The Relevance of Socioeconomic Dimensions in Management and Governance of Sea Ranching

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Abstract: The southern coast of West Java has great potential tourism development due to the abundant resources of coral fish, coral reefs, sea grass, seaweed, sea turtle, mangroves and white sand beaches. On the other hand, there are challenges coming from fishing activities, which exploit the resources and thus leading to social conflict. This situation encourages communities to develop sea ranching, which is expected to open opportunity to harvest resources as well as to conserve it, such that the tourism potentials can be maintained. The research aims to analyze and evaluate a local social economy based model for ranching sea management. This research used primary and secondary data, which were processed using the Analytical Hierarchy Process (AHP). The results of the analysis showed that for the development of sea ranching in the area, the preferred strategy is the management by local communities which put forward a number of important aspects in the region namely bioecoregion, fish species, technology, and socioeconomic values. Further, the results of the study concluded that sea ranching activities need to synergize the development of marine tourism and marine aquaculture, where in the main goal is the availability of alternative business for local people and reduction of pressures on resources.

Key-Words: sea ranching, local social economy, community, bioecoregion, management

1 Introduction

The utilization of fish resources in Indonesia is faced with the problem of scarcity and over fishing from the condition of open access. Firstly, unlimited fisheries resources are accessed by the number of unlimited vessels which cause damage to fisheries resources. Secondly, there is no control over vessel access and regulation of catches and a decrease in the level of fishermen's welfare which is part of socioeconomic conditions.

For these reasons, Fisheries authority in Indonesia's coastal areas, especially in the area Pangandaran, West Java Province is necessary to manage the fishery resources to improve the welfare of fishermen (Nurhayati, 2014). As an example is to increase fish stocks of aquaculture activities by releasing organisms into the natural stocks of the same species on a regular basis, with the aim of increasing the abundance of fish stocks.

Bell et al. (2008) asserts that the restocking and stock enhancement should be placed in the framework of a management system that integrates seeding with suitable controls to the efforts of fisheries and habitat protection. This implies the need for a system that combines fisheries with capture fisheries. At sea, the cultivation is done in floating net cage systems, pen culture system (cage), and others. The fishery is done by sowing seeds in the sea until one day they be recaptured. This 'fish farming in the sea' system is known as the sea ranching system. Systems that combine the activity of aquaculture and sea ranching in the sea that is known for sea farming.

Sea farming is currently being implemented in the area of Pangandaran, West Java. Aquaculture fish in floating net cages in these waters is already running and the types of fish that are cultured grouper. However, restocking is done in the area of aquatic sea

ranching is not running optimally. Therefore, it is necessary to develop systems that balance between cultivating the sea ranching system such that optimal, both in terms of ecological, economic and social (Nurhayati, 2014). Sea ranching is done by increasing fish stocks in the sea. Fish stock can be increased through restocking activities whose seeds are produced by hatchery activities. In sea ranching, hatchery as one of the mariculture activities plays a role in replacing the natural reproduction and growth of fish in the sea (natural) so that it can increase the survival rate of the fish.

Restocking requires the temporary release of aquaculture organisms into wild stocks that have been exhausted by overfishing, extreme environmental conditions, with the aim of accelerating the recovery of fisheries resources stock. One program to be able to increase capture fisheries production and maintain the condition of the marine environment to be better through the management of the sea ranching model. Sea ranching is done by increasing fish stocks in the sea. Fish stock can be increased through restocking activities whose seeds are produced by hatchery activities (Nurhayati, 2013).

Sea ranching is the maintenance of fish in an aquatic area and the area has natural isolation so that fish that are stocked (restocking) are usually as certained that they cannot move places and can be recaptured (Effendi, 2004). Sea ranching is an alternative to increase productivity in marine aquatic ecosystems where there are excessive catches or exploitation of catches. (Ungson ,1993).

In sea ranching human control began to wane in which everything depends on the carrying capacity of life of local life. Control of the sea ranching is only in controlling and regulating the arrest by monitoring local fishing gear fishing season and size of fish that may be caught. Sea ranching activities include several activities including: location determination survey, habitat improvement by installing artificial reef habitat, natural growth of sea weed or by preparing prepared seeds, selection of fish, shrimp and shellfish species to be released into sea, management, arrest and organization (Azwar and Ismail, 2001)

Sea ranching will depend on the geographic and hydrographic characteristics of the region, so that the technological elements used will be highly adapted to the location. Sea ranching models must consider the condition bioecoregion and ecosystem conservation in a coastal area. Bioecoregional point land water mass with a strong ecological connectivity which is also characterized by the dominance of marine and fisheries resource potential. (Nurhayati and Purnomo, 2017). According to Maasaru (1999), sea ranching has two types, namely harvest and recruitment. In the type of harvest the seeds to be stocked will be produced and raised (to a certain size) in a hatchery, harvesting in the wild is carried out when the organism has reached commercial size. At type recruitment, seeds are produced and raised in hatcheries that are stocked in an area of water and then left to reproduce, so the seeds stocked are expected to grow, mature eggs, spawn and then hatch in the fishing area for natural reproduction with the help of adequate fisheries management .

