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Potential development of marine culture in the Coastal of the Village of Rat, Southeast Maluku regency

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Abstract

The development of marine culture activities aims to meet the needs of fisheries production that continues to increase due to declining capture fisheries production. This research aims to analyze the suitability of marine culture in Rat village so that it can be used as the basis for the development of cultivation in the area. The research was conducted in the waters of Rat village, Southeast Maluku district from February to September 2017 by combining interview method, observation and endurance testing of sea pens. Based on the research result, it can be concluded that the waters of Rat village can be utilized for the development of sea cucumber cultivation (*Holothuria* sp), swimming crabs (*Portunus* sp), sea urchin (*Diadema* sp), and *Gracilaria* sp with sea pens method.

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Introduction

Indonesia is a country producing aquaculture products in the world. The Government through the Ministry of Marine Affairs and Fisheries is currently continuing efforts to increase the production of aquaculture fisheries from various communities to meet the needs of national and international markets. Several factors that may affect cultivation production are: 1) increased demand for export of marine products, 2) growing cultivation technology, 3) sustainable cultivation development and 4) wide availability of land but not yet utilized optimally. The development of marine aquaculture activities aims to meet the needs of fisheries production that continues to increase due to decreased capture fisheries production, increased population growth and changes in public consumption to healthier animal protein.

Maluku is one of the Indonesian fishery producers province (Suryawati & Tajerin, 2015). Southeast Maluku Regency is one of the regency in Maluku Province which is geographically composed of small island clusters. Coastal expanse on island clusters is a good potential for marine aquaculture activities. Sea cultivation business that has been developed in this regency, among others, cultivation of seaweed *Eucheuma cottoni*, pearl oyster cultivation *Pinctada maxima*, grouper cultivation and cultivation of sea cucumber *Holothuria scabra*. Especially for Rat village, the cultivation activity that has been developed is the cultivation of pearl oyster in the region depth 10 m and above. While the coastal areas that have ups and downs of sea water has not been used for marine commodity cultivation activities. Whereas sea cultivation that utilize coastal area (intertidal) able to give very good contribution to local community and at the same time help to realize Maluku province as national fish granary from cultivation sector.

To ensure an optimum and sustainable use of coastal resources with maximum production from the marine culture sector, it is necessary to conduct a scientific study to identify and analyze the suitability of potential marine areas for the development of aquaculture business. This research aims to analyze the suitability of marine culture based on the physical, chemical and biological parameters of the waters so that it can be used as the basis for the development of marine culture in the coastal of Rat village.

Research methods

Time and Place

This research was conducted in the waters of Rat village, Southeast Maluku regency and lasted from February to September 2017. Rat village is located on the eastern part of the island of Kei Kecil with the coordinates of S.0550'43,1 "and E.13248'53,6".

Research Design

Data collection was done by combining interview technique, field observation and container endurance experiment which can be used for marine culture. Interviews and field observations (free collection methods) aim to determine the condition of the substrate and the existence of economically viable marine organisms.

To support the observation data on the feasibility of coastal areas is feasible as a place of organism cultivation, then placed a container of marine organisms in the form of sea pens. The tested sea pens measured 3 m x 2 m x 0.6 m and as many as three (Fig. 1). Sea pens made of wood plugged into the substrate and fenced with a net (waring). Sea pens are installed in areas that although at low tide, always inundated 20 cm deep. Sea pens are cleansed every two weeks with the aim of sea pens not easily attached biofouling that can accelerate sea pens damage. The same time, there are also water quality measurements (current, wave, degree of acidity (pH), salinity, dissolved oxygen, temperature and brightness).

Fig. 1. Sea pens.

Data Analysis

The research data is presented in the form of figures or tables and discussed descriptively and systematically.

Results and discussion

Condition of Rat Village Coastal

Based on the observation, it is known that the intertidal waters of Rat village are dominated by sandy substrate overgrown with seagrass beds. In addition, this village has a sloping water base and there is a coral fracture at the front of the intertidal area. It is also known that along the coastline there is no river mouth. Water quality of Rat village waters for eight months of measurement is shown in Table 1.

Table 1. Rat village water quality.

