PAPER NAME

22. nternational Journal of Multidisciplinary Research and Growth Evaluatio.pdf

WORD COUNT

4099 Words

CHARACTER COUNT

20009 Characters

PAGE COUNT

7 Pages

FILE SIZE

674.2KB

SUBMISSION DATE

May 22, 2023 11:02 AM GMT+8

REPORT DATE

May 22, 2023 11:02 AM GMT+8

6% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- Crossref Posted Content database
- 6% Submitted Works database

Excluded from Similarity Report

- Internet database
- Publications database
- Crossref database
- Bibliographic material

International Journal of Multidisciplinary Research and Growth Evaluation.

Aspects of Population Dynamics of Shortfin Scad Fish (*Decapterus Macrosoma*) in the Flores Sea, Bulukumba, South Sulawesi, Indonesia

Andi Asni [1*], Muhammad Ikhsan Wamnebo [2], Mustamine [3], Juspinar [4]
[1, 2, 3] Department of Utilization of Fishery Resources, Indonesian Muslim University. Jl. Urip Sumoharjo Km.5, Makassar 90231, South Sulawesi, Indonesia
[4] Alumni of the Department of Utilization of Fisheries Resources at the Muslim University of Indonesia. Jl. Urip Sumoharjo Km.5, Makassar 90231, South Sulawesi, Indonesia

* Corresponding Author: **Andi Asni**

Article Info

ISSN (online): 2582-7138
Volume: 04
Issue: 03
May-June 2023
Received: 04-04-2023;
Accepted: 22-04-2023
Page No: 278-284

Abstract
Shortfin Scad (*Decapterus macrosoma*), is a pelagic fish that plays a role in the economic sector of fishermen in South Sulawesi waters. Apart from being consumed by the public, Shortfin Scad is also used as bait for tuna and is exported frozen. Shortfin Scad is a type of small pelagic fish that is dominantly caught and has high economic value, especially for areas with more oceanic waters such as in eastern Indonesian waters. The aim of the study was to determine the population dynamics of the Shortfin Scad (*D, macrosoma*) in Bululumba waters. The research was conducted in the waters of the Flores Sea, Bulukumba, South Sulawesi. Sampling of fish to measure fork length and to observe gonadal maturity was carried out randomly every month. Information on population parameters obtained in this study is group age, Yield Per Recruitment, Growth, Mortality and level of exploitation. The results showed that there were 3 groups of Shortfin Scad (*D. macrosoma*), the female fish had a long mode range: 18.4 – 22.08 cm; 21.16cm – 25.8cm; 20.24 – 26.7 cm and in male fish it has a long mode: 17.3 cm – 22.3 cm; 21.05 cm – 24.8 cm,; 24.8cm – 28.6cm. The asymptote length is 33,293 cm for female fish and 27,023 cm for male fish. The estimated Y/R for female fish was 1.96 gram/recruit and male fish was 2.91 gram/recruit. The threshold value (E) of female fish is 12.60 per year and male fish is 17.84 per year. in the female and male fish that exceeds the optimum limit. The value of the rift rate of Shortfin Scad (*D. macrosoma*) in the waters of Bulukumba Regency experienced over fishing.

DOI: https://doi.org/10.54660/.IJMRGE.2023.4.3.278-284

Keywords: Shortfin Scad, Age (cohort), population dynamics

Introduction

Bulukumba Regency is located in the southern part of the Sulawesi Peninsula and is approximately 153 kilometers from the provincial capital of South Sulawesi, located between 05^0 20' – 05^0 40' south latitude and 119^0 58' – 120^0 28' east longitude. It is bordered by Sinjai Regency to the north, Bone Bay to the east, Flores Sea to the south, and Bantaeng Regency to the west. Nearly 95.4 percent of the Bulukumba Regency area is at an altitude of 0 to 1000 meters above sea level (asl) with a general slope of 0-40^0.