The release of fish in a sufficiently specific area should pay attention to ecological and social economical aspects. This ecological aspect is intended not to interfere with the food chain process in a particular area where the fish to be released must be native fish from the area or fish in the arae. Economical aspect is meant is that the released fish must have a significant economic value in a particular area and not cause social conflict. In terms of habitat, the area suitable for the development of sea ranching is coral reefs, mangroves and bays.

The success of aquaculture in sea ranching system is determined by the environmental suitability factor is one which must be considered in determining the area for sea ranching. Therefore, spatial planning strategy must be based on the concept of sustainability is done systematically and comprehensively. Through a comprehensive assessment by considering all aspects of biophysics, harmony and balance of the environment based on sustainability, socio-economic aspects by taking into account the aspirations of the people who use coastal areas (stakeholders) so that conflicts of interest can be

avoided. Aquatic environmental conditions both directly and indirectly will affect aquatic productivity which in turn will affect fish grouping (Widodo, 1998). If the environmental conditions deteriorate, pelagic fish species are still able to migrate to new waters that are better in condition, while demersal fish species such as reef fish are unable to evade, which can lead to a decrease in reef fish abundance. Several studies reveal that physical parameters have an important influence in determining the distribution of aquatic organisms, especially currents, depths and substrate (McGehee, 1994).

The suitability of the area is certainly not independent of the type and economic value of the endogenous aquatic organisms that are targeted for sea ranhcing activities (Nurhayati, 2017). The socioeconomic component that is run in sea ranching is like a business, which produces goods and services in the fisheries sector, namely fish production and maritime tourism services to meet market needs, but in its management directs the value of surplus production to achieve social and environmental goals.

Socioeconomic lies in thinking of the capitalists as the first attempt to create an alternative community response to the capitalist economy through the use of the cooperative model. The concept is very quickly used to refer to companies and associations collectively guided by ethical and moral considerations, not only material benefits but to consider the social aspect and the environment by involving elements of mutualism, connectivity, collectivity and social control. Socio-economic as association-based initiatives that are based on the values of solidarity, autonomy, and citizenship contained in principle with the main purpose of services to members or the community rather than to collect profits; management is autonomous; democratic decision-making process (Nurhayati, 2018).

The sea ranching model requires adequate community institutions so that they can be managed properly. Institutional capacity building is expected to play a role in technical assistance and the formation of business groups related to reef fish cultivation with sea ranching systems. Making regulatory formulations to design a series of policies and objectives to be achieved regarding restocking and rehabilitation of coral reefs in supporting tourism activities. Institutional strengthening should be supported by the existence of a clear property right system for the sea ranching area through the creation of "limited fishing" areas (Demarcated Fishing) so that in its management it does not cause conflict between various authorities in the region. There is legal recognition from the local government on local agreements that have been determined (Nurhayati, 2018).

Supportive activities are expected so that sea ranching marine tourism and mariculture can be run in synergy, which leads to the situation where local communities have alternative operations, so the pressure on fisheries resources can be suppressed and indirect conservation efforts can be implemented. Commodities that can be developed as aquaculture businesses that are economically valuable are seaweed, groupers, lobsters and sea cucumbers that have high economic value and are profitable. Thus this area remains sustainable, where the economic and ecological functions become optimal, of course, still has a high selling value as a tourist attraction.

2 Problem Formulation

2.1.Time and Location Research

This research was conducted in the Pangandaran bay area of West Java province. The research was conducted in January to August 2018. The method of determining the station points to the source of biophysical data (coral reef, reef fish, water quality) was done with a purposive sampling method, where the station point determination is done based on certain considerations. Considerations taken include the area of coral reef waters, a wide range of research locations, transportation, researcher safety and time and costs. Broadly speaking, the data sources taken are two, namely primary and secondary data. Biophysical data in the form of coral reef closure and observations of the density of reef fish and data on water conditions. Social data in the form of fishing activities, fishing methods,

socio-economic conditions and institutions of local fishermen.

2.2.Procedure Data Analysis

The selection of fish species is also based on data and information obtained from the field and policy makers and experts who have knowledge about coral fisheries. Alternative fish commodities that will be cultivated are done by ranking and scoring then analyzed using Analytical Hierarchy Process (AHP) with computer-based data processing using Expert Choice 2000 software. The use of Analytical Hierarchy Process (AHP) in the selection of reef fish commodities because the aspects and criteria that are taken into consideration are quite numerous, complex and unstructured. Decision making by using AHP is done by simplifying all the unstructured criteria aspects, arranged them into component parts of a hierarchical arrangement, then given numerical consideration by the respondent. (Saaty, 2008).

