



Regulated Fisheries Regime for Sea-ranching at Semak Daun Island Shallow Water, Kepulauan Seribu-Jakarta

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Abstract

Fish demand increase as consequence of population growth. This escalates fishing pressure and affects overfishing. One of approaches for enhancing fish capacity of overfished fisheries is sea ranching. Sea ranching is a process of releasing juvenile into enclosed water under put-grow-take system. Sea ranching system requires demarcated area. One of the critical factor for implementing sea ranching is reducing/controlling access of fishermen to the resource.

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Then, fishing is needed to be regulated with closed/restricted access. Unfortunately, it doesn't meet the current open access fishing regime. This paper is aimed to identify required fishing regulations and fishing right for ensuring sea ranching at Semak Daun Island shallow water of Kepulauan Seribu-Jakarta. Result of the study express fishing at the study site is under open access or quasi open access regime. Fishing regulation is required internally which is based on the well-developed harvest planning and control. Fishing regulation content are fish size, time, volume and fishing gears allowed. Regulation that embraces externally is fishing right at the demarcated area, which is under form of property right. The fishing right must meet its characteristics i.e. exclusivity, duration, flexibility, quality of title, transferability and divisibility. Legal-formal aspect of demarcated right of sea ranching area must be acquired from local authorities to achieve strong and robust fishing right for sea ranching implementation. However, fishing right must meet legal aspect but need more reason for morally accepted.

Keywords: demarcated right; fishing right; open access; overfishing; regulated fisheries; sea-ranching.

1. Introduction

The future of marine capture fisheries is depended on political evolution, social and regional economy [1], and access to exploited stocks [2]. Globally, increasing demand of food stuff as an impact of population growth leads to increasing fish demand. Currently, fishing productivity is situated by highly pressured that originate from fishing, increasing organic pollution, poisonous contaminants, coastal degradation, and climate change [3], which is also happened in coastal and small island fisheries.

Due to global fish population decrease, there is a raise awareness on the need of marine capture stock enhancement [4]. Increase of fishing capacity in the long term, links to crucial decisions on reducing effort, fading away of fishing capacity excess and establishing institution which support right or incentive for better management [1,5]. Only few of successful restocking and stock enhancement program worldwide [5]. Stock enhancement is simultaneous efforts for achieving both of ecological and socio-economic goals [6]. Wild stock stability is ecologically benefited, while increasing fish catch meet socio-economic objectives. Time frame is important matter for assessing the success of stock enhancement and restocking program. Then, it is need to be more precise objective of juvenile release into nature world.

Release of juvenile into nature are in the forms of restocking, stock enhancement, and sea ranching [5,7,8]. Sea ranching is a release of cultured juvenile into particular enclose marine ecosystem under put-grow-take system [8]. This system mainly lie on natural capacity and there is no additional feeding. Because of recaptured objective, some infertile stocks are occasionally used when natural recruitment process is precisely unexpected [9]. It is aimed for ensuring and maximizing somatic production and estimation will be able to be conducted better.

Sea ranching is a pattern for improving marine fish stock from juvenile cultured which is designed to increase fish catch [10,9], not for enhancing natural recruitment or recovering of depleted stocks purposes [11]. Although it is possible, releasing juvenile for sea ranching is not intended to enlarge spawning biomass. Sea

ranching become one of the alternative approaches for increasing fishing capacity of overfished fisheries. This is a balance activities that include of culture of juvenile, rear fish and recapture fish at consumable size. Then, ecosystem utilization will be as sustainable activities processes.

