Abstract

Fishery is one of the renewable natural resources in which its exploitation should be well-planned. Today, overfishing has become a global issue. Total allowed catch (TAC) should be applied to maintain sustainable fish biomass stock. There are three methods to determine TAC. The first method is maximum sustainable yield (MSY) which focuses on maintaining the sustainability of fish stock. The second method is marginal economic yield (MEY) which focuses on single fishing effort to maximize profit. The third method is optimum sustainable yield (OSY) which focuses on maximizing absorption of fishermen employment sector.

TAC policy will affect on fish processing industries especially fresh fish processing. The core of marine fishery capture is industrial cluster involving thousands of fishermen. So, fish processing industry will give added value product. Before applying TAC policy, deep analysis should be done first to study the impact of regulation. Policy simulation can help determine the right policy for the region. The research objectives are (1) to develop the sustainable fishery industrial cluster model, (2) to study interlink between marine capture fishery and fish processing industry in a cluster, (3) to identify the effect of TAC regulation on the cluster and (4) to decide the suitable regulation for the region.

Powersim Studio Academic 2005 software is used to build a dynamic system, modeling system of sustainable fishery industrial cluster. The model consists of five sub models (1) sub model of fish stock, (2) sub model of fishing effort, (3) sub model of fishery economic, (4) sub model of fish processing industry and (5) sub model of industrial economic. Equilibrium model as logic of sustainable fishery model defines as equality between total catch with natural growth of fish stock, and the equality between fish production with total capacity of fish processing industries. The equilibrium condition will assure the sustainability of fish stock and economic industry by minimizing shortage of fresh fish. The model is tested by data of Muncar fishery industrial cluster.

There are four scenarios for model simulation, namely: (1) Condition without TAC, (2) TAC on MSY level, (3) TAC on MEY level and (4) TAC on OSY level. The Gordon Schaeffer formulation is used to determine fishing effort number. The model simulation reaches a steady state condition on stable value of fish stock.
Meanwhile, MSY scenario reaches the steady state in the year 2023, and MEY scenario in the year 2019, and OSY scenario also in 2019. Fish stock is representation of ecological aspect and a significant point in fishery management planning. MEY has the highest stock among all approaches. Economic aspect is presented by profit gain of fishing vessels and processing industries and the total of both are the regent’s profit. The profit resulted from all vessel owners in Muncar and all TAC scenarios. TAC on MSY level gives profit worth of Rp 95 billion/year, TAC on MEY level gives profit worth of Rp 144 billion/year, and TAC on OSY level gives profit worth of 60 billion/year. The total profit of industry on MSY method is 353 billion/year, on MEY method is 352 billion/year, and on OSY method is 272 billion/year. Social aspect is presented by a number of workers involved in the cluster. MSY approach absorbs 9,000 workers, MEY approach absorbs 6,000 workers and OSY approach absorbs 11,000 workers. Then, all sustainable fishery industrial cluster indicators are multiplied by its weight and its rating factors and compared to relevant indicator value on each scenario. The calculation result shows that TAC on MSY level and MEY level have the same value on the final result. However, MEY has the best result on economic and ecological indicators.

The testing model has proven that the model is able to give indicator value on aspects of ecology, economy as well as social aspect to support policy decision making process. Simulation output has given a good estimation on how much time needed by biomass stock to reach sustainable level after TAC regulation applied. After the model simulation reaches a steady state, the equality of total catch and natural growth can be seen on the model. Well-planned equilibrium condition assure sustainable economy for fishing vessels and processing industries. Model of fishery industrial cluster has given scientific framework in planning and assessment to the point of view of sustainable issue on cluster based on resources in fishery industrial cluster.

Key words: Industrial cluster, sustainable fisheries, dynamic system, simulation.