The steps in data analysis with *Analytical Hirarchi Proces*: (1). Defining the problem and determining the solution to the problem; (2) Create a hierarchical structure that begins with general objectives, followed by sub-goals, criteria and possible alternatives at the lowest criteria level; (3) Create a pairwise comparison matrix that describes the relative influence or influence of each element on each of the objectives above that level, a comparison based on the judgment of the decision makers by assessing the importance of one element compared to other elements. To quantify the qualitative data on the interview material, the value of the comparison scale 1 - 9 was based on the Saaty Scale; (4) Do pairwise comparisons, this activity is carried out by competent stakeholders based on the results of stakeholder analysis; (5) Calculating feature roots, feature vectors, and testing their consistency. If it is not consistent then the data collection is repeated or corrected. Consistency Index (CI) states consistency deviations and states the size of the consistency of a pairwise comparison assessment. The value of consistency measurement is needed to determine the consistency of answers from respondents because it will affect the validity of the results.

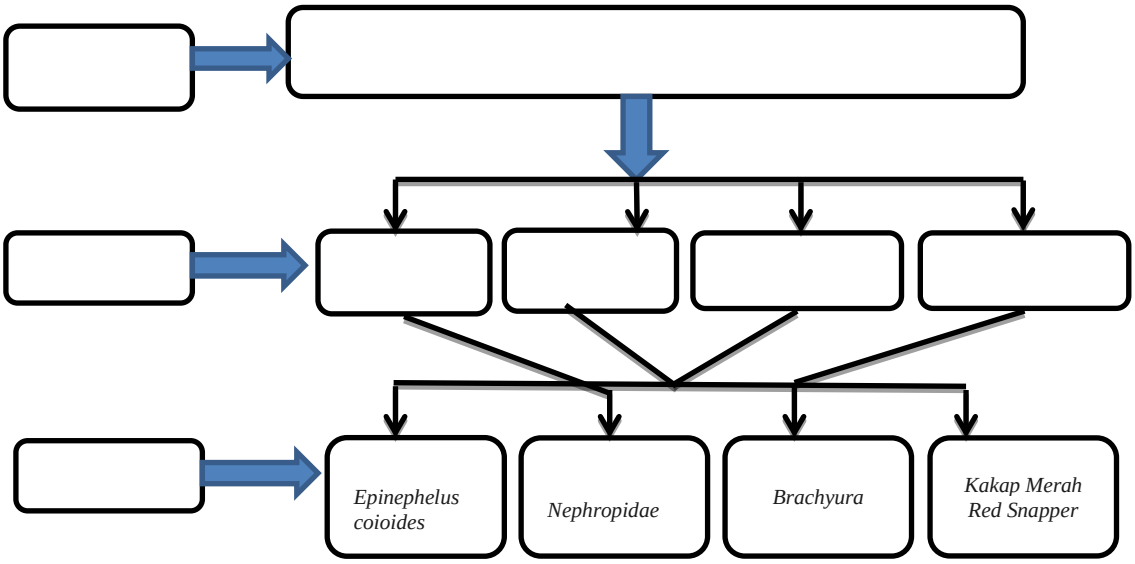

Fig.1. Hierarchy of selection of reef fish commodities with sea ranching system.

3 Problem Solution

3.1. General Conditions of Research Locations

Pangandaran area is located in West Java Province which borders Ciamis district and Banjar City in the north, Cilacap district in the east, Indian Ocean in the south, and Tasikmalaya district in the west. The birth of Pangandaran district is based on Law No. 21 year 2012, namely as a new district, signed by the President of the Republic Indonesia on November 16, 2012. Then it was promulgated by the Ministry of Law and Human Rights on November 17, 2012, then Pangandaran officially became a District in West Java Province. In Law No. 21/2012 mentioned, District Pangandaran from a portion of the Ciamis district.