It is clearly, juvenile release is targeted to be recaptured at a certain consumable size. For ensuring satisfactory natural growth of released juvenile in the specific enclosed ecosystem, the pressure must be controlled or if it is possible to be removed [12]. At least there are three crucial factors that must be considered including : uncontrolled harvest/recapture process (time and volume), habitat degradation, and unauthorized catching. Thus, open access fishing (harvesting) is no longer permitted and need to shift unregulated into restricted/closed access and regulated fishing regime. One of the potential site of sea ranching is Pulau Semak Daun shallow water in part of administrative authority of Kepulauan Seribu Municipal Administration -Jakarta. Sedentary species brown marbled grouper (*Ephinepelus fuscogutatus*) is a favor species. For doing so, it is important to do analysis of fishing regime changes as a requirement of sea ranching system. Internally, tactical regulation for harvesting/recapturing of fishes which live in particular sea-ranching area is necessary developed, to ensure the processes of sea ranching are going well and satisfactorily. Regarding to the demarcated waters as a precondition for sea ranching system, the study of legitimated fishing right both of internal and external perspectives is necessarily conducted.

2. Method

2.1. Time and Location

This research was conducted at May-August 2014. It is located at the Semak Daun shallow water, which is administratively belonged to Pulau Panggang Village, Northern Kepulauan Seribu District-Kepulauan Seribu Municipal Administration (KSMA). This site is potential for development of sea-ranching of brown marbled grouper (*Ephinepelus fuscogutatus*) [13].

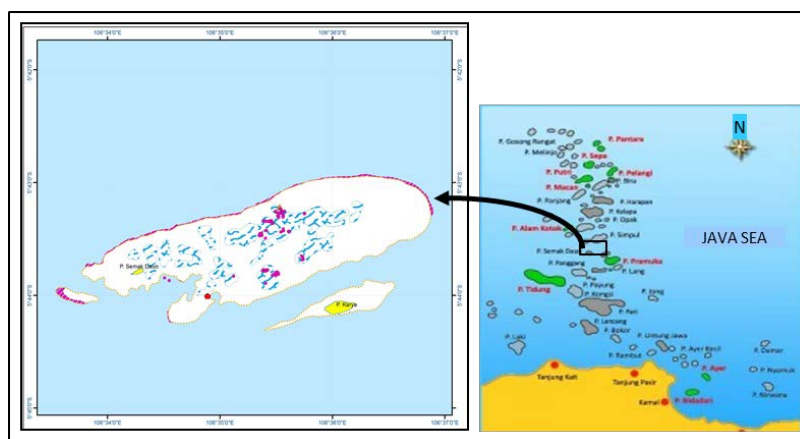


Figure 1: Location of study

2.2. Procedure

This research is exploited both primary and secondary data. Primary data was collected by questioner-based interviews, focused group discussion (FGD) and in-depth interview. Questioner-based interview was conducted to 65 local fishermen who lived in two different islands namely Pulau Panggang and Pulau Pramuka. Accidental sampling and snowball sampling method was applied for selecting respondents. FGD was conducted among members of local mariculture group, which most of them are local fishermen. In-depth interview was conducted to several local leaders. Secondary data accessed from previous research at the site such [14,13] and [15]. Restocking simulation data of sea ranching is based on the work of Kurnia [13].

2.3. Data Analysis

Data collected through questioners are analysed descriptively, and presented into table and graphic both in percentage (%) and absolute number. Discussion of the result is referred to the concept of right over resource including access and property right.

3. Result

3.1. Grouper Fisheries of the Site

Semak Daun Island is abandoned and owned privately. It is one of 13 islands belonged to Pulau Panggang Village, Northern Kepulauan Seribu District of Kepulauan Seribu Municipal Administration (KSMA)-Jakarta Province. It has 0.50 ha land width which is surrounded by 315 ha corral dominated shallow waters. Within this area, there are five deep water reefs (local name is *goba*) with approximately 33.3 ha width. This five deep water reefs are in the eastern side of Semak Daun Island. Each of reefs is connected by a column for water way ("galer" in local name) to others, that possible for small boat to pass through and connect among the reefs [13].

