University of Muhammadiyah Malang, Indonesia
e-ISSN 2622-4836 Vol 5. No. 1. February 2022. pp. 24-32
IJOTA
Indonesian Journal of Tropical Aquatic
Journal homepage: http://ejournal.umm.ac.id/index.php/ijota

Habitat prediction of shrimp Barong (Panulirus spp) in East Java waters

Samsul Huda[1,a*], Siti Naviah[1,b]

[1] Faculty of Agriculture / Fisheries, University of Dr. Soetomo. Surabaya, Indonesi Malang, Indonesia.
[a]samsulhuda@unitomo.ac.id [b]siti.naviah@unitomo.ac.id

[*]Corresponding author: samsulhuda@unitomo.ac.id

ARTICLE INFO

Kata kunci:
Barong Shrimp
Habitat
Panulirus spp
Sustainable
Trap.

ABSTRACT

The production of barong shrimp (Panulirus spp) is mostly caught from the sea, although restocking efforts have been initiated, the results have not had an impact. The high demand and its economic value increase the frequency of catching efforts, therefore information on the stock condition of barong shrimp (Panulirus spp) and their distribution habitat is needed to create a sustainable resource. This study aims: to obtain the stock of sustainable potential and the distribution of their habitat in the waters of East Java. The research method uses the Walter-Hilborn model approach, the results conclude that the standard type of fishing gear is Trap, the prediction of potential biomass stock in open access conditions in 2030 is 37,763.64 Kg, the remaining stock in 2030 is 21 percent (%), sustainable fishing effort 143,2000 trips/year, maximum sustainable catch 45820.15kg/year, fishing power 0.0000004, habitat distribution dominance in Water Management Area 712.

How to cite: Huda, S., Naviah, S. 2022. Habitat prediction of shrimp Barong (Panulirus spp) in East Java waters. *IJOTA,* 5(1): 24-32
DOI: https://doi.org/%2010.22219/ijota.v5i1.20364

1. Introduction

Possessing potential economic value, one of the most popular genera of marine crustaceans in the world is the Barong shrimp (Panulirus spp) and belongs to the Panuiridae tribe, the characteristics of which are white meat, delicious and high protein. Several species are found in Indonesia, including Barong shrimp (Panulirus spp), bamboo lobster (Panulirus versicolor), stone shrimp (Panulirus penycilatus), king prawn (Panulirus longiceps), pearl shrimp (Panulirus ornatus), Jatropha shrimp (Panulirus pholypagus). and the green sand lobster (Panulirus homarus) (Moosa, 1984). Its habitat is different according to its species, however, it likes rocky areas and hides in holes, its distribution covers tropical to sub-tropical areas along the coast of America, Africa to the

Indo Pacific (Indonesia) waters, including the waters of East Java (WPP 712 and 573). The sustainable potential of fish resources (MSY) based on the Indonesian Fisheries Management Area, especially WPP 712 is 1,341,631 (tons), WPP 573 is 1,267,540 (tons), lobster for all WPP is 11,158 (tons), while based on the status of the potential utilization level Indonesian marine fish resources, especially lobsters in WPP 712 are in an "over-exploited" condition and WPP 573 is in a "fully-exploited" condition, however, overall utilization of marine and land fisheries potentials has increased. since 2010-2018 with an average annual increase of 9.1% (KKP, 2020).

The condition of overfishing has become a reality in various world capture fisheries, FAO estimates that 6% of the world's marine fisheries stocks are under-exploited, 20% moderately exploited, 50% have been fully fished, 15% overfished, 6% depleted and only Only 2% of the resources are still in a developing condition, this condition requires a long recovery time, to avoid this condition, sustainable resource management is needed, as is the case with barong shrimp (Panulirus spp). Although barong shrimp/lobster is a renewable biological resource, if proper management is not carried out, it does not rule out the possibility of overfishing, the problem is how much stock of existing resources can be exploited without disturbing its existence so that its use is sustainable, approach this problem carried out using the Walter-Hiborn method model. The aim is to find out the potential stock of Barong Shrimp (Panulirus spp) and their distribution habitat in the East Java Water Management Area.

