The Rufford Small Grants Foundation

Final Report

Congratulations on the completion of your project that was supported by The Rufford Small Grants Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Dok Doma
Project title	Assessment of the status of marine fisheries resources and management practices in Sre Ambel area
RSG reference	8509-1
Reporting period	August 2010 – August 2011
Amount of grant	£5959
Your email address	dokdoma@gmail.com
Date of this report	5th August 2010

1. Please indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Explore existing management style		No	Chapter 3 of the final report	

This chapter assesses and reviews the state of the Sre Ambel marine fisheries and fishery resources, based mainly on fish catch statistics as imparted by the fishers based on their memory from 2002 to 2009 and relevant stock assessment and other complementary information available until 2004. The introductory chapters refer to the general situation and major trends of the area marine capture fish production and the state of the area's marine fishery resources. More detailed information is provided from all stakeholders in the area, together with a discussion of the major trends and changes that have occurred with the main fishery resources exploited in each area and comments on the stock assessment work undertaken in support of local fisheries management in the lagoon. Special sections address the general issue of caught species and other abundance species such as the five endangered species found in this research.

Cambodia is predominantly an agricultural country (Nesbitt, 1998) and land ownership for subsistence agriculture is crucial, especially for alleviating rural poverty. Almost 80% of the country's population live in rural areas and 75% are farmer-headed households that depend primarily on the culture of rain-fed rice. Average rice yield, however, is considered as one of the lowest in the world due to poor soil fertility and adverse climatic conditions over the past years (Ahmed et al. 1999).

Nesbitt (1998) estimated that as an average, a typical annual low-land and rain-fed rice farm's production is sufficient to sustain only about 7 -10 months of a household's consumption. Recently, efforts in increasing crop productions have been a major preoccupation of the government such that increase of annual crop production was observed from 1.7 tons in 1998 to 2.1 tons per hectare in 2002 (Lim ENSAT, pers.data.).

The coastal area of Cambodia is divided into two provinces, Koh Kong in the north and Kampot in the south, and two municipalities, Sihanoukville and Kep. Cambodia's marine capture fisheries are characterised by a multitude of species and the use of a range of fishing gears. Reference to DoF fisheries statistics indicates that marine fisheries production as recorded by DoF has not yet shown a decrease by species and landing place but there has been a decrease by province and grade as according to fish value and size in domestic fish markets. Most the sources for the survey of the marine fish catch were taken from the recollection of the fishers and local residents as well as information from the stakeholders in the area. This study likewise conducted a perception survey from a different diversity of residents whose livelihoods are based on the marine resources, especially fish catch, shrimp, crab, and molluscs.

Notwithstanding the poor system of recording fish catches, records of marine fisheries production by province and municipality from 1992 to 2001 are still available at the governmental central level. These statistics are not at the species level, but grouped according to higher taxa and commercial or market names. DoF estimates that fish caught outside Cambodian waters constitute around one quarter of the recorded production. Fish caught by subsistence fishers are not included in the official statistics. For Kep municipality there are no data from 1980 to 1996, due to the fact that

administrative structure for this municipality was institutionalised only in 1996.

So far, there have been no stock assessments conducted in Cambodian marine waters. However, comments from fishers and the results of several related studies indicate that the threat of overfishing in the Gulf of Thailand is now at a critical stage and is such that it has affected fish catches at the Sre Ambel Lagoon as well.

The collection of catch per unit effort (CPUE) data for Sre Ambel's marine fisheries does not occur. Thus, the status of marine fisheries in terms of CPUE is unknown. Surveys from the residents and outsiders, such as commercial fishermen and non-commercial fishermen during the research field reconnaissance survey had given some indication as the hypothesis to reach this comprehensive quest. The results of long-term fish catches of fishermen indicate that daytime catches in the Sre Ambel declined from 90 kg/day in 2003 to 30 kg/day in 2005 and to 20kg/day in 2008. Catches of night time fishing operations declined almost 60% from 2005 to 2008 (Chief of fishery community, 2008). Results of studies in some places also highlight rapid declines in yield (Ibrahim, 1999). However, the scale of operation and types of fishing gears used differ between Sre Ambel lagoon and coastal fisheries. Hence, the researcher has decided not to use the data available at the governmental fisheries centre, but has relied on local perception as a primary source of data.

Fishing in the Sre Ambel lagoon has three types of scale: small, large and medium. Small scale fishing was predominant during the last five years, followed by medium scale fishing. Few fishers were involved in large scale fishing in the lagoon, and most of them are foreign vessels that fished in the lagoon,but landed in areas outside the lagoon, some exported directly to neighbouring countries. The large scale fishing was not met during the survey because they were located in offshore area so far from the community centre down to deep sea. Most complaints referred to resources exploitation of large scale, but there was not sufficient to confirm this is really the case due to insufficient information.

Many types of fishing gears were found in the area and there are 12 common fishing gears in the Sre Ambel Lagoon. The most common fishing gears were anchovy encircling seine, encircling seine and gill net. Shrimp gill net and crab gill net comprise about 15% of the total 210 fishing gears in the area. Although the government has already banned the use of certain types of fishing gears such as trawl and purse seine net and other explosive materials, these were still found in the area, especially in the offshore where water depth is less than 20 meters. The illegal fishing gears still being used in the area comprise 2% to 5% of the total number of fishing gears used. Notwithstanding its seemingly negligible number, such illegal gears affected the supply of fish in the whole lagoon.

