



STOCK CONDITION EVALUATION USING POPULATION DYNAMIC PARAMETERS : CASE OF RED SNAPPER (*LUTJANUS GIBBUS*) AT ALOR WATERS, EAST NUSA TENGGERA, INDONESIA

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Abstract

Red snapper is an important fishery commodity in East Nusa Tenggara Province, exploited throughout the year without management policies, so it is feared that the condition of the fish stocks has decreased. This study aims to evaluate the condition of red snapper stock in the waters of East Nusa Tenggara. Fish length data were collected from March 2018 to March 2019. Stock conditions were analyzed using the Mallawa Scoring method. Population dynamics parameters used in the analysis of the stock size structure of fish size, number of age groups, growth rate, mortality rate of capture, exploitation rate, yield per recruitment were calculated using the help of FISAT II software, and percentage of eligible capture size using the Mallawa method. The results of the study that red snapper stock is dominated by pre-adult fish, the population consists of three age groups, the population growth rate is high enough, the mortality rate of capture and exploitation rate is relatively low, the recruitment process is close to optimal and the percentage of eligible capture size in catches is quite high. The conclusion is that the red snapper stock in East Nusa Tenggara waters is good condition.

Keyword: Red snapper, stock condition, population parameters, Alor Waters

Introduction

The condition of the population or stock of exploited fish will change by four main variables, namely growth, recruitment, capture mortality, and natural mortality, where the stock can increase or decrease in the number of individuals or biomass spatially and temporally. If the amount of biomass from growth and recruitment is greater than the amount of biomass by capture and natural death, the population or stock will grow, otherwise the population or stock will decrease if the amount of growth and recruitment biomass is smaller than biomass by capture and natural death (Mallawa, 2012). The characteristics of the stock condition of a type of fish have decreased namely the size of fish in the catch is getting smaller, the growth rate is relatively low, the number of age groups in the population is not much. Other are the mortality rate due to fishing is high, high exploitation rate, the recruitment process is not optimal and the percentage of eligible capture size in catches is low (Mallawa *et al.*, 2017).

Stock assessment in the tropics is generally more difficult than in temperate waters. There are a large number of reasons for this, and two of them may be listed here. First, tropical fisheries especially demersal fisheries often exploit a number of species simultaneously, with the result that neither the commercial fishery nor the artisanal fisheries even when relatively well monitored, can be expected to provide detailed catch and catch per effort statistics on a per species basis. For this reason, it is common in tropical fisheries to treat whole species assemblages as if they were single species. Second, tropical countries generally have a relatively limited research capability as far as fisheries research is concerned which often leaves most of the stocks sustaining their fishery completely uninvestigated (Gulland, 1997). The habit of fishermen who do not land their catches on official fishing ports but are scattered along the coast according to fishermen's residence and too many types of fishing gear

used causes annual production data and annual efforts to be biased (Gulland, 1983). Ministry of Maritime and Fisheries of the Republic of Indonesia, (Mallawa *et al.*, 2018) released information about the conditions of fisheries stocks in Indonesia generally uses the approach of utilization level or exploitation rate. Potential and utilization rates are presented according to fish groups (small pelagic fish, large pelagic fish, demersal fish, consumption reef fish etc.) and per the Indonesian Fisheries Management Area (WPP-RI). The MSY value is generally calculated using the Ricker and Fox Production Surplus method with annual production data and annual effort input data. Based on the level of stock utilization, fish groups in the WPP RI are stated to be in over exploited, moderate exploited and low exploited.

Red snapper is one type of reef fish that has a high economic value so that it becomes a target of catch by fishermen in various waters in Indonesia so that it is suspected that there has been a decline in the condition of its stock. In the waters of East Nusa Tenggara, red fish is one of the fisheries commodities that become fish target fishermen because it can provide high income for them. This type of fish is exploited throughout the year using traditional fishing tools such as hand line, bottom traps, and bottom gill net without a management policy (Mallawa *et al.*, 2018). (MMAF 2016) Explained that the condition of stocks of a type of fish can decrease as a result of intensive fishing, the use of unsustainable fishing equipment and the absence of good and correct management policies.

