Fisheries Resource Management through Local institutions in Empowering Community Based on Local Wisdom in Coastal Madura Strait

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Abstract
This research was conducted from May until September 2013. Research location is Madura strait coastal, especially 4 sub-district in Probolinggo District, namely Randu Putih, Randu Tatah, and Karang Anyar and Gili Ketapang. This study purpose was to analyze potential and utilization of fishery resources, local wisdom values that have close relationship with fishery resources management, programs and activities and efforts by government and local institutions in utilizing and managing fishery resources, perceptions and society aspirations of local wisdom values and adherence to tradition/customary law that applicable to fishery resources management, how far opportunity empowerment of local wisdom values can be maintained and utilized to formulate fisheries resource management policies and alternative livelihoods choice in accordance with local resource conditions and strengthening livelihood alternatives that will be developed in accordance with local institutional based on local wisdom. Research type is descriptive qualitative and quantitative. Techniques used in data collection are questionnaires, observations, interviews and documentation. Samples required in this study were 100 payang fishermen and some key informant from stakeholders. Data analysis used for qualitative descriptive method is In-depth analysis. Quantitative analysis uses Household Economic Model. The research results demonstrate that potential and utilization of fishery resources in Madura Strait are follows: sustainable fish resource potential is 49.506 million tones and fish resources have utilization reached 58.547 million tones. Therefore, there has been over fishing or in Madura Strait. Local wisdom values that have close relationship with fishery resources management in Madura Strait are: Petik Laut, Onjem, Nyabis, Andun, Telasan, Pengambek and Contract Systems Work. Public perception on local wisdom value still very strong and people aspiration local wisdom value and adherence to tradition/customary law applicable in fisheries resources management is still quite large. Still there are many opportunities to empower local wisdom values can be maintained and utilized to formulate fisheries management policy. Selection alternative livelihoods choice in accordance with regional resources conditions and strengthening livelihood alternatives that will be developed in accordance with local institutions is based on local wisdom by tapping labor in agro-industries such as fish processing, and marketing. From research result, policy recommendations suggested are fishing management policy in Madura Strait need to empower local wisdom values (onjem and andun) for resource conservation efforts as well as food security.

Key Word: Local wisdom, onjem, andun, sustainable fish resources, household economy, alternative livelihoods choice.
Introduction

Food security, as mandated by Law No. 7 of 1996, aims to achieve food security for all households, with sufficient quantity, good quality and proper nutrition, safe to eat, and affordable by every individual household. One source of food is fish and marine products as well as a potential income of coastal communities, which currently under pressure from various human activities, especially fish resource conditions that experienced over fishing. Nonetheless, FAO (2005) states fisheries resources still have important potential for food security and poverty reduction in many countries. Along with that, higher fishing effort should do to meet food needs of around community and inter-island market demand in this country and abroad (Pudji, P, 2010).

Inability to integrate a local wealth also causes failure in coastal resource management efforts. In many places/areas in Indonesia, there are always customs habits and continue to uphold values of indigenous/traditional and suitable and effective in maintaining natural resources sustainability of coastal life. Application of Law No. 32 of 2004 on Regional Government has consequences on district and/or city as base organizers of regional autonomy. First, district/city is required to be able to manage their self. Today people more realize the coastal and marine natural resources and its resource potential that quite promising in supporting the economic level of community, especially for fishermen. Logical consequence of coastal and marine resources as common property resources and is open access to public in utilization of coastal and marine natural resources today that increased in almost all regions (Stefanus, S, 2005).

It is consistent with the increase of fishing effort in meeting food needs of both surrounding community and to the inter-island market demand in the country and abroad. Ghofar (2004) said that higher exploitation of marine and coastal natural resources today (catching, cultivation, and extraction of materials for medical purposes) has become an area of economic activity that is controlled by market (market driven), especially economical high value, thus encouraging exploitation of marine and coastal natural resources in quite large scale and intensity.

