CHAPTER III

MATERIALS AND METHODS

3.1 SECONDARY DATA COLLECTION

Relevant data of razor clam, ecology, Don Hoi Lord and Multi-agent systems and Role-playing game or Companion modelling (article, thesis, scientific papers, the past data of razor clam harvesting and map etc.) were gathered from government offices, libraries, online internet sources and others.

3.2 PRIMARY DATA COLLECTION

Primary data collections were carried out every month from March 2004 to February 2005. It is consisted of population of razor clam and human activities on razor clam habitat. Both sets of data were used in model construction.

3.2.1 Site selection

The largest sand dune in Don Hoi Lord was selected in this study. It covers an area of approximately 321 hectares. This sand dune is located closely to local communities and people can easily access it. Moreover, tourists who visit Don Hoi Lord usually come to visit this sand dune. This sand dune may have been affected by human activities and challenge in management.

Figure 3.1 The sand dune study site of this study

3.2.2 Razor clam population

Line transects and quadrat sampling method (Krebs, 1989) were used to data collection of razor clam population following:

- 4 line transects were laid in the sand dune during the low tide, covering all study area.
- Each line transect has stations to collect razor clam. The interval distance between stations is around 200-250 m. depending on physical characteristics of the sand dune. Every station was recorded position in GPS (Global Positioning System) and returned to the same position in each station through the field data collection.
- 3 sampling quadrats (size 1 m^2) were designed at each station to collect razor clam by following method:
    1) Using a bamboo stick dipped lime and dropped in to the razor clam hole.

2) Using spade to dig sand around 30 cm deep from the surface, to collect all remaining razor clam.

Caught razor clam were separated into 2 groups, first from dropping lime and second one from digging sand.

- Count the number, measure length and weight of every individual in the quadrat

Figure 3.2 Quadrat size 1 m^2 which designed for razor clam collection

3.2.3 Human activities

Socio-economic data were collected monthly from human activities follows:

- To count a number of local fishermen who came to harvested razor clam in the study sand dune 4 days/month
- To survey and interview local fishermen who harvested razor clam as his/her career based on 3 main questions as follow:
    1) How many razor clams can they catch in this month?
    2) Where do they go to catch razor clam in this month?
    3) How long do they catch razor clam in each day during this month?
    4) How much can they sell razor clam to trader?

- To survey and interview trader to investigate market demand and mechanism of razor clam prize formation.
- To interview tourists with questionnaire.
- To count the number of tourists who come to visit sand dune 4 days/month

3.3 DATA ANALYSIS

Razor clam population data were analyses by program Excel 2003 and SPSS for Windows 11.5. The following data analyses were performed:

1) Density of razor clam (individual/m^2) by Excel
2) Mean weight of razor clam (g./individual) by Excel
3) Mean length of razor clam (cm./individual) by Excel
4) Relationship between weight and length of razor clam by Excel
5) Cluster analysis for separating razor clam density by SPSS for use spatial model construction

- Questionnaire data were analysed by program SPSS for Windows 11.5 to investigate general data and general behavior of tourist who visited Don Hoi Lord.

3.4 COMPANION MODELLING FOR DON HOI LORD

According to the concept of companion modelling, multi-agent systems and role-playing game were carried out in Don Hoi Lord. The main objective of Don Hoi Lord companion modelling was to share experience among researchers and stakeholders (local fishermen, trader and local government) and find the acceptable razor clam conservation method from stakeholder.

3.4.1 Principles

To apply principle of companion modelling to razor clam conservation at Don Hoi Lord, There are 2 main parts; first was the computer simulation model and second one was the role-playing game.

The linkage between computer simulation model and role-playing game aims at facilitating knowledge sharing. Therefore, the computer simulation model was built from secondary data combined with primary data from field study. The simulation model was consisted of 2 major sub-models. The first was the razor clam population model and the second sub-model was the local fisherman model. Both of the sub-models interacted through fishermen harvesting razor clam.

Role-playing can help researcher improve a simulation model by facilitating the sharing of knowledge from the simulation model to stakeholders (human) in the system and also from stakeholders to the model. Role-playing game can facilitate knowledge from computer simulation model to Don Hoi Lord local fishermen by letting them play in the game and discuss to find suitable conservation strategies. As a result, local fishermen know what researcher think and researchers know what fisherman think also.

