



**PARTICIPATORY MANAGEMENT OF MANGROVE RESOURCES
(PMMR) PHASE 1 FINAL REPORT**

**MANGROVES MEANDERINGS:
LEARNING ABOUT LIFE IN PEAM KRASAOP WILDLIFE
SANCTUARY**

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**SUPPORTED BY: IDRC, CANADA / MINISTRY OF ENVIRONMENT, CAMBODIA
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FINAL TECHNICAL REPORT FOR PARTICIPATORY MANAGEMENT OF MANGROVE RESOURCES IN CAMBODIA

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ACRONYMS

ADB	Asian Development Bank
AIT	Asian Institute of Technology
APHEDA	Australians Promoting Health and Education Development Abroad
CARE	Collaboration Assistance Relief Everywhere
CBCRM	Community-based Coastal Resource Management
CBNRM	Community-based Natural Resource Management
CCU	Coastal Coordinating Unit
CEMP	Cambodian Environmental Management Project
CEPA	Culture Environment Prevention Association
CF	Community Forestry
CORIN	Coastal Resource Institute
CoRR	Coastal Resources Research
CZM	Coastal Zone Management
DANIDA	Danish International Development Assistance
DFFH	Department of Fishing, Forestry and Hunting
DoE	Department of Environment
EIA	Environmental Impact Assessment
ETAP	Environmental Technical Advisory Program
FAO	Food and Agricultural Organization
GIS	Geographical Information System
GTZ	German Technical Cooperation
ICLARM	Integrated Center for Living Aquatic Resources Management
IDRC	International Development Research Center
IK	Indigenous Knowledge
IO	International Organization
IRIC	Integrated Resource Information Center
IRS	Indian Remote Sensing
KR	Khmer Rouge
MoE	Ministry of Environment
MOU	Memorandum of Understanding
NGO	Non Governmental Organization
PA	Protected Area
PKWS	Peam Krasaop Wildlife Sanctuary
PMMR	Participatory Management of Mangrove Resources
PR	Participatory Research
RGC	Royal Government of Cambodia
SPEC	Support Program to the Environment in Cambodia
SWOTS	Strengths, Weaknesses, Opportunities, Threats, Strategies
UN	United Nations
UNDP	United Nations Development Program
UNTAC	United Nations Transitional Authority Committee
WI	Wetlands International
WWF	World Wildlife Fund

ACKNOWLEDGEMENTS

It is people that make a project possible and, fortunately for us, the Participatory Management of Mangrove Resources team has been involved with amazing people. This acknowledgement section is particularly difficult to write considering how many people have supported our work: villagers, chiefs, government staff, co-workers, friends and family. Our list could easily be pages long. Those of you involved with our work you have helped us immensely. You know who you are, the gems in life who makes ones path easier.

The PMMR team has had tremendous support both from within and outside Cambodia. IDRC has provided excellent training and learning opportunities that range from workshops, study tours to direct 'hands-on' field support. A special thanks to Dr. Gary Newkirk who has continuously supported our work, asked us fantastic questions and encouraged us to 'learn by doing'. Dr. Brian Davy has played an essential supportive role back in Ottawa, Canada helping us out immensely. Thank you both.

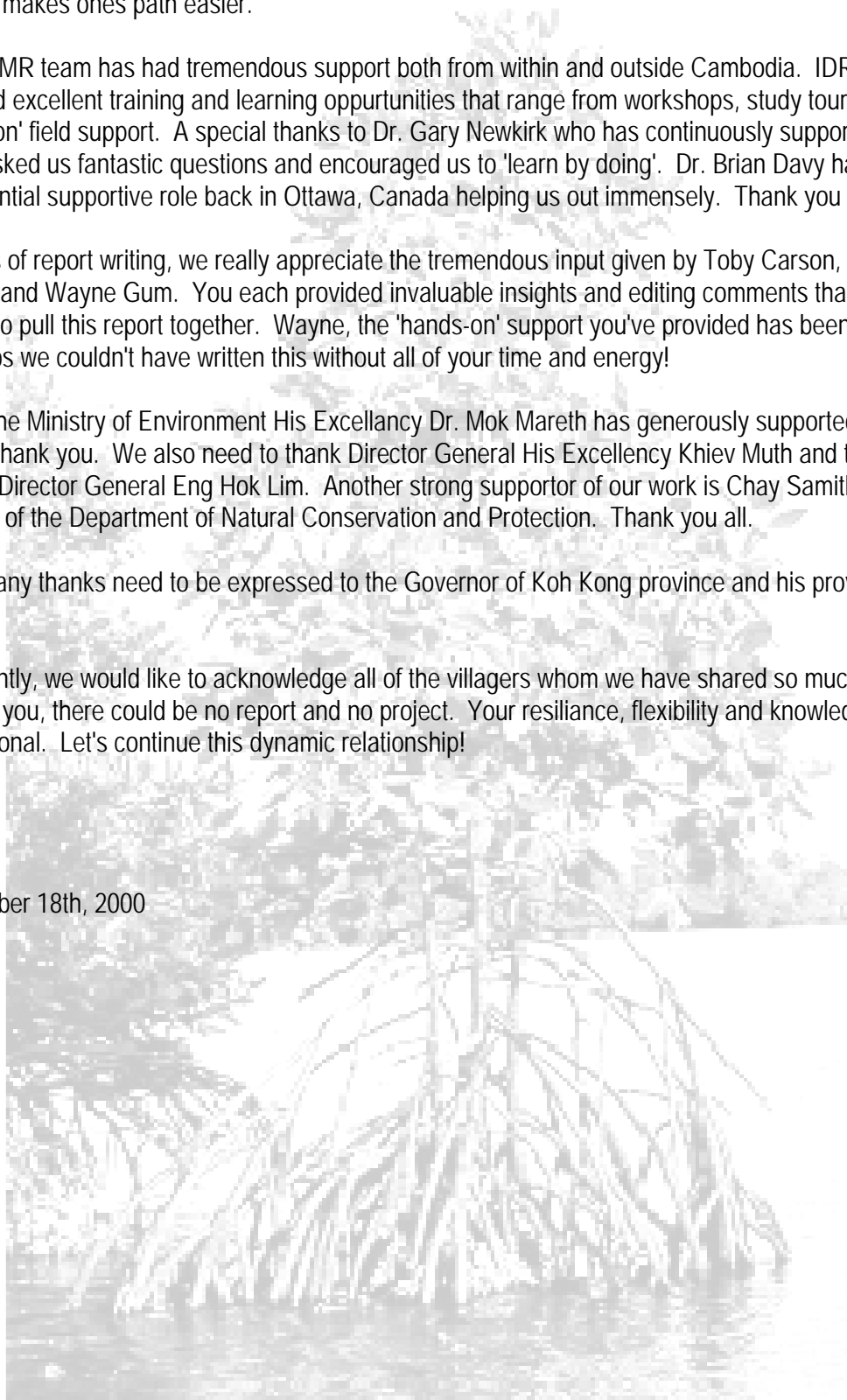
In terms of report writing, we really appreciate the tremendous input given by Toby Carson, Noelle O'Brian and Wayne Gum. You each provided invaluable insights and editing comments that really helped to pull this report together. Wayne, the 'hands-on' support you've provided has been amazing and Tobs we couldn't have written this without all of your time and energy!

Within the Ministry of Environment His Excellency Dr. Mok Mareth has generously supported our work. Thank you. We also need to thank Director General His Excellency Khiev Muth and the Deputy Director General Eng Hok Lim. Another strong supporter of our work is Chay Samith, Director of the Department of Natural Conservation and Protection. Thank you all.

Also, many thanks need to be expressed to the Governor of Koh Kong province and his provincial officers.

Importantly, we would like to acknowledge all of the villagers whom we have shared so much with. Without you, there could be no report and no project. Your resilience, flexibility and knowledge is inspirational. Let's continue this dynamic relationship!

PMMR
September 18th, 2000



EXECUTIVE SUMMARY

The Participatory Management of Mangrove Resources (PMMR) project was implemented in Peam Krasaop Wildlife Sanctuary (PKWS), Koh Kong province in December 1997. Consisting of national Ministry of Environment staff, provincial technical staff and Canadian project advisors, this interdisciplinary team facilitates a participatory research (PR) process in PKWS focusing on sustainable livelihood and management issues. One of the requirements from the funder, Canada's International Research Development Center (IDRC), is that PMMR's research be documented in the form of a Technical Report. Hence, this Technical Report compiles research undertaken by the PMMR team from December 1997 until February 2000. It is hoped that those interested in Koh Kong province, Protected Areas (PA's) Management, Community-based Coastal Resource Management (CBCRM) initiatives and sustainable livelihood issues can learn and further this research.

PKWS boasts a unique mangrove ecosystem, and was designated as part of Cambodia's system of PA's in 1993. Although this area was once rich in natural resources, illegal extraction activities threaten the mangrove ecosystem and the livelihood of communities dependent upon its' resources. This project was established as an attempt to learn more about resource usage in PKWS, and to work with communities on livelihood and resource management activities. This report introduces the reader to PMMR project goals and activities. Importantly, the research methodology employed throughout the research process is discussed and analyzed. This project is driven by the PMMR team, and supports local initiatives and potential alternatives in a culturally appropriate manner. This project is both process and output driven.

Koh Kong province is isolated from other parts of Cambodia and relatively unpopulated. Until recently, one could only access eastern Koh Kong province, the area where the PMMR project works, via boat. After the catastrophic Khmer Rouge (KR) regime some villagers, faced with landlessness in other parts of Cambodia, migrated into Koh Kong hoping to earn a living from the lush resources found in the coastal area. However, migrants and local villagers were not the only people interested in mangrove and aquatic resources – there is also business pressure from Thailand. Most resources from PKWS, including aquatic resources, logs and illegally produced mangrove charcoal, are sold to the Thai market. Cambodian's continue to be lured to the area in the hopes of making a profit. Unfortunately, resources have been rapidly depleted, and it is now difficult for local people to earn a livelihood from resources in PKWS.

The PMMR team has worked in a series of villages in PKWS. Villages in the Wildlife Sanctuary are inter-connected, although villages definitely hold their own unique characteristics. Villagers live in PKWS for a variety of reasons: as long-term residents, for resource extraction opportunities, for fishing opportunities, for government work (navy, military, police, government officials) or following family to the area. Some in-migrants consider PKWS their home whereas others plan to return to their birth province. Understandably, villagers hold different interests and connections with their environment. As environmental awareness has increased, there is a growing demand from both villagers and government authorities to work towards measures that will protect the mangrove resources of PKWS. While this is a positive step, it remains a challenge to convince 'power' players who benefit greatly from resource extraction of the long-term benefits of resource conservation initiatives.