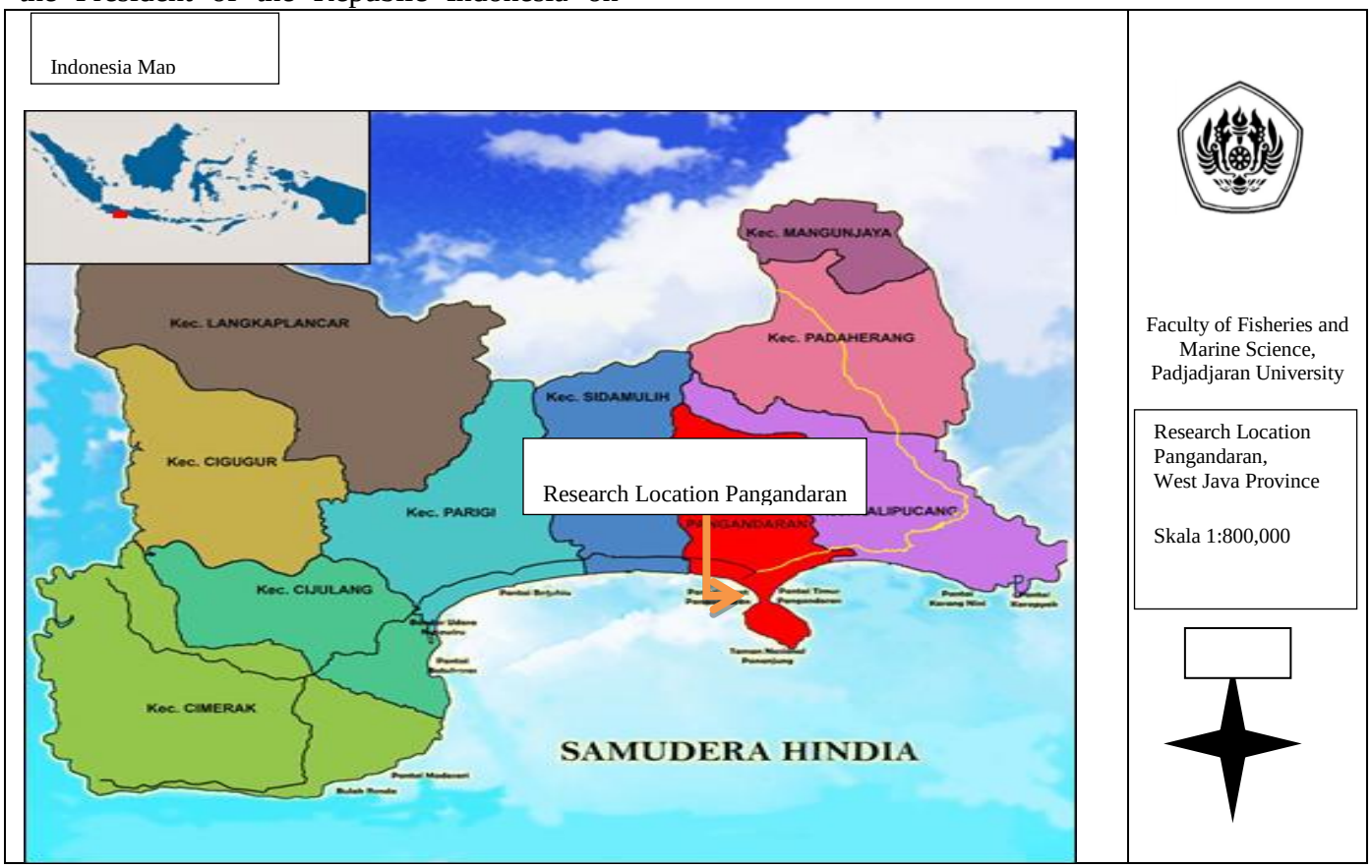

Fig 2 Research Location In Pangandaran West Java Province,Indonesia

Pangandaran District already become an important area and so the strategic areas in West Java province. One of the regions is Pangandaran a which includes 5 sub districts (Cijulang, Parigi, Sidamulih, Pangandaran, Kalipucang). This area has been designated as growth centers according regulation No. 12/2014. The total area is 168,509 ha. Pangandaran district with an area of 67,340 ha sea. Pangandaran district has a beach length of 91 Km (Regional planning agency of West Java Province, 2016). The geographical structure of the Pangandaran district which is a coastal area so that many people have a living perspective as fishermen in the number of fishermen in Pangandaran Regency based on 2016 data as many as 4,411 people.

Fishermen in the Pangandaran district are able to produce a relatively large amount of capture fisheries production even though using minimal fishing equipment and low technology.

Most fishermen use outboard motors with the power of 2 GT engines to catch fish, this happens because the required operational costs are more affordable compared to the use of larger capacity vessels (Marine and fisheries agency of Pangandaran district, 2016).

In general Pangandaran has a tropical climate with two seasons, the dry season is often referred to as the east season and the rainy season or the western season with an average rainfall of about 1,647 mm per year, humidity between 85-89% with a temperature of 20-30^{0}C (Meteorlogical, Climatological, and Geophysical Agency, 2016). The east and west seasons will directly affect the fishing season in Pangandaran waters. The east season occurs from May to October, where during this season the sea does not have big waves and the waters are calm, so that fishing operations in the sea are not disturbed. The west season occurs from November to April, where during this season many fishermen do not carry out fishing operations in the sea due to sea conditions with large waves and relatively heavy rainfall.