Months	Parameter kualitas air						
	Salinity (ppt)	Temperature (°C)	DO ppm	pH (mg/l)	Current cm/s	Brightnes s (cm)	Waves (m)
Februari	33 - 34	29,3 -29,5	6,83 - 7,31	7,23 – 7,85	11,7 – 20,3	160	0,6 – 0,8
Maret	33 - 34	29,2 – 29,3	5,14 - 5,44	7,41 – 7,57	10,8 – 19,5	140	0,5 – 0,7
April	32 - 33	29,1 – 29,2	6,26 - 6,92	7,26 – 7,42	18,9 – 23,7	100	1,3 - 1,6
Mei	33	31,2 – 31,3	7,78 - 7,98	7,34 – 7,9	37 – 45,4	104	1,5 - 2
Juni	34 - 35	28,3 – 29,3	5,87- 5,98	7,9 – 8,1	37,3 – 42,2	105	1,6 - 2,1
Juli	31 - 32	29,6 - 31	5,28 -5, 58	7,5 – 7,8	25 - 35,2	95	1,5 – 2
Agustus	34 - 35	28 -29	4,12–4,76	7.14 – 7.76	39,7	104	1,3 – 1,5
Sertember	33 - 34	28 -29	6,05 – 6,78	7,5 – 8,2	35,6 – 42,9	112	1,1 – 1,3

Based on interviews and observations, some important marine organism families are found, including sea cucumbers (*Holothuria scabra, H. nobilis, H. fuscocinerea, H. edulis, Holothuria atra* and *Stichopus* sp), swimming crabs (*Portunus pelagicus* and *P. sanguinolentus*), urchin (*Diadema setosum* dan *Mespilia globules*) and seaweed *Grasilaria* sp. Sea cucumbers are export commodities of high economic value that can give socio-economic contribution to coastal communities. The cultivation of sea cucumbers can be carried out waters with salinity 28-35 ppt (Indriana *et al*, 2017), temperature 26-32°C (Andriyono *et al*, 2009), dissolved oxygen:> 5 ppm (Purcell *et al*, 2006), pH: 6, 9-8.5mg/l (Giraspy and Walsalam, 2010), brightness: > 40cm (Komala, 2015), current: 5-40 cm/sec (Rahman & Mansyur, 2016) and strong waves: 0.6-1m (Windupranata (2007). Referring to the water quality standards for the cultivation of sea cucumbers, the coastal of Rat village is good for cultivation of sea cucumbers.

Swimming crab (*Portunus pelagicus*) has great potential to become one of Indonesian fishery export commodities (Primyastanto and Muntaha, 2015). Enlargement of crab is carried out in ponds and sea pens with the qualities of the waters: 25-35 ppt (Jose, 2017), temperature: 27-30°C, pH: 7-8mg/l (Oniam *et al*, 2012), current 20-40cm/sec (Satriawan *et al*, 2017), dissolved oxygen: 4.03-8.32 ppm, brightness: > 104cm (Agus *et al*, 2016) and waves: 0.6-1m Windupranata (2007). When compared to the quality of water obtained with water quality standards for the cultivation of blue swimmer crabs, then the coastal of the village of Rat has the potential for the development of blue swimmer crab cultivation.

Sea urchin is a benthos macro type of echinoidea class that can be utilized to meet human nutritional needs. Gonad sea urchin is of high nutritional value. Sea urchin can be rearing at the bottom of the coastal in intertidal areas such as coral reefs or seagrass beds (Rahman *et al,* 2014). Sea urchins live and rearing in waters with salinity: 25 - 35 ppt, temperature: 27 - 31 °C, brightness: > 50 cm Suryanti and Ruswahyuni (2014), dissolved oxygen: > 4 mg/l and pH: 7 - 8 mg/l (Angreni *et al* (2017), current 20-40 cm/sec (Ambasari *et al*, (2013) and wave 0.6-1 m Windupranata (2007). Based on the water quality data obtained in the field (Table 1), the sea urchin can be cultivated in the coastal of Rat village.

Gracilaria sp is one of the sea resources that is easy to be cultivated, has important economic value and has bright market prospect in National and International. A coastal can be used as a cultivation location of *Gracilaria* sp if the coastal have a salinity of 31-34 ppt, temperature of 28-31 ° C (Tomatala, 2014), pH 7.9-8.3, current of 14 - 44 cm/sec (Hasan *et al.* 2015), dissolved oxygen : > 4, brightness 30 - 40 cm (Zain *et al.* 2012) and waves: 0.6 - 1 m (Windupranata, 2007). Referring to the water quality standards for the cultivation of *Gracilaria* sp, the coastal of Rat village can be utilized for the cultivation of *Gracilaria* sp.

One of the determinants the success of marine culture is the selection of the right location. Errors in the selection of locations will cause cultivation business activities do not last long. Selection of cultivation location is closely related to water quality data so that assessment of water quality must be done in determining the location of cultivation.