PKWS is diverse in mangrove species, aquatic species, upland species, corals, sea grass and waterfowl. This is a diverse, fascinating ecosystem. Much of the traditional knowledge held by local residents in PKWS has been lost because of the KR and the rapid in-migration into the area.

However, even new-comers to the area hold bits and pieces of environmental knowledge, and as a cumulative effort people are able to shed insights into different mangrove species and how they can be used. The predominant use of mangrove species is for charcoal production that is then sold to the Thai market. Also, mangrove wood is used for house construction, charcoal and green mussel culture.

Unfortunately, aquatic resources are also rapidly depleting. Illegal offshore trawling activities from both Cambodian and Thai trawlers wreck the sea-bottom and contribute to the significant decline in aquatic species. Local fishers now spend far more time fishing than they did ten years ago. In response to fish declines, some local fishers are resorting to illegal cyanide and grenade fishing in the hopes of earning higher fish returns.

Perhaps there are ways to address some of these issues. For example, small-scale fishing gear helps to maintain sea grass beds, corals and minimize the waste fish that are caught. Silviculture for charcoal production is another possibility. And, as government authorities and local people consider management initiatives, aquaculture activities can then be possible. A limited amount of testing was introduced during the past two-years, although siting is a problem given security issues in PKWS at night. Further market surveys will shed insight into how the market fluctuates and potential species that could be sold to the Thai market.

Legislation supporting environmental protection is limited. Although some legislation is either being drafted or has just been passed, dissemination of these legal instruments is minimal. Moreover, legislation is drafted in Phnom Penh and often does not meet the needs of rural, coastal communities. The draft *sub-decree on Protected Area's Management* will affect villagers in PKWS through a zoning system that dictates what resources can be used where. Although legislation is important, it is equally important to develop systems that allow local villagers to work on resource protection measures. Fortunately, this concept is gaining ground in Cambodia and it is hoped that communities will be able to work with relevant authorities in resource protection measures.

The finalizing of this Technical Report coincided with an internal phase 1 PMMR project review. Considering how new Community-based Coastal Resource Management (CBCRM) and PR concepts are for the PMMR team and how isolated PKWS is, a lot has been accomplished over the two-year period. While the team continues to need more technical support, the PMMR team has facilitated a process that enables local, provincial and national level government authorities to learn from and dialogue with local people. Villagers are being encouraged to take local initiatives; indeed, a lot can be learned from the communities of PKWS. As villagers analyze their problems and become more confident in voicing their ideas and solutions, measures allowing for income generation activities while supporting resource conservation techniques can be found.

CHAPTER I: INTRODUCTION TO THE PMMR TWO-YEAR TECHNICAL REPORT

This technical report summarizes two years of research undertaken by the Participatory Management of Mangrove Resources (PMMR) team, a Ministry of Environment (MoE) project funded by the International Development Research Center (IDRC), in Peam Krasaop Wildlife Sanctuary (PKWS), Koh Kong province, Cambodia. This is the first major report produced by the team and provides a comprehensive overview of community resource uses in PKWS.

The reader is first introduced to the PMMR project, main research activities and the research methodology employed throughout the two years. Following this introduction, fieldwork findings are presented. A wide range of topics pertaining to PKWS are examined including: an introduction to the study area; the villages and the natural resources; resource use patterns; roles and responsibilities of governmental institutions working in PKWS and Cambodia's legal framework for environmental protection. Further workshop reports, appendices or other documentation are referenced throughout – this documentation should be referred to when additional details are required. The editing of this Technical Report coincided with an internal evaluation of phase 1 of the PMMR project, and highlights of these proceedings have also been included. Conclusions and recommendations stress successes and constraints within this project, along with possible objectives for phase 2 work.

HOW THIS REPORT WAS WRITTEN

The findings within this Technical Report are a result of a cumulative effort from the PMMR team. Members organized and conducted field research, documented and analyzed their findings and then began the long process of sorting through information to combine the most relevant details into this Technical Report. The PMMR team first drafted a version in Khmer, which included much of the history and institutional analysis found in this report. That report was then translated into English, and the Project Advisor(s) began editing information. After discussing 'what was missing,' further research took place. As more information compiled, it was then edited and included into this version of the report. Although it took a significant amount of time to produce this document, this was an excellent learning experience and helped the PMMR team to review and focus its' learnings of the past two years.

WHERE TO FIND WHAT

The project goals and objectives¹ are listed below. Research findings are woven throughout this report, and appendices further supplement these discussions. Included under each objective heading is the chapter number(s) where specific information relating to an objective is presented.

Objective 1:

TO DOCUMENT AND ASSESS PATTERNS OF RESOURCE USE AND THE DEPENDENCY OF LIVELIHOOD ON MANGROVE RESOURCE DIFFERENTIATED BY SOCIAL GROUPS, WITHIN THE CONTEXT OF DEVELOPING A FRAMEWORK FOR CBCRM.

- See Chapter 3 and 4.

Objective 2:

¹ For a more detailed summary of the project's goals, refer to the phase 1 project proposal.

TO IDENTIFY AND EVALUATE THE INSTITUTIONAL ARRANGEMENTS IMPORTANT FOR MANGROVE RESOURCE MANAGEMENT IN A COASTAL VILLAGE AND THEIR RELATION WITH COMMUNE, PROVINCIAL AND NATIONAL INSTITUTIONS, AND TO ASSESS THE FEASIBILITY OF THESE OR AS NECESSARY ALTERNATIVE INSTITUTIONS FOR THE MANAGEMENT OF PKWS;

- See Chapter 5.

Objective 3:

TO EVALUATE THE ROLE OF LOCAL COMMUNITIES IN, AND SUPPORT THEM IN DRAFTING PLANS FOR, MANAGEMENT OF THE KOH KAPIC RAMSAR SITE AND PKWS WHICH WILL IMPACT LOCAL COMMUNITIES;

- See Chapter 6.

Objective 4:

TO ASSESS THE STATUS AND RECENT CHANGES OF THE MANGROVE, SEAGRASS BEDS AND CORAL REEFS IN KOH KAPIC RAMSAR SITE AND PKWS, AND DOCUMENT THE DISTRIBUTION AND EXPANSION OF COMMUNITIES IN THE AREA;

- See Chapter 3.

Objective 5:

TO ASSESS, THROUGH PR, OPTIONS FOR SUSTAINABLE LIVELIHOODS IN ONE VILLAGE HIGHLY DEPENDENT ON THE MANGROVE ECOSYSTEM AND AS POSSIBLE, TEST OPTOINS FOR FOOD PRODUCTION AND INCOME GENERATION ON A PILOT SCALE.

- See Chapter 2 and 6.

WHO IS THE PMMR TEAM?

The PMMR team is an inter-disciplinary team composed of national MoE and provincial Department of Environment, Department of Agriculture and Department of Rural Development staff. Many individuals have helped the team in numerous ways; however, the following team members have worked consistently with the project:

National Level

Mr. Kim Nong, Project Leader, Ministry of Environment;
Mr. Nin Vanntha, Field Team Leader, Ministry of Environment;
Ms. Mean Sok Aun, Office Support, Ministry of Environment.

Provincial Level

Mr. Khy An, Team Member, Department of Fisheries, Koh Kong;
Mr. Chey Pich Rathna, Team Member, Department of Environment, Koh Kong;
Mr. Ven Virak, Team Member, Department of Environment, Koh Kong;
Mr. Som Chea, Team Member, Department of Rural Affairs, Koh Kong.

National Consultants

Mr. Vann Monyneth, Coastal Coordinating Unit, Ministry of Environment;
Mr. Chan Dara, Ministry of Transportation;
Mr. Mak Sideth, Department of Education, Ministry of Environment.

International Consultants

Mr. Toby Carson, Project Advisor (1997 onwards);
Ms. Melissa Marschke, Project Advisor (September 1999 onwards; Master's student 1998).

IDRC Advisors

Dr. Gary Newkirk, Dalhousie University, CoRR;
Dr. Brian Davy, Program Officer, IDRC.

Each team members' contribution has been invaluable. Indeed, this project depends on the passion and energy of both the PMMR team and of villagers. Community members are inspirational in their resourcefulness and dedication to their environment in spite of the hardships and challenges faced in PKWS.

SUMMARY OF PMMR ACTIVITES²

The following activity time-line is divided into six months periods³ to provide an overview of project activities. Not included in this time-line are the many meetings that have taken place over the two years with different NGO's, IDRC staff, other project's, government departments and individuals. In order to facilitate the many training and study tours, the team has networked with many individuals and projects. The collaboration section of this chapter (page 17) contains more information on formal institutional collaborations.

PERIOD 1: DECEMBER 1997 TO MAY, 1998

ACTIVITY SUMMARY	TIME-LINE
❑ Project initiation, planning and team selection	Dec. 1997
❑ Coral Reef Training, DANIDA – CZM	Jan 1998
❑ <i>Mangrove, Fisheries and Aquaculture Workshop</i> , co-funded with DANIDA	
❑ Facilitated study tour for IDRC and MoE officials;	Feb. 1998
❑ Workshop report writing;	
❑ Team leader joined DANIDA - CZM study tour in Thailand;	March 1998
❑ Preparation for PRA training and study tour with ICLARM;	
❑ PRA Training, Koh Kong, Tambouyog, the Philippines;	April 1998
❑ <i>Case-study writing workshop</i> in Hue, Vietnam;	
❑ ICLARM study tour in Thailand and Malaysia;	May 1998
❑ Study tour report writing;	
❑ Began investigating resource use patterns, initial bird survey work and collecting institutional information for Koh Kong.	

During the first 6 months of the PMMR project, activities focused on project implementation, relationship building and training for the team. The goals and objectives of the proposal and the research philosophy, design and methodology were reviewed and discussed by the team. Training and study tours were a first step in building team capacity and the capacity of provincial authorities and technical departments, particularly related to CBCRM and mangrove conservation initiatives.

² For specific details on workshops, training's and study tours, see Appendix A.

³ Refer to first annual PMMR report for Year 1's activities, outputs and work plan.