The length of the beach is 128 km with characteristics on the east side dominated by white sand (Sea sediment) while on the west side it is dominated by black sand (land sediment). The number of coastal districts consists of 7 (seven) districts. The length of the beach for each sub-district is according to: Gantarang District (10 km), Ujung Bulu District (11.5 km), Bonto Bahari District (48.2 km), Bonto Tiro District (10.6 km), Herlang District (16 km) , Kajang District (20.2 Km). If viewed from a

geographical perspective, Bulukumba Regency is one of the districts that has great potential from the marine and fisheries aspect. This area is located between 2 (two) oceans, namely the Flores Sea and Bone Bay.

This strategic position allows Bulukumba Regency to become a maritime service center for the southern region of South Sulawesi, even with this position Bulukumba is projected to become a service center for the eastern part of Indonesia. Apart from that, with this geographical location, Bulukumba fishermen are almost not affected by the season, because in the West Season where strong waves occur in the Flores Sea, fishermen move to Bone Bay to catch, and vice versa in the East season, fishermen move to the Flores Sea to carry out fishing activities. . This situation has a positive impact on the sustainability of fishery production because entrepreneurs are guaranteed a continuous production supply. A strong maritime culture, this can be seen from the existence of the Phinisi Shipbuilding industry which has been passed down from generation to generation. Their knowledge of shipping construction is not obtained through formal legal channels but through strong instincts forged by strong natural conditions and maritime social culture. Their Phinisi boat building method is also very different from other regions. If in other areas the construction of the ship starts from the frame, in Bulukumba Regency the construction of the ship starts with the installation of new walls followed by the installation of the frame. However, with this construction method, the Phinisi Made in Bulukumba ship is very stable in dealing with waves.

Shortfin Scad (*Decapterus macrosoma*) is a small pelagic fish resource that plays a major role in the economic sector of fishermen in South Sulawesi. This is shown from the catches of pelagic fish such as: purse seine, bagan, gill net, and payang. The utilization of Shortfin Scad (*Decapterus macrosoma*) resources needs to be managed in a sustainable manner, meaning that its utilization should not exceed the available sustainable potential.

The potential value of Shortfin Scad (*Decapterus macrosoma*), namely the stock density and size of the fish resource, will decrease if utilization activities are carried out without paying attention to the sustainability aspects of the flying fish resource. Efforts to manage fishing in certain waters must be supported by some important information, including biological aspects, economic aspects and stock assessment aspects, where this information is very much needed as a basis for consideration in further fisheries management efforts. Based on this, research on the dynamics of flying fish is needed as a basis for consideration in fisheries management efforts.

Research Methodology

This research was conducted in 2020 in the waters of the Flores Sea, Bulukumba Regency, South Sulawesi. The research location can be seen in Figure 1 below.

