Darwin South East Asian Wetland Restoration Initiative

Final report

Conor Linstead, Edward Maltby and Harriot Beazley

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Contents

Darwin Initiative

Final Report

1 Darwin Project Information

Project Reference No.	162/12/034
Project title	South East Asian Wetland Restoration Initiative
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2 Project Background/Rationale

The Mekong Delta is one of the worlds largest and most important Deltas. It sits at the outflow of a major international river basin. The Mekong River is the 12th-longest in the world at approximately 4,800km, and the 8th-largest by volume with an annual discharge averaging 475 km^3. The basin area is 795,000 km^2 including Tibet, where it rises, China's Yunnan province, Myanmar, Thailand, Laos, Cambodia and Vietnam.

The Mekong Delta covers an area of approximately 5.5 million hectares of Vietnam and Cambodia, 3.9 million hectares of which (71%) lie within Vietnam. Within the Vietnamese part of the Delta there are a number of distinct wetland zones within three main geomorphological areas: the floodplain, the costal complex and a broad depressional area (Chiem, 1993).

In the early 20th Century there were still extensive and varied wetland habitats including *Melaleuca*, *eleocharis* grasslands, mangroves and tropical peatland. Since the 1980s, however, the Mekong Delta has seen a rapid expansion of agriculture and population. The population of the Delta in 1996 was 16.9 million and growing at approximately 2.2% per year (Ni *et al*., 2003). This increasing and high density population is creating an ever greater pressure on the natural resources of the Delta. Natural wetland areas are now estimated to occupy 7% of the Mekong delta (Ni *et al.*, 2003).

Local communities have traditionally relied on the free resources that were available in natural wetland areas. The simultaneous growth of the population and the reduction in wetland area has placed increasing pressure on the remaining wetlands to provide for the needs of the local communities. There is an urgent need to ensure that the remaining natural wetland areas are protected and their management meets the needs of local communities and, at the same time, maintains their biodiversity.

This project aimed to build the capacity of ecosystem managers and scientists and to improve the understanding of how local communities access resources by identifying which groups use the

resources, which resources are they accessing and how much they take. In addition to understanding the use of natural resources, to improve ecosystem management it is important to understand the biophysical conditions in the wetlands. In parallel with the collection of socio-economic data from the local communities, the project monitored the water quality conditions at the project study sites and carried out surveys of the availability of the key resource categories (fish, plants and birds).

The need for the project was identified during the course of an earlier Darwin Initiative project carried out the Mekong Delta (Melaleuca Wetlands Project (162/04/073)).

3 Project Summary

The project objectives were contribute to the achievement of the three key objectives of the CBD (conservation, sustainable development and equitable benefit sharing) by building the capacity of wetland managers and farmers in the Mekong Delta, Vietnam, to deliver sustainable livelihoods and enhanced biodiversity through wetland restoration and more effective wetland management, building on the effective linkage of wetland ecology and the needs of local people.
The objectives of the project were:

1. The training of scientists, farmers and other stakeholders in wetland restoration and management;
2. The development of a wide range of practical tools and information resources for Vietnamese scientists and communities, including restoration and management guidelines, together with wetland functional databases (e.g. including roles in flood amelioration and fisheries support)
3. Improved awareness of the requirements of local communities, the biodiversity and functioning of various wetland types and the environmental variables determining their distribution;
4. A strategic management and restoration plan for wetlands in the Mekong delta, using the Ecosystem Approach including an analysis of threats, to permit the more effective management and protection of these habitats and assist in the use of this approach to deliver the Biodiversity Convention in Vietnam;
5. Further regional capacity building by the targeted dissemination of project outputs.

The objectives of the project were not significantly modified during the course of the project. The operational plan was modified in order to adapt to the changing circumstances of the project. The main changes to the operational plan were:

- engaging Dr Harriot Beazley as a consultant to the project following her move to the University of Queensland. Given Dr Beazley's involvement in the project from its inception and her expertise it was important for the project's success to ensure her continued involvement
- the implementation of two additional socio-economic and biophysical surveys designed to enhance the integration of the socio-economic and biophysical data.
- the extension of the project completion date from November 2005 to February 2006 in order to enable the participation of all members of the project team at the final workshops.

All of these changes were agreed with the Darwin Secretariat.

Success of the project in meeting objectives
Objective 1 The training of scientists, farmers and other stakeholders in wetland restoration and management
The objective of improving the capacity of scientists involved in the project in the area of wetland management and restoration was achieved though training courses on the ecosystem approach, field techniques and data analysis and presentation. The host country scientists gained from

the early project training in techniques and the opportunity to apply those techniques in conjunction with the UK project team. The senior biophysical and social scientists involved in the project were experienced and benefited less from the training than other members of the project team.
Through the course of the project it became clear that the area where capacity building was most necessary was in the analysis and interpretation of data and this was focussed on in the training. This training included the identification of gaps in data and the modification of research protocols to address these gaps.

The biophysical field techniques that were implemented were relatively straightforward and once applied were easily mastered. For this reason the capacity building in the biophysical team was less obvious than in the socio-economic team. For the latter, the Participatory Rural Appraisal (PRA) techniques being taught were new but the team grasped them quickly and made rapid progress. The success of the capacity building in the socio economic team was clearly demonstrated in the rapid improvement of the quality of the data and the sophistication of the techniques being applied.
Local community groups, composed not only of farmers but a cross section of the community were engaged throughout the course of the project research with a capacity building element taking place towards the end of the project. The purpose of the capacity building was modified slightly from the original programme of work to better match the understanding of what was needed gained through the course of the project. Engagement with stakeholders at the policy making and senior wetland management levels identified the need for raising awareness of the values of wetland goods and services amongst the local communities as a means of improving the protection of wetland areas. For this reason the capacity building in among local communities focussed on building awareness of the value of wetlands. The findings of the project were presented to the local communities around the three project sites that were involved in the data collection phase of the project. This served two purposes, firstly revisiting these communities and presented the findings gave further opportunities for checking and enhancing the data. It also demonstrated to the local communities why the data were collected and the purposes of the PRA exercises that were undertaken, what the research team did with the information and what was concluded from it. This developed a sense of ownership of the project. Secondly, it provided an opportunity to explain to the local communities about the values provided by wetlands and the need for protection of these resources and explain some basic concepts in wetland management.

Within the scope of the project this training was a success and the discussions generated at the local community meetings were lively and interesting. However, the overall impact of this capacity was necessarily limited by the small number of people than could be reached in this way. In addition to scientists and local communities, there were two other groups of stakeholders that were involved in the capacity building – policymakers from the district, provincial and national level, and senior management from the protected areas. These two groups were involved in the initial training in the ecosystem approach conducted at the start of the project and their involvement continued throughout the project, in particular through the programme of workshops to develop the strategic guidelines report. The ecosystem approach training was carried out in response to a need identified by Vietnam's Environmental Protection Agency (VEPA). The success of this training will be determined by the degree to which the ecosystem approach is implemented in future strategies and plans within the Mekong Delta.

Objective 2 The development of a wide range of practical tools and information resources
This objective was successfully achieved. The project has compiled detailed inventories of species found within natural and semi-natural wetland areas within the three study sites. Inventories of the resources that the local communities' access have also been compiled. These are reported on under Section 4. The restoration and management guidelines aspect of this objective was achieved through integration within Objective 4- the strategic management guidelines report. This is discussed below.

Objective 3. Improved awareness of the requirements of local communities, the biodiversity and functioning of various wetland types and the environmental variables determining their distribution.
Through the integrated biophysical and socio-economic fieldwork this objective has been achieved. By providing a better understanding of the way in which local communities access natural resources, and the types of resources they access, the PRA exercises carried out have provided an improved awareness of the requirements of local communities. The biophysical field research has provided detailed inventories of biodiversity and information on functioning of wetlands, in particular, the differences between protected areas and the surrounding ecosystems.

Objective 4. A strategic management and restoration plan for wetlands in the Mekong delta.
This objective had been successfully achieved and the associated report, which discusses threats and opportunities for the application of the ecosystem approach in the Mekong Delta, is attached as an annex. It is expected that this report will feed into the CBD sourcebook on the ecosystem approach. Two workshops were held with stakeholders to develop the report, which provides strategic guidelines for wetland management using the ecosystem approach as a framework. The first workshop in August 2005 was a training workshop on the ecosystem approach and a structured discussion on how each of the principles of the ecosystem approach are currently being applied to wetlands, and where the stakeholders saw areas for improvement. The output from this workshop was written up as a draft report and circulated to the stakeholders for comment before a second workshop was held in February 2006. This second workshop then allowed further input into the process of developing the report and discussion on the application of the ecosystem approach.
The first workshop in August 2005 had 46 participants and the February workshop had 35 participants from Vietnam's Environmental Protection Agency, Ministry of Natural Resources and Environment, People's Committees of provinces, Women's and Farmer's Unions, Director the boards of Reserves and Parks and scientists

Objective 5. Further regional capacity building by the targeted dissemination of project outputs.
This objective has been achieved. The project outputs have been used to contribute to the curriculum for a Mekong basin university network (Laos, Thailand, Cambodia, Vietnam), which is being led by the host country co-ordinator at Can Tho University (Dr D V Ni). Each year since 2003 a three week training programme has been held, which rotates between participating countries. The aim of the network is to build capacity for young scientists and wetland managers. In 2003 the training was held in Vietnam and participants went to Can Gio and Tram Chim, two of the Darwin project sites. The host country co-ordinator taught elements of the course relating to the issue covered in the Darwin project training: wetland soils, chemical transformations, theory and measurement methods, ecosystem approach and participatory approach to wetland management.

The Darwin project also contributed to the improvement of facilities at Hoa An research station (e.g. the educational trail). The facilities at Hoa An are used by both Vietnamese and international students. Over the course of the Darwin project 60 masters students from Vietnam and 72 overseas students have visited Hoa An and use the trail.

Figure 1 Training on the educational trail at Hoa An research station (Photo DV Ni)

4 Scientific, Training, and Technical Assessment

4.1 Training Activities

4.1.1 Introduction

In parallel with the field research activities the project team carried out a number of training activities scheduled throughout the project.

The training and capacity building activities were as follows and are detailed in the following sections:

1. Ecosystem Approach training workshop – November 2003
2. Field techniques training for biophysical and socio-economic field teams – November 2003
3. Data analysis and report writing workshop – November 2004
4. Stakeholder engagement on application of the ecosystem approach to wetlands in the Mekong Delta – August 2005
5. Training in community engagement techniques – August 2005
6. Stakeholder workshop to review draft strategic management guidelines report – February 2006
7. Community engagement workshops – February 2006
8. Regional training activities – 2003-2005

Relevant training materials for these activities are appended to this report.

4.1.2 Ecosystem Approach training workshop November 2003

The purpose of the workshop was to give an introduction to the ecosystem approach and the Convention on Biological Diversity (CBD) to the project stakeholders. It was also intended that this workshop would develop support for the project among the stakeholders. The workshop was led by the UK project leader (E Maltby) and was attended by 40 participants from 14 provinces and protected wetland sites in the Mekong Delta.

The workshop clarified the role of the ecosystem approach within the objectives of the CBD and explained the rationale and the benefits of the approach. It also clarified the existing terminology (sustainable management, wise use, environmental management etc.). The role of the SEAWRI project as an example of the ecosystem approach and wetland management was explained and stakeholders were engaged on how the project could contribute positively to the CBD using the ecosystem approach principles from the start.

A session on the Vietnamese perspective on the ecosystem approach was led by the CBD focal point and included the interpretation of the approach and the response to CBD decisions to date in Vietnam. This session also included case studies of the application of the ecosystem approach in Vietnam with an element on the difficulties or constraints in applying the approach.

The UK project leader led a session on the ecosystem approach principles and the points of operational guidance. Some examples from Vietnam were discussed in the light of the principles, led by the host country project co-ordinator.

Group discussions were then held to discuss the following questions and report back to the group as a whole:

1. To what extent can the Darwin Initiative project contribute positively to the implementation of the CBD in Vietnam and what can be done to enhance this? e.g. capacity building, new tools, communication/training/education
2. How can the lessons learnt from existing examples given in the workshop be built upon?
3. How can the principles be made understandable and recognisable? Are they relevant? Do they need modifying?
4. What practical guidance can be elaborated on so that the ecosystem approach can be applied more widely?
5. Should the guidelines be culturally specific? Should they be ecosystem specific?
6. How can we arrive at a common vision in answer to all of the above questions? e.g. of Tram Chim management (high water levels prevent fire, lose important species as a result). Also Tram Chim is managed solely for nature conservation (not EA principles) there are no institutional mechanisms to account for these conflicting needs.
7. What is the way ahead? What are the new support needs/needs for technical assistance (government, NGOs, scientific institutions)?

4.1.3 Field techniques training – November 2003

4.1.3.1 Biophysical field techniques

Following the ecosystem approach workshop, nine days of training in the biophysical field techniques that were to be used in the project was undertaken. This training was attended by approximately ten people and covered:

1. Vegetation surveys
   - selecting study areas using satellite imagery, land use/landcover maps
   - plot selection and random sub-plot selection
   - Sampling the sub-plots (using quadrats, identifying species and estimating percentage cover)
   - use of recording sheets and note taking
   - different techniques for herbaceous and woody vegetation
2. Soils
   - Recording the 'Topsoil Moisture'(flooded wet, moist dry)
   - Collecting a soil sample using a soil auger
   - Recording the soil matrix and mottle colour
   - Identifying the type of soil material – organic and inorganic soils
   - Identifying the mineral particle size
   - Identifying the 'organic material characteristics'
   - Recording the soil pH

4.1.3.2 Socio-economic field techniques

In parallel with the training in biophysical field techniques about 20 individuals were trained in Participatory Rural Appraisal (PRA). Although the training was tailored for the needs of those working on the Darwin project, it was attended by both those involved in the Darwin project and other postgraduates and members of staff from An Giang University and Can Tho University from relevant departments who would benefit from the training. This training covered:

- analysis of secondary data material, (how to identify and analyse existing research reports etc on related topics in the Mekong delta)
- training in PRA skills, (including a field trip to the Hoa An research station to practice PRA data collection)
- facilitating the identification of research questions for the social science team (this process is so that the researchers themselves identify and decided on the research questions that they think are important for the research process. This technique ensures that the researchers have a feeling of ownership process and they can identify with it aims and objectives)
- designing of PRA research instruments to be used by the team in the field.

4.1.4 Data analysis and report writing workshop – November 2004

The purpose of the workshop was to review the data collected by the project team and to start the process of analysis. This module of the training programme was restricted to the project teams from An Giang University and Can Tho University.

While the original intention was to cover basic and multivariate statistical methods, it was felt that it was more appropriate for a more general training in data presentation and non-statistical methods of data analysis. During the course of the project one of the key capacity building needs identified in the project team was in the interpretation of data and the ability to draw conclusions from data, rather than seeing the collection of data and its presentation in tabular form as the end of the process.

Therefore, the workshops concentrated on :

- correcting methodological problems in the data collection
- formatting of data – coding of socio-economic data
- how to interpret data
- the presentation and assessment of the data collected at that stage of the Darwin project
- identifying gaps in the data to be filled during the December 2004 surveys
- linking the socio-economic data and the biophysical data

4.1.5 Data analysis and drawing outline conclusions – August 2005

There were two workshops held in August 2005 relating to data analysis and drawing outline conclusions. Firstly, a one day workshop with the project teams was held to review and analyse the data collected to date on bird, fish and plant diversity, the water quality and socio-economic resource use data. It is clear that there is now an extensive and valuable dataset on resource availability and use within the three study sites. With regard to the aim of the project to build capacity in the host country research teams, there was a marked increase in the quality of the data from the first survey socio-economic in August 2004. This indicates that the data analysis workshop held in November 2004 was a valuable exercise for the project as it was an opportunity to review data collected and to alter data collection mistakes.

The teams were led through the process of data analysis and presentation in preparation for the second workshop where the outline conclusions were presented for discussion to a group of stakeholders. The purpose of this workshop was to disseminate the project results to these key stakeholders at a stage where their views and responses could be taken into account in the

finalisation of the project conclusions and give a greater sense of ownership of the project results. There were 46 participants in this workshop from the Vietnam Environmental Protection Agency (VEPA), Ministry of Natural Resources and Environment (MONRE), People's Committees of the Provinces, Women's and Farmer's Unions, Scientists and Directors of the boards of Reserves and Parks. The workshop was also attended by two representatives of the IUCN Mekong Wetland Biodiversity Programme. With a total budget of $32million this is a much larger project than the Darwin project but the collaboration between the two projects has allowed the Darwin project to make a significant contribution to it by providing key baseline data to inform the data collection strategy of this project.

Several of participants commented that it was a highly unusual situation to have so many stakeholders from such a wide variety of organisations in the Mekong Delta in one place, and that it provided a great opportunity to disseminate ideas and share common problems in wetland conservation and management.

4.1.6 Training in community engagement techniques – August 2005

The data review exercise was followed by a half day training in community engagement techniques for the project researchers. This training was in preparation for the community level dissemination workshops held in February 2006. The training focussed on techniques for identifying and communicating key messages from complex data and issues. The result of the training was a series of key points that the researchers felt were important to communicate from the data they have gathered.

The workshop aimed to:

- Extend existing understanding of community engagement
- To build skills and knowledge about how to plan, conduct and evaluate community engagement
- Help initiate discussion around the implementation of community engagement strategies within the Darwin project

The workshop covered key concepts and some practical skills. It was based on adult learning principles where the workshop processes were based on an appreciation of existing knowledge and experience of the participants of working with the communities in the three research sites.

MAIN TOPIC	Sub-topics
Community Engagement in Context	• Clarification of what community engagement is • The goals and objectives of engagement • Implications for wetland managers
Planning Community Engagement	• Organising a community engagement program • Stakeholder Analysis • Assessing stakeholders, their likely needs and how best to engage them • Working out what is negotiable and what is not
Implementing community Engagement	• Ensuring appropriate engagement of communities • Managing practical realities of working with communities • Co-ordination of engagement with other agencies
Methods and Skills	• Methods of sharing information with stakeholders and community • Ways of consulting communities • Techniques for developing active participation with stakeholders • Choosing appropriate methods

The principal techniques for community engagement that were presented and discussed in the in the training were:

1. Dissemination of result to PRA/ data gathering sites to community and key stakeholders,

including information on main goals of the project ↔ feedback from the community
2. Feedback/ listening groups
3. Public meetings/ community meetings (gender issues?)
4. Women's Group meetings
5. Focus Group Discussion
6. Workshops with Stakeholders/ key interest groups (farmers, Women' groups, Action research Techniques related to main issues)
7. 'Training of Trainers'
8. Incentive raising
9. Increase of penalties for illegal exploitation ?
10. Media: fact sheets; posters; information flyers; priests sermons; monks; community radio at village level
11. Field trips and study tours

4.1.7 Workshop on the application of the Ecosystem Approach to wetland management in the Mekong Delta – August 2005

A two-day workshop was held with a group of approximately 25 stakeholders on the strategic management plan for the Mekong Delta's wetlands that forms one of the key outputs from this Darwin project (see Appendix VII). The group of stakeholders was drawn from provincial civil servants (from the Departments of Natural Resources and Environment and Departments of Technology), the Vietnam Environmental Protection Agency (VEPA), Ministry of Natural Resources and Environment (MONRE), People's Committees of the Provinces, Women's and Farmer's Unions, Scientists and Directors of the boards of Reserves and Parks.

The consultation was led by the UK project leader (E Maltby) and was designed to contribute to a set of strategic guidelines for applying the ecosystem approach to management and restoration of wetlands in the Mekong Delta. The workshop was structured around the ecosystem approach with the first part of the workshop reviewing the twelve principles and the points of operational guidance of the ecosystem approach. The workshop participants were then split into groups that covered different areas of expertise and the groups discussed and reported back against each of the principles on the following:

- identify the actions that are already being done that take account of this principle in the management of wetlands
- recommend priorities for action to implement this ecosystem approach principle in the management and restoration of wetlands in Vietnam
- identify the constraints in applying the principle
- do the project data and outline conclusions tell us anything about its implementation?

The contributions from the stakeholders were subsequently written up into a draft report for further consultation at the February 2006 workshop, reported on below.

4.1.8 Stakeholder engagement and finalisation of Strategic Guidelines report – February 2006

A follow up workshop to the August 2005 stakeholder meeting, where the initial consultation on the strategic guidelines report took place, was held in February 2006. This meeting presented the draft strategic guidelines reort and conclusions that had been written up following the discussions at the August 2005 workshop. This gave the participants the opportunity to provide feedback on the report, an opportunity to influence the final document and for corrections and fact checking.