It is suitable with regional autonomy that accompanied by stronger role democratization demands and community (stakeholders) improvement, equity and justice as well as attention to region potential and diversity. Therefore, development process of coastal and marine areas should be arranged in integrative approach framework synergistically and harmonious, with respect to system values and institutions are growing and developing in local community and consistent with local potential sources development (Mimit, P, 2011 b).

Institutional development of coastal communities that based on local resources will increase public participation in decision-making and supervisory management of resource potential. This will ensure higher income sustainability and conservation resources.

In coastal fisheries sub-sector, interaction between main resource, fisheries technology, socio-economic communities and institutions are quite problematic. We need to understand interaction and impact of development programs as an effort to increase revenue of this fishery. From this approach, an effort to increase sustainable economic growth can be cultivated through development of alternative livelihoods in fishermen families live based on optimum utilization of local resources that should able to improve life quality in this region. It is also intended to allow fisherman communities to improve welfare and to meet their food needs continuously, so in future they become strong society with alternative livelihoods. It is very important to analyze alternatives in effort to increase fishery revenue at a certain level of abstraction. This study purposes are to look at possibility of long-term consequences of various alternative development, researching fishery resources management in Context of Local Institutions Through Empowering Community -Based Local Wisdom In Coastal Madura Strait. The purposes of this study were: (1) Analyzing potential and utilization of coastal fishery resources in Madura Strait, (2) Identifying local wisdom welfare that has close relationship with coastal area fishery resources management of Madura.
Strait. 3. Knowing perceptions and aspirations of people to local wisdom values and adherence to tradition/customary law applicable in management of coastal and marine natural resources in coastal Madura Strait 4. Development of alternative livelihoods can be carried out in accordance with local institutional potential of area.

Method

Research approach

This study divided into some part. Therefore, it is necessary to know stages of research conducted. Initial phase was in-depth – analysis (Mbete, A. Aro, 2005). It is about in-depth study of institutional and local wisdom within coastal communities of Madura Strait. The next phase is Household economic analysis method, namely study empowerment of fishermen household economic to search models of coastal communities in sustainable fishery resources management in order to achieve food security.

Research Type

Based on research objectives, it is a descriptive research. According Arikunto (1997), descriptive research is “research would to tell problem-solving based on data, so it also presents, analyze and interpret data. It is also comparative and correlative.” Narbuko,C and A, Achmadi (2007) said the purpose of descriptive study is a systematic problem solving and factual information on facts and properties of population. In accordance with purpose and nature of terms within descriptive research Masri, S and Effendi. S (1995) describes this descriptive study as follows: “A careful measurement of specific social phenomenon, and researchers develop concepts and gather the facts.”

Data Analysis Methods

Population and Sample

The population was institutional and stakeholders related to usage and management of coastal and marine resources in Probolinggo. Population consists of several of institutions including government (from village to district level), private sector (NGOs and business) and local community. Samples are 100 fishermen paying. It is consists of four research sites, namely: Gili Ketapang : 75 fishermen payang, Karang Anyar : 5 fishermen payang, Randu Putih : 10 fishermen payang and Randu Tatah : 10 fishermen paying, as shown in image below :

Data Collection Techniques

This study uses a qualitative approach. If relevant, quantitative data is still relevant also be used to explain problems of coastal resource management and empowerment of local wisdom. Data was collected in several ways as follows : 1. Observation; 2. Interview and 3. Group interviews ;

Data Analysis Techniques

Harvest Estimation and Maximum Effort

To answer potential and utilization of fishery resources with maximum effort and harvest estimation, by incorporating environmental variables, O’Rourke (1971) explain harvest function in following equation :

\[
\frac{Y}{E} = b_0 + b_1E + b_2F + b_3T
\]
where:
\[ Y = \text{number of captured fish} \]
\[ E = \text{amount of fishing effort} \]
\[ F = \text{environment temperature} \]
\[ T = \text{trend variable} \]

In-depth Analysis

Socio-cultural aspects were studied by in-depth Analysis. It describes comparative qualitative analysis of values and perspectives also perceptions and aspirations of local communities on local wisdom value and meaning of narrative tradition in various rituals related to natural resource management of coastal and marine.