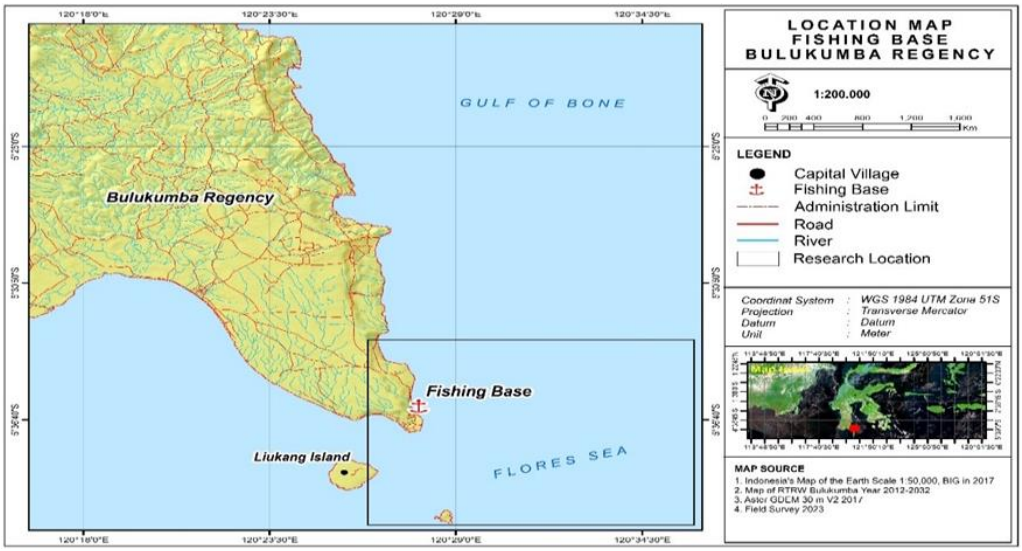

Fig 1: Map of Research Locations

Tools and materials

Tools that can be used in research activities to analyze population parameters and exploitation levels of Shortfin Scad (*Decapterus macrosoma*) in the waters of Bulukumba Regency includeTable 1.

Table 1: Tools and Functions

Tool Name	Function
Electric scale	Measures the weight of fish
Ruler	Measure the length of the fish
Writing Tools	Record the measurement results
Camera	Documentation

While the material used in this research activity is fresh fish caught from fishermen, in the waters of Bulukumba district using Purse Seine fishing gear.

Research methods

The research method used is the survey method, namely by looking directly at the research location, taking direct measurements at the fish landing site (TPI).

Primary data collection was carried out by direct measurement of flying fish caught with purse seine fishing gear at fish landing sites (TPI), while secondary data collection was data obtained from the Maritime Affairs and Fisheries Service of Bulukumba Regency.

Fish length was measured by measuring the fork length of the Shortfin Scad (*Decapterus macrosoma*), the catch was when the fish were still fresh after being landed at TPI. The fork length of the fish is measured from the very front end of the head to the fork (Effendi 1997) [6].

Sampling Method

Fish are taken directly when landing at the Fish Auction Place (TPI), after the fishing process takes place on board the fishing boat. The number of sample fish (samples) taken during the research period, sampling (fish) was carried out randomly from all catches of Shortfin Scad (*Decapterus macrosoma*).

Measured Parameters

Age group

The age group was determined using the Bhattacharya method (1967) in (Sparre et.al.1989), namely by dividing the Shortfin Scad (*Decapterus macrosoma*) in the length range (L), then mapping the mean value of each class length as the X axis to the difference the natural logarithm of the frequency of length as the Y axis. The straight line intersection of the regression with the X axis gives the average length value for each age group. The number of straight lines formed indicates the number of age groups.

$$Fc = \frac{n.dl}{S\sqrt{2\Pi}} \exp\left[\frac{-(x-x)^2}{2\,S^2}\right]$$

Where

Fc	=	Calculate Frequency
n	=	Number of Fish
dl	=	Class Interval
S	=	Standard Deviation
x	=	Average Length
X	=	Middle Class Total Length

3.3.1. *Yield per Recruitment*

Relative yield per recruitment (Y/R) is known from the Berverton and Holt equation (Sparre et.al.1989), namely:

$$Y/R = E.U^{M/K}$$

$$U = 1 - L/L\infty$$

$$M = K/Z$$

$$E = F/Z$$

Where

M	=	Natural mortality
E	=	Exploitation rate
F	=	Mortality due to capture
Z	=	Total mortality
L	=	Average length of fish caught
L^1	=	Minimum limit of fish caught

Result and Discussion

Age group

The fish obtained during the study totaled 146 females and 260 males, and the maximum length was 33,293 for females and 27,023 for males. The fishing gear used in the area, especially in the Bonto Bahari District to catch Shortfin Scad, is the purse seine.

The results of the mapping between frequency and middle class obtained 3 age groups as follows:

a. Female fish namely, the first age group is in the range of 18.4 cm – 22.08 cm in length, the second age group is in the range of 21.16 cm – 25.8 cm in length, and the third age group is in the length range of 20, 24cm – 26.7cm.

b. Male fish namely, the first age group is in the long range, namely, 17.3 cm – 22.3 cm, the second age group is in the long range 21.05 cm – 24.8 cm, and the third age group is in the long range 24.8cm – 28.6cm.