The report is organised according to the twelve ecosystem approach principles. The workshop briefly revisited the explanation of the principles and outlined the main conclusions and guidelines developed from the contributions at the August 2005 workshop. Discussions and feedback on each of the principles were then opened up to the participants. A number of

questions and the means to implement recommendations in the report were left open for discussion and contributions from stakeholders at the workshop. In particular, one of the important recommendations was the need for a forum with in the Mekong Delta to allow integrated and cross-sectoral management of wetlands. However, the means of implementation of this forum was left open for discussion at the workshop and participants were invited to make suggestions as to how such a forum might operate. The proposed model is elaborated in the final report and, given the broad support within the stakeholders, represents a major step forward in the management of wetlands.

4.1.9 Community engagement workshops – February 2006

A series of community engagement workshops were held in the local communities where the PRA research was carried out (Tam Thôn Hiep, TamNong and Vinh Loi). At each site, these consisted of one half-day workshop with members of the local community with between 10 and 40 people attending and more formal half day meetings with the local People's Committee, Women's and Farmer's Union, village heads and park management.

At these meetings the findings of the project were presented to the local communities. This served two purposes, firstly revisiting these communities and presenting the findings gave further opportunities for checking and enhancing the data. It also demonstrated to the local communities why the data were collected and the purposes of the PRA exercises that were undertaken, what the research team did with the information and what was concluded from it. Secondly, it provided an opportunity to explain to the local communities about the values provided by wetlands and the need for protection of these resources and explain some basic concepts in wetland management.

Figure 2 Community engagement workshop in Can Gio (Photo C Linstead)

Figure 3 Meeting with People's Committee and Reserve management at Can Gio (Photo L Khoa)

4.1.10 Contributions to regional capacity building

The project outputs have been used to contribute to the curriculum for a Mekong Basin University Network (Laos, Thailand, Cambodia, Vietnam), which is being led by the host country co-ordinator at Can Tho University (Dr D V Ni). Each year since 2003 a three week training programme has been held, which rotates between participating countries. The aim of the network is to build capacity for young scientists and wetland managers. In 2003 the training was held in Vietnam and participants went to Can Gio and Tram Chim, two of the Darwin project sites. The host country co-ordinator taught elements of the course relating to the issue covered in the Darwin project training: wetland soils, chemical transformations, theory and measurement methods, ecosystem approach and participatory approach to wetland management. The training materials used in this course are appended to this report.

4.2 Research activity report

4.2.1 Introduction

The research activity of the project was divided into two main elements: socio-economic research and biophysical research. Each of these strands of research were designed so that the results formed coherent studies in themselves but could also be integrated to provide a greater understanding of the link between the availability and use of natural resources within local communities. The sections below summarise the activities that were undertaken and the results for each of these research elements and the integration of the results.

4.2.2 Biophysical research

4.2.2.1 Introduction

The biophysical research was composed of two main parts:

- monitoring of water quality across sites with different degrees of disturbance and wetland types
- ecological surveys of the availability of key natural resource categories (fish, birds and plants)

Each of these strands of research are reported on below. The biophysical research concentrated on three protected areas – Tram Chim National Park, Lang Sen Wetlands Reserve, and Can Gio Biosphere Reserve – and the area immediately surrounding these sites. Each of these sites is described briefly below.

4.2.2.1.1 Tram Chim

The Tram Chim National Park is located in the Plain of Reeds within Dong Thap Province. The closed floodplain area of Dong Thap Muoi (Plain of Reeds) is a depression covering approximately 697,000 ha. As a result of its geomorphology, the Plain of Reeds traps floodwater and releases it slowly giving a longer inundation period than other wetland types in the Delta, with the soil surface remaining moist until the end of the dry season. Within the Plain of Reeds the typical flood depth is 3m and the natural ecosystem is Melaleuca forest interspersed with *Eleocharis* grassland.

The area of the Tram Chim National Park is approximately 7,740 hectares and is bounded by a high dyke. With the park there is a network of canals approximately 53km long which divides the park into six management zones. In combination with the high dyke (which contains sluice gates) the canals are used to control the water level in the Park.

Of particular note ecologically, and one of the principal reasons for its designation as a national park, is the presence of the eastern Sarus Crane (*Grus antigone*). Over 600 individuals have been recorded at the site, out of a total regional population estimated to be about 1000.

4.2.2.1.2 Lang Sen

Lang Sen is designated as a wetlands reserve and the designated area covers 3,280 hectares. The site is located approximately 25km from Tram Chim National Park and, prior to the construction of the dyke around Tram Chim the two sites were hydrologically connected during the flood season. The remnant semi-natural forest and seasonally inundated grassland covers 700ha of the site with the remainder primarily under rice cultivation with some plantation *Melaleuca* forest.

4.2.2.1.3 Can Gio

Can Gio is designated as a Biosphere Reserve and covers an area of 75,740 hectares, located in the coastal area in the east of Ho Chi Minh City. In contrast to the other two sites in this project, Can Gio is predominantly mangrove forest, incorporating both salt water and brackish water habitats. Much of the original vegetation cover was destroyed by defoliants during the late 1960s and early 1970s but, following the war in 1978, the area was replanted with mangroves. The average elevation of the area is low (approximately 1.5m) and much of the Biosphere Reserve is under water at high tide. The dominant tree species are *Rhizophora apiculata* and *Avicennia alba.*

Figure 4 shows the location of these three sites within the Mekong Delta.

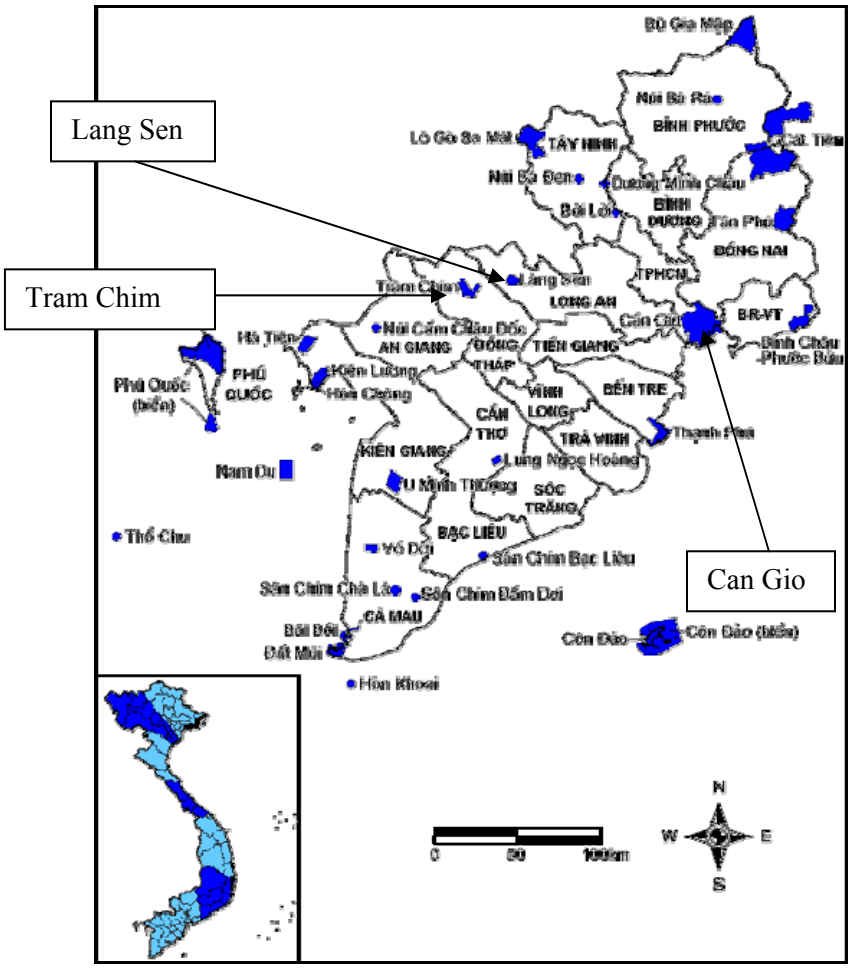

Figure 4 Wetland sites in the Mekong Delta with the Darwin project study sites highlighted

4.2.2.2 Water quality surveys

The purpose of the water quality component of the study was to demonstrate the effect of different degrees of disturbance and wetland types on water quality throughout a one year cycle and relate the water quality status of the sites to their ecological status.

Within each of the three sites, four 'treatments' or 'states' are being studied:

- Highly disturbed
- Moderately disturbed
- Natural/core
- River/canal

Table 1 shows the summary descriptions of the water quality monitoring sites, their location and category.

Site code	Location	Description	Category	Latitude	Longitude
CG1	Can Gio	Centre of mangrove forest	Natural/core	10 31.510	106 52.626
CG2	Can Gio	Edge of mangrove forest	Natural/core	10 31.454	106 52.611
CG3	Can Gio	Long Tau River	River/canal	10 31.407	106 52.545
CG4	Can Gio	Shrimp pond	Moderately disturbed	10 30.343	106 54.106
CG5	Can Gio	Compartment 12, abstraction channel for shrimp pond	Moderately disturbed	10 30.301	106 54.148
CG6	Can Gio	Hot Hoa channel Mung 5 river	River/canal	10 30.290	106 54.067
CG7	Can Gio	Shrimp pond	Highly disturbed	10 33.299	106 48.458
CG8	Can Gio	Abstraction channel for shrimp pond	Highly disturbed	10 33.301	106 48.456
CG9	Can Gio	Tac Ca Chay channel	Highly disturbed	10 33.299	106 48.476
LS10	Lang Sen	Melaleuca forest	Moderately disturbed	10 46.911	105 42.711
LS11	Lang Sen	Edge of melaleuca forest	Moderately disturbed	10 46.882	105 42.745
LS12	Lang Sen	Channel T4	River/canal	10 46.909	105 42.704
LS13	Lang Sen	Rice field	Highly disturbed	10 47.355	105 42.057
LS14	Lang Sen	Irrigation channel for rice field	Highly disturbed	10 47.377	105 42.041
LS15	Lang Sen	Channel T1	River/canal	10 47.324	105 42.085
LS16	Lang Sen	Melaleuca forest, core area	Natural/core	10 47.180	105 42.041
LS17	Lang Sen	Edge of forest	Natural/core		
TC18	Tram Chim	A2 Area of Tram Chim , Melaleuca forest	Moderately disturbed	10 41.596	105 33.568
TC19	Tram Chim	Edge of forest	Moderately disturbed	10 41.619	105 33.507
TC20	Tram Chim	Nong Truong channel	River/canal	10 41.781	105 33.392
TC21	Tram Chim	Rice field	Highly disturbed	10 41.774	105 33.360
TC22	Tram Chim	Abstraction channel for rice field	Highly disturbed	10 41.831	105 33.393
TC23	Tram Chim	A1 Area of Tram Chim , Melaleuca forest	Natural/core	10 40.940	105 31.405
TC24	Tram Chim	Edge of Melaleuca forest	Natural/core	10 40.919	105 31.414
TC25	Tram Chim	Dong Tien channel	River/canal	10 40.857	105 31.396

Table 1 Water quality monitoring site descriptions, locations and categories.

Water samples and in-field water quality measurements were taken bi-monthly from December 2003 until October 2004. The water quality parameters measured were:

- Salinity (%)
- Conductivity (µS/cm)
- Turbidity (NTU)
- Biological Oxygen Demand (BOD, ppm)
- Dissolved Oxygen (DO, ppm)
- Nitrate (NO_3^-, ppm)
- Nitrite (NO_2^-, ppm)
- Sulphate (SO_4^{2-}, ppm)
- Phosphate (PO_4^{3-}, ppm)
- Ammonium (NH_4^+, ppm)
- *Escherichia coli* (Colony Forming Units (CFU) per 100ml)
- Total Coliform (Colony Forming Units (CFU) per 100ml)

The water quality monitoring data collected provide a considerable quantity of baseline data on the physical conditions at the three study sites. These data are presented in full in Appendix V with the results for two key parameters, pH and DO presented in Figure 5 and Figure 6

below. Where the figures show a value of zero this is due to the sample site having no water during the dry season.

The pH of the Tram Chim and Lang Sen sites is of particular significance given the problems experienced with acid sulphate soils in this part of the Delta (see Appendix VII report). The high level of acidity is due to the presence of potential acid sulphate soils which, when subject to oxidation from, for example drainage for agricultural activities, leads to the production of sulphuric acid. Soil water acidification leads to a reduction in agricultural productivity, negative impacts on biodiversity and human health.

The data shown in Figure 5 clearly demonstrate the impact on water quality of agricultural activities. The least impacted sites show near neutral pH throughout the year. However, the moderately disturbed sites at Tram Chim and Lang Sen show significant reductions in pH, down to approximately 3, during the dry season (December to August). Interestingly, at Tram Chim the retention of water within the high dyke surrounding the park delays the onset of the oxidation and the pH in the moderately disturbed sites remains near neutral for much longer into the dry season than at the equivalent sites in Lang Sen.

Although having some acid sulphate soils, Can Gio is not affected to the same degree as Tram Chim and Lang Sen as a result of less extensive acid sulphate soils and the disturbance being due to aquaculture rather than rice farming. As the shrimp ponds retain water for much of the time there is less oxidation of the soil and the cropping cycles for different farms are synchronized to a lesser degree.

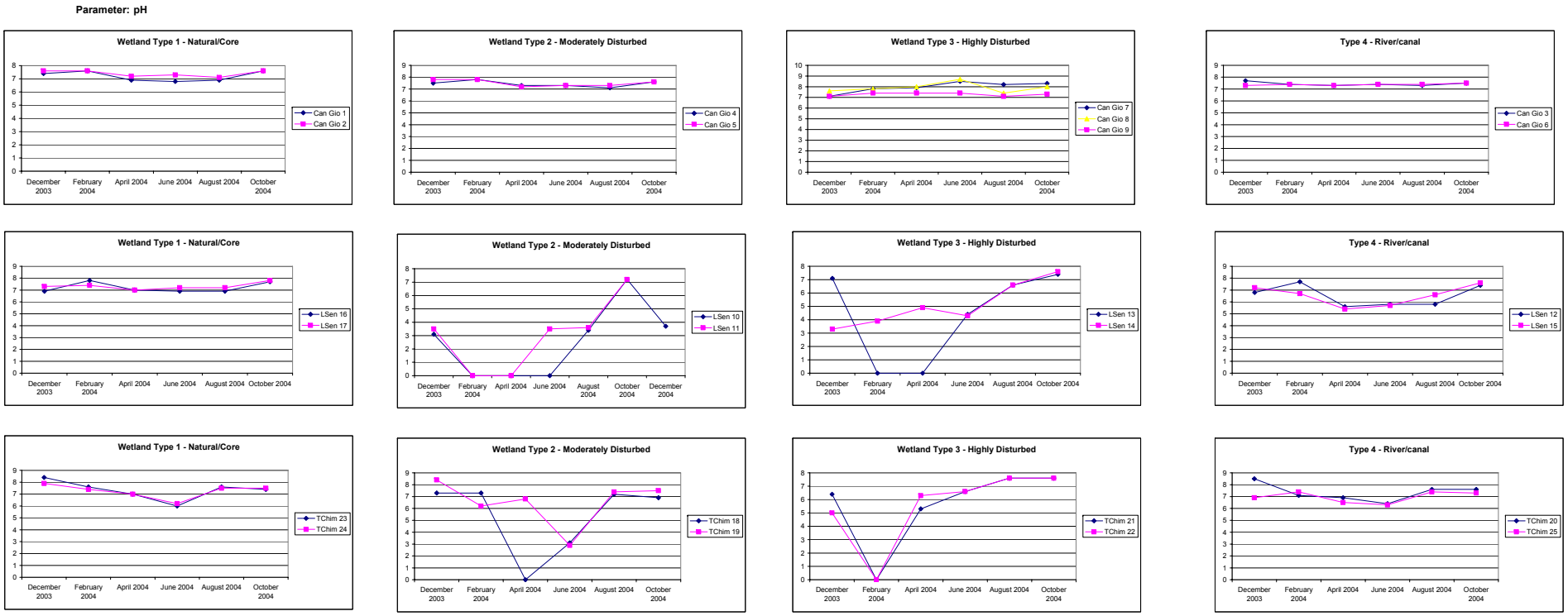

Figure 5 pH at Can Gio, Lang Sen and Tram Chim (December 2003 to October 2004)

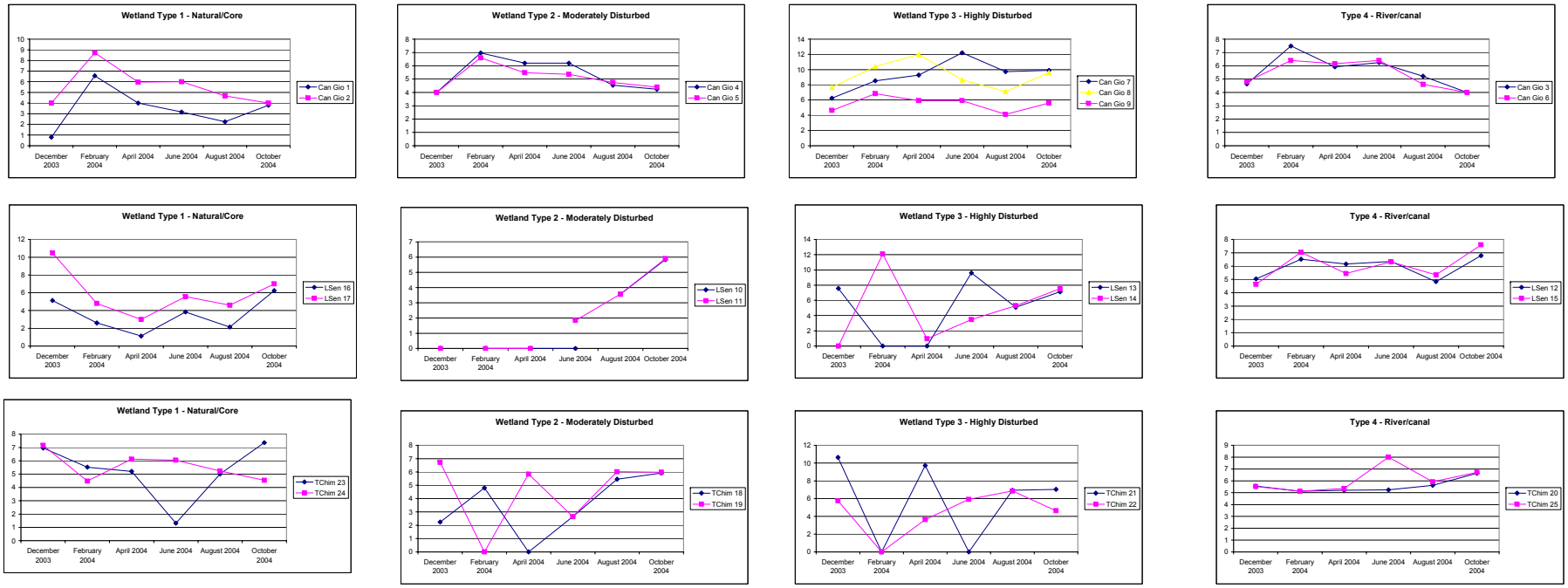

Figure 6 Dissolved oxygen at Can Gio, Lang Sen and Tram Chim (December 2003 to October 2004)

4.2.2.3 Ecological research

4.2.2.3.1 Introduction

In addition to the bi-monthly water quality surveys, two surveys of natural resource availability were carried out in August 2004 (end of the dry season) and December 2004 (end of the wet season). These surveys covered fish, plants and birds.

4.2.2.3.2 Plant surveys

4.2.2.3.2.1 Methodology

The plant surveys were carried out according to the methodology defined in the first project training workshop in November 2003. For the August 2004 survey only Tram Chim and Lang Sen were surveyed. For the December 2004 survey all three sites were surveyed. Random 20m x 20m plots were selected and divided into 1m x 1m sub-plots. For canal sites the procedure was adapted to a 100m x 4m plot, given the linear nature of the habitat.

The different plant communities within the main plots were identified visually and, for each different community, three 1m x 1m sub-plots were randomly selected for plant species identification. Within each of these sub-plots the species present were identified and the proportion of cover for each species was estimated. At each plot conductivity, pH, depth and salinity (for coastal Can Gio sites only) were measured in the field.

4.2.2.3.2.2 Results

The different plant communities identified during each of the two ecological surveys are shown in Table 2. As the surveys were undertaken at different times of the year, the plant communities identified during each survey are different. The distribution of these plant species inside and outside the protected areas is shown in Table 3. Those plants with uses identified by the field teams are indicated in the table.