Distributions of fishing sites of local grouper fishermen are water area of Semak Daun Island (46%), Karang Congkak (46%), Karang Bongkok (8%), Kelapa Island (3%), Karya Island (11%), Jokong Island (3%), and others (16%) (Kurnia, 2012). Fishing gear applied by local grouper fishermen are trap (76%) and hook (23%); which each of fishermen deploy 3-10 traps per trip. The catch of each fisherman is 1-3 pieces brown marbled grouper (*Ephinepelus fuscogutatus*) per week that less than 500 gram each. According to time temporal, after year of 2000 the productivity of grouper trap is less than before year of 2000 [13].

Grouper is a highest economic value species of the site, but catch indicate significantly decrease. By used of participatory stock assessment (PSA) technique, the indices of resource state of grouper at Semak Daun Island water is 0.0-0.325 (less than 0.5) that express less than optimal biomass (B_{∞}) and that indicate of recruitment overfishing [13]. Factually, it is indicated by most of fish catch size is less than 1.5 kg weight or 46.6 cm length each and immature. Then it is suggested for sea ranching implementation.

3.2. Local Fishermen Perspectives on Fishing Right

Local fisheries are multigear and multispecies. Most of local fishermen use more than one fishing gear with

more than one species target. Local fishermen dominantly operate gillnet and hook at the current time. The other fishing gears are trap, set net (“sero”), and spear gun (Figure 1).

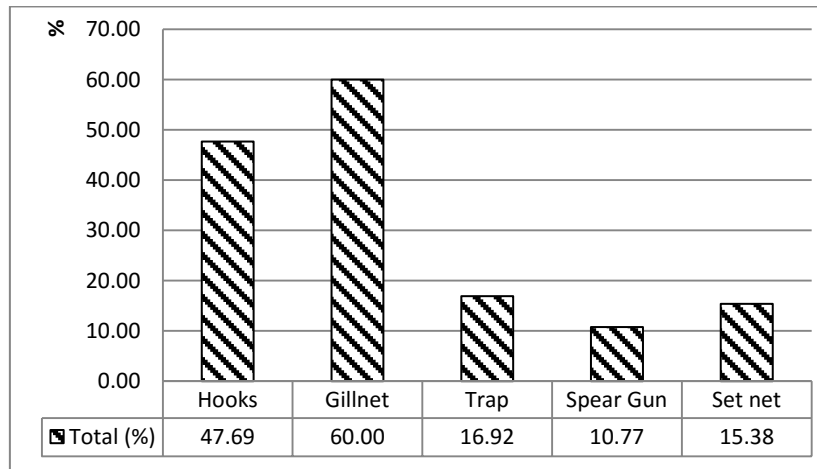


Figure 2: Fishing Gear Operated by Local Fishermen

The greatest problem of development of fishing regulation links with fishermen perception on their fishing activities. Most of local fishermen answers that fishing in entire Kepulauan Seribu waters is not need necessary any special permit (66%) and only 29% of respondents express requirement of special permit (Figure 2).

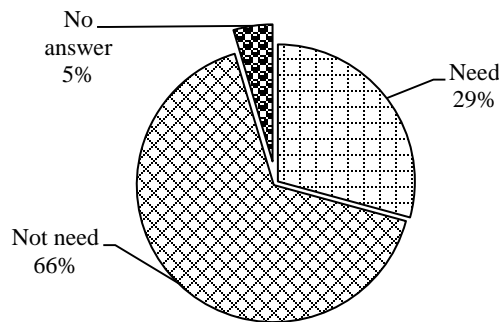


Figure 3: Respondents Perception on Permit Requirement for Fishing in the KSMA Waters

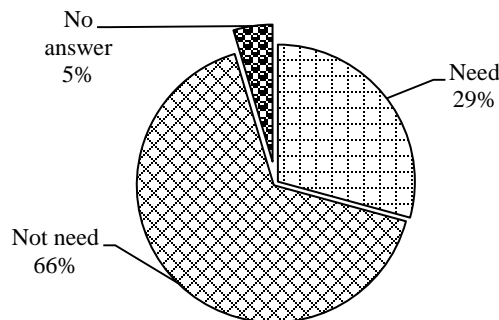


Figure 3: Respondents Perception on Right Holder For Fishing in the KSMA Waters

Local fishermen have opinion that any fishermen from out of site who want to do fishing in any place of KSMA water just shall give information to local authority bodies/persons such as marinir office, fisheries and marine affair office of KSMA or even single local fishermen leader. However, most of them (60%) belief that fishermen who have right to do fishing in their waters are KSMA fishermen and only of them (35%) have tolerance opinion that both of local and incoming fishermen are legally authorised (Figure 3).

