The Institute of Oceanography
Nhatrang, Vietnam

FINAL REPORT
(SECOND RSG PROJECT)

RESTORATION THE MARINE ANIMAL RESOURCES IN SEAGRASS MEADOWS AT CAM HAI DONG, CAM RANH BAY, KHANH HOA PROVINCE, CENTRAL VIETNAM.

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1. INTRODUCTION:

Cam Ranh bay area is situated from 11º49'07" to12º06'56" North latitude and from 109º07'03" to 109º10'54" East longitude, where the seagrass meadows have concentrated distribution with the superficies up to more than 1000 ha, there are 6 common species of seagrasses have been found there, among them *Enhalus acoroides* which has long leaves (1-2 m), dense density (40-100 shoots/m^2) and high cover (70-100%) is dominant.

The seagrass ecosystem play an important role in biodiversity, marine resources and ecological balance. Studies showed that, there were 37 species of mollusc, 13 species of crustacea, 12 species of echinoderms and 87 species of marine fish have been found (Nguyen Huu Dai et al., 2000). Valuable resources in this area were: shrimp (Penaeidae), crab (Portunidae), sea-horse (*Hippocampus kuda*), mollusc (Strombidae, Arcidae, Veneridae…), sea-urchin and sea-cucumber (*Holothuria scabra*). Among 87 fish species, 30% of which are commercial species (Siganidae, Lutianidae, Mugilidae, Serranidae, Ambassidae, Apogonidae, Sillaginidae…).

The role of seagrass beds in nursery grounds in this area also have been reported . The results of study showed that, the species composition as well as the density of juvenile of shrimp, crab and fish in seagrass beds were higher (3-5 times) than those in bare substrata. Fishing in seagrass beds has become more important as a food source and livelihood for coastal people in the region.

But now, because of human activities (shrimp culture development and some destructive fishing gear and methods), seagrass distribution areas were reduced. Recent studies showed that seagrass beds in Khanh Hoa were loss or reduced up to 30% of distributive areas (Nguyen Huu Dai, Pham Huu Tri, 2004). The main reasons are: extensive shrimp farming, fishing by pushnet or trawling, degradation of seawater quality by waste water discharged from shrimp ponds and eutrophication from small rivers. More important, by demand of food for lobster cages, destroyed fishing way by digging seagrass beds for mollusc (*Lingula* spp) is main reason of seagrass loss. The consequence of seagrass degradation and over fishing cause the decreasing of biological resources, some valuable species reduced or disappeared .

In the year 2007 thanks to the financial supportation from the Rufford Maurice Laing Foundation we implemented the Phase 1 of the project "Rehabilitation and conservation the seagrass meadows at Cam Hai Dong, Cam Ranh bay, Khanh Hoa province, central Vietnam"

In this project we replanted an area of 5ha of seagrasses (*Enhalus acoroides*) at Cam Hai Dong village, Cam Ranh bay and set up some pilots for rearing the sea-cucumber and sea-horse in the seagrass meadows covered by net, these studies had good success and would be the pattern for the local community to apply (see the final report were submitted to Rufford Maurice Laing Foundation)

In order to keep the continuity of the project as well as to consolidate the secured achievements some other contents of project are needed to continue to implement at right now such as: monitoring the restorated seagrass area and replanting the lost seagrass areas, restoration the marine animals living in the seagrass bebs such as: sea-horses, sea-cucumbers, bivalves, molluscs… in order to increase the marine biological resources and biodiversity of seagrass meadows.

Apart from that, in order to help the local community to reduce catching the natural animal resources live in the seagrass meadows we will train and transfer, to them, the skills in culturing the economic seaweeds (*Kappaphycus alvarezii, Kappaphycus striatum*) and others marine animals such as: mollusc (*Strombus spp*), bivalves (*Perna viridis*) sea-cucumber(*Holothuria scabra*), sea-horse (*Hippocampus kuda*) in the buffer zone of seagrass area. The culture of these objects will help the local community to improve their livelihood.

Simultaneoutly, to implement successfully this project will help the local community having stably the means of livelihoods, bring knowledge to the people of the village about the biological resourses in the seagrass meadows where they are living and built their capacity to conserve the natural resources.

2. OBJECTIVES:

The aims of this project are:

1. To restore and conserve the biodiversity and biological resources in seagrass meadows: in particular, the conservation of sea-horses and sea-cucumbers. An added bonus is conserving the habitat of animals that live outside seagrass meadows but use them as nursery or breeding areas.

2. To train and transfer the technologies of culture the marine animals and economic seaweeds to local community (bivalves, molluscs, seaweeds)

3. To help the local community to improve their livelihoods by culturing the seaweeds and others marine animals in the buffer zone of seagrass meadows in order to reduce the catch of marine animals in seagrass beds.

3. MATERIALS AND METHODS :

3.1 Project site:

The project site was selected at the Cam Hai Dong village, Cam Ranh bay, Khanh Hoa province (Fig.1, 2, 3)