August 2004 survey	
Melaleuca cajeputi	*Nymphoides indicum, Nymphaea pubescen, Hymenachme acutigluma*
Oryza rufipogon (Wild rice)	*Leersia hexandra, , Nymphoides indicum, Nymphaea pubescen.*
Eleocharis dulcis	*Nymphoides indicum, Nymphaea pubescen, Salvinia cucullata, Ludwidgia adscendens*
Polygonum tomentosum	*Salvinia cucullata, Hymenachme acutigluma, Ludwidgia adscendens, Polygonum pulchrum, Impomoea aquatica, Commelina diffusa, Cyperus platystylis, Cyperus digitatus*
Nelumbo nucifera (Lotus)	*Ludwidgia adscendens, Salvinia cucullata.*
Salvinia cucullata	*Leersia hexandra, Ischaemun indicum, Eichhornia crassipes, Sagittaria sagittaefolia, Nymphaea pubescen, Cyperus platystylis*
Cultivated rice field (*Oryza sativa*)	*Hemarthria longiflora, Digitaria ciliaris, Echinochloa stagnina, Echinochloa crus-galli, Hymenachme acutigluma, Chamaeraphis brunoniana, Nymphoides indicum, Nymphaea pubescen, Cyperus digitatus, Cyperus platystylis, Cyperus halpan., Cyperus polystachyos, Fuirena umbellate, Eleocharis dulcis, Oryza sativa, Leptochloa chinensis, Ludwidgia octovalvis*
Astrantia (Snowstar)	*Nymphoides indicum, Nymphaea pubescen*
December 2004 survey	
Melaleuca cajeputi	*Utricularia aurea, Hydrilla verticilata, Nymphaea pubescen, Blyxa aubertii*
Oryza rufipogon (Wild rice)	*Leersia hexandra, Utricularia aurea, Salvinia cucullata.*
Eleocharis dulcis	*Utricularia aurea, Panicum repens*
Polygonum tomentosum	*Ipomoea aquatica, Commelina diffusa, Ludwidgia adscendens, Ischaemun indicum*
Nelumbo nucifera (Lotus)	*Utricularia aurea, Hydrilla verticilata, Blyxa japonica, Salvinia cucullata.*
Salvinia cucullata	*Kyllinga sesquiflora, Cyperus platystylis, Leersia hexandra, Oryza rufipogon, Ischaemun indicum, Cyclosorus gongylodes*
Nymphaea pubescen (Water lily)	*Nymphoides indicum, Nymphaea nouchali, Utricularia aurea, Hydrilla verticilata, Blyxa japonica, Salvinia cucullatat, Ludwidgia adscendens, Hymennachme acutigluma, Eleocharis dulcis*

Utricularia aurea	*Hydrilla verticilata, Blyxa japonica, Nymphaea pubescen, Panicum, Leersia hexandra, Eleocharis dulcis*
Ludwidgia adscendens	*Utricularia aurea, Hydrilla verticilata, Blyxa japonica, Hymennachme acutigluma, Polygonum tomentosum, Leersia hexandra*
Leersia hexandra	*Oryza rufipogon, Hymennachme acutigluma.*
Panicum repens (Torpedo grass)	*Alternanthera paronychioides, Ipomoea maxama, Merremia hederacea, Passiflora foetida, Brachiaria mutica*
Scirpus grossus	*Utricularia aurea, Hydrilla verticilata, Blyxa japonica, Eleocharis dulcis*
Eicchornia Crassipes (Water hyacinth)	*Sesbania sesban*
Mimosa pigra	*Phyllanthus reticulata, Mimosa pigra, Mnesithea laevis , Saccharum spontaneum, Alternanthera sessilis , Sphaeranthus africannus, Grangea maderaspatana , Commelina diffusa, Aniseia martinicenses , Merremia hederacea, Phyllanthus reticulata, Ludwidgia octovalvis, Ludwidgia adscendens, Passiflora foetida, Panicum repens, Phragmites vallatoria, Eragrostis atrovirens, Chamaeraphis brunoniana, Echinochloa stagnina, Saccharum spontaneum, Oryza rufipogon, Mnesithea laevis , Polygonum tomentosum*
Eleocharis ochrostachys	*Utricularia aurea,Hydrilla verticilata , Utricularia punctata, Panicum repens, Blyxa aubertii, Eleocharis ochrostachys*
Hydrilla verticilata	*Blyxa japonica, Utricularia aurea, Nymphaea pubescen, Nymphaea nouchali, Salvinia cucullata, Nymphoides indicum, Ludwidgia adscendens, Pistia stratiotes*
Rhizophora apiculata	*Acrostichum aureum, Phoenix paludosa, Nypa fruticans, Finlaysonia obovata, Derris trifolia, xylocarpus granatum, Ceriops tagal*
Avicennia alba	*Acanthusilicifolius, Lumnitzera racenosa, Excoecaria agallocha, Aegiceras corniculata, Sonneratia ovata, Avicennia officinalis*

Table 2 Plant communities identified in the two ecological surveys

	Location						***Uses***					
Scientific name	***Outside Tram Chim National Park***	***Inside Tram Chim National Park***	***Outside Strictly Protected Area - Lang Sen***	***Inside Strictly Protected Area - Lang Sen***	***River bank of Can Gio***	***Forest area of Can Gio***	***Edible plant***	***Animal fodder***	***Building materials***	***Roofing material***	***Medicinal***	***Fuel***
Acanthusilicifolius					X	X						
Acrostichum aureum						X						
Aegiceras corniculata					X							
Alternanthera paronychioides	X											
Alternanthera sessilis			X				x					
Aniseia martinicenses			X	X							x	
Avicennia alba					X	X						x
Avicennia officinalis					X							x
Blyxa aubertii		X										
Blyxa japonica		X		X								
Brachiaria mutica	X											
Ceriops tagal						X						
Chamaeraphis brunoniana			X									
Commelina diffusa	X	X	X				x					
Cyclosorus gongylodes				X								
Cyperus platystylis				X								
Derris trifolia						X						
Echinochloa stagnina			X					x				
Eichhornia crassipes	X			X								
Eleocharis dulcis		X		X								
Eleocharis ochrostachys		X										
Eragrostis atrovirens			X									
Excoecaria agallocha					X	X						
Finlaysonia obovata						X						
Grangea maderaspatana			X				x					
Hydrilla verticilata		X		X								

Hymenachme acutigluma		X						x					
Ipomoea aquatica	X	X		X			x						
Ipomoea maxama	X												
Ischaemun indicum		X	X	X				x					
Kyllinga sesquiflora				X									
Leersia hexandra		X	X	X				x					
Ludwidgia adscendens	X	X	X	X			x						
Ludwidgia octovalvis			X								x		
Lumnitzera racenosa					X	X					x		
Lygodium microphyllum				X									
Melaleuca cajyputi		X		X					x			x	
Merremia hederacea	X		X								x		
Mimosa pigra	X		X										
Mnesithea laevis	X		X										
Nelumbo nucifera		X		X			x						
Nymphaea nouchali		X		X			x						
Nymphaea pubescen		X		X			x						
Nymphoides indicum		X		X									
Nypa fruticans						X				x			
Oryza rufipogon		X	X	X				x					
Panicum repens	X	X	X					x					
Passiflora foetida	X		X				x						
Phoenix paludosa						X							
Phragmites vallatoria			X					x					
Phyllanthus reticulata	X		X								x		
Pistia Stratiotes				X									
Polygonum tomentosum	X	X	X								x		
Rhiziphora apiculata					X	X			x				
Saccharum spontaneum	X		X										
Salvinia cucullata		X		X									
Scirpus grossus		X											
Sesbania sesban	X												
Sonneratia ovata					X	X	x						
Sphaeranthus africannus			X								x		
Utricularia aurea		X		X									
Utricularia punctata		X											
Xylocarpus granatum						X							

Table 3 Location and uses of plant species identified in plant surveys

4.2.2.3.3 Fish surveys

Methodology

The purpose of this project was to better understand the connection between the availability and use of natural resources in wetland areas. For this reason, the fisheries surveys concentrated on the locations where fishing was taking place and the actual fish species being caught rather than attempting to provide an estimate of the populations or complete species lists.

Two fisheries surveys were carried out; one in August 2004 and one in December 2004. The project team located fishermen in the project areas (both outside protected areas and those fishing illegally within the protected areas). The location (using a GPS receiver), method of fishing, number of fish caught and species were recorded and, where possible, the fish were measured and weighed.

Table 4 and Table 5 below summarises the data for fish, showing for each site the species that were observed. The data for Tram Chim and Lang Sen are presented together as these two

sites are freshwater and located close to each other, whereas Can Gio is a coastal brackish site. Where an individual could not be identified to species level, the genus or family is given. The data in the table, therefore, represent a minimum number of species observed. Note that some different species have the same local name and some species have more than one local name.

Given the methodology of the survey it is difficult to make inter-site comparisons. For instance, as fishing is illegal within Tram Chim National Park, the methods being used and the degree of fishing effort were different to outside the park. Outside the park, methods such as seine nets, beam trawls and Chà were used, which were observed to catch the largest numbers of species (see Table 6, Table 7 and Table 8). In the second survey inside Tram Chim National Park the most common fishing methods were observed to be

Chà is a traditional fishing method whereby sticks and branches are used to create a habitat of several cubic meters that attracts a high density and diversity of fish species. The structure is left in place for several months after which it is surrounded by a fine net to prevent any fish escaping. The sticks and branches are then removed and the fish are collected.

For Lang Sen, sites in canals adjacent to the protected area but not necessarily part of the protected area have been assigned to be 'inside Lang Sen', given their close proximity and the hydrological connectivity, which is not the case at Tram Chim where there is a high dyke surrounding the park.

		First survey				Second survey			
Vietnamese name	Scientific name	Lang Sen - inside	Lang Sen - outside	Tram Chim - inside	Tram Chim - outside	Lag Sen inside	Lang Sen outside	Tram Chim inside	Tram Chim outside
Cá chìa vôi	*Acanthopsis choirorhynchos*		x		x				
Cá rô đồng	*Anabas testudineus*	x	x	x	x	x		x	x
Cá bạc đầu	*Aplocheilus panchax*							x	
Cá chèn	*Bagarius bagarius*								x
Cá mè vinh	*Barbonymus gonionotus*	x	x	x	x	x			x
Cá he đỏ	*Barbonymus schwanenfeldii*					x			x
Cá trèn răng	*Belodontichthys dinema*								x
Cá lia thia	*Betta plendens*		x	x	x			x	
Cá heo	*Botia . eos*		x		x				
Cá heo	*Botia hymenophysa*		x		x	x			
Cá heo	*Botia modesta*					x			
Cá heo	*Botia sp.*								x
Cá heo xanh	*Botia sp.*								x
Cá bống mắt tre	*Brachygobius doriae*								x
Cá dầy	*Channa lucius*			x					
Cá lóc bong	*Channa micropeltes*	x		x				x	
Cá lóc	*Channa striata*		x	x	x	x	x	x	x
Cá lóc đồng	*Channa striata*	x				x		x	
Cá linh ống	*Cirrhinus jullieni*		x		x	x	x		x
Cá duồng	*Cirrhinus microlepis*					x			
Cá trê trắng	*Clarias batrachus*					x			x
Cá trê	*Clarias macrocephalus*					x		x	
Cá trê vàng	*Clarias macrocephalus*	x	x	x	x	x	x	x	x
Cá cơm song	*Corica sp*								x
Cá duồng bay	*Cosmochilus harmandi*					x			
Cá trắm cỏ	*Ctenopharyngodon idella*								x
Cá ba kỳ đỏ	*Cyclocheilichthys apogon*					x	x	x	
Cá cóc	*Cyclocheilichthys enoplos*				x	x			x
Cá ba kỳ	*Cyclocheilichthys sp.*			x	x	x	x	x	x
Cá lưỡi trâu	*Cynoglossus lingua*					x			x
Cá chép màu	*Cyprinus carpio*								x
Cá cơm	*Engraulidae*					x			x
Cá lòng tong bay	*Esomus goddardi*			x	x				
Cá bống cát	*Glossogobius giuris*						x		x

Cá ngựa	*Hampala dispar*					x	x		
Cá ngựa	*Hampala macrolepidonta*		x	x		x	x		
Cá ngựa	*Hampala sp.*							x	x
Cá khoai	*Harpadon nehereus*								x
Cá lăng	*Hemibagrus wyckii*	x	x	x	x	x	x		x
Cá lìm kìm	*Hemiramphidae*						x	x	x
Cá kết	*Kryptopterus bleekeri*					x			x
Cá trèn mỡ	*Kryptopterus cryptopterus*								x
Cá ét mọi	*Labeo chrysophekadion*		x	x	x	x			
Cá trôi ấn	*Labeo rohita*						x		
Cá linh rìa	*Labiobarbus siamensis*		x	x	x	x	x		x
Cá chài	*Leprobarbus hoevenii*	x	x		x				
Cá lòng tong	*Luciosoma bleekeri*				x				
Cá chạch song	*Macrognathus aculeatus*		x	x	x	x			x
Cá chạch bong	*Mastacembekus taeniagaster*	x				x	x		x
Cá chạch	*Mastacembelidae*								x
Cá chạch bong	*Mastacembelus sp*		x		x				
Cá chạch lấu	*Mastacembelus armatus*					x	x		x
Lươn	*Monopterus albus*	x	x	x	x			x	
Cá chốt giấy	*Mystus cavasius*					x	x		x
Cá chốt trâu	*Mystus planiceps*					x			x
Cá chốt sọc	*Mystus rhegma*		x		x				
Cá chốt sọc	*Mystus vittatus*					x	x		x
Cá chốt trắng	*Mystus wolffii*				x				x
Cá thát lác	*Notopterus notopterus*	x	x	x		x			
Cá thát lát	*Notopterus notopterus*								x
Cá trèn bầu	*Ompok bimaculatus*		x	x	x	x	x		x
Cá mè lúi	*Osteochilus hasseltii*	x	x	x	x	x	x		x
Cá mè hôi	*Osteochilus melanopleura*								x
Cá mè dãnh	*Osteochilus sp*								x
Cá mê rổ	*Osteochilus sp*								x
Cá bống xệ vẩy to	*Oxyurichthys sp*								x
Cá tra nuôi	*Pangasius hypophthalmus*					x			
Cá vồ đém	*Pangasius larnaudii*					x			x
Cá xác sọc	*Pangasius macronema*					x			
Cá lành canh	*Parachela oxygastroides*					x	x		x
Cá thiểu	*Paralaubuca riveroi*		x	x	x				
Cá sơn	*Parambasis sp*					x		x	
Cá rô biển	*Pristolepis fasciatus*		x		x	x	x		x
Cá chốt chuột	*Psedomystus siamensis*		x		x				
Cá dãnh	*Puntioplites proctozysron*	x	x	x	x	x	x		x
Cá rầm	*Puntius leiacanthus*			x	x	x		x	
Cá lòng tong đỏ	*Rasaboa borapetensis*			x	x			x	x
Cá lòng tong	*Rasabora sp.*							x	x
Cá lòng tong đá	*Rasbora lateristriata*			x	x	x	x	x	x
Cá trèn	*Siluridae*								x
Cá nhái	*Strongylura strongylura*					x			
Cá nhái	*Strongylura strongylura*								x
Cá heo sọc	*Syncrossus helodes*					x	x		x
Cá chày	*Tenualosa ilisha*					x			
Cá nóc	*Tetraodon sp*								
Cá nóc	*Tetraodon sp*					x			x
Cá sặc điệp	*Trichogaster microlepis*			x		x	x		
Cá sặc rằng	*Trichogaster pectoralis*			x					
Cá sặc bướm	*Trichogaster trichopterus*		x	x	x	x		x	
Cá bãi trầu	*Trichopsis vittatus*		x	x	x			x	x
Cá cua đồng	***Unknown***								x
Cá đen	***Unknown***							x	
Cá đuôi đỏ	***Unknown***								x
Cá éc	*Labeo sp.*						x		x
Cá heo xanh	*Botia sp.*						x		
Cá linh vàng	***unknown***					x			
Cá lóc đen	*Channa sp.*							x	
Cá mè cám	***unknown***					x			
Cá trắng	***Unknown***							x	

Cá leo	*Wallago attu*								x
Cá lìm kìm đuôi đỏ	*Zenarchopterus sp.*							x	
Total number of species identified		12	27	27	33	51	25	24	58

Table 4 Fish species identified inside and outside protected areas at Tram Chim and Lang Sen sites for both surveys.

		First survey		Second survey	
Local name	**Scientific name**	**Can Gio - inside**	**Can Gio - outside**	**Can Gio – inside**	**Can Gio - outside**
Cá bống tối	*Acentrogobius sp*			*x*	x
Cá úc nghệ	*Arius cealatus*	x	x		x
Cá úc trắng	*Arius sciurus*		x		
Cá úc gạo	*Arius sp*				
Cá úc sào	*Arius truncatus*				x
Cá hàm ếch	*Batrachomoeus tripspinosus*			x	
Cá bống trân	*Butis butis*	x	x	*x*	
Cá mào gà trắng	*Coilia greyii*				x
Cá mào gà đỏ	*Coilia macrognathos*	x	x		x
Cá cơm biển	*Commersonii anchovy*		x	x	x
Cá cơm song	*Corica sp*				x
Cá thu ảo	*Cybim commersonii*		x		
Cá lưỡi trâu	*Cynoglossus lingua*			x	x
Cá đuối	*Dasyatis akajei*		x		
Cá nhái	*Dermogenys pusillus*		x		
Cá chét	*Eleutheronema tetradactylum*	x	x		
Cá móm vây dài	*Gerres filamentosus*			*x*	
Cá móm	*Gerres setifer*	x	x		
Cá móm	*Gerres setifer*				x
Cá bống cát	*Glossogobius giuris*	x	x		x
Cá bống cầu	*Gobiidae*	x			
Cá bống râu	*Gobiopsis macrostoma*	x	x		
Cá chình hoa	*Gymnothorax reevesii*				x
Cá dìa	*Hoplegnathus fasciatus*			*x*	
Cá đù	*Johnius macrorhynus*				
Cá chẻm	*Lates calcaifer*	x	x		
Cá liệt	*Leiognathus equalus*				x
Cá ngãng	*Leiognathus sp*	x	x		
Cá nhám	*Loxodon macrorhinus*				x
Cá mang ếch	*Monotreta leiurus*	x	x		
Cá đối thường	*Mugil cephalus*			*x*	
Cá đối	*Mugil sp*	x	x		
Cá lưỡi mèo	*Mystus armatus*		x		
Cá chốt	*Mystus planiceps*		x		
Cá chốt sọc	*Mystus vittatus*				
Cá rô phi	*Oreochromis mossabicus*	x			
Cá úc thép	*Osteogeneiosus militaris*		x		x
cá đù sạn	*Otolithoides biaurutus*				x
Cá thờn bơn	*Padarchirus povorinus*			x	
Cá bông lao	*Pangasius krempfi*		x		
Cá tra nghệ	*Pangasius kunyit*		x		
Cá sơn gián	*Parambasis siamensis*				x
Cá sơn	*Parambasis sp*	x	x		
Cá thòi lòi	*Periophthalmodon*	x	x		
Cá chai	*Platycephalus indicus*				
Cá ngát	*Plotosus canius*	x	x		
Cá ngát	*Plotosus canius*			*x*	x
Cá ngát sọc	*Plotosus lineatus*		x		
Cá phèn vàng	*Polynemus longipectoralis*			x	x

Cá bống kèo vảy nhỏ	*Pseudapocryptes elongatus*	x	x		
Cá sửu	*Pseudoscianae soldado*				x
Cá nâu	*Scatophagus argus*	x	x		
Cá kẻ	*Sciaena russelli*				x
Cá lẹp vàng	*Setippinna breviceps*		x	x	
Cá lẹp trắng	*Setippinna taty*				x
Cá đục biển	*Sillago sihama*		x	*x*	x
Cá chìa vôi	*Strongylura strongylura*		x		
Cá nhái	*Strongylurastrongylura*			*x*	
Cá nóc	*Tetraodon sp*		x		
Cá nóc xanh	*Tetraodon sp*			x	
Cá căng	*Therapon jarbua*	x	x		x
Cá mang rổ	*Toxotes chatareus*	x	x		
Cá bồng vẩy cao	*Trapauchen vagina*				x
Cá bống kèo đỏ	*Trapauchen vagina*				x
Cá hố	*Trichiurus haumela*		x		
Cá lưỡi trâu	*Typhlachirus elongatus*		x		
Cá lạc chó	***Unknown***				
Cá nhồng vẩy mịn	***Unknown***				x
Cá ướp	*Crenidens carissphorus*				
Cá trap	***Unknown***			*x*	
Cá tráp vây lưng dài	***Unknown***				x
Cá đù bản	***Unknown***				x
Cá mối gấm	***Unknown***				x
Cá ống đủa	***Unknown***				
Cá lìm kìm	*Zenarchopterus pappenheimi*		x		x
Total number of species identified		20	37	15	30

Table 5 Fish species identified inside and outside Can Gio protected area for both surveys

Habitat/ species	**Canal**	**Scirpus grossus**	**Melaleuca forest**	**Leersia hexandra-Panicum**	**Oryza rufipogon**	**Ludwidgia adscendens**	**Polygonum tomentosum**	**Lotus swamp**	**Total**
Number of surveyed sites	12	2	2	4	2	2	2	4	30 sites
Fishing methods	**Number of observed species**								
Gill net	1			1	4				6
Long line	4								4
Pole line	1								1
Electro-fishing	1	4							5
Observation by project team	2							2-3	4-5
Other fishing methods	4-7		2-3		4				10-14

Table 6 Number of fish species observed inside Tram Chim national park during the second survey (December 2004) by fishing method and habitat type.

