



Status of black sunu (*Plectropomus areolatus*) at Wakatobi National Park

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Abstract. Black sunu (*Plectropomus areolatus*) is one of the reef fish resources originating from Wakatobi National Park in Wakatobi Regency, Indonesia. Fishers always catch black sunu regardless of their size. This interferes with the sustainability of the fish population. This study aimed to determine the status of black sunu, so that it can have a sustainable life in Wakatobi National Park, as a natural resource. The research methodology used purposive sampling on fishers fishing in the waters of Wakatobi Regency, with catch landed on Wangi-Wangi Island. Research data was based on fish total length from 400 fish, 200 from the west monsoon and 200 from the east monsoon (May 2020 until October 2020). Data were analyzed using the Spawning Potential Ratio (SPR). This study showed that the average total length in the east monsoon was 35 cm and the average total length in the west monsoon was 23 cm, with SPR values obtained being 4 and 19%, respectively (less than 20%). Black sunu is considered overfished in the east and west seasons. Overfishing is rising, while, based on interviews with fishers, from year to year, the size of fishing has been decreasing. Therefore, continuous and systematic long-term monitoring must be applied. One of the measures that can be applied towards the sustainability of black sunu populations in the region is regulating the size of the catch, allowing the fish to reproduce.

Key Words: length of maturity, monsoon, reef fish, spawning potential ratio.

Introduction. Black sunu (*Plectropomus areolatus*) is a species of live coral fish that is a commodity with a high selling value. This fish is a popular species in high demand, consumed by many people. *P. areolatus* is one of three widely caught species of live reef fish trade (LFRT). It is also included in the IUCN Red List, with a vulnerable status (Khasanah et al 2019).

Wakatobi Regency is one of Indonesia's national park and conservation areas and was established as a conservation area in 2002, through the Forestry Minister Decision No. 6186/Kpts-II/2002 (Firmansyah et al 2016). There are four islands within Wakatobi National Park: Wangi-Wangi Island, Kaledupa Island, Tomia Island, and Binongko Island. Wakatobi Regency is rich in natural resources (Sopari et al 2014). It has eight important natural resources: coral reefs, mangroves, fish spawning areas (SPAGs), seagrasses, spawning grounds for birds, whale and dolphins watching (cetacean), sea turtle nests, and some reef fish with high economic value (Alamsyah et al 2013).

Reef fish are one of the most important resources at Wakatobi National Park. According to Ramadhan et al (2016), reef fish that are primary targets for fishing at Wakatobi Regency are the two-banded snapper (*Lutjanus biguttatus*), rabbitfish (*Siganus guttatus*), emperor fish (*Lethrinus* sp.), and grouper (*Epinephelus* sp.). In addition to national public consumption, reef fish are also exported overseas. Reef fish are in demand by consumers because of the quality of their meat, and are very popularly used in the Chinese New Year cuisine. Lau & Jones (1996) and Bergenius et al (2006) stated that the high demand for these fish is due to their attractive body-color (red skin and white meat). Therefore, the grouper is one of the main dishes on Chinese celebration occasions, such as the Chinese New Year, where the color red symbolizes good luck in the Chinese culture.

The most common fish at Wakatobi Regency is the black sunu (*Plectropomus areolatus*). Black sunu is a species of live coral fish that is a commodity with high selling value. This fish is popular and in demand. Black sunu is a standard consumption fish marketed in Wakatobi Regency and outside Wakatobi Regency, including Bau-Bau and Kendari. The market distribution of the fish is not only for domestic markets, but also abroad as live fish or frozen.

In addition to the increase in fishing fleets, another problem is illegal fishing accompanied by irresponsible fishing methods. However, illegal activities, including illegal fishing and using fishing equipment that is not environmentally friendly, will impact the environment and fishery resources of black sunu. Based on this, it is necessary to know the status of black sunu in Wakatobi National Park, so that the resources of black sunu remain sustainable.

Material and Method

Description of the study sites. The study was conducted on Wangi-Wangi Island, in Wakatobi Regency, Indonesia, from May 2020 until October 2020 (Figure 1).