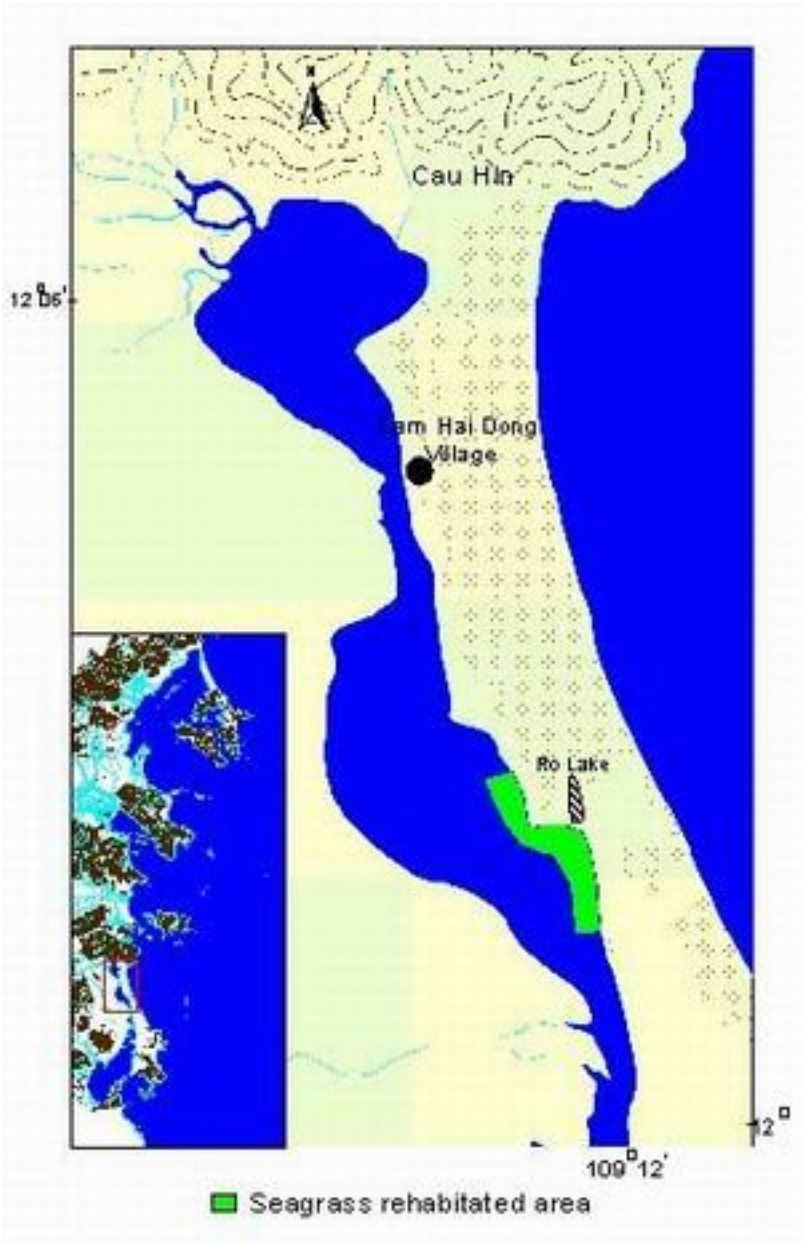


Fig. 1 Map showing the seagrass rehabilitated area at Cam Hai Dong, Cam Ranh bay

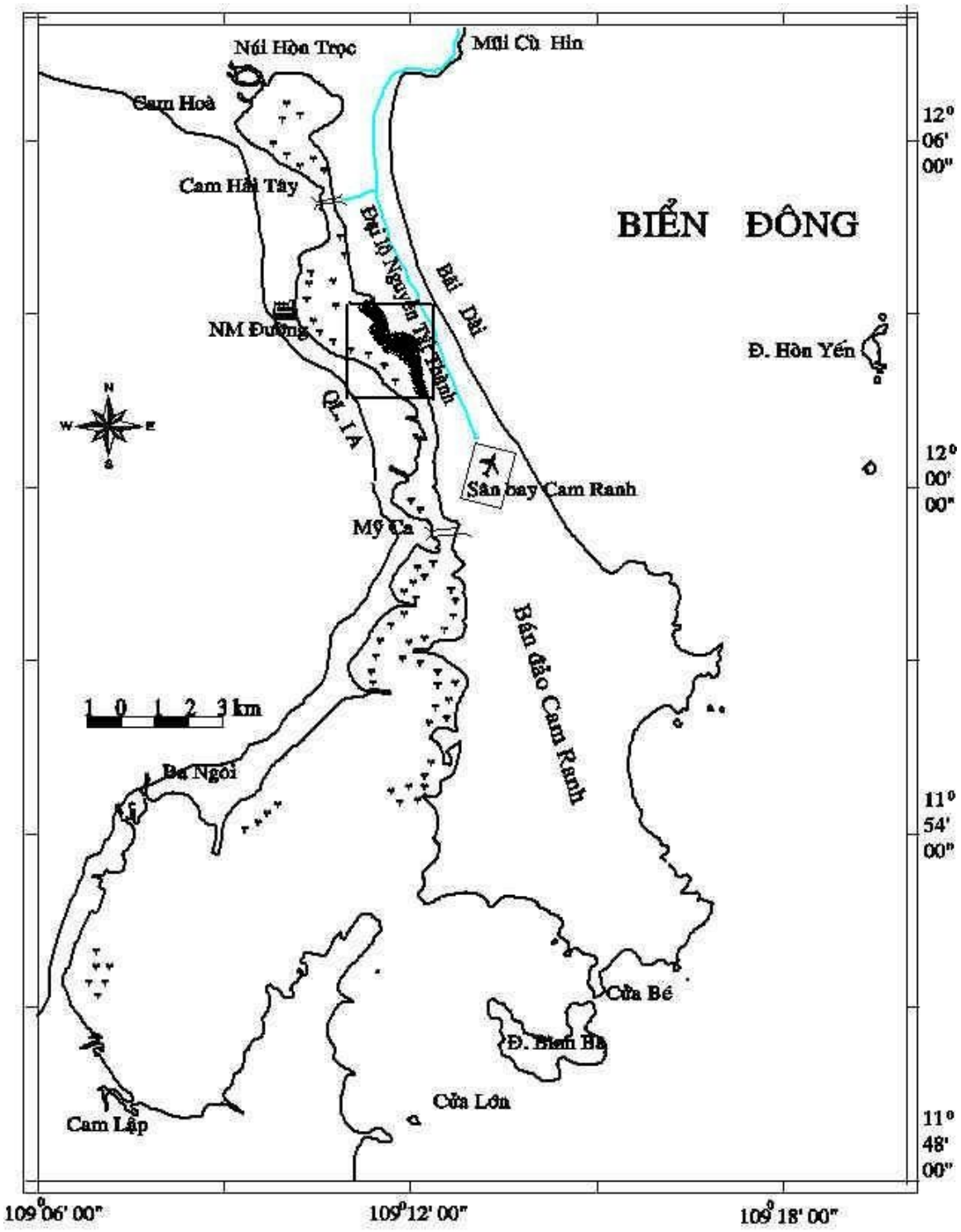


Fig. 2 [redacted] Seagrass rehabilitated area at Cam Hai Dong, Cam Ranh bay

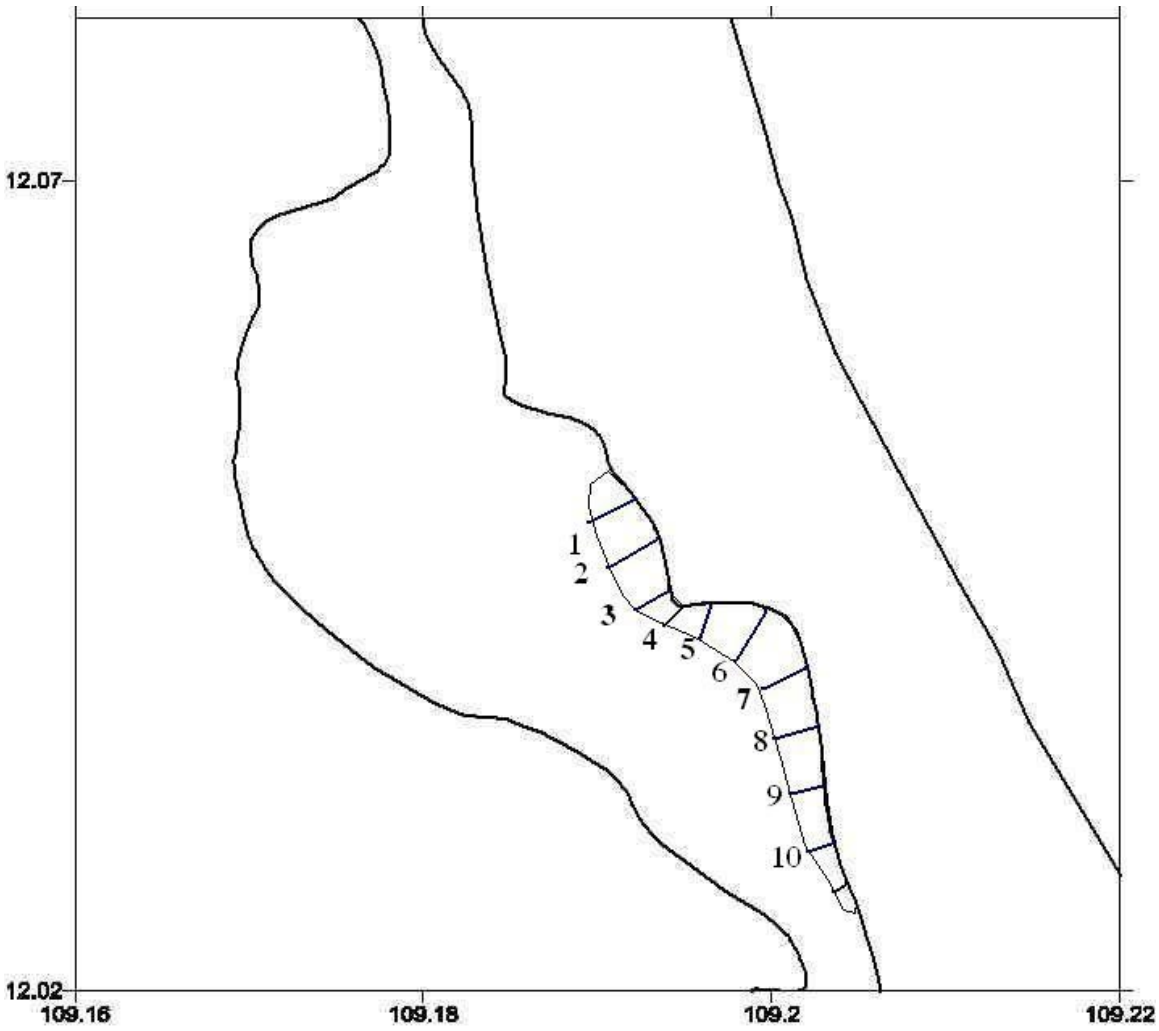


Fig. 3 Transect sketch of the rehabilitated area

3. 2 Duration of the project:

This project have been implemented from January 2009 to December 2009 and local community participated to replant and manage the rehabilitated seagrass meadows.

Training workshops were organized every 2 months in order to train and transfer the techniques of cultivation the marine animals such as bivalves, molluscs, sea-horses, sea-cucumbers and economic seaweeds: *Kappaphucus alvarezii and Kappaphycus* striatum.

These training workshops also helped to increase the awareness of protection the natural seagrass ecosystem and build its capacity to conserve natural biological resources in seagrass beds.

3. 3 Planting techniques:

3.3.1 Economic seaweeds:

Economic seaweeds were selected for planting in Cam Hai Dong are *Kappaphycus alvarezii* and *Kappaphycus striatum,* they are the major raw material using for processing carrageenan, many companies needs to buy for their productive requirements so the price of raw material have been raised day by day.

- The planting techniques of the two economic seaweeds *Kappaphycus alvarezii* and *Kappaphycus striatum* by using two methods:

+ Bottom monoline method: This method is used in the shallow water area. In this method, the seaweeds is tied along the nylon cord which is attached to a stake and is allowed to grow for 3 months. In a monoline method a 1 hectare area is divided into 4 smaller section of 0,25 ha hectare (2,500 sp m.) size or smaller. The distance between each section should be at least 5 feet apart.

+ Floating monoline method: This method may be done in deeper sites or in sites with a very irregular bottom contour. In this method the monoline was arranged in a similar manner as in the ” bottom monoline method” described above but these are tied to a buoy on each end. The whole structure floats naturally because of the buoys, but floating can still be reinforced by attaching of buoys along the sides of the structure. The whole set-up is then tied to the bottom on its four sides.

+ Preparation of seedlings: to prepare the seedlings for planting by cutting or splitting with a knife the *Kappaphycus* seed stocks into 100 to 300 grams. Tie each with a 25 cm long " tie-tie" or soft plastic straw. Make sure that the "tie-tie" is positioned at the center of gravity of the seedlings before making a knot in order to hold it firmly.

+ Tie each seedling to the monoline at 15 to 25 cm intervals. Be sure that the seedlings are tied securely to the monoline. In order to facilitate the maintenance and management of the farm, planting should be done on a unit or module basis. In order words, a unit of the farm should be planted fully first before proceeding to plant the next unit.

3.3.2 Marine animals:

- Sea-horses (*Hippocampus kuda*): Juveniles of *Hippocampus kuda* at 60 days of age were supplied from the Laboratory of the Institute of Oceanography (artificial spawning) and transported them to the rehabilitated seagrass area.