Household Economic Analysis

Regression analysis is used to analyze household Economic aspects. According Usman, H and Nachrowi, D (2002), regression models that used to make relationship between one dependent variable and several variables independent is called multiple regression models. The multiple linear regression models that used to analyze these data are: influence of some Local wisdom, as nyabis, onjem, and andun.

Fishing Area

Fishing Areas (DPI) depend on ship assets (ASKJ) used, fuel prices (PBM), level education and experience of employee (PDPP) education and experience level of employer (PDPJ), fish price (PIK), work time for agro-industries of worker household (CDPA), local wisdom of Nyabis (NY) and local wisdom of Onjhem (ONJ). It is because ASKJ related to credit, fishing gear, employer income and rural infrastructure. These factors also indirectly affect the reach of fishing area (Sahri. M, 2011). Function of fishing areas as the following equation:

\[ DPI = b_0 + b_1\text{ASKJ} + b_2\text{PBM} + b_3\text{PDPP} + b_4\text{PDPJ} + b_5\text{PIK} + b_6\text{CDPA} + b_7\text{NY} + b_8\text{ONJ} + U_2 \]

wherein:
\[ DPI = \text{fishing areas (km)} \]
\[ ASKJ = \text{Ship Asset (GT, tons)} \]
\[ PBM = \text{diesel fuel price at sampling sites (Rp/liter)} \]
\[ PDPP = \text{education length and experience of worker (years)} \]
\[ PDPJ = \text{education length and experience of employer (years)} \]
\[ PIK = \text{Fish Price (PIK)} \]
\[ CDPA = \text{Work tapping of Agro-Industry worker} \]
\[ NY = \text{Local wisdom of Nyabis} \]
\[ ONJ = \text{Local wisdom of Onjhem} \]
Parameter estimation of hypothesis: \( b_1, b_2, b_3, b_4, b_5, b_6 \neq 0 \).

Gross Income of Fishing Employer

Gross income of sailing employer (RJM) is based on two possibilities, namely: (1) identity equation, and (2) behavioral equations. Identity equation choice refers to economic models of agricultural households, which assumes commodity is one type of fish. While Behavioral equations choice is based on phenomenon of multi-species fishery commodities. In fact at field, Gross income of sailing employer (RJM) may change with changes in fish production (QNM) and fish price (PIK), also change with types of fish caught change.
Behavioral equations gross income of sailing employer (RJM) organized in the following equation:

$$RJM = h_0 + h_1QNM + h_2PIK + h_3SSDA + h_4AND + U$$

where:

- RJM = Gross income of sailing employer (Rp/year)
- QNM = fish production (tons/year/ship)
- PIK = fish price produced per unit ship (USD/Kg)
- SSDA = dummy the resource status of each region
- AND = Local Wisdom of Andun

Parameter estimation of hypothesis: h1, h2, h3, h4.

Results and Discussion

Potential and Utilization of Fishery Resources in Madura Strait.

Catch result varies depending on amount of fishing effort. It makes equilibrium level of fish population size at each level of fishing effort. With basic equations of catch and CPUE, from catch data at specified time period (time series), maximum sustainable yield can be obtained, where balance of highest fishing can be achieved without reducing amount of fish availability (stock) there.

The maximum utilization levels hereafter is known as point of Maximum Sustainable Yield (MSY). With basic production functions, fishing exploitation in a certain waters by Panayotou, T. (1982) can be classified into two categories, namely: (1) Exploitation level before peak production, hereinafter referred to as “under-exploited”, and (2) Exploitation level after peak production, hereinafter called “over-exploited”.

Within “under-exploited”, fisheries development strategy can be pursued through addition of fishing effort, but within “over-exploited” category, improvement strategies need to be taken fishing to achieve maximum utilization of fishery resources sustainability. Maximum condition depends on objectives understanding achieved. If the purpose is to achieve maximum level of fish harvest, exploitation rate is the result of fishing (harvesting) maximum sustainable ecological criteria (Panayotou, T, 1982).