Fishing has many functions, the most common of which was related to the types of fishing boats used, the length of boat, motorised machine, and the number of fishing efforts (trips). Fishers who used big boats are able to catch a larger volume of fish than those who use small boats because big boats are able to bring in many gears per trip. However, the trips of efforts could not be increased seasonally unless the machine capacity of boats was big enough (high than 10 hp). Thus, fishing unit (trips) has also a function of boats (capacity of machine). Nevertheless, the physical condition of the lagoon would also affect the volume of fish catch because small boats with less fishing gears do not have the capacity to reach deeper waters since it can only fish in places where water depth was about 2 to 5 m. Fish resource depletion may probably cause the decrease of fishing household fishing trip seasonally. Some converted from medium scale fishing to small scale fishing because small boat consumes less fuel.

The whole lagoon was also deeply affected by sand excavations which has increased for the last three years. Every sand shipment that came from the excavation was approximately 20 to 30 tons of sand, exported either locally or abroad. Because of the excavations many places in the lagoon have become deeper making them unsuitable for small scale fishers using small fishing gears.

Seasonal household fishing unit (tons) had declined drastically during the last 5 years. Fish catch volume per fishing season decreased from 4 tons in 2005 to 2 tons in 2009. While statistical volume of fishing landing in Sre Ambel decreased one third in comparison with the fish landing in 2005. The decrease of fish landing in all ports of Sre Ambel was the result of the decrease of the total number of fishing trips in the area as well. The total decrease of fishing trips in the area was the result of the decrease of fishing raw materials such as price of gear, labours, maintenance, and especially price of fuel for those who use motorised fleets. Local fishers have shifted from using high capacity and high-powered boats to low capacity and low-powered boats because fuel has become quite expensive. Nowadays, most fishers commonly use motorised boats with a capacity of 6 hp. The change in the capacity of the fishing boats caused the changes in the size of fishing fleets as well and inevitably the decline of fish landings at the Sre Ambel coast.

Finally, it can be concluded that fishing performance has changed over the last 5 years. This in turn caused some changes in the fish landing in the area as well. The drop of fishing efforts caused the decrease in seasonal fish landing at all ports of Sre Ambel. The change in the motorisation of fishing boats also affected the seasonal fish catch per family, which resulted in the decrease of fish landing in the area. On the other hand, physical changes in the fishing ground, such as the change in water depth, also affected the efficiency of fish catch per family in the fishery community. Meanwhile, the measures of the local government to ban illegal fishing gears were not effectively enforced since trawl and push seines were still used in the area.
Do the laws and regulations affect the fisheries activities in the area?
What are the real factors affecting the decline of fish catch?

Factors that responsible for the low of fish catch in the area		No	Chapter 5 of the final report	

One of the main factors that affect fish catch is the style of fisheries management. Currently, several guidelines and regulations are being enforced inside and around the areas of the lagoon. Nonetheless, these guidelines and regulations did little to improve the volume of fish catch in the area. As a result, the volume of fish landings has steadily declined from year to year, according to government records. Management which applies the top-down approach, was ineffective in ensuring the conservation of the natural resources in the area or the increase in the volume of fish catch. The existing mechanism proposed by the government was ineffective in ending the conflicts among stakeholders which continued to escalate.

The secondary factors affected include changes in the number of fishing trips per family, change in the depth of fishing grounds, and changes in the capacity of fishing boats from high to low horsepower. Socio-economic changes had a concomitant change on the volume of fish catch. Aside from this, climate variation and agricultural practices have also affected the volume of fish in the lagoon. The fishers claimed that because of the large amount of fertilisers used by the large sugarcane plantation adjacent to the lagoon to increase the yield of sugarcane, the quality of water

along the shoreline has severely declined. This claim, unfortunately, is not backed by any scientific research. Notably, fishers who catch fish in shallow depths were able to catch a greater number of fish than those who fish in places where water depth is high because of the fishing gears that they use. The exploitation and excavation of marine sand resources has likewise affected the shore and offshore morphologies of the lagoon, inevitably affecting the volume of fish catch.

The management of the Sre Ambel lagoon must be improved and the "bottom-up" approach should be adopted, so that the stakeholders themselves are given a voice in its administration. A change from the current open access system to a common resources property regime can be a good alternative extractive reserve system for the conservation of the lagoon's resources. The institution of a controlling mechanism at the lagoon level would also be necessary to protect the area from the use of illegal fishing gears by outsiders.

Explore socioeconomic growth		No	Chapter 4 of the final report	

What can we learn from the interactions between the Sre Ambel Lagoon's ecological and socio-economic systems? How can we improve the Lagoon management?

Agrawal and Yadama (1997, p.457) suggest that although "socio-economic forces are important in influencing resource management and the condition of renewable resources … their influences [can] usually [be] mediated through community institutions." The Sre Ambel case shows that in the late 2000s, there was almost no local resource management institution influencing the Lagoon system. In fact, the system was being negatively affected by State policies (e.g., weak rule enforcement, no access restriction), technological factors (e.g., inappropriate fishing gears, development projects), market pressures (e.g., high demand for shrimp) and population pressures (e.g., large number of local residents, outsiders and tourists).

In order to craft community institutions to mediate the negative effects of such factors, to create social and economic incentives for better Lagoon management, and to incorporate the six principles into a new management plan, I suggest the establishment of a Sre Ambel Lagoon Management Forum through a co-management process. The Forum may be a long-lasting institution able to deal with the current problems and to actively respond, through an adaptive management approach (Holling 1978, Walters 1986), to future socio-economic-ecological problems.