3.2.Resource Potential of Fisheries and Maritime Tourism in Pangandaran District

The potential of fisheries resources and marine tourism in the Pangandaran region cannot be separated from the ecological functions of coral reefs, among others, as a place of spawning, enlargement, foraging for various types of reef fish. Coral reefs are also considered important because it produces products such as reef fish, ornamental fish, shrimp, algae, and bioactive materials. Coral reefs are complex ecosystems with high biological diversity that supports the productivity of fisheries. In Pangandaran District, coral reefs are found scattered on the Krapyak Beach 2.5 km long and approximately 75 m wide, East and West Coast Pangandaran along 1.5 km with a width of 50 m, Karangjaladri beach approximately 200 m wide and 100 m wide and in Parigi waters area is spread locally with a total area of about 390 hectares at a depth of between 2 - 20 m.(Environmental Agency of West Java Province, 2016).

Based on the results on the field the condition of coral reefs has been damaged. On the south coast of seagrass found in Pangandaran, Ciamis form *Thallassia hemprichii* communities that grow on a substrate of sand and dead coral species. Mangrove ecosystem in Pangandaran District scattered in the area Majingklak-Kalipucang to Parigi. The mangrove ecosystem is one of the coastal resources that serve as habitats, feeding ground, nursery grounds, spawning ground for various organisms (Bengen 2001). One organism that has an ecological relationship in mangrove areas is mangrove crabs. (Keenan et al. (1999) states that the mangrove crab consists of four types, namely: *S. serrata*, *S. tranquebarica*, *S. paramamosain*, and *S. olivacea*. Mangrove crabs are one of the important economic fisheries that are consumed as a quality animal food source and used as export commodities, so that mangrove crabs are placed as exclusive types of seafood with quite expensive prices. Fisheries become the leading commodity in Pangandaran. These marine biodiversity include types of consumption reef fish (snapper, grouper, baronang, kuwe), ornamental reef fish, lobster, crab (blue swimming crab), mangrove crab, layur fish and various other pelagic fish that migrate to coastal waters (Directorate General of Capture Fisheries, 2007).

The use of reef fish has developed in Pangandaran, but its management received less attention. Utilization of reef fish resources included in the utilization directly on coral reefs, so the impact on the ecosystem utilization also quite large, therefore it is necessary for the recovery of fish stocks. Recovery of fish stocks is an integral component of fisheries management (Powers, 1996). The term fish stock recovery is defined as the activity intended to increase or preserve recruitment fisheries resources and aims to increase the total production of fishery resources that will be selected and still below the sustainable level of natural processes (FAO, 1999). Fish stock recovery activities by conducting seed or parent stocking are usually carried out in public waters covered in land but begin to be carried out in semi-closed sea waters such as Pananjung

Pangandaran Bay. The potential of coastal resources are owned by the Pangandaran is fisheries and marine tourism. The tourism objects in Pangandaran are: Pangandaran Beach, Pananjung Nature Reserve, Batu Hiu Beach, Batu Karas Beach, Madasari Beach, Karapyak Beach, River Tourism and Green Canyon (Tourism and cultural Agency of Pangandaran district, 2017).

3.3. Suitability of the Aquatic Environment for the Sea Ranching Model

The success of managing the sea ranching model is determined by the environmental suitability factor which is a stage that must be considered in determining the area for sea ranching. Therefore the spatial planning strategy must be based on the concept of sustainability which is carried out systematically and integrated manner. Through a comprehensive assessment by considering all aspects of biophysics and balance of the environment based on sustainability, socio-economic aspects by taking into account the aspirations of the people who use coastal areas (stakeholders) so that conflicts of interest can be avoided (Nurhayati, 2012).

In the hierarchy process the selection of fish species in the sea ranching model is used as the first level which is the goal of Anayitical Hierarchy Process. The criteria are based on the results of field observations and based on references to factors that influence the success rate of sea ranching in the Pangandaran region, which consists of: (1) ecology, (2) economy, (3) social. Alternative determination (type of fish) is placed at the lowest level in the hierarchy process of fish species, namely: (1) grouper, (2) Lobster, (3) mangrove crab, (4) red snapper.

Table 1 Results of comparison between criteria for selecting fish commodities with sea ranching models

No	Criteria	Weight
1.	Ecology	0.3342
2.	Economy	0.3015
3.	Teknology	0.1581
4.	Social	0.2754

Analysis of the four criteria for selecting fish species for sea ranching, showed that ecology had the highest priority values with weight (0.3342), economy (0.3015), social (0.275) and technology with weights (0.1581). The weight of each complete criterion can be seen in Table 1.

The high weighting to ecological criteria (0.3342) caused by the indicator suitability of the aquatic environment (temperature, salinity, physical, chemical, biological), availability of seed, availability of natural food, is a crucial factor in the continuity of the model of sea ranching. Environmental suitability is a top priority in the selection criteria for fish species because not all types of fish are cultivated in all conditions of the aquatic environment.