- Sea-cucumbers (*Holothuria scabra*): Juveniles of *Holothuria scabra* were supplied from the Lab. of the Research Institute for Aquaculture No. 3 and also by fishermen from nature (collected them in the open sea areas)

Rearing them in the seagrass areas covered by net, with the density at 10 *Hippocampus kuda*/m^2 and 10 *Holothuria scabra*/m^2. An amount of 2000 *H. kuda* at 50- 60 mm long and 1000 *H. scabra* at 80-100gram weight were reared.

- Bivalves:

a. Green mussel (*Perna viridis*) : Juveniles of green mussel can take in the natural environment by using the stakes which were staked in the buffer zone of seagrass beds near the current of seawater and the juveniles of green mussel will stick on these stakes. At Cam Hai Dong, local community bought the juveniles of green mussel from Nha Phu lagoon (Ninh Ich, Ninh Loc villages) and transplanted them to the cultured sites. There are two methods for culturing the green mussel:

+ Using the monoline: In this method the nylon bags of juveniles is tied along the nylon cord which is attached to a stake. During low tides, the monoline should be about 0.5 to 1.0 meter deep so that the juveniles of green mussel will not be exposed to sun and air.

+ Using the stake: In this method the nylon bags of juveniles is tied along the stakes which were staked in the bottom.

b. Clam (*Meretrix meretrix*) : This kind of clam were cultured in the buffer zone of seagrass beds by covering the net surrounding the cultured area. Juveniles of clam were supplied from nature. In the harvest (March to April) fishermen can collect in the open sea areas with the density 30-40 individuals/m^2.

Local villagers cultured this species with the density at 50 ind./m^2

- Molluscs (*Babylonia areolata*- Babylone snails): Babylone snails is the kind of mollusc which has the high value in nutrition, most delicious in all the kinds of seafood.
Babylone snails were reared in the pond with cage which covered by net. The juveniles of babylone snails were supplied from the lab. of the Research Institute for Aquaculture No. 3. Breeding yough molluscs with the density of 100 individuals per m^2 (6,000-8,000 Individuals weight per kg)

3.3.3 Management and taking care of the rehabilitated area at Cam Hai Dong, Cam Ranh bay:

Local community participated to take care and guarded the rehabilitated area, to replant the seagrass loss, to restore the marine animals in seagrass beds, to culture the sea-horses, sea-cucumbers, bivalves, molluscs and economic seaweeds in the buffer zone.

A suitable management regime was introduced that is acceptable to the local villagers and retain biodiversity in the seagrass meadows. Seahorses, seacucumbers culture will reduce the take of natural stocks and bivalves or molluscs culture will reduce the need to take all molluscs found by gleaning.

An education program have been introduced to show villagers the need for careful management. Species like the sea- horses, sea-cucumbers, crabs have been better conserved.

In the future the local villagers has authority to exploit reasonably the biological and environmental resources of seagrass ecosystem.