The frequency of fully caught fish was found in the second age group in the long range for female fish 21.16 cm – 25.8 cm with a total sample of 3 Shortfin Scad and for jantang fish it was in the long range 21.05 cm – 24.8 cm with a total sample of 3 Shortfin Scad , the average sample frequency was found in the first age group in the length range for female fish 18.4 cm - 22.08 cm and for male fish in the long range 17.3 cm - 22.3 cm with a total 4 samples, while the smallest sample frequency was found in the third age group in the length range for female fish, namely 20.24 cm – 26.7 cm and for male fish, it was in the 24.8 cm – 28.6 cm long range with a total samples of 3 Shortfin Scad. The frequency histogram of the results of the study with the calculated frequency Fc of the three age groups, can be seen in the following figure,

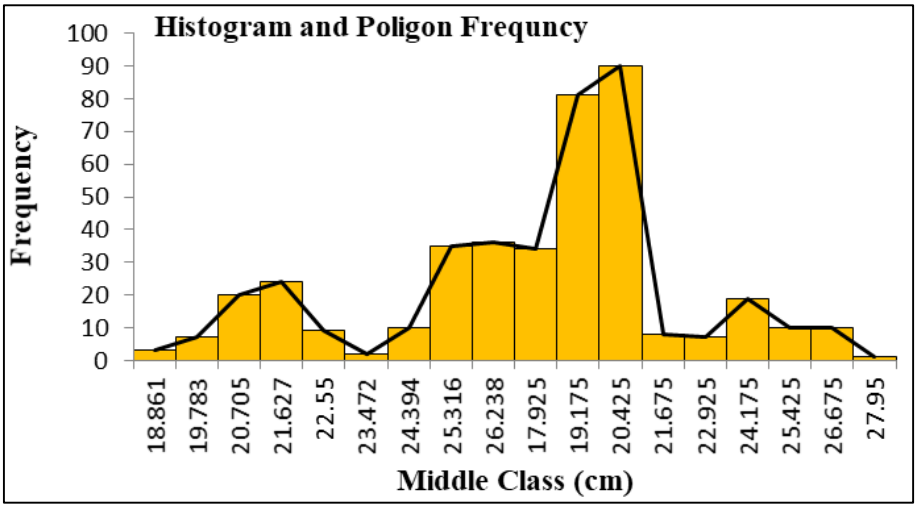

Fig 2: Histogram Graph of the Relationship between Frequency and Middle Class from Three Groups of Longevity Shortfin Scad (*Decapterus Macrosoma*) in the Waters of Bulukumba Regency, South Sulawesi.

Based on the results of the analysis of the Bhattacharya model (1961) in sparre et.al. (1999) [13] using the results of mapping

the difference in the natural logarithm of the cumulative frequency to the class median, it was obtained for each of the three age groups with a long mudus such as for female fish is 20.97 cm; 23.09 cm; 25.49 cm, while for male fish is 19.43 cm; 22.67 cm; 24.56cm. The relationship between the relative longevity range and the long mode of Shortfin Scad in the waters of the Bulukumba Regency can be seen in the following table 2.

Table 2: Relationship between Age Groups and Long Mode for Females of Shortfin Scad (*Decapterus Macrosoma*) in the waters of Bulukumba Regency

Age	Long mode (cm)	Long range (cm)	Fish Frequency the Caught	Total Frequency
1.	20,97	18,4 – 19,32	3	39
		19,32 – 20,24	7	
		20,24 – 21,16	20	
		21,16 – 22,08	9	
2.	23,09	21,16 – 22,08	24	61
		23,01 – 23,93	2	
		23,93 – 25,8	35	
3.	25,49	20,24 – 21,16	20	80
		21,16 – 22,08	24	
		25,8 – 26,7	36	

Table 3: Relationship between Age Groups and Long Mode for Males in Shortfin Scad (*Decapterus Macrosoma*) in the waters of Bulukumba Regency

