

Development of information system for Lemuru Fisheries Data in Bali Strait with Fishing Gear Using Purse Seine, Payang, and Gill Net

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ABSTRACT

The intensive exploitation of lemuru fishery resources in the Bali Strait began in the 1970s with the development of the purse seine fishing gear which had higher productivity compared to the existing fishing gear. During its development, the number of fishing gears and the fishing capacity of the purse seine is quite rapid so that it has a significant effect on the depletion of lemuru fish resources. The number of purse seine fishing gear from Muncar port is 203 vessels and from the validation results the number of purse seines has decreased to 176 vessels which are still considered active. Lemuru fisheries in the Bali Strait currently do not take output-based management actions (limiting catch), this is of course very dangerous because it does not provide opportunities for lemuru fish to carry out stock recovery. So that the need for IT Controlling through Fish Controlling on the web-base can be used to control a number of fishermen with different types of fishing gear, types of fish caught, and the number of catches in each fishing ground. Moreover, fishery sustainability analysis for Bali strait fishing ground has been performed in this study.

Key words : Purse seine, Payang, Gill net, Lemuru fish, Fish controlling, Information technology

Introduction

Lemuru Fish (*Sardinella lemuru* Bleeker, 1853) is a very important small pelagic fish species in Indonesia, especially for fishermen in the Bali Strait area (Arief Wujdi *et al.*, 2012). Therefore, this commodity is mostly exploited by fishermen. The Bali Strait lemuru fishery resources have an important meaning for the Muncar community, where Muncar is not only a base for catching and landing the Bali Strait lemuru fishery resources as well as developing processing businesses, both traditional and modern. Thus, the lemuru fishery resources have contributed significantly to the economy in East

Java, especially in Muncar. This processed product is not only marketed domestically, but also exported abroad.

The intensive exploitation of lemuru fishery resources in the Bali Strait began in the 1970s with the development of the purse seine fishing gear which had higher productivity compared to the existing fishing gear. In its development, the number of fishing gears and the fishing capacity of the purse seine is quite rapid so that it has a significant effect on the depletion of lemuru fish resources. Therefore, the need for proper management of lemuru fisheries in the Bali Strait is considered increasingly urgent due to the fact that the supply of lemuru fish in the wa-

ters of the Bali Strait is decreasing. This is reinforced by the results of several studies with an analytic and holistic approach, showing that lemuru fish resources have been over-exploited (Saputra *et al*, 2017).

Materials and Methods

Primary Data

Primary data is data obtained directly from research activities from objects that are observed and recorded for the first time (Sugiyono, 2009). The primary data collection carried out is as follows:

- Observation, namely making systematic observations and notes on the symptoms or phenomena being investigated without asking questions. In this case, the concern is the biology of lemuru, facilities and infrastructure, development of fishing fleets and fishing techniques.
- Interviews, namely how to collect data by means of unilateral questions and answers that are carried out systematically and based on research objectives. These interviews were conducted with fishermen, community leaders and related service officials.

Secondary Data

According to Nazir (2009), secondary data are data obtained indirectly, namely from government agencies, private institutions, related agencies, libraries and other reports. The secondary data required is periodic data (time series) of catches and efforts to catch lemuru with standardized fishing gear that catch lemuru in the Bali Strait from 2003 to 2013, from the annual report of the East Java Province Fisheries and Marine Affairs Office.

Results and Discussion

Purse Seine Fishing Equipment and Awitan

In Muncar there are 2 types of purse seine vessels, namely 2 boats (two boat systems): nets and hunting boats, and 1 boat (one boat system) with the golean ship type. From the results of validation of ship data and purse seine ship owners who are still active, there are 56 vessels for 2 ships (two boat systems), 103 units for 1 mini purse seine vessel (one boat system / guard), 17 ships for calloused purse seines, and the onset ship 43 units of the ship, so the number of fishing gear purse seine is still active

amounted to 176 units of the ship including the onset. From the results of the data validation of the ship and the owner of the Payang ship, known as Payang oras, which are still active, there are 42 vessels. From the results of data validation, the ship owner and gill net ship owner, known as the active set, totaled 203 vessels.