From data analysis results of fish production, effort (E), Catch Per Unit Effort (CPUE) Madura Strait can be seen in appendix 1:

Based on data analysis in appendix 1, production function estimation results is obtained with Bio-Economic Model of Schaefer - Gordon as follows:

$$CPUE = 0.0089 - 4E - 10 Effort$$

Sustainable Potential Estimation Result of fish resources or Sustainable Maximum Yield (MSY) is 49,506,000 tons, while in last year (year 21st), status of utilization of fish resources in Madura Strait have reached 58,547,000 tons. Therefore, has exceeded of MSY and can be said to have undergone Over Fishing (Mimit, P, 2011 a).

Public Perception of Madura Strait Fishermen toward Local Wisdom Values

Public perception at research sites toward local wisdom value, customary law, and cultural traditions until today is recognized still very strong. Based on observations and in-depth interviews, both individually and focus group discussions, it can be described that Madura Strait until now considers that existing local wisdom value, particularly with regard to utilization and management of marine and coastal fishery...
resources is an integral part and attached with their life activities. Fishing activities is a high risk activity. It is not just about amount of capital at stake and the search of speculative profit, but also relates to the salvation of soul. Natural disturbances come at any moment, such as the large waves and wind. They are things that can threaten fishermen safety. There are two things that always become attention main when fishing boats operating, namely life safety hope and lucky come to them.

This value system is an institution that can guide and regulate their relationship with natural world. They have an understanding and belief that God Almighty as Creator of nature has a force and he was the one who could give them sustenance and good luck. On the other hand, they also believe that in certain circumstances, as inhabitants of this nature, humans are greedy and act to use marine and coastal natural resources that do not conform to religious value system, customary law and cultural traditions embraced.

God Almighty as Creator will give sanction and punishment to humans. Recognition of local wisdom also implement the laws in religion, same with China country as follows: In-depth analyzes show that people consciousness of ecological conservation was derived from the edification of kinds of ancient eco-ethical wisdom, such as totemism, nature worship, Zhou Yi, Taoism, Buddhism, Confucianism, Mohism, etc. (Maolin Li, et.al, 2010).

According to local belief system, punishment that God Almighty gave to them when they use marine and coastal natural resources that are not consistent with religious values, laws and traditions of local communities, can be a natural disaster, pain which can not be treated medically, accident at sea and on land. Intrinsically, man don’t do damage to environment on land and at sea. Human relationship with the environment is a necessity, therefore man as caliph in earth have a great responsibility to always maintain balance. (Mimit. P. et al, 2010).

Madura Strait Fishermen Aspirations toward Local Wisdom

Coastal communities and fishermen in study sites have aspirations, ideas and a strong will to preserve Local wisdom, customs, and its customary law. This aspiration and desire based on public awareness about importance of local wisdom value as a basic philosophy to guide moral aspect in managing harmonious relationship between man and natural resources around them.

They are well aware that such values is ancestor’s legacy that must be promoted to become moral guidance and institutions in community to organize coastal and marine resources usage in a responsible and sustainable manner. Public awareness to preserve local wisdom, customs and customary laws relating to coastal and marine resources management also caused by a fear to fade or loss of local wisdom values.

Other phenomena at everywhere show coastal and marine resource usage tends destructive and environmental unfriendly. In addition, people in the study site was pessimistic and doubtful toward positive laws implementation, including toward enforcement officers. Community response to positive laws and its applications is very low. This is due to fact that environmental destruction perpetrators is not settled clearly and do not make environmental destructive perpetrators become deterrent.

Household Economy Analysis

Area Fisheries Catching (DPI)

Table 1 shows estimation results the effect of local wisdom of onjem and nyabis on fishing operations in area Madura Strait fishermen fishing. Fishing area behavior (DPI) is influenced by variables ship assets (ASKJ), fuel prices (PBM), education and experience of employer (PDPJ), education and experience of worker (PDPP), Agroindustry work tapping of Worker household (CDPA), Fish price (PIK), and onjem as indigenous culture of fishing communities in Madura Strait payang. Nyabis variable does not affect on
DPI behavior. Education length and work experience of employer and worker is a proxy for human resources quality of payang fishermen at Madura Strait.