To summarize, Don Hoi Lord companion modelling is shown in figure 3.3

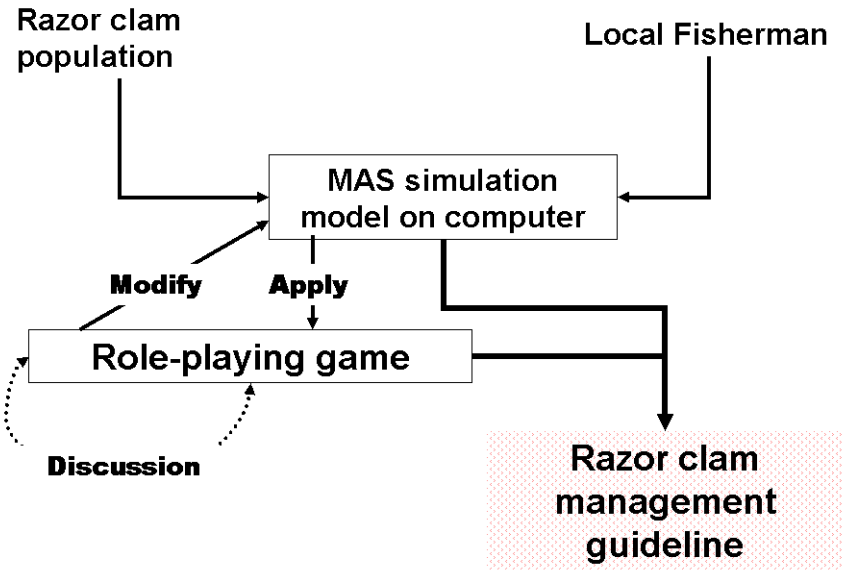

Figure 3.3 General principle of Don Hoi Lord companion modelling

3.4.2 Computer simulation model

The computer simulation model was constructed on Cormas simulation platform. This program is available at http://cormas.cirad.fr for free. However, any ecological modelling must start from a conceptual model so the consequences to construct the computer simulation model are:

- To create a conceptual model
- To apply the concept of MAS to the conceptual model by defining spatial entities (spatial), social entities (agent) and their interaction
- To create Unified Modelling Language (UML), a standard methodology to represent models (Le Page and Bommel, 2004). Furthermore, a sequential diagram is also created to represent activities in the model.
- To implement the model in Cormas platform with Smalltalk language. The Cormas platform is consisted of 3 modules (figure 3.4) following:
    1) Design specific entities
    2) Specify the sequence of task
    3) Define method of visualization

