STUDY OF KAPAH CLAM (*Meretrix* sp.) MANAGEMENT IN AMAL BEACH ZONE TARAKAN CITY, EAST KALIMANTAN

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A B S T R A C T

Amal beach is the side of Tarakan Island and it has high biodiversity. One of fauna found which associated with the mangroves is kapah clam (Meretrix sp.). That has economic value so that faced high exploited along season. Considering that condition study of kapah clam management was very importance. This study were studied from September until October 2009 until December 2010 . This study use primer and secondary data's include ecology and capture information. SWOT analysis used to take for certain management strategies. Kapah clam (Meretrix sp) collected at intertidal area with survey method and stratified systematic sampling. In each location divided based on zonations area i.e. upper, middle, lower and investigated by using belt transects with frame 1x10 m2 divided in 10 subplot. The distribution, and mean density of the shell were difference at each station. Management strategies priority for kapah clam at Amal beach are : monitoring of Kapah clam source at Amal Lama Beach, selection size in capture, management time for capture, Determine of protecting area and maintaining with restocking.

Keywords *: Amal Lama beach, Meretrix, Strategic management*

INTRODUCTION

Amal Lama beach is side of Tarakan Island and its have high biodiversity. There many economic faunas which be founded. There are shrimps, many crabs, many species of gastropods, many different bivalves and many of economic fishes like snapper, pelagic and bottom fishes. Cause that, this location always used as fishing ground of Tarakan Fishermans. Its have high economic values and that faced high exploited at every days.

One of economic faunas is kapah clam, the clam type which have potency and economic valuable is *Meretrix sp.* Linnaeus, 1758. In English its recognized by the name of is oriental hard clam, while in Indonesia, it is referred as tofu clam. While in Tarakan City this clam type is surroundings recognized with kapah clam.

Capture of kapah clam (*Meretrix sp.*) in Tarakan island specially at Amal Lama Beach have been done during the years with high exploited along season. Amal Lama Beach, one of the area which often as made capture area of kapah clam. From result of interview with some fisherman's who catch kapah clam and sea food shop in Amal Lama Beach Area show that have happened degradation of amount harvest per days. Like in area of Panimbang, Province of Banten, cropping can take place during the year and taken by all size measure.

This region is estimated have happened abundant intake (overexploitation) causing drastic degradation to its population from year to year (Rudi, 2002). Research about

kapah clam management with information of it condition (population structure and its distribution) and environment at Amal Lama Beach until now not yet available. This research is very important for collect base data and it's can be used in potency management program for sustainable resources especially kapah clam by Tarakan government. Considering that condition study of kapah clam management was very importance.

The purposes of this research is to arrange of strategic management for sustainable of kapah clam (*Meretrix sp*.) at Amal Lama beach. Result of this research is expected can give benefit for becoming consideration and input for decision making in managing and exploiting of kapah clam (*Meretrix* sp.) for its sustainable and also give information basis for development of furthermore research.

METHODS

The research were studied in around of Amal Lama Beach, Amal Beach Village Tarakan City from October 2009 until December 2010 . This research including represent descriptive and explorative as mean to dig existing fact. First step int his research is collect potency information of kapah clam, research direction is to get population structure data information and distribution kapah clam (*Meretrix sp.*) resource around at Amal Lama Beach.

And than collected the information about plankton, environment condition include water quality and substrate condition and economic value. Data which is used in this research consist of primary and secondary data. Collecting of primary data through take direct perception on field, by doing measurement of density, distribution and size of kapah clam, water quality and substrate where the clam were founded and also direct interview to person who related with the kapah clam. Collecting of secondary data by collecting documents result of study or researches and other supporter data which were released by some stake holder. From all information's, will be use as considered to arrange of strategic management for sustainable potency of kapah clam at Amal Lama Beach In Tarakan City.

Kapah clam collected at intertidal area with survey method and stratified systematic sampling. In each location divided based cross on zonations area i.e. upper intertidal, middle intertidal, and lower intertidal. Kapah cockle are investigated by using belt transects with frame 1x10 m2 divided in 10 subplot and in each area were taken by 2 frame with the distance one frame and others is 5 meters.

The time Intake of sample conducted when the level sea water is low. the substrate collected direct square plot by hand. To find kapah clam, the substrate was dug until 15 cm with spade and entered into sieve later. Environmental factor measured with direct perception to habitat characteristic and vegetation. Temperature, salinities measured by water checker, location coordinate point determined with GPS 12.