Table 1. Regression Analysis Calculation Results of Regional Fisheries Catching (DPI)

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Regression result</th>
<th>t-count</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Ship asset (ASKJ)</td>
<td>-9.436</td>
<td>-4.70***</td>
<td>0.10</td>
</tr>
<tr>
<td>Fuel price (PBM)</td>
<td>-0.526</td>
<td>-6.05***</td>
<td>0.10</td>
</tr>
<tr>
<td>Education/Experience of worker (PDPP)</td>
<td>-0.127</td>
<td>-0.87</td>
<td>NS</td>
</tr>
<tr>
<td>Education/Experience of employer (PDPJ)</td>
<td>-0.113</td>
<td>-1.20*</td>
<td>0.30</td>
</tr>
<tr>
<td>Fish price Ikan (PIK)</td>
<td>-0.0004</td>
<td>-2.11***</td>
<td>0.10</td>
</tr>
<tr>
<td>Agroindustry work tapping of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker household (CDPA)</td>
<td>0.008</td>
<td>1.07*</td>
<td>0.30</td>
</tr>
<tr>
<td>NYABIS</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONJHEM</td>
<td>2665.133</td>
<td>6.09***</td>
<td>0.10</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.499</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F count</td>
<td>17.45***</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Durbin-Watson (D/W)</td>
<td>1.787507</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description:

***: It means significantly different from zero at alpha level = 0.10
** : It means significantly different from zero at alpha level = 0.20
*  : It means significantly different from zero at alpha level = 0.30
NS : Non Significant

Parameter of capture area (DPI) variable positively influenced by Agroindustry work tapping of Worker household (CDPA); and onjhem. It can be interpreted that in catching fish at sea, employer and worker more rational to consider work tapping of Worker household for agroindustry as fish processing with high quality and marketing. Onjhem become nest for fish as restocking of fish or fishery resources in order fishing areas become wider. The higher fish results obtained, the more work tapping in fishing industry. To facilitate high level of seas fishing activities (fishing area), most fishermen put onjhem or fish nest in sea. Onjhem is made from intact palm leaves, bamboo sticks, and stones as load. Onjhem will become place for fish to spawn fish. It can help fishermen to catch fish (Kusnadi, 2000). Future need onjhem empowerment with wider area to increase fish resources catching as well as conservation efforts by stakeholders.

Local wisdom of onjhem has visible contributions as for future fisheries development. Sea as characteristic natural conditions have been met if referring to Christy (1992). Onjhem is thought result that occurs because of pressure in order human adapt to nature. Onjhem also have boundaries in management, although there is no advanced technology used, and only use traditional way of knowing these boundaries can be defined in inherent common law. For example, if Onjhem instinctively does not belong to us, then we will not engage fishing activities there.

This is a form of unwritten customary law in fishing communities of Madura Strait. This practice is taught by Islam, as mentioned in the Quran Surah An - Nisa' verse 29 : " O ye who believe! Eat not up your property among yourselves in vanities: But let there be amongst you Traffic and trade by mutual good-will: Nor kill (or destroy) yourselves: for verily Allah hath been to you Most Merciful!

From technology aspect, although modest compared to modern rumpon (fads) today, the technology used still can function properly even though the results have not been better compared to catch at sea. Therefore, technological aspects is fulfilled although simple and traditional. Cultural aspect also fulfilled by onjhem of fishing communities in Madura Strait, it can be seen from the culture respect “if it is yours then I can not use it without your permission” and if violated then the results will be taken by onjhem owner Onjhem and...
there is moral sanction from society. Wealth distribution aspects is not met because Onjhem is owned privately although Onjhem in communal area and there is no law protection and land ownership. Although government authorities lack of laws to protect this activities or traditions, it does not mean illegal and unlawful. Even if we look and examining deeply, it will have a positive impact to environment. Onjhem presence become nest for fish to spawn and refuge from predators. In addition, it become as a manifestation of natural food balance. It is one form of public environment awareness of Madura Strait fisherman with local wisdom implementation of Onjhem. At future, it development can be fostered better technology, ie the artificial reef construction efforts (Mimit. P, 2011c).