Experiment of container cultivation

The cultivation container is the means used to preserve the organism. The sea pens is one of the cultivation containers used to nurture marine organisms. The sea pens is a cultivation container that can be used to rearing sea cucumber, *Holothuria sp* (Hair *et al.* 2016), abalone, *Haliotis* sp (Wu Fucun and Zhang, 2016), crabs (Primavera *et al.*, 2010) and sea urchin, *Diadema* sp (Manuel *et al*, 2013).Trial testing of sea pens in the coastal of Rat village aims to strengthen the concept of cultivation that can be developed in the village of Rat. The observation results on the resilience of the construction of sea pens are shown in Table 2.

Table 2. The results of observation of the resilience of the construction of sea pens.

Observation time	Condition of Sea pens
February	- Making of sea pens
March	- Strong wood construction. All sides of the net have been plastered with dirt (moss).
April	- The wooden construction remains strong. The dirt file that is attached to the net starts to appear even after it has been cleaned. The sea pens is not damaged
May	- The wooden construction remains strong. Sea pens is not damaged
June	- The wooden construction remains strong. Starting to see a small tear in the area of connection nets but only on 1 sea pens.
July	- The wooden construction remains strong. There is a small tear in the net area but only on 1 sea pens
August	- The wooden construction remains strong. There was a small tear in the area of the net joint and evenly distributed on all three replicates.
September	- The wooden construction remains strong. There is a small tear in the connection area of the net and the front of the sea pens facing the coming current and wave (Fig. 2). he damage is evenly distributed on all three replicates.

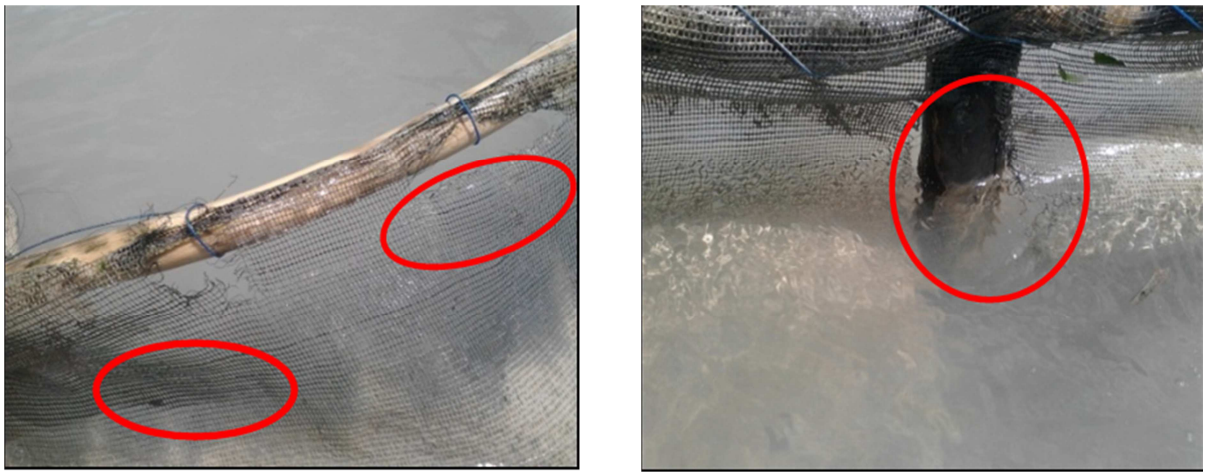

Fig. 2. Damage position of sea pens at the end of the research.

In Table 2 it is read that the cultivation containers began to suffer damage in June. Damage to sea pens is assumed to occur due to ocean and current wave factors caused by wind blowing speed. Risandi *et al.* (2015) states that the main cause of the wave is the wind. Whereas according to Loupatty (2013) in addition to wind, ocean waves can be caused by earthquakes, volcanic eruptions, underwater landslides that cause destructive waves (tsunamis) and the attraction of the moon and earth that produces permanent sea waves known as tidal waves receding. During the time interval of the research no other natural phenomena that caused the occurrence of large sea waves in addition to wind and tidal.

For the tidal observed that from February to March, the tidal waves generated at high tide are not as large as in May to September. The research area located in the eastern part of Kei Kecil island caused this area to experience the physical strikes of waters (waves and currents) in East Season while in the West Season was relatively quiet. Southeast Maluku Regency experienced two wind-blowing seasons in a year of East and West seasons. Sudarto (2011) explains that the Maluku province including the Southeast Maluku regency experience the East Season which runs from April to October while the West Season runs from October to April. In April and October there was a seasonal transition that caused relatively calm coastal.