Data Collection System

The system of recording the data production results of catches that in doing in Muncar port as long as this is done by way of sampling by officer's Points auction Fish. The method of sampling is done because (1) the number of fishing base in the District Muncar as a place of landing of fish, (2) the limited number of personnel to record all the results of the fish landed if being done by the census, (3) the limited budget of operations that are available to complete the job of data collection results catch the fish and the number of fleets fishing catch that aktif and not active, (4) have not been the discovery of a system of data collection that is adequate or reliable to obtain valid data ang right time, one of them where the data collection for this is done by manually. The method of sampling the collection of data is done with the counting number of the results of the catch of fish based on the number of baskets that contain fish of fleet units' fisheries were selected as sample. The criteria for a basket containing fish are as follows: 1 basket full of fish to the limit of the basket / peres = 100-120 kg, $\frac{3}{4}$ basket = 75 - 80 kg, $\frac{1}{2}$ basket = 50-60 kg.

After the data is collected then the data in the input and compiled into reports production results of catches daily by officers who at the end of the month will be compiled into a report the production of monthly and report production yearly at the end of the year for in report to the Department of Marine and Fisheries that exist at the level of province of East Java. In the report the production of the results of the catch is not known to the production of each vessel as prepared by the amount of production of the type of fish and the value of its production.

Information Technology (IT) Based Data Collection System

In developments in the modern era, management control is often collaborated with information technology (IT) (Merrifield *et al.*, 2019). It was because of the advantages that given technology information (IT) to facilitate the work becomes a thing that is

very important to be applied in managing an activity that is associated with time efficiency. One of the activities that need a touch of IT is an activity in the field of fishing control. Fish Controlling is an activity to control the number of fishermen with the type of tool to catch, the type of fish the result of the catch, and the number of catches that vary in each fishing ground. Fish Controlling is an activity that involves many actors of activities fishery example fishermen, fish port officer, and the Department of Marine and Fisheries. With many actors in activities that have a process that is different required a system of management that is organized so that each offender activity no confusion in doing any activities.

The complexity of the system of management which should be implemented by the Fish Controlling require a system that can control the activity to run in accordance with standard operating procedures that have been applied by the institution related. It is very important to do so that the activities run by the well in accordance with the policies that have been set. By because it is, the application of technology information (IT) in the form of software Fish Controlling Management System becomes a thing that is very important is applied to the activities of this. It was intended to support the institutions related to perform each activity management. With the application of the Fish Controlling Management System software, it is hoped that it will help related institutions in determining policies regarding fishing (Anuchiracheeva *et al.*, 2003).

Implementation of Fish Controlling Management System Software

From this background, subsequently has developed a Fish Controlling Management System Software that is designed specifically to accommodate the entire needs of the activities catching fish to support his activities as a maximum. The modules which are provided in the Fish Controlling Management System Software will provide convenience for the agencies related to monitor every activities of catching fish. So that the institutions related to perform digital Controlling, improving the effectiveness of the work, as well as creating a managerial were healthy with efektifive and efficiently. Each module will be applied to each part of the fishing activity actors. Modules that includes Fish Type Inventory, Fishing Gear Inventory, Inventory Ground Fishing, Date and timer, User privilege , and Chart Analysis.

In the purposes of development, a Fish Controlling Management System Software can do development (develop) with the addition of system print out reporting. Where the system is able to run it automatically provides reports the results of the catch of fish which obtained nelayanan every day . By applying a Fish Controlling Management System Software on the activities of catching fish is expected to facilitate the work agencies associated in running every activity , so that the monitoring of institutions related to running with maximum and effective.

Web-Base Engine Builder

Fish Controlling Management System Software is built by using a basic program web-based. Where this software has been designed for the benefit of system development. In addition to the software is also already equipped with a variety of modules to support the maximization of management based IT conducted by institutions associated in doing activities.

The advantages of Web- Base as a builder engine are:

- Easy in maintenance and development.
- Does not depend on the Operating System (OS) on the computer used for activities.
- The risk of virus attack is very small, so the software is safer.
- Can be connected to the Internet, so the software can be online right.

The web-based program which is the engine builder of this software has been prepared to be used online, so that related institutions can monitor the development of fish farming activities in real time . By utilizing an online system, it will provide benefits in cost savings for server development.

Previlage Page

In the use of Fish Controlling Management System, each section will be equipped with the page privilege. The privilege page is made for security purposes (Security System). Where only people who have access rights can run this software. The privilege page is made based on the SOP set by the relevant institution. Privilege called as well as restrictions on the right to access , for example, the fishing just can see the amount of fish that is caught daily from each fisherman , UPPI has the right to access to control the activities of the arrest of the fishermen set out to sea until the results of the catch were ob-

tained, DKP has the right of access to see the results of the report are generated from fishing activities. Each will receive a user name and password are different.

One Gate Fishermen Controlling

The system has also been designed for the needs of a fishing activities that have some fishing gear and *fishing base* is different. The obstacle from the difference between fishing gear and *fishing base* is the control of fishermen who carry out fishing activities with different tools at each fishing base related to the catch, therefore this system has also been equipped with an Integration Data Base so that all the catches are possible. found that fishermen can be controlled easily by the relevant agencies.