PERIOD II: JUNE 1998 TO NOVEMBER, 1998

SUMMARIES ACTIVITIES	TIME-LINE
<ul style="list-style-type: none"> ❑ Project review and planning for next 6 months; ❑ ICLARM workshop on <i>Management of Fisheries, Coastal Resources and the Coastal Environment in Cambodia: Institution Legal and Policy Perspectives</i>; ❑ Began case study on Institutional and Management Analysis of PKWS, Koh Kong Province for case writing project on CBCRM in Southeast Asia; 	June 1998
<ul style="list-style-type: none"> ❑ PMMR team join training on <i>Participatory Management and Zoning of Protected Area</i> held by ETAP/UNDP, SPEC, IDRC and WWF; ❑ Introduced Master's student, Melissa Marschke, to village chiefs in PKWS; ❑ Low research activities because of Cambodian National Election 	July 1998
<ul style="list-style-type: none"> ❑ Began socio-economic field work; ❑ Prepare case study; ❑ Case Study Writing Project on CBCRM, the Philippines; 	Aug. 1998
<ul style="list-style-type: none"> ❑ Networking at the national and local levels; ❑ Field research: socio-economic data, historical resource use profiles; ❑ Facilitated the <i>Environmental Education and Mangrove Resource Protection through local Community Participation</i> training course for local villagers. 	Sept. 1998
<ul style="list-style-type: none"> ❑ Workshop report writing; ❑ Mangrove transect in Koh Kapi stream, mangrove and shrimp farm data; ❑ Organizing technical report guidelines; 	Oct. 1998
<ul style="list-style-type: none"> ❑ Write the first PMMR annual report; review phase 1 work; prepare work plan for the second year; 	Nov. 1998

During the second six months of the project, the PMMR team spent a lot of time in the field with local people learning how to do field research. At the same time, more networking took place within the region i.e. study tours and case study writing workshops. The 1998 summer election period proved difficult for field work as all government departments and local authorities were busy with election campaigning. September's Environmental Education workshop in Koh Kong was an exciting event, since it enabled villagers to learn about their environment and to share their reality with our team. This was the first village-level workshop in PKWS that focused on local people and their issues.

Period III: December 1998 to May, 1999

SUMMARIES ACTIVITIES	TIME-LINE
<ul style="list-style-type: none"> ❑ Completed the next six-month plan; ❑ Follow-up research on institutional analysis, roles and responsibilities; ❑ Fieldwork: research on: charcoal production; fishing patterns; upland species; grouper culture. Review of mangrove replanting and protection measures for PKWS; 	Dec. 1998
<ul style="list-style-type: none"> ❑ Reviewed project objectives; ❑ Field work: fisheries data, began identifying local species; Facilitated the <i>Workshop on Participatory Mangrove Forest Resources Protection and Conservation in PKWS</i>; ❑ Began mapping connections with IRIC; 	Jan. 1999
<ul style="list-style-type: none"> ❑ Study tour for PMMR team and village chiefs on Participatory Experiences of Communities in Coastal Resource Protection and Conservation, CORIN Thailand; ❑ Began local testing of small-scale aquaculture techniques; ❑ Reviewed project activities with Dr. Gary Newkirk, and planned for the project evaluation meeting in the Philippines; 	Feb. 1999
<ul style="list-style-type: none"> ❑ Facilitated a trip to Koh Kong for the Minister of Environment; ❑ Prepared a report on PMMR activities for upcoming workshop in the Philippines; 	March 1999
<ul style="list-style-type: none"> ❑ <i>Workshop on Evaluation and Planning for the Implementation of CBCRM</i>, the Philippines; ❑ Training for provincial team member on Mangrove and Aquaculture Friendship, Vietnam; ❑ Fieldwork: helped MoE control water quality in PKWS; organized an Environmental Clean-up Day of Koh Sralao Village with gov't authorities; 	April 1999
<ul style="list-style-type: none"> ❑ Provided information to the media on the clean-up of Koh Sralao village; ❑ Team meeting to compare activity results with the project work plan; prepared next six month work plan; ❑ National Workshop on Forest Community; ❑ Fieldwork: monitoring aquaculture test sites; visiting crab culture site; research coral reef and sea grass species; supported mangrove replanting; researched history of Peam Krasaop; 	May 1999

During the next six months (the second year of the project), the team focused on participatory planning. A CBCRM study tour in Thailand was organized for the PMMR team and village chiefs to learn and exchange ideas about community organizing around mangrove resources and resource planning and management. A workshop was held with technical departments to discuss resource planning and to link resource management with long-term sustainability. As a continuation of fieldwork, the team worked with villagers on aquaculture testing, mangrove replanting, environmental education regarding waste management in Koh Sralao and undertook a survey on upland forest species.

PERIOD IV: JUNE 1998 TO NOVEMBER, 1999

SUMMARIES ACTIVITIES	TIME-LINE
<ul style="list-style-type: none"> ❑ Coordinated IDRC mission to Cambodia; secured six-month project extension; reviewed field activities; began work for phase 2 proposal; ❑ Fieldwork: IDRC project review 	June 1999
<ul style="list-style-type: none"> ❑ Planning: drafting a six-month plan; project design, goals and objectives for next phase; ToR's for project counterparts in next phase; evaluation and monitoring plan; draft budget notes; ❑ Research into the draft sub-decree on PA management, issues of zoning and boundary demarcation; RADARSTAT mapping; ❑ Provincial team member participated in the workshop on "Biological Monitoring Water Quality" ❑ Fieldwork: set up K.K. office; 4 day-long community planning meetings in PKWS; 	July 1999
<ul style="list-style-type: none"> ❑ Fieldwork: workshop report writing; helped community leaders prepare a country paper for the workshop In the Hands of the Fishers, Trang, Thailand; prepared a draft map to define the Community Development Zone, Buffer Zone and Core Zone with the team; visited mangrove replanting site; choose green mussel site; ❑ Key meetings with MoE staff inputting into the draft sub-decree on PA Management; ❑ Compiled pictures to share with participants at the SI2 conference in Halifax and with others to show the PMMR project activities and results; 	Aug. 1999
<ul style="list-style-type: none"> ❑ SI2, PR research for CBCRM, Halifax, NS; reviewed last three months of the project (project advisors, team leader, provincial level staff); ❑ Team members not at SI 2 participated in the Workshop Wetlands and IK; ❑ SI2 follow-up, wrote a 'concept note' for Phase 2; planning for next 3 months; ❑ Study tour and information exchange with the FAO 'Participatory Resource Management in the Tonle Sap' project in Siem Reap; 	Sept. 1999
<ul style="list-style-type: none"> ❑ Technical report; ❑ Fieldwork: local bird and mangrove survey; green mussel cultivation; introduction to the 'new village'; meeting with the Governor on strategies to help; GIS training; report writing skills for provincial team. 	Oct. 1999
<ul style="list-style-type: none"> ❑ Reviewing CBCRM Khmer method book and CCU Newsletter; ❑ Fieldwork: Researched and wrote <i>Smashed Livelihoods: life as a charcoal producer in PKWS</i> case study; collaboration with DANIDA for livelihood inputs, specifically mangrove training; facilitated ADB study tour; ❑ Reviewed technical report and drafted objectives for phase 2 proposal with Gary; 	Nov. 1999

During the final six months of phase 1, the PMMR team focused both on planning (six-month planning, phase 2 project proposal) and fieldwork. The main outputs included a draft version of this two-year technical report, research into the process of mapping and boundary demarcation, and providing input on the draft *Sub-decree of Protected Areas* in Cambodia. The research team worked closely with local communities to discuss initial ideas on how planning and management in PKWS could work at a local level. Fieldwork activities included mangrove and bird surveys and a case study entitled, *Smashed Livelihoods: life as a charcoal producer in PKWS*. Finally, a series of study tours both inside and outside Cambodia enabled the team to discuss and learn more about PR and CBCRM issues.

PERIOD V: DECEMBER 1999 – FEBRUARY 2000

SUMMARIES ACTIVITIES	TIMELINE
<ul style="list-style-type: none"> ❑ Community Forestry Workshop, Sihanoukville combined with field visits to the mangrove replanting site, Kampot and Ream National Park; ❑ Fieldwork: research on middleman / laborer relationship; mapping on where fishers fish; follow-up information for Smashed Livelihoods; transect walks with elders on medicinal properties and identification of mangrove species; monitoring of green mussel culture; more report writing skills for provincial team; ❑ Phase 2 proposal, field reporting; 	Dec. 1999
<ul style="list-style-type: none"> ❑ Meeting's with: WI, DANIDA, CCU, Canada Fund, Oxfam America, ADB on collaboration issues; ❑ Finalizing mapping options: GTZ Dept of Forestry (LANDSTAT and IRS imagery), Aruna Technologies (RADARSTAT imagery), IRIC (aerial photography); ❑ Fieldwork: workshop preparations; <i>Workshop on Participatory Planning and Management of PKWS</i>; green mussel monitoring; visit to the 'new village'; working with Checkpoint staff on 'facilitation skills' in kiln destruction; organizing trip for Minister of Environment and Canadian Ambassador to PKWS (fell through because of waves); 	Jan. 2000
<ul style="list-style-type: none"> ❑ Writing: incorporated comments into <i>Smashed Livelihoods</i> case study; finished English and Khmer versions of Workshop Report; finished inputting into the Technical Report; ❑ Fieldwork: began water resources case study; green mussel monitoring; ❑ Mapping: boundary comparison; ❑ Evaluating two years of project; preparing an evaluation plan for next phase; ❑ Reviewing the technical report, case studies and finalizing phase 2 proposal. 	Feb. 2000

The first months of 2000 have been part of an extension phase, where the team has focused on finishing research and editing this technical report. The initial steps of developing the second phase proposal have taken place and an internal project evaluation has been completed. The team facilitated a workshop on *Participatory Planning and Management in PKWS*, which built on previous workshops and introduced the need for collaboration on issues such as boundary demarcation. Field research also continued. As a continuation of field research, the team began gathering information on water resources in PKWS, continued monthly green mussel testing and in early March facilitated a study tour with the Minister of Environment, the Canadian Ambassador and a representative of USAID.

METHODOLOGY

The PMMR team has adopted a participatory research (PR) strategy whenever possible i.e. fieldwork, facilitation of group meetings and workshops and in training courses. PR methodology is a new research approach in Cambodia, and was combined with more traditional research approaches⁴.