Fishing method	**Number of observed species**
Cast net	10-12
Beam trawl	20
Chà	20
Barrier net	6-11

Gill net	10
Seine net	16

Table 7 Number of fish species observed outside Tram Chim National Park by fishing type during the second fisheries survey (December 2004). The only habitat type where fishing was taking place at the time of the survey was in the canal system.

Fishing method	Number of observed species
Chà	41
Hand line	1
Cào	53
Electro fishing	29
Lift net	12
Vó kéo	26
Cast net	16

Table 8 Number of fish species identified by method of fishing outside Land Sen reserve area (second survey December 2004) demonstrating the greater number of species caught by the Chà method when compared with other fishing techniques.

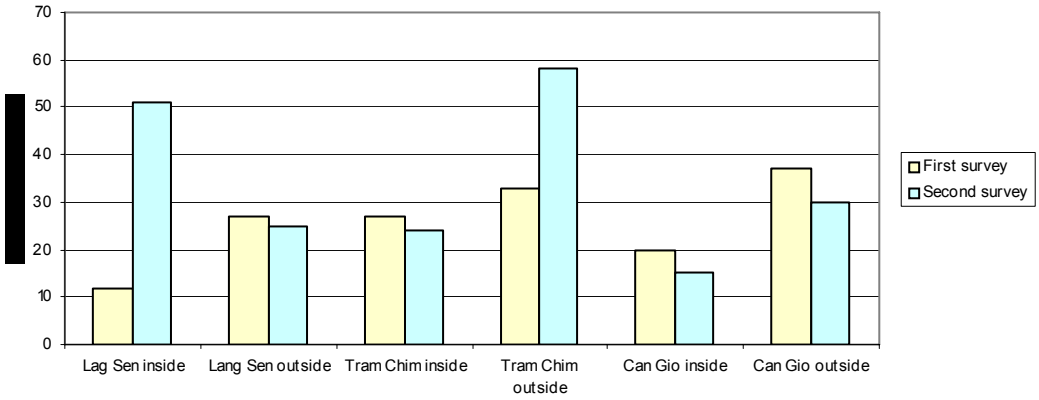

Figure 7 Number of fish species observed in Tram Chim, Lang Sen and Can Gio

Figure 7 summarises the number of species observed inside and outside the protected areas. Although, as stated above, the differences in fishing methods and fishing effort inside and outside the protected areas make it difficult to draw conclusions, it is clear that there are no large differences in species numbers between sites or between inside and outside the protected areas. To date, the data above represent one of the only comprehensive fish surveys of any nature in the study areas.

One of the hypotheses proposed prior to the collection of the data and raised during the stakeholder consultations was that, as a result of the hydrological isolation of Tram Chim National Park, there are problems with low dissolved oxygen inside the park towards the end of the dry season. Analysis of the observed fish species shows no significant difference in the proportion of the total number of species observed that are tolerant of low oxygen conditions.

4.2.2.3.4 Bird surveys

During the field surveys one of the field team had responsibility for observing birds. Bird species were identified and counted and the results are summarised in Table 9. The habitat type where the bird was observed was also recorded. The table shows the numbers of individuals of each species found inside and outside the protected areas for Lang Sen and Tram Chim and totals for the Can Gio site.

All of the sites show similar number of bird species apart from outside the Tram Chim National Park, where only one individual was observed. It is thought that this was due to disturbance from the local community, the survey boat and other members of the survey team at these sites. Both the Lang Sen and Tram Chim sites show significantly larger numbers of

individuals inside the protected areas compared without side, although as stated, for the Tram Chim site no conclusions can be drawn from this observation.

		Can Gio	Lang Sen		Tram Chim	
		Total	Outside protected area	Inside protected area	Outside protected area	Inside protected area
Vietnamese name	**Scientific name**					
Hút mật đuôi nhọn	*Aethopyga christinae*	10	8			
Hút mật họng vàng	*Aethopyga gouldiae*		4			11
Bồng chanh	*Alcedo atthis*	1		1	1	5
Mồng két	*Anas crecca*			100		1000
Vịt trời	*Anas poecilorhyncha*			38		21
Điên điển	*Anhinga melanogaster*		14	10		5
Yến càm trắng	*Apus affinis*	7				
Diệc xám	*Ardea cinerea*	3				46
Diệc lửa	*Ardea purpurea*		1			41
Cò ma	*Ardeola bacchus*	5	16	98		237
Cò xanh	*Butorides striatus*			5		
Rẻ đuôi nhọn	*Calidris acuminata*	4				
Rẻ cổ xám	*Calidris alba*	1				
Rẻ lưng đen	*Calidris temminckii*	1				
Bìm bịp nhỏ	*Centropus bengalensis*	1				
Bìm bịp lớn	*Centropus sinensis*	3				4
Bói cá nhỏ	*Ceryle rudis*		4			2
Nhạn đen	*Chlidonias hybridus*					13
Nhạn xám	*Chlidonias leucopterus*					12
Chiền chiện đồng hung	*Cisticola juncidis*		2			
Le nâu	*Dendrocygna javanica*		9	5		22
Chim sâu vàng lục	*Dicaeum concolor*	3	5			8
Chèo bẻo mỏ quạ	*Dicrurus annectans*		3	4		43
Cò trắng	*Egretta eulophotes*		48	384		107
Cò trắng	*Egretta garzetta*	29				
Cò ngàng nhỏ	*Egretta intermedia*	19				
Diều trắng	*Elanus caeruleus*					7
Sẻ đồng ngực vàng	*Emberiza aureola*					14
Sẻ đồng hung	*Emberiza rutila*		8			58
Sẻ đồng	*Emberizidae*		2			
Gà đồng	*Gallicrex cinerea*			1		15
Nhàn chân đen	*Gelochelidon nilotica*	1				
Sả ngực nâu (sả hung)-	*Halcyon coromanda*					4
Sả đầu nâu	*Halcyon smyrnensis*	1				1
Nhạn bụng trắng	*Hirundo rustica*	96	59			114
Nhàn caspia	*Hydroprogne caspia*	1				
Cò lùn nâu	*Ixobrychus eurhythmus*			2		
Cò rán	*Ixobrychus sinensis*					19
Rẻ mỏ dài	*Limnodromus scolopaceus*	1				
Di đầu đen	*Lonchura malacca*		4			
Di đá	*Lonchura punctulata*	2				
Bói cá lớn	*Megaceryle lugubris*		4			2
Trảu ngực nâu	*Merops philippinus*					6
Hút mật họng tím	*Nectarinia jugularis*	2	8	6		6
Phướn	*Phaenicophaeus tristis*		2			
Cồng cọc	*Phalacrocorax carbo*		107			229
Trích	*Porphyrio Porphyrio*					481
Cuốc ngực nâu	*Porzana fusca*			1		
Rẻ quạt họng trắng	*Rhipidura albicollis*	10	2	1		1
Sẻ đầu đen	*Saxicola torquata*	1				
Nhàn nhỏ	*Sterna albifrons*	2				
Nhàn	*Sterna hirundo*	34				4
Cu cườm (cu gáy)	*Streptopelia chinensis*					2
Le hôi	*Tachybaptus ruficollis*			1		21
Total individuals observed		238	310	657	1	2561
Total number of species		24	20	15	1	33

Table 9 Summary of bird survey data

4.2.3 Socio-economic research

4.2.3.1 Introduction

Data was collected over two data collection periods in the three wetland sites of Tram Chim National Park, Can Gio Mangrove Reserve and Lang Sen Wetlands in the Mekong Delta.

After a training workshop in Can Tho to develop research questions and to practice data collection methods (outlined in the Training section of this report), data was collected through Participatory Rural Appraisal (PRA) and household surveys.

4.2.3.2 Research Questions

Research Questions for the socio economic team were developed by the research team following a participatory brainstorming workshop, where all participants were invited to outline what information was known already about the use of wetland resources (through secondary data etc), and what they still needed to know. Once all research questions were established they were divided into five main themes:

- What are the livelihood strategies of the communities in the three research sites?
- How do the local people exploit Natural Resources?
- Do they exploit resources from inside the protected zone?
- What are their attitudes to wetlands
- What health issues do they face?

The research protocol for the Socio economic research was then developed by the research team, by deciding which research tools would be used to answer which questions. After the first data collection period, data was analysed in a data Analysis Workshop, and the research questions were then refined in response to questions still identified as unanswered and the requirements of the biophysical team. The second data collection period took place from November 2004-January 2005. The final analysis workshop was held in November 2005, and the community engagement workshops in February 2006.

4.2.3.3 Data Collection

There were two rounds of data collection in all three sites:
First Round: Household surveys and PRA Surveys in all three sites between November 2003- April 2004
Second Round: PRA only data collection in all three sites November 2004- January 2005

In the first round of data collection data was collected via Household surveys, developed by the host country socio-economic research co-ordinator and his team, and through the use of PRA techniques. Household Surveys and PRA sessions were carried out at three selected sites, Cần Giờ, Tân Hưng and Tam Nông districts. The research was conducted by 5 research staff from An Giang University, and local staff who had attended the PRA training in Can Tho, including the protected area management staff from the three sites.

All the villages and hamlets were selected by the project staff except for the two villages in Tram Chim where the staff of Tram Chim National Park suggested two villages that were representative. Participants for the PRA sessions at respective sites were selected by the research team. Participants for the PRA sessions were selected in order to have representation of all age groups, gender, occupation and wealth groups from the local community.

In the second round of data collection Data was collected in the three research sites through PRA methods only, in order to address specific questions that were raised after the first data analysis workshop. During the second the research team specifically wished to target seasonal migrants and people of low economic status. They identified these households based on the local government classifications, and the relevant household were pointed out the research team. Although it is preferable that through PRA sessions the villagers themselves will identify the different wealth groups and the ‘poor’ within their community, this was not

possible given the cultural context, and the local government criteria had to be adhered to. It was indicated on this basis that Poor households are those have monthly income per capita below 128.000 VND.

The following PRA Tools were used for data collection:

1. **Pie chart** for income sources per income group, weight of income sources.
2. **Resource map** One of the participants in the PRA draws a map showing the locations of their houses, where resources are harvested, and the distribution of the resources. Collection of information was accompanied by a questionnaire including questions relating to household income such as which different type of income generating activity are undertaken, including income from natural resources.
3. **Mobility map**: Participants were asked to describe the mobility of the groups and events at marked time periods.
4. **Transect:** members of community describe the transect along the path they take during their daily activities.
5. **Seasonal calendar**: information on seasonal migration, occurrence of health problems, period of abundant resources/no resources, crop calendar, dry/rain/flood seasons, crop production, animal husbandry, fishery, hired work, natural resource harvest, migration, health, festivities, income.
6. **Ranking and scoring:** Resources and occurrence of health problems were collectively identified and ranked according to frequency and importance. Scores from 1 to 5 were assigned according to frequency and degree of importance where 5 is the most frequent and most important. Ordering of the contribution of production activities to household income based on was also scored by the participants (1 to 10).
7. **Historical events and trends** - concentrating on milestones: time of establishment of reserve area. Trend and event analysis focuses on following change: area and boundary of reserve area, change in principal resources, livelihood, land tenure, migration, community work, dike, forest fire, participation in training, income, production, hired work, percentage of local community on resources of reserve area, change in resource abundance, soil and water quality, education, transport, communication, recreation and health, awareness in natural resource protection

Groups of men, women and children separately took part in the socio economic research. Later in the research groups of poor people and migrants were involved separately as, during the course of the research, it emerged that these two groups are important users of natural resources.

As three or four groups were questioned at each site, the ranking and scoring exercise produced a considerable amount of data (over 1600 resources). These data are summarised in Appendix VI, where the key resources (as determined by the sum of the score for importance and frequency) are shown for each group at each site. The highest scoring ten resources for each site and group are displayed. Where more than ten resources were given the maximum score (10) all resources which received the maximum score are shown.

4.2.3.4 Research findings

In November 2003, the socio-economic team conducted household survey based on prepared questionnaires and PRA exercises at Can Gio (Can Gio Mangrove Biosphere Reserve), Tam Nong (Tram Chim National Park) and Tan Hung (Lang Sen) districts. In each study district, sample households (10 households from each hamlet) and households attended PRA sessions selected from neighbouring areas to where the biophysical research was conducted. Following are some summaries of data from household surveys from all three research sites that were conducted during this time. The data provides a general overview of the demographics of the populations who participated in the study in all three research sites and a summarised in Table 10 and Table 11.

Site	Zone / village	Average household size (person)	Average household labour (person)
Tram Chim (Tam nong)	Phu Tho C	4 – 5	3 – 4
	Phu Tho B	5 – 6	4 – 5
Lang Sen (Tan hung)	Core	4	2 – 3
	Buffer	4 – 5	2 – 3
Can Gio	An Thoi Đong	4 – 5	3 – 4
	Tam Thon Hiep	6	4 – 5

Table 10 Household demographics of study areas

District	Tam Nong		Tan Hung		Can Gio	
Zone / village	**Phu Tho C (%)**	**Phu Tho B (%)**	**Core (%)**	**Buffer (%)**	**An Thoi Đong (%)**	**Tam Thon Hiep (%)**
Farming	50	100	45.5	45.5	18.2	8.3
Melaleuca cultivation	37.5		27.3	18.2		
Selling labour	12.5		9.1	18.2	36.4	33.3
Fishing			9.1	18.2	9.1	16.7
Trading					9.1	8.3
Shrimp cultivation					9.1	16.7
Fish raising			9.1			
Nypa leaves					9.1	
Broom making					9.1	
Contract fee						16.7
Total sample	**8**	**11**	**11**	**11**	**11**	**12**

Table 11 Most common income generating activities (% of households):

District	Village	Mean income (mil. VNĐ/household/yr)
Tam Nong	Phu Tho C	46.2
	Phu Tho B	47.5
Tam Hung	Core zone	32.3
	Buffer zone	12.3
Can Gio	An Thoi Đong	5.4
	Tam Thon Hiep	8.4

Table 12 Mean household income in study sites

Overall it was clear form both the household surveys and PRAs that the catching of fish is the most important natural resource as both a source of food and income in all three research sites. Other activities of exploitation of natural resources include collecting fuel wood, collecting grass to make brooms and collecting nypa leaves to make thatch roof.

4.2.3.4.1 TRAM CHIM NATIONAL PARK

The main research findings to emerge in Tram Chim national park in relation to biodiversity conservation and the sustainable use of wetland resources can be grouped into a number of themes:

- Population density
- Seasonal migrants
- Exploitation of resources
- Management of the National Park
    - fire and water management
    - relationship with the local community

Each of these themes are developed in the following sections.

Population density
The research concluded that there has been a significant increase in population density on the edge of the protected zone of the Tram Chim National Park. Approximately 40,000 people live around the perimeter of Tram Chim National Park. According to our research the majority of these people are newly arrived migrants who are very poor and lack capacity in income earning activities. They have come to the area to lease land for rice planting, or to work as hired labourers, which has caused increased poverty. The livelihoods of the local poor depend on hired work and fishing inside the national park.

The research identified a contradiction in government policy. The Government's transmigration program of re-populating poor people in the area is in direct opposition to the government's desire for wetland conservation. The transmigration policy brings poor people (relocated from other provinces in Vietnam) to live on the vacant land surrounding the national park. As a result of problems with acid sulphate soils these people find it difficult to make a living from agriculture. The people are therefore forced to exploit the natural resources in the National Park in order to survive. In addition to forced migration, many other people, including seasonal migrants come to the area to worked as hired labour in the rice fields and to exploit the resources in the National Park for food, fuel and income (by harvesting resources to sell in the market). It appears from the research that no matter how strict the policy is on the management of people's exploitation of resources, they still find ways to exploit the resources

Seasonal Migrants
There is also an issue with seasonal migrants who come to the national park to exploit the core and buffer zones, and to work as hired labour at various times in the year. Seasonal migrants are also poor and come to the national park to live and work as hired labour and exploit the natural resources year-round. Seasonal migrants from An Giang, Tien Giang, Ben Tre and Long An provinces come to the park area to cultivate rice (March to June and October to January), to fish and to find hired work. The fishing is done inside and outside of the park, in the canals and rivers outside of the park. If the seasonal migrants cannot find hired work then they will go into the illegal areas to collect resources to survive. Seasonal migrants come to Tram Chim for a long time, almost the whole year round, and only go home during Tet (Lunar New Year in January/ February).

National Park Rangers have reported that it has been very difficult to engage some of these new comers in discussion or strategies for protection of natural resources. This is particularly the case for the seasonal migrants who tend to stay on their boats and do not mix with the other local people.

Exploitation of National Park Resources
Although originally fearful, after the first round of data collection when people denied entering the protected area of the national park, during the second round of data collection the people reported to the researchers on their exploitation activities in the core zone. It was discovered that as a result of the increase in population (poor people and seasonal migrants), there has also been an increase in poaching and in the illegal exploitation of natural resources, both inside and outside the park.

Figure 8 Resource map generated during PRA exercises, identifying location of different resources within Tram Chim National Park (Photo H Beazley)

The seasonal calendar as created by poor inhabitants of Tram Chim clearly shows that they enter the national Park in February-June (for snakehead fish), May and June (when there is no other available work), and to collect water lily from August-October (see Table 13 and Table 14)

Most intrusions into the National park have been identified as taking place within 1.5km from the protection dykes. In addition fisherman are reported to most frequently enter the National park by crossing Dong Tien River (where people go fishing daily - mostly for household consumption), or by traversing the *Eleocharis* and *Melaleuca* areas. Fishing is mostly conducted by men, with the assistance of their wives, who then sell the fish in the local market. Catfish and climbing perch (*Anabas testudineus*) and eel are abundant in the park area from December to June, when people come to the National park to fish using the electric shock mechanism. This finding was confirmed by the ecological survey. Fish are reported to be more abundant at depression areas inside the National Park. In the non- flood season local people catch fish with large nets in the river. The peak period of fishing in the National Park is from May to June, when the water level outside the park is at its lowest . During the flood season (August- November), men can be found fishing in the flooded fields, where Linh (*Thynnichthys thynnoides, Cirrhinus jullieni, Labiobarbus siamensis*), Loc (*Channa striata*) and Ro (*Anabas testudineus*) are abundant. Birds are normally crane (*Gruidae*), tric (*Porphyrio Porphyrio*) and cong coc (*Phalacrocorax carbo*), all year round, and red eyed birds (unidentified species) are in the breeding season. People often use the recorded sound of the bird to lure them into traps.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fish catching by migrants (*)								X	X	X	X	
Cá linh (*Thynnichthys thynnoides, Cirrhinus jullieni, Labiobarbus siamensis*), cá lóc (*Channa striata*), cá rô (*Anabas testudineus*) outside of National Park								X	X	X	X	
Catch cá lóc (*Channa striata*), cá rô (*Anabas testudineus*) rắn (snake), lươn (eel) in National Park by electric equipment	X	X	X	X	X	X						X
Catch birds outside National Park		X	X	X	X	X	X	X	X	X	X	
Catch Mắt đỏ ('Red-eye' bird unknown species) white birds by Cassette player	X											X

Table 13 Seasonal calendar for men in Phu Tho B hamlet outside Tram Chim National Park (*as reported by this group)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Do not enter the National Park		X	X	X			X	X				
Fishing in rice fields									X	X	X	X
Going to NP (no hired work available)					X	X						
Ca linh (*Thynnichthys thynnoides, Cirrhinus jullieni, Labiobarbus siamensis*) in rice field							X	X	X	X	X	
Catch cá lóc (*Channa striata*), cá rô (*Anabas testudineus*) in rice field	X									X	X	X
Cá lóc (*Channa striata*), cá kỳ đỏ (unknown species) in rice field					X	X						
Cá trèn (*Ompok bimaculatus*), hột mít (*Puntius binotatus*), chốt (*Rattus* sp.), trê (*Clarias* sp.) in rice field											X	X
Cá lóc (*Channa striata*) in NP		X	X	X	X	X						
Water-lily on IP								X	X	X		
điên điển (*Sesbania* sp.) season								X	X			
Collect lotus seed in NP	X	X	X									

Table 14 Seasonal calendar for poor people in Phu Tho B hamlet outside Tram Chim National Park

The research did show, however, that although it is the poor who exploit the natural resources in the park, many only go into Tram Chin National Park seasonally, when there are no other forms of income. There is a group of poor people, however, who enter the National Park all year round. This was reported by informants during the PRA research and in the community engagement workshops. In addition to the exploitation of natural resources, local people have been planting eucalyptus along roads and dykes, and selling eucalyptus seeds. This is a result of a government program encouraging people to plant eucalyptus.

