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DEVELOPMENT OF CAPTURE FISHERIES POTENCY IN THE WATERS OF KABUPATEN INDRAGIRI HILIR, RIAU PROVINCE

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ABSTRACT

A proper strategy for fisheries management is needed in enforcing sustainable fisheries resource management. There is no comprehensive study yet has been conducted on perspective continuation of ecological, economical, social and technological in Kabupaten Indragiri Hilir waters until recent year. The selected fisheries should consist of fishing unit which can be operated technologically, financial and ecologically in sustainable manner. Survey method was used to collecting information and data from the field. Schaefer model was used to determine the limit of fishery utilization by determining the Maximum Sustainable Yield (MSY). Linear Goal Programming (LGP) Model was used to analyse the fishing unit allocation based on all determined target. Scoring method was applied to indicate the best kind of capture fisheries technology. The results of this study indicated that selected fish resource in the South China Sea Indragiri Hilir Regency are giant threadfish (Eletheronema tetradactylum)", white shrimp (Peneus semisulcatus), yellow pike-conger (Congresox talabon) and barred spanish mackerel (Scomberomorus commersoni) and with fishing technology of longline, "kurau net", gillnet and shrimp net. The optimum amount for the selected fishing technology in Indragiri Hilir Regency waters are 5825 unit.

Key words: selected fish resources, selected fishing technology, optimum amount, South China Sea

INTRODUCTION

Development of capture fisheries cannot be separated from the carrying capacity components that make up the marine fishing. Carrying capacity of capture fisheries resources is an important factor considered for capture fisheries resources are highly vulnerable to change. Particularly fish resources, biological resources because it is much influenced by changes in external and internal, that is, changes that occur inside and outside the ecosystem, as a result of changes in biotic or abiotic environment.

Implementation of legislation on regional autonomy, which the district has the authority to manage natural resources the area of jurisdiction, including fishery resources.

Law number 25 of 2002 on the establishment of Riau Islands Province, this formation as the expansion of the Riau Province on the potential consequences owned fisheries, as well as fisheries management areas are responsible for.
Changes in administrative areas requires evaluation of potential fisheries, particularly the potential for capture fisheries to determine the pattern of capture fisheries development policy in the province of Riau.

Research Objectives

- Identifying potential selected fish resources.
- Analyzing the fishing units to catch the selected fish.
- Optimization component of capture fisheries in the region to be developed .

METHODOLOGY

Research conducted in the South China Sea waters Indragiri Hilir in March-October 2007. The data used in this research are secondary data and primary data. Secondary data obtained from statistical reports issued by the relevant agencies, and from other sources and studies related to this research. Primary data obtained from measurements in the field, as well as guidance on data collection questionnaire.

In-depth interview techniques to guide questionnaire conducted with respondents to determine optimal retrieval techniques using the survey technique combined with accident sampling and snow-bowling techniques. Where, respondents determined based on the previous respondents. This meant that occur deeper connections about the status and characteristics of respondents to each other.

Data Analysis Standardization of Fishing Effort

Standardization function is to uniform unit of fishing effort for certain fishing gears (standard). Based on the formula of Gulland (1983), the process of standardization is as follows:

$$CPUE_s = \frac{C_s}{F_s}$$

$$CPUE_i = \frac{C_i}{F_i}$$

$$FPI_s = \frac{CPUE_s}{CPUE_s} = 1$$

$$FPI_i = \frac{CPUE_i}{CPUE_s} \quad \text{.........................} (1)$$

For other fishing gear using the following equation.
Standard Effort = Σ FPIi x Σ E .... (2)
Description :

CPUEs catch per Unit effort of standard fishing gear
CPUEi catch per Unit effort of fishing gear i
Cs number of catches of the standard fishing gear
i

Fs	number of effort of the standard fishing gear
Fi	number of effort of the fishing gear i
FPIs	fishing power index of standard fishing gear
FPIi	fishing power index of standard fishing gear i

Fish Resources Analysis

Analysis of resource utilization rate of fish is done by first suspected the value of the maximum sustainable production or Maximum Sustainable Yield (MSY) by using the Schaefer model (Gulland 1983), with determine catcth per unit effort that have been standardized (c / f) in units of kg / trip and fishing effort that has been standardized (f) of the trip unit then calculated by linear regression model, thus obtained a constant value of regression (b) and intercept (a). Intercept value (a) and the regression constant (b) is then used to determine the value of MSY = a2 / 4b.