The Forum could be a joint effort from all the stakeholders, state and municipal government agencies holding any responsibility for the Lagoon management and most, if not all, of the other Lagoon stakeholders (e.g., local fishers, outside fishers, local residents, tourists, and tourism businessmen). Some scientists and natural resource managers may also join the Forum. In designing and implementing management strategies, all parties should be involved in decision-making to increase the process's transparency and subsequent rules compliance (*participation principle*).

Non-governmental stakeholders may create one or more local non-governmental organisations (NGOs) to represent them in this Forum. To encourage stakeholder participation in the Forum, there is a need to develop environmental education programmes to reach them. These programmes might use examples from the present case-study to demonstrate that human-made impacts on the Lagoon ecosystem and its surroundings emerge later as impacts on humans themselves. That is, the *responsibility principle* may be realised from the beginning, and a mechanism that indoctrinates the

community according to this principle must be implemented very early on.

Any 'development' project or management regulation may be planned so that it adheres to three conditions. First, the plan should internalize as many local monetary and non-monetary costs and benefits as possible. Second, people holding local ecological knowledge (e.g., old fishers) should be involved in planning and decision-making. Third, representatives from governments from different political scales should be involved because some costs and benefits may affect other socio-ecological systems (*scale-matching principle*). Because the long-term impacts of water pollution, deforestation, overfishing, and shrimp stocking are uncertain, a cautious approach to management design and implementation should be the rule rather than the exception (*precautionary principle*). That is, some mechanisms could be developed to incorporate the long-term ecological value of the lagoon ecosystem services and goods into their current prices.

As the Sre Ambel case clearly demonstrates, socio-economic and ecological systems co-evolve in a non-linear, uncertain way. Hence, in designing and implementing any management plan, effort must be made to continuously monitor the social, economic and ecological systems (*adaptive management principle*). Although it is quite difficult to do so, effort must also be made to identify and allocate all of the internal and external costs and benefits (social and ecological) of alternative management plans (*full cost allocation principle*).

I propose that the Sre Ambel Lagoon Management Forum may initially address at least the following major issues: fishing activities, other related activities (agricultural farm extensive scale), management of seasonal catches of marine resources, sewage systems, garbage dumping, irregular buildings close to the Lagoon margins, and deforestation along the Lagoon margins and along springs that drain freshwater into the Lagoon. For each of these issues, feasible policy instruments can be established. As Jacobs (1993, p.162) puts it:

The appropriateness of any particular instrument in any given circumstance will clearly depend on which of the criteria [ideology, effectiveness, motivation, administrative cost, efficiency, political acceptability and distributional impact] are regarded as most important, and on the particular context and nature of the environmental damage to be prevented.
I present a policy alternative and some policy instruments that may be used to approach sustainable fisheries management at the Sre Ambel Lagoon and that may exemplify how the six principles may be addressed.

Stakeholders conflicts and solutions across policy levels		No	Chapter 6 of the final report	

Sre Ambel Lagoon is the largest estuarine ecosystem in the Cambodia's coastal zone. The lagoon has a large diversity of marine species, especially fish species. From year to year, some fish species have disappeared in the catches with a decline in total volume of catch as well. The decrease in fish catch and fish species has led to user conflicts in this famous ecosystem area. The conflicts remained unsolved by both the local administration and central fisheries administration. Therefore, user-participation in fishery resource management may be the best approach to solve the problem. A successful solution to these problems will involve thorough investigation of stakeholders' interests and their goals for livelihood improvement. What is the best approach to solve the problem?

Interviews with 210 respondents from fisheries households including key informants from various governmental sectors and fisheries communities in the area were conducted. The questions were developed to acquire information on knowledge, conflicts, concerns, and regulations across the lagoon. They were also used to obtain information about the background of the area, ecosystem resources, and fish catch and fish landing, and especially the management and mechanism required to conserve the resources at the lagoon level. The notes from the field could best be used in comparing the experiences of the inhabitants of the study area with other similar events in various countries.

Citations from more than 20 papers across the world were influential in developing the proposed solution for this area. The citations were related to a feasible approach and included resource users, ecological knowledge, ecosystem processes, and especially the mechanism to solve specific conflicts. Political commitment by the local authority of Sre Ambel Lagoon was also presented in some proclamations by the local government, and this was important for communicating that the central government was concerned about resource depletion and conflicts.

The investigation found eight conflicts between stakeholders inside and outside the lagoon. These conflicts included conflicts between the fishery community and medium-scale fishers, conflicts between small-scale fishers and users of illegal fishing gear, conflicts between medium-scale fishers and marine fishery administration, conflicts between local fishers and outsiders, conflicts between local fishers and outsider fishers, conflicts between fishermen and mining exploration enterprises, conflicts between fishers and large farm investment in agriculture, and conflicts between local fishers and marketing middlemen. The conflicts differed in nature and origin of cause, and varied from one village to another. The availability of fishery laws and regulations indicated that there have been plenty of legislative documents since 1995 to present. The application of those laws and regulations, however, has been limited because of the gradual increase in conflicts of interest.

There is a need for an alternative management plan for the lagoon. The proposal of this alternative approach, however, is still dependent on the extent of political commitment of the government at different administration levels. The proposed solution has to modify the current management structure on the basis of coordination and actions at all different levels in the area of management and policies, development of a mechanism to allow all stakeholders to have good opportunities to address their concerns and conflicts at the forum, and incorporation of user knowledge into management under consensus from all stakeholders. To proceed with this proposed lagoon management approach there is a need to build an outstanding forum with the support of central governmental legislative framework and policies.