Sea ranching system is in addition carried out habitat improvement is usually followed by a fish restocking activities in order to increase the productivity of fisheries. This sea ranching system in addition to habitat improvement is usually followed by fish restocking activities in order to increase fisheries productivity. Economic criteria with weights (0.3015) are the criteria that become the second priority in the selection criteria for the type of fish to be carried out with the sea ranching model.

The high selling price is a factor that influences the selection of fish species for sea ranching because the selling price for each type of fish varies greatly. The social criteria (0.2754) is the third priority in the implementation of the sea rancing model by involving local institutions in the fishing community, namely the association of Indonesian fishermen, fishermen cooperatives, fishermen's association and fishermen groups in the Pangandadran area which are expected to minimize fishermen conflict from the model activities sea ranching to be able to maintain the condition of internal and external ecosystems through participatory institutions.

Technology criteria (0.1581) are the lowest priority weight, because the application of sea ranching technology in general is relatively similar for each type of fish. The difference in management lies only in differences in the living characteristics of each type of fish and can be adjusted by technically modifying it through habitat improvement through coral transplantation systems or making FADs and

others. This is done, given that the condition of coral reefs in the Pangandaran area is in moderate condition. Alternative analysis of fish species is obtained through alternative comparisons to criteria. This comparison is done to see the relative comparison between alternatives for each set criteria.

The results of the comparison analysis between alternatives on each criterion in the hierarchy process are as follows:

1. Ecological Criteria

Analysis of four alternative types of fish to ecological criteria shows that lobster has the highest weight. Lobster (0.3523). Furthermore, successively, the priority weight of fish species on land suitability criteria is grouper (0.3011), red snapper (0.2745) and mangrove crab (0.0721). The weight of each alternative to the criteria for availability of seeds for more clearly can be seen in Table 2

Table 2 Weight of alternative priority fish species of the ecological criteria

No	Criteria	Weight
1.	Grouper	0.3011
2.	Lobster	0.3523
3.	Mangrove Crab	0.0721
4.	Red Snapper	0.2754

Based on observations of species of fish in the Pangandaran area, Lobster species (0.3523) have ecological criteria that are suitable for the sea ranching model in the Pangandaran area. Based on the results of research in the field of lobster species in the Pangandaran area, namely Lobster Bambu (*Panulirus versicolor*), Lobster Batu (*Panulirus homarus*), Lobster Mutiara (*Panulirus ornatus)* dan Lobster Pasir (*Panulirus cygnus*). Lobster fishing season mainly occurs in November to February, with the peak season occurs in December. This month is the rainy season, and the wind blows from the northwest.

At that time, the condition of the northern coastal waters would be very bumpy, while the southern coast waters were relatively calm. Every organism in a community has a different tolerance for each limiting factor that works in its environment and affects its life and development. If an area has a temperature exceeding the tolerance limit of a species, then in this area certain species may not be found.

From the survey results on the biophysical conditions of coral reefs, there were no significant differences in water quality and almost homogeneous in each observation. Water quality factors are still within tolerance for growth and development of coral biota. The spread of reef fish is found in dead and living coral areas, on fine rocky sand.

2. Economic Criteria

Analysis of four alternative types of fish to economic criteria shows that lobster has the highest weight that is Lobster (0.3011). Next, successively, the priority weight of fish species to the suitability criteria of grouper land (0.2513), red snapper (0.2612) and mud crab 0.1864. The weight of each alternative to economic criteria for more clearly can be seen in Table 3

Table 3 Weight of alternative priority fish species on economic criteria

No	Criteria	Weight
1.	Gouper	0.2513
2.	Lobster	0.3011
3.	Mangrove Crab	0.1864
4.	Red Snapper	0.2612

Based on observation of fish species in Pangandaran, the type of Lobster (0.3011) have the appropriate economic criteria for sea ranching models in Pangandaran. Lobster is a leading fishery commodity that has high economic value in the fishery product trade at local and international levels. Some types of fish have an important economic value, both for domestic consumption and export. Except in the form of fresh, frozen or processed, sea fish are also widely exported in living conditions, among others are grouper and red snapper. Type of grouper in the Pangandaran area is Tiger Grouper (*E. fuscoguttatus*), Sunu Grouper (*Plectropomus maculatus*), Duck Grouper (*Cromileptes altivelis*).

3. Social Criteria

Fisheries resources can be recovered and renewed but need management to remain sustainable. In addition to management, competitive power to utilize fisheries resources and dependence on production from fishing efforts need to be reduced. Therefore, it is necessary to consider the concept of utilization

and management of fisheries resources based on community institutions, thus opening opportunities to develop fisheries business through sea ranching.