Fishing Base

Fishing activity is an activity involving many actors who support the smooth running of these activities, especially fishermen, in fishing activities fishermen have different fishing bases, so there must be special management that can sort out the catch from each fisherman on each fishing ground. Therefore, this system is also equipped with a fishing base, where each head of the fishing base can import the catch of fishermen from various types of fishing gear, so that the fish catch is known in each fishing base. This system will simplify the management of fishing activities so that it will make it easier for the related institutions to analyze and provide policies for each fishing base.

Synchronizing Data Base

In the application development process, Fish Con-

trolling Management System Software in the building with attention to sync data base. Where each application will be integrated into one, so as to form a unity system that despite having different functions but still connected. By integrating the data-base, it will be possible for the software to be used in various different places, so that related institutions will find it easier to monitor fishing activities.

Dynamic Design

Fish Controlling Management System Software is also supported with the display design are dynamic, so the design that dynamic also will make it easier for every user in the operate system.

Census Results of Lemuru Fish Production Data

Results of data monitoring of data production of fishery lemuru on the month in August up to November 2020. From the results of these, it can be seen production lemuru on month in August 2020 are caught by means of catch purse seine based on the name of the ship, area arrest, TPI and types of fish lemuru.

Catch, Effort and Catch Per-Unit of Effort (CPUE) are three quantities that are related to each other. If two of the three quantities is known then the third magnitude can dihitung. These quantities are the basic parameters required in applications Surplus Production Model (MPS - the Surplus Production Model) that leads to the estimation of the point of ' maximum sustainable yield ' (MSY). MPS is one of the simplest stock assessment models and is the easiest to explain and accept by fish resource managers. The assumption underlying this model is that fish resources are an entity, without taking into ac-

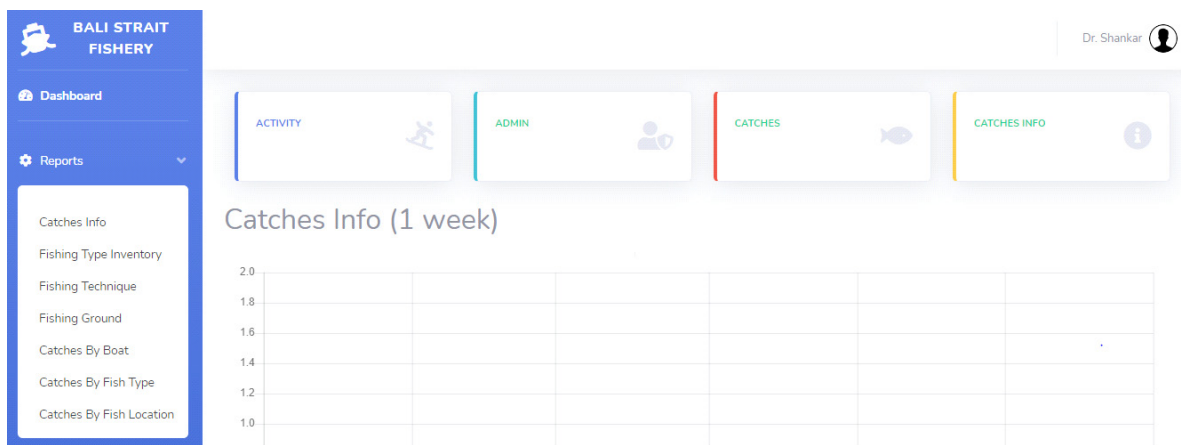


Fig. 1. Main Page Fish Controlling Management System

New catches for "Unggul Jaya" Go back

Fishing Location
Selat Bali

Departure Date: 11/11/2020 Arrival Date: 14/11/2020

Fishing Type
Beget

Quantity: 100 Price: 20000

Create

Fig. 2. Fish Catches Data Entry

Catches Info + Back

Copy CSV Excel PDF Print

Search:

#	Location	Boat	Departure	Arrival	Fish Type	Quantity	Price
1.	Probolinggo	Jonggrang 1	2020-01-31	2020-01-31	Kerapu	11.00	22.00
2.	Probolinggo	Jonggrang 1	2020-01-31	2020-01-31	Kerapu	11.00	22.00
3.	Probolinggo	Jonggrang 1	2020-01-16	2020-01-22	Kerapu	2.00	908.00
4.	Probolinggo	Anugrah Makmur	2020-01-01	2020-01-03	Kerapu	11.00	2000.00
5.	Probolinggo	Anugrah Makmur	2020-01-22	2020-01-10	Kerapu	566.00	1234.00

Showing 1 to 5 of 5 entries Previous Next

Fig. 3. Fish Catches Report

count the processes that are actually not simple which cause the formation of these entities. Experts claim that this model oversimplifies the processes that occur (over-simplified). This model only requires catch and effort data, two types of data that have been collected so far known as fisheries statistics. However, at least it is necessary to know the

characteristics of the fish resources, the behaviors and the limits of the resilience of these fish resources to fishing pressure. Below are pictures that show how fluctuating lemuru CPUE per day of purse seine operation during June to November 2020.