PR has been a successful method for encouraging community cooperation and participation in data collection and analysis of local issues. PR techniques enable villagers to work together to develop their own plans for resource management. Importantly, PR fosters strong relationships between relevant institutions, communities and researchers. PR provides opportunities for everyone to learn from each other and it forces people to work together rather than focus on conflicts.

⁴ Traditional research strategies include survey techniques, secondary data collection and structured interviews.

The team learned to do PR research in a number of ways:

- ❑ One short, intensive training course on PR given by Filipino experts;
- ❑ Reading PR methodology books;
 - ❑ Translating the CBCRM PR book into Khmer;
- ❑ Attending workshops with other organizations i.e. DANIDA-CZM workshops;
- ❑ Attending workshops on PR in Thailand and Canada;
- ❑ Learning by doing i.e. fieldwork and organizing workshops.



A villager presenting the results of her group discussion to the larger group.

Photo: PMMR, September 1998

PR techniques have been used with many levels:

- ❑ Local authorities;
- ❑ Technical departments;
- ❑ Respected elders;
- ❑ Long-time residents of PKWS;
- ❑ Groups with IK or environmental experiences;
- ❑ Newcomers to PKWS;
- ❑ General population.

The PR tools used in these sessions include: mapping exercises, seasonal calendars, problem trees, historical transects, oral histories, venn diagram's and ranking exercises⁵. These exercises have been done in workshops, large and small group meetings, with individuals and in focus groups i.e. gender perspectives, IK.

PR was used to collect information for various component objectives. The PMMR team facilitated a process that enabled team members and the target group to learn from each other. Research has allowed for a two-way transfer of knowledge. A PR process engages communities in discussions relevant to their environment, and enables communities to rank their problems and to prioritize potential actions. Community members have participated in study tours in Thailand and Sri Lanka that have focused on community-level discussions of resource management issues and potential solutions. Environmental education has a close link with PR because a participatory style is used when teaching people or facilitating group discussions and workshops on environmental issues i.e. mangrove degradation, waste management, fish declines.

The team analyzes information through a strength, weakness, opportunity, threat, strategy (SWOTS) analysis. This tool to help the team organize and analyze information while also considering strategies that could help local people.

EXAMPLES OF THE PR PROCESS⁶

What follows are two examples of the PMMR team's PR work:

In October 1999 the PMMR team worked with local villagers on a mangrove survey. The team was interested in learning from local villagers about their understanding of the mangrove environment and how they used mangrove species. A Thai mangrove species book was used as reference material.

⁵ See the IDRC CBCRM tool kit for details on specific tools.

⁶ For an analysis of PR methodology in Cambodia see Chapter VI of this technical report or read Marschke, M. 1999. Participatory Research: is this possible in rural Cambodia? *Out of the Shell*. Halifax: CoRR.

Time was spent in each village working with groups of people to identify mangrove species and specific qualities known to these mangroves i.e. location, uses, medicinal values. After fieldwork, the team compiled the findings and then returned to the communities to discuss and enhance the results. A day was spent with village elders to learn more about traditional medicine. This process was a useful way for the team to gather information about mangrove species in PKWS, and group discussions enabled villagers to learn from each other. In fact, more villagers should be included on mangrove walks with elders.

A mapping process was also undertaken to learn more about where villagers fished. The team began by gathering information about the type of fishing gear used in each village and then worked with village groups to map the areas where villagers fished according to each gear type. This information was compiled on a sketch map, which will be particularly useful when the PMMR team begins working on 'management' issues.

COLLABORATION

IDRC's philosophy supports collaboration - organizations can support each other and enhance each other's learnings'. Although the PMMR team, until recently, has worked largely in isolation in Koh Kong province, there has been tremendous encouragement both in-country and regionally. Such support has led to more formal collaborations and initiatives.

The PMMR team has organized workshops with DANIDA-CZM and participated in study tours hosted by both DANIDA-CZM and by the ICLARM project. The team has worked with the Cambodian national NGO CEPA to participate in the *In the Hands of the Fishers* workshops in Thailand and plans to organize a workshop in Cambodia later in 2000.

The DANIDA-CZM project supported an international mangrove expert to assess Cambodia's coastal resources. This expert spent several weeks in Koh Kong working with the PMMR team assessing mangrove sites and strengthening the PMMR team's understanding of the mangrove eco-system. It is hoped that further collaboration in this next phase of the DANIDA-CZM project will continue and strengthen the work of both projects.

CARE - Australia is now working in two villages of PKWS and plans to use some of the PMMR research findings in the development of a proposal on sustainable rural livelihoods.

An important regional link has been facilitated through IDRC's CoRR as it has enabled the team to participate in case study writing workshops, PR workshops and evaluation workshops with participants from Canada, Vietnam, the Philippines and Cambodia. This international forum provides an excellent venue for information exchange and networking.



Villagers living in PKWS visit Ream National Park to exchange ideas with other villagers working on resource management initiatives.

CHAPTER II: INTRODUCTION TO KOH KONG PROVINCE

HISTORICAL BACKGROUND OF KOH KONG PROVINCE

The history of Koh Kong province has never been clearly documented in Khmer, French or English. During the French Protectorate, there was no official name for what is now known as Koh Kong province as this entire area was then managed under Kampot province⁷. Since Kampot province covered a large area and was difficult to manage, the Royal Government of Cambodia (RGC) under King Sihanouk created Koh Kong province around 1960.

Koh Kong province has always been relatively isolated from other cities in Cambodia, especially Phnom Penh. The area was considered to be source of epidemics: fever, diarrhea and other diseases and was considered to be a 'prison' of sorts. Historically, government staff who abused their power were banished to Koh Kong and Cambodian's, escaping persecution elsewhere, fled to the area.

Koh Kong has always held strong economic links with Thailand - this province has bounced back and forth between Thai and Khmer leadership. Interestingly, one temple found in Koh Kong town dates back hundreds of years and is depicted with traditional Khun Chhang-Khun Phen story.⁸ This indicates Koh Kong's historical connection with Cambodia.

Koh Kong's name was derived from Koh Kong Island. Voyagers sailing ships throughout Kampot crossed back and forth between a series of islands including the vast Koh Kong Island. The present day provincial town, Koh Kong town, was once a base for the City of Royal Armed Forces⁹. General Lon Nol, Major Sok Chiep, first Governor of Koh Kong province and Captain Sek Sam Eatt, second Governor of Koh Kong province, under the control of King Sihanouk were involved in establishing Koh Kong town.

In 1958, with the aim to develop Koh Kong prosperously, King Sihanouk altered government policy and appointed government officials and asked for volunteers to work for the province. The City of Royal Armed Forces developed during this period. Additionally, schools, hospital, banks and administration buildings were established. National route No. 18 (now national route No. 48) was also constructed between 1960-1962. Fish processing and ice plants were constructed in 1963-1964 and managed by the State. However, the Khmer Rouge (KR) (1975 – 1979) era changed all of this.

During the KR period, villagers were forced inland to live on communal rice farms. After the KR, a few returned to their coastal villages and others fled to Thailand. For Khmer in other parts of Cambodia, villages had been destroyed and KR guerilla activities continued. Some people sought to make their livelihood in other provinces including Koh Kong. Many of these newcomers have migrated into the coastal communities within PKWS¹⁰.

⁷ Under Kampot jurisdiction, two districts encompassed Koh Kong province: Koh Kong district (now Koh Kapic commune) and Kompong Som district (now Sre Amble).

⁸ This is an old Khmer story; however, the team is not so clear as to the history of this story.

⁹ Name given to the Royal Army.

¹⁰ Marschke, 1999.

Koh Kong became province became a major smuggling route in the 1980's of a series of products, including narcotics, sex workers and natural resources. Although smuggling activities have lessened, illegal activities continue to thrive in the border areas of Koh Kong province. During this time period, the Vietnamese played a significant role in Cambodian politics.

In the early 1990's Cambodia began opening its doors to the rest of the world. The United National Transitional Authority Committee (UNTAC) elections took place in 1993. Lasting 21 months and costing more than 2 billion dollars, the purpose of this UN operation was to oversee the democratic election agreed to in the 1991 peace process and to promote post-conflict reconstruction and rehabilitation¹¹. While the international community largely declared UNTAC a success, UNTAC also caused problems. For example, although many Khmer refugees were repatriated, the number of internally displaced persons increased. In part, this accounts for the increase in people in Koh Kong: a resource rich area that appeared to offer better opportunities than one's home province. At the same time, market pressures from Thailand for resources significantly increased.

GENERAL STATUS OF KOH KONG PROVINCE

GEOGRAPHICAL FEATURES

Koh Kong province is located in the south-western part of Cambodia. Koh Kong borders Pursat province in the north, Kampong Speu province in the east, Kampot province in the south-east, Sihanoukville in the south, and the Gulf of Thailand and Thailand in the west. The distance from Phnom Penh to Koh Kong province (through national route No. 18 / 48) is roughly 350 km. Koh Kong province covers an area of 11,637 km². Its coastline is 237 km, stretching from the Cambodia-Thai border at Cham Yiem point to the boundary of Sihanoukville.



Koh Kong province is divided into 8 districts: Smach Meanchey, Mondul Seima, Koh Kong, Kiri Sakor, Botum Sakor, Thmor Bang, Sre Ambel and Kampong Seila¹². These districts are then divided into 30 communes. Within these communes, there are 124 villages.

Koh Kong's terrain is either mountainous or coastal: around 70 percent is mountainous (the Cardamom mountains) and 30 percent is coastal¹³. Koh Kong is known for its resources and natural beauty. The coastal zone is rich in bio-diversity with estuaries filled with mangrove stands, fresh water streams and sandy beaches. Further inland, there are reported to be excellent areas for rice production.

¹¹ Marschke, 1999

¹² Kampong Seila has just been set up (late 1998), before belonging to Sre Ambel District.

¹³ PMMR team estimations

CLIMATE AND WATER PROPERTIES

Average temperature rates are between 24° and 38°C in Koh Kong province. Although the saltwater temperature (between 27.1° and 30.9°C) does not vary greatly, the atmospheric temperature does. The annual average rainfall is 1,070 mm. The climate in Koh Kong province is influenced by the tropical monsoons - there is a dry and wet season. In the dry season, winds blow from the land to the sea i.e. from northeast to southwest. Then, the sea is calm with small waves. The average wind speed is merely 2-4 m/s. On the contrary, during the wet season when winds blow from the sea onto the land, winds reach an average of 16 m/s.