Propose a policy alternative for lagoon management			Chapter 7 of the final report	

Ability of Community Fisheries to Apply Laws and Regulations

Existing policies and regulations do not currently function in the lagoon fisheries management. Regulations show very much relevance to centralisation rather than empower the local fisheries communities to establish, manage, and control local resources. Because the community are not satisfied with the existing management style, they are reluctant to study and learn anything in the guidelines and other regulations. General education of the local people is sufficient to apply an

appropriate law and regulation. Results show their abilities to identifying illegal fishing gears, they have strong purposes to engage, plan, and implementing any appropriate rules and regulations. It is an evident that community fisheries have strong willingness to establish new extractive reserve in the applicable way that will benefit them better than existing guidelines and regulations. The community desire to have common property regime to replace current open-access regime. The most appropriate management system of the lagoon is to increase access restrictions avoiding either local illegal fishing gears or outsiders on overexploitation. In establishing the new system capacity building should be considered to carry along the generality of the community for all-inclusive benefit. How can the new Extractive Reserve Policy work for Sre Ambel Lagoon?

7.6.2 Extractive Reserve Policy for Sre Ambel Lagoon

It is unlikely that the lagoon system will ever approach sustainable use in an open-access situation (i.e., unrestricted number of fishers). This is because lack of access restrictions is a probable cause for overexploitation, even when 'how to fish' rules are appropriate and effectively enforced. Since the extractive reserve concept seems to be an appropriate instrument for marine conservation, and is relevant to part of the government's environmental policy, it seems feasible to create an extractive reserve at Sre Ambel Lagoon as a way to: (a) restrict the number of fishers with 'use rights', (b) seek better enforcement of regulations, and (c) mitigate mining explorations' negative impacts on the Lagoon. By creating an extractive reserve, the Sre Ambel Lagoon system may be transformed from an open-access situation into a common property regime, where 'use rights' are controlled by a fishery community and other parties (e.g., local administration agents) (Begossi, 1998). Indeed, extractive reserves provide a combination of common-property and state-property regimes (Begossi, 1998). In such a co-management arrangement, responsibility for resource management is shared by organisations of fishers and the government.

To develop and implement a management plan for the Sre Ambel Lagoon Extractive Reserve (SLER), a co-management forum could be created. This forum could serve as an arena for negotiation, joint problem-solving, and mutual learning among local fishers, government agencies, researchers, and other stakeholders. The co-management forum should address the major categories of policy instruments for sustainable fisheries management as presented. Since the majority (*OP=0.8*) of local people have willingness to change style of management, specific policy instruments that are discussed regarding the extractive reserve are addressed during the field work through local workshop. Potential issues in the design of this policy, such as administrative costs, enforceability, effectiveness, distributional effects, and use of revenues, will also be addressed.

7.6.3 Major Categories of Policy Instruments

Jacobs (1993) outlines four classes of policy instrument for natural resource and environmental management: (1) regulations, (2) financial incentives (also known as market mechanisms), (3) voluntary mechanisms, and (4) government expenditures. In fisheries, *regulations* may encompass standards concerning 'where', 'when', and 'how' (technological standards) to fish as well as 'how much' to fish (e.g., fishing quotas). Monitoring, enforcement, and punishment (by fines or imprisonment) are imperative for the effectiveness of regulations. Acheson and Wilson (1996) argue that controlling 'how' people fish reduces information and enforcement costs relative to controlling 'how much' people fish.

Financial incentives use price mechanisms to obtain management goals. In fisheries, at least two

types of financial incentive may be applied: resource depletion taxes and tradable permits (or their variant, licenses). By increasing the costs associated with resource use, taxes encourage less and more efficient use of the resource and its conservation. *A depletion tax* levied on the fishery harvest "is set at the rate which reduces extraction to the sustainable (or otherwise defined) level" (Jacobs 1993, p.139), though governing authorities may have to iteratively adjust the tax rate from year to year to approach this theoretical ideal. In a *tradeable permit system*, the governing authority fixes the aggregate fishery harvest (presumably at the sustainable level), and then allocates rights to the aggregate harvest by issuing permits among fishers. Fishers can reallocate rights to portions of the harvest by buying and selling permits among themselves. Fishers who buy permits take on a cost associated with harvesting above the level represented by their initial permit allocation. The information needed to establish Total Allowable Catch (TAC) is quite costly, as is the monitoring and enforcement of the permit system. *A licence* is a type of permit that may be tradable but which has no defined TAC attached to it. Licence prices may be used to exclude ineffective fishers from the system, thereby reducing the number of fishers. A comparison between two types of tradable permits, fishing quotas and fishing licenses, is presented in a following subsection.

Voluntary mechanisms cause "actions unenforced by law and un-persuaded by financial incentives, which individuals, groups and firms take to protect the environment" (Jacobs 1993, p.134). The most prevalent form of voluntary mechanisms is the provision of information, often in a persuasive manner, with the idea that economic agents will behave sustainably when informed about the effects of their behaviour. Another common form of voluntary mechanisms is the allocation of property rights to people close to a resource, in the hopes that they will then voluntarily manage the resource sustainably. In fisheries, voluntary mechanisms may include environmental education of resource users who may be interfering with or negatively affecting fishing activities and the ecosystem itself (e.g., aquatic sports performers and water polluters). Voluntary mechanisms may also appear in fisheries when 'ownership' and control of fisheries management is transferred to the local population, who "are likely to regard the environment as a source of long-term survival, which therefore needs protection" (Jacobs 1993, p.136).

