Egyptian Journal of Aquatic Research xxx (2018) xxx–xxx

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Contents lists available at ScienceDirect

Egyptian Journal of Aquatic Research

journal homepage: www.sciencedirect.com/locate/ejar

Full length article

Model designs of Indonesian tuna fishery management in the Indian Ocean (FMA 573) using soft system methodology approach

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ARTICLE INFO

Article history:
Received 20 September 2017
Revised 7 June 2018
Accepted 7 June 2018
Available online xxxx

Keywords:
FMA 573
Indian Ocean
Indonesian tuna fisheries management
Model design
Soft system methodology

ABSTRACT

The Indonesian Fisheries' Management of the Indian Ocean (FMA 573) has great tuna resources, especially yellowfin and bigeye. There are various problems regarding activities of tuna fisheries in this area, and now is the time to initiate an integrated management. This research aims to evaluate the biological and technological aspects of tuna fishing activities in the FMA 573, and to design a management model on resources and fishing technology aspects of Indonesian tuna fisheries in the Indian Ocean area (FMA 573). Model design was carried out using the soft system methodology approach. The study resulted in identifying three problems regarding resources and six problems regarding the technological aspect. Finally, the model design of tuna fisheries management in the Indian Ocean (FMA 573) gave a solution for regulating the number of fishing effort in the Indian Ocean (FMA 573) as well as for realigning the use of FADs with its technical and implementation guidelines. Lastly, the study aimed at helping in building a system which is capable of guaranteeing the national implementation on the certification of competence for ship captains and crew through policymaking and budget allocation. The conceptual model was constructed based on the definition of RDs.

Introduction

The Indian Ocean of the Indonesian Fisheries Management Area (FMA 573) has great tuna resources. Nowadays, tuna fishing activities in FMA 573 is carried out using a variety of fishing gear such as longline, trolling line, and pole and line. Fish aggregating devices (FADs) are fishing tools which are used by trolling line and pole and line. Jaquemet et al. (2010), state that FADs are intensively used in tropical tuna fisheries which could concentrate fish around FADs and then increase the catches.

The Ministry of Marine Affairs and Fisheries created a fishery management plan (FMP) for tuna, skipjack and thunnus, which has been stated in the Decree of Indonesian Minister of Marine Affairs and Fisheries No. 107/KEPMEN-KP/2015. The FMP is expected as a reference for sustainable management of Indonesian tuna fisheries. However, in practice, the FMA could not be properly implemented because of various problems that still face the activities of tuna fisheries, such as capture of small tuna, low fish quality, and increasingly distant fishing ground (Nurani et al., 2015; Nurani et al., 2016; Gigentika, 2016).

Various problems as mentioned above, need to be addressed through the implementation of good fishery management systems, before they cause an adverse impact toward the sustainability of resources or a decrease in the stock of tuna. Based on the above background, it is time for efficient management of the tuna fishing activities in the Indian Ocean, particularly in the waters covered by the Indonesian Regional Fisheries Management (FMA 573).

One approach that can be used to solve a complex fishery problem is soft system methodology (SSM). It is a problem-solving framework designed specifically for situations where the nature of the problem is difficult to define (Checkland 1990; Checkland, 1999; Checkland and Scholes 1990). The essence of SSM it to build a system's model through deep understanding of problems related to the faced phenomenon (Williams, 2005). Studies using SSM approach in various fields have been carried out (Brocklesby, 1995; Bunch, 2003; Bunch et al., 2003; Mahregan et al., 2012). This research aims to evaluate the biological and technological aspects of tuna fishing activities in the FMA 573 and design models of tuna management at FMA 573 using soft system methodology approach.

Peer review under responsibility of National Institute of Oceanography and Fisheries.

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https://doi.org/10.1016/j.ejar.2018.06.005
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Please cite this article in press as: Nurani, T.W., et al. Model designs of Indonesian tuna fishery management in the Indian Ocean (FMA 573) using soft system methodology approach. Egyptian Journal of Aquatic Research (2018), https://doi.org/10.1016/j.ejar.2018.06.005

Methods

The framework of the problem solving approach in this study uses the soft system methodology (SSM). According to Checkland and Poulter (2006), SSM is implemented through seven stages which are: 1) understanding of unstructured problems 2) formulating problems in a holistic manner 3) developing the definition of the problem 4) creating a conceptual model 5) comparing the conceptual model with the facts on the field 6) determining the desired changes, and 7) taking action for improvement. In this study, only Phase 1 to Phase 4 will be conducted, while Phase 5 to Phase 7 are the implementation of the model into the system, and that will be done in the next research.

First phase is namely understanding of unstructured problems which is the comprehension towards the system's problems which are unstructured, complex, and inneed of a wide perspective. Problem comprehension is carried out through study literature, statistical data analysis, field observation and discussions with stakeholders in the research's sites.