There is no meteorological station in Koh Kong province to record sea tides; however, it appears that tide levels are low during the rainy season and fluctuate by about 0.70 m whereas during December and January tides reach their highest fluctuation around 2 meters¹⁴.

Salinity significantly changes between the wet and dry season, ranging from 10 ppt to 35 ppt. Oxygen concentration only changes a little averaging 4.8 mg / l¹⁵.

ECOSYSTEMS

Within Koh Kong province one finds a diversity of ecosystems: mangrove forests, mountainous forests, coral reefs and sea grass beds where a host of wild animals, fish and other aquatic habitat thrive. The systems are diverse: fresh water systems¹⁶, mangrove estuaries and sandy beaches all linked to the sea and islands dot the waterway¹⁷.

TRANSPORTATION, TELECOMMUNICATION AND MEDIA SYSTEMS

All transportation routes were destroyed during the war (1970). Therefore, one can connect to Koh Kong via waterway or air transportation¹⁸. The existing road network is only for around Koh Kong town although a number of major logging roads are under construction. National route 48 was officially opened by Prime Minister Hun Sen for construction on April 27th, 2000 and, when completed, will connect Koh Kong with Phnom Penh.

There is a telecommunication system between Koh Kong town and other cities and countries. However, email and internet is not yet possible. Normally, people use Thai and Khmer radio and television.

SOCIO-ECONOMIC STATUS

DEMOGRAPHY, SETTLEMENT AND OCCUPATION

The total population of Koh Kong province is 127,554, including 63,540 women¹⁹. There are 6 ethnic groups: Khmer, Thai, Chinese, Vietnamese, Cham and Lao; however, the population is predominately Khmer or Koh Kong - Thai²⁰.

¹⁴ Tide fluctuations have not been formally measured: these numbers are calculated from discussions with local villagers and team observations.

¹⁵ PMMR team, 1999.

¹⁶ Five major rivers flow through Koh Kong province.

¹⁷ There are 24 islands in Koh Kong. All the islands are significant as a barrier to prevent waves, strong storms, for fishermen and other people at sea. These islands are also served as habitat for fishery resources and beautiful natural recreation.

¹⁸ Air transportation began re-operating in February 2000 after the runway was successfully de-mined.

¹⁹ Cambodian National Census, 1999.

²⁰ Long-term residents sometimes refer to themselves as Koh Kong-Thai, given the long-term affiliation with Thailand (and isolation of Koh Kong from Phnom Penh) and that long-term residents often speak both languages or a mix of Thai and Khmer.

There are two kinds of people in Koh Kong: long-term settlers and in-migrants. In general, in-migrants have come to Koh Kong from central and eastern Cambodian provinces²¹. In-migrants can be government officials, business people, fishers, shrimp farm owners, loggers (forest collectors) or charcoal producers. For some in-migrants, Koh Kong is a temporary home while others re-establish themselves here.

People choose to settle in Koh Kong in part for its natural resources and employment opportunities. Those who are sellers mostly live in and around Koh Kong town, and those who are fishers generally reside in the coastal area and islands, such as the people who live in Koh Kong, Mondul Seima and Botum Sakor districts. Farmers, who do crop production and shifting agriculture, usually reside in mountainous, forested and highland areas. For instance, the people in Thmar Bang and Kampong Seila districts depend on logging, crop farming, forest wine production and forest by-product collection.

There has been a net influx of people since 1979; in fact, it is estimated that the average annual growth rate in Koh Kong is 16 %²². For specific numbers in population increase, see Appendix B. Unfortunately, over time the increase in population has put pressure on mangrove resources.

POPULATION STATISTICS PER FAMILY IN THE DISTRICTS OF KOH KONG PROVINCE

District	1995 # of families	1998 # of families
Smach Mencheay	3 567	5 425
Mondel Siema	1 476	2 434
Koh Kong	844	1 767
Kiri Sakor	742	1 249
Botum Sakor	1 979	3 281
Thmor Bang	648	1 291
Sre Ambel	6 212	9 182

²¹ These provinces tend to be over-populated, and are characterized by poor rice yields from drought.

²² Khim, L. 1997. *A Case Study of Environmental Planning in Koh Kong Province*. Phnom Penh: MoE.

Chapter III:

PKWS, ITS VILLAGES AND ITS NATURAL RESOURCES

PEAM KRASAOP WILDLIFE SANCTUARY (PKWS)

PKWS is one of Cambodia's 23 protected areas, and was officially established by the *Creation and Designation of Protected Areas Royal Decree* dated 01 November 1993. PKWS is one of 10 Cambodian Wildlife Sanctuaries and of 6 protected areas in Koh Kong province. PKWS covers an area of 23,750 km², and boasts a mangrove ecosystem.

Protected Area Map of Cambodia

This large Wildlife Sanctuary was created because of the unique mangrove habitat: the mangroves are some of the largest and densest in Southeast Asia. Many different birds use the Wildlife Sanctuary on their migratory routes, substantial wildlife lives within the area, and aquatic life flourishes within the mangrove ecosystem. Humans also depend upon the mangroves for various livelihood activities including fishing, crabbing and charcoal kiln production and exportation.

There are a series of waterways found within PKWS; specifically, Toul Koki stream, Tach Tai stream and Tropang Ruing stream. Two estuaries are found within PKWS: Peam Krasaop estuary (Peam Krasaop commune) and Lamdam estuary (Koh Kapic commune). Hence, PKWS provides an excellent habitat for aquatic creatures and wildlife.

The PMMR team is mainly working within three communes of PKWS:²³ Peam Krasaop commune, Toul Koki commune and Koh Kapic commune. The PMMR team has undertaken the bulk of its fieldwork in these communes, focusing on socio-economic data collection, environmental data collection, management planning and sustainable development options for villages. Numerous field trips, group discussions, environmental education sessions and PR activities have taken place in each of these communes. Research findings shed insight into village issues, and should be considered when working with other villages and communes in PKWS and Koh Kapic Ramsar site.²⁴

A SNAPSHOT OF SOME OF THE VILLAGES IN PKWS²⁵

THE BEGINNING OF SETTLEMENT: PEAM KRASAOP VILLAGE

Peam Krasaop village has been used by Thai and Khmer fishers for years as a docking area. Small huts were constructed of wood and bits of scrap material, and this is the oldest fishing village in PKWS. Perhaps of all the villages in PKWS, this village holds the strongest connections with Thailand. Many villagers continue to speak a mix of Thai and Khmer. The Commune chief, who also resides in this village, is strongly committed to environmental protection. He has worked extensively with the PMMR team, undertaking various initiatives to stop illegal resource extraction activities, replant mangroves and to teach people about the importance of a healthy future for the area.

²³ There are 3 districts with 6 communes in PKWS.

²⁴ Ramsar sites are wetlands deemed to be of international ecological significance. There are three Ramsar sites within Cambodia. One village exists in Koh Kapic Ramsar site that is not part of the PKWS boundaries.

²⁵ For a further, more detailed look at resource changes over time, family profiles and changes in villages, see Marschke, M. 1999. *Using Local Environmental Knowledge: a case study of resource management practices in PKWS*. Master's Thesis: Dalhousie University.

KOH KAPIC VILLAGE

Koh Kapic is a long established fishing village located in PKWS. Prior to the KR, this village was the administrative headquarters for the area. Koh Kapic is surrounded by mangrove forests and the sea; the small upland area is now an abandoned coconut plantation. Fishing and fishing activities provide the main livelihood for villagers, although some people cut mangrove trees, make charcoal or sell goods. Over 500 families live in this village.

Due to the former abundance of lush, tall mangroves, and rich bio-diversity, the RGC incorporated Koh Kapic into Koh Kapic Ramsar Site. Unfortunately, the famous Koh Kapic stream, which leads into Koh Kapic village, was clear-cut during the 1998 election period. Reports suggest that district authorities were involved.

KOH SRALAO VILLAGE

Koh Sralao is another old fishing village located within PKWS; perhaps established in the 19th century. This village has attracted many newcomers over the years, often lured by the economic incentives found within mangroves. The majority of villagers either fish or, until the 1999 charcoal crackdown, produced charcoal²⁶. Now, 270 families live in Koh Sralao.

Koh Sralao is 2 600 m long (east to west) and 2 100 m wide (north to south); the highest point is 27 m from sea level. Koh Sralao's terrain can be divided into upland and lowland sites.

- ❑ Lowland sites: cover 65% of the total area of the village, located in the western part of Koh Sralao. Lowland sites consist of high grasses and abandoned rice fields;
- ❑ Highland sites: perhaps covering 35 % of Koh Sralao, this terrain is hilly and forested. In the highlands, people do upland farming.
 - ❑ The highland areas provide an excellent water supply source for villagers. Cultivated crop species include: banana, pineapple, palm, sugarcane, jack fruit, potato, corn, rambutan, cashew, and custard apples.

KOH KANG VILLAGE

Koh Kang is a newly established charcoal production village. This village is located in the heart of the wildlife sanctuary, near the Department of Environment (DoE) Checkpoint. Although charcoal kilns no longer exist in Koh Kang, many villagers cut mangrove trees or generate charcoal deep in the mangrove forest²⁷. A large number of charcoal exporters live in Koh Kang. Villagers are all newcomers to the area; indeed, people were lured to the area because of the rumored abundant resources. There are now 100 families in Koh Kang.

TOUL KOKI VILLAGE

Toul Koki is a long established rice-farming village, near national route # 48, surrounded by both mangrove and upland forests. Its terrain is considered as a highland site, where there are plenty of mountainous forests and water systems that connect to the coastal area. Most villagers earn their livelihood through rice farming and upland agriculture; the remaining villagers fish, cut mangrove

²⁶ This is an excellent example about the state of flux in villages. For some reason, charcoal production within Koh Sralao remained rampant long after charcoal production had been curbed in other villages (the production was obviously backed by the police and other 'power' people). However, in the fall of 1999 all the charcoal kilns were destroyed. Some villagers switched to crab trapping, others fled to their homeland (the population decreased by 63 families in the past year) and a few others took up illegal logging activities (only to be caught in January, 2000).

²⁷ It is difficult to talk to middlemen in Koh Kang because of the proximity to the DoE's Checkpoint and the illegal nature of this activity. It appears that some charcoal middlemen switched to being crab trapping middle men in the fall of 1999 and some fled to their home provinces (3 of the 6 former charcoal middle men remain in Koh Kang). It appears others switched to green mussel production.

wood, make charcoal or sell goods. For farmers, fishing practices supplement the family income or are undertaken for subsistence use. There are 95 families living in this village.