4. RESULTS:

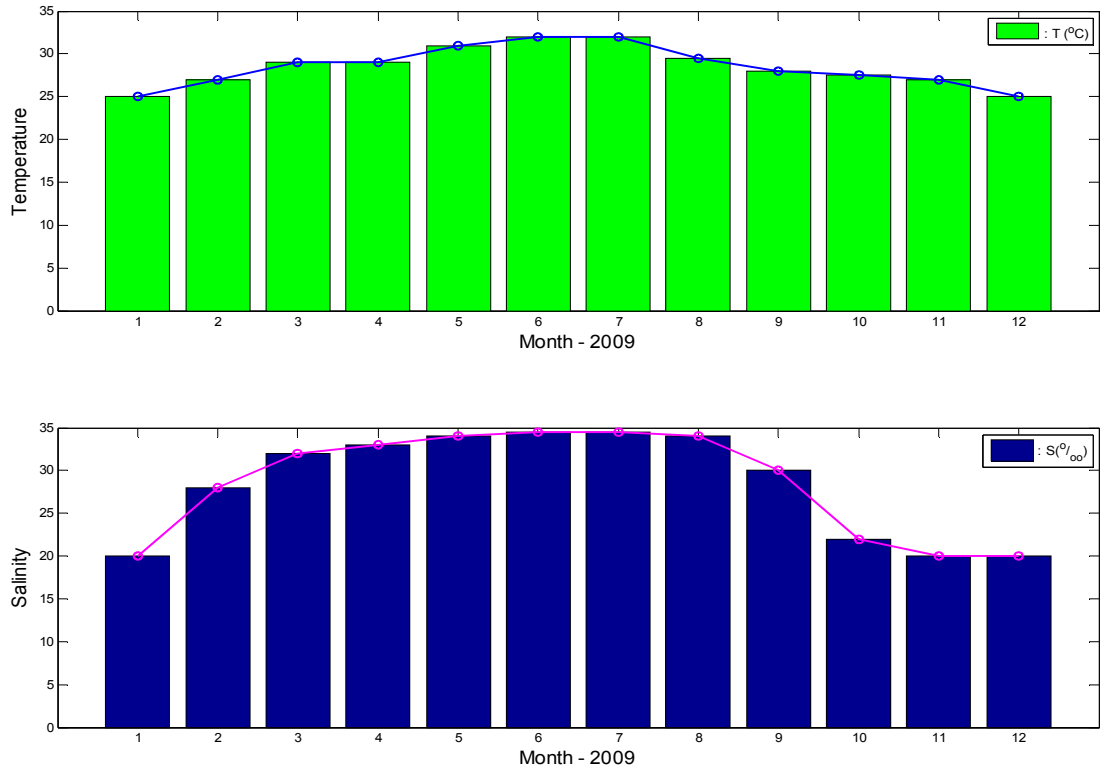
4.1 The natural environmental elements in the rehabilitated area – Cam Hai Dong- Cam Ranh :

Some natural environmental elements were calculated, among them the number of exposed times by daytime were studied because it affect to the existence of seagrasses and marine animals. The result is showed as follows (Table 1):

Table 1: The natural environmental elements in the rehabilitated area In 2009.

Time (month)	The average temperature of sea water at 12 :00 noon (˚ C)	Exposed time of low tide by daytime (hour/day)	The average of salinity (‰)
Jan/2009	25	1 hour(morning)	20
Feb/2009	27	1-2 hours(morning)	28
March/2009	29	3 hours(afternoon)	32
April/2009	29	4 hours(afternoon)	33
May/2009	31	4-5 hours(afternoon)	34
June/2009	32	5 hours(afternoon)	34,5
July/2009	32	4 hours(afternoon)	34,5
Aug/2009	29,5	3 hours(afternoon)	34
Sep/2009	28	2 hours(afternoon)	30
Oct/2009	27,5	1 hour(afternoon)	22
Nov/2009	27	2 hours(morning)	20
Dec/2009	25	2 hours(morning)	20

Fig. 1 Variation of Temperature and Salinity of seawater at the rehabilitated Area.



4.2 Economic seaweeds:

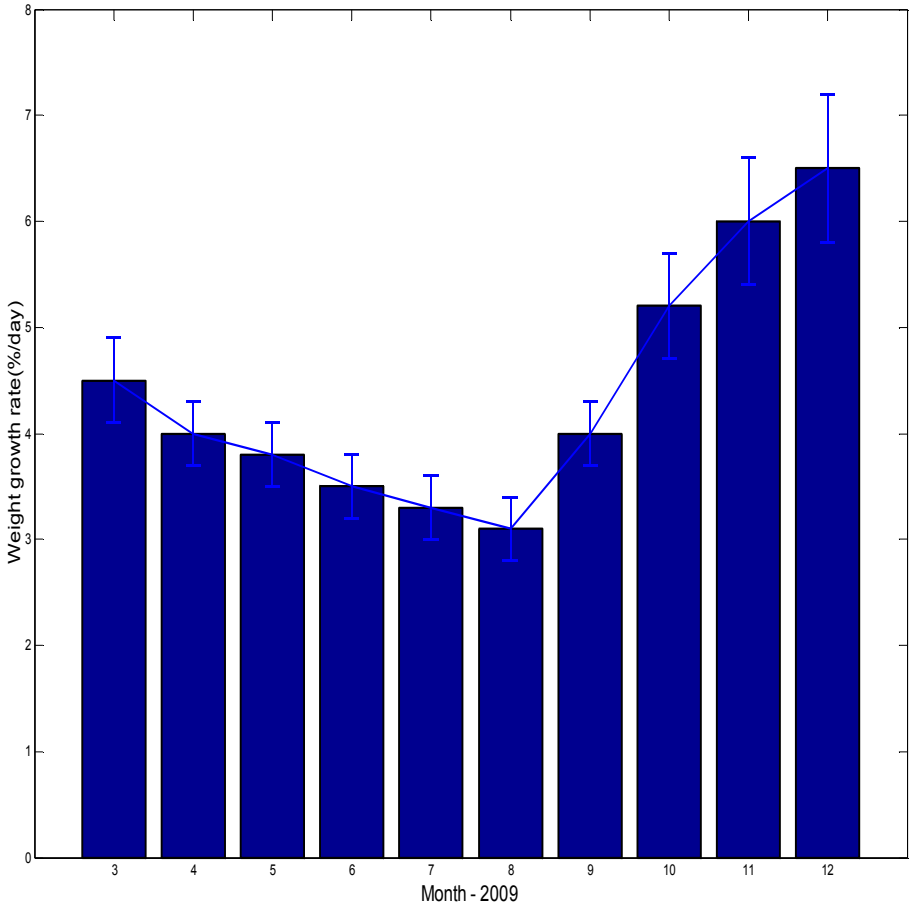
4.2.1 *Kappaphycus alvarezii* Doty:

This species of seaweeds used for the production of carrageenan is commonly known as *Eucheuma cottonii*. This kind seaweed at present, is widely cultivated in the Philippines. Farming of this seaweed started in southern Mindanao in the mid' 60s and had expanded to other parts of the Philippines and to other countries like Indonesia, Fiji, Micronesia, China. In Vietnam this kind seaweeds was transplanted from 1993 and farmers planted them along the coastal waters of Ninh Thuan, Binh Thuan, Phu Yen and Khanh Hoa Province. This seaweed is easily planted and well developped in the coastal areas in Vietnam. In Cam Hai Dong village we encouraged the villagers to plant in the buffer zone of seagrass area and the result of study is as follows:

Table 2. Weight growth rate of *Kappaphycus alvarezii* were planted in the buffer zone of seagrass area.