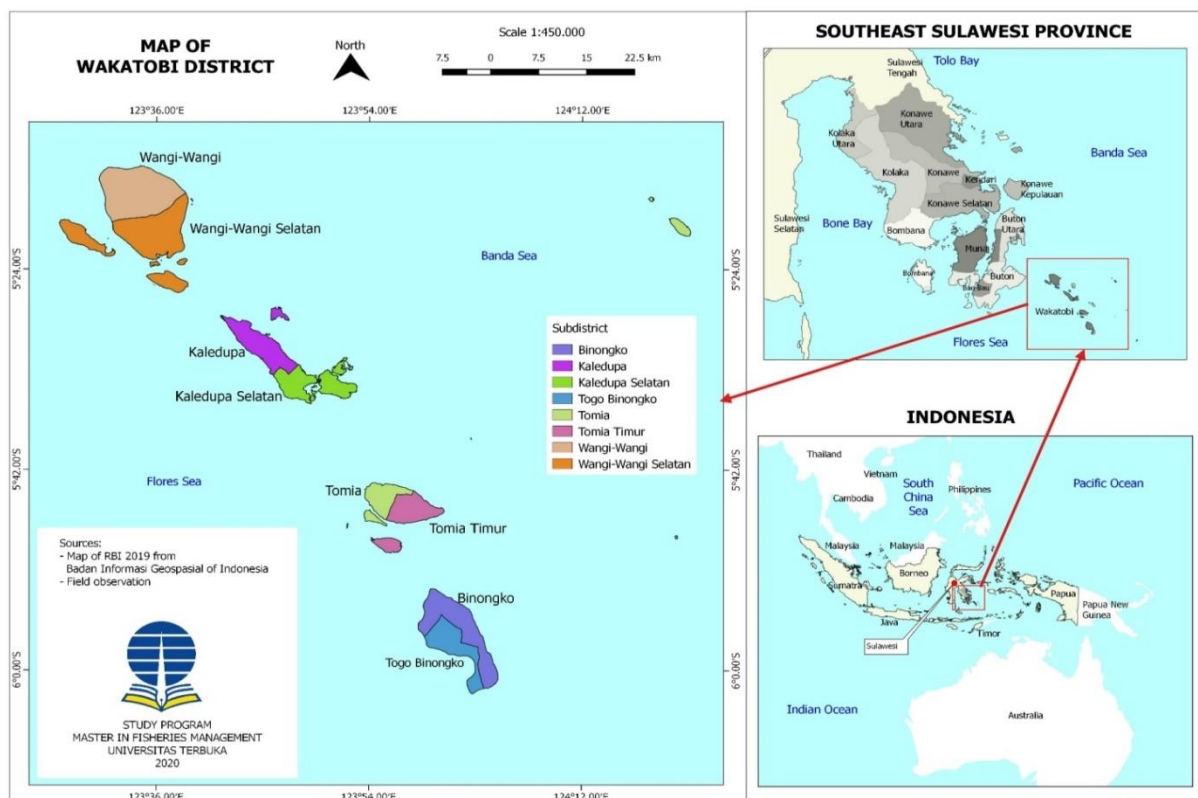


Figure 1. The location of Wakatobi Regency, Southeast Sulawesi Province, Indonesia.

Data collection. This study used primary and secondary data. Primary data used in this study is represented by the total length of black sunu captured by fishers in the waters of Wakatobi Regency. Sampling was conducted randomly by fishers who caught reef fish in Wakatobi Regency, and landed the catch on Wangi-Wangi Island. The number of fish used in this study was 400. 200 were captured during the east monsoon and 200 during the west monsoon. In addition to primary data, this study uses secondary data obtained from scientific publications and reports of the Marine Affairs and Fisheries Agency of Wakatobi Regency.

Statistical analysis. The data was analyzed using the Spawning Potential Ratio (SPR) analysis. The estimation of SPR was done online at <http://barefootecologist.com.au/lbspr>, determining the length-based spawning potential ratio (LB-SPR) (Hordyk et al 2014).