Kapah clam sample result of work field is continued in laboratory of Water Quality, University of Borneo. Kapah clam (*Meretrix sp.*) were measured and than make a groups of clam The formula is used to get density of kapah clam based from Yulianda (2002).

$$Di = \frac{ni}{A}$$

Clarification :
Di = density of species (individual/m^2)
Ni = amount of certain individual
A = totalizing wide of sampling area

To get distribution type of kapah cockle is used distribution Morista Index (Morista 1962 *in* Yulianda, 2002), with the following formula :

$$Id = n\frac{\sum X^2 - \sum X}{\sum (X)^2 - \sum X}$$

Clarification :
Id = Morista index
n = amount of sampling unit
$\sum X$ = individual totalizing of certain organism
$\sum X^2$ = individual totalizing of certain organism in square

Identity of Morista indexes show that are:
Id < 1 = uniform distribution type
Id = 1 = random distribution type
Id > 1 = group distribution type

Density of mangrove species (Ki) is the amount of species individual of i in expressed area unit (Bengen, 2001):

$$\mathbf{Ki = ni / A}$$

Clarification;
Ki =density of species (indvidu/m^2)
ni =amount of certain individu
A =totalizing wide of sampling area

Density relative species (KRI) is comparison between amount of species individual of i (ni) and is full scale o] individual entire all species, with the following formula.:

$$\mathbf{KRi = (ni / \Sigma n) \times 100}$$

Plankton was collected in one cycle tidal water at intertidal area in one station with survey method sampling in daily. The time Intake of sample is all time in days at about 0.5 m of depth. Environmental factor measured with direct perception to habitat characteristic and vegetation. Temperature, oxygen dissolved, and salinities measured by water checker. Analysis of plankton and water sample as result of work in field was done in laboratory of Water Quality, University of Borneo. Plankton sample were measured to find species and its abundance.

The formula was used to get abundance of plankton based from Rimper (2002).

$$\mathbf{N = n \times (Vr/Vo) \times (1/Vs)}$$

The information's, N as amount cel per liter; n as Totally plankton from observation; Vr as Volume of water in the net (ml); Vo as Volume of observation water (ml); Vs as Volume of Water from field (l). Biodeversity Index was used index Shannon-Wiener (H') by Krebs (1989):

$$\mathbf{H = \sum (Pi \, Ln \, Pi)}$$

The informations, H as Biodiversity Index; Pi as Amount of n species/Totally. The biodiversity value index is depend on Wilhm and Dorris modification (1968) in Masson (1981). If the value H' < 1 that mean plankton have low biodiversity, If the value 1 < H' < 3 that mean the plankton intermediet biodiversity, If the value H' < 3 that mean plankton have high biodiversity. SWOT analysis was used for arrangement management strategies.

RESULT AND DISCUSSION

According to result of sample perception and intake at research location got that from 4 station perceived with intake 6 plot each station was founded totally 35 individual kapah clam. The biggest appearance of kapah clam (*Meretrix sp.*) found at station 2 with totally apparition 17 individuals. While if according to division of intertidal area got biggest apparition at intertidal middle areal with totally is 17 individual (plot number 3 and 4) Apparition of kapah clam posed at table 1.

Community structure of kapah clam obtained information that at station number I was found 2 individual with density value equal to 0,033 individual/m^2, and distribution index equal to 0,00 indicate that distribution type of kapah clam in this station is uniform (Id < 1). At station number II was founded 17 individual of kapah clam with density value equal to

0,283 individual/m^2, and distribution index equal to 2,294 indicate that distribution type of kapah clam in this station is group (Id>1). At station number III was founded 7 individual of kapah clam with density value equal to 0,117 individual/m^2, and distribution index equal to 1,143 indicate that distribution type of kapah clam in this station is group (Id>1). At station number IV was founded 9 individual of kapah clam with density value equal to 0,150 individual/m^2, and distribution index equal to 1,167, indicate that distribution type of kapah clam in this station is group (Id>1).

