seasonal variation. The high precipitation will decrease pH value because the addition of freshwater with lower pH value (figure 3).

3.2. Potential fishing ground
Based on definition from Indonesia Ministry of Marine Affairs and Fisheries, fishing is an economic activities to catch or collect fishes/other aquatic animals/aquatic plants that grow naturally in inland openwater/marine areas and no belong to the property of any person [1]. Whereas, based on definition from Philippine Statistic Authority, fishing ground refers to areas in any body of water where fish and other aquatic resources congregate and become target of capture [10]. So, we can conclude that potential fishing ground is areas in any body of water where potentially profitable for economic activities to catch or collect fishes/other aquatic animals/aquatic plants. In this paper, we depict the potential fishing ground for decapterus sp.

Figure 2. Vertical distribution of (a) salinity, (b) dissolve oxygen (DO), and (c) temperature in study area

Figure 3. Seasonal Average Rainfall in Study Area (2005-2012)
The green area in figure 4 is the potential fishing ground for decapterus sp based on average condition during 2005 – 2012. Based on Figure 4 each season had a different pattern of potential fishing ground. In general potential fishing ground in FMA 712 was distributed wider than FMA 711. Consequently the amount of capture fisheries production of FMA 712 was showed higher based on the fishery statistics of Indonesia Ministry of Marine Affairs and Fisheries. As shown in figure 5, the capture in FMA 711 reached 2,564 tons in 2010 and 5.694 tons in 2014. This total capture was far below the capture of FMA 712 which reached 81,690 tons in 2010 and 84,443 in 2014 [1][11]. In general, Java sea has higher pH value than at western Kalimantan. In dry season and autumn, the area with pH value less than 7.75 spreads in the western waters of Kalimantan. This indicated that the Java sea to be a better habitat for the scad fish. During the rainy season, lowest SST has correspond to highest DO among all season (figure 2). It makes the highest potential fishing ground occurs in rainy season. Not also wider, the potentialsai fishing ground also reach 70 m depth in small part of west Karimata Strait (figure 4). While the narrower potential fishing ground occurred at second transition season correspond to the low pH value due to high rainfall (figure 3).
4. Conclusions and Further Work
Based on the results the fishing period should be done during the rainy season. This is based on the area of potential fishing ground that almost covers the entire study area. We also conclude that the least potential fishing period occur at second transition season based on the narrow potential fishing ground.

This study still has many deficiency. For the next research, the authors will include the chlorophyll factor as the scad’s food and also ocean currents to get a more accurate map. In addition, the total fish catch referred to is calculated based on the landing port of those fish. So, it is not quite accurate to describe the abundance of fish in certain waters.

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