Government expenditures are monies spent to manage resources in a sustainable way. In fisheries, government expenditures may include information costs to define TAC and appropriate regulations on 'how to fish,' enforcement costs, other management costs, and subsides for fishers to engage in alternative livelihoods. Government expenditures differ from regulations and financial incentives in that "the cost of environment protection is borne by the taxpaying community as a whole", while in the latter cases, the cost is borne by primary resource users (Jacobs 1993, p.137).

To design fisheries management policies, a combination of policy instruments is often needed to achieve the desired management goals. The appropriateness of each instrument will depend on the social-political context in which it will be implemented and on the goal(s) it will be expected to achieve. Of these four classes of policy instruments, this study focuses on regulations and financial incentives including licensing.

7.6.4 Policy Instruments to Manage the Lagoon's Fisheries

A co-management forum is one option for running the Sre Ambel Lagoon Extractive Reserve (SLER). Because any change in fishing regulations has to be approved by the Fisheries Administration (FA), the Forum may present the FA with more appropriate suggestions about how, where, and when to fish in the Lagoon. Decisions about how regulations can be enforced and about earmarking

expenditures could be made by the Forum. That is, there will be a need for devolution of decision-making power from the central offices of FA to the Sre Ambel Lagoon Forum (which should have at least one FA officer). The Forum may also decide who may or may not fish (regulations), and at what 'price' (financial incentives). This will be further explored in the next section.

7.6.5 Defining Fisheries Groups and 'Use Rights'

Lagoon fishers can be classified according to their legitimacy (professional licensed fishers, sport licensed fishers, or unlicensed fishers), their dependence on fishing (full-timers, part-timers, or subsistence fishers) and their origins (locals or outsiders). Rights to use the SLER should be given only to local fishers holding a professional fishing license. Locals are likely to encompass all full-timers, most part-timers, some subsistence fishers, and very few, if any, recreational fishers. Indeed, the baseline differentiating local subsistence fishers (who fish for domestic consumption) from local sport fishers (who fish for entertainment) is very unclear; in both cases, fishers are forbidden to sell their catches. Based on the result of field interview, it is reasonable to include local subsistence fishers in the local sport licensed fishers category. Fishers from outside represent most sport fishers, licensed or not. Fishers from outside should not have usage rights to the SLER.

Basing use rights on a distinction between local fishers and fishers from outside requires defining 'local fisher'. To determine this, survey should be conducted in each of the seven communities to identify full-time, part-time, and sport fishers. To determine which of these fishers is local, the criterion may then be the testimony of three other local, non-relative fishers. Another criterion may be birth, or a minimum of 10 years of residence in one of the seven communities, or marriage to a local person in the past five years. Of course, the specifics of the design must be defined by the Forum; the above are only suggestions.

One important question about use rights is how they are to be transferred from one generation to another. While this decision rests with the Forum, some considerations are suggested here. Use rights should initially be vested in local individuals and may only be transferable to other local individuals with the Forum's approval. If all descendents of those who hold the first 'use rights' were eligible to inherit the same rights, the Lagoon system would again be overwhelmed by a large number of local fishers in a short time.
Based on the case of a Sri Lanka shrimp fishery (Amarashinghe et al., 1997), it is suggested that, to avoid this situation, each use rights holder be allowed to bequeath those use rights to only one descendent. In the absence of a descendent, the right of inheritance is automatically discontinued with the death of a fisher.

7.6.6 Implementing a licensing system

Although the SLER may limit the number of fishers with use rights, this may not be sufficient to ensure sustainable fishing. This section proposes a combination of regulations and financial incentives to achieve sustainability. In addition to these, two other policy instruments may be used to manage the SLER. First, the transfer of control of resources, at least in part, to the local population, is expected to induce local users to voluntarily conserve those resources, as they are likely to see the long-term benefits of doing so. Second, government expenditures should occur, especially to build ability, in the process of creating a Forum to manage the SLER.

By only awarding use rights to local fishers, the extractive reserve will limit the number of fishers,

but the reduced number may still represent a very large fishing effort for the size of the Lagoon and its stocks. One way to solve this problem is by further limiting the number of fishers through a licensing system specific to the SLER. In the proposed SLER licensing system any fisher must *buy a* SLER fishing license to fish in the Lagoon. That is, holding a right of use is necessary but not sufficient to permit someone to fish in the Lagoon; local fishers with use rights must still buy a license to legally fish in the Lagoon, but under their use rights designation they will be guaranteed a licence (provided they pay for it). Licence prices and purchase eligibility criteria can restrict the number of fishers using the Lagoon, and license prices can fluctuate annually according to resource conditions and environmental and market uncertainties.

There could be two types of fishing licences in the SLER licensing system: annual fishing licences and daily fishing licences. Fishers holding an annual licence may be allowed to fish for shrimp, mullet, crab or other species. Daily licences, on the other hand, may be specific for each species and priced accordingly. In the first attempt to restrict fisher numbers, the system may account for both fishers with use rights and fishers with no use rights. That is, outsiders would still be allowed to purchase any leftover daily licences to fish at the Lagoon. However, only local fishers would be allowed to buy annual licences. Additionally, outsiders would pay higher prices than local fishers for daily licences. (The higher payment works to incorporate the dynamic costs of fishing activity into outsiders' decision about whether to fish).