This perception arise in response to local government athonomy regulation, which leads perception that authority for managing local marine resource is going to local governments. They simplicity this issues by assuming that fishes in their local marine water are mainly dedicated for local fishermen. They have also experience when they go fishing into other local government’s marine water they are complained and sued by local fishermen. However, larger portion of respondents (84%) belief that fishermen who are allowed to do fishing in Semak Daun Island water is both of fishermen who live in the Pulau Panggang Village and the rest of KSMA area (outside) (Figure 4).

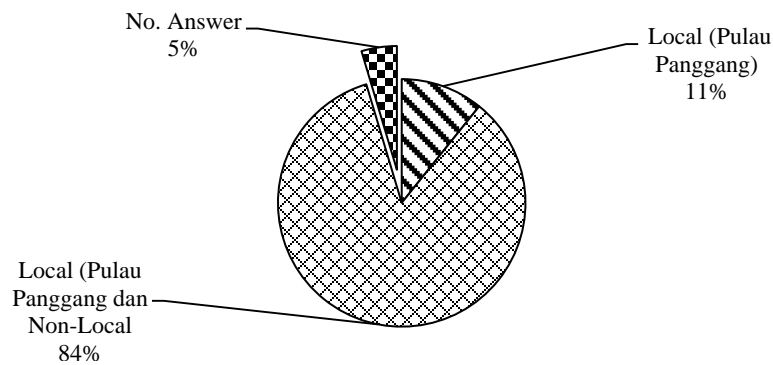


Figure 4: Respondents Perception on on Right Holder For Fishing in the Pulau Semak Daun Waters

This perception arise as their consideration that Semak Daun Island water is part of KSMA water and it is pledged for all KSMA fishermen. Most of local fishermen have strongly inclusive perception among of them. Feeling as a community who live separately from the mainland make this perception crystalised, while in fact most of their families are relatives in particularly because of they are belonged to same ancestries. Especially inhabitants who live in neighborhood islands. Dominan ethnics of the occupant are Bantenese, Sundanese, Javanese, Mandar and Bugis; but inter-ethnic marriages have been ocured from many generations.

4. Discussion

4.1. Setting of fishing regulations

Sea ranching is a pattern to increase marine capture stock using aquaculture product for lifting up catches [10,9], but not for enhancing natural recruitment or even for stock recovery of depleted species [11]. Under sea ranching system, harvest as a result of recapturing is a result of downstream process that securely links to put-grow-take system. So, development of rules must cover a whole process of sea ranching, include

harvesting/recapturing (taking system). In the context of resource management there are some rules need to be developed. The wonderful work addressed to Ostrom and colleagues [16,17] can be valuable as suggestion specifically : (1) boundary rules, (2) position rules, (3) choice rules, (4) information rules, (5) aggregation rules, (6) payoff rules and (7) scoping rules. Those rules are important and required for whole process of sea ranching (put-grow-take), that must be accepted and adopted by all of both internal and external parties as a reference.

One of critical factors for developing and implementing sea ranching system is access restriction of local fishermen to resources stock. The restriction access is designed for both of internal sea ranching fishermen and external. The restriction for internal fishermen is through fishing regulation, which is constructed based on harvest planning and control. But restriction access for fishermen who are not part of sea ranching system is lied on fishing right of the demarcated area of particular water. Most specific term that can be adopted is a territorial use right for particular demarcated enclosed water.