The SPR is a relative reproductive index used to determine stock conditions in exploited fisheries (Prince 1984). In other definitions, the SPR of a fish stock is defined as a proportion of the reproductive potential of a fish stock left behind at various levels of catching pressure (Walters & Martell 2004). SPR is distinguishing the current supply of fisheries that have been exploited through the relative reproduction index. SPR is an index of the relative production rate in stocks of exploited resources (Brooks et al 2010). SPR analysis is often used to determine fisheries management strategies in fisheries with limited and poor fishery data (Hordyk et al 2014).

SPR can be interpreted as a proportion of the reproduction potential from a resource supply that has not interacted with fishing activities (Prince et al 2015). The SPR can be determined with the following formula:

$$SPR = \frac{SSB_F}{SSB_{F=0}}$$

Where: SPR - spawning potential ratio; SSB_F - spawning stock at fishing; $SSB_{F=0}$ - early spawning stock (before fishing).

LB-SPR analysis results were then compared with the reference values based on three types of fishery status according to Walters & Martel (2004) and Prince et al (2015), namely: underexploited, when $SPR > 40\%$, moderate, when $20 < SPR < 40\%$, and overexploited, when $SPR < 20\%$.

Results and Discussion. From 2010 to 2018, fishery production increased in Wakatobi Regency (Figure 2). As a result of this demand, there was an increase in fleets. The demand increase also occurred in Southeast Sulawesi, especially in Kendari and Makassar.

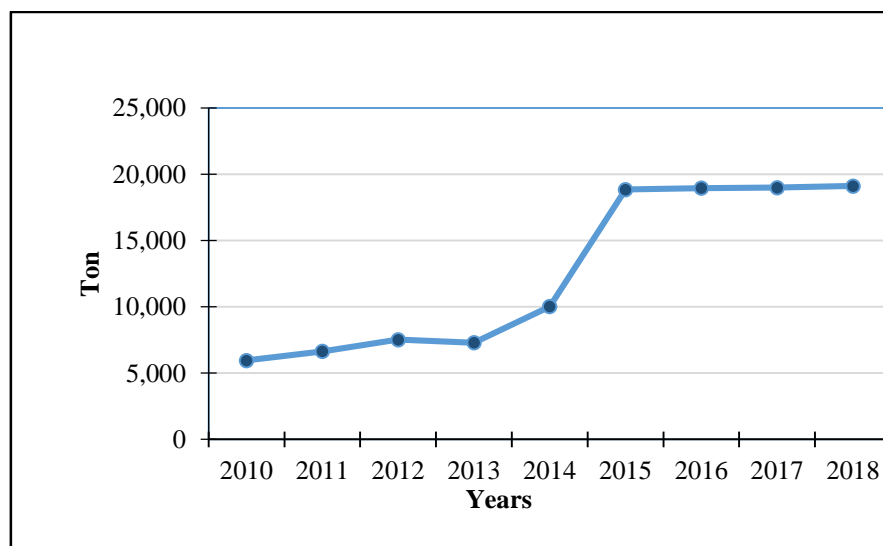


Figure 2. The fisheries production in Wakatobi (Department of Marine Affairs and Fisheries for Wakatobi Regency 2020).

According to Prasetiawan (2020), at least 31 families of fish can be found on Wangi-Wangi Island. Some of them are target fish partially, and there are some reef fish that have an increasing demand, especially from the families: *Serranidae*, *Lutjanidae*, *Kyphosidae*, *Lethrinidae*, *Acanthuridae*, *Mullidae*, *Siganidae*, *Labridae* (*Chelinus*, *Hemigymnus*, *Choerodon*) and *Haemulidae*. The report from LCEAFM University of Halu Oleo (2016) stated that the composition of coral fish species caught from 2012 to 2014

illustrates the tendency of the proportion of catch composition to increase in target fish. The proportion of target to non-target fish is 3:1 in the four islands (Wangi-Wangi, Kaledupa, Tomia, Binongko). The interviews with fishers also revealed that fishers still prefer target fish because the target fish has a high demand and a higher price in the market.