Age	Long mode (cm)	Long range (cm)	Fish Frequency the Caught	Total Frequency
I	19,43	17,3 – 18,55	34	213
		18,55 – 19,8	81	
		19,8 – 21,05	90	
		21,05 – 22,3	8	
II	22,67	21,05 – 22,3	8	34
		22,3 – 23,55	7	
		23,55 – 24,8	19	
III	24,56	24,8 – 26,04	10	21
		26,04 – 27,3	10	
		27,3 – 28,6	1	

The results of this study were carried out by mapping the difference in the theoretical natural logarithm of the theoretical frequency to the mean length class which formed 3 regression lines, the three cohorts formed with the result of the intersection on the x axis as the average length of fish (L1, L2, and L3), can be seen in the figure following :

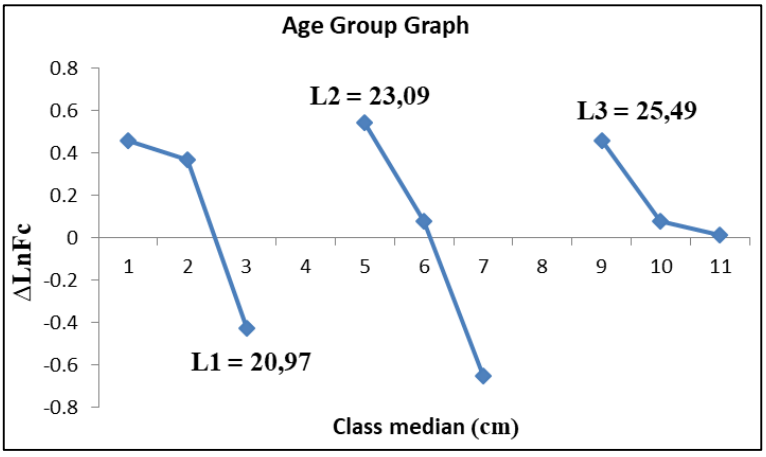

Fig 3: Graph of the difference between the natural logarithm of theoretical frequencies and the class median for female fish in each age group of Shortfin Scad (*Decapterus macrosoma*) in the waters of Bulukumba Regency.

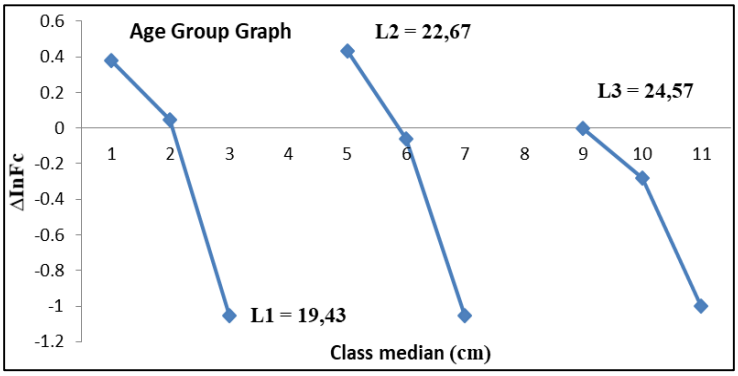

Fig 4: Graph of the difference between the natural logarithm of theoretical frequencies and the class median for male fish in each age group of Shortfin Scad (*Decapterus macrosoma*) in the waters of Bulukumba Regency.

Growth

The results of the analysis using the Ford – Walford method (Sparre et.al 1999) [13] obtained the asymptote length (L∞) for female fish is 33.293 cm and the asymptote value for male fish is 27.023 cm, the growth rate coefficient (K) for female fish is 0, 21 per year and for male fish is 0.55 per year, while the value (to) is obtained using Pauly's (1983) formula, namely -0.68 years for female fish and -0.26 years for male fish. Based on the L∞, K, and to values obtained, using the von Bertalanffy equation, the growth equation for the Shortfin Scad (*Decapterus macrosoma*) is obtained.

$$Lt = L\infty (1 - ek (t-to))$$

From this equation, it can be estimated that the length of the Shortfin Scad (*Decapterus macrosoma*) of various ages can be calculated so that the increase in Shortfin Scad for each year can be calculated until it reaches its asymptote.