Of the six graph HpPU / CpUE the month of August, September, October and November can be

said that only happen once the peak CpUE per month with a date that is different. Even found that the purse seine on several trips to sea did not produce a catch of fish lemuru at once.

Analysis of Program Strategy

To formulate a strategy for the Lemuru Fisheries

Data Management Arrangement program in the Bali Strait, the Rapfish (Rapid Appraisal for Fisheries) analysis approach is used by using a 5 (five) dimensional approach, namely the Economic, Social, Technological, Ethical, Ecological and Biological Dimensions and their attributes in assessing status. Lemuru fishery resources in the Bali Strait. The re-

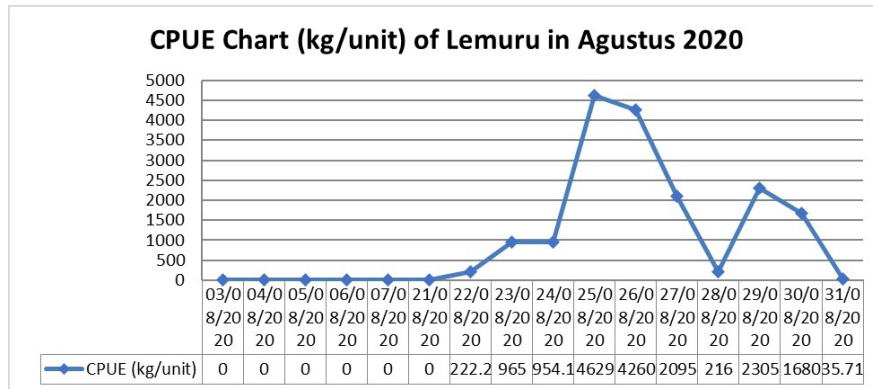


Fig. 4. Catch per unit effort (HpPU / CpUE) Purse Seine Fishing Gear for Lemuru Fish in Muncar, Banyuwangi Regency in August 2020

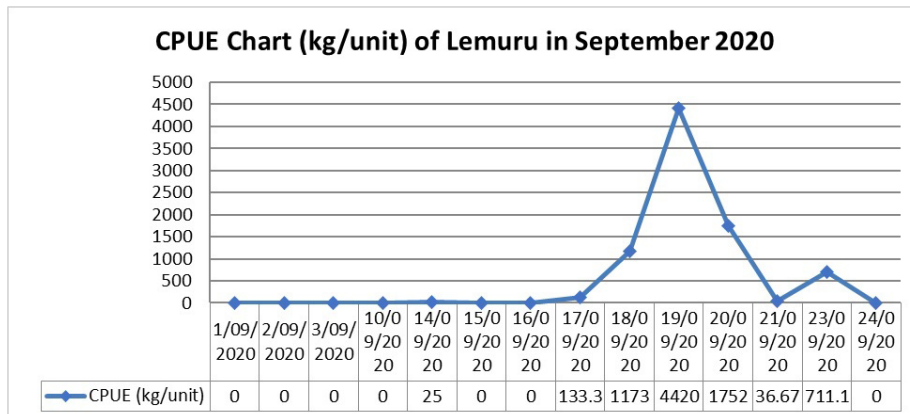


Fig. 5. Results catch per unit effort (HpPU / CpUE) instrument captured purse seine to fish lemuru in Muncar Regency Banyuwangi in the month September 2020

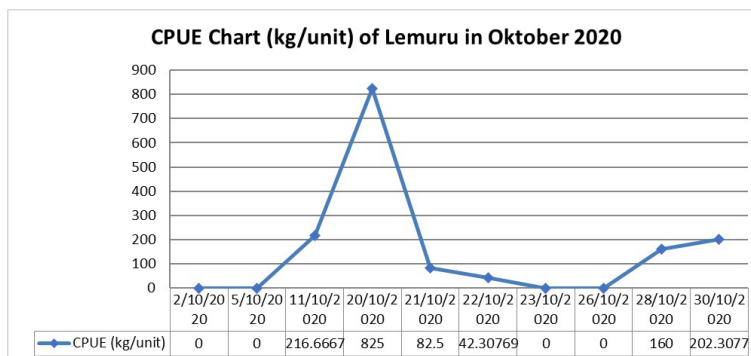


Fig. 6. Results catch per unit effort (HpPU / CpUE) instrument captured purse seine to fish lemuru in Muncar Regency Banyuwangi in the month October 2020

sults for each dimension are as follows:

Economic Dimensions

This dimension is a reflection of whether or not a capture fisheries resource utilization activity can obtain results that are economically viable in the long term and sustainably. The definition of this dimension in the frame of sustainable capture fisheries development is then translated into eight attributes, which operationally can describe the condition of capture fisheries as analyzed from the economic dimension. Further analysis of leverage dimensions of economy can be seen in the image at the bottom of this.

Economic attributes that cause unsustainable economic conditions are the attributes of quota restrictions (24.8%), time flow (39.2%), the labor sector (41.6%) and fish prices (41.6%). Lemuru fisheries in

the Bali Strait currently do not take output-based management actions (limiting catch), this is of course very dangerous because it does not provide opportunities for lemuru fish to carry out stock recovery. The full time outpouring experienced by fishermen shows that fishing activities in the Bali Strait are under heavy pressure in terms of time allocation, if the SDI lemuru condition worsens, fishermen and their families should start shifting their economic activities to the non-capture fisheries business sector. Likewise, on the labor sector side, when SDI Lemuru was still good, many RTPs and RTPPs worked in the capture fisheries sector in the Bali Strait, but the problem of passive behavior towards environmental responses to shift and see business opportunities around them resulted in fishing communities trapped in unsustainable economic conditions.

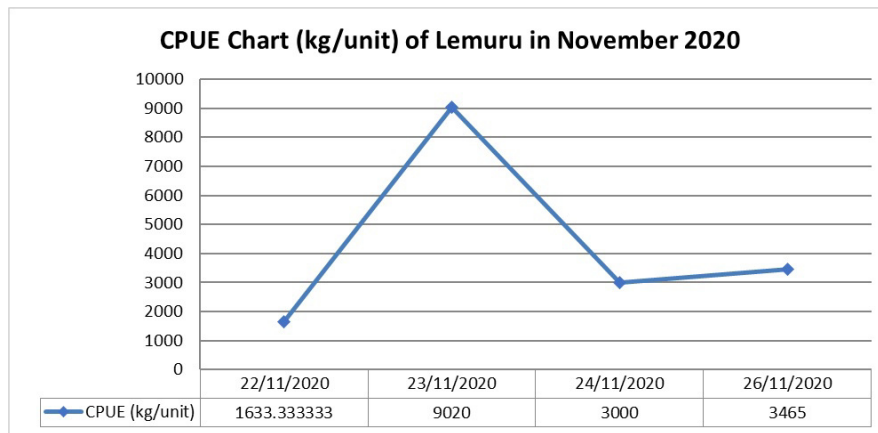


Fig. 7. Results catch per unit effort (HpPU/CpUE) instrument captured purse seine to fish lemuru in Muncar Regency Banyuwangi on the month November 2020

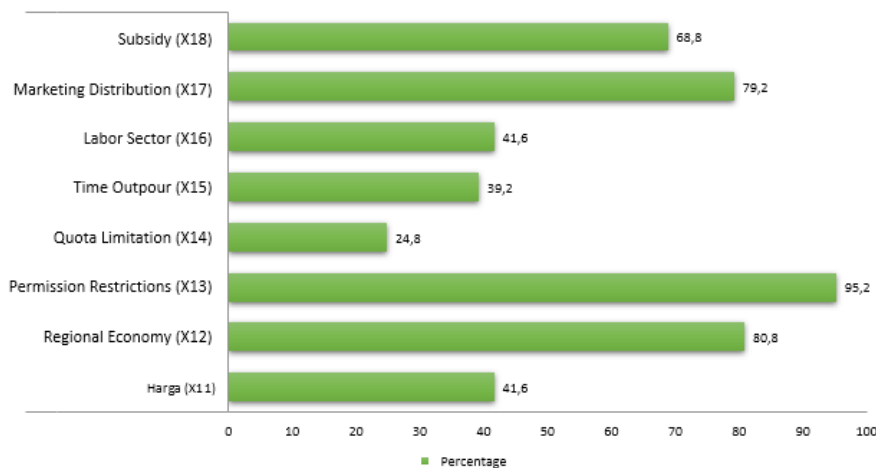


Fig. 8. Economic Dimensions Leverage Analysis

Social Dimensions

This dimension is a reflection of the social system of the capture fisheries community that occurs and supports the long-term and sustainable development of capture fisheries. The definition of this dimension in the frame of sustainable capture fisheries development is then translated into nine attributes, which operationally can describe the conditions of capture fisheries analyzed from the social dimension.