Month	Natural Environmental Elements						Weight growth rate (% /day)
	Temperature of seawater (ºC)		Light intensity (10^3 Lux)		Salinity (‰)	P^H	
	Morning	Afternoon	Morning	Afternoon			
3/2009	29	30	40,0	47,0	31	7,5	4,5±0,4
4/2009	30	31	46,0	53,5	32	7,1	4,0±0,3
5/2009	30	32	46,0	36,5	32	7,1	3,8±0,3
6/2009	31,5	32,5	42,0	52,0	33	7	3,5±0,3
7/2009	32	32,5	40,0	35,0	32	7	3,3±0,3
8/2009	30	31	41,0	40	33	7	3,1±0,3
9/2009	28	29	40,0	32	31	7,5	4,0±0,3
10/2009	27,5	28	33,0	30	29	8	5,2±0,5
11/2009	27	27,5	30,0	26	28	8,1	6,0±0,6
12/2009	25	26	28	29	25	8,1	6,5±0,7

Fig. 2 Variation of weight growth rate of *Kappaphycus alvarezii*



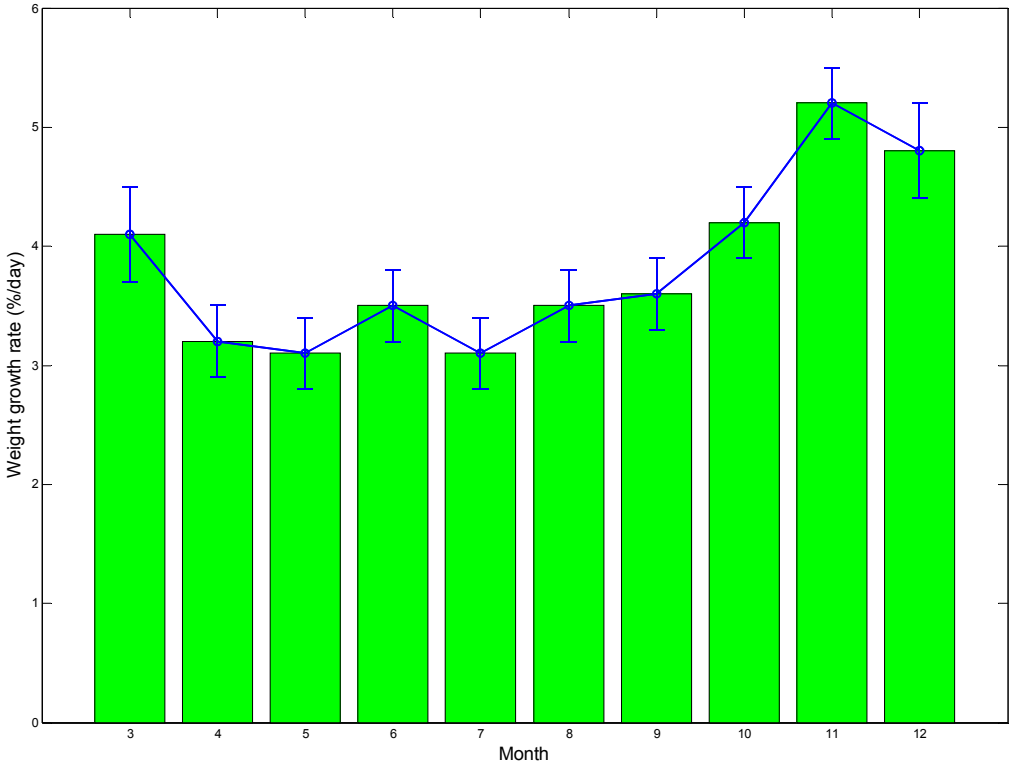
4.2.2 *Kappaphycus striatum* Doty:

This species of seaweeds also used for the production of carrageenan and has transplanted from Philippines from 2005. This kind seaweeds can grow in the summer (when the temperature of seawater is low) in spite of the dimension of this species is smaller than the *K. alvarezii* but the carrageenan content of them is the same.

Table 3. Weight growth rate of *Kappaphycus striatum* were planted in the buffer zone of seagrass area.

Month	Natural Environmental Elements						Weight growth rate (% /day)
	Temperature of seawater (ºC)		Light intensity (10^3 Lux)		Salinity (‰)	P^H	
	Morning	Afternoon	Morning	Afternoon			
3/2009	29	30	40,0	47,0	31	7,5	4,1±0,4
4/2009	30	31	46,0	53,5	32	7,1	3,2±0,3
5/2009	30	32	46,0	36,5	32	7,1	3,1±0,3
6/2009	31,5	32,5	42,0	52,0	33	7	3,5±0,3
7/2009	32	32,5	40,0	35,0	32	7	3,1±0,3
8/2009	30	31	41,0	40	33	7	3,5±0,3
9/2009	28	29	40,0	32	31	7,5	3,6±0,3
10/2009	27,5	28	33,0	30	29	8	4,2±0,3
11/2009	27	27,5	30,0	26	28	8,1	5,2±0,4
12/2009	25	26	28	29	25	8,1	4,8±0,4

Fig. 3 Variation of weight growth rate of *Kappaphycus striatum*



4.3 Marine animals:

4.3.1 *Perna viridis* Linnaeus:

Perna viridis or green mussel is a native to the Asia-Pacific region where it is widely distributed. It has been introduced elsewhere around the world through ship ballast, hull fouling and the experimental introduction for farming. *Perna viridis* can quickly form dense colonies in a range of environmental conditions.

Perna viridis is a large mussel, 80-100mm in length, occasionally reaching 165mm (Rajagopal et al. 2005). The shell has a smooth exterior surface characterised by concentric growth lines and slightly concave ventral margin. The shell is covered with greenish

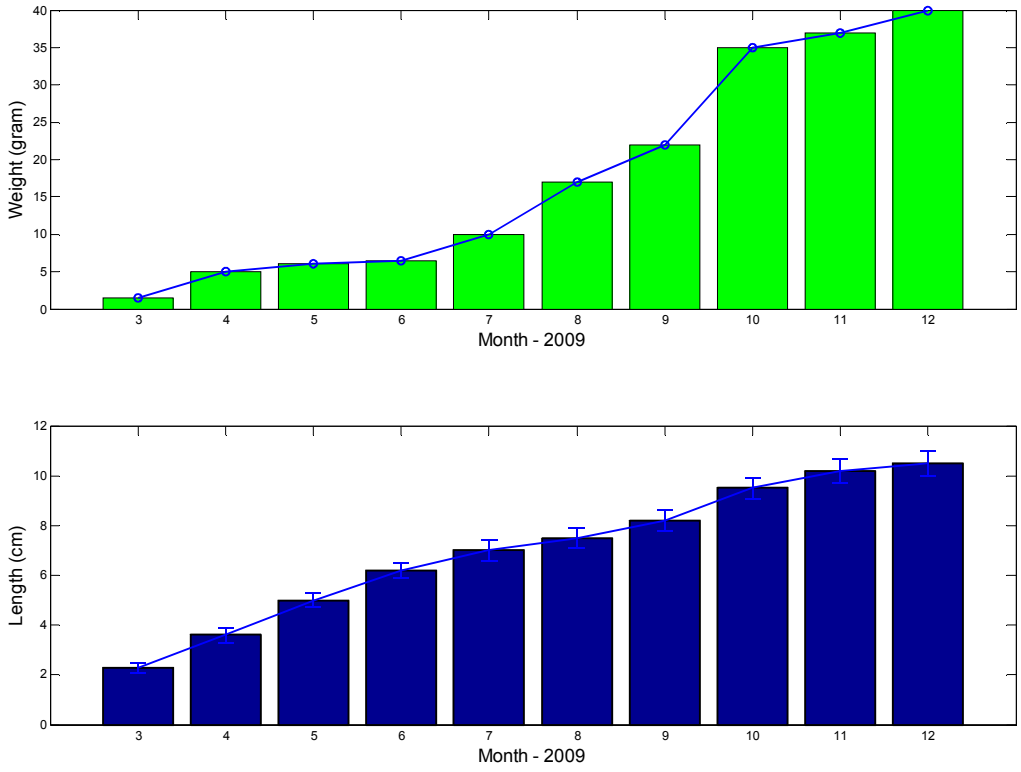
(variable in older mussels) periostracum; periostracum is generally intact in young ones and with patches peeled off in older ones.The colour of the perostracum is bright green in juveniles, fading to brown with green edges as it matures.