Tabel 1. Apparition data of kapah clam each reseach station

Station	Sample Plot						Total Individu
	I	II	III	IV	V	VI	
I	0	1	0	0	0	1	2
II	0	1	0	10	4	2	17
III	1	1	2	3	0	0	7
IV	1	0	2	0	3	3	9
Total	**2**	**3**	**4**	**13**	**7**	**6**	**35**

According to division of intertidal area, at plot number 1 was founded 2 individual of kapah clam (*Meretrix sp.*) with density value equal to 0,033 individual/m^2. At plot number II was founded 3 individual of kapah clam with density value equal to 0,050 individual/m^2. At plot number III was founded 4 individual of kapah clam with density value equal to 0,067 individual/m^2. At plot number IV was founded 13 individual of kapah clam with density value equal to 0,216 individual/m^2.

At plot number V was founded 7 individual of kapah clam with density value equal to 0,116 individual/m^2, and at plot number VI was founded 6 individual of kapah clam with density value equal to 0,100 individual/m^2. Mean distribution index value each research station show equal to 1,151,this indicate that distribution type of kapah clam in all research station is group (Id>1). Distibutin of kapah clam always found group distribution that influenced by various factor.

The among others factor is the condition of substrate living of kapah clam. Organic material in its substrate useful as source of food kapah clam and also supported by condition water quality in Amal Lama Beach which reside in at gyration support the continuity of kapah clam life. According to Parker (1975) *in* Rudi (2002) that animal distribution of benthos influenced by condition environment of substrate.

In general, Kapah clam distribution of mangrove area Amal Lama Beach always found in group at each station (Table 2), except station number I (uniform type). The type of kapah clam distribution was founded make uniform, its guest that kapah clam have high ability to adaptation in environment. While kapah clam distribution type always make group , its guest that it have nature character which life group and uniform at one place all time. Result of research show that type of substrate is always muddy sand. According to Nirarita *et.al*. (1996) in general, animal like benthos like living in substrate with popular mud more than sandy only.

Table 2. Distribution type of kapah clam at mangrove area Amal Lama Beach based on Morista index

Station	Morista Index	Distribution Type
I	0.00	Uniform
II	2.294	Group
III	1.143	Group
IV	1.167	Group
Mean	**1.151**	**Group**

Beside to get population structure data information and distribution kapah clam, this research is also supported by data shell length measurement kapah clam that founded at each station. Size of shell Kapah clam that was found in each station is varying from small until big size. At station number I was founded kapah clam with size 3.0 – 6.8 cm, station number II was founded kapah clam with size 0.9 – 7.9 cm, Station number III was founded kapah clam with size 4.1 – 5.6 cm, and at station number IV was founded with size 2.8 – 8.8 cm. The mean shell size at station IV was founded more big than the other station, its guest that organic matter as food kapah clam available abundance, its because this station is near estuary with high density mangrove than other station.

Adult *Meretrix sp.* represent is feeder filter organism, as also to bivalve in general. Relate to the nature of eating this cockle, Dahuri (2002) important reminding of cockle sanitation because organism of filter feeder will accumulate food, materials and dirt of pollution other in its flesh

In general, The food of *M. meretrix* are detritus and fitoplankton (Rudi, 2002). From other reseach show that whole fill stomach of *Meretrix lyrata* indicate that 90% its contents is detritus (Vo, 2000 in Rudi 2002). This Detritus is available from mangrove exist in around this area or brought to through river water. Nutrient content will be high especially during the rains. Existence exploitation activity of mangrove can lessen cockle food in quality and quantity, its can improve sedimentation in river estuary. The protection is needed to absolute mangrove ecosystem for maintain territorial water stability.

Organic materials which required by kapah clam at this research station is come from vicinity environment, among others come from runoff river estuary and from mangrove forest in upper intertidal area.

Based on observation in field show that at each station growed by type mangrove of *Sonneratia alba* and *Avicennia alba* with different density at each other. Mangrove density value at station number I is equal to 0,02 individual/m^2, at station number II is 0.07 individual/m^2, at station number III is equal to 0.04 individual/m^2, and at station number IV is equal to 0.09 individual/m^2. Height density of mangrove in station number II, III and IV cause the amount of kapah clam found also more abundance to than at station number I. Mean of mangrove density value posed at table 3.