An understanding of the system's conditions has been done through: firstly, field survey to measure tuna catches that landed at several fishing ports, which were Tamperan and Pondokdadap (East Java) from June to September 2013, Sadeng (Yogyakarta), Oeba and Tenau (East Nusa Tenggara) between April and July 2014. Then, collecting fishery statistics data for the past 5 years from these locations to estimate the stock of tuna, as well as the in depth investigation through focus group discussions (FGD) with tuna fishery stakeholders in the Fishing Port Cilacap and Palabuhanratu from May to July 2016. The locations of data sampling is shown in Fig. 1.

Then the second phase, namely formulating problems in a holistic manner, works to uncover the structured problem through three basic analyses: namely intervention analysis, social system analysis and political system analysis. This stage produces a clear picture of the complexity of the problem in rich details. A rich picture is basis to establishing a relevant system.

Third phase is developing the problem's definition (root definitions), which is an attempt to build the definition for the root of the problem including some particular views of the problem's situation in accordance with relevant perspectives. Root definitions (RDs) compiles information about the organization that has been collected, explored and discussed in the previous phase. The relevant system will be controlled by CATWOE (Customers, Actors, Transformation, Welltanschauung, Owners, Environmental). Three criteria are used as a reference for "how this transformation process should be implemented", namely 3Es: efficacy, efficiency, effectiveness.

The 4th phase is namely creating a conceptual model, which describes the operation of the system according to the observed problems. The model is built based on the researcher's idea to be able to provide solutions for problems that occur in the system. The model is made based on RD guidelines.

Result

The disclosure of problem situations

The disclosure of problem situations was acquired from the results of phase 1 and 2 of the soft system methodology. Disclosure issues included resource aspects and fishing methods. Conditions of tuna resources in the Indian Ocean are presented in the following sections.

Aspect of fish resources

Conditions of tuna resources in the FMA 573 have already been fully exploited. Based on the results of catch per unit effort (CPUE), CPUE of longline in OFP Cilacap tended to decline. CPUE of longline in OFP Cilacap from 2011 to 2016 amounted to 5,07 tons/trip but then declined to 0,15 tons/trip, respectively.

The results of Schaefer model analysis (Schaefer, 1954) estimated that the Maximum Sustainable Yield (MSY) of tuna in the Indian Ocean of southern waters of East Java was at 2.568,72 tons/year, with optimum effort (Eopt) amounting to 959 units of trolling line/year. The utilization rate of tuna resources in these waters for period between 2008 and 2012 was approximately 78,81% of the total allowable catches (TAC). While the estimation of the maximum sustainable potential value of tuna resources in the Indian Ocean of southern waters of Yogyakarta was at 441,75 tons/year, with optimum effort (Eopt) amounting to 755 trips/year for trolling line. The average utilization rate of tuna in

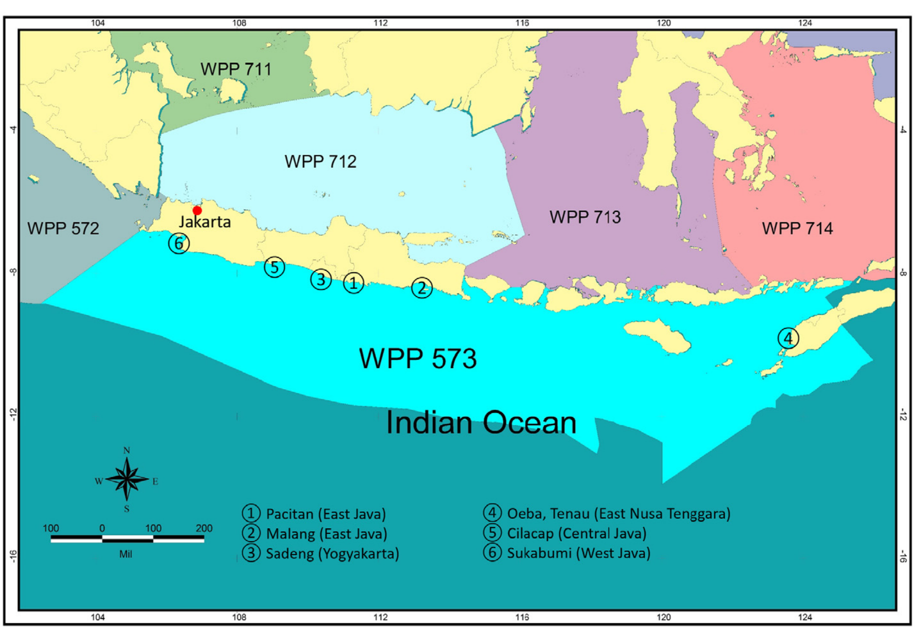

Fig. 1. Sample data location.