Black sunu is one of the high-demand reef fish that became a fishing target for its high-quality meat. Based on the interviews with fishers, black sunu is a main target throughout the year, and, as a result, the total catch of black sunu is decreasing. According to Alamsyah et al (2013), if the fishing of black sunu is carried out continuously during the spawning period without proper regulation and control, it can pressure the fish population from the Kapota reef.

Black sunu in Wakatobi Regency are caught using arrow fishing gear, fishing rods, traps, and spear guns. In this study, fish were mainly captured using fishing arrows. According to Tadjudah et al (2013), this fishing tool is shaped like a rifle. In general, this fishing technique is only used by fishers from the Bajo tribe, where the fishing areas are relatively close to their villages. Sometimes, they carry these fishing tools and their hand line or a net to catch fish.

The location of Kapota reef is close to Wangi-Wangi Island. Kapota reef is a good location for grouper fishing. Kapota reef represents a fishing area because it has vast coral reefs with various species of reef fish (Alamsyah et al 2013).

Alamsyah et al (2013) noted 36 points of grouper (*Serranidae*) fishing around Wakatobi Islands, fishers from South Mola Village reinforcing the information. The main areas of fishing are Kamponaone reef, Kaledupa reef, Tomia reef, Runduma reef, Koko reef, Koromaho reef, and Kapota reef. Within Kapota reef, there are five catch areas. Three areas are still active, and the other two are no longer used because of destructive fishing (like using explosives). Patanda et al (2018) found many reef fish areas in the Kapota reef.

The black sunu fishery in Wangi-Wangi Island is divided into two monsoons. There are the west monsoon, when black sunu catch is high, and the east monsoon, when black sunu catches are very low, even missing. Thus, the SPR analysis is divided on the two monsoons. Figures 3, 4, and 5 show the results of the SPR analysis.

Figure 3 shows the length-frequency for black sunu landed on Wangi-Wangi Island. In the east monsoon, the fish length ranged from 25 cm to 55 cm, with most values being around 35 cm. Meanwhile, in the west monsoon, the fish length ranged from 22 cm to 48 cm, with most of values around 23 cm.

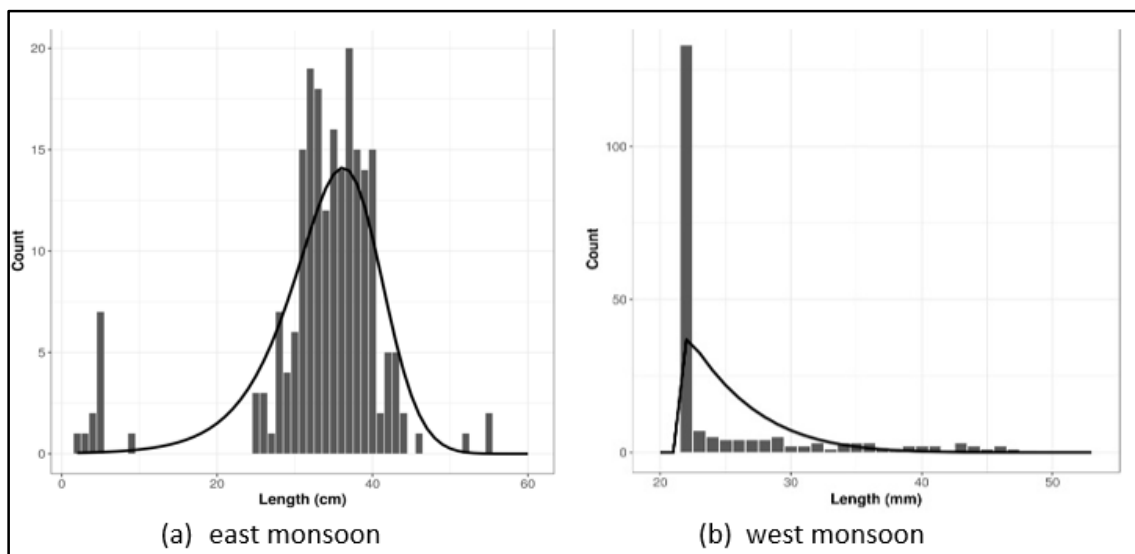


Figure 3. Length-frequency of the black sunu (*Plectropomus areolatus*) landed on Wangi-Wangi Island.