Table 3. Mean of mangrove density (ind/m^2) in mangrove forest Amal Lama Beach

Kinds	Stasiun							
	I		II		III		IV	
	Ki	KRi	Ki	KRi	Ki	KRi	Ki	KRi
Sonneratia alba	0.02	9.09 %	0.05	22.7 %	0.03	13.63%	0.07	31.81%
Avecennia alba	0.00	0 %	0.02	9.09 %	0.01	4.54%	0.02	9.09%
SUM	0.02	9.09%	0.07	31.8 %	0.04	18.18%	0.09	40.91%

Plankton Condition

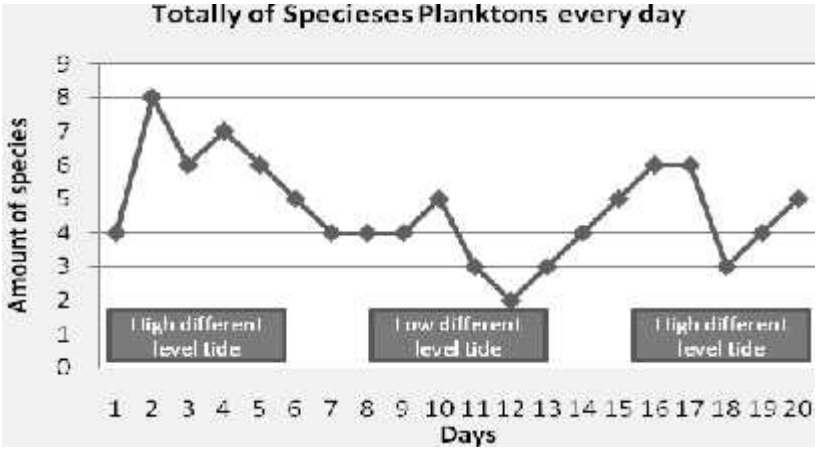
Totally of plankton density value is between 7.500 – 47.000 individual/l. Plankton at Amal Lama waters area is very variants and its have fluctuate at daily on August and September 2010. The highest abundance plankton found in fourteenth (14) of days with the amount is 47.000 cell/ml. The lowest was founded in 8, 9 and 19 of days. The amount plankton in that all day is about 7500 cell/ml. In one and half cycle of tidal waters type mixed tide prevailing semi diurnal, the high abundance always be founded at high different level tide with intermediate level of biodiversity , and rare abundance plankton be founded at low different level tide with low level of biodiversity too and it time plankton have dominant species.

Phytoplankton was founded is about 17 specieses. The most plankton appear in daily that is *skeletonema costatum* and *Dytilum* sp.. *Skeletonema costatum* appear eleven time in twenty days with totally amount is 85.500 cell and *Dytilum* sp., appear twelve time with totally amount is 75.000 cell. At generally, *Crysophyceae* or diatom class is the dominant plankton that always appear in daily all time in this research. The cause is water sea have composition with silica element which it needed for make a wall of diatom class.

Zooplankton was founded is about 7 specieses. They are some classes (Crustacean larvae, Bivalve larvae , Annelida class, copepods larvae and others). The specieses of zooplankton are *calanus* sp., *Acatia* sp., *Harpacticoid copepods*, Annelida larvae and bivalves larvae. *Calanus* sp. appear two time in twenty of days with totally amount is 3000 cell, the others means appear only one time in twenty of days. In Generally The zooplankton was founded is larvae of organism at waters, it cause tidal water bring that larvae to the coastal area include mangrove water area, and its have function as nursery area for support living organism at waters.

Biodiversity

According identification result that plankton groups (*phytoplankton* and *zooplankton)* in high different level tide to low different level tide water about ten days of twenty of days sampling plankton that its been founded in all days. Plankton groups (*phytoplankton* and *zooplankton)* in low different level tide water to high different level tide water about ten days of twenty of days sampling plankton that its been founded in all daysThe data show that in low different level tide water the biodiversity of specieses always low which its until found 2 specieses only and after that its will be increase in high different level tide water. Generally, Totally of specieses plaktons number that its founded at daily in one and half cycle tidal water in mangrove waters at Amal Lama beach showed by the chart (Picture 1).