LINKS BETWEEN VILLAGES

Communities, while isolated, remain dependent upon each other for a variety of reasons: consider water supply resources (see page 35) or the role of middle person's (see page 38). There are also family connections between villages. For example, the Chief of Peam Krasaop Commune is the brother of the Vice-chief of Toul Koki Commune. Both these long-term residents are committed to resource management issues, and strongly influence villagers. Also, in the mid-1980's Koh Sralao grew extensive amounts of opium that was then processed in Toul Koki village for sale. The PMMR team should undertake more research in the next phase of the project to further understand the linkages of the villages with each other. Certainly, villagers are not as isolated as it appears and at the same time each village has its own unique characteristics.

NET IN-MIGRATION TO PKWS

Prior to 1975, most people who lived in the PKWS area were born there. However, newcomers from provinces and municipalities of Cambodia have come to PKWS, along with a few Thai and Vietnamese. The population of PKWS is around 9 000 people (see Appendix B) and as many as 90 %²⁸ of villagers are newcomers. Elders died during the KR regime, others fled to other countries and some people moved elsewhere in Cambodia. The following population statistics were gathered during group interviews and through discussions with each village and commune chief over the past two years. Interestingly, there has been a net decrease in population as charcoal kilns have more consistently been destroyed.

Each village has faced an increase in population. Some chiefs, elders and villagers were quite specific about numbers and when their population had increased, others could not be as specific

POPULATION CHANGES IN PEAM KRASAOP WILDLIFE SANCTUARY				
Year	Toul Koki	Koh Kapi	Koh Sralao	Koh Kang
1970	90 families	More than in 1998	100 families	
1975 KR				
1979/81	7 families	50–70 families	27-40 families	
1985	40 families		70 families	20-30 families
1990	50 families	250 families	140 families	120 families
1995	60-70 families		220 families	120 families
1998	95 families	590 families	303 families	120 families
2000	?	?	270 families	100 families

suggesting that population had been steadily increasing especially since UNTAC.

People have migrated into PKWS because of:

- ❑ A low population density and abundance of natural resources;
- ❑ Favorable conditions for livelihoods in terms of fishing, charcoal production, trading and farming;
- ❑ PKWS (1980-1993) was considered an important economic corridor for the import-export of goods between Cambodia and Thailand;

²⁸ Bann's 1996 economic study placed the in-migration rate at 97 %; however, time in the villages suggests that perhaps more than 3 % of villagers are longer time residents. Statistics aside, there has been a significant net in-migration into villages. The question then becomes, after how long is someone no longer a newcomer? For example, people who have lived in PKWS for more than 15 years, while not born to the area, now consider this home and hold significant local knowledge.

- ❑ Natural disasters and shortage of land in other provinces;
- ❑ Socio-political factors.

SETTLEMENT IN PKWS

People reside closely together, living in clusters or in villages. Housing structure and style depends upon the village location; for example, if the village is near mangroves or upland forests. Villagers in coastal communities use mangrove wood for construction purposes:²⁹ perhaps 70 % of the house is made from mangrove wood and 30 % of the houses are made from upland timber³⁰. A few houses are made from concrete although this is a material that only the rich can afford. Most villagers are poor and are forced to use odd scraps in combination with mangrove wood and thatch.

In Koh Sralao, as in other mangrove fishing villages, villagers settle in the lowland areas near the water. This is easy for communication, fishing and boat mooring. Houses in Koh Sralao are all wooden. The following roofing material was observed on houses in Koh Sralao:

- ❑ 48 % thatch roof;
- ❑ 42 % zinc roof;
- ❑ 10% cement roof.

²⁹ See the PMMR *Local Mangrove Survey* for details of which mangrove species are used for construction purposes.

³⁰ PMMR, 1998.

The housing quality then can be divided into the following categories:

- ❑ 5 % good quality;
- ❑ 10 % medium quality;
- ❑ 35 % poor quality;
- ❑ 50 % very poor quality.

MANGROVES AND THEIR USES IN PKWS³¹

Mangrove forests are fertile, diverse saltwater ecosystems found in the coastal zone which provide food and shelter for inhabitants. These productive natural environments provide breeding habitats for a variety of birds, reptiles, mammals, insects, fish species, crustaceans and shellfish. New plant tissue is constantly being broken down within these forests, thereby contributing to the life support system for vast numbers of animal consumers including humans. Human dwellers further find a primary source of income, fuel, medicine and other basic necessities for their livelihood within mangrove forests.

PKWS covers a large area of mangroves³² that can be divided into tree, palm, shrub and vine species. The results of the local mangrove survey, undertaken by the PMMR team in October / November 1999³³ (see Appendix C), indicated over 64 different mangrove species (including palm, shrub and vine)³⁴. An overview discussion of mangrove species and uses in PKWS follows.

In general, the predominant mangrove along the estuarine system of PKWS is the *Rhizophoran sp.* especially *Rhizophora apiculata*, while a mix of species inhabit the extensive rear or depression estuarine areas³⁵. The *Rhizophoran sp.* grow in soft mud, near the edge of the stream; hence, such species are easily visible and accessible. *Rhizophora apiculata* are burned for charcoal, used for house construction and the root of the tree is used for medicinal purposes. It is ground and mixed with lemon juice to relieve pain when pricked with the scales of a fish.

Forest production is highest in the depression forests and here mangrove trees grow to their tallest³⁶. Such tremendous growth could once be observed in the now decimated Koh Kaptic stream. At the stream's edge a few *Bruguiera sp.* and *Xylocarpus sp.* remain intact at a height of 25 – 30 m. *Bruguiera sp.* are used for charcoal in PKWS and house construction and its' fruit can be ground and made into a rice-like soup. *Xylocarpus granatum* is used for house construction. Interestingly, when the seeds are taken from the fruit (known as canon ball fruit), ground into a powder and mixed with CaCO₃, this concoction is excellent for treating wounds.

Avicenia sp. often grow together along the sandy coast where tides fluctuate. Such conditions extend throughout the estuaries between Peam Krasaop village and Koh Kaptic village. These species of mangroves are adaptable to high salinity and to sand; indeed, the leaves can be identified by their salty taste. Their trunks are large, solid, tough and protect against strong waves and storms. The crowded growth of these species creates good habitats and allows for other species of

³¹ This section is informed by extensive fieldwork undertaken with mangrove expert Michael Mastaller and in working with Wayne Som Sak's father, a traditional medicine man. Thank you both for the extensive time you spent working with the team.

³² For a more detailed description and discussion of mangroves in Cambodia and mangrove replanting techniques, refer to Mastaller, M. 1999. *Environmental Assessment of the Coastal Zone of Cambodia: assessment of sustainable livelihood alternatives to mangrove exploitation*. DANIDA:CZM.

³³ See methodology section for a detailed description of the methodology used in this survey. For specific results, refer to Appendix C. This survey focused on local knowledge of mangrove species, location, threats, uses and medicinal values.

³⁴ Of these 64 mangrove species, the PMMR team has observed 47 of these species. More time will be spent with elders to see if other species can be found.

³⁵ Mastaller, 1999.

³⁶ Mastaller, 1999.

mangroves to grow behind the *Avicennia sp.* When these species are cut, the protective barrier is gone and other species, especially *Rhizophora sp.* die because their roots suffocate from being buried in sand. The death of *Rhizophora* can be observed in front of Peam Krasaop village, where IDRC and CEPAC attempted, somewhat unsuccessfully³⁷, to replant mangroves. For information regarding the multiple uses of the *Avecenia sp.*, see the PMMR *Local Mangrove Survey*, Appendix C.

Apart from these species, other species are observed along the coastline. For example, *Heritiera littoralis* also grows in sandy areas. These tall trees easily indicate signs of stress: the tops die when the ecosystem is not healthy. When someone has stomach ulcers, people boil this bark and mix with pepper, garlic and CaCO_3 to relieve the ulcer. The *Sonneratia sp.* also grow well in sandy areas, and people use the fruit of this tree to make sour soup.

As one continues towards the upland areas (away from the coastline of PKWS), mangrove vegetation changes slowly to freshwater vegetation and terrestrial forest types, for example, the *Melaleuca* tree. In the infertile, silty river banks, *Nypa* palms frequently cluster, often accompanied by dense growths of mangrove ferns, *Acrostichum sp.* These ferns cluster together as undergrowth in the higher portions of the rear mangrove communities³⁸. Vine mangrove species mostly grow on or hang on stems of mangroves growing in hard muddy areas.

Although mangrove species can often be found in layers parallel to the riverine border, mangrove species can also be found in patches. For example, one finds patches of both *Ceriops sp.* which is excellent for silviculture for charcoal production (fast growing, burns well) and *Exoecaria agallocha*. Interestingly, this itchy, poisonous sap causes blindness and diarrhea and if people drink the sap, they can die; however, women use the leaves to steam their faces after giving birth. *Lumnitzera sp.* are also observed in PKWS. This species tends to grow in clusters and in harder muds: tides do not always reach these areas. This wood is excellent for both construction and charcoal purposes.

OTHER MANGROVE INITIATIVES IN CAMBODIA

The APHEDA project in Kampot, Cambodia replanted 5 ha of mangroves in an abandoned shrimp pond (active from 1983 – 1987) in 1995. The entire 5 ha took one month to replant. Mostly *Rhizophora apiculata* propagules were planted, with a few *muscrunata*, and some *Avecenia sp.* and *Ceriops sp.* on an experimental basis. The *Rhizophora sp.* were growing excellently; in fact, the mud surrounding the *Rhizophora sp.* was softer than the mud in other areas of the replantation site and life was returning to the area. The first time the area was replanted, with seedlings, it did not take (small crabs ate the seedlings, roots did not hold). The second time that the propagules were transplanted was successful. During this time, APHEDA produced a children's storybook in Khmer dealing with mangrove ecology and replanting. The pictures in the storybook are really well presented and easy to follow. The PMMR team should consider making such a book for PKWS in its second phase.

CHARCOAL PRODUCTION IN PKWS

For an in-depth look at the different sizes of kilns that have been found in PKWS, see Appendix D. This Appendix also provides an estimation of the amount of mangrove trees used for charcoal production in 1998.