In Cam Hai Dong village we transplanted the green mussel from Ninh ich seawaters and cultured them in the buffer zone of seagrass area and the result of culture is as follows:

Table 4. Monthly variation of weight and length of *Perna viridis* were cultured in the buffer zone of seagrass area.

Month	Natural Environmental Elements				Weight (gram)	Length (cm)
	Temperature of seawater (ºC)		Salinity (‰)	P^H		
	Morning	Afternoon				
3/2009	29	30	31	7,5	1,5	2,3±0,2
4/2009	30	31	32	7,1	5,0	3,6±0,3
5/2009	30	32	32	7,1	6,0	5,0±0,3
6/2009	31,5	32,5	33	7	6,5	6,2±0,3
7/2009	32	32,5	32	7	10,0	7,0±0,4
8/2009	30	31	33	7	17,0	7,5±0,4
9/2009	28	29	31	7,5	22,0	8,2±0,4
10/2009	27,5	28	29	8	35,0	9,5±0,4
11/2009	27	27,5	28	8,1	37,0	10,2±0,5
12/2009	25	26	25	8,1	40,0	10,5±0,5

Fig. 4 Monthly variation of weight and lenght growth of *Perna viridis*



4.3.2 *Meretrix meretrix* Linnaeus(Asiatic hard clam)

This kind of clam live in the sand-flat or tidal mud flat along the seashore. This is the first time we carried out to culture in the sand-mud of buffer zone of seagrass beds. The studied results showed that they well developped in the sand-mud environment of buffer zone area with the gowth rate is high.

The studied data have been collected and will be presented in the next phase when we had complete data for this study.

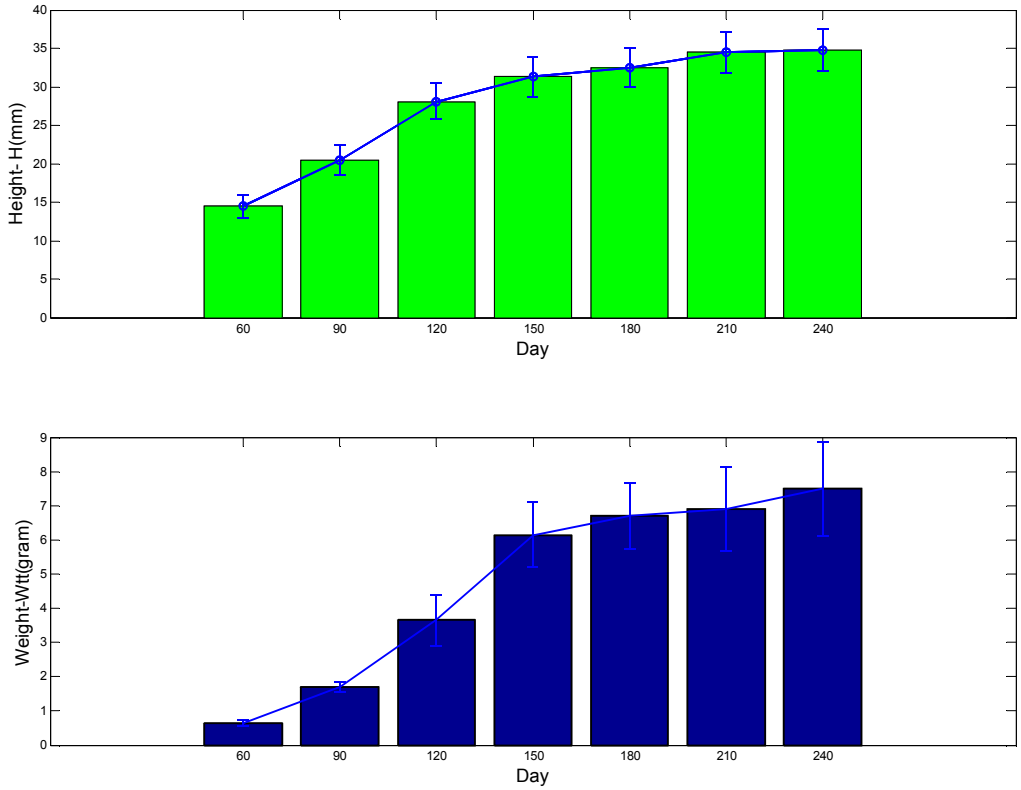
4.3.3 *Babylonia areolata* Linnaeus:

Babylone snails (*Babylonia areolata*) live in coastal waters with depths of about 5-10 m, sandy and muddy substratum. Babylone snails use the dead animal as food and they grow faster than other mollusc species. The result of study on growth of babylone snails is showed as below:

Table 5. **Time variation of height and weight of *Babylonia areolata* were cultured in the buffer zone of seagrass area.**

Time of culture (days)	Height of shell H(mm)	Weight Wtt(gram)	Survival rate (%)
60	14,5±1,48	0,65±0,09	60,50
90	20,5±1,92	1,70±0,14	59,50
120	28,10±2,31	3,65±0,76	58,47
150	31,30±2,60	6,15±0,95	57,55
180	32,50±2,52	6,70±0,96	55,70
210	34,50±2,70	6,90±1,23	54,80
240	34,80±2,73	7,50±1,38	53,80