Onjhem should be preserved and empowered with environmentally friendly technologies touch. Artificial reef construction at certain place become as a fishing ground for extending fishing area for fishermen arrests.

Expansion of fishing areas adversely affected by changes in ship assets (ASKJ), fuel prices (diesel) or (PBM). It can be interpreted that increase in ship assets, coupled with a fuel prices increase, will reduce the extent and reach of fishing area. Logically, it have an impact because it increase asset ship and fuel prices will increase operations cost at sea. Fisherman payang supplies and expenses is limited, so this limitation is anticipated by shortening distance to sea fishing areas. If government made a policy to increase fuel prices, Madura Strait payang fishermen will respond quickly to shorten the fishing area reach (Mimit. P, et al, 2014)

Government policy to raise fuel prices will have an impact on paying fishermen behavior in Madura Strait in deciding range of fishing areas, namely : (1) fishing coverage area has declined, so catching fish in coastal areas will be more and coastal fishery resources will become over fishing. It contrary with fishery resources in the Exclusive Economic Zone (EEZ) that can not be optimized and resulting huge losses for the fishermen, and (2) Catch productivity has declined, operational costs increase, it make fishermen income decrease (Mimit. P. et al, 2013 b)

Therefore, to encourage fishermen payang of Madura Strait to expand fishing area in particular and the national fishing fleet in general, in order to replace foreign fleets that perform illegal fishing in ZEE, policy to increase fuel price bust be done wisely. Government should consider a combination program to enhancement size ships. While further efforts to expand fishing area, governments need to pursue training and education with technology about onjhem (Fads). It become addition to fish nest and also an attempt to preserve the fish availability as well as an effort to conserve fish resources.

Fish prices parameter as explanatory variables have a negative effect on catching fish area. It is interpreted as a form of fishermen adaptation to environment ecosystem, where for paying fishermen the physical environment of sea have a lot of risk. Because fishermen are hunting for fish, the results can not be determined certainty. Everything is almost completely speculative. Issues of risk and uncertainty occurs because the sea is an area that considered free to be exploited (open access) (Anderson, L. G 1986). Unlimited area utilization will likely lead to excessive exploitation or over fishing. Individuals who have the best access to capital and technology tend to benefit most from it. Facing these circumstances, fishermen communities tend to develop different patterns of adaptation and often not understood by people outside the community to deal many risks and uncertain (Mulyadi S, 2005).

These risks and uncertainties are advised to be overcome by developing adaptive patterns of a specific form of economic behavior which in turn affects economic institutions, including changes to increase fish price , although it even shorten the catching fish distance. Alternative livelihoods (AMP) can be seen effect of Agroindustry work tapping of Worker household (CDPA), namely by developing Agroindustry that interrelated between upstream and downstream, with synchronizing between production, processing and marketing in an integrated system to optimize natural resource or fish (SDA) in a sustainable manner with human resources (HR) (Mimit. P. et al, 2013).
Gross income of sailing employer (RJM)

Table 2. Regression Analysis Calculation Result the Gross Income of Sailing Employer (RJM)

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Regression result</th>
<th>t-count</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sailing Fisherman Production (QNM)</td>
<td>859823.7</td>
<td>17.35***</td>
<td>0.10</td>
</tr>
<tr>
<td>Fish Price (PIK)</td>
<td>27183.87</td>
<td>7.09***</td>
<td>0.10</td>
</tr>
<tr>
<td>Production Level Produksi MSY (SSDA)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANDUN</td>
<td>-9.273E7</td>
<td>-1.73**</td>
<td>0.20</td>
</tr>
<tr>
<td>Adjusted R^2</td>
<td>0.757</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F count</td>
<td>155.81***</td>
<td></td>
<td>0.10</td>
</tr>
<tr>
<td>Durbin-Watson (D/W)</td>
<td>1.471026</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Description:

***: It means significantly different from zero at alpha level = 0.10
** : It means significantly different from zero at alpha level = 0.20
*: It means significantly different from zero at alpha level = 0.30

Estimation analysis result of behavior equations in groups and Income and Revenue group at household employer can be seen in Table 2. Gross income of sailing employer (RJM) are affected and responded positively by explanatory variables QNM, and PIK. This is logical because catch value is product of production number at specified price (QNM x PIK). Let alone both of them improved, it will certainly increase RJM value. This phenomenon can be interpreted that price changes, for example due to changes in quality of fish is followed by inelastically by changes in sailing employer income, because the perishable nature of fish (perishable food). There are monopoly allegations by traders to make fish price at rural coastal, because fish auction is not working properly.

Fisheries commodity marketing system generally determined by market fish price. Individually, fisheries producers are price takers. With such market conditions, virtually there is no fishermen can set prices from fishing capture (Pranadji, 1995).

SSDA variable has no effect, while for Andun local wisdom variable has effect and respond negatively on income. This can be interpreted because with Andun, fishermen sail to other areas located in Madura Strait, with greater cost and type of fish caught is not much different. It higher costs are not comparable to the results obtained. Besides andun, there is also place transfer from Probolinggo who are experiencing famine due to gending wind. According to Illo and Pollo (1970), when andun, fishermen sail their ship to other regions, and they do not go to other regions more distant because of risk that cost will borne fairly large. Andun is temporary movement of fishing effort by fishermen due to some constraints, one of them is influenced by bad weather. According with key informants: gending wind is very strong wind at sea and waves are very malignant.

Although fish is abundant but fishermen are reluctant to sail because their safety risks. Andun as an attempt to fish elsewhere is inseparable from belief in religious orders which he believed, namely Islam, where the Islamic scholars invite Madura Strait fishermen to work everywhere, namely: “And when the prayer is ended, then disperse in the land and seek of Allah’s bounty, and remember Allah much, that ye may be successful.” (Q.S. Al - Jumu’ah : 10). This suggests that Andun local wisdom Andun, in addition to move in searching new fish resources, also give an opportunity for the fish in their place to do restocking. It create sustainable preservation management efforts of fish resources. Future regulations and policies pursued by the government should direct andun local wisdom to South of Java Sea which is still under exploited, or fishermen that affected by quota restrictions at Madura Strait were resettled to Eastern Indonesia. It is still considerable potential for fish resources (Mimit. P, 2012)
Between two seasons, dry season and the rainy season, there is a transition season that usually characterized by dry winds with strong enough blows from Southeast to Northwest. It is called “Wind Gending.” These conditions do not allow Madura Strait fishermen to catch fish. Dry season begin from April until October with an average rainfall + 29, 5 mm rain per day. While rainy season begin from October to April with an average rainfall per day + 229 mm rain. High rainfall occurs in December through to March with an average rainfall per day + 360 mm rain (Hagi et al, 2012)

Madura Strait fishermen generally do andun to Paiton area (border Probolinggo and Situbondo) and Pasuruan regency. Andun process itself is done by sailing the ship and entire crew to sea that specified by captain of fishing ship. Generally, it will be done if there is gending wind, ie in the months August to October and early November (Mimit. P. et al, 2013 a)

Conclusions and Recommendations

Conclusion

Conclusions of this study are : (1) The potential of Sustainable Yield (MSY) is 49, 506, 000 tons, while in the last year (year 21), utilization status of fish resources in Madura Strait have reached 58, 547, 000 tons. It has passed MSY point and can be said Over Fishing. (2) Society perception in research sites on local wisdom values, customary law, and cultural traditions until to day still very strong. (3) Coastal communities and fishermen in study sites have aspirations, ideas, and a strong will to preserve Local wisdom, customs, and its customary law. (4) alternative livelihoods that can be developed is working on agro-industries such as fish processing and marketing. (5). Local wisdom that has potential to be developed is onjhem and andun.