Figure 4 shows the comparison of length at first capture (L_c) and length at first maturity (L_m) of the black sunu landed on Wangi-Wangi Island. In the eastern monsoon, the L_c is on average 34 cm, smaller than L_m , 38 cm, meaning that the fish caught are generally immature. In the western monsoon, the L_c was 22 cm, while L_m was 32 cm. Thus, the fish usually captured are not mature. These results are similar to the research of Noiija et al (2014), who observed the red snapper in the northern waters of Cirebon, the Java Sea, with an overall L_c lower than L_m . Agustina et al (2018) stated that $L_c < L_m$ conditions show a relatively high chance of over-fishing. The possible overfishing condition is growth overfishing. Growth overfishing occurs when small fish dominate the catch. The condition of growth overfishing aligns with the responses of fishers, who notice that the size of reef fish caught is smaller from year to year. Similarly, Saranga et al (2019) stated that if the value of $L_c < L_m$, then the condition of fish resources suffers under catching pressure. To avoid this, the fishers should catch fish of mature size.

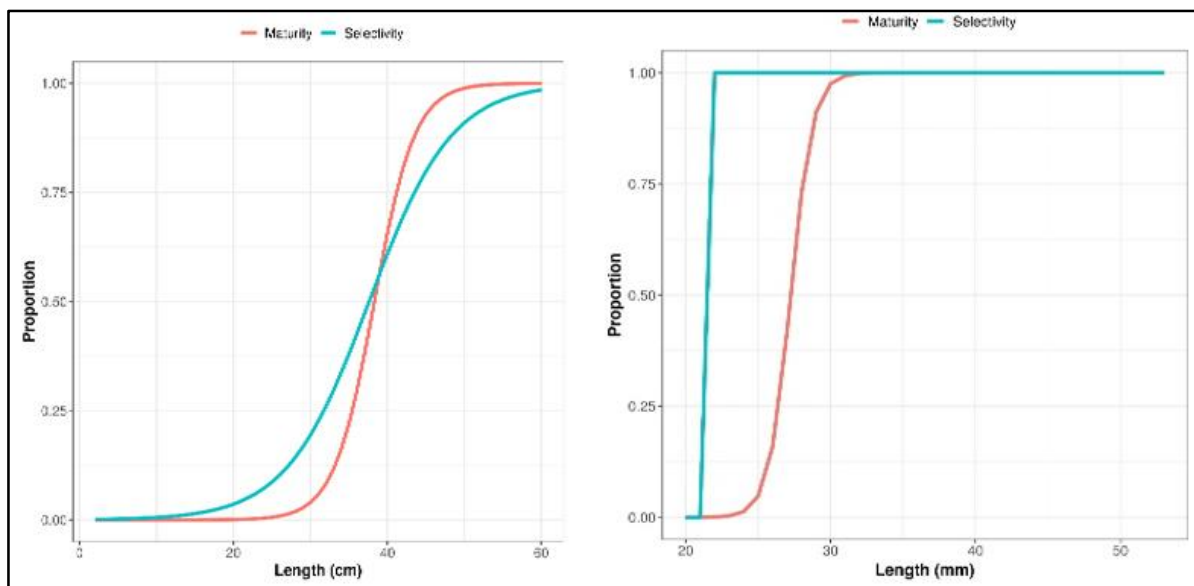


Figure 4. Comparison of length at first capture (L_c) and length at first maturity (L_m) of black sunu (*Plectropomus areolatus*) landed on Wangi-Wangi Island.