Research on the condition of red snapper stock in Indonesia has been conducted in the waters of the Sunda Strait in Banten, Indonesia by (ARFS, 2017) using the Surplus Production Model and by (Prihatningsih *et al.*, 2017) using the Length-based Spawning Potential Ratio (SPR) method, both results the study explained that the condition of red snapper stock decreased. Catching activities in the waters of Palau have caused the condition of red

snapper stock to decline which is marked by a decrease in the average length of fish in the catch of fishermen and the value of the Spawning Potential Ratio (SPR) in the last twenty years (Satria and Sadiyah 2017, Hordyk *et al*, 2015; Hordyk *et al*, 2015; Lindfield, 2017). For stocks of a type of fish whose annual data are lacking the condition of the stock can be known using the Length-Based Spawning Potential Ratio (LB-SPR) method (Prince *et al*, 2015, Prince, 2017).

This study aims to evaluate the condition of red snapper stock in the waters of East Nusa Tenggara using several biological parameters and population dynamics including fish size structure, percentage of fish worth catching, population growth rate, catch mortality rate, exploitation rate and yield per recruitment,

Materials and Methods

Time and Research Location

This research was conducted for approximately one year, namely from March 2018 to March 2019 in the waters of Alor, East Nusa Tenggara. Sampling was carried out in the fishing landing area (fishing base) of fishermen who catch snapper in the waters of Alor, namely in Treweng Island, East Pantar District, Pura Besar Island, Pura District, and Buaya Island, Alor Batar Laut District. The geographical position of the study sites is 8° 6' - 8° 36' LS and 123° 48' - 125° 48' BT (Figure 1).