The proposed SLER licensing system may work to accomplish sustainability goals. The fact that fishers can be charged a significant price to fish (instead of fishing for free (except for their equipment and time costs)) leads us to believe that only those who can profit from fishing or who are willing to pay for entertainment would buy a licence. Inefficient commercial fishers (i.e., full-timers and part-timers) who could not profit from fishing after paying the license fee would probably not enter the system. Commercial fishers holding annual licenses would have an incentive to wait and fish for large (high-priced) shrimp, crab or bivalves instead of catching small individuals early in the season. Moreover, commercial fishers (either locals or outsiders) who bought daily licences would probably risk fishing only after being convinced that large (high priced) individuals were present in the Lagoon. Thus, capturing small individuals could be reduced by this licensing system. However, recreational fishers might still fish for small individuals as they have no economic incentive to fish for large individuals.

Based on the above discussion, the pricing of different types of licences could follow certain principles. First, prices could be tied to target species. Daily licences for each target species (shrimp, fish, or crab) could reflect market prices for these species. Second, pricing could be fair. Daily licences could be accessible to local subsistence fishers, and annual licenses should ensure fishers enough profits to maintain their livelihoods. Third, prices could discriminate between locals and outsiders. Daily licences for locals (who hold use rights) should be cheaper than for outsiders. Fourth, prices could vary with resource conditions. Licence prices in one year may be higher or lower than the year before based on monitoring of Lagoon stocks in the year before (see below). Fifth, prices could account for environmental and market uncertainties. Part of a licence price could be a type of insurance against a year of very low production or of very low market prices. This is further explained in the section on earmarking licence revenues.

An alternative way of limiting fishing effort in the SLER may be the establishment of an annual or seasonal total allowable catch (TAC), which could then be implemented through the allocation of fishing quotas such as Individual Transferable Quotas (ITQs) among fishers. ITQ is a type of tradable

permit that specifies catch amounts and may, according to Hartwick and Olewiler (1998), lead to an optimal amount of effort and harvest.

However, the licensing system, proposed here, is more appropriate to Sre Ambel Lagoon than the often-advocated ITQ system because ITQs must be established based on a TAC. Determining TAC for Sre Ambel Lagoon is not feasible due to three factors. First, the Lagoon's production is highly dependent on environmental factors and season opening; hence, there is a high degree of uncertainty in each season – the TAC could vary widely from season to season, and it would be impossible to know this (at a reasonable cost level) in time to set the TAC each season. Second, as most of the Lagoon margins are easily accessible to anyone, surveying all fisher landings would be difficult, thus making monitoring and enforcement of an ITQ system overly costly. Third, because many fishers sell shrimp directly to consumers, estimating the Lagoon's total production from middlemen's booklets is inaccurate. These last two factors also make a resource depletion tax inappropriate for maintaining the Lagoon resource at a sustainable level.

Potential Issues Concerning the SLER Policy

In designing any policy, some issues must be discussed. The remainder of this section addresses issues relating to administrative costs, enforceability, effectiveness, adaptations to approach sustainability, distributional effects, and use of revenues at the SLER.

Administrative Costs

The administrative costs for managing the SLER will probably be high at first because of the costs of establishing the co-management Forum. However, after a while, if the policy is well designed, the system may be financially self-sustaining. That is, revenues from selling licenses and charging fees to transgressors may be able to cover all administrative costs. Initial costs for setting up a Forum may include costs related to building the ability of both government and non-government personnel (including fishers), administrative infrastructure (including physical space and technological resources), and preliminary research to define who are the local fishers and other major stakeholders. Government expenditures could be used for these purposes. Annual administrative costs would encompass costs of resource monitoring and other information gathering to decide upon license prices and policy design from year to year, costs of regulation enforcement, and costs of running the Forum and its meetings.

Enforceability

The proposed policy design is based mainly on two instruments: fisheries regulation and a licensing system. Enforcement of regulations concerning 'how to fish' and 'who is allowed to fish' is one of the first problems the Forum might have to deal with. Heavy penalties for transgressors, including stiff fines and imprisonment, already exist in the case of regulations concerning 'how to fish' (DoF, 2006). The problem to date has been a lack of resources and personnel to enforce them. One possible solution to this problem may be achieved by creating two fishery inspector positions for the SLER. Inspectors should be familiar with the region and its fisheries problems. They should gain legitimacy through their official ties to the competent, local authority (the Forum). This would make enforcement more effective. It will be essential to pay inspectors adequately to remove any temptations they may face to accept payoffs for not reporting or penalising transgressors. In addition

to controlling 'how to fish', inspectors may also control 'who is allowed to fish' and penalties to transgressors can be stipulated concerning the licensing system.

Effectiveness

Although result shows high commitment of local fishers to participate with the new policies (OP=0.7), guidelines, to assess the effectiveness of policy design, some criteria should be defined *a priori*. For instance, to adjust license prices accordingly over time, what will be considered as a sustainable level of resource use? Because monitoring fishing efforts and assessing stocks in the Lagoon are not feasible (as explained earlier), a workable solution might be to ensure that enough stock exits the Lagoon at the end of a harvest season to generate offspring that will return to the Lagoon. It is clear that some research will have to be undertaken to calculate the amount of stock. Monitoring this criterion seems feasible; for example, data collection may take place in the channel connecting the Lagoon to the ocean during the first 5 days after channel opening (the period when most shrimp and fish leave the Lagoon). Of course, the Forum may devise other criteria.