Scoring Method

Determination of types of selected fishing technology to the method of scoring. Ion to the value of standardization was done by using the function values (Platform & Triwiji 1988). The value function performed by the formula:

$$V(x) = \frac{X - Xo}{Xi - Xo}$$

$$V(A) = \Sigma Vi\,(Xi)$$

Description:

i	1,2,3, ... n
V (x)	function value of the variable x
X	Variable x
Xo	worst value of criterion x
V (A)	function value of alternative A
Vi (Xi)	function value of the alternatives on the i-th criterion
Xi	Criterion to-i

Linear Goal Programming Model

The general form of mathematical equations LGP model (Lee et al. 1985; Muslich 1993): (1) Objective function,

Minimum $Z = \Sigma$ Wik Pk (d-i – d+i)

(2) Constraint functions,

$\Sigma aij\ Xj + d\text{-}i - d+i = bi\ (i=1,2,3,...,m)$

$Xj, d\text{-}i, d+i \geq 0$

Pk	= order of priority (Pk>>> Pk + 1)
Wik and Wik-weight +	= 1 for the deviation variables in a priority level k
d-i and d + i	= negative and positive deviation
aij	= technology coefficient
xj	= Decision variable

RESULTS AND DISCUSSION

Identification of Selected Fish Resources

Marketing is a pretty important part in spurring the production and support the success of fisheries through subsistence of fish, both for domestic and export markets with reasonable prices at the level of fishing. Approach to the marketing aspect is used as the criterion of production value, price, marketing areas, and its added value. Based on the scoring method analysis by using the value function, can be determined 5 commodities of selected fish in the waters of South China Sea in Indragiri Hilir e.i : giant threadfin, mantis shrimp, silver pomfret, yellow pike-conger and barred spanish barred spanish mackerel.

Location Of Fish Marketing In Indragiri Hilir

Species of fish landed in Indragiri Hilir marketed for local purposes. Beside, species and size of certain fish are also marketed for the purpose of inter-regional (national) and even for export (international). The objectives of regional fish marketing inter-regional is Tanjung Balai Karimun, Moro and Durai in Riau Islands province, Bengkalis, Rengat and Jambi. While under its export destination (international) are Singapore, Malaysia and Thailand.

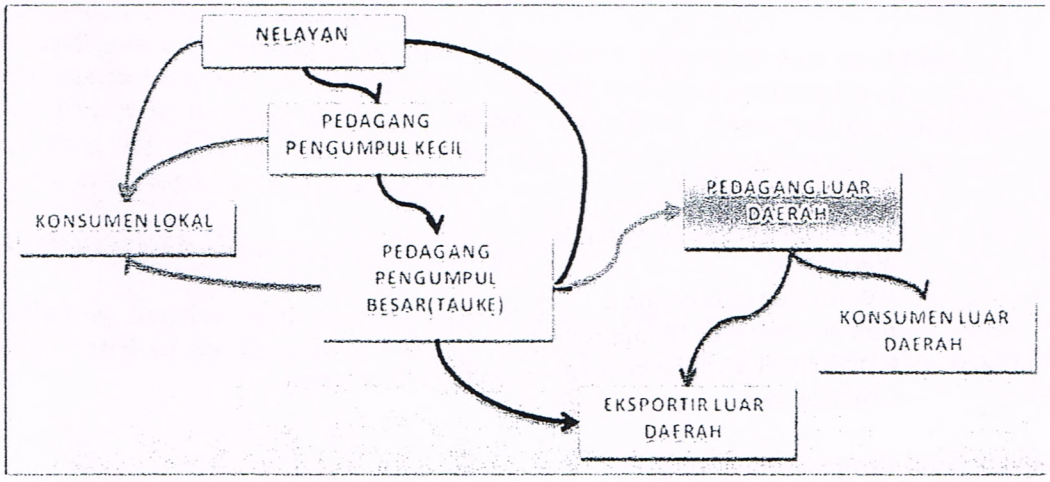

Figure 1. Fish Market location in Indragiri Hilir

Fish Marketing Chain In Indragiri Hilir

Fish landed by fishermen in Indragiri Hilir collectors sold to small, large collectors or directly to local consumers. Small middlemen then sell the fish to the great collectors or to the consumer. Major collectors to sell the fish to the inter-regional traders or to consumers. Besides great collectors also sells its fish to the exporters who are outside the region (Figure 1). While inter-regional traders then sell the fish to the exporters in the region to be exported and made some more to be marketed in the region (Figure 2).