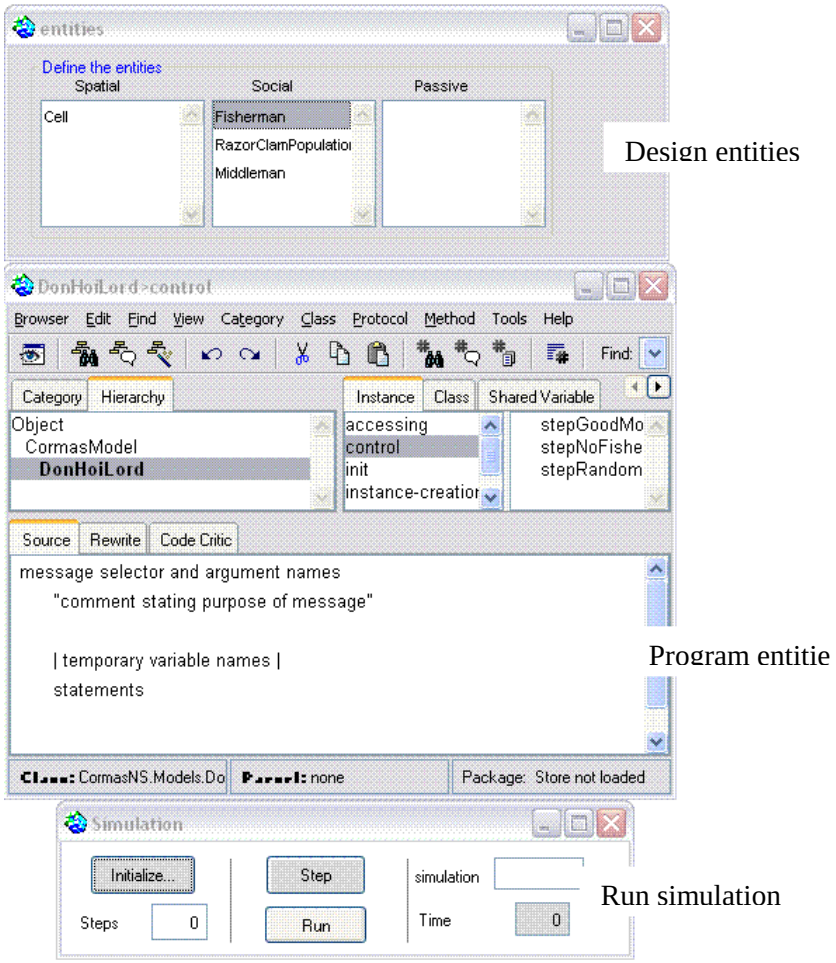

Figure 3.4 Three modules of Cormas platform

3.4.3 Role-playing game (RPG)

The RPG method was used to facilitate knowledge staring with local fishermen and to conduct collective discussion regarding razor clam conservation. Moreover, RPG enhanced researcher understanding of local fisherman behavior in razor clam harvesting. Two rounds of role-playing were conducted on 28 March 2005 and 14 July 2005 at the Chu Chi government clinic closed to Don Hoi Lord. The general features of the game included:

<u>First role-playing game</u>

- Players: 11 local fishermen
- Roles: Razor clam harvester, Trader by researcher
- Game set Computer simulation, board and player sheets

- Step 1 year
- Gaming session 1 day (morning and afternoon session)

Second role-playing game

- Players: 10 local fishermen from 2 villages and 1 trader
- Roles: Razor clam harvester, Trader
- Game set Computer simulation, board and player sheets
- Step 1 year
- Gaming session 1 day (morning and afternoon session)

Each step represents 12 months or 1 year, local fisherman had to decide area in Don Hoi Lord map to go to harvest razor clam in each month. Moreover, local fishermen decided to do other jobs in some months reflecting real situation. Then, the computer simulation calculates harvested razor clam from decision data and returned harvested data to local fisherman. After that local fishermen brought razor clam to sell to trader and got amount of money in past year, whereas total harvestable razor clam in the past year was declared in the end of turn and let local fisherman freely discuss among them before start new step.

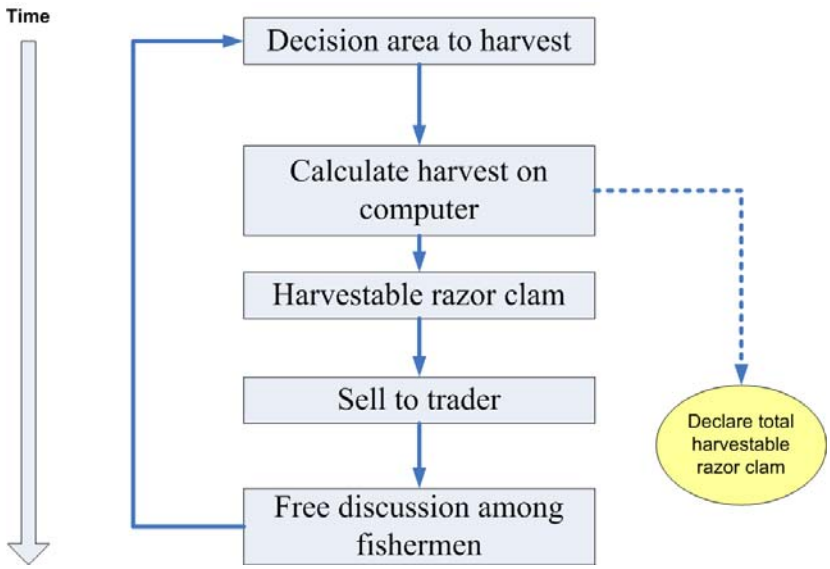

Figure 3.5 Overview of Don Hoi Lord Role-playing game

Components of the game

I Player sheets

Every local fisherman received 3 sheets: a map of study area, a decision table and an account table.