³⁷ IDRC replanted 8 ha of mangroves (*Rhizopharan* propagules) in 1998 in this area. The success rate was not so high because of the intense wave action and lack of protection. In the future, it would make more sense to build up the protective layer (i.e. with species that are resistant to sand suffocation) and then to plant *Rhizophora apiculata*.

³⁸ Mastaller, 1999.

HISTORY OF CHARCOAL PRODUCTION IN PKWS

Nobody knows exactly when charcoal production began; however, elders in Toul Koki and Koh Sralao report that charcoal activities have operated since their grandparents' time. Probably, mangrove charcoal kilns were established during Sihanouk Regime and were under the direct administration of the Department of Fishing, Forestry and Hunting (DFFH). Management and control of charcoal production was effective because people asked permission from the DFFH, could only make charcoal in specific zones and paid taxes. Mangrove cutting was done through sound techniques i.e. a selective cutting, rotation system and mangrove replanting. Usually, the charcoal kiln was large. Its bottom diameter was 5 - 8 m and height was 3.5 - 6 m. Kilns were located in 9 locations within the location now known as PKWS.³⁹ Those who produced charcoal at that time were rich.

INCREASE IN CHARCOAL PRODUCTION

In Koh Sralao village, in 1980, there were 2 - 3 charcoal kilns built to supply local cooking fuel demands. However, charcoal production dramatically increased in the late 1980's when the charcoal market opened in Thailand. Charcoal producing families owned anywhere between 5 – 16 kilns, and could rely solely on the profits from charcoal production for survival. Since charcoal production is illegal, the RGC began cracking down on charcoal production in the mid-1990's. Such mangrove exploitation has led to an intense battle between the DoE and local people. As soon as kilns were smashed, new charcoal kilns spring up. Some charcoal kilns were supported by local authorities, thereby avoiding destruction⁴⁰. The DoE has little money for enforcement activities, and only recently has the DoE attempted to enforce charcoal kiln destruction in a consistent manner.

People have responded by fleeing deeper into the mangrove forests, and producing smaller charcoal kilns. By the late 1990's, charcoal production had significantly decreased and only poor people continue to make charcoal as earlier profits are no longer attainable. Some people have returned to their birth provinces, others have begun fishing and others still have fled deeper into the mangroves, now using soil kilns to avoid detection. For more specific details about charcoal production, legislation and a local reality, see the PMMR February 2000 case study *Smashed Livelihoods: life as a charcoal producer in PKWS*.

ECONOMICS OF CHARCOAL PRODUCTION

Although no economic study has taken place to compare the time and effort it takes to produce charcoal with the effort it takes to fish for different species with different gears, charcoal producers and fishers all reported that it is far easier to produce charcoal than it is to fish. One does not require the start up gear or the training that it takes to become a fisher. Charcoal production is hard work, especially when one has to cut down the trees or build the kiln, but one has plenty of waiting time when the kiln is burning. Once charcoal is produced, one is able to sell the whole amount for a lump sum of money. One could earn around US\$ 24 per medium size kiln per burning. Therefore, the effort to make charcoal is seen to be far less than the work of a fisher, who is forced to work daily.

Some former charcoal producers have switched to fishing as production has become increasingly controlled; however, many former charcoal producers also decided to return to rice farming in their home provinces rather than to take up fishing activities.

³⁹ Charcoal was made at: Lor Ta Ngiev, Preak Kdouch, Koh Kapic, Koh Sralao, Koh Chark, Koh Sne, Koh Kang and Khing Khong.

⁴⁰ Kilns were backed by military or police and other authority figures were rumored to own the kilns themselves. DoE staff were known to sometimes accept bribes to allow kilns to remain operational.

As enforcement of charcoal has increased, so too has the price of charcoal. This follows the classic demand and supply curve. As the supply decreases, the demand continues therefore driving charcoal prices up. For those charcoal producers that can avoid having their kiln destroyed, there is the potential of high returns.

THE AVERAGE MARKET PRICE FOR CHARCOAL

Year	Price per kg in Thai Baht	Price per kg in \$ US
1997	2.15 Baht	\$ 0.05
1998	2.4 Baht	\$ 0.05
1999	2.55 Baht	\$ 0.06
2000	4.16 Baht	\$ 0.1

Source: PMMR team observations

MANGROVE SPECIES USAGE

Villagers reported that they used the following species for charcoal production.

- | | |
|---|--|
| <input type="checkbox"/> <i>Bruguiera cylindrica</i> ; | <input type="checkbox"/> <i>Ceriops decandra</i> ; |
| <input type="checkbox"/> <i>Bruguiera gymnorrhiza</i> ; | <input type="checkbox"/> <i>Lumnitzera littorea</i> ; |
| <input type="checkbox"/> <i>Bruguiera sexangula</i> ; | <input type="checkbox"/> <i>Lumnitzera racemosa</i> ; |
| <input type="checkbox"/> <i>Cerbera odollam</i> ; | <input type="checkbox"/> <i>Rhizophora apiculata</i> . |
| <input type="checkbox"/> <i>Rhizophora mucronata</i> ; | |

These species can also be used for firewood, although villagers mostly reported using *Rhizophora apiculata* for firewood (given its abundance, this makes sense).

Villagers use the *Phoenix paludosa* (mangrove palm) and *Lumnitzera sp.* as poles for green mussel culture; also, some people used bamboo wood. Since it is now difficult to find these species, people resorted to using upland forest species (Khmer name 'Samach') for green mussel culture after the rainy season of 1999. It remains to be seen how successful this upland wood will be in terms of culture collection.

In general, mangrove species are used extensively for house construction. Particular species are used for house pillars, walls and for roof structures. *Nypa* palms are used as wall and roofing material. Hard woods, like the *Lumnitzera sp.*, are used as bases in houses and as posts in bridges.

Some mangrove species are also used for fishing gear or in aquaculture. However, at this point in time the PMMR team only has general information and not the specific species that are used. Villagers report that mangrove species are used for fish and crab traps, *Phong*⁴¹ *Phang* posts, fish refuge barricades, fish barriers and green mussel posts. In the past, the mangrove bark of some species is also used for tanning and dyeing fishnets.

AQUATIC FAUNA

According to the geographical features of PKWS, aquatic fauna can be divided into three types:

- ☐ aquatic fauna in salt water;
- ☐ aquatic fauna in brackish water;
- ☐ aquatic fauna in fresh water.

However, some aquatic fauna can live in more than one of the water types or in the various salt concentrations. For example:

- ☐ *White Seabass*: fresh, brackish or salt water;

⁴¹ This is the Khmer name for coastal bag net.

- ❑ *Red Seabass* and *Grouper sp.*: brackish and salt water;
- ❑ *Giant Freshwater Prawn* and *Blowfish sp.*: freshwater (in the rainy season freshwater flows from highland areas or mountainous areas).

Some aquatic fauna change their habitat according to the seasons and their life cycles (see Appendix E).

So far, there has been no detailed, proper documentation of coastal aquatic fauna. There was fisheries research undertaken by scientists from the Soviet Union in cooperation with Khmer scientists from the Department of Fisheries in 1983 – 1986. However, this research focused on offshore aquatic fauna. Although there is little scientific research, the PMMR team recognizes PKWS as an area with a variety of aquatic fauna, and provides habitat for spawning, feeding and growth. Dolphin and the sea cow species have also been found in PKWS. Further research is required in this area.

FISHING

Fishing methods and seasons have changed over time. Traditionally, gear was not overly efficient, thus ensuring that resources were not over-exploited⁴². Prior to the KR, there were specific seasons for fishing, and laws ensuring that people did not fish during the spawning season were enforced. The PKWS area was firmly managed by DFFH officials who were able to educate fishers. At that time, mangrove species were quite abundant and there was little destructive action or clearance of mangrove forest for shrimp farming.

As the population has increased, so too has the number of fishers in the PKWS area. Since 1990 when the Thai market was opened up and more efficient fishing gear was introduced (often illegal i.e. cyanide fishing or illegal trawling), villagers have noticed a gradual decline in resources. Most people in PKWS no longer fish merely for subsistence purposes⁴³, and while some people continue to crab trap, other fishing gear is also used. Fishers now use nylon nets; trawlers use polysynthetic nets. Push netting and trawling in shallow waters is illegal, as is dynamite and cyanide fishing; however, illegal fishing is quite popular.

Fishers using medium and large-scale gear should be taxed, and illegal activities should be prohibited according to the *Fisheries Law*. Moreover, anyone exporting fish to Thailand should be paying taxes. In reality, few people are ever taxed as the Department of Fisheries has neither the capacity nor the power to monitor and enforce fishing activities in and around PKWS. Technically, the *Fisheries Law* determines the tax depending upon the gear type, amount and size used.

In general, the following small-scale types of fishing gear are found in PKWS:

- ❑ CRAB TRAP: Used to catch mangrove mud crabs and swimming crabs. Fishers use a rowboat with fixed oars or long tern boats with a 5 Hp engine. Families may have anything between 50 to more than 100 traps, with one or two members crab trapping;
- ❑ CRAB NET: Used to catch swimming crab. People use a long stern boat with a 5 Hp engine. Two people operate the crab traps. Each family has between 1-3 Units of net (1Unit = 10 Hands, 1 Hand = 25 m);

⁴² According to the Fisheries Law, traditional gear refers to gear that is used for subsistence purposes. That is, if someone has 20 crab traps then they are using traditional gear (regardless of material) whereas if someone has more than 100 crab traps this person is then using modern fishing gear, and therefore subject to taxation. Trawling would never be considered traditional since one would never use trawling gear merely for subsistence purposes.

⁴³ In those villages, such as Toul Koki, that are not solely dependent upon fishing for their livelihood, families do continue to fish for subsistence purposes.

- ❑ FISH NET: People use different sizes of fish nets to catch fish in sites near the coastline and in the sea. People use a long stern boat with engines of different horsepower.

For a detailed look at the type of fishing boats and the horsepower of the engines used in each village, see Appendix G.

PROCESSING OF FISHERY RESOURCES

There are two types of fish processing, described as follows:

- ❑ Small-scale or subsistence processing: dried salt fish, salt fish, fish sauce, mollusk fermentation etc.;
- ❑ Large-scale or market processing: shelling of crab for pure meat, small shrimp fermentation, jellyfish processing, fish freezing etc. These products are exported to Thailand and sold to local markets.

The following table, compiled data from different field visits, depicts the changes in resources and lifestyle in PKWS. Elders who have resided in the area for a long time contributed significant information.