Ethical Dimensions

This dimension is a reflection of how the existing and ongoing ethical system of capture fisheries communities can / cannot support the long-term and sustainable development of capture fisheries. The definition of this dimension in the frame of sustainable capture fisheries development is then translated into eight attributes, which operationally can describe the conditions of capture fisheries which are analyzed from an ethical dimension.

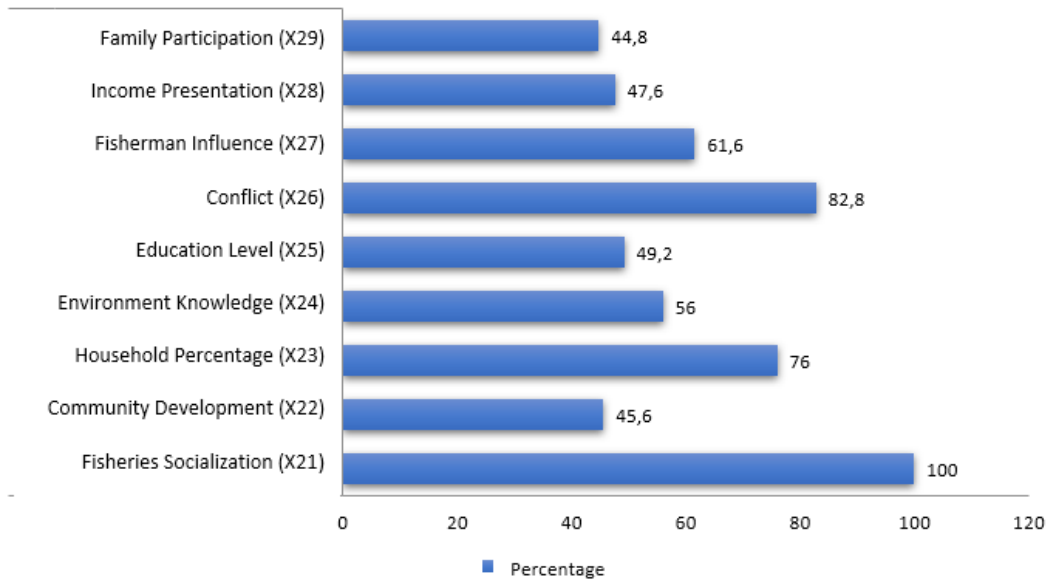


Fig. 9. Leverage Analysis of Social Dimension

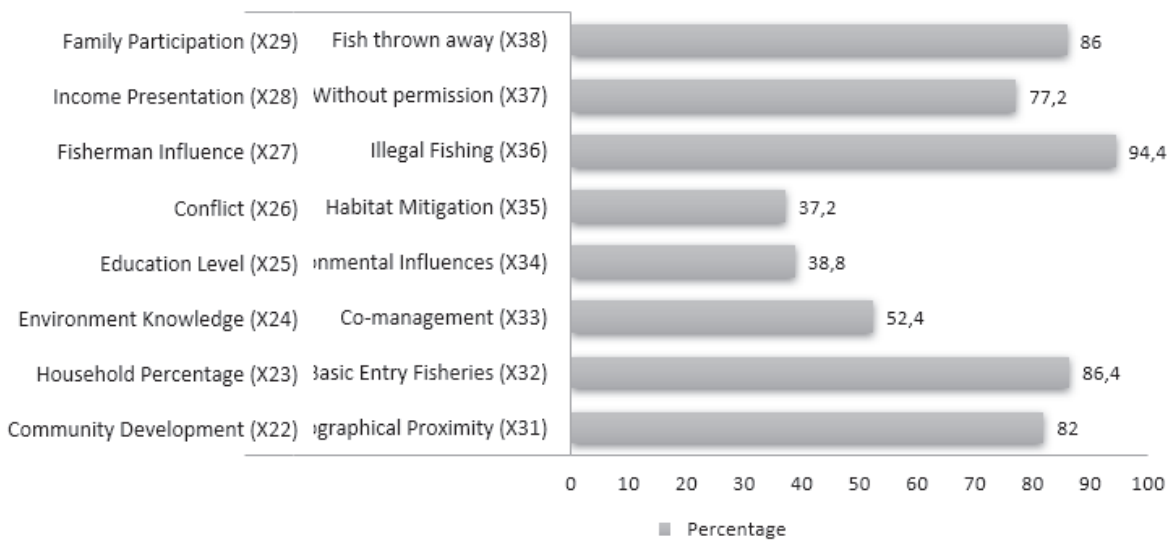


Fig. 10. Leverage Analysis of Ethical Dimensions

The problem is the lack of a spirit of mitigation in habitats and SDI (37.2%), the influence of an exploitative environment on SDI (38.8%) where people behave more anthropocentrically, namely exploitative behavior in which fish are economic goods that do not respect the right of fish to be sustainable as well as the co-management process that has not been successful in uncovering the mitigation measures for SDI and habitat in its implementation (52.4%) has had a bad impact on the sustainability of the forest in the Bali Strait.

Dimensions of Technology

This dimension is a determinant of the degree of use of capture fisheries resources using a technology. Good technology is technology that can increasingly support in the long term and sustainably every economic activity in the capture fisheries sector. The definition of this dimension in the frame of sustainable capture fisheries development is then translated into eight attributes that can operationally describe the conditions of capture fisheries which are analyzed from the technological dimension.