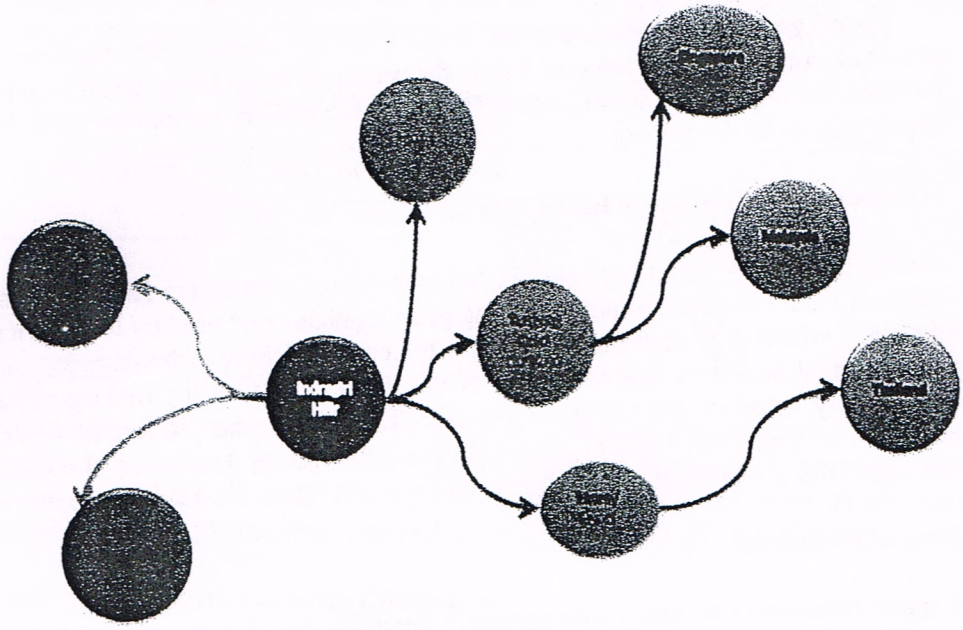

Figure 2. Fish marketing chain in Indragiri Hilir Regency

Fish economical aspect in terms of price, based on economic principles by using a scoring method to obtain economic commodity Indragiri Hilir, are presented in Annex A. The calculation results using the scoring method can be determined the value of 5 economically important fish of Indragiri Hilir is giant threadfin fish, mantis shrimp, silver pomfret, yellow pike-conger and barred spanish mackerel.

Status And Level Of Utilization Of The Selected Fish Resources

The results of field surveys, questionnaires and interviews with fishermen and analytical approach to the market aspects in Indragiri Hilir Regency, the dominant commodities that landed by local fishermen and become an selected commodity; giant threadfin fish, mantis shrimp, silver pomfret, yellow pike-conger and barred spanish mackerel. The results of the analysis of the potential of fish resources with approaches of production surpluses method and utilization rates for all the commodity, are presented in Table 1.

Table 1. Potential and utilization level of fish resources in the waters Indragiri Hilir of Riau Province.

No	Species	potency /MSY	Utilization level (%	Development Opportunity
	INDRAGIRI HILIR REGENCY			
1	Giant threadfin	1267.68	45	Very large
2	Mantis shrimp	3253.62	45	Very large
3	Silver pomfret	4522.14	40	Very large
4	Yellow pike-conger	1364.24	55	large
5	Barred spanish mackerel	5698.73	51	large

Based on the potential estimation analysis for the selected fish resources shows, that almost all commodities of selected fish in the waters of South China Sea Indragiri Hilir Riau Province below 60% for it utilization. Thus all these leading commodities still have a great opportunity to be developed.

Technical Aspects of the Selected Fishing Gears

Fishing technology which operated in Indragiri Hilir Regency are still largely small scale and traditional character. Types of fishing gears available and used by local fishermen quite diverse. Variability of technical aspects for the current fishing technology in Indragiri Hilir are presented in Annex B. Assessment of this aspect of variability ranking of fishing gear productivity based on the value per trip (CPUE), fishing gear productivity per year, and distances to reach the fishing ground. Current technology to capture the commodity of Indragiri Hilir are gill nets, trammel net and kurau net was ranked the best in Indragiri Hilir.

Financial Analysis

Capture fisheries in the study sites generally favorable, but to prove it scientifically requires financial analysis of the capture fisheries. In this financial analysis will be discussed on the business analysis/benefit and feasibility analysis, capture fisheries business development at the location of the study.

Business Analysis

Capital investment needed for a fishing effort varies depending on the type of boat and fishing gears that will be attempted. Capital investment in capture fishries consists the purchase cost of ships, engines, fishing gears and other. Details of the amount of investment capital of fishing effort in the study locations are presented in table 2.