As aligned with potential site, recapture is both for achieving food and recreational fisheries. Sea ranching also possible for developing recreational fisheries [18] -- Target species of this recreational fishing is grouper. This is possible for additional income of sea ranching management. So that, setting regulation is dedicated for both conventional (for food) and recreational fishing. But, whatever is the instrument (output or input based, regulatory or economic, market oriented or not) it is the structure of access rights that is initially affected [19].

Setting of fishing regulations is technical work which is compatible for all internal parties of sea ranching. Even though recreational fishing involved external parties, all tourists must comply this internal fishing regulations. Regulation setting of fishing consist of volume, time and size of fish harvested; and fishing gear allowed. The regulator as regulation maker must be powerful and legitimated, so that regulation as its product is internally legitimated and adopted as well. The best design and successfully enforce fishing regulation will be significantly a key factor which determine success of sea ranching implementation.

Individual growth model of grouper with consider to length and weight as variables confirms that after 9 month release size of fish will be more than 500 gram. Hence, time for growing fish from 17 cm length into 33 length (or approximately 500 gram/pieces) is taken 9 months [13]. This, reasonable to make decision that time for harvesting is 8-9 months after time of releasing juvenile. He suggests for the first year is close season for fishing. Afterward grouper juvenile is released every month so that harvest is possible in every month with multistage aquaculture. Consumer preferable size is not less than 300 gram/pieces or not less than 28 cm length. This is also reference point, that fish harvested size is not less than 300 gram/pieces. Once get less than 300 gram/pieces, fish will be released or it will be reared at special floating cages.

Fishing gear allowed must be characterized by high selectivity and passive [20] just to consider that grouper is not fast swimmer, short migration area, tend to be in the bottom of water and associated with corral [21]. Passive fishing gear is applied also to protect corrals which live on the bottom surface. Currently, one of main fishing gear used by local fishermen is trap. Referring Table 1, trap is quite recognizable gear, even though operated far away from the site. Traps for grouper is actually include round funnel trap and rectangular funnel trap [22]. Recreational fishing is defined as fishing of aquatic animals (mainly fish) that do not constitute the

individual's primary resource to meet basic nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets [23]. At present grouper become popular target of recreational fishing globally, so that sea ranching is promising for this kind of recreational fishing as well. Recreational fishing is in lines with economic growth of certain society [23]. The users of recreational fisheries are increase with the development of economic society, due to trade off leisure time and working time. Unlikely, number of user of fishing for food is decrease with the development of economic society. However, recreational fisheries is also potentially foster ecosystem problem as changes in aquatic community and ecosystem [23], such as excessive fish catch mortality, selective mortality, non-target species mortality, injury fish and infectious transmission, littering and noise pollution from boats [23].

In the recreational fisheries framework [24] are noticed of some issues such as by-catch, catch and release, fisheries-induce selection, tropics change, habitat degradation, fishing technology, fishing effort and production regime. Fortunately, some instruments for recreational fisheries aligned with "for food" fisheries [25]. Furthermore, the instruments are commonly applied in the regulated fisheries. For example closing instruments (time and area), catch limitation, effort management, fishing gear restriction, fish caught size, allowable species caught, and code of conduct for recreational fisheries.

Total efforts allowed must be calculated accurately, both of traps and hooks. Concerning that recapture is apart of sea ranching system, total recaptured fishes represents the whole sea-ranching production. Calculation of total production must recognize production from both of each food purposed fishing and recreational fishing. Except production from non-released species that occasionally caught. The calculation as simulated by previous study [13] must be a reference.

4.2. Fishing Regime and Fishing Right for Sea Ranching

Grouper fisheries at study site is situated by recruitment overfishing [13]. This indicate an absent of effective controll of fishing activities. In order to increase fishing capacity, sea ranching is one of possible alternative approach. However, there are some potential obstacles. The fundamental problem is related to the most significant requirement of sea ranching development namely particular demarcated fishing ground with closed or resctricted access regime.