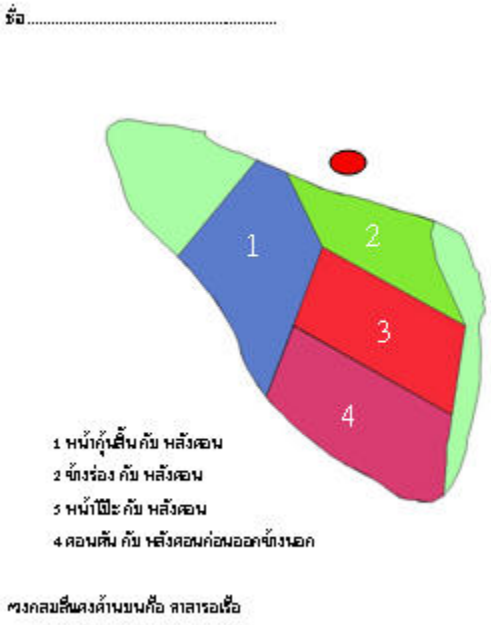

Figure 3.6 Map of study area and name of each zone in player sheets

The study area (figure 3.6) was separated into 4 zones, each with a unique name form local fisherman understanding in each zone.

Figure 3.7 Decision table in player sheets

The decision table sheet is consisted of 3 decision tables, each represents one year. The components of table included month in year round in horizontal direction and vertical direction is selected area to harvest razor clam, harvestable razor clam and remark.

Figure 3.8 Account table in player sheets

The account table in the player sheets represent total harvestable razor clam in

each year for 1 local fisherman who own the table and total money in the year from sold razor clam to trader.

II Simulation model for role-playing game and Game board:

The simulation model which used for role-playing game was developed from the computer simulation model. The simulation model for RPG separated the study area into 4 zones, each zone has a unique name following fisherman understanding and the used interface of simulation model for RPG as a game board to represent a number of local fisherman in each area. In addition, there is one board to declare total harvestable razor clam when finish turn.