In Fig. 2 it is seen that there is no great damage to the sea pens being tested. This condition occurs because the construction of sea pens is low so it is not long and receives a lot of wind, waves and currents that are continuously very likely to damage the construction. In addition, the sloping coastal conditions and coral fractures (front of the intertidal area) that serves as a natural wave barrier that helps reduce the strong currents and waves caused by the wind.

The main problem of cultivation development in Rat village is potential of cultivation container damage due to the hitting of currents and waves in East Season. The results showed that the sea pens tested suffered minor damage during the East Season and the damage was easy to repair so that sea pens could be used for at least one year.

Firdaus *et al.* (2016) reported that sea cucumbers require maintenance time 6-8 months before harvesting on the condition that seeds are stocked 40-60 grams. Swimming crab takes 120 days of maintenance until it reaches the size of 100 gr and can be marketed (Jose, 2017).

Sea urchins can be marketed when measuring 7-8cm with maintenance time of 6-8 months (PCCARRD, 2012) and maintenance *Gracilaria* takes 35 to 50 days (Tomatala, 2014). Thus the cultivation of sea cucumbers, swimming crabs and sea urchins by sea pens method can be implemented on the coastal of the village Rat. While *Gracilaria* sp. can be cultivated using basic planting.

For the development of efficient cultivation, the method of utilizing the container together with two types of cultivated organisms (*polyculture*) can be applied. Organisms that can be rearing together are swimming crab with *Gracilaria* and sea cucumbers with *Gracilaria*. According Suerte (2015), states that swimming crabs and *Gracilaria* can be cultivated in polyculture because *Gracilaria* sp can be a good protector for enlargement of blue swimmer crabs. Wang *et al.* (2015) states that sea cucumbers (*H. scabra*) and *Gracilaria* sp. can be rearing together because mutualism symbiotic.

Conclusion

Based on the results of research for eight months observation can be concluded that the coastal of Rat village can be utilized for the development of marine organism cultivation such as sea cucumber (*H. scabra*), swimming crab (*P. pelagicus*), sea urchin (*Diadema* sp) and *Gracilaria* sp. by sea pens method.

Suggestion

Further research is needed on the growth of marine organisms and sea pens construction engineering so that the coastal space in Rat village is more utilized for the development of marine organism cultivation.

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References

Agus SB, Zulbainarni N, Sunuddin A, Subarno T. 2016. Spatial distribution of blue swimmer crab (*Portunus pelagicus*) during southeast monsoon in Lancing island, Kepulauan Seribu. Jurnal Ilmu Pertanian Indonesia **21,** 209-218.

Ambasari L, Gandasasmita K, Sudad U. 2013. Strategy for development of aquaculture area in East Lampung regency. Globe Journal **15,** 137-145.

Angreni F, Litaay M, Priosambodo D, Moka W. 2017. Community structure of echinodermata in seagrass meadow of Tanakeke island Takalar regency South Sulawesi. Jurnal Biologi Makassar **2,** 46-55.

Azam Khairul and Singh, Jyotishma J. 2013. Development of value added products from dried sea cucumber *(Holothuria scabra)*. Journal of Oceanography and Marine Research **1,** 1-3.

Giraspy DAB, Walsalam IG. 2010. Aquaculture potential of the tropical sea cucumbers *Holothuria scabra* and *H. lessoni* in the Indo- Pacific region. SPC Beche-de-mer Information Bulletin **30,** 29-32.

Hair C Mills DJ, Mclntyer R, Southgate PC. 2016. Optimising methods for community based sea cucumber ranching: experimental reseases of cultured juvenile, *Holothuria scabra* into seagrass meados in Papua New Guinea. Aquaculture Reports **3,** 198-208.

Hasan MR, Rejeki S, Wisnu R. 2015. Effect of different initial weights on growth gracilaria sp. cultivated with longline methods in fishpond waters abraded in Kaliwlingi village Brebes District. Journal of Aquaculture Management and Technology **4,** 92-99.

Indriana L, Firdaus F, Suprono M, Munandar H. 2017. Survival rate and growth of juvenile sandfish (*Holothuria scabra*) in various rearing conditions. Journal marine research in Indonesia **42,** 11-18 pp.

Jose Josileen. 2017. Seed production and farming of blue swimmer crab, *Portunus pelagicus*. Central Marine Fisheries Research Institute. India 243-248.

Komala R. 2015. Diversity of sea cucumbers in seagrass and coral reefs ecosystem of Bira Besar Island, Kepulauan Seribu, Jakarta. Prosiding Seminar Nasional Masyarakat Biodiv Indon **1,** 222-226.

Loupatty Grace. 2013. Characteristic of wave energy and current velocity of coastal area at Maluku Province.Jurnal Barekeng **7,** 19-22.