Table 2. Capital investment of fishing capture

Fishing Gear	Boat (Rp)	Engine (Rp)	Fishing gear (Rp)	misc	Amount (Rp)
Long line	7.000.000,00	6.500.000,00	7.500.000,00	-	21.000.000,00
Kurau net	9.000.000,00	5.500.000,00	15.000.000,00	-	29.500.000,00
Gill net	6.500.000,00	6.500.000,00	4.500.000,00	-	17.500.000,00
Trammel net	1.000.000,00	-	2.000.000,00	-	3.000.000,00

Business costs for capture fisheries in Indragiri Hilir Regency can be seen in Annex C. The composition of business costs, generally consist of fuel costs, the cost of fishing supplies, the cost of ice purchasing, bait procurement costs, profit-sharing, management of licensing, maintenance, depreciation and income taxes.

The amount of benefits affected by catches and fishing effort costs incurred. By looking at the profit level, showing that the arrest attempt in the study location is profitable and feasible to be developed. Value balance revenue - cost (R / C) fishing effort in the Indragiri range 1.38 - 1.85. The amount of the value of R / C is influenced by the catches and fishing effort costs incurred.

The calculation of investment criteria (Table 3) shows that the capture attempt in the ...ped. The amount of the value of NPV, net B / C

and IRR is strongly influenced by the catches and fishing effort costs incurred. Variability of financial aspects of the current fishing technologies are presented in Annex D.

Table 3. The value of business investment criteria

Fishing gears	Description			Feasibility
	NPV	Net B/C	IRR	
Long line	5.621.717	1,55	42,8	feasible
Kurau net	39.168.731	1,38	30,9	feasible
Gill net	37.742.082	1,85	69,1	feasible
Trammel net	15.146.175	1,81	75,5	feasible

Scoring techniques was used in order to determine the priority of current fishing technology. Assessment for variability ranking aspects using the NPV criterion, Net B / C, IRR, and profitability. Results showed that scoring variability of financial aspects of gill nets, shrimp nets and kurau nets was ranked the best in Indragiri Hilir Regency.

Optimization Capture Fisheries Component

Components of fish resources

The Maximum Sustainable Yield (MSY) of selected fish commodities in the waters of Riau Province by using the Schaefer model estimated 33,324.34 tonnes / year, with details presented in Table 4.

Table 4. The Maximum Sustainable Yield (MSY) and the Total Allowable Catch (TAC) for the five types of fish in the South China Sea waters Indragiri Hilir Regency

No	Type of fish	MSY (ton/year)	TAC or 80% x MSY (ton/year)
1	Giant threadfin (Eleutheronema tetradactylum)	1267.68	1014,14
2	Mantis (Uratos guilla nepa sp.)	3253.62	2602,90
3	Silver pomfret (Pampus argenteus)	4522.14	3617,71
4	Yellow pike-conger (Congresox talabon)	1364.24	1091,39
5	Barred spanish mackerel (Scomberomorus commersoni)	5698.73	4558,98
Total		16106,41	12885,12

Optimization effort between the availability of resources (stocks) of fish with utilization rates in each fishing ground is very important to ensure the efficiency or profitable and sustainable the capture fisheries business systems. If the level of utilization of fish resources in an area exceeds of its optimum value, there will be a reduction in fishing effort efficiency and will cause overfishing phenomenon. Therefore, to know the optimum level of balance between the amount of resources (stocks) of fish that may be utilized with the maximum number of facilities or fishing units.

Components of fishing units

Optimization capture fisheries directed to make the productive fishing unit, selective, efficient and environmentally friendly. Thus the decision variable for the Indragiri Hilir Gill

Nets (X1), Long line (X2), and net Shrimp (X3). Resolution process for goal programming model uses a computer program Lindo LINDO (Linear Interactive Descrete Optimizer). Goals to be achieved in optimizing the allocation of selected fishing vessel technology in Indragiri Hilir are as follows:

Optimum Allocation of Selected Fishing Technology

Allocate the optimum amount of selected fishing technology in this research used goal programming approach. Objectives to be achieved in this allocation is to optimize the utilization of commodity (pro poor), employment absorbtion (pro job), and increased foreign exchange (pro-growth). Decision variables in Indragiri Hilir is Gill Nets (X1), long line (X2), and trammel net (X3).