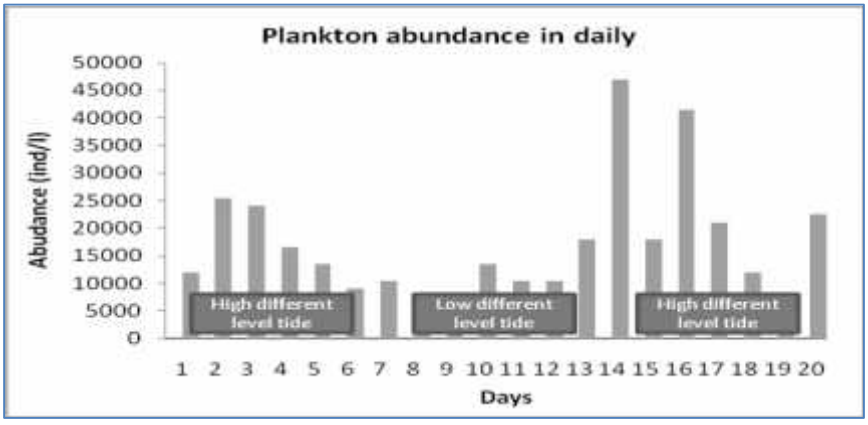
Picture 1. Cycle tidal water in mangrove waters at Amal Lama beach

The guest why its case be conducted because in high different level tide the curent of water is very fast than low different level tide. Of course, Its make turbulency on the water and the result nutrien in water will be increase that its can support plankton have good and fast growth in water. Generally, from the data, its show that biodiversity of plankton in research area (mangrove water at Amal Lama beach) is intermediate level.

Plankton Abundance

Plankton groups (*phytoplankton* and *zooplankton)* in low different level tide water to high different level tide water about ten days of twenty of days sampling plankton that its been founded in all days. The data show that in low different level tide water the amount of totally plankton always low which its until found 10500 indivudual/l planktons only and after that, its will be increase in high different level tide water.

The abundance of daily plankton in one and half cycle tidal water in mangrove water at Amal Lama beach showed by the chart (Picture 2(. That is picture show fluctuative plankton abundance in daily.



Picture 2. Totally plankton in high different water level tide is high than low different water level tide.

Biodiversity index

According analysis result that plankton groups (*phytoplankton* and *zooplankton)* in high different level tide to low different level tide water about ten days of twenty of days sampling plankton that its been founded in all days. The biodiversity index value of plankton in this cycle about ten days is 1.213 – 1.840. The data show that in high different level tide water the biodiversity plankton index value always increase which the higest until found 1.840 in second day and after that its will be down in low different level tide water that its down until 1.311 in tenth of days.

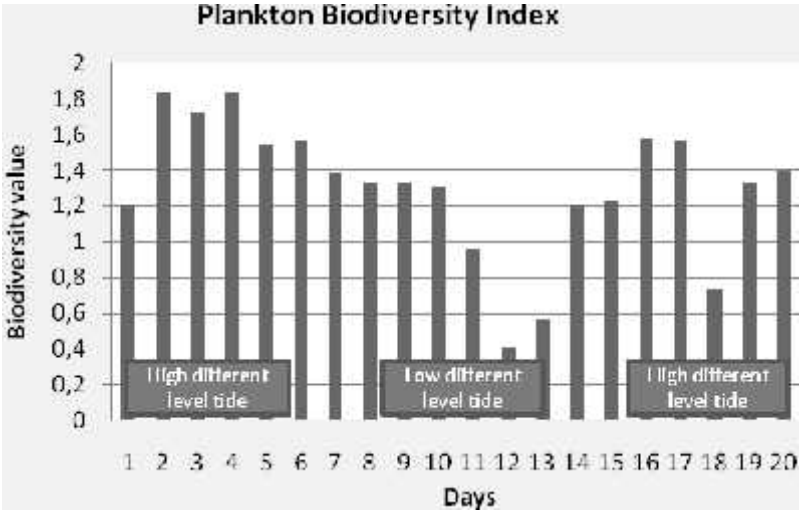
Plankton groups (*phytoplankton* and *zooplankton)* in low different level tide water to high different level tide water about ten days of twenty of days sampling plankton that its been founded in all days. The biodiversity index value of plankton in ten days in this cycle is 0.410 – 1.577. The data show that in low different level tide water the biodiversity plankton index value always low to, and after that its will be increase in high different level tide water.

The biodiversity index value of daily plankton in one and half cycle tidal water in mangrove water at Amal Lama beach showed by the chart (Picture 3). Other factor supporter of existence kapah cockle in territorial water that is condition of bio physic. Kapah cockle like other sea biota require that condition to the continuity of its life.