Management of the national park

Illegal access

There is some controversy over the ineffective buffer and core zone management. There are a reported team of 60 national park staff at Tram Chim, and there have been six directors in the past six years, each bringing a new management style and approach. It seems to be overwhelmingly acknowledged (at the stakeholder workshop, through comments and points raised during presentations) that the management of Tram Chim requires capacity building support to develop skills and approaches for managing the national park and supporting livelihoods. Further, illegal practices by National Park staff were reported by the research team who witnessed a park guard at one of the check-point posts allowing local people to enter the national park for a fee of 10,000 dong. In order to reduce pressure on the resources in the core and buffer zones it is recommended that these park managers need to have skills for communicating with the local community about the importance of biodiversity conservation of these wetlands, and how to ensure sustainable use. They may also need training themselves in the importance of wetland conservation and the detrimental effect of allowing people in to the park through the 'back door'

Water Management

People in Tram Chim say there should be a better water management system in the National Park. This is a sensitive political issue as Tram Chim does not come under provincial government, but under central government. In particular the control of the sluice gates to the core zone is a big issue for the residents, and the impact of water and fish being released (or not being released), and the fact that they have no control over the sluice gates. It was reported to researchers that fish concentrate more in the lower part of canals, so the local people cannot access them when the water level is high. They also complained that the local community cannot receive benefits of resources inside the national park in the dry season, when the sluice gates are shut.

Access to clean water is also a reported problem for poor people living outside of Tram Chim, as they are forced to rely on canal and river water and pond water for their daily needs. The source of their consumption of water is mainly from Dong Tien river and rain water.

Fire Management

Water level control for fire management was also raised by some participants as an important issue in the National Park. During discussions with Park managers it was agreed that we do not know enough about the relationship between fire, hydrology and the flora and fauna in these wetlands. This issue is explored in greater detail in the attached strategic guidelines report (Appendix VII).

Relationship between the local community and Park management

The issue was raised by local people that there was a conflict between the reserve and the local people, and how to share the benefits of the park to the community. The point was made that poor people know little about conservation and the sustainable use of resources, and that their subsistence requirements are always in direct contradiction with park management objectives for wetland conservation. It was felt that it is vital for the management of the reserve to communicate the reasons for conservation and management of the wetlands in the long term, by teaching local residents about wetlands impact on the environment, and on people's health and livelihoods. The problem of seasonal migrants and communicating the importance to them was identified as a key issue for Tram Chim.

During a stakeholder meeting when the results of the research were presented to National Park staff and other key stakeholders by the research team, the Director of the Women's Union in Tram Chim, made the comment that previous Director had established good connections with the local community and local government, but that staff and management were now working in isolation and no longer with the local community. She also said that the relationship between the park staff and the local government was no longer good. She stressed that they need participation and representation of the local community through organisations in the management of the park, and to organise people into groups. She said it was possible to organise these groups, but that they do not have the funding to do this. The woman also said that we need livelihoods support for the people as they do not have any choice but to exploit the natural resources. They also need vocational training, including the making of handicrafts from the Hyacinths, she said.

According to the current Director of the Park, there is a Tram Chim National Park Protection Club, members include local people. It has 600 members, but is not really functioning at present. They receive assistance from the women's organisation and other international organisations for poverty alleviation strategies (e.g. IUCN, CARE). He also reports that 60% of poor households have had improvements in their livelihoods. Poaching is a big problem in Tram Chim according the Director. The Director also raised the issue of lack of capacity of his staff in community engagement.

Recommendations for Tram Chim

During stakeholder workshops held at the University in Can Tho in November 2005, and the Community Engagement workshops held in Tram Chim where the research was conducted, in February 2006, the following recommendations were tabled by key stakeholders, research participants, and community members:

There should be a reassessment of resettlement policy. This is a difficult recommendation as Tram Chim is under central government control and therefore hooked into national policy. Although it was acknowledged by the workshop participants that it would be the ideal, it was also pointed out that the government's resettlement program is a very political and sensitive issue. The buffer zone is under local authority. Participants recommended that the government should be decentralized in order to have the participation of the local community, and there

should be a mechanism of communication across province for local communities.

During the community engagement workshop in Tram Chim there was a lot of discussion about the water management issue and the level of water and the related fire risk. There was some speculation that it was not the people who were frightened of the fire but the government who are really afraid of it. The control of sluice gates certainly needs to be addressed as the local people said they don't catch much fish outside the park when the water level is high in the park, as the fish cannot get out of the park through the sluice gates: again this is a political and sensitive issue. However, the participants acknowledged it was a problem.

Local people and seasonal migrants need to be educated about the benefits of wetland conservation, and they need to be involved in conservation strategies. The representative of the Women's Union was adamant that the local people needed education about the value of wetland (together with training in alternative income generating activities). There was some speculation about the results of the research that showed that 42 % of the respondents did not think wetland conservation and environmental protection was worthwhile. Some local people could not accept this figure, including local government officials. It was argued however, that if people are involved then they are more likely to have a sense of ownership and to act on their responsibilities of wetland conservation. This can be done by providing people with mutual responsibility for the buffer zone, together with the national park management (who at present do not consult with the local people about their strategies). Consulting with the local people at every stage is imperative for gaining the support from the local community.

It has also been recommended by stakeholders to prohibit electro fishing, and local people during community consultation said that the people (including migrants) need to be educated as to the reasons for this prohibition and again it needs to be monitored and implemented by the local people themselves. Incentives could be provided to support the new prohibition and perhaps the imposition of penalties.

With regard to education it was commented on at the meeting with the People Committee's that 'education [about wetland management] is useless' if the local people do not also have their income generating opportunities improved. It was agreed by the National Park managers, the People's Committee, and local community that the best way to protect the park was to develop the income of the people living near the park. There are plans to introduce activities to increase the incomes of the local people and to reduce the pressure on the park. The Women's Union and the local people support this initiative, and it was recommended by the People's Party Committee and the local people that some research/mapping needs to be conducted to establish what types of income generating activities the men and women would like to be involved with and trained in.

Suggestions from the community for income generating activities included: the development of eco-tourism; credit for animal raising; skills training for handicrafts; tailoring, weaving. Traditional medicine is not seen as form of income generation as they can be obtained free from the monks at the pagoda, and the local community supply the monks with the resources from the park and forests for free. The monks process the plants and give the medicine to those who need it for free.

Finally it was commented by on by stakeholders from the Park management that more research is required into:

- the wealth groups who access the park (it was reported at the community engagement workshop that most people who go into the park are poor but some people go in who are not poor.
- health related issues and resources/ clean water (lack of clean water in the dry season results in more cases of diarrhoea). Many people complain of feeling tired and having headaches which may be related to nutritional levels
- 'Women's health complaints'. Women frequently complained of a 'white discharge', which they medicate with a local medicinal plant.

4.2.3.4.2 LANG SEN

Key findings

There are two degrees of protection in the Lang Sen Wetlands Reserve. Firstly there is a strictly protected area and, secondly, there is an 'economic zone' where limited exploitation of resources is allowed. There are still 60 houses in this area and the land still belongs to them until a negotiated settlement is agreed on for them to move. There is some water control by dykes within the reserve but it is not as extensive as in Tram Chim National Park. Although there is a high degree of exchange of water between the protected and unprotected areas it was reported by the local community that the water level is kept high in the dry season in the dyked area, which increases population of water lilies, but other plants decrease as it is too deep for them to survive/ put down roots.

The fact there is no clear boundary between the protected and the semi economic areas is a challenge for many local inhabitants as the boundary of the strictly protected area is not clearly defined. The research found that in practice few local people know where the boundaries are between the different protection zones. They are also unclear about the function of the economic zone, although it appears that they are clear about what resources it is illegal and legal to collect in the different areas. Local communities are concentrated around River 79.

Seasonal migrants stay out of the reserve area and live on raised platforms along the rice fields. Most of the people found fishing are seasonal migrants. Migrants from An Giang, Ben Tre, Tien Giang, arrive at the area in January/February and May/June for hired work in rice cutting and during the flood season (August-November) for fishing.

Lang Sen suffers from labour scarcity in the rice fields, which influences the people's decision making about the collection of natural resources. Although people are poor in Lang Sen the income level is increasing and the population density is not as high as Tram Chim, so problems of intrusion into the protected areas are not as acute. There has been a newly planted area of melaleuca, which has become a newly defined area for the reserve, This planting has raised an important issue of how to compensate the people who have planted the melaleuca, and have been asked to relocate from the area. The people from this village have not yet moved and are still waiting to agree on compensation. According to consultants from IUCN they have contacts with officials and this is why the process is taking so long as they know they can demand more money.

Exploitation of natural resources

Intrusion into the reserve area is mainly carried out for fishing in the canals; collecting honey and medicinal plants. Other natural resources that are exploited in Lang Sen include golden snails (*Pomacea canaliculata*), which are often caught by children, food plants, stone crab, milk crab, tortoise, eel, shrimp, field rats, snakes and birds. Local people report that the area is also well known for its cranes (*Gruidae*). *Mimosa pigra*, and alien invasive is collected for fuel. *Melaleuca* is also cultivated outside of the government restricted areas, and fallen branches are also collected in the protected area. It is mostly used for paper making and construction. Nypa leaves (*Nypa fruticans*) are also collected by local residents for making brooms and roofing materials.

Figure 9 Resource map of Lang Sen drawn by local community during PRA exercise (Photo H Beazley)

Medicinal plants are also collected by local people, including lotus flower; cỏ mực grass (*Eclipta alba*) for women's health, nhãn long (*Passiflora foetida*), rau bo (unidentified) for back ache. Water quality and the chemicals from rice fields and shrimp cultivation into the canals was mentioned as a problem by the local people, who tend to use the canal as their source of drinking water.

Local communities reported that there are plentiful fish in the canals and the importance of canals as breeding areas is recognised. However, older villagers complained that fish were not as plentiful as they used to be and that the size of fish was much smaller than before. During PRA surveys it was clear that poor people, including their children, were involved in the exploitation of natural resources in the national park. Table 15 shows how much children participate in generating products form the wetlands.

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Health problems	x	x	x			x	x	x	x	x	x	x
Fish: linh (*Thynnichthys thynnoides, Cirrhinus jullieni, Labiobarbus siamensis*), rô (*Anabas testudineus*), lóc (*Channa striata)*							x	x	x	x	x	x
Cá trê (*Clarias* sp.)								x	x			
trèn (unknown), cá heo (*Botia sp.)*, tép (*Macrobrachium sp.*)	x						x	x		x	x	x
Bird: vòng vọc (unknown), cò (*Ardeidae*)	x						x	x	x	x	x	x
Ricefield rats		x	x			x	x					
Cua (*Brachyura* sp.), trích (*Porphyrio Porphyrio*)							x	x	x	x	x	x
Snakes: nước (*Natrix piscater*), bông sung (*Enhydrid enhydrid*)							x	x	x			
Điên điển (*Sesbania* sp), muống (*Ipomoea aquatica*)							x	x	x	x	x	x
Càng cua (*Brachyura* sp.) , bông sung (*Nympheaceae*)			x	x			x	x	x			
Nhãn lòng (*Passiflora foetida*), rau dừa (*Nypa fruticans*)			x	x	x		x	x	x			
Snail: golden (*Pomacea canaliculata*), lát (*Pila* sp.), đá (unknown), quắn (*Sinotaia* sp.)	x									x	x	x

Table 15 Seasonal calendar for children in Tan Hung hamlet, Lang Sen

Event	Trend	Reason or impact
Livelihood	Improved	More rice planting, credit, fishery
Dependence on the protected areas	More	People from other regions
Fishery	Decreased	Dyke building, over fishing
Hired work	Decreased	Seeking job in other places
Water quality	Decreased	Land preparation, chemicals from rice culture
Soil condition	Improved	Acidity flushed to canals
Transportation	Improved	Available motor boats
Health	Improved	Health centre, more availability of medicines

Table 16 Time trends at Cá Sách hamlet, Lang Sen

Recommendations

While Lang Sen has the lowest level of legislative protection of the three sites studied in this project, being neither a National Park of Biosphere Reserve, the low level of management intervention and relatively low population density in the surrounding area present opportunities for the future. There are valuable 'lessons learned' from Can Gio and Tram Chim, which Lang Sen should take account of. For example, reserve managers should encourage the maintenance of a low population density in the area surrounding the reserve and should ensure that the exchange of water between reserve area and the wider floodplain is maintained.

Information sharing should also be a vital component of the overall management objective. Education and training should be provided for people so they know exactly where the different zones are and their function. The benefits of wetland conservation and environmental management should also be demonstrated to the local community. It is vital that there is an expansion of income earning opportunities for both men and women in the area, in order that they are not forced to exploit the natural resources for their survival.

Possible income generating activities that have been discussed include the controlled legal honey production in Lang Sen, eco-tourism, handicrafts and medicinal plant production as small business enterprises.

4.2.3.4.3 Can Gio Biosphere Reserve

Key findings

Can Gio is near to Ho Chi Minh City. Before the war, the area was high in diversity but during the war it was destroyed by herbicides and defoliants, including 'Agent Orange'. After the war the Vietnamese government had a strategy to restore the area by replanting with mangrove forest, including the species *Rhizophora apiculata*, which was planted on half of the devastated land (19,000 hectares). The other half is planted with over 30 different species including *Nypa fruticans, Eucalyptus, Avicennia* and *Rhizophora mucronata.* The restoration in Can Gio is generally regarded as having been very successful. The principle purpose of the research was therefore to learn about the communities views about the wetland restoration and how they regarded wetland resources, in terms of personal use and protection.

High density of Rhizophora Apiculata planting

During the PRA surveys and focus group discussions, it was reported by the local people that there is a high density of *Rhizophora Apiculata* planting and there had been a lack of diversity of species planted. The local people complained that the thick planting of *Rhizophora* damages soil and water quality, leading to compact and hard soil and reduced aquatic resources. They also reported that it impacts on agricultural production as the roots of mangroves are choking other crops and depriving them of nutrients. It was also suggested by the members of the People's committee that the structure of the forest may be a problem, as it is too dense and people are unable to penetrate the forest at all.

National park and government officials from Can Gio biosphere however objected to this

finding, stating that there was only a certain amount of hectares (19,000) of *Rhizophora apiculata*. They also questioned whether it was impacting on the quality of water and the number of fish species, as well as the hardness of the soil. These conflicting views may be because the surveyed individuals came from the population who live in or near the *Rhizophora apiculata* plantation.

Local people also reported that as the water is saline drinking water is hard to access in the dry season and that it has to be brought in from far away on trucks or by boat and people must pay for it. Poor people cannot afford to buy water and as a result they and their children get sick from using poor quality water.

Shrimp Cultivation

There was also controversy over the impact of shrimp cultivation in the reserve. It was claimed by some local people that there was a decline in water quality in Can Gio due to shrimp cultivation. This they claim this has impacted on availability of fish resources as the pollution is killing the fish.

However, as shrimp cultivation is an important source of income for many local people it was also a contentious issue among local community participants from Can Gio and some stressed the importance of the shrimp cultivation and stated that the pollution came from downstream from Ho Chi Minh City. It was also mentioned that the agricultural run-off from the rice fields contains high levels of agricultural chemicals.

The Biosphere Reserve management and the government officials are adamant that there is no negative impact of the shrimp cultivation on the protected area and attribute the perceived decline in fish to over fishing rather than pollution of the water. Similarly the local people in the Community Engagement workshop did not think that the shrimp ponds could have too much of an impact on the fish or agricultural production as they are too far away. They said that the decline in fish is to do with over fishing, and nothing to do with pollution.

Although there is clearly an impact on mangrove wetlands in the area of Can Gio from conversion to shrimp aquaculture, this was not raised by the local community in discussions. This issue is discussed in greater detail in the attached report on wetland management.

Population growth

The research in Can Gio Biosphere reserve found that there has been a significant growth of population in the area around Can Gio from 1990-2005, with over 50% of population growth since 1990. Most of these new inhabitants came to settle from other provinces.

In addition some people now living just outside the reserve have been moved from inside the reserve. The research team conducted research with this group of people and they reported that it was hard to adjust to their new environment. One reason for this is that they had planted large amounts of mangrove in their previous home. At the time of the research they were trying to negotiate with the national park about compensation for loosing their land and planted melaleuca. The fact that they had planted melaleuca in high numbers gives some indication of its contribution to sustaining their livelihoods. It is recognised resource for fuel but also for attracting honey bees and breeding fish. It is also recognised as contributing to stopping the soil erosion from tidal wash and typhoon waves

Seasonal Migrants

Discussions with the local community during the first survey (April 2004) indicated the importance of seasonal migrants in the use of natural resources. Seasonal migrants were reported to come from the central provinces and remain all year round, living on their boats, moving between tides. They work as hired labour in the shrimp cultivation business and fishing. They catch crab from June-December and Rau lim kim (*Phyla nodiflora*) and bui (unidentified plant species) from the forest all year round. Migrants from Tien Giang come to Can Gio and specialise in fishing all year round, only returning home at Tet (lunar new year festival).

Given that the local community saw the migrants as being responsible for the over-exploitation of resources, this group were interviewed separately during the second survey. During the second round of data collection, the interview of migrants created the following seasonal calendar which clearly shows the types of natural resources which they exploit at different times of year

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cá úc (*Ariidae*), cá phèn (*Polynemus* sp.)		x	x	x	x	x						
Cá dứa (*Pangasius polyuranodon*)				x	x	x	x	x				
Cá đối (*Mugil cephalus*)									x	x	x	
Cá bống kèo (*Trapauchen vagina*)	x									x	x	x
Young Crab			x	x	x							
Adult crab						x	x	x	x	x	x	
Breeding crab	x											x
Natural shrimp (dark)		x	x	x								
Shrimp (white)	x										x	x
Cuttle fish				x	x	x	x	x				
Squid	x								x	x	x	x
Rau lìm kìm (*Phyla nodiflora*), bui (unknown)				x	x	x	x	x	x	x	x	

Table 17 Seasonal calendar for seasonal migrants in Can Gio.

Exploitation of Natural Resources

Many of the new inhabitants around Can Gio are poor and, as with the other research sites, the people that were most likely to exploit the natural resources were the poorest inhabitants living near to the reserve. However, they commented that the protected area of forest was actually too hard to penetrate, and that they did not fell trees, but only looked for crab and fish.

Local people were interviewed by the research team, and participated in PRA surveys as well as focus group discussions. The research team then returned to the research site for Community Engagement workshops, specifically to present the research findings to the People's Committee and Ho Chi Minh Government officials and, separately, a group of local people who lived in the area and had been involved in the research.

During the Community Engagement Workshops at Can Gio, it was confirmed by both the People's Committee and the local people that the information and data that we had collected from Can Gio Biosphere reserve was correct.

The local people reported that their fishing activities were related to the tide and that in order to go into the forest they had to enter early in the morning when the tide was high, they have to wait for the low tide to come to catch fish, and then wait for the high tide to come back. This was the schedule for both men and women, although women usually go fishing in the morning and then in the afternoon they go to the market to sell fish and to buy provisions and spend time in the house. Some people use large fish fixed traps (permanent constructions on platforms) to catch fish and this is thought by the local community to contribute to the over-fishing in the area. It was also reported that the local children also participate in fishing inside the reserve. They catch small crabs which are processed into a fermented crab paste to eat with rice. Only children who have parents with enough money go to school, the rest of them drop out at about age 14 to help their parents.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cá đối (*Mugil sp*.)							x	x	x	x	x	
Cua (*Brachyura sp*.)		x	x	x	x	x						
Tôm bạc (*Metapenaeus sp*)									x	x	x	
Tôm bạc (lớn) (*Metapenaeus sp. – large*)	x											x
Cá kèo (*Pseudapocryptes elongatus*)												x
Cá lóc, cá trê (*Channa striata, Clarias gariepinus*)								x	x	x	x	x
Nha (*Dotilla fenestrata*)								x	x	x	x	x

Table 18 Extract from seasonal calendar for poor group Can Gio (An Thoi Dong - An Hoa)

Table 18 shows the seasonal calendar collected for the poor group at Can Gio (An Thoi Dong hamlet). The resources identified by the group were resources that they considered to be important and the table indicates the months of the year in which they collect these resources. Several types of wild plants are collected in the protected area, including traditional herbal plants which are given to the pagoda to be processed and distributed to the local community.

The older members of the local community commented on the fact that fishing in the canals has declined very much in the past 10-15 years, and the numbers of fish are about 20-30% less than before. An old lady said that many people, including migrants do not care about local rules such as not fishing during breeding season, and they continue to fish with nets, barriers and large traps, selling fish in the market. This issues is discussed in further detail in the attached strategic guidelines report (Appendix VII).

Income generation

Honey is an important source of income for the local people. The local population collect honey in the core zone to sell in the market. They are able to collect about one litre of honey a day. Mangrove forests are the only place where it can be found. The cost of honey is in Can Gio is three times the controlled honey rate (53,000 dong versus 20,000 dong) if you buy it from the collectors. It costs more if you buy it in the market. They also collect and sell Royal Jelly which is even more lucrative. Birds are valued but are hard to catch, and it is quite common to find snakes in the forest and can fetch a high price in the market if caught . The local people said that they never see wild mammals although they had seen their foot prints so they know that they are around. Other forms of income generation from the forest resources include selling Nypa fruit (4,000 per kilo)

Table 19 shows the results of a ranking and scoring exercise carried out with the local community in Can Gio to determine what they consider to be the most important income generating activities.