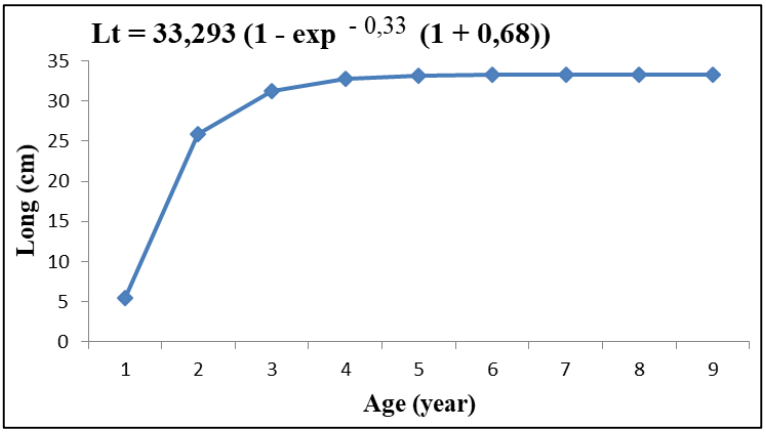

Fig 5: Growth Curve of Shortfin Scad (*Decapterus Macrosoma*) for Female Fish in the Waters of Bulukumba Regency

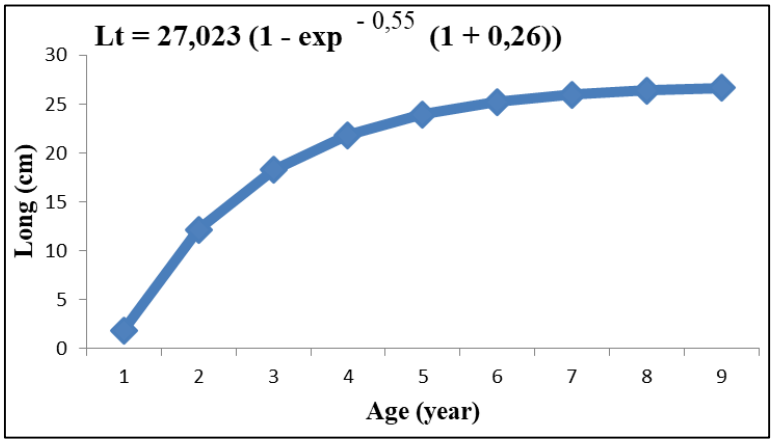

Fig 6: Growth Curve of Shortfin Scad (*Decapterus Macrosoma*) for Male Fish in the Waters of Bulukumba Regency

Based on the growth curve, it can be seen that the rapid growth in length of the Shortfin Scad (*Decapterus macrosoma*) occurs at a young age and becomes slower with increasing age until it reaches an asymptote length where the fish do not increase anymore.

This is in accordance with the statement of Effendi (2002), that fast growth occurs in fish when they are 3-5 years old. In old fish, even though the growth continues, it runs slowly. Old fish generally lack excess food for growth, because most of their food is used for body maintenance and movement.

Mortality

Based on the growth parameter values obtained, the calculation results show that the total mortality rate (Z) for female fish is 1.88 per year, and for male fish is 1.20 per year. The natural mortality rate (M) for female fish is -21,76 per year and for male fish is -20.24 per year, usually natural mortality (M) is related to M/K. The fishing mortality rate (F) for female fish is 23.64 per year and for male fish is 21.44 per year. The exploitation rate value (E) is divided by the F value by the Z value so that the value (E) is obtained, namely, for female fish it is 12.60 per year and for male fish it is 17.84 per year.