Most of the attributes of fishing technology carried out by Muncar fishermen do not show the sustainability of SDI. This attribute is the selectivity of fishing gear (24.4%), meaning that the use of purse seine fishing gear tends to cause fish to be caught from all size groups, this is due to the nature of fishing gear, especially the small mesh size net

bag, fishing gear activity (29.6%), the capacity of the fleet (40.8%) and the size of the ship (42.4%) were getting bigger, causing SDI to experience heavy fishing pressure.

Biological and Ecological Dimensions

This dimension is a reflection of the quality of the environment and fisheries resources along with the natural processes therein, whether or not they can sustainably support every economic activity carried out in the capture fisheries sector. The definition of this dimension in the frame of sustainable capture fisheries development is translated into 3 biological attributes and 4 ecological attributes. Operationally all these attributes can describe from an ecological point of view the analyzed capture fisheries conditions.

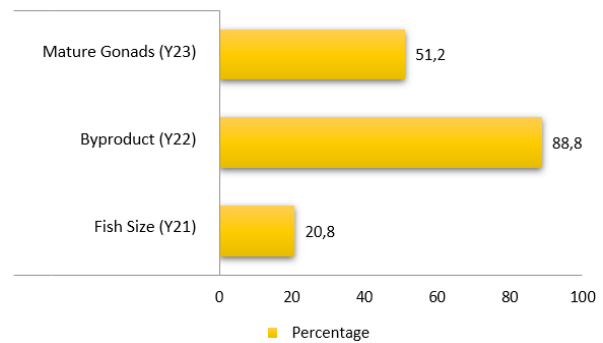


Fig. 12. Leverage Analysis of Biology Dimension

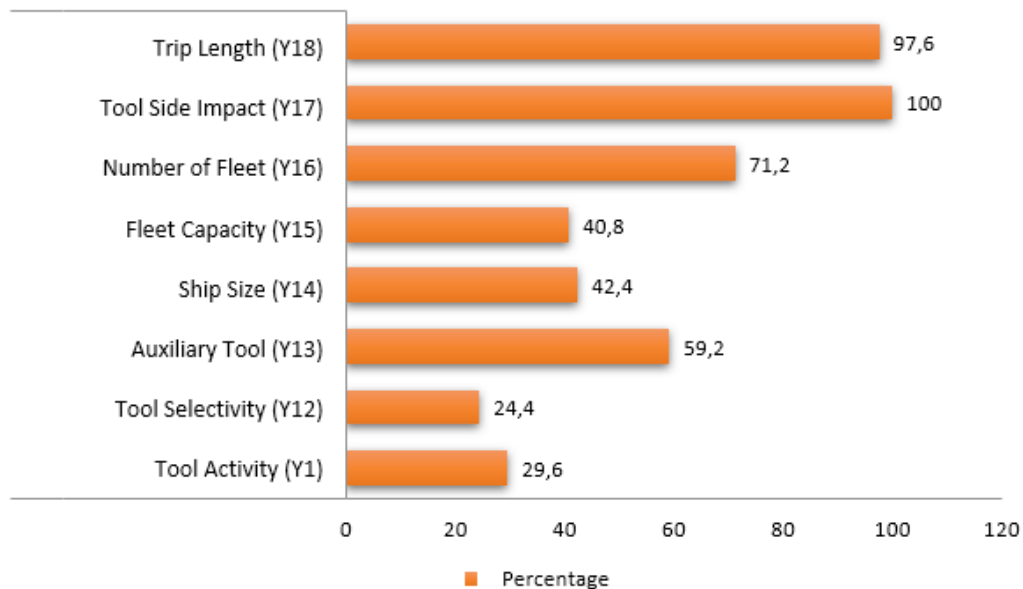


Fig. 11. Leverage Analysis of Dimension Technology

From the biological attributes, it can be said that the size of the fish is getting smaller and the size of the fish caught is that the size of the fish is still immature, causing the biological conditions of lemuru to not be sustainable (20.8%).