Fiugure 2-4 clearly demonstrate perception of local fishermen on fihsing regime which is strongly open acces for local fishermen or at least quasi open access for fishermen coming from out of site. Perception on open access is stronger for local fishermen. Factually, it is not barely perception, but also a common practice for not only in this particular site but for all Indonesian water. Indeed, this regime is not suitable and does not meet requirement for sea ranching development. The it is reasonable to make a change.

Honestly, marine ranching program can not be implemented individually [25], but must be part of integrated planning which recognise technology, biology, genetic, ecology, socio-economy and politics factors. Political factor become key factor for promoting a shifting of fisheries (fishing) regime to be closed/restricted acces to support sea ranching implementation. Sales and tenancy are the other measures [26], but it will be very

hardworking because nowadays there is no proper legal basis.

Sea ranching is intended for increasing aquaculture-based fishing capacity [27]. Sea ranching is one of three main instruments for sustainable fisheries resource management, in addition to effort control and habitat restoration or conservation. However currently sea ranching concept have been experienced by contextual evolutionary [27], which the need of fishing capacity enhancement is triggered by increasing importance and awareness of fisheries system as the interface of marine capture and aquaculture. In the sea ranching system, fishing become most prominent element which constitute success through recapture practice in the context of put-grow-take system. Then, fishing (recapturing) must be planned accurately both in terms of time and volume of catch. It is clearly, this sistem can not be executed under open acces system of resource use. Conversely, that resource quality under private is greater than in the open access steady state [28].

Grouper sea-ranching that possibly applied at study site has been simulated previousuly [13] with two different approach i.e. recruitmen type and harvest type. In the recruitment type approach, optimal size of released grouper juvenile is 17 cm length each with stocking density rate 2,000 pieces and mortality rate 0.4. The yield is 529.831 kg. In the harvest type, optimal size of released grouper juvenile is 17 cm lenght each with stocking density rate 4,000 pieces and yields as of 1.059,661 kg.

Fishing right affect externally by explicitly determining who have and have not right to do fishing in a whole demarcated area of sea ranching. Fishing right have direct impact to and able to restrict access of fishermen from out of sea ranching system. This fishing right must be legitimated, accepted and adopted by all internal and external parties. Fshing right concept consist of notion on who have right to fish with specific reason why this right is imposed to certain people. Fundamentally, fishing right link with all aspects of sea ranching system.

One of important socio-economic issue of sea ranching is an incentive system which gurantee specific right for recapturing the fish to every party that has released juvenile as investment [8]. So that, the most important prerequisite for implementing sea ranching is right for fishing in a particular demarcated area (demarcated fishing right). For example, Japan's fishing regulation provide fishing right for specific area (*kukaku gyogyoken*) which is endorsed in the form of special demarcated fishing right for floating cage mariculture and seaweed culture fisheries [29]. But, territorial behavior as a consequence of enforcing demaracated right is expected when the costs of exclusive use compensate for the benefits gained from this use [30]. It is a major concern and economically important for assuring sea ranching sustainability. The previous studies conclude that successfull sea ranching (and other setock enhancement program) is conducted by cooperative or private sector [8].

Fishing right must be delivered to inividual fishermen or a group who has restocked juvenile into sea ranching area. The only legitimate members of the group who have right to fish, and is descended from group regulation. Fishing is allowed only in the provided demarcated area as a sea ranching teritory. Clear and explisite signs of the area is necesseary to avoid conflict due to unclear boundaries. The effective boundary at study site is natural steepy coral wall that isolate fish. This boundary also as sign that only legitimate member

are allowed to enter and to fish within the site. Fishing right is connected to fishing regulation that need to be developed for implementing sea ranching. The most important thing to note is legal rights must be coupled with moral responsibilities [31]. Devolution of right to local community who involve in sea ranching, must be kept as social contract for ensuring resource sustainability and its stream benefit.