Policy Adaptations to Approach Sustainability

The local fishers understand well the impacts of mangrove, illegal fishing gear, except trawl, and the period of fish spawn. Furthermore they should be offered trainings on the operation of license system, and the benefit of license system at lagoon level. The persistence of overfishing after the first year of management would indicate that the number of licenses issued was too large (i.e., their prices were too low) or that regulations were inadequate (e.g., mesh size of nets were too small), and that fishing in the Lagoon needs to be further reduced. One way to reduce fishing is to increase license prices for the next season. At higher prices, fewer fishers will be willing to pay for licences; that is, only very efficient or wealthy fishers will buy licences.

A second way to further reduce effort is to decrease the number of annual licenses available in each year, and the number of daily licenses available for locals and for outsiders in each month. Moreover, daily licenses for outsiders may not be available during certain months because local fishers have priority in fishing at the SLER. Limiting the number of licenses available demands an auction scheme in which fishers can bid for a license. All annual licences could be sold at once and daily licences could be sold monthly in two steps: first local fishers apply for licences, and then outsiders can apply for any remaining licences. In all cases, licences should have a minimum price, but the price paid by a fisher will depend on the number of fishers entering the competition and on each fisher's confidence in his ability to profit or on how much he is willing to pay for entertainment. Again, this mechanism is likely to exclude inefficient fishers from the system (see the shrimp fishery case at a Sri Lankan estuary presented by Amarashinghe et al. 1997).

A third way to reduce fishing effort is changing fisheries regulations on how, where, and when to fish. For instance, fishing seasons may be shortened. Shrimp fishing may only be allowed two months after closing period, which is the minimum time needed for shrimp to grow from post-larvae to young adult. Fish harvests may only be allowed during closed channel seasons, as the practices used in this fishery may repel fish back into the ocean during open channel season. In proposing new fisheries regulations, both fishers' ecological knowledge and scientific knowledge may be used.

Distributional Effects

The capacity of local people in the lagoon is likely suitable enough to share equal benefits among beneficiaries. Therefore, they indicated strongly their perceptions on the new system application. Even though majority of local people propose a new strong extractive reserve, but they should think about the distribution of effects from the system. What are the probable distributional effects of the proposed policy design? Charles (1988, 281) reviews some critiques of limited entry regulatory mechanisms in fisheries and points out that "there may be losses as well as gains from limited-entry programs" concerning their social consequences. It is clear that some people's well-being will decline when implementing an extractive reserve, but the cumulative decline may be at least compensated for by the corresponding cumulative welfare gains received by other people. For example, some local fishers may directly benefit from this management approach through increased incomes, while other local residents, tourists, and fishers from outside may indirectly benefit from it through the improved long-term ecological sustainability of the Lagoon. In the case of Sre Ambel Lagoon, it is likely fishers from outside are the ones whose well-being will decrease. The majority of fishers from outside do not make their living from fishing (i.e., recreational fishers) and are often wealthier than full- and part-time local fishers. Therefore, though more socio-economic research needs to be conducted on the distributional effects, it is expected that limiting access to the Lagoon in the proposed manner will improve local fishers' well-being without decreasing the welfare of fishers from outside by an amount that is harmful and thus unfair.

If the minimum licence prices, established by the Forum, are constantly increased in order to reduce fishing effort, they might reach a price that only relatively wealthy fishers are able to pay, excluding local, subsistence, and commercial fishers who depend on fishing from the system. In this case, the management system will flip from a market-oriented shrimp fishery to a consumption-oriented fishery. The Forum then could direct revenues from fishing licence sales toward finding alternative livelihoods for those local fishers who are highly dependent on fishing.

To avoid such a flip in the fishery system, restriction of licences issued and a bid mechanism is proposed above. The distributional effect of this new design in comparison to the extractive reserve alone is not quite clear. As licences will be limited, fewer local fishers will directly benefit from the system; however, the same number of local and outside people will indirectly benefit from the sustainable use of the Lagoon. Fishers from outside are likely to lose even more well-being in this new design. However, what the new design offers is a better chance of increasing the well-being of future generations by ensuring sustainable resource use, without decreasing the welfare of the present generation to an amount that may threaten people's livelihood.

Use of Revenues

Since the abilities of local farmers are above moderate of education background (Table 1), there will be most effective way to operate revenue systems. Revenue from selling fishing licenses and from charging regulation infraction fees could be earmarked to improve both Lagoon management and local fisher welfare. For instance, it could be used to fund the Forum's administration, pay fishery inspectors, and monitor resource use. Part of this revenue could be used as a form of insurance against environmental and market uncertainties, by providing small loans to full-time fishers during shrimp and fish off-seasons. This would reduce their dependence on middlemen and give them the freedom to trade their product for the best prices year-round. License sales revenues may also be used to investigate economic alternatives for fishers who reduce their fishing in and therefore their income from, the Lagoon (as in the case of San Miguel Bay in Philippines). In addition, licence sales revenues may be used to investigate potential markets for the Lagoon's other fish and crabs.

The level of education of the community is above moderate; therefore the community are able to understand regulations and guidelines. However, they are not satisfied with existing guidelines and regulations. For this reason, are the willingness of local people is very strong to propose new style of management of extractive reserve. According to their experiences, common property regime of resources management is very much appreciated by all local people. *Can the extractive reserves model be used for marine fish conservation*? This paper has shown that the extractive reserves concept, by definition, restricts the number of resource users and may help implement policies leading to sustainability. The implementation of an extractive reserve, however, is insufficient to guarantee its sustainability. Several policy instruments must be used jointly to achieve such a goal.