Analysis of four alternative types of fish against social criteria shows that lobster has the highest weight (0.2711). Furthermore, successively, the priority weight of fish species on the land suitability criteria is grouper (0.2457) and red snapper (0.2612) and mangrove crab (0.2210). The weight of each alternative to social criteria for more clearly can be seen in Table 4

Table 4 Weight of alternative priority reef fish species on social criteria

No	Criteria	Weight
1.	Gouper	0.2467
2.	Lobster	0.2711
3.	Mangrove Crab	0.2210
4.	Red Snapper	0.2612

Institutional social criteria and regulations are a key determinant of the success of sea ranching more broadly. This criterion includes the existing institutions of the fisheries community, the role and function of the institution, the fishermen group, management regulations, and the opportunity to carry out monitoring on the sea ranching model.

4. Technology Criteria

Analysis of four alternative types of fish on the technology criteria of sea ranching model shows that grouper has the highest weight, namely grouper (0.2823). next, respectively, the priority weight of fish species on sea ranching technology criteria is red snapper (0.2713), mud crab (0.2630) and lobster (0.2342). The weight of each alternative to sea ranching technology criteria can be seen in Table 5.

Table 5 Priority weights Types of fish to technological criteria

No	Criteria	Weight
1.	Gouper	0.2823
2.	Lobster	0.2630
3.	Crab	0.2205
4.	Red Snapper	0.2342

The results of observations show that most fishermen place lobster fishing businesses as part-time livelihoods. The fishing gear used is dominated by net trap, and compressors, all of which are less environmentally friendly and damage basic aquatic habitats, it is recommended the use of fishing gear for the sea ranching model is more environmentally friendly. This shows that sea ranching technology has experienced significant improvements such as seed production, releasing, recapturing techniques. Technically this system is relatively not requiring high technology in construction design, because the maintenance of the fish is done naturally, namely by using coral reefs as natural habitats.

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Comprehensive comparison analysis between alternatives to all criteria to obtain the priority weight of the most fish species as a commodity for restocking. The relationship between alternative fish species with all the criteria of reef fish commodities with sea ranching system. The results of inter-alternative comparison analysis of all criteria shows the relative comparison between the types of fish that are most suitable for all criteria to be used as commodities. Comprehensive comparison analysis between alternatives to all criteria for obtaining priority weight of the most suitable fish species in the sea ranching model, as follows

Table 6 The results of the analysis of the relative comparison of fish species with sea ranching models

No	Fish Species	Ecology	Economy	Social	Technology	Weights
1.	Gouper	0.3011	0.2513	0.2467	0.2823	0.2913
2.	Lobster	0.3523	0.3011	0.2711	0.2630	0.3230
3.	Crab	0.0721	0.1864	0.2210	0.2205	0.1547
4.	*Red Snapper*	0.2754	0.2612	0.2612	0.2342	0.2310

The results of the analysis in Table 6 show that for fish species for sea ranching activities the total highest priority weight is lobster

32.30% (0.3230), followed by grouper 29.13% (0.2913), red snapper 23 , 10% (23.10) and mangrove crabs 15.47% (0.1547).

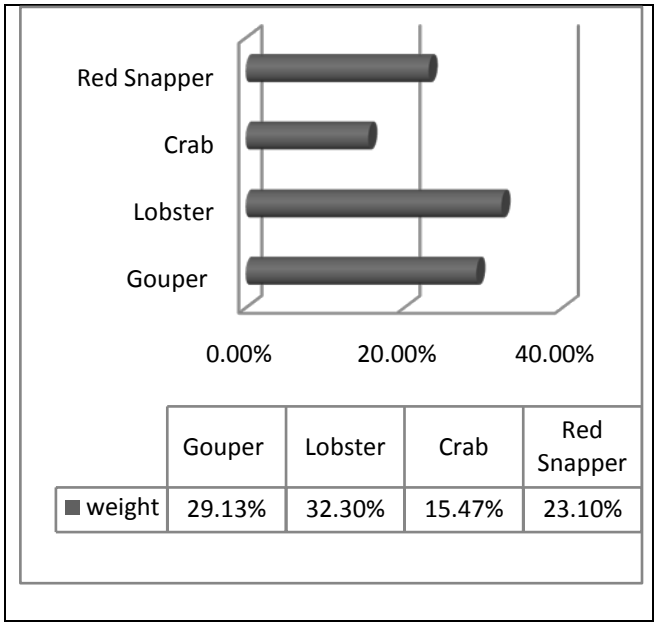

Fig 3 Fish Species For Sea Ranching

The selection of lobster as a cultivation commodity using the sea ranching model, because lobster has a high enough priority value in almost all criteria. This is not separated from the interrelationship between each factor where all the criteria influence each other. The factors that influence the selection of lobster as a type of fish with the sea ranching system in Pangandaran are: (1) having high economic value, (2) the condition of the aquatic environment that is suitable for the growth and development of lobster; (3) model technology by sea ranching is relatively easy to do with supporting ecosystem conditions, (4) social institutions through a participatory approach are able to support the implementation of the sea rancing model to be applied in other regions.