Based on observation in field show that condition of water quality in each station research obtained by gyration assess territorial water show that temperature 31.0 – 31.8 ^{0}C, salinity 26-28 ppt, water pH 7.8 – 8.0, electrics value 41 - 43 mS/cm and dissolve oxygen between 3.7 - 4.9 mg/lt. condition of water quality at each research station still supporting to kapah clam living. Condition of water quality and substrate posed at table 4. Condition of the quality of water in research location posed at table 6 as according to for the life of kapah clam (*Meretrix* sp). This Matter as according to result of study which have been conducted by Rudi (2000) in Miskam Panimbang Bay.

Table 4. Water quality and substrate condition at each reseach station

Parameter	**Stasiun**			
	I	**II**	**III**	**IV**
Temperature	31.6	31.0	31.8	31.5
pH	8.0	7.8	7.9	7.8
Salinity	27.5	28.0	26.7	27.7
Dissolve oxygen	4.93	3.73	4.99	4.53
Electrics	42.5	43.3	41.4	42.5
Substrate	Muddy sand	Sandy mud	Muddy sand	Muddy sand



Picture 3. The biodiversity index value of daily plankton in one and half cycle tidal water in mangrove water at Amal Lama beach

From result of this study is known that kapah cockle life at temperature 28 - 30 0C, gyration of salinity 10 - 32 ppt, dissolved oxygen gyration 4 - 6 mg/l and pH between 6 – 7. In general, condition of substrate is muddy sand which predominate in each research station, this substrate type according to for the life of kapah clam (*Meretrix* sp.).

This Matter as according to Carpenter and Neim (1998) expressing that the typical of *M. meretrix* inhabit in territorial water at zone of intertidal and of sublitoral is muddy sand substrate. The results of R / C ratio is 20.6. that indicates greater than 1 (> 1), this means catching kapah clam (*Meretrix* sp) is worth it.

Management strategies for sustainable resources of kapah clam at Amal Lama Beach are :

Monitoring of Kapah clam source at Amal Lama Beach

This is first activity must be do for get information of kapah clam at Amal Lama Beach, In this strategic we have some information for arrangement next strategic in the future.

Selection size in capture

In capture process by farmers, all size of kapah clam will be collected. This condition have bad impact to the resources. In this strategic farmers must be selection when they collected the kapah clam.

Management time for capture

Kapah clam have high economic values and that faced high exploited at every days. Capture of kapah clam (*Meretrix sp.*) in Tarakan island specially in Amal Lama Beach have been done during the years with high exploited along season. Amal Lama Beach, one of the area which often as made capture area of kapah clam. From result of interview with some fisherman's who catch kapah clam and sea food shop in Amal Lama Beach Area show that have happened degradation of amount harvest per days.

Like in area of Panimbang, Province of Banten, cropping can take place during the year and taken by all size measure. This region is estimated have happened abundant

intake (overexploitation) causing drastic degradation to its population from year to year (Rudi, 2002). Management time for capture is make kapah clam (*meretrix sp*.) have much time for growth and this will help its to survive.

Determine of protecting area

For determine of protecting area, we must determine it location based on breeding area of kapah clam. This strategic will protect adult kapah clam from degredation cause of over capture. And than it can breeding with itself.

Maintaining with restocking

The last strategic is with restocking kapah clam seed. This is long strategic, because before we restocking we must make hatchery facilities for kapah clam (*Meretrix sp*.). For this strategic will be needed specific and a feasibility study.

CONCLUSION AND SUGGESTION

Community structure of kapah cockle (*M. Meretrix*) obtained information that at each research station was founded 35 individual totally with density value between 0.033 individual/m^2 until 0,283 individual/m2 and mean distribution index value 1.151, indicate that distribution type of kapah cockle (*M. Meretrix*) in this station is group (Id < 1). The size of shell cockle kapah is varying between 0.9 – 8.8 cm.

From result of this study is known that kapah cockle life at temperature 31.0 – 31.8 ^{0}C, salinity 26-28 ppt, water pH 7.8 – 8.0, electrics value 41 - 43 mS/cm, dissolve oxygen between 3.7 - 4.9 mg/lt and condition of substrate is muddy sand which predominate in each research station,

Management strategis are monitoring of Kapah clam source at Amal Lama Beach, selection size in capture, management time for capture, Determine of protecting area and maintaining with restocking.

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