Based on Figure 5, the SPR result showed a value of 4%, meaning that fish are overfished. According to Hordyk et al (2014), when the SPR value is below 25%, the status is overfishing, and a SPR value below 20% indicates a decrease in stock. Ault et al (2008) also mentioned that a value of 25% is under the SPR standard, indicating overfishing. According to Jaya et al (2017), a lower SPR value shows a higher disruption rate of the fish resource. If the current condition continues, some fish resources could become extinct. Extinction can also occur due to the lack of time for the resource to recover itself. The ratio of deaths caused by capture and natural death (F/M) is >1 , which means that the death of black sunu is mainly caused by catching activities instead of natural causes.

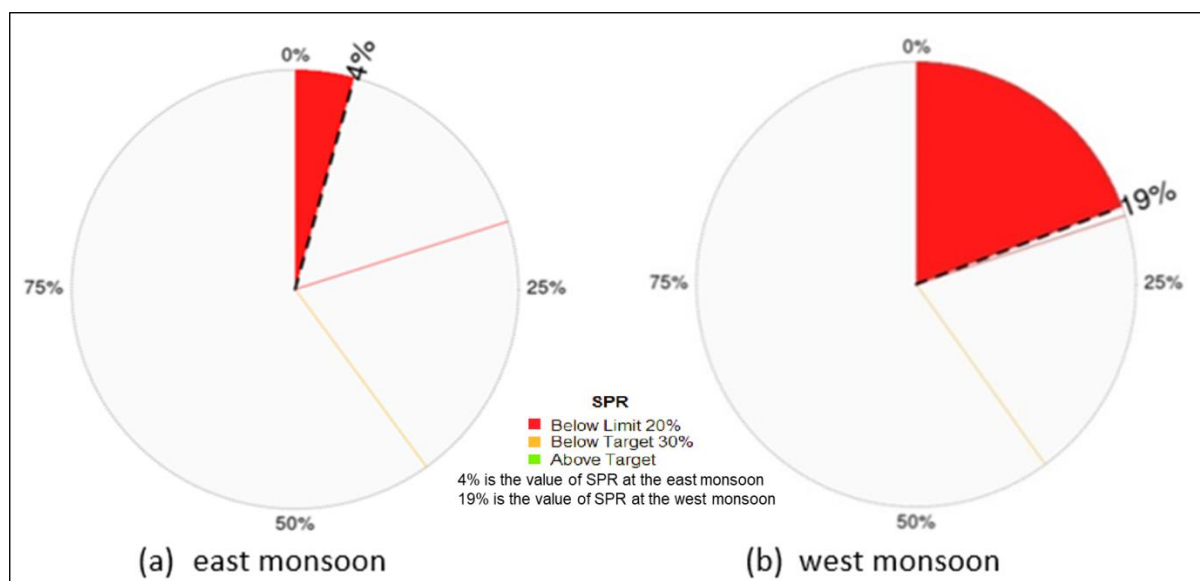


Figure 5. Specific growth rate (SPR) values in the two monsoon seasons for black sunu (*Plectropomus areolatus*) landed on Wangi-Wangi Island.

The results of this study are in accordance with the status issued by the Ministerial Decree No. 45 of 2011 concerning the estimation of demersal fish resources in Fisheries Management Area 714, the resources being fully exploited. Alamsyah et al (2013) found that there are differences in growth patterns between males and females of *P. areolatus*, maturing at a different pace.

One of the fisheries management measures of black sunu that can be implemented/applied in Wakatobi National Park is to set a rule for the minimum capture size of 38 cm. In addition, alternative management measures of black sunu could be the arrangement of fishing gear and the arrangement of the fishing fleet. Other measures that can be taken are to maintain local wisdom and prohibit fishers to use non-environmentally friendly fishing activities such as the use of bombs or cyanide.

Conclusions. The study showed that black sunu (*Plectropomus areolatus*) is overfished in both seasons (west and east seasons), the condition being growth overfishing. Thus, new regulation on catching black sunu should be created and implemented on Wangi-Wangi Island, including setting the minimum size of fish caught to at least 38 cm total length.

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Conflict of Interest. The authors declare that there is no conflict of interest.

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