Table 4: Mortality Value and Exploitation Rate of Shortfin Scad (*Decapterus Macrosoma*)

Parameter	Estimated Value (Female)	Estimated Value (Male)
Natural Mortality (M)	-21,76	-20,24
Total Mortality (Z)	1,88	1,20
Arrest Mortality (F)	23,64	21,44
Exploitation Rate (E)	12,60	17,84

From the table it can be seen that the fishing mortality (F) for female fish is 23.64 and for male fish is 21.44 which is greater than the natural mortality (M), namely for female fish is -21.76 and for male fish is -20 ,24. This shows that the death of the Shortfin Scad (*Decapterus macrosoma*) in the waters of Bulukumba Regency is caused by fishing factors. Based on the results of the interviews, this Shortfin Scad is one of the most popular fish because of the increasing demand from the community and it is evident from the catch of fish in Bulukumba Regency in 2016 which reached 14,624 tons. Mortality is defined as the number of individuals lost during a certain time interval (Ricker, 1975). In fisheries, there are generally two causes of mortality, namely natural mortality (M) and fishing mortality (F). In the case of non-exploited fish stocks, mortality (Z) is directly natural mortality (M), namely Z = M. If stocks have been exploited, then mortality.

(Z) is Z = F + M.

High natural mortality will be found in organisms that have a large growth rate coefficient value and conversely low natural mortality will be found in organisms that have a small growth rate coefficient value (Sparre et.al. 1989). Furthermore, it is also said that natural mortality is death caused by several things, including predation including cannibalism: disease, stress during spawning, hunger and old age. Estimation of the total mortality rate (Z) was analyzed using the Beverton and Holt method (Sparre et.al.1989).

Yield per Recruitment

The results of calculating Yield per Recruitment (Y/R) using the Beverton and Holt method, by entering the values in the table. Based on the results of the analysis it can be seen that the estimated Y/R value for female fish is 1.96 gram/recruitment and for male fish is 2.91 gram/recruitment taken as catch. This means that for each recruitment that occurs there are 1.96 grams of female fish and 2.91 grams of male fish taken as catches. Each increase in the E value will be followed by an increase in Y/R, the current Y/R value for female fish is 1.96 gram/recruitment and E is 12.60 while for male fish is 2.91 gram/recruitment and E is 17, 84. This shows that the value of the exploitation rate exceeds the optimum limit, namely, 0.5 or 50% (overfishing).

The level of exploitation has exceeded the optimum limit, resulting in a smaller maximum length of fish. Fish that have exceeded the optimum limit or can be said to have experienced overfishing. This is caused by the large market demand for Shortfin Scad (*Decapterus macrosoma*) and high consumption levels, so that fishing occurs every day by fishermen.

The value of fishing mortality is influenced by the level of exploitation. In accordance with the opinion of Azis (1989) that if fishing is carried out continuously to meet consumer demand without any regulatory effort, then fish biological resources (in the future) may experience excess catches and result in disrupting the sustainability of biological resources. Recovery efforts can be made by regulation of fishing gear selectivity and limiting the size of fishing gear.

The size of the fish at first maturity is very important information in the implementation of responsible fisheries. As a reference, the size of the first gonad maturity should receive more attention from policy makers, so that there will be less concern about decreasing fish populations in the future. When fish gonads mature for the first time as an indicator of reproductive stock availability. The circumference of the fish body behind the operculum is used as a reference in determining the minimum mesh size. In gill net fishing gear with a trapping system, the mesh size is the same as the body circumference. However, in fishing gear where the net functions as a wall, the mesh size must be smaller than the body circumference, for example in boat body fishing gear, Fridman (1986).

Exploitation pressure from day to day tends to be greater due to the intensity of fishing and the modernization of fishing gear and the number of fishing units which tends to be constant and even increase. This happens because human needs are increasing.

Estimation of Yild per Recruitment (Y/R) stock is a model that can be used as a basis for a strategy in managing fishery resources, because this model will provide an overview of the short-term and long-term effects of different actions (Gulland, 1982).). The Yild per Recruitment model according to Beverton and Holt is easier and more practical to use, because this model only requires fewer input population parameter values when compared to other Yild per Recruitment models. (Pauly, 1980).