2. Material and methods

2.1 Material

This study uses a quantitative descriptive method using the Wolter Hilborn model which is used to estimate the stock of sustainable resources. The data collection model is a purposive sampling of fishermen from East Java, the fishermen in question are Barong Shrimp (Panulirus spp) who have fishing gear. Because tropical fisheries have the characteristics of various species (multi-species) and various fishing gear (multi-gear), standardization is carried out, by determining the type of standard fishing gear based on the dominant species caught by Barong Shrimp (Panulirus spp). This standardization analysis uses the following equation (Gulland, 1983):

2.2 Analysis Data

$$CpUE = \frac{Qi\,{}^{n}_{i=1} * C_{fish}}{Ei\,{}^{n}_{t=1}}$$

Where :

CpUE = Catch per unit of effort

$Qi^{n}_{i=1}$ Average portion of fishing gear 1 to total fish production

C_{fish} = average fish catch by the bycatching tool

$Ei^{n}_{t=1}$ = average effort of lata catch that is considered standard (trip)

$$RPF = \frac{Ui\,{}^{n}_{t=1}}{U_{Standar\ tools}}$$

Where :

RFP= fishing gear conversion index

$Ui\,_{t=1}^{n}$Catch per unit effort of each fishing gear

$U_{Alat\ standar}$ = Catch per unit effort of the tool standard

$$E_{(Std)t} = \sum_{i=1}^{n} (RFP_1\ x\ E_{i\,(t)})$$

Where :

$E_{(Std)t}$ = number of standard fishing gear on year t (trip/fishing gear)

RFP_1= fishing gear conversion index I (I= 1 – n)

$E_{i\,(t)}$= number of fishing gear type I (in year t(trip/fishing gear)

$E_{i\,(t)}$= Number of fishing gear type I (in year t(trip/fishing gear)

Walter and Hilborn. Method

The Walter and Hilborn model is a development model of the surplus production model (Schaefer model), wherein in this analysis model we can estimate each parameter of the surplus production function r, q, and K.

$$P_{(t+1)} = P_t + \left[r * P_t - \left(\frac{r}{k}\right) * P_t^2\right] - q * E_t * P_t$$

Where :

P_((t+1)) = the amount of biomass stock at time t+1

P_t = amount of biomass stock at time t

R = intrinsic growth rate of biomass stock (constant)

K = maximum carrying capacity of the natural environment

q = maximum carrying capacity of the natural environment

E_t = number of fishing efforts to exploit biomass year t (trips/fishing gear)

3. Results and Discussion

East Java Province has 229 islands with a land area of 47,130.15 Km2 and an ocean area of 110,764.28 Km2. Its territory stretches between 111°0′ East Longitude – 114° 4 East Longitude and 7° 12′ South Latitude – 8° 48′ South Latitude. The northern side of the territory is bordered by the Java Sea, to the South by the Indonesian Ocean, to the East by the Bali Strait/Bali Province, and West by the Central Java Province. Capture Production. Based on the research results, the dominant fishing gear used to catch Barong Shrimp (Panulirus spp) in East Java waters is Bubu/Trap. Meanwhile, the number of catches landed in East Java waters during 2006-2020 is shown in Figure 1 below:

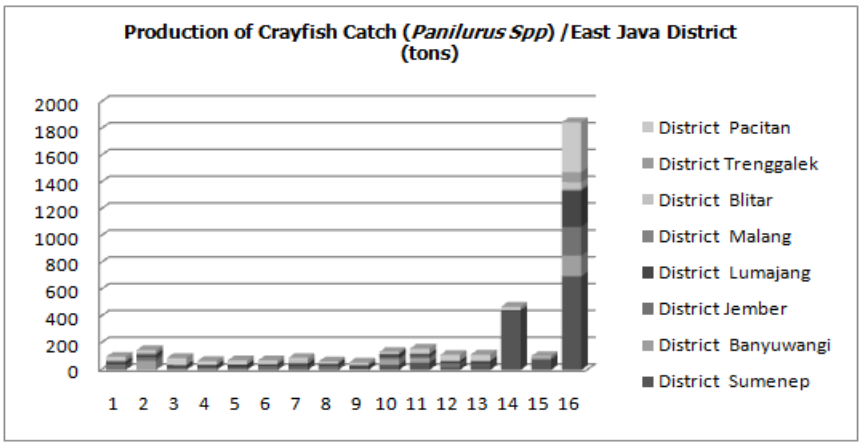

Figure 1. Chart of Catch Production (tonnes) Barong Shrimp (Panulirus spp) The year 2006-2020.