Right to fish must meet legal aspect but need more reason to be morally right [31]. The very basic question in relation to fishing right is based on what reason of a certain people have privilege to fish in a particular fishing area while others are prohibited. Right to fish is a right to stream of benefit of the present of fishes. In the sea ranching system, the fish come from released juveniles where they grow up to consumable size. If there is demarcated right over the certain sea ranching area, and the fish brought there are belonged to people or a group who is particularly a right holder of the area; then right to fish in the site meet both of legal and moral qualification.

In principles, right to and over resources are distinguished into two different categories i.e. access right and property right [32,33]. Access is based on an ability, which represents a bundle of power; while property is right based on acknowledgeable claims either legal-formal or customary law. Indeed, because of fishing right in the sea ranching system is now based on recognisable claims or not only because of ability (power); this resource right have shifted from access right into property right regime. Property right can be interpreted in many ways, but basically including the distinction between tangible and intangible or absolute versus relative property right [34]. But in terms of the "owners" of the right, this type of property right can be categorized in range between private to communal property right [35]. The right is not automatically belonged to all of community members, but only for one who is as a legitimated member of sea ranching group. Of course, there are some ordinal levels of property right that must be considered [36,17,37]. However, the ownership and territory right as the two important precondition for sea ranching are also costly. The cost include time, social involvement, money and politic [30].

Within property right regime for particular group, exclusion system is possibly imposed and common property characteristic have no longer exist since then [31]. Exclusion system must be derived from accepted regulation (legal and customary) and need to be strengthened and accommodated by upper level regulation regime. The exclusion system need to explicitly state who is allowed to fish in the sea ranching area. It can be individual or group that have legitimate claims over the fishes (claimant). Indeed claims over this fish stocks are originated from two essential reasons: (1) juveniles released are belonged to property of a claimant, and (2) because of its territorial use right, fishes which live in certain demarcated water are belonged to claimant. Concerning to this analogy, fishes and water body are embedded and become a resource unit when one or more resource unit compose a resource system. This resource system is parallel pair of governance system as composed by many users in the social-ecological system (SES) [38]. Clear fishing right is notable and it is clearly understood that why successful sea ranching is managed by cooperatives or private sectors [8].

Under sea ranching system, resource unit (set of fish and water resource) become right's object, including management right. Currently, study site is administratively belonged two authority bodies i.e. Kepulauan Seribu Marine National Park (KSMNP) and KSMA. Therefore, for more and stronger legalised of the sea ranching site

as a particular demarcated area; it is demanded a political affirmation from those two authority bodies on the legal basis. This political affirmation will definitely lead to stronger fishing right. However, this right must be protected with several characteristics [39] namely exclusivity, duration, flexibility, quality of title, transferability and divisibility. These characteristics are precisely political memorandum that will be legalised administratively. More arrangements have to be developed in regards to those characteristics. But, bestowal of fishing right as property right to the community must consider to the principle adjacency and historic of use [40]. It means the right should go to local fishermen who have been suffered by overfished of coastal fisheries. This is primary spirit of the development of sea ranching at the site.

5. Conclusion

Fisheries in the study site is situated by open access regime for local fishermen and quasi open access for out of site fishermen. For implementing sea ranching then it is need to be politically reinforced become closed/restricted access fisheries regime for particular demarcated area. This regime is based on property status of release juvenile and demarcated area.

Sea ranching implementation need effective internal fishing regulation both for fishing (food objective) and recreational. So that, fishing management must have powerful legitimation. However, fishing right need strong and complete recognition by both of internal and external parties (societal and legal-formal). The acknowledgement of fishing right as a form of property right will be more effective if the government (as of resource owner) legally bestow its right to be demarcated right for a group of local fishermen as a sea ranching management clearly and explicitly. But this bestowal is required by clear characteristic of the property right such as exclusivity, duration, flexibility, quality of title, transferability and divisibility. Some of those attributes are part of internal rules-in-use but some of have to be accompanied by explicit regulation from the local government.

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