Fig. 5 Time variation of height and weight of *Babylonia areolata*



4.3.4 Result of restoration the sea-horse at the rehabilitated area:

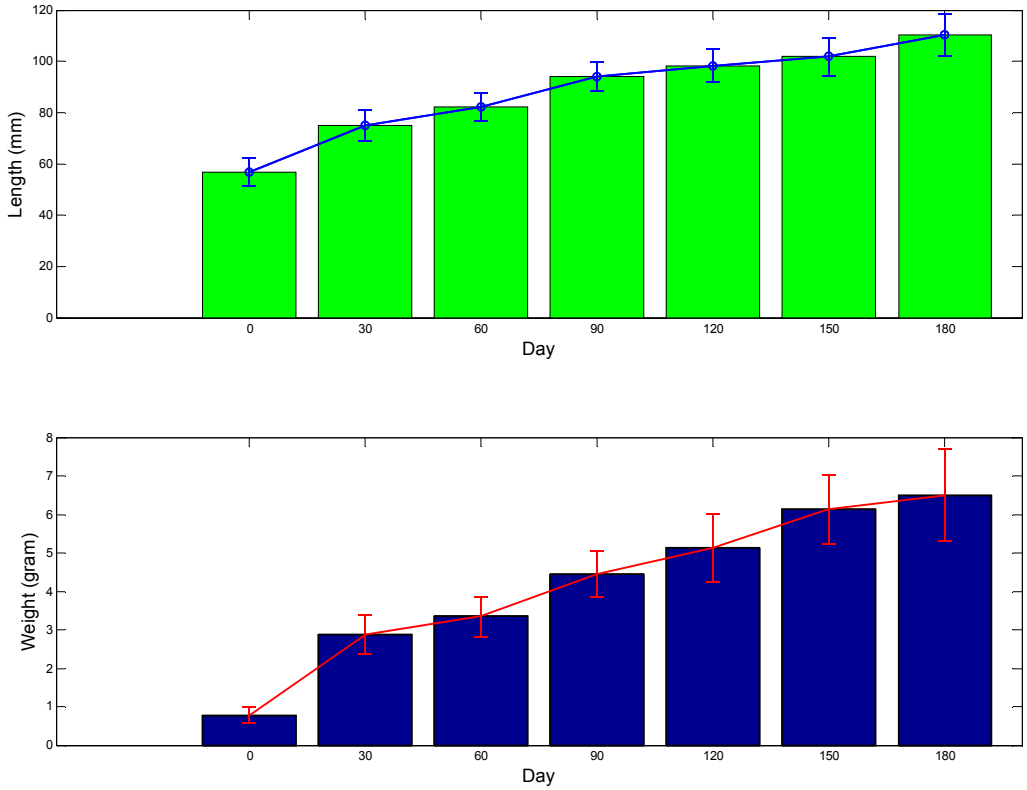
In the year 2007 in the first RSG we implemented a pilot aquacuture for rearing the seahorse (*Hippocampus kuda)* and the seacucumber(*Holothuria scabra*), in this second RSG project, we continued to rear them and extend the areas of culture in the rehabilitated seagrass area.

The juveniles of sea-horses after spawning 2 months of age in aquarium were reared in the seagrass area covered by net, each month they were checked and calculated the length and weight, the result of calculation is showed as follows(Table 6):

Table 6: The average growth of lenght and weight of *Hippocampus kuda* in the rehabilitated area.

Time of culture (days)	Length after rearing (mm)	Weight after rearing (gram)	Survival rate (%)
0	56,60±5,30	0,78±0,21	100,00
30	75,07±6,03	2,87±0,50	62,50
60	82,20±5,51	3,35±0,52	58,40
90	94,02±5,60	4,45±0,60	57,50
120	98,35±6,38	5,12±0,89	52,30
150	101,78±7,25	6,13±0,90	50,65
180	110,20±8,24	6,50±1,20	48,38

Fig. 6 Time growth of lenght and weight of *Hippocampus kuda*



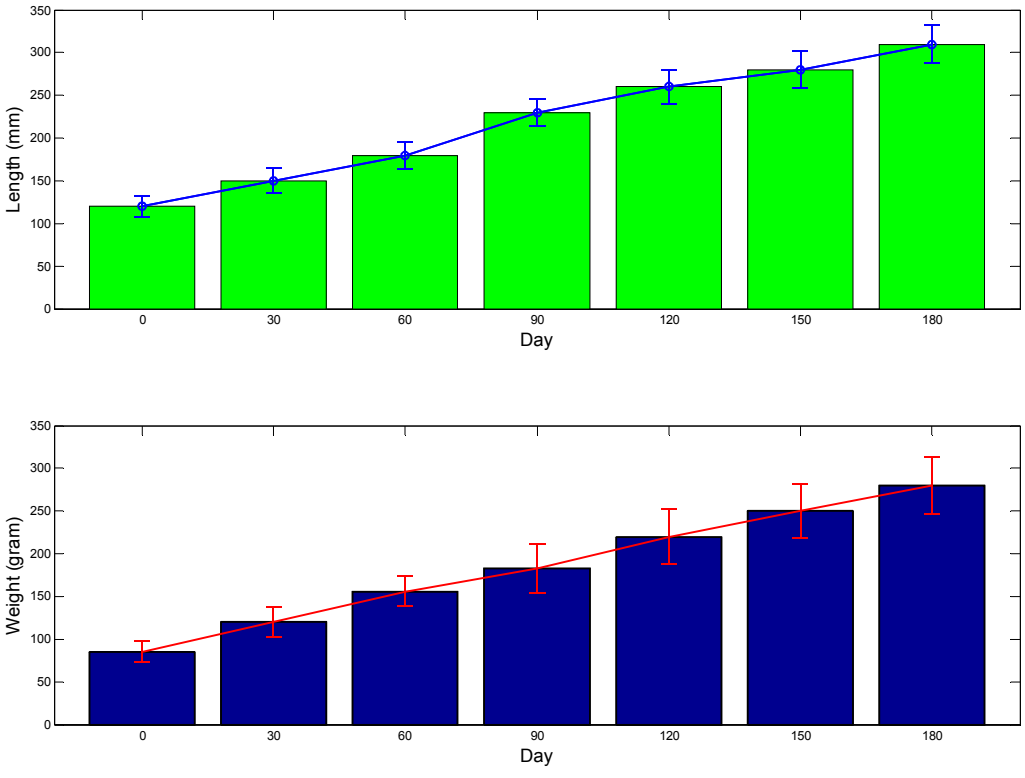
4.3.5 Result of restoration the Holothurian at the rehabilitated area:

The juveniles of Holothurian(*Holothuria scabra*) were supplied from nature and were reared in the seagrass area covered by net, each month they were checked and calculated the length and weight, the result of study is showed as follows (Table 7):

Table 7: The average growth of lenght and weight of *Holothuria scabra* in the rehabilitated area.

Time of culture (days)	Length after rearing (mm)	Weight after rearing (gram)	Survival rate (%)
0	120±12	85±12	100,00
30	150±15	120±17	92,50
60	180±16	156±18	88,40
90	230±16	183±28	77,50
120	260±20	220±32	72,30
150	280±22	250±32	70,65
180	310±22	280±33	68,38

Fig. 7 Time growth of lenght and weight of *Holothuria scabra*



4.3.6 Restoration the Molluscs (*Strombus luhuanus* Linnaeus):

In vietnam, there are 30 species belonging to the genus strombus among them the *Strombus luhuanus* has the high economic value.

Strombus luhuanus live in the seagrass beds and were over exploited by local villagers so the natural resource was serioustly reduced in recent year. In this project together with local community we set up a pilot in the rehabilitated seagrass area for culturing this species. The juveniles were collected from open-sea by fishermen.

Result of study showed that they well developped in the seagrass environment, the studied data have been collected and will be presented in the next phase when we had complete data.

4.3.7 Conservation the sea-urchin (*Diadema setosum*):

Diadema setosum is a species of long-spined sea urchin belonging to the family Diadematidae. It is a typical sea urchin, with extremely long, hollow spines that are mildly venomous. The species can be found throughout the Indo-Pacific region, from Australia and Africa to Japan and the Red Sea. In Vietnam this species distribute in lagoon, bay, along seashore, islands… where has the quiet seawater. Many years before they developped too much with dense individuals, however at present they are the aliment for aquaculture (such as Lobster, crab, fish….) and were exhaustedly exploited.

In order to protect the biodiversity of biological resources in seagrass beds, together with local community we protected the community of *Diadema setosum* in covering by net their distruted areas in seagrass beds.