Activities	Score
Aquaculture	26
Catching fish	11
Pig raising	9
Harvesting nypa leaves	4
Honey collection	2
Catching snake	1
Hunting wild pig	1
Hunting other animals	1
Fuel wood	1
Hired work	1

Table 19 Most important production activities at An Thôn Hiệp hamlet, Can Gio, ordered by people during PRA session

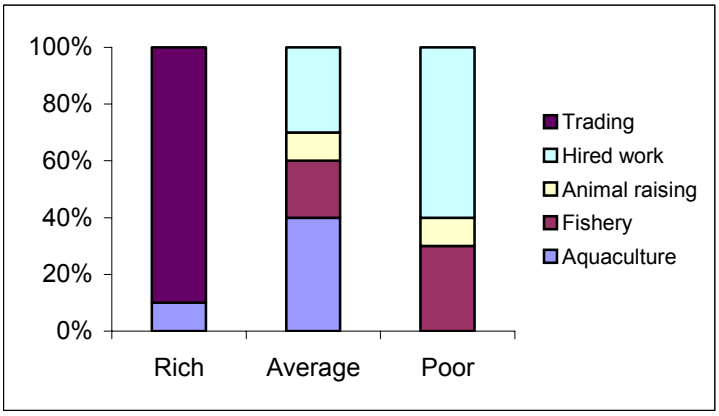

Figure 10 Income structure by wealth group in Can Gio

Indicators of success

The communities who were involved in the research commented on the successful implementation of a community based forest protection policy. Local families are allocated an area of the mangrove wetland to manage and are paid a protection fee of 315,000 VND/ha/year by the reserve management. They are given limited rights to use the resources within their area. They are allowed to catch fish and aquatic resources but it is forbidden to catch animals or fell trees in the area.. In comparison, in similar schemes in other parts of the county participants are paid 50,000 VND/ha/yr. This approach has improved the income of the local people and is locally seen as a very good scheme to be involved with. Credit schemes for poor people to invest in planting nypa palm and other enterprises, including shrimp cultivation, are seen as good schemes by the local community.

From the perspective of the reserve management and government officials, the success of wetland restoration at Can Gio was seen to be due to the government protection policy of fee payment in conjunction and the close integration of the Department of Agriculture with the reserve management and other organisations. Government officials and reserve management also noted the favourable change in climate since the planting of the mangroves, and also the reduction in soil erosion during the typhoon season which brings strong waves to the area.

The PRA and household surveys did identify some acknowledgement of the importance of wetland conservation from the participants, particularly in Can Gio Reserve, where it is clear that there has been a systematic awareness program of raising by the reserve staff (see Table 20). The population with the lowest rating of the importance of wetland were the inhabitants living outside of Tram Chim National Park, where only 57.9% of the population though that wetland conservation was important. The reason for this low response may be that the population are poor and uneducated and there is an acknowledged poor communication between the National Park staff and local people.

District	Important (%)	Not important (%)
Tam Nong	57.9	42.1
Tan Hung	63.6	36.4
Can Gio	87.3	21.7

Table 20 Percentage of surveyed individuals indicating whether they thought wetlands are important or not

Recommendations

It has been recommended by key stakeholders that further research is carried out to establish the gender and the educational level of people exploiting natural resources in the core zone. It is also clear that the management of the area could be improved by the tighter controls on intensive aquaculture and fishing activities (including a restriction on different fixed traps, electro fishing), and the provision of technical support to improve the efficiency and lessen the impact of semi-intensive aquaculture. The reserve area management also need training in environmental education and how to communicate information to the local people. Local people also need to be educated about the benefits of wetland conservation and to be involved in conservation. Support for alternative income generating activities in the area for the poor people is also vital so that they find other modes of generating income from fishing and exploiting natural resources

4.2.4 Integrating biophysical and socio-economic data

The PRA techniques applied in this project fall into two broad categories, qualitative techniques (e.g. transect walks, resource mapping) and semi-quantitative (e.g. seasonal calendars and resource ranking). While the qualitative techniques can give a broad understanding of the sociological context of the use of natural resources (as reported above) and help in general terms to place the results of the ecological surveys in this context, the semi-quantitative techniques that were applied can help to bridge the gap between the socio-economic data and the biophysical data to a much greater extent. These techniques create an overlap in the datasets, which can be used to integrate the datasets in their entirety and provides a more holistic understanding of the use of natural resources than either dataset can alone. In particular, the results of the seasonal calendars and the resource ranking and scoring can provide a basis for comparison of the resources that were observed during the ecological surveys and those that were reported to the socio-economic project team.

Appendix VI summarises the key resources identified by each group that were interviewed for the resource ranking PRA exercise. The table also indicates whether these resources were identified in either ecological survey and whether this was inside or outside the protected area.

As an example of the integration of the socio-economic and biophysical data, Table 21 shows the ranking and scoring results for two key resources identified in the ranking and scoring – Cá lóc (*Channa striata*) Rau muống (*Ipomoea aquatica*) – and comparison with locations where the resources were identified in the biophysical surveys. Table 22 shows the seasonal calendars for these two resources for each group involved in the PRA exercises that listed Cá lóc (*Channa striata*) Rau muống (*Ipomoea aquatica*). Given the ease of carrying out ranking and scoring exercises compared with seasonal calendars, not all the resources included in the ranking and scoring have an associated seasonal calendar. Compiling seasonal calendars can be a time consuming process so the field teams restrict this method to a few key resources to avoid participant fatigue.

Site	Group	Average score	April 2004 survey: Identified inside protected area	April 2004 survey: Identified outside protected area	December 2004 survey: Identified inside protected area	December 2004 survey: Identified outside protected area
Rau muống (*Ipomoea aquatica*)						
Tram Chim - Tam Nong – Phu Tho B	Poor	10.0	x		x	x
Tram Chim - Tam Nong – Phu Tho B	Children	10.0	x		x	x
Tram Chim - Tam Nong – Phu Tho B	Women	10.0	x		x	x
Lang Sen - Tan Hung - Vinh Loi	Men	10.0			x	
Tram Chim - Tan Nong - Phu Tho C	Children	10.0	x		x	x
Tram Chim - Tan Nong - Phu Tho C	Women	10.0	x		x	x
Tram Chim - Tan Nong - Phu Tho C	Women	10.0	x		x	x
Lang Sen - Tan Hung - Vinh Loi	Children	9.6			x	
Can Gio – An Hoa - Tam Thön Hiëp	Women	9.2				
Lang Sen - Tan Hung - Vinh Loi	Women	8.6			x	
Can Gio – An Hoa - Tam Thön Hiëp	Children	6.0				
Lang Sen - Tan Hung - Vinh Loi	Migrants	5.1			x	
Cá lóc (*Channa striata*)						
Lang Sen - Tan Hung - Vinh Loi	Poor	10.0		x	x	x
Lang Sen - Tan Hung - Vinh Loi	Men	10.0		x	x	x
Lang Sen - Tan Hung - Vinh Loi	Women	10.0		x	x	x
Tram Chim - Tam Nong – Phu Tho B	Migrant	10.0	x	x	x	x
Tram Chim - Tan Nong - Phu Tho C	Men	10.0	x	x	x	x
Lang Sen - Tan Hung - Vinh Loi	Children	9.8		x	x	x
Can Gio - An Thoi Dong - An Hoa	Men	9.8				
Tram Chim - Tam Nong – Phu Tho B	Women	9.6	x	x	x	x
Can Gio - An Thoi Dong - An Hoa	Women	8.5				
Can Gio – An Hoa - Tam Thön Hiëp	Children	8.4				
Can Gio - An Thoi Dong - An Hoa	Poor	8.3				
Tram Chim - Tam Nong – Phu Tho B	Men	8.2	x	x	x	x
Lang Sen - Tan Hung - Vinh Loi	Migrants	8.1		x	x	x
Tram Chim - Tam Nong – Phu Tho B	Children	7.6	x	x	x	x
Tram Chim - Tan Nong - Phu Tho C	Children	7.6	x	x	x	x
Tram Chim - Tan Nong - Phu Tho C	Women	7.6	x	x	x	x
Can Gio - An Thoi Dong - An Hoa	Children	7.6				
Can Gio – An Hoa - Tam Thön Hiëp	Women	6.3				
Tram Chim - Tan Nong - Phu Tho C	Poor	2.0	x	x	x	x
Can Gio – An Hoa - Tam Thön Hiëp	Men	2.0				
Tram Chim - Tan Nong - Phu Tho C	Women	1.9	x	x	x	x

Table 21 Ranking and scoring results for two key resources – Cá lóc (*Channa striata*) Rau muống (*Ipomoea aquatica*) – and comparison with locations where the resources were identified in the biophysical surveys.

	Group	Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cá lóc (*Channa striata*)														
Location not disclosed	Poor	Can Gio - An Thoi Dong - An Hoa								x	x	x	x	x
Location not disclosed	Men	Can Gio - An Hoa - Tam Thön Hiëp							x	x	x	x		
Location not disclosed	Children	Can Gio - An Hoa - Tam Thön Hiëp							x	x	x			
Location not disclosed	Women	Lang Sen - Tan Hung - Vinh Loi											x	x
Location not disclosed	Migrants	Lang Sen - Tan Hung - Vinh Loi												x
Location not disclosed	Poor	Lang Sen - Tan Hung - Vinh Loi								x			x	
Location not disclosed	Women	Tram Chim - Tan Nong - Phu Tho C							x	x	x	x	x	x
Outside National Park	Men	Tram Chim - Tam Nong – Phu Tho B								x	x	x	x	
Inside National Park (by electro-fishing)	Men	Tram Chim - Tam Nong – Phu Tho B	x	x	x	x	x	x						x
Outside National Park	Poor	Tram Chim - Tam Nong – Phu Tho B	x				x	x				x	x	x
Inside National Park	Poor	Tram Chim - Tam Nong – Phu Tho B		x	x	x	x	x						
Rau muống (*Ipomoea aquatica*)														
Location not disclosed	Women	Can Gio - An Hoa - Tam Thön Hiëp							x	x	x			
Location not disclosed	Children	Lang Sen - Tan Hung - Vinh Loi							x	x	x	x	x	x

Table 22 Seasonal calendars for the two key resources – Cá lóc (*Channa striata*) Rau muống (*Ipomoea aquatica*) – listed in Table 21.

As can be seen from the above tables, at Can Gio local communities identify *Channa striata* as an important resource throughout the wet season (July – December) but was not found by the biophysical surveys.

At Tram Chim both the poor group and the men's groups who provided seasonal calendar information on *Channa striata* disclosed that they caught the fish inside the National Park during the dry season, as they were not available outside the National Park. However, the fisheries survey found *Channa Striata* both inside and outside the National Park during the dry season (April 2004) survey. At Lang Sen the different groups identified *Channa striata* as only being caught in the wet season. The fisheries survey only found *Channa striata* outside the protected area during the dry season survey and both inside and outside the protected area during the wet season survey. This suggests that, contrary to the situation in Tram Chim, people are not entering the protected area for this resource to the same degree in Lang Sen as it is more available outside at the time they catch *Channa striata*.

Seasonal calendar information was given by two groups for rau muống (*Ipomoea aquatica*), which is collected and used as a vegetable. Both groups indicated that it is only collected during the wet season but did not disclose whether they collected it inside or outside the protected area. At Can Gio, *Ipomoea aquatica* was not found in the wet season survey. At Tram Chim it was found both inside and outside the National Park but at Lang Sen it was only found inside the protected area. While *Ipomoea aquatica* was not identified outside Lang Sen in the vegetation survey, given the methodology used, its presence cannot be discounted. However, these results do indicate that *Ipomoea aquatica* is more abundant inside the protected area and it is likely that local communities will enter the protected area to collect it. During the dry season *Ipomoea aquatica* was only found inside Tram Chim National Park.

This type of analysis can be carried out for all the resources identified in the biophysical surveys and PRA exercises. These techniques therefore can provide a good means of integrating the different types of data and elaborate both sets of data, providing more and richer information than a single type of data can by itself.

5 Project Impacts

Evidence that the project has accomplished its purpose was demonstrated by the stakeholder presentations at the end of the August 2005 eocsystem appproach training/discussion workshop. At this workshop stakeholders from the protected areas studied in the project gave

presentations on how the the results of the project and the ecosystem approach has been incorporated into the management planning for their sites.

The project has significantly advanced the understanding of ecosystem management, in particular within wetland managers and provincial policy makers with responsibility for wetland issues. The involvement of the CBD focal point throughout the project has also enhanced its impact with policy makers at national level.

At the start of the project it was identified that an important issue with the application of the ecosystem approach is the interpretation of the principles. There is a standard Vietnamese translation of the ecosystem approach principles but it was not clear if this translation conveyed a proper understanding of the underlying concepts and ideas. For example a discussion of Principle 2 and the most appropriate level for decentralisation of management centres around the current level of decentralisation of management, not whether it is appropriate or not. Discussion around understanding and managing ecosystems in a economic context leads to discussions of economic valuation of the natural resources, not how to apply these valuations to the improve ecosystem management. Discussion of the appropriate scale for the application of the ecosystem approach leads to a description of the sizes of protected areas.
This understanding of the ecosystem approach was a priority issue in the training and workshops undertaken with stakeholders from the management of the protected areas and district, provincial and national government. The clarification and elaboration of the ecosystem approach during this project has been a significant achievement.

The project has enabled the socio-economic fieldwork leader to apply to a Darwin Fellowship which, while unfortunately unsuccessful, has demonstrated his commitment to further training and capacity building. He has also applied for further training from United Nations Institute for Training and Research on ecosystem, management and biodiversity management, which used the experiences gained through the Darwin project to strengthen the application. He is also continuing to pursue options for PhD study in the UK.

This project has strengthened existing links and collaboration between the UK partner and Can Tho University and extended this relationship to An Giang University. The project has also facilitated greater links between the IUCN, the protected area management, the research community and government departments at district, provincial and national level. It was commented on by one of the workshop participants that it is uncommon to have such a wide grouping together at workshops.

6 Project Output

The following outputs are those given in the project schedule

Output 1. Trainers trained: wetland functioning and restoration techniques, Ecosystem Approach training.

Indicator 1. Reports produced, training attendance monitored and progress posted on web-site.

As reported above, this output was successfully achieved. Local scientists were trained in biophysical and socio-economic field techniques. The socio-economic field team at An Giang University were also trained in techniques for community engagement.

A series of linked training workshops on the ecosystem approach were also carried out through the project for district, provincial and national government representatives and protected area managers. The training materials (presentations) given at these workshops are appended to this report.

Output 2. Scientific and socio-economic databases of wet-land biodiversity and values.

Indicator 2. Outputs from the analysis of field research described and catalogued on a database.

These outputs have been partially achieved. The databases of wetland biodiversity and values have been established (summarised above in the discussion on project research activities). However, these data and analysis have not been published in peer reviewed papers or manuals although outlines of two potential papers have been developed, one demonstrating the integration of socio-economic and ecological field surveys and a second, drawing on the stakeholder consultation exercises for the strategic guidelines report, on the management of wetlands in the Mekong Delta with particular attention on the potential Mekong Wetland Forum proposed in the report.

Output 3. Materials produced to support training and build awareness.

Indicator 3. Published materials as an output of the data collection, analysis and expert knowledge.

Training materials used in the stakeholder workshops were distributed to participants in the workshops and are attached as annexes to this report. Key elements of the training material have been included in the strategic guidelines report and will be included in future peer reviewed publications, however, the materials themselves were not produced in a format suitable for publication. It is expected that the strategic guidelines report will feed into the CBD sourcebook on the ecosystem approach.

Outputs 4. Stakeholder engagement and capacity building between university and research staff in Vietnam and other areas in SE Asia.

Indicator 4. Capacity building through project research and training programs.
As discussed above, the capacity building for scientists was undertaken through training in field techniques and their application within the research element of project, which was monitored by the UK project team. Stakeholder engagement and training was also undertaken through a series of workshops on the application of the ecosystem approach to wetland management in the Mekong Delta and a series of community engagement exercises.

Regional capacity building was conducted through DV Ni's involvement in the Mekong basin university network (Laos, Thailand, Cambodia and Vietnam). Each year since 2003 a three week training programme has been held, which rotates between participating countries. The aim of the network is to build capacity for young scientists and wetland managers in the lower Mekong Basin. In 2003 the training was held in Vietnam and participants went to Can Gio and Tram Chim, two of the Darwin project sites.

7 Project Expenditure

	2003/2004	2003/2004	2004/2005	2004/2005	2004/2005	2005/2006	2005/2006	2005/2006	TOTAL	TOTAL	BALANCE
	Budget	Expenditure	Original budget	Revised Budget	Expenditure	Original Budget	Revised Budget	Expenditure	Budget	Expenditure	Diff +/-

Approved adjustments

1. From Rent, rates carry forward £1684 from year 04/05 into year 05/06
2. From Postage etc, carry forward £800 from year 04/05 into year 05/06
3. From Travel and Subsistence year 04/05, vire £6622 to Salaries and carry forward £4700 into Travel and Subsistence year 05/06
4. From Others carry forward £112 from year 0/05 into year 05/06

Table 23 Tabulated grant expenditure using the categories in the original application/schedule.

8 Project Operation and Partnerships

Two local partner institutions worked with SWIMMER on project activities; Can Tho University and An Giang University. These were the only partners that were included in the original project proposal. Their role in the project was to collect ecological and water quality data (Can Tho University) and socio-economic data (An Giang University) with guidance from SWIMMER. Both partners were equally active and involved in the project.

All planning decisions were taken jointly with the two host country partners and, under direction from SWIMMER, were responsible for project implementation with regard to fieldwork and workshop organisation. As discussed above, the ongoing dialogue between the partners in the project resulted in some changes to the project plans, although these changes did not significantly affect the project objectives.

The strongest collaboration with similar projects was with the IUCN Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP). This is a five-year (2004 – 2009), $30 million programme within the four Lower Mekong countries – Cambodia, Lao PDR, Thailand, and Vietnam. Two of the Darwin project sites were chosen as demonstration sites for the MWBP (Tram Chim and Lang Sen). Can Tho University is acting as a technical advisor to the project and the results from the Darwin project has been used to design the field data collection for this project.

Two representatives of this project attended the ecosystem approach workshop held in November 2003 and project members also participated in the two workshops with led to the production of the strategic guidelines report. It has been agreed that, once published, the data collected by this project will be provided to the MWBP. Consultations have also taken place with the CBD focal point in Vietnam, who attended two of the ecosystem approach workshops held at Can Tho University and has provided direct input into the project report on wetland management guidelines.

The local partnerships have continued to be active at the end of the project. The involvement of Can Tho University in the IUCN MWBP gives it a direct link into the local biodiversity strategy process. There has always been a recognition by the project partners that community participation is important and they are continuing to encourage greater participation with the community in local government biodiversity work and the management of wetlands.

9 Monitoring and Evaluation, Lesson learning

Over the course of the project progress has been monitored through regular trips to the host country for meetings, training and workshops. This approach identified research gaps and training needs not recognised in the initial project proposal. The success of this approach is demonstrated by the fact that it was possible to adapt the project structure to respond to changing circumstances throughout the project. For instance, the identification of the need for additional field surveys to integrate the socio-economic and biophysical data and the change in the emphasis in training from statistical data analysis to data interpretation and presentation are two examples of how this strategy worked to improve the project.
On completion of the project it has been evaluated by comparing the outputs of the project with the original objectives, the indicators of project success being the meeting of the project objectives. In the longer term, the success of the project will be determined by the degree to which the ecosystem approach is incorporated into plans, programmes and strategies for wetland by the national and provincial government in Vietnam.

The main problems encountered during the project were language and communication difficulties. While some members of the project team in the host country could speak good English, most of the fieldwork teams were not fluent English speakers. This resulted in a lot of the information from discussions not being translated, lost in translation or mis-translated. Difficulties in translation and the use of local terms for different resources has resulted in some of the resources listed by the local community not being fully identified. Even where

language was not a problem, cultural differences often made situations difficult to interpret.

The key lesson learned from this project is that it is necessary to ensure that a sufficient number of the project team members have a common language so that all the information collected can be translated into English. An understanding of the cultural context in which the information is collected is also important. It should be understood that some questions which may seem reasonable to ask may be culturally sensitive in the host country and that sometimes information is not translated or mis-translated for cultural reasons. For example, although ricefield rats (*Rattus argentiventer*) are captured as a food source, these were translated as voles (*Microtus* sp.) because of the sensitivities of rats being seen as unhygienic.

10 Actions taken in response to annual report reviews (if applicable)

The principal issues raised by annual report reviews have been related to the lack of supporting information and project outputs provided with previous annual reports. This has been addressed with this report by the attachment of all training materials and outputs as annexes to this report.