In the case of Sre Ambel Lagoon, this paper discusses an alternative policy consisting of the establishment of an extractive reserve to restrict the number of fishers and a combination of regulations and a licensing system to operate such a reserve. The reasons for using licences to regulate the number of fishers and to improve management are that license prices can exclude inefficient fishers, can account for resource conditions as well as environmental and market uncertainties, and can generate revenues that can be used to improve management, and to improve the living standards of fishers. The licensing system is a complement, and not a substitute, for other management regulations concerning how, when, and where to fish.

Although there is no optimal management alternative, the best alternative is developed collaboratively among all stakeholders in a way that incorporates all, or at least most, of the Lisbon principles (Constanza et al., 1998). These are: participation, responsibility, scale-matching, precautionary, adaptive management, and full-cost allocation. Specifically, a highly representative Forum with management rights should be created.

Finally, unless government supports local actions, by creating political space for experimentation, and provides legal mechanisms for access restriction, Sre Ambel Lagoon will never approach sustainability.
Table 7.1: Weighting Average Index (WAI), ability of fishers to apply guidelines and regulations in Sre Ambel Lagoon

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled (if relevant). Raining season may provide the challenges for the field investigation, but it will put strong efforts to overcome the obstacles.

Of cause, raining is the most difficult for this project, especially during the mobilisation of the fishers and other residents for meetings and capacity building training program for alternative policy for local management. On the other hand, it was difficult also during the approach to government officials for discussion concerning policy development for marine resources management. Most of governmental official's at all level s were busy and they were sometimes reluctant to provide us information and data. They were always claiming the DSA or other incentive for the invitation to meet with the local residents for the meetings.

3. Briefly describe the three most important outcomes of your project.

- Explored the existing practices and management of marine fish resources in the area, which had particular differences from the other part of the country and even in the Southeast Asia countries.

- It had identified the potential factors that affecting the marine resources declination that mostly from the factor of management and capacity of the people complied with laws and regulations.
- Proposed a policy alternative for lagoon management which agreed by all stakeholders in the areas and their commitment for the marine resources conservation.
- Provided capacity building to all stakeholders related to the conservation of marine resources.

4. Briefly describe the involvement of local communities and how they have benefitted from the project (if relevant).

Two communities were involved this project; Chroy Svay Fisheries Community and An Cha Eurt Community Fisheries. Each of community has its members of 210 fishers. There will have eight workshops for this project. Workshop one and two will conduct during the field investigation. It was 350 attendants for the capacity building for the new policy instruments awareness. Each attendant was receiving £3 per workshop. Workshop three and four were conducted during the completion of field work, and proposed mechanism of conflict solutions. Workshop five and six were provided the capacity buildings on the proposed alternative for lagoon management. The last two workshops were to refresh them on these two subjects.

5. Are there any plans to continue this work?

The policy alternative for lagoon management is fully already being accepted by both local government and grassroots, it is important to the continuous stage of setting up institutional arrangement and provide more training program of this policy alternative. Workshop at the national level is needed at the first instance.

6. How do you plan to share the results of your work with others?

This project was considered by the local government and other people to be an interesting model for the other coastal lagoon management in the whole countryside or in the regions. It will be shared through real application and submit the report to governmental sectors. Especially, it will be shared through the national workshop and regional workshop for the next funded, if applicable.

7. Timescale: Over what period was the RSG used? How does this compare to the anticipated or actual length of the project?

This project has been implemented for the full one year started from August 2010 – August 2011. The implementation has gone through the work plan as anticipated.

8. Budget: Please provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Workshop 1	£994	350 participant x £3 = £1050	(-£56)	Workshop at the first time to introduce people about the objective of the project

Workshop 2	£994	350 participant x £3 = £1050	(-£56)	Explored the issue of current management style
Workshop 3	£994	350 participant x £3 = £1050	(-£56)	Join –governmental officials workshops about the conflict resolution for marine resources management
Workshop 4	£994	350 participant x £3 = £1050	(-£56)	Identified the factors affecting the decline of marine fishes catch
Workshop 5	£994	350 participant x £3 = £1050	(-£56)	Consensus on the effective policy alternative for lagoon management; first draft and submitted to the stakeholders for agreements / changed if possible.
1) Workshop 6 2) General Operation at fields during the last workshop (field trips of governmental officers)	£994£	**1) 150 participants x £3 = £450** **2) £259** **Total £709**	£285	Key –selected stakeholders for capacity building on new policy alternative for lagoon management. It included field trip of participants at the new coastal area.

9. Looking ahead, what do you feel are the important next steps?

Next steps are to bring all possible policies and regulation to the ground, and let's to guide local fishers apply more effectively in the context of extractive reserve for marine fisheries.

10. Did you use the RSGF logo in any materials produced in relation to this project? Did the RSGF receive any publicity during the course of your work?

Yes, I have informed all people for this project with the logo of Rufford Small Grant Foundation

11. Any other comments?

This project is very much required to have next steps of implementation because this proposed policy mechanism have strongly welcomed by all residents and local administrative officers. If this project implemented further, it will be an impact of the fish catch, which expected to have been increased in the other next years of fish landing. It will importantly be a tool for conserve the whole ecosystem of the area as well.

After the project completion, it can find out any international conference for this project's outputs