4 Conclusion

Based on the results of research A Local Socio Economy Based Model For Sea Ranching Management, four criteria are needed in determining the commodities that are suitable for sea ranching models, namely ecology, economics, social and technology with the main commodity types, namely lobster. Sea ranching models need to synergize the management between maritime tourism, capture fisheries and aquaculture. This also need to accommodate socio-economic values in fishing communities, by not damaging coastal ecosystems.

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References

Azwar, Z.I. and Ismail, W. 2001. Increased Productivity of Coastal Fishing by Sea Ranching Method. Marine Exploration Research Center. Jakarta.

Begen, D.G. 2001. Introduction and Management of Mangrove Ecosystems. Bogor Coastal and Marine Resources Study Center. Bogor

Bengen, D.G. 2001. Coastal and Marine Resource Ecosystems and Integrated and Sustainable Management, (Proceedings of Integrated Coastal Area Management Training, Bogor 29 October - 3 November 2001. IPB Coastal and Ocean Resources Study Center) [Indonesia]

Directorate General of Capture Fisheries 2007. Statistics of fishery product exports and imports 2005. Directorate General of Capture Fisheries. Jakarta.

Environmental Agency of West Java Province, 2016. http://dlh.jabarprov.go.id/Tourism and cultural Agency of Pangandaran district,2017. http://dispar.pangandarankab.go.id/profil-pariwisata-kabupaten-pangandaran/

Effendi. I. and Taryono, W.O. 2003. Structuring of Marine Cultivation Area (Preparation of Sea Cultivation Plan of Semak Daun Island, Coral Island, Congkak Island, Coral Island of Bangkok and Rice Island Coral). Government of the Thousand Islands of LPM-IPM. Bogor

Food and Agriculture Organization of the United Nations. 1999. FAO Spacies Identification Guide for Fishery Purposes : The Living Marine Resources of the Western Central Pacific Vol 3-5. Roma.

Keenan C.P. 1999. The Fourth Spesies of Scylla. In Mud Crab Aquaculture and Biology. ACIAR Proceedings N0.78. Canberra. Page. 48-58.

Marine and fisheries agency of Pangandaran district, 2016. Fisheries and Marine Statistics Book. Pangandaran.

Masaaru. 1999. Marine Ranching: Present Situation and Perpective in Marine Ranching Global Perpective with Emphasis on The Japanese Experience. FAO Fisheries Circular.

Meteorlogical, Climatological, and Geophysical Agency, 2016. https://www.bmkg.go.id/. Meteorlogical, Climatological, and Geophysical Agency, 2016. https://www.bmkg.go.id/.

McGehee M.A. 1994. Correspondence between Assemblages of Coral Reef Fishes and Gradient of Water Motion, Depth, and subtrace Size. Ecol. Prog.

Nurhayati, A. (2012). Regional Government Policy Analysis In Support of Fishery Resource Level Sustainability (Case Study in Pangandaran Area). *Journal of Social Economic Policy on Marine and Fisheries* Vol. 2 No. 2 .2012.

Nurhayati, A. and Purnomo, A.H. 2014. A Case Study on Sustainability Analysis of Fisheries in Pangandaran, West Java Province. Journal of Agricultural Science and Technology B Vol.4. Number 4 April 2014: 321-330.

Nurhayati.A.,2013. Analysis of Sustainable Potential of Capture Fisheries.Journal Akuatika Vol IV No 2 September 2013:195-209.

Nurhayati, A. and Purnomo, A.H. 2017. Developing the Marine and Fisheries Industry in Pangandaran using a Bioecoregion-Based Technopark Framework. Journal of STI Policy and Management. 15 July 2017: 43-52.

Nurhayati, A. and Purnomo, A.H. 2018. Bioecoregion and Socio-Economic Connectivity Oriented Coastal Zone Management. Journal Applied Ecology and Environmental Sciences, 2018, Vol. 6, No. 1, 31-34.

Powers, J.E. 1996. Benchmark requirements for recovering fish stocks. North American Journal of Fisheries Management 16:495-504

Saaty, T.L. (2008). Decision Making with the Analytic Hierarchy Process . Int. J. Services Sciences, Vol. 1 No. 1, pp. 83-98.

Widodo J.K. and Aziz, A. 1998. Potential and Spreading of Marine Fish Resources in Indonesian Waters. National Commission for Assessment of Marine Fish Resource Stock. Indonesian Institute of Sciences, Jakarta, Indonesia. (Regional planning agency of West Java Province, 2016.