The reviewer also raised the possibility that there would be a delay in finalising papers for publication because of the modifications made to the fieldwork schedule. This has indeed happened but outline concepts for the papers have been developed and will draw on the research results presented in this report and the strategic guidelines report (Appendix VII).

11 Darwin Identity

The Darwin logo has been used on all training materials, presentations and reports produced during the project.

As a result of this and other projects in the Mekong Delta, and in Vietnam as a whole, the Darwin Initiative has a very good reputation for high quality research and conservation work. The high standing of the Darwin Initiatives was mentioned by a participant within one of the workshops. Within the Mekong Delta, protected area managers and district, provincial and national government officials in departments and ministries associated with conservation (e.g. Ministries of Agriculture and Rural Development, Forestry, Natural Resources and Environment) are likely to be familiar with the Darwin Initiative.

The host country co-ordinator (DV Ni) has made two appearances on VTV (Vietnam Television) discussing the role of wetland conservation in sustainable development and the threats of alien species on wetlands at Tram Chim. He also made one appearance on CVTV (local Can Tho province television station) discussing wetland values and functions in the Mekong Delta. He has also written a number of articles for the media on the subject of wetlands.

The project was seen as a distinct project with a clear identity but the project team made an effort to ensure that the project was seen in the context of the wider programme of activity and links and parallels were drawn to other work wherever possible.

12 Leverage

During the project no additional funds were attracted to biodiversity work associated with the project.
UK project staff have helped the host country partners to apply for additional funding (e.g. Darwin Fellowship and United Nations training). Efforts were also made to secure funding through IUCN for a continuation of the work associated with this and earlier projects carried out in the region but the funding was not secured.

13 Sustainability and Legacy

The research carried out for the project represents a unique assessment of the use of natural resources within the Mekong Delta. It has provided a very valuable dataset for the region and

has made a significant contribution to the understanding of the interaction of local communities with wetlands. The enhanced understanding within the wetland policy makers of the ecosystem approach is also a significant achievement and, if this understanding is translated into policy, programmes or strategies will represent an enduring achievement for the project.
All of the UK and host country project staff have remained in position since the completion of the project. The relationships with the partners are long-standing, preceding the Darwin project, and are likely to continue into the future.

14 Value for money

The project represents good value for money as there has been a considerable amount of useful data collected that will inform the development of wetland management plans and strategies. The training in the ecosystem approach given to key policy makers in the Mekong Delta will also help to ensure that the data collected by the project are utilised to improve the management of wetlands.

15 Appendix I: Project Contribution to Articles under the Convention on Biological Diversity (CBD)

Please complete the table below to show the extent of project contribution to the different measures for biodiversity conservation defined in the CBD Articles. This will enable us to tie Darwin projects more directly into CBD areas and to see if the underlying objective of the Darwin Initiative has been met. We have focused on CBD Articles that are most relevant to biodiversity conservation initiatives by small projects in developing countries. However, certain Articles have been omitted where they apply across the board. Where there is overlap between measures described by two different Articles, allocate the % to the most appropriate one.

Project Contribution to Articles under the Convention on Biological Diversity		
Article No./Title	**Project %**	**Article Description**
6. General Measures for Conservation & Sustainable Use	20	Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	25	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation		Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity	20	Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	15	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).

13. Public Education and Awareness	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
16. Access to and Transfer of Technology		Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information	15	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Total %	**100%**	**Check % = total 100**

16 Appendix II Outputs

Please quantify and briefly describe all project outputs using the coding and format of the Darwin Initiative Standard Output Measures.

Code	Total to date (reduce box)	Detail (←expand box)
Training Outputs		
1a	Number of people to submit PhD thesis	
1b	Number of PhD qualifications obtained	
2	Number of Masters qualifications obtained	
3	Number of other qualifications obtained	
4a	Number of undergraduate students receiving training	
4b	Number of training weeks provided to undergraduate students	
4c	Number of postgraduate students receiving training (not 1-3 above)	
4d	Number of training weeks for postgraduate students	
5	Number of people receiving other forms of **long-term** (>1yr) training not leading to formal qualification(i.e not categories 1-4 above)	
6a	Number of people receiving other forms of **short-term** education/training (i.e not categories 1-5 above)	30
6b	Number of training weeks not leading to formal qualification	40 19 training days in total for the training courses detailed above with and average of 15 participants
7	Number of types of training materials produced for use by host country(s)	2 Presentations, reports
Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country(s)	12
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	1
10	Number of formal documents produced to assist work related to species identification, classification and recording.	
11a	Number of papers published or accepted for publication in peer reviewed journals	
11b	Number of papers published or accepted for publication elsewhere	
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	
13a	Number of species reference collections established and handed over to host country(s)	
13b	Number of species reference collections enhanced and handed over to host country(s)	

Dissemination Outputs		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	2
14b	Number of conferences/seminars/ workshops **attended** at which findings from Darwin project work will be presented/ disseminated.	1
15a	Number of national press releases or publicity articles in host country(s)	
15b	Number of local press releases or publicity articles in host country(s)	1
15c	Number of national press releases or publicity articles in UK	
15d	Number of local press releases or publicity articles in UK	
16a	Number of issues of newsletters produced in the host country(s)	
16b	Estimated circulation of each newsletter in the host country(s)	
16c	Estimated circulation of each newsletter in the UK	
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	3 – host country co-ordinator appeared on Vietnam Television to talk about wetland values
18b	Number of national TV programme/features in the UK	
18c	Number of local TV programme/features in host country	
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	
19b	Number of national radio interviews/features in the UK	
19c	Number of local radio interviews/features in host country (s)	
19d	Number of local radio interviews/features in the UK	
Physical Outputs		
20	Estimated value (£s) of physical assets handed over to host country(s)	
21	Number of permanent educational/training/research facilities or organisation established	
22	Number of permanent field plots established	
23	Value of additional resources raised for project	

17 Appendix III: Publications

Provide full details of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications Database that is currently being compiled.

Mark (*) all publications and other material that you have included with this report

Type * (e.g. journals, manual, CDs)	**Detail** (title, author, year)	**Publishers** (name, city)	**Available from** (e.g. contact address, website)	**Cost £**

18 Appendix IV: Darwin Contacts

To assist us with future evaluation work and feedback on your report, please provide contact details below.

Project Title	Darwin South East Asian Wetland Restoration Initiative
Ref. No.	*162/12/034*
UK Leader Details	
Name	Prof E Maltby
Role within Darwin Project	Project leader
Address	SWIMMER, Nicholson building, University of Liverpool, Liverpool L69 3GP, UK
Phone	
Fax	
Email	
Other UK Contact (if relevant)	
Name	Conor Linstead
Role within Darwin Project	Project co-ordinator
Address	SWIMMER, Nicholson building, University of Liverpool, Liverpool L69 3GP, UK
Phone	
Fax	
Email	
Partner 1	
Name	Dr DV Ni
Organisation	University of Can Tho
Role within Darwin Project	Host country co-ordinator
Address	Hoa An Biodiversity - Application - Research Center Can Tho University, Can Tho City, Vietnam
Fax	
Email	
Partner 2 (if relevant)	
Name	Dr NT Khiem
Organisation	An Giang University
Role within Darwin Project	Host country socio-economic research co-ordinator
Address	An Giang University (AGU), Long Xuyen, An Giang Province, Vietnam
Fax	
Email	

19 Appendix V: Logical Framework

Project summary	*Measurable indicators*	*Means of verification*	*Important assumptions*
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve • the conservation of biological diversity, • the sustainable use of its components, and • the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose To build the capacity of wetland managers and farmers to meet commitments to the CBD through the restoration and protection of biodiversity and sustainable livelihoods based on the diversity of wetlands in the Mekong Delta, Vietnam.	1. Short and long-term socio-economic benefits derived from (restored) wetlands. 2. Tools and educational demonstrations for evaluating, managing/restoring wetland functioning. 3. Identification of priority sites for potential restoration and establishment of wetlands 4. Skills and ability for sustainable management of wetland resources.	1. and 2. Training materials; workshops (manuals; AV; website). 3. Facilitation of the methods needed for the identification of sites through project notes and reports. 4. Training materials; workshops (manuals; AV; website) 5. Improvements to a potential training centre in Hoa An, Vietnam.	1 + 2. Sites can be identified, accessed and sampled. 3. Successful engagement and facilitation of relevant wetland managers and farmers. 4. Engagement of significant stakeholders, workshop participation of motivated trainees, subsequent wider dissemination 5.Continued relationships between collaborators.
Outputs 1. Trainers trained: wetland functioning and restoration techniques, Ecosystem Approach training. 2. Scientific and socio-economic databases of wet-land biodiversity and values. 3. Materials produced to support training and build awareness. 4. Stakeholder engagement and capacity building between university and research staff in Veitnam and other areas in SE Asia.	1. Reports produced, training attendance monitored and progress posted on web-site. 2. Outputs from the analysis of field research described and catalogued on a database. 3. Published materials as an output of the data collection, analysis and expert knowledge. 4. Capacity building through project research and training programs.	1. Review of reports from the project, web-site updates. 2. Multi-variate and uni-variate statistical tests carried out as well as descriptive data analysed and published in manuals, reports and papers submitted for publication 3. and 4. On-going training course at an established training centre, attendance monitored and web-site updated. Workshop reports and questionnaires posted on web-site.	1. Successful engagement of stakeholders. Successful knowledge transfer. 2. Successful field data collection, a statistically valid sample is taken. 3. Production of materials. 4. Regional participants willing and able to travel to Vietnam.
Activities	***Activity Milestones (Summary of Project Implementation Timetable)***		
Workshops/Meetings and Training	Yr 1: Project planning; task allocation, identifying locations and relevant permissions (May-July '03); Training on socio-economic and natural scientific field techniques and methodologies, survey design (Nov '03); Yr 2/3: Training on the analysis of data (July '04); Dissemination workshops (training trainers from SE Asia) (Dec '04-Mar '05).		
Field Research	Methods and protocols for habitat and socio-economic surveys to be established July '03, sites identified and mapped Aug '03. Field research to be carried out between Dec '03 to June '04. Identify priority habitats throughout field research.		
Training Materials	Analysis of data and collation of field surveys and other relavent information by Nov '04. Production of manuals for training workshops Nov '04; database and website available by May '05		
Dissemination and publicity material	Final reports; publications as manuals in Vietnamese and English by Sept '05. Website containing the training information and database May '05. Facilitation of demonstration sites May-Sept '05		

20 Appendix V: Water quality data

Sample Number	Date	BOD (ppm)	Coliform (CFU)	Conductivity	DO (ppm)	E.coli (CFU)	NH4+ (ppm)	N-NO2- (ppm)	N-NO3- (ppm)	pH	PO43- (ppm)	Salinity %	S-SO42- (ppm)
Can Gio 1	December 2003	7	88	30100	0.8	N.D.	0.19	0	0.4	7.4	0.42	18.9	290
Can Gio 2	December 2003	3	87	29800	4	N.D.	0.06	0	0.2	7.6	0.12	18.6	272
Can Gio 3	December 2003	5	190	29800	4.64	N.D.	0.04	0	0	7.7	0.11	18.6	272
Can Gio 4	December 2003	4	N.D.	34700	4	N.D.	0.07	0	4.5	7.5	0.04	21.9	290.9
Can Gio 5	December 2003	4	30	34600	4	N.D.	0.06	0	0	7.8	0.03	21.8	300
Can Gio 6	December 2003	5	36	34500	4.8	N.D.	0.04	0	0	7.3	0.04	21.8	308
Can Gio 7	December 2003	3	750	17260	6.24	N.D.	0.1	0	4	7.1	0.04	10.3	63.6
Can Gio 8	December 2003	3	75	19070	7.68	N.D.	0.07	0	1	7.6	0.01	11.4	120
Can Gio 9	December 2003	2	120	24600	4.64	N.D.	0.06	0	0	7.1	0.04	15	181.8
LSen 10	December 2003	8	N.D.	1975	0	N.D.	0.34	0	0	3.1	0.01	0.9	220
LSen 11	December 2003	2	N.D.	975	0	N.D.	0.35	0	0	3.5	0.03	0.3	105
LSen 12	December 2003	3	51	230	5.04	N.D.	0.86	0	0	6.8	0.01	0	30
LSen 13	December 2003	20	600	745	7.56	N.D.	19.16	0	0.5	7.1	0.14	0.1	78.7
LSen 14	December 2003	30	N.D.	2460	0	N.D.	6.87	0	0	3.3	0.03	1.1	163.6
LSen 15	December 2003	16	150	271	4.64	N.D.	1.29	0	0	7.2	0.03	0	44.5
LSen 16	December 2003	4	100	178	5.12	N.D.	0.07	0	0	6.9	0.01	0	16.4
LSen 17	December 2003	3	84	175	10.48	N.D.	0.04	0	0	7.3	0.01	0	17
TChim 18	December 2003	3	59	102	2.24	N.D.	0.05	0	0	7.3	0.02	0	7.8
TChim 19	December 2003	15	230	151	6.72	N.D.	0.13	0	0	8.4	0.04	0	10
TChim 20	December 2003	6	120	197	5.56	31	0.47	0	0	8.5	0.12	0	15.5
TChim 21	December 2003	6	150	354	10.64	N.D.	0.48	0	0	6.4	0.05	0	45.5
TChim 22	December 2003	7	180	445	5.76	N.D.	0.26	0	0	5	0.06	0	59.1
Tchim 23	December 2003	5	63	117	6.96	N.D.	0.06	0	0	8.4	0.02	0	7.3
TChim 24	December 2003	3	59	115	7.16	N.D.	0.05	0	0	7.9	0.02	0	4.5
TChim 25	December 2003	3	140	164	5.52	N.D.	0.49	0	0	6.9	0.06	0	14.1
Can Gio 1	February 2004	6	85		6.56	N.D.	0.047	0	0.6	7.6	0.076	20.2	310
Can Gio 2	February 2004	4	120		8.72	N.D.	0.066	0	0.3	7.6	0.055	20.8	291
Can Gio 3	February 2004	4	79		7.48	N.D.	0.045	0	0.3	7.4	0.041	21.1	283

Can Gio 4	February 2004	3	23	6.96	N.D.	0.062	0	3.5	7.8	0.04	22.1	319
Can Gio 5	February 2004	3	36	6.6	N.D.	0.059	0	0.8	7.8	0.036	22.8	306
Can Gio 6	February 2004	4	N.D.	6.4	N.D.	0.061	0	0.2	7.4	0.026	22.5	316
Can Gio 7	February 2004	6	310	8.52	N.D.	0.202	0	3.5	7.8	0.03	13.9	83.2
Can Gio 8	February 2004	4	280	10.4	N.D.	0.233	0	1.5	7.8	0.023	14.2	96.8
Can Gio 9	February 2004	3	700	6.84	N.D.	0.036	0	0.3	7.4	0.029	15	193
LSen 10	February 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
LSen 11	February 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
LSen 12	February 2004	3	20	6.52	N.D.	0.121	0	0	7.7	0.054	0	19.3
LSen 13	February 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
LSen 14	February 2004	9	N.D.	12.08	N.D.	7.019	0	2.29	3.9	0.018	0.5	69.8
LSen 15	February 2004	6	98	7.04	N.D.	0.17	0	0	6.7	0.062	0	20.8
LSen 16	February 2004	4	320	2.6	N.D.	0.067	0	0	7.8	0.015	0	8.29
LSen 17	February 2004	4	790	4.8	N.D.	0.081	0	0	7.4	0.012	0	9.01
TChim 18	February 2004	4	560	4.8	N.D.	0.587	0	0	7.3	0.035	0	15
TChim 19	February 2004	7	930	0	120	0.092	0	0	6.2	0.024	0	16.2
TChim 20	February 2004	4	100	5.12	20	0.073	0	0	7.1	0.09	0	8.79
TChim 21	February 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
TChim 22	February 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
Tchim 23	February 2004	3	56	5.52	N.D.	0.049	0	0	7.6	0.02	0	6.39
TChim 24	February 2004	3	31	4.48	N.D.	0.037	0	0	7.4	0.014	0	3.61
TChim 25	February 2004	4	86	5.12	N.D.	0.092	0	0	7.4	0.025	0	9.16
Can Gio 1	April 2004	7	530	4	N.D.	0.06	0	1.2	6.9	0.18	19	234
Can Gio 2	April 2004	6	130	5.96	N.D.	0.13	0	0.8	7.2	0.46	19.3	230
Can Gio 3	April 2004	4	39	5.92	N.D.	0.06	0	0.5	7.3	0.29	19.5	225
Can Gio 4	April 2004	6	290	6.2	N.D.	0.09	0	2.1	7.3	0.13	19.9	238
Can Gio 5	April 2004	6	47	5.48	N.D.	0.1	0	0.3	7.2	0.13	20.8	250
Can Gio 6	April 2004	6	30	6.16	N.D.	0.08	0	0.2	7.3	0.15	20.6	246
Can Gio 7	April 2004	11	129	9.28	N.D.	0.06	0.4	3.7	7.9	0.17	14	104
Can Gio 8	April 2004	6	1100	12	N.D.	0.08	0	2.9	8	0.15	14.9	130
Can Gio 9	April 2004	8	67	5.92	N.D.	0.09	0	0.2	7.4	0.11	18.2	150
LSen 10	April 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.

LSen 11	April 2004	N.S.	N.S.		N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
LSen 12	April 2004	8	N.D.		6.16	N.D.	2.77	0	0.7	5.6	0.1	0	29
LSen 13	April 2004	N.S.	N.S.		N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
LSen 14	April 2004	19	N.D.		0.96	N.D.	3.24	0.8	2.8	4.9	0.18	0.2	116
LSen 15	April 2004	7	N.D.		5.44	N.D.	3.3	0	0.5	5.4	0.12	0	37
LSen 16	April 2004	7	130		1.12	N.D.	0.2	0	0	7	0.23	0	18
LSen 17	April 2004	6	150		3	N.D.	0.22	0	0	7	0.11	0	19
TChim 18	April 2004	N.S.	N.S.		N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
TChim 19	April 2004	9	41		5.84	N.D.	0.05	0	0	6.8	0.13	0	12
TChim 20	April 2004	7	30		5.2	N.D.	1.15	0	0	6.9	0.12	0	20
TChim 21	April 2004	14	700		9.72	40	6.18	0	4.2	5.3	0.36	0	50
TChim 22	April 2004	9	29		3.64	N.D.	3.79	0	2.8	6.3	0.1	0	62
Tchim 23	April 2004	13	35		5.2	N.D.	0.41	0	0	7	0.14	0	11
TChim 24	April 2004	6	30		6.12	N.D.	0.27	0	0	7	0.12	0	8
TChim 25	April 2004	6	65		5.36	N.D.	1.24	0	0	6.5	0.05	0	18
Can Gio 1	June 2004	4	1115	26900	3.16	N.D.	0.153	0.3	3.8	6.8	0.34	17.1	250
Can Gio 2	June 2004	5	33	27100	6	N.D.	0.188	0	0.4	7.3	0.21	17.4	223
Can Gio 3	June 2004	5	33	28000	6.24	N.D.	0.16	0	0.4	7.4	0.22	17.8	221
Can Gio 4	June 2004	5	71	32300	6.2	N.D.	0.171	0	0.3	7.3	0.2	20.7	258
Can Gio 5	June 2004	6	88	31500	5.36	N.D.	0.421	0	0.2	7.3	0.22	19.9	251
Can Gio 6	June 2004	5	47	31600	6.4	N.D.	0.43	0	0.2	7.4	0.19	20	253
Can Gio 7	June 2004	10	26	15040	12.2	N.D.	0.444	0	1.8	8.5	0.33	9.2	86
Can Gio 8	June 2004	11	170	14830	8.64	N.D.	0.073	0	2.5	8.7	0.58	9.1	112
Can Gio 9	June 2004	9	32	25000	5.92	N.D.	0.185	0	0.2	7.4	0.35	15.7	158
LSen 10	June 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.		N.S.	N.S.	N.S.
LSen 11	June 2004	9	N.D.	2660	1.84	N.D.	0.326	0	12	3.5	0.5	1.1	82
LSen 12	June 2004	7	N.D.	318	6.34	N.D.	0.326	0	0.3	5.8	1.54	0	64
LSen 13	June 2004	3	N.D.	2430	9.6	N.D.	0.127	0	1.9	4.4	0.88	1	173
LSen 14	June 2004	6	N.D.	2350	3.48	N.D.	0.107	0	2.5	4.3	0.96	0.8	182
LSen 15	June 2004	8	51	303	6.32	N.D.	0.031	0	0.2	5.7	1.52	0	39
LSen 16	June 2004	6	63	235	3.84	N.D.	0.013	0	0	6.9	0.36	0	5.5
LSen 17	June 2004	4	110	242	5.56	N.D.	0.024	0	0	7.2	0.25	0	3.6