4.4 Train and transfer the technologies of culture the economic seaweeds and marine animals:

. Local education programmes and training workshops have held regularly every two months to help increasing the awareness of the local community on the protection the biological resources in seagrass meadows. They have been also taught the basic aquaculture of seahorses, holothurians, bivalves, molluscs and economic seaweeds.

Economically, the people should be better off and certainly in the long-term they will benefit by sustainable use of their seagrass resources. This project assisted local community to understand the resource on which they live. Culturing seahorses, holothurians, bivalves, molluscs and economic seaweeds brought in added revenue and the capacity of the people have been enhanced by these added skills.Overall benefits of this project have been to the community in which it is carried out.

A suitable management regime have been introduced that is acceptable to the local villagers and retain biodiversity in the seagrass meadows. Seahorses culture will reduce the take of natural

stocks and bivalves, molluscs culture will reduce the need to take all molluscs found by gleaning. Seagrass meadows will be restored where damage or loss has occurred.

4.5 Benefit from the aquacuture:

Before carrying out this project, most of local villagers earned their living by gleaning the bivalves, molluscs, fish in the seagrass beds.

The gleaning process entails people walking over seagrass and digging and collecting the animals at low tide or by wading in water up to waist depth.

The gleaning by people trampling and digging is damaging the seagrass meadows and, at the same time, depleting meadows of the animals which form part of a complex food web.

But at present they have changed the way for earning their livelihoods by culturing the bivalves, molluscs and planting the economic seaweeds. This change contributed to restore and conserve the seagrass beds and its biological resources.

The net income of planting seaweeds for each harvest (3 months) per hectare is 30 millions VND($USD 1,700) there are 2 harvests per year, for the green mussel the revenue per hectare in one year $USD 22,000 and for the babylone snails (*Babylonia areolata*) is $USD 35,000.

These high incomes help them to stop gleaning the marine animals resources living in the seagrass beds.

5. CONCLUSION:

The project accomplished its objectives:

- To restore and conserve the biological resources in seagrass beds(the holothurians, seahorses, sea-urchin, bivalves, molluscs) this work were done by local community self consciously. The restoration of marine animals will increase biodiversity values and local villagers can be expected to take part in restoration activities bringing the community together for planting operations.

- To train and transfer the skills of planting the economic seaweeds and culture the marine animals. In participating to these training workshops and to replant the seagrasses and marine animals the awareness of local community were increased, they were trained and transferred the technologies and methods to restore and sustainably use seagrass ecosystems, they can manage and sustainably exploit the biological resources in seagrass beds.

- To help the local community to improve their livelihoods by culturing the economic seaweeds and others marine animals in the buffer zone of seagrass beds.

6. RECOMMENDATION FOR FUTURE WORK :

- Continue to open training workshops to train and transfer the skills of culture others marine animals, to advance the awareness of the local community on conserve biological resources, maintain the biodiversity in seagrass beds , to protect the coastal environment.
- Continue to monitor the restorated seagrass area and replant the seagrass loss, to restore others marine animals.
- To encourage the local villagers to extend the marine culture in the buffer zone of seagrass beds, to support them finance if needed. Local villagers will manage and exploit reasonably the biological and environmental resources in seagrass beds.

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APPENDIX:

Fig. 1 Local community of Cam Hai Dong are participating in the training workshop

Fig.2. Local community were taught the skills of planting the seaweeds and marine animals

Fig. 3 Seedlings of *Kappaphycus alvarezii*

Fig. 4 Seedlings of *Kappaphycus striatum*

Fig. 5 Farmers are preparing the seedlings for planting

Fig.6 Transplantation the seedlings to planted area

Fig 7 To set up a frame of floating monoline method

Fig. 8 To set up a frame of monoline method

Fig. 9 Seaweeds(*K. alvarezii*) after 2 months planting

Fig.10 Seaweeds(*K. alvarezii*) after 3 months planting

Fig.11 Harvest of seaweeds after 3 months planting

Fig.12 After harvesting, the seaweeds are sun-drying

Fig.13 To drive in a stake in a green mussel Cultured area

Fig.14 Farmer are checking the juveniles of green mussel (*Perna viridis*) after 3 days culturing

Fig.15 Juveniles of green mussel (*Perna viridis*) after 1 week culturing

Fig.16 Juveniles of green mussel (*Perna viridis*) after 1 week culturing

Fig.17 Farmer are checking the juveniles of green mussel (*Perna viridis*) after 3 weeks culturing

Fig.18 Juveniles of green mussel (*Perna viridis*) after 3 weeks culturing

Fig.19 Juveniles of green mussel after 3 weeks are available to culture

Fig.20 Farmer are staking the stake with juveniles of green mussel

Fig.21 Farmer are collecting the green mussel after 6 months culturing

Fig.22 Farmer was satisfied with his harvest

Fig.23 Harvest of the green mussel after 6 months culturing

Fig.24 Harvest of the green mussel after collecting

Fig.25 Quality classification of green mussel after collecting

Fig.26 Green mussel after quality classifying

Fig.27 Green mussel are available for selling

Fig.28 Packing and transporting to the market

Fig.29 Farmer are checking the juveniles of clam (*Meretrix meretrix*) after 3 weeks culturing

Fig.30 Rejecting the bad clam

Fig.31 Juveniles of clam after 3 weeks culturing

Fig.32 The clam after 2 months culturing

Fig.33 Ponds culture of babylone snails (*Babylonia areolata*)

Fig.34 Farmer are checking the juveniles of babylone snails

Fig.35 Babylone snails after 6 months cullturing

Fig.36 Babylone snails is available for selling

Fig 37 Seahorses after 6 months culturing are available for selling

Fig.38 Holothurian after 6 months culturing

Fig.39 Mollusc(*Strombus luhuanus*) are culturing in seagrass beds

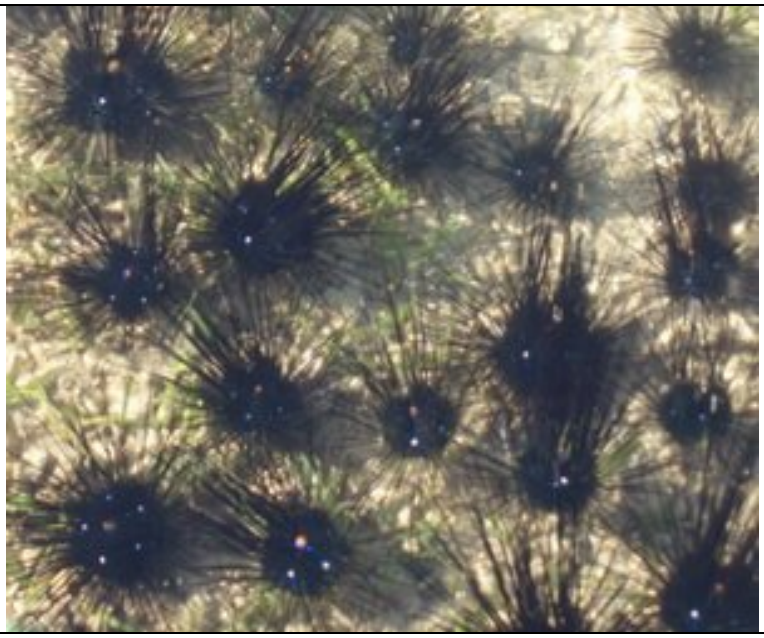

Fig.40 To conserve the sea- urchin (Diadema setosum) in seagrass beds