Based on Figure 1, it turns out that there was an increase in the number of Barong shrimp catches in 2020, while the number of trips (catch efforts) based on the dominant fishing gear used to catch Barong Shrimp (Panulirus spp) during the period 2006-2020 is shown in Figure 2 below:

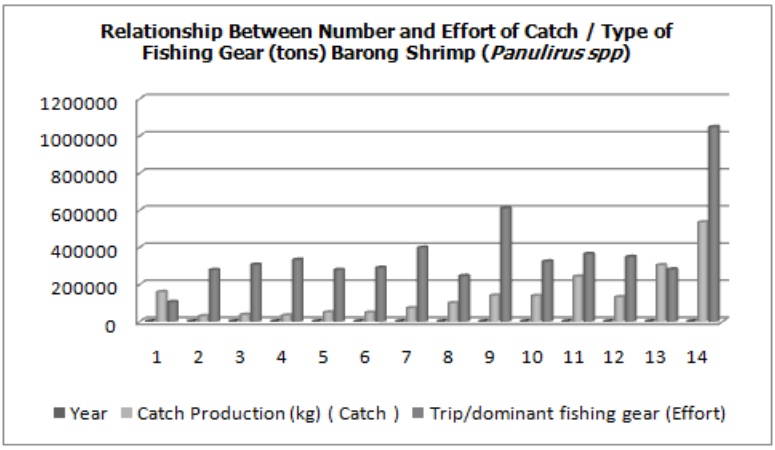

Figure 2. Graph of Number of Trips per Fishing Tool Barong Shrimp (*Panulirus spp*) Year 2006-2020.

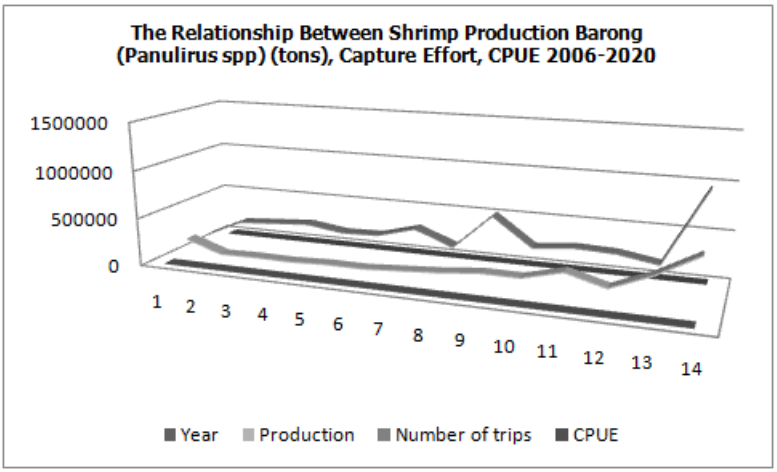

Figure 3. Graph of Relationship Between Result Barong Shrimp Catch (*Panulirus spp)*/Tool Unit Catch 2006-2020.

Based on the graphic above, it turns out that the production of Barong shrimp catches tends to decrease, there has been an increase starting in 2019 where the catch production and the number

of trips are the highest, this shows that the increase in capture exploitation is also followed by an increase in catches, but in this case, the condition of the resource must be studied more deeply. Barong Shrimp has led to an "overfishing" condition while the previous year the average catch was low, the number of trips for the dominant fishing gear was highest in 2019 for the Bubu/Trap fishing gear, it turns out that the increase in Bubu/Trap fishing gear trips was also followed by an increase in catches, however, it is necessary to study more deeply about the use of environmentally friendly and sustainable Barong Shrimp (*Panulirus spp*) fishing gear. This fluctuation in catches is influenced by other factors, including the presence of habitat and conservation, considering that the waters of Southern East Java (WPP712) are the habitat of Barong Shrimp (*Panulirus spp*) because the waters still have coral reefs. perceptions between fishermen and the tourism industry to create coral reef restoration and sustainable resource use (Johnson, 2015).