Suggestion

For sustainable fish resources management in Madura it should make restriction of fishing fleet, opening new employment opportunities with models ranging from agrofishery production, processing and marketing in a controlled system, and empowerment of local wisdom and andun onjhem as a cultural heritage that can be applied in fisheries resources management while maintaining food security at Madura Strait coastal communities, East Java, Indonesia particularly and the nation in general, even humanity globally.

References


ISSN 2309-0081
### Appendix 1.

Table 3. Result Analysis the Potential and Utilization of Fish Resources in Madura Strait

<table>
<thead>
<tr>
<th>Year</th>
<th>Fish Production (PI)</th>
<th>Catching Effort (E)</th>
<th>Per Unit Catching (CPUE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>23,709</td>
<td>9,293,531</td>
<td>0.0026</td>
</tr>
<tr>
<td>2.</td>
<td>36,072</td>
<td>9,543,758</td>
<td>0.0038</td>
</tr>
<tr>
<td>3.</td>
<td>34,127</td>
<td>8,441,553</td>
<td>0.0040</td>
</tr>
<tr>
<td>4.</td>
<td>34,004</td>
<td>9,496,496</td>
<td>0.0036</td>
</tr>
<tr>
<td>5.</td>
<td>43,434</td>
<td>5,994,225</td>
<td>0.0072</td>
</tr>
<tr>
<td>6.</td>
<td>31,200</td>
<td>7,196,627</td>
<td>0.0043</td>
</tr>
<tr>
<td>7.</td>
<td>27,711</td>
<td>10,695,540</td>
<td>0.0026</td>
</tr>
<tr>
<td>8.</td>
<td>29,835</td>
<td>9,245,622</td>
<td>0.0032</td>
</tr>
<tr>
<td>9.</td>
<td>31,685</td>
<td>8,039,580</td>
<td>0.0039</td>
</tr>
<tr>
<td>10.</td>
<td>33,113</td>
<td>9,818,933</td>
<td>0.0034</td>
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<tr>
<td>11.</td>
<td>52,322</td>
<td>7,197,368</td>
<td>0.0073</td>
</tr>
<tr>
<td>12.</td>
<td>35,291</td>
<td>9,728,884</td>
<td>0.0036</td>
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<td>13.</td>
<td>36,202</td>
<td>8,848,597</td>
<td>0.0041</td>
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<td>14.</td>
<td>50,206</td>
<td>5,758,977</td>
<td>0.0087</td>
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<tr>
<td>15.</td>
<td>64,451</td>
<td>7,852,836</td>
<td>0.0082</td>
</tr>
<tr>
<td>16.</td>
<td>52,812</td>
<td>9,296,664</td>
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<tr>
<td>17.</td>
<td>56,026</td>
<td>10,530,462</td>
<td>0.0053</td>
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<tr>
<td>18.</td>
<td>54,847</td>
<td>11,446,026</td>
<td>0.0048</td>
</tr>
<tr>
<td>19.</td>
<td>57,500</td>
<td>12,315,587</td>
<td>0.0047</td>
</tr>
<tr>
<td>20.</td>
<td>57,283</td>
<td>11,905,906</td>
<td>0.0048</td>
</tr>
<tr>
<td>21.</td>
<td>58,547</td>
<td>13,850,813</td>
<td>0.0042</td>
</tr>
<tr>
<td>Average</td>
<td>42,875</td>
<td>9,357,047</td>
<td></td>
</tr>
</tbody>
</table>

**CPUE Equation**

\[ Y = 0.0089 + (-4E-10 \times X) \]

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>b1</td>
<td>0.0089</td>
<td></td>
</tr>
<tr>
<td>b2</td>
<td>-4E-10</td>
<td></td>
</tr>
<tr>
<td>MSY (ton)</td>
<td>49,506</td>
<td></td>
</tr>
<tr>
<td>Eopt</td>
<td>11,125,000</td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>Over Fishing / Over Exploited</td>
<td></td>
</tr>
</tbody>
</table>

Source: Secondary data processed (2013).