Manuel Jr. JI, Prado VV, Tepait EV, Estacio RM, Galves GN, Rivera RN. 2013. Growth performance of the sea urchin, *Tripneustes gratilla* in cages under La Union condition, Phillppines. E-International Scientific research Journal **5,** 195-202.

Oniam V, Chuchit L, Wasana A. 2012. Reproductive performance and larval quality of blue swimming crab (*Portunus pelagicus*) broodstock, fed with different feeds. Songklanakarin Journal of. Scienci and Technology **34.** 381-386.

Primavera JH, Binas JB, Samonte-Tan GPB, Lebata MJJ, Alava VR, Walton M, LeVay L. 2010. Mud crab pen culture: replacement of fish feed requirement and impacts on mangrove community structure. Aquaculture Research **14,** 1211-1220.

Primyastanto M, dan Muntaha A. 2015. Blue crab agrobusiness development at blue crab processing enterprises group Pasuruan. Jounal of Innovation and Applied Thecnology **1,** 145-150.

Purcell S, 2012. Principles and science of stocking marine areas with seacucumbers. Asia–Pacific tropicalsea cucumber aquaculture, ACIAR Proceedings **136,** 92-103 pp.

Rahman A, dan Mansyur A. 2016. Conformity utilization of waters for aquaculture development in the staring bay area Konawe Selatan district. Jurnal Bisnis Perikanan **3,** 31-48.

Rahman MA, Arshad A, Md. Yusoff F. 2014. Sea Urchins (Echinodermata: Echinoidea): Their Biology, Culture and Bioactive Compounds. International Conference on Agricultural, Ecological and Medical Sciences (AEMS-2014). London. 39-48 pp.

Risandi J, Sagala SL, Pranowo WS. 2015. The application of wave characteristic numerical model for site selection of marine aquaculture development in Situbondo, East Java. Jurnal Kelautan Nasional **10,** 21-31.

Sapto A Masithah ED, Winarni D. 2015. The study of sea cucumber (*Phyllophorus* sp.) gonads histology: Thermal shock to the spawning process. Journal of Natural Sciences Research **5,** 101-105

Satriawan R, Utami and Kurniawan E. 2017. Analysis difference feed type of catch crabs (*Portunus pelagicus*) in the gulf water Kelabat Pusuk village. West Bangka. Jurnal Sumberdaya Perairan **11,** 44-50.

Sudarto. 2011. Utilization and Development of wind energy process for production of salt in Eastern Indonesia. Jurnal TRITON **7,** 61-70.

Suerte Nora O. 2105 Feasibility of Blue Swimming Crab *Portunus Pelagicus* Linnaeus 1758 and Red Seaweed *Kappaphycus alvarezii* Doty Polyculture in Floating Net Cages. Mindanao Journal of Science and Technology **13,** 196-212.

Sulardiono B, Purnomo P, Haeruddin W. 2017. Environmental suitability for holothuroidae habitat in karimunjawa. Indonesia Journal of Fisheries Science and Technology **12,** 93-97.

Suryanti and Ruswahyuni. 2014. The difference in abundance of echinoideas on coral ecosystem and seagrass beds in Puncuran Belakang, Karimunjawa, Jepara. Indonesia Journal of Fisheries Science and Technology **10,** 62-67.

Suryawati S, Tajerin H. 2015. Evaluation of readiness for Maluku as "Lumbung Ikan Nasional". Journal Sosek KP **10,** 1-19.

Tomatala P. 2014. Growth of *Gracilaria* sp. Reared of Net Cage In The Waters of Sathean Southeast Maluku. Prosiding Seminar Ilmiah Perikanan dan Pembangunan 78-82.

Wang Jun, Tian xinqli and Jiang Wenlian. 2015. Growth of sea cucumber and water quality features in polyculture of sea cucumber with seaweeds *Sargassum thunbergii* and *Gracilaria lichenoides*. **Journal** *Fisheries Science* **9,** 583-589.

Windupranata. 2007. Development of a Decision Support System For Suitability Assessment of Mariculture Site Selection. Disertasi. Coastal Engineering and Geoscience, University of Kiel Germany.

Wu Fucun and Zhang Guofan. 2016. Pacific abalone farming in China: Recent innovations and challenges. Journal of Shellfish Research **35,** 703-710.

Zain MZ, Fajar B, Rejeki S. 2012. Land suitability analysis and cultivation development strategy of Glacilaria sp. in the pond area in Ulujami district, Pemalang regency. Jurnal Perikanan **14,** 71-80.