TChim 18	June 2004	6	N.D.	1950	2.64	N.D.	0.05	0	0	3.1	0.41	0.6	168
TChim 19	June 2004	14	N.D.	2345	2.64	N.D.	0.164	0	0	2.9	0.68	0.8	209
TChim 20	June 2004	6	53	208	5.24	N.D.	0.069	0	10	6.4	1.17	0	19
TChim 21	June 2004	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	6.6	N.S.	N.S.	N.S.
TChim 22	June 2004	14	151	343	5.92	N.D.	0.323	0	0	6.6	1.19	0	26.4
Tchim 23	June 2004	5	33	319	1.32	N.D.	0.292	0	0	6	1.4	0	31.8
TChim 24	June 2004	4	25	316	6.04	N.D.	0.286	0	0	6.2	1.3	0	32.7
TChim 25	June 2004	4	76	237	8	N.D.	0.088	0	0	6.3	1.24	0	17.3
Can Gio 1	August 2004	6	57	14000	2.24	N.D.	0.19	0.44	2.81	6.9	0.11	13.1	198
Can Gio 2	August 2004	5	649	13000	4.67	66	0.09	0.55	1.22	7.1	0.14	11.7	179
Can Gio 3	August 2004	6	64	24100	5.22	N.D.	0.06	0	0.82	7.3	0.1	14.7	202
Can Gio 4	August 2004	6	113	28700	4.54	N.D.	0.05	0.25	0.48	7.1	0.1	17.7	227
Can Gio 5	August 2004	4	88	28400	4.75	N.D.	0.07	0.21	0.3	7.3	0.11	17.5	235
Can Gio 6	August 2004	4	101	28900	4.61	N.D.	0.05	0	0.25	7.4	0.12	17.8	241
Can Gio 7	August 2004	10	61	7340	9.73	N.D.	0.07	0.54	2.21	8.2	0.08	4	62
Can Gio 8	August 2004	8	258	9820	7.14	N.D.	2.8	0.23	1.82	7.4	0.1	5.5	89
Can Gio 9	August 2004	4	275	11650	4.11	N.D.	0.1	0	0.4	7.1	0.06	6.7	110
LSen 10	August 2004	3	N.D.	810	3.57	N.D.	0.15	0	0	3.4	0.03	0.4	140
LSen 11	August 2004	4	N.D.	805	3.57	N.D.	0.18	0	0	3.6	0.04	0.4	163
LSen 12	August 2004	5	138	154	4.83	N.D.	0.07	0	0	5.8	0.06	0	19
LSen 13	August 2004	4	345	157	5.09	N.D.	0.07	0	0	6.6	0.06	0	13
LSen 14	August 2004	4	645	156	5.3	N.D.	0.08	0	0	6.6	0.08	0	12
LSen 15	August 2004	4	263	154	5.34	N.D.	0.08	0	0	6.6	0.03	0	17
LSen 16	August 2004	6	117	228	2.14	N.D.	0.11	0	0	6.9	0.03	0	6.9
LSen 17	August 2004	5	180	226	4.6	N.D.	0.13	0	0	7.2	0.06	0	6.3
TChim 18	August 2004	7	168	145	5.46	N.D.	0.15	0	0	7.2	0.06	0	11
TChim 19	August 2004	7	245	144	6.02	N.D.	0.14	0	0	7.4	0.08	0	9.2
TChim 20	August 2004	5	108	151	5.62	N.D.	0.16	0	0	7.6	0.09	0	8.2
TChim 21	August 2004	6	130	144	6.94	N.D.	0.26	0	0	7.6	0.13	0	7.5
TChim 22	August 2004	6	850	146	6.85	63	0.25	0	0	7.6	0.07	0	7.5
Tchim 23	August 2004	6	105	140	5.01	N.D.	0.08	0	0	7.6	0.05	0	5
TChim 24	August 2004	7	88	130	5.23	N.D.	0.08	0	0	7.5	0.12	0	5.6

TChim 25	August 2004	5	112	129	5.92	N.D.	0.16	0	0	7.4	0.09	0	6.2
Can Gio 1	October 2004	5	158	16020	3.8	N.D.	0.38	0	0.42	7.6	0.12	9.2	250
Can Gio 2	October 2004	5	93	19700	4	N.D.	0.05	0	0.42	7.6	0.08	11.7	256
Can Gio 3	October 2004	6	280	20500	4	N.D.	0.04	0	0.83	7.5	0.11	12.3	269
Can Gio 4	October 2004	8	267	23200	4.24	N.D.	0.02	0	4.17	7.6	0.12	14.1	263
Can Gio 5	October 2004	5	68	23300	4.4	N.D.	0.06	0	2.5	7.6	0.11	14.1	269
Can Gio 6	October 2004	5	48	23300	4	N.D.	0.02	0	2.5	7.5	0.15	14.1	278
Can Gio 7	October 2004	8	33	5520	9.88	N.D.	0.09	0	5	8.3	0.11	3	88
Can Gio 8	October 2004	8	89	5250	9.6	N.D.	6.75	0	1.67	8	0.81	2.8	81
Can Gio 9	October 2004	7	111	5670	5.6	N.D.	0.11	0	1.67	7.3	0.14	3.1	95
LSen 10	October 2004	4	75	95.1	5.84	N.D.	0.16	0	0	7.2	0.12	0	37.5
LSen 11	October 2004	3	61	90	5.9	N.D.	0.15	0	0	7.2	0.13	0	31.3
LSen 12	October 2004	4	N.D.	89.2	6.78	N.D.	0.12	0	0	7.4	0.11	0	2.5
LSen 13	October 2004	6	N.D.	88.4	7.12	N.D.	0.13	0	0	7.4	0.11	0	1.88
LSen 14	October 2004	6	N.D.	88.3	7.52	N.D.	0.17	0	0	7.6	0.14	0	1.88
LSen 15	October 2004	5	29	88.3	7.6	N.D.	0.17	0	1.67	7.6	0.11	0	2.5
LSen 16	October 2004	5	81	168	6.24	N.D.	0.1	0	0	7.7	0.12	0	6.25
LSen 17	October 2004	5	64	168	7	N.D.	0.16	0	0	7.8	0.11	0	6.25
TChim 18	October 2004	5	58	102	5.92	N.D.	0.14	0	0	6.9	0.13	0	1.88
TChim 19	October 2004	5	51	99.8	5.98	N.D.	0.11	0	0	7.5	0.13	0	1.88
TChim 20	October 2004	5	N.D.	101	6.64	N.D.	0.14	0	0	7.6	0.14	0	2.5
TChim 21	October 2004	6	31	105	7.04	N.D.	0.46	0	0	7.6	0.54	0	1.88
TChim 22	October 2004	6	N.D.	105	4.64	N.D.	0.38	0	0	7.6	0.09	0	1.88
Tchim 23	October 2004	5	34	117	7.36	N.D.	0.06	0	0	7.4	0.09	0	2.5
TChim 24	October 2004	4	N.D.	102	4.54	N.D.	0.11	0	0	7.5	0.11	0	2.5
TChim 25	October 2004	4	N.D.	105	6.72	N.D.	0.09	0	0	7.3	0.09	0	3.75

N.D. – Not Detected
N.S. – Not Sampled

21 Appendix VI – Outline integration of biophysical and socio-economic data

The following table shows the ten highest scoring key resources for each group engaged in the PRA exercises.

Resource	Scientific name	Identified by ecological surveys		Resource	Scientific name	Identified by ecological surveys	
		Inside	Outside			Inside	Outside
Can Gio - An Thoi Dong - An Hoa				**Tam Nong – Phu Tho B**			
Women				**Women**			
Rau sam	*Portulaca oleracea*			Mắt đỏ	***Unknown***		
Rau má	*Centella asiatica*			Chim sâu	*Dicaeum concolor*	x	
Cua	*Brachyura sp.*	x	x	Tép	*Macrobrachium sp.*		
Cá đối	*Mugil sp.*	x	x	Cua	*Brachyura sp.*		
bống sệ	*Oxyurichthys sp*			Bạch đàn	*Eucalyptus*		
bống sao	*Boleophthalmus boddarti*			Rau chai	*Commelina diffusa*		
bống kèo	*Pseudapocryptes elongates*	x	x	Điên điển	*Sesbania sp.*		x
bống dừa	*Oxyeleotris siamensis*			Rau muống	*Ipomoea aquatica*	x	x
bống cát	*Glossogobius giuris, Glossobius sparsipapillus*	x	x	Rau ngổ	*Enhydra fluctuans*		
tôm đất	*Metapenaeus brevicornis*	x	x	Rau tầng	***Unknown***		
				Rau mác	*Monochoria hastata*		
Men				Tràm	*Melaleuca sp.*		x
me	*Tamarindus indica L.*			Cỏ mần trầu	*Eleusine indica*		
được	*Rhizophoraceae*	x	x	Bông súng	*Nymphea sp.*	x	
Tôm tích	*Squilla mantis*						
rắn nước	*Matrix piscator*			**Men**			
Cá lóc	*Channa striata*			Cá linh	*Thynnichthys thynnoides, Cirrhinus jullieni, Labiobarbus siamensis*	x	x
Cá kèo	*Pseudapocryptes elongatus*	x	x	Chuối	*Musa sp.*		
Ốc dừa	*Terebralia palustris*			Tràm	*Melaleuca sp.*	x	
cỏ mực	*Eclipta prostrata*			cỏ bắc	*Leersia hexandra*	x	
chằng nghịch	*Rallus striatus*			cỏ mực	*Eclipta prostrata*		
Cá rô	*Anabas testudineus*			điên điển	*Sesbania sp.*		
				Cá lăng	*Hemibagrus wyckii*	x	x
Poor				chốt sọc	*Mystus vittatus*		x
Ốc dừa	*Terebralia palustris*			chốt giấy	*Mystus cavasius*		x
Tôm đất	*Metapenaeus brevicornis*	x	x	lòng tong bay	*Esomus goddardi*	x	x
Cá trê phi	*Clarias gariepinus*						
Dạm	*Dotilla fenestrata*			**Poor**			
Nha	*Dotilla fenestrata*			lòng tong bay	*Esomus goddardi*	x	x
Tôm bạc	*Metapenaeus sp*	x	x	Cá bống tượn	*Oxyeleotris marmorata*		
Cu đất	*Streptopelia orientalis*			Cá khoai	*Acanthopsis choirorhynchos*		
Còng	*Dotilla fenestrata*			Chốt sọc	*Mystus vittatus*		x
Cá lóc	*Channa striata*			chốt giấy	*Mystus cavasius*		x
Tôm sú	*Penaeus monodon*	x	x	Chim sâu	*Dicaeum concolor*	x	
				chim se sẻ	*Passer sp.*		
Children				chim áo già (brown bird)	***Unknown***		

Tôm sú	*Penaeus monodon*	x	x	dòng dọc	*Ploceus philippinus*		
Đối	*Mugil sp.*	x	x	chim én	*Hirundinidae*	x	
Còng	*Dotilla fenestrata*						
Cua	*Brachyura sp.*	x	x	**Migrants**			
Tôm đất	*Metapenaeus brevicornis*	x	x	Rau muống	*Ipomoea aquatica*	x	x
Rau má	*Centella asiatica*			Bông súng	*Nymphea sp.*	x	
Cá bống kèo	*Pseudapocryptes elongatus*	x	x	Sen	*Nelumbo sp*	x	
Tôm tích	*Squilla mantis*			Chuột	*Rattus sp.*	x	x
Càng cua	*Peperomia pellucida*			Cá lóc	*Channa striata*	x	x
Cá trê phi	*Clarias gariepinus*			Cá trê vàng	*Clarias macrocephalus*	x	x
				Cá rô đồng	*Anabas testudineus*	x	x
AN HOA -TAM THÔN HIỆP				chim én	*Hirundinidae*	x	
Women				Cỏ mực	*Eclipta prostrata*		
Bóng kèo	*Pseudapocryptes elongatus*	x	x	Lươn	*Anguilliformes*		
Tôm bạc bông	*Metapenaeus sp*	x	x				
Cá đối	*Mugil sp*	x	x	**Children**			
Tôm bạc	*Metapenaeus sp*	x	x	Dơi	*Chiroptera*		
Cua	*Brachyura sp.*	x	x	Rau muống	*Ipomoea aquatica*	x	x
Rau muống	*Ipomoea aquatica*			Bông súng đồng	*Nymphea sp.*	x	
Cá ngát	*Plotosus canius*	x	x	Ốc quắn	*Sinotaia sp*		
Tôm thẻ	*Penaeus merguiensis*			Vẹm	*Palaeoheterodonta*		
Nha	*Dotilla fenestrata*			Hến	*Corbicula fluminea*		
Dền	*Amaranthaceae*			Tôm	*Penaeus sp.*		
				Tép	*Macrobrachium sp.*		
Men				Cua	*Brachyura sp.*		
Cá đối	*Mugil sp*	x	x	Lươn	*Anguilliformes*	x	x
Đước	*Rhizophoraceae*	x	x	Rắn nước	*Matrix piscator*		
Cá ngát	*Plotosus canius*	x	x	Rắn bông súng	*Enhydris enhydris*		
mấn	*Avicennia sp*						
tôm bạc	*Metapenaeus sp*	x	x	**Tan Hung - Vinh Loi - Ap 1**			
Cá dứa	*Pangasius polyuranodon*			**Women**			
dừa nước	*Nypa fruticans*			Cá lóc	*Channa striata*	x	x
Cá út	*Arius thalassinus*			Rô biển	*Pristolepis fasciatus*	x	x
bần gạch	*Sonneratia caseolaris*			Tràm	*Melaleuca sp.*	x	
Cá chẽm	*Lates calcarifer*	x	x	Nhãn lồng	*Passiflora foetida*		
				Rau muống	*Ipomoea aquatica*	x	
Poor				Cá trê	*Clarias macrocephalus*	x	x
Tôm thẻ	*Penaeus merguiensis*	x	x	Cá trèn	*Siluridae*		
Tôm sú	*Penaeus monodon*	x	x	Cò trắng	*Bubulous ibis*		
Chìa vôi	*Motacilla sp.*			Rau trai	*Commelina diffusa*		x
Rau lìm kìm	*Phyla nodiflora*			Thù lù	*Physalis angulata*		
Cá chẽm	*Lates calcarifer*	x	x	cỏ mực	*Eclipta prostrata*		
tráp trắng	*Pagrus auratus*						
tôm đất	*Metapenaeus brevicornis*	x	x	**Men**			
Cá Đuối	*Rajiformes*			Cá lóc	*Channa striata*	x	x
Sò huyết	*Anadara granosa*		x	Chốt sọc	*Mystus vittatus*	x	x
Cá mang rỗ	*Toxotes chatareus*	x	x	rô biển	*Pristolepis fasciatus*	x	x
				Lươn	*Anguilliformes*	x	x
Migrants				Cá ba kỳ	*Cyclocheilichthys sp.*	x	x
Cá đối	*Mugil sp.*	x	x	Lúi đất	*Osteochilus vittatus*		
Tôm đất	*Metapenaeus brevicornis*	x	x	Bông súng	*Nymphea sp.*	x	
Tôm bạc	*Metapenaeus sp*	x	x	Rau muống	*Ipomoea aquatica*	x	
Cá kèo ruộng	*Pseudapocryptes lanceolatus*			dừng (dứa dại)	*Pandanus tectorius Sol*		
Cá út	*Arius sp.*		x	trai	*Commelina diffusa*		x
Cua	*Brachyura sp.*	x	x	lìm kìm	*Zenarchopterus pappenheimi*		x

Cá ngát	*Plotosus canius*	x	x	Nhãn lồng	*Passiflora foetida*		
Mề gà	*Coilia sp.* *Boleophthalmus boddarti*			rau diệu	*Alternanthera sp.*		
Bóng sao				thuốc vòi	*Pouzolzia zeylanica*		
Lìm kìm	*Zenarchopterus pappenheimi*		x	rau cóc	*Grangea maderaspatana*		x
				lá hẹ	*Allium sp.*		
Children				rau bợ (trị thận)	*Marsilea quadrifolia*		
Đước	*Rhizophoraceae*	x	x	Điên điển	*Sesbania sp.*		
Bạch đàn	*Eucalyptus sp*			rau đắng	*Hlinus oppositifilius*		
Nhãn lòng	*Passiflora foetida*			tai tượng	*Acalypha sp.*		
Cá bống kèo	*Pseudapocryptes sp.*	x	x				
Tôm	*Penaeus sp.*	x	x	**Poor**			
Cua	*Brachyura sp.*	x	x	Cá lóc	*Channa striata*	x	x
Tôm bò	*unknown*			Tràm	*Melaleuca sp.*	x	
Tôm tích	*Squilla mantis*			bạch đàn	*Eucalyptus sp*		
Dừa nước	*Nypa fruticans*		x	tre	*Bambusaceae*		
Cò ma	*Ardeola bacchus*	x	x	Hủ hoa	*Momordica charantia*		
				Nhãn lòng	*Passiflora foetida*		
Tan Nong - Phu Tho C				Mướp gai	*Lasia spinosa*		
Women				cò trắng	*Bubulous ibis*		
Cúc	*Turnix suscitator*			cò ma	*Ardeola bacchus*	x	x
Lòng tong đá	*Rasabora sp.*	x	x	quốc	*Cuculodae*		
Tra	*Pangasius hypophthalmus*						
Diệc	*Ardeidae sp.*	x		**Migrants**			
Cá éc	*Labeo chrysophekadion*			Nhãn lòng	*Passiflora foetida*		
Chim áo vàng (brown bird)	***Unknown***			Mắt mèo	*Mucuna Pruriens*		
Điên điển	*Sesbania sp.*	x		cúm núm	*Porzana cinerea*		
Lìm kìm	*Zenarchopterus pappenheimi*	x		chạch cơm	*Macrognathus aculeatus*		
Cá nhái	*Strongylura strongylura*		x	rau cóc	*Grangea maderaspatana*		x
Chìa vôi	*Motacilla sp.*			Cá lóc	*Channa striata*		
Mắt mèo	*Mucuna Pruriens*			trích cồ	*Porphyrio Porphyrio*		
Cóc	*Cyclocheilichthys enoplos*		x	cò trâu	*Egretta sp.*		
Bìm bịp	*Centropus sp.*	x		bông súng	*Nymphea sp.*	x	
Bồ cắt	*Accipiter*			Cá trê vàng	*Clarias macrocephalus*	x	x
Áo già (brown bird)	***Unknown***						
				Children			
Men				Sâu	*Dicaeum concolor*		
Cá Đối	*Mugil sp.*			Diệc	*Ardeidae sp.*		
Rau muống	*Ipomoea aquatica*	x	x	Quốc	*Cuculodae*		
Bông súng đồng	*Nymphea sp.*	x			*Phalacrocorax carbo*		
				Còng cọc			x
ốc đắng	*Sinotaia sp*			Cúc	*Turnix suscitator*		
Vẹm	*Palaeoheterodonta*			Ong mật	*Apis sp.*		
hến	*Corbicula fluminea*			Cá rô đồng	*Anabas testudineus*	x	x
Tôm	*Penaeus sp.*			Rô biển	*Pristolepis fasciatus*	x	x
Tép	*Macrobrachium sp.*			Cá heo	*Botia sp.*	x	x
Cua	*Brachyura sp.*			Cá mè vinh	*Barbonymus gonionotus*	x	x
Lươn	*Anguilliformes*			Cá lóc bông	*Channa micropeltes*	x	
				Cá bống	*Gobiidae*		
Poor				Éc	*Labeo chrysophekadion*		

Cá bông	*Channa micropeltes*	x		Cá thác lác	*Notopterus notopterus*	x	x
Cá kết	*Kryptopterus bleekeri*		x	Răn nước	*Matrix piscator*		
Rắn voi voi	*Enhydris bocourti*			Rắn bông súng	*Enhydris enhydris*		
Cá khoai	*Acanthopsis choirorhynchos*		x	Tép	*Macrobrachium sp.*		
Trứng cá	*Fish roe*			Ốc quấn	*Sinotaia sp*		
Rắn bông súng	*Enhydris enhydris*						
Rắn nước	*Matrix piscator*						
Mimosa pigra	*Mimosa pigra*		x				
Cỏ lồng vực	*Echinochloa crus-galli*						
Cỏ chỉ	*Cynodon dactylon*						
Children							
Cá Đối	*Mugil sp.*						
rau muống	*Ipomoea aquatica*	x	x				
bông sung đồng	*Nymphea sp.*	x					
ốc đắng	*Sinotaia sp*						
vẹm	*Palaeoheterodonta*						
hến	*Corbicula fluminea*						
Tôm	*Penaeus sp.*						
Tép	*Macrobrachium sp.*						
Cua	*Brachyura sp.*						
Lươn	*Anguilliformes*	x	x				
Rắn nước	*Matrix piscator*						
Rắn bông súng	*Enhydris enhydris*						

22 Appendix VII

22.1 Application of the Ecosystem Approach to strategic wetland management in Vietnam's Mekong Delta

See attached report.