Conclusion

Shortfin Scad (*D. macrosoma*) in the waters of Bulukumba Regency consists of 3 age groups with a long mode, namely, as in female fish: 20.97 cm; 23.09 cm; 25.49cm. Whereas in male fish, namely: 19.43 cm; 22.67 cm; 24.57 cm. The asymptote length for female Shortfin Scad is 33.293 cm and for male fish is 27.023 cm. The estimated Y/R value of female fish is 1.96 gram/recruitment and male fish is 2.91 gram/recruitment. The value of the exploitation rate (E) of Shortfin Scad (*D. macrosoma*) in the waters of Bulukumba Regency for female and male fish exceeds the optimum limit, namely 0.5 or 50%, which has experienced overfishing.

References

1. Aprilianti Henny. Reproductive Aspects of Layang Fish in Sibolga Waters. IPB Faculty of Fisheries Thesis, 2002, 75.
2. Aziz. Fish Population Dynamics, Bogor: IPB, 1989.
3. Beverto RJH, SJ Holt. On the dynamics of exploited fish populations. Chapman & Hal. Fish and Fisheries Series

11. University Of British Columbia. Vancouver, Canada, 1975.
4. Bhattacharya CG. A Simple method of resolution into Gaussion Component. Biometrics, 1967.
5. Cushing DH. Fisheries Biology. A Study in Population Dynamics. Univ. Wisconsin Prees. Madison Wisconsin, 1981.
6. Effendi MJ. Fisheries Biology. Nusantara Library Foundation. Yogyakarta, 1997.
7. Effedie MI. Fisheries Biology. Part II. Fish Population Dynamics. Faculty of Agriculture. Bogor Agricultural Institute. Bogor, 1999.
8. Kamsur M. Potential and Level of Exploitation and Several Parameters of Population Dynamics of Flying Fish (Decapterus spp) around Majene Waters. Faculty of Animal Husbandry. Hasanuddin University. Edge of View, 1993.
9. Najamuddin. Study of Sustainable Utilization of Flying Fish (Decapterus spp) Resources in Makassar Strait Waters. Dissertation. Postgraduate Program in Agricultural Sciences. UNHAS Makassar, 2004.
10. Nontji A. Archipelago Sea. Bridge. Jakarta, 1992.
11. Nybakken JW. Marine Biology An Ecological Approach. Gramedia. Jakarta, 1988.
12. Rosmini. Exploitation Levels and Population Dynamics of Flying Fish (Decapterus spp). Around the waters of Luwu Regency. Thesis, Fisheries Resources Utilization Study Program. UNHAS Makassar, 2008.
13. Sparre P, Venea SC. Introduction to Tropical Fish Stock Assessment. Fisheries Research and Development Agency. Translated by the Fisheries Research and Development Center, Fisheries Research and Development Agency, Jakarta, 1999.
14. Sumadhiharga K, Hukom Fd. Relationship of Length, Weight, Food and Reproduction of Skipjack Fish (Katsuwonuspelamis) in the Banda Sea. Paper at the VIII National Biology Congress. Purwokerto, 1987.
15. Widodo J. Technical guidelines for planning the utilization and management of small pelagic fish resources and their fisheries. Department Jakarta, 1994.

6% Overall Similarity

Top sources found in the following databases:

- Crossref Posted Content database
- 6% Submitted Works database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Universitas Mataram on 2023-03-13 Submitted works	3%
2	Universitas Hasanuddin on 2021-11-15 Submitted works	1%
3	Konsorsium Turnitin Relawan Jurnal Indonesia on 2022-07-08 Submitted works	<1%
4	Universitas Brawijaya on 2023-04-12 Submitted works	<1%
5	Universitas Brawijaya on 2019-09-16 Submitted works	<1%
6	Universitas Al Azhar Indonesia on 2022-08-15 Submitted works	<1%
7	CSU Office of the Chancellor on 2021-04-07 Submitted works	<1%
8	Iona College on 2011-08-28 Submitted works	<1%