From the ecological attributes, it can be said that the tendency of the catch per unit effort has decreased quite sharply, this is indicated by the catch trend attribute (21.6%). This problem must be resolved immediately if you want the lemuru-based capture fisheries business activity not to collapse.

Fisheries Sustainability Status in Muncar Fishing Port

Judging from the 5 (five) dimensions stated earlier, it can be described in the flyover diagram, namely in the Figure below.

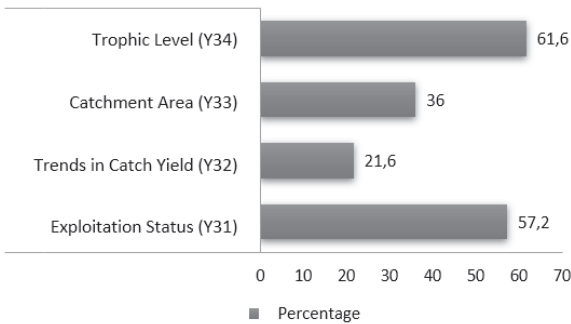


Fig. 13. Leverage Analysis of Ecology Dimension

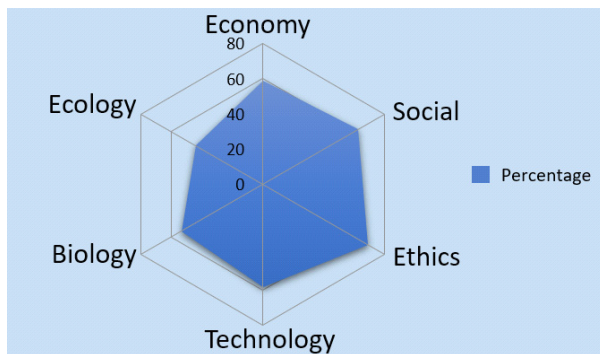


Fig. 13. Fishery Sustainability Kites Diagram at Muncar Fishing Port

From the table above it can be explained that the index value of the ecological dimension, which is related to the sustainability of SDI, is a problem that must be resolved immediately through management and accommodative action for all stakeholders in order to keep fishing business activities sustainable and SDI sustainable.

Table 1. Fishery Sustainability Status at Muncar Fishing Port

Dimension	Percentage Status
Economy	58,9
Social	62,62
Ethics	69,3
Technology	58,15
Biology	53,6
Ecology	44,1

Conclusion

Based on data analysis in this study, the conclusions are as follows:

- According to CPUE data, the catch of payang in August, September, October and November varies every day. The difference in production every day is due to the different numbers of the fleets that carry out fishing operations. CPUE payang in August, September, October, and November seen a difference. The highest CPUE results on September 17, 2020 experienced an increase and had the largest number of 1,500 kg / unit. And on August 5, 2020 and October 7, 2020, the amount was recorded at 1,035 kg/unit and 1,100 kg/unit. For the lowest CPUE results seen on September 9, 2020 with a total of 162 kg/unit.
- Fish Controlling is an IT-based management process through a global web-based broken down into small management forms with a structured pattern. These include Fish Type Inventory, Fishing Gear Inventory, Fishing Ground Inventory, Date and timer, User Privilege, and Chart Analysis. This software has been designed for the benefit of online system development, so that related institutions can monitor the development of fish farming activities in real time. By utilizing an online system, it will provide benefits in cost savings for server development.
- Lemuru fisheries in the Bali Strait currently do not take output-based management actions (limiting catch), this is of course very dangerous because it does not provide opportunities for lemuru fish to carry out stock recovery. The full time outpouring experienced by fishermen shows that fishing activities in the Bali Strait are under heavy pressure in terms of time allocation, if the SDI lemuru condition worsens, fish-

ermen and their families should begin to shift their economic activities to the non-capture fisheries business sector. Likewise, on the labor sector side, when SDI Lemuru was still good, many RTPs and RTPPs worked in the capture fisheries sector in the Bali Strait, but the problem of passive behavior towards environmental responses to shift and see business opportunities around them resulted in fishing communities being trapped. in unsustainable economic conditions.

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