Optimizing the Utilization of Selected Fish Resources

Giant threadfin commodity - The value of optimum production estimate or JTB for Giant threadfin is 1267.68 tons / year. The species was captured by selected fishing technology, namely: long line (rawai). Assumed ideal productivity value of each unit to capture the species is 0.11 tons / year, so the constraint equations goal (goal constrain) for optimal utilization can be written as follows:
DB1 - DA1 + 0.11 X2 = 1014.1

Yellow pike-conger Commodity - The value of optimum production estimate or JTB for yellow pike-conger is 1364.2 tons / year. The species was captured by selected fishing technology, namely: long line (rawai). Assumed ideal productivity value of each unit to capture the species is 0.11 tons / year, so the constraint equations goal (goal constrain) for optimal utilization can be written as follows:
DB2 - DA2 + 0.11X2 = 1091.4

Silver pomfret Commodity - The value of optimum production estimate or JTB for Silver pomfret is 4522.14 tons / year. The species was captured by selected fishing technology, namely gill nets (jaring insang). Assumed ideal productivity value of each unit to capture the species is 0.13 tons / year, so the constraint equations goal (goal constrain) for optimal utilization can be written as follows:
DB4 - DA4 + 1,5 X1 = 3617.7

Barred spanish mackerel Commodity - The value of optimum production estimate or JTB for Barred spanish mackerel is 5698.73 tons / year. The species was captured by selected fishing technology, namely gill nets (jaring insang). Assumed ideal productivity value of each unit to capture the species is 1.5 tons / year, so the constraint equations goal (goal constrain) for optimal utilization can be written as follows:
DB3 – DA3 + 1.5 X1 = 4559

Mantis shrimp commodity - The value of optimum production estimate or JTB for Mantis shrimp is 5698.73 tons / year. The species was captured by selected fishing technology, namely trammel nets (jaring udang). Assumed ideal productivity value of each unit to capture the species is 1.34 tons / year, so the constraint equations goal (goal constrain) for optimal utilization can be written as follows:
DB5 – DA5 + 1.34 X3 = 2602.9

Maximizing Manpower Absorption

The expected in the allocation of labor can absorb as much as possible. Based on fisheries statistics, the number of fishermen in the waters of Indragiri Hilir recorded at 14.691 people. Observations and interviews indicate that each selected technology in Indragiri Hilir, long line absorbed per unit of 3 people, 2 people per unit of gill nets and 2 people per unit of shrimp nets. Based on this information, then the constraint equations goal (goal constrain) for employment which can be written as follows optimal;

$DB6 + 3\ X1 + 2\ X2 + 2\ X3 \geq 14691$ (Kabupaten Indragiri Hilir)

Foreign Exchange Revenue Maximizing Target

Assuming if 50% of the catch from each of selected capture technology can be exported with an average price of U.S. $ 4.65/kg, the estimated foreign exchange earnings from each unit of this type of technology selected estimated arrest follows: Indragiri Hilir, gill nets can contribute to U.S. $ 210/unit/tahun, long line can donate U.S. $ 545/unit/tahun and shrimp nets can donate U.S. $ 350/unit/tahun. Then, target the foreign exchange earnings from export activities per year is U.S. $ 5.000.000, -. Based on the estimated value and the target, goal constraint equations (constrain goal) to maximize foreign exchange earnings capture fisheries can be written as follows;

$DB7 + 0.21\ X1 + 0.545\ X2 + 0.350\ X3 \geq 5000$

Resolution Process For Goal Programming Model Uses A Computer Program LINDO (Linear Interactive Discrete Optimizer)

LGP analysis results also showed that almost all the targets and the desired goal is achieved as indicated by the value of the deviation variable (either DA or DB) is equal to zero, except the target for optimum utilization of commodities such as silver pomfret (921 tons), yellow pike-conger (998 tons) and giant threadfin (3222 tons) under its JTB; while for the utilization of commodity mantis shrimp and barred spanish mackerel in accordance with the allocation of the value of JTB. Employment target of 14,691 people will be achieved and the earnings target of foreign exchange of U.S. $ 5 million / year is not reached yet even underneath the registration 3221. Results of optimum allocation of selected fishing technology in Indragiri Hilir: gill nets as much as 3039 units, 844 units of long line and shrimp nets as much as 1942 units.

CONCLUSIONS AND RECOMMENDATION

- The commodities in Indragiri Hilir Regency are giant threadfin, mantis shrimp, silver pomfret, yellow pike-conger and barred spanish mackerel.
- The fishing units the option to catcth leading commodities in Indragiri Hilir waters are gill nets (gillnet), shrimp nets (trammel net) and kurau net (bottom drift gillnet) are ranked.
- Estimate the optimum value of the components of capture fisheries in the waters of Riau province is as follows:
- Number of potential for optimum catches of fish seed resources in Riau Province of 33,324.34 tons / year,