The stages of socialization of national policies in which fishermen are resource users to create a balance in conservation management (Glaser et al, 2015). This agrees with (Hopf., et al 2016) the need for a simultaneous restructuring between the benefits of stock conservation and rezoning to avoid the negative impact of social vulnerability of fishermen. Furthermore, to avoid the extinction of Barong Shrimp (Panulirus spp) it is necessary to protect coral reefs and mangrove habitats as migration sites. (Lobato et al, 2016). A similar study also recommends the need to promote the conservation and sustainable use of the *Panulirus penicillatus* species as this endemic subpopulation in the Pacific coast of Costa Rica (Naranjo-madrigal, H. (2020), while connectivity between the subpopulations of Panulirus argus in the Gulf of Mexico studied by (Baeza, JA), and Macmanes, M. (2020) support previous research which states that species protection programs can increase the size of Panulirus argus in the Gulf of Mexico, the study was carried out using a particle tracking model combined with realistic hydrodynamic simulations generated with the Hybrid Coordinate Ocean Model by releasing larvae. virtual 12 potential subpopulations.

The results of the research analysis turned out that the CPUE value fluctuated during 2006-2020 this was in tune with fluctuations in fishing effort (effort) to catch Barong Shrimp (*Panulirus spp*). 2019 catch efforts increased followed by the number of catches. This condition is almost the same as the decline in catch conditions for sailfin groupers (*Mycteroperca olfax*) in the Galapagos Islands due to the absence of effective catch management rules to ensure sustainability of fishery resources (Usseglio., et al, 2015). Other researchers also recommend the need for management arrangements to create sustainable resources (Bawole et al, 2017). Researchers (Johnson, 2015) stated that the degradation of coral reefs resulted in decreased catch production.

Stock Prediction Analysis.

The analysis of the estimated stock of Barong Shrimp (*Panulirus spp*) aims to obtain quantitative predictions about the Allowable Catch (JTB), the risk of overfishing, and providing growth opportunities to reach the size according to applicable regulations (Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number l/PERMEN- KP/2015). Initial information on the existence of Barong Shrimp (*Panulirus spp*) stock is very necessary, it is used as a starting point for creating sustainable resources. The existence of a Government policy (kep.18/men/2011), regarding a balanced management system between resource utilization and conservation efforts, due to fishing activities that are not environmentally friendly, resulting in damage, plus the implementation of Law No. 27 of 2007 concerning Coastal Area Management. and Small Islands. Although the Barong Shrimp (*Panulirus spp*) is a renewable biological resource, if proper catch management is not carried out, it is possible for overfishing to occur. sustainable use, this problem approach is carried out using the Walter – Hiborn method model. Estimation of stock

and presence of Barong Shrimp (*Panulirus spp*) in East Java waters was analyzed based on the trip aspect per dominant fishing gear in open access resource conditions in the 2006-2020 period, using the Walter-Hilbron Non-Equilibrium Model analysis, with the following results: The value of the intrinsic growth rate of the population (r) of Barong Shrimp (*Panulirus spp*) is 47.35 % per year, the maximum carrying capacity of the waters (k) is 2525737.451 Kg/year, the ability to catch (q) is 0.0000003 and the resource potential of Barong Shrimp (*Panulirus)* spp) (Pe) of 1262868.726 kg/year. The fluctuations in the results of the Non Equilibrium condition analysis are shown in detail in the dynamics of the stock with Open Access limits and the amount of biomass without a catch and with Barong Shrimp (*Panulirus spp*) catches separately. order as Figures Graphs 4, 5, and 6 below:

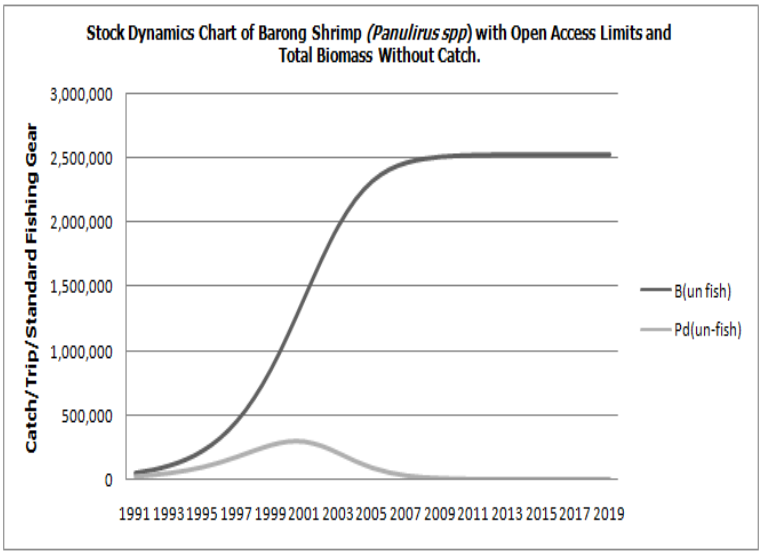

Figure 4. Chart of Stock Dynamics of Barong Shrimp (*Panulirus spp*) with Open Access Limits and Total Biomass Without Catch.

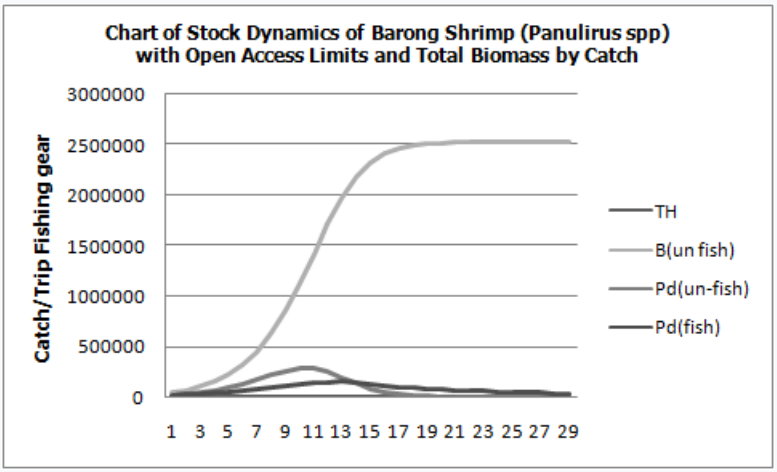

Figure 6. Chart of Barong Shrimp Stock Dynamics (*Panulirus spp*) With Open Limit Access

Based on (Graphs 4.5 and 6) above, stock dynamics with standard trip/gear limits in open access biomass conditions, the amount of Barong Shrimp (*Panulirus spp*) biomass in 2030 is

41,135.72 Kg, so that it is compared with the potential sustainably in 2030 the biomass of Barong Shrimp (*Panulirus spp*) remains 21%.

4. Conclusion

The results of this study obtained the following conclusions:

1. The standard fishing gear for catching Barong Shrimp (Panulirus spp) in the waters of East Java is the type of Bubu, the fishing power of the gear is 0.0000004, the stock of potential sustainable open-access conditions in 2030 is 45,820.17 kg, the remaining biomass reserves are 21%, the effort sustainable catch is 143,2000 trips/year and the maximum catch is 45,820,10 kg/year. 2. The distribution habitat includes the districts of Sumenep, Banyuwangi, Jember, Lumajang, Malang, Blitar, Trenggalek and Pacitan (WPP 712). Further research is needed on a stock estimation of Barong Shrimp (Panulirus spp) to determine the stock of recruitment, mortality, growth, gonad maturity level, carapace weight and width measurements, and the use of environmentally friendly fishing gear in a sustainable manner so that its potential can be identified, especially the creation of capture management Barong Shrimp (Panulirus spp).

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