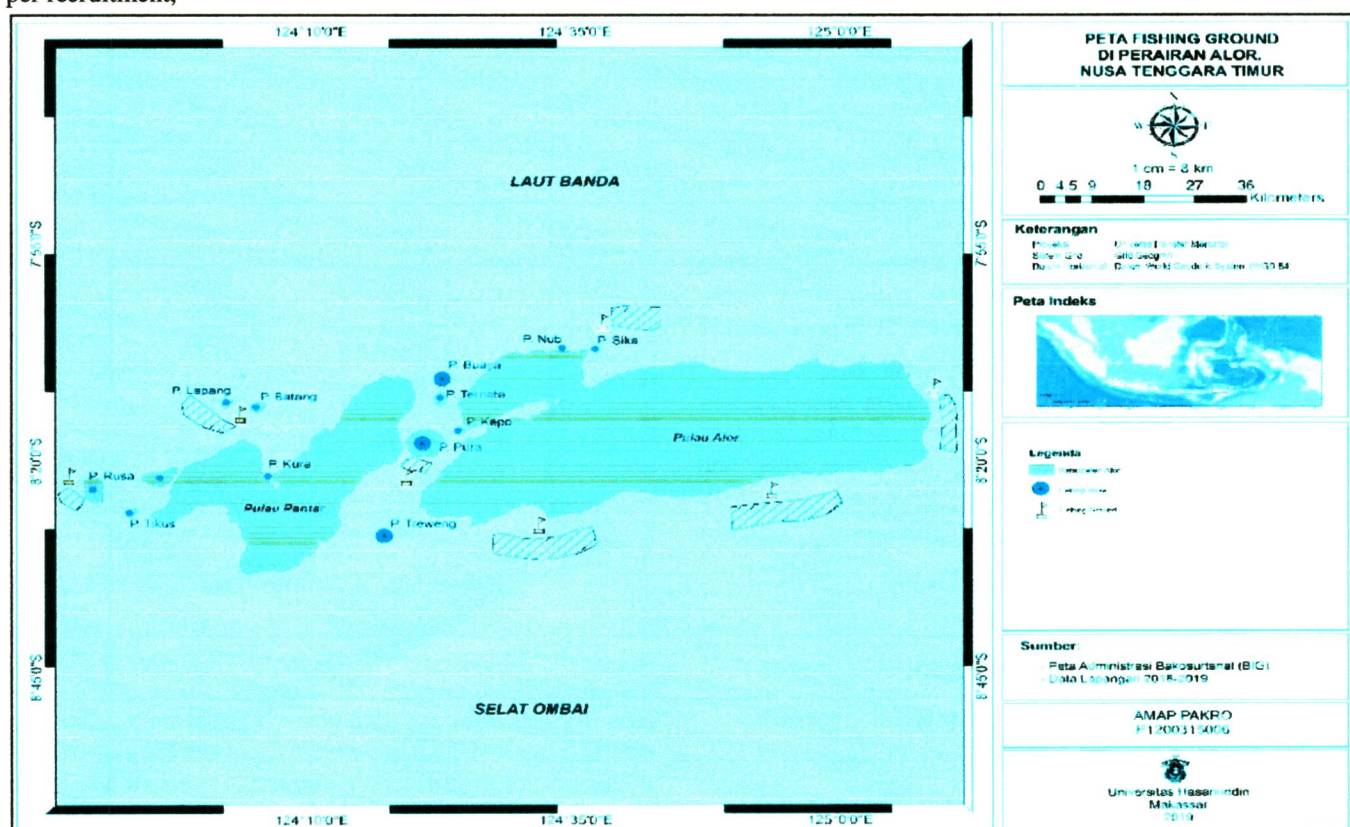


Fig. 1 : Research location [15]

Materials and equipment

The materials used in the study are red snapper, aquadest, 10% formalin, data sheet tables, interview boards, and equipment such as measuring boards, digital weighted, sample bottles, GPS, digital thermometers, cameras, computers and software such as SPSS and FISAT II.

Data Collection

Data on fish length (cm, TL) are collected directly by following the fishermen and at the fish landing site (TPI). Sample fish measurements are carried out twice a month from hand fishing fishermen and at three fish landing sites. Fish samples are taken using the stratified random sampling method, where as a stratum is a fishing ground, a place for observing fish and fish size. The number of sample fishes taken is adjusted to the number of catches, if the number of catches is large, sample fishes are taken 10% of the amount of fish caught and if the catch is less then all fishes are taken as sample fish (Sugiarto, 2009, Mallawa and Amir, 2019). During the study, as many as 4100 red snapper fish were measured, a combination of 1360 specimens in Traweng

Island waters, 2150 specimens in Pura Besar Island and 590 specimens in Buaya Island.

Data Analysis

The condition of red snapper stock in Alor East Nusa Tenggara waters was analyzed using the scoring method (Mallawa *et al*, 2015). This method uses several biological parameters and population dynamics including size structure, number of age groups, population growth rate, catch mortality rate, exploitation rate, percentage of capture size and yield per recruitment. Each test parameter is weighted according to the level of influence on the stock conditions. Each parameter is divided into three sub-parameters and then a value is assigned according to the conditions of observation. Good condition sub-parameters are given a value of 5, moderate are given a value of 3 and not good are given a value of 1. Good condition sub-parameters are given a value of 50, moderate are given a value of 30 and not good are given a value of 10. Furthermore, we do a multiplication of the weights and the acquisition value of each parameter (Table 1).

the use unsustainable fishing gears (Mallawa *et al.*, 2018, Prince, 2017, Gayanilo and Pauly, 1997) In the Palau waters, the average length of red snapper in catches decreased by a period of 287 mm in 1982 - 1984 to 278 mm in 1991-1992 and 272 mm in 2014 to 2015 as a result of the loss of large red snapper in the population by fishing (Hordyk *et al.*, 2015) The low level of exploitation of red snapper in the waters of iQoliqoli Fiji makes the condition of fish stocks very good (Lindfield, 2017, Prince, 2017) Due to the high rate of the capture, the condition of red snapper stock in the waters of Northern Palau decreased which marked by a decrease in the average length of the fish in the catch over time (Lindfield, 2017)

Conclusions

The condition of the red snapper stock in Nusa Tenggara waters is in the good category. The main cause of red snapper stock is not in the very good category is the catch that is carried out continuously throughout the year and has implications for the loss of large red fish in the population

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