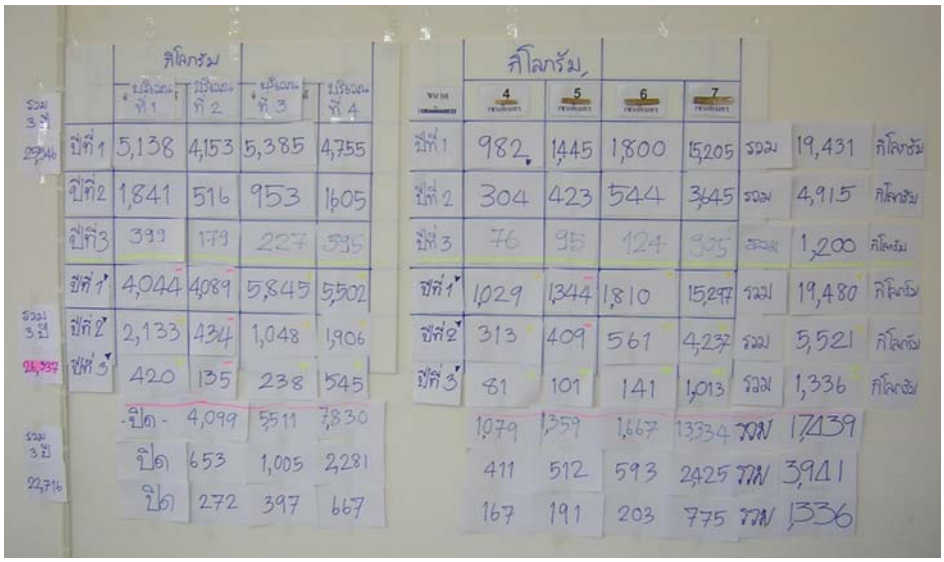

Figure 3.9 Total harvestable razor clam board

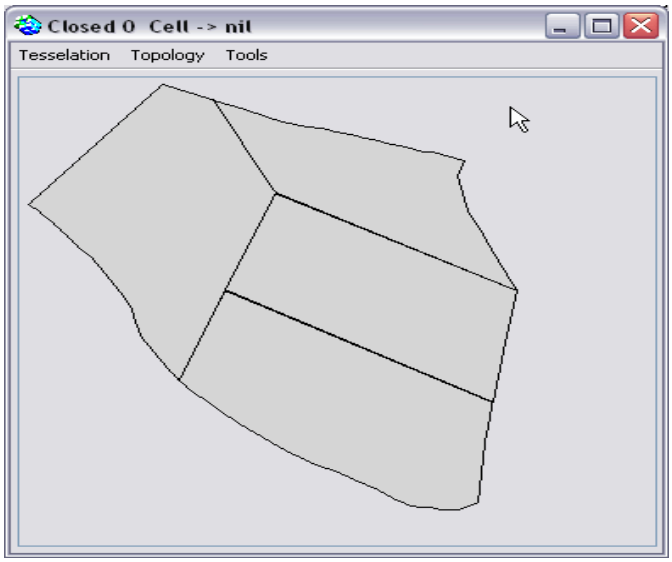

Figure 3.10 Interface of simulation model for RPG

III Gaming session

Don Hoi Lord role-playing game was conducted into 2 sessions: morning and afternoon session. In the morning session the introduction and explanation about the game were carried out to local fishermen and let them play the game 6 steps. After finish each step, local fishermen can has shot discussion among

them before start new step and they can able to change some rules in the game if they had collective decision.

In the afternoon session, the game was continued for 3 steps and the researcher presented local fisherman two alternative scenarios in the game on the simulation model for RPG. Finally, the collective discussion from stakeholders (local fisherman, researchers and local government) was conducted regarding razor clam conservation until finished afternoon session.

IV Step of the game

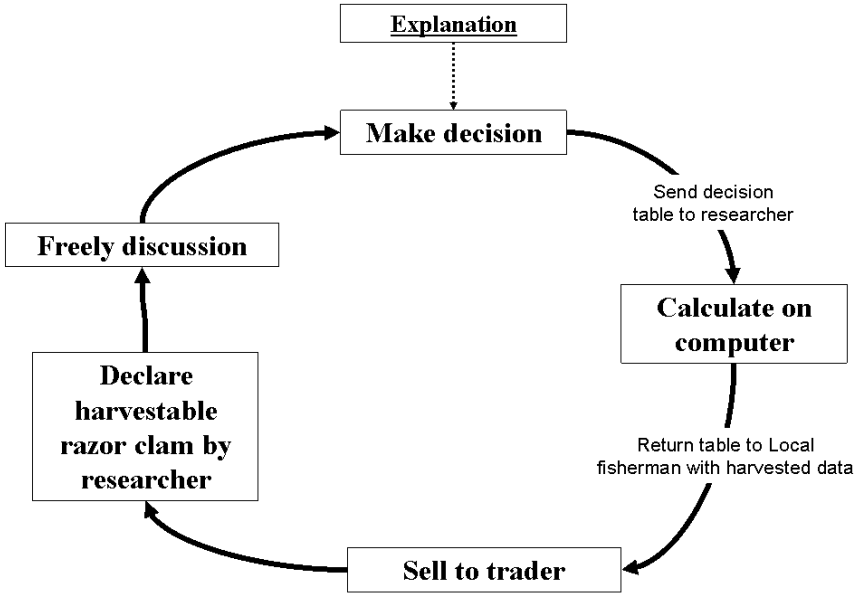

Figure 3.11 Step of the Don Hoi Lord role-playing game

The game started with the explanation of the background, the components of the game and the gaming loop (figure 3.11).

First step, Make decision; the local fishermen makes decision from the map in player sheet: where they want to go to harvest razor clam for each month? They wrote their decision for all 12 months in the decision table. In addition, local fisherman can decide to get another job but they have write in the decision table also in the remark box.

Second step, Calculate on computer; player sheets were returned to the researcher. Selected area data from each fisherman were put in the simulation model to calculated harvested razor clam. During the calculation, the interface showed the number of local fishermen in each area in each month. When the calculation was finished, harvested razor clam of each fisherman was written in decision table and returned to local fishermen.

Third step, Sell to trader; every local fisherman went to the trader desk and sold harvested razor clam to the trader. Total money from selling razor clam was written in to the account table which was then to local fisherman.

Fourth step, Declare harvestable razor clam; Total harvested clam from the computer simulation in each area and size were declared on total harvestable razor clam board and let local fisherman see productions of the razor clam.

Lastly, Freely discussion. Before the end of each turn, local fishermen were allowed to have discussions among themselves regarding production of razor clam, total amount of money from sold razor clam and other issue. In addition, they could discuss with researchers in terms of rules or steps of the game, and they were able to change some components of the game, if the change came from mutual agreement of the stakeholders.