EVOLUTION OF NATURAL RESOURCES USAGE IN PKWS

Time Period	Activities or Occurrence
1953 to 1970	<ul style="list-style-type: none"> ❑ Low population, subsistence fishing (traditional gear used); ❑ Market for production in Singapore (boat came to buy fish); ❑ Families worked fishing boats together; abundant supply of fish; ❑ Better 'management' by the Department of Fishing, Forestry and Hunting (DFFH); villagers took part in mangrove replanting; ❑ DFFH controlled charcoal production (limited to specific sites);
1970 to 1975	<ul style="list-style-type: none"> ❑ Similar to 1953 – 1970 time frame; ❑ Government management systems began to break down with the war; ❑ Some people fled the area because of fear and the disruption caused by the war;
1975 to 1979	<ul style="list-style-type: none"> ❑ No people live in PKWS (only Pol Pot 's Navy);
1979 to 1989	<ul style="list-style-type: none"> ❑ Abundant supply of fish (could easily catch 100 kg / family / night); number of fishers increased; ❑ Mangrove wood burned for charcoal; in the late 1980's there was a significant increase in charcoal production; ❑ The area was controlled by the Department of Agriculture; ❑ Provincial authority controlled the number of in-migrants into the area;
1990 to 1993	<ul style="list-style-type: none"> ❑ Fish catch began to decline as population increased; ❑ Mangrove destruction activities increased; ❑ Shrimp farming began; ❑ Fishing gear became more efficient (and illegal as with trawling or dynamite fishing) ❑ Poor management due to political crisis; net in-flux of people; ❑ Opening up of export markets i.e. Thailand.
1994 to 1997	<ul style="list-style-type: none"> ❑ Illegal fishing gear used; family catch / night / family is 12 kg; ❑ Nearly 800 ha of the mangrove forest cleared for shrimp farms; ❑ Large market for charcoal exports; ❑ Large net in-migration, little 'management' in the area;

	<ul style="list-style-type: none"> ❑ Declared a wildlife sanctuary in 1993, MoE took charge; ❑ Strong military, police and navy activities in the area; un-controllable illegal activities causing serious mangrove degradation;
1997 to 1999	<ul style="list-style-type: none"> ❑ Shrimp farms proved unsuccessful (diseased each other out because of poor siting) so less and less land was cleared for shrimp ponds; ❑ Continuing decline in resources i.e. fish and mangrove ❑ Fewer people have access to fishing modern fishing gear i.e. trawlers, some resort to cyanide fishing, crab trapping or green mussel culture; ❑ Charcoal exportation activities continue, perhaps somewhat reduced at times; ❑ Given tighter control of the area, some migrants returned to their birth provinces; ❑ 1998 elections proved to be a resource extraction bonanza, since then activities were somewhat more controlled.

As noted, there have been significant changes in resource abundance over time. Most villagers, even those that have lived in the area for only a few years, are able to discuss the changes in resources and suggest possible reasons. Where villagers are not always able to make a link is between the cutting of mangrove trees for charcoal and the decline in fisheries resources (some do and some do not).

AQUACULTURE IN PKWS

Aquaculture development is favorable in PKWS given the geographical context and natural resources found in this region. To date, coastal aquaculture includes extensive, semi-intensive and intensive shrimp pond culture, crab farms and green mussel culture.

Perhaps shrimp culture began in a limited manner in the early 1980's. By the early 1990's, investors from Thailand became interested in the Cambodian market. Apparently, Thai investors had World Bank money and needed to spend it so they picked the Cambodian market, even though experts warned of potential problems. The soils are too peaty and no matter how much lime one adds to compensate, the pH remains too acidic. By 1997, there were 23 shrimp farms that covered over 800 ha. However, since early 1998 most of the shrimp farms have stopped operations.

Shrimp farms have not been successful in PKWS considering how poorly sited ponds were and that inadequate waste ponds were built. In 1999, one shrimp farm remained operational with one or two ponds operating. The owner was experiencing a significant loss with this operation. One pond is one hectare. Extensive shrimp culture and semi-extensive shrimp culture has also not been that successful in this region. Extensive shrimp culture and crab fattening is being tested in one of the old shrimp ponds. Shrimp production is low: perhaps 100 kg in two months. Crab fattening has also just begun and there is no indication of how successful this will be⁴⁴. Crab fattening was also being tried near Koh Kang - but when the crabs molted, the hard crabs ate the soft crabs. Despite these problems, it appears that many of the sites would be ideal for crab fattening and crab culture. Interestingly, a few abandoned shrimp ponds appear to be natural breeding grounds for *Grouper sp.*, *Sea Bass*, *Milk Fish* and *Talipia sp.*⁴⁵.

⁴⁴ We recently learned that the crab fattening, for some reason, had not been successful. Perhaps because we noticed that the pond could not be adequately drained.

⁴⁵ *Talipia* is known as a non-indigenous species; somehow it has been introduced into this area.

GREEN MUSSEL CULTURE

Green mussel culture began near Koh Kang village, PKWS in 1994. Initially, green mussels were cultured as feed for the shrimp farms (between 1994 – 1997). However, when shrimp farms collapsed in 1998 people were forced to find alternative markets for their product. The market price in Thailand was high, and people began exporting green mussels and in 1999 the number of people growing green mussels increased.

To culture green mussels, poles are planted vertically into the bottom of the stream. The spat collects in October or November and the harvest is in April or May. The PMMR team has planted an area with 3 000 poles to learn more about how green mussel culture works and to gain a better understanding of the difficulties faced in mussel production.

It is estimated that in 1998 there were 15 owners of green mussel poles; however, the market price fell and in 1999 there were only 6 – 7 owners of green mussels. The market price for green mussels was stable in 1999, and as a result there are now 10 owners of green mussel poles for the 2000 season. It remains to be seen what the market price will be for green mussels come harvest time.

OTHER CULTURES

Grouper and snapper culture were tried, unsuccessfully, with one villager near Koh Sralao. Grouper culture began in January 1999, and was followed by snapper culture in February 1999. Although the project was begun enthusiastically, the villager, eventually, lost interest.⁴⁶

Grouper culture and snapper culture were not successful because:

1. SITING – the cages were placed too close to the house, for security reasons, with low tides of less than 1 m;
2. UPLAND RUNOFF – in the upland areas, one of the yellow creepers are processed into a powder that is then exported to Vietnam to be used in some medicine. When processing this plant, sulfuric acid and chloridic acid are used;
3. CYANIDE FISHING – these wastes are harmful to the fish; the grouper did not appear healthy;
4. MARKET CONSTRAINTS – the Thai market was unstable i.e. buying and selling price the same; therefore, no profit;
5. COSTS – it is difficult to find trash fish for feed. Snapper especially like to eat a lot;
6. FRESHWATER – since one can only raise saltwater fish for a six-month period until the rains begin, this is not a suitable time period to raise fish for the market.

If market constraints eased up and the pens were to be sited in a different location, perhaps these fish species could be successfully raised six-months per year. Until the market becomes more stable, it is not recommended that *Snapper sp.* or *Grouper sp.* should be raised.

The PMMR team thinks that perhaps *sea bass* might be a good fish to try pilot testing. *Sea bass* can grow in fresh, marine and brackish waters; although it can be problematic when the salinity changes quickly. Market prices for *Sea bass* are strong in Thailand and appear to be stable.

Although the department of fisheries has suggested that more people begin to raise *Talapia sp.*, there is no Thai market for *Talapia sp.* right now. Caution should be taken before encouraging people to raise this non-indigenous species. Increasing numbers of this species in PKWS could be problematic for other fish species.

⁴⁶ The fact that the villager's charcoal kiln was destroyed during this time period, causing him financial duress, or that his house was robbed certainly did not help this pilot-testing project!

OTHER NATURAL WONDERS

WILD ANIMALS

Because birds are migratory in nature and people in PKWS have migrated from other parts of Cambodia, the PMMR team felt that bird species might be something that villages would recognize even if they had only recently arrived in PKWS. A local bird survey was conducted in 5 villages of PKWS. Villagers identified over 190 bird species. Some birds are found throughout the year, some birds use PKWS as part of their migration routes and other species have now become rare. Further work needs to be done, both with local people and with bird experts, to verify these results.

According to discussions with local people, there are 29 reptile species in PKWS. Some species are rare; for example, the sea turtle and the scaly anteater.

Approximately 10 mammal species are known to inhabit PKWS. The number is much lower than in former times when elders discussed just how many mammal species were in the Wildlife Sanctuary. In fact, elders joke around that the Wildlife Sanctuary should have been created during the Sihanouk time when there really were many animals! The mangrove monkey is now endangered because of the extensive mangrove cutting in PKWS and from people trying to trap this monkey.

To see the list of corals, fish and upland species found in PKWS, refer to Appendix H.

Hunting is considered as a supplemental occupation in PKWS. Sometimes, outsiders come to hunt and catch wild animals in this area. Species of wild animals caught include: small deer, water chicken, mangrove monkey, large bats and wild lizards. In fact, these wild animals, illegal to catch and sell, are sold to restaurants in Koh Kong town. For catching the water chicken, hunters clear patches of mangroves to place the trap and the tape recorder. A melodious sound is played to attract the water chickens to the traps.

ANIMAL HUSBANDRY

There is a little animal husbandry in PKWS. For example, chickens, ducks, pigs are all raised for people's subsistence purposes. In farming villages like Toul Koki and Preak Svay, cows and buffaloes are found.

CORAL REEF AND SEA GRASS

Sea grass beds are known to exist near Koh Barang and Chhrouj Pros; moreover, coral reefs are found near Koh Kong Island. Since sea grass beds are considered to be good habitat for grouper seeds, much of the habitat has been destroyed from trawling and push netting activities. Although these areas have been sited, further detailed research needs to be conducted on these areas. So far, the PMMR team has worked with local people, using a coral book, to identify different coral types. Interestingly, in Khmer people refer to both sea grass and corals by the same name. See Appendix H for coral reef information.

MOUNTAINOUS FORESTS

A number of areas within the Wildlife Sanctuary are rich in mountain forests because of the topography. In particular, the research on plant species in Koh Sralao mountain, undertaken by the PMMR team in cooperation with local people, shows that there are 73 upland forest plant and bush species in Koh Sralao (see Appendix H). These mountains also provide a source of wood used as construction materials. What is significant about the forests of Koh Sralao, besides being rich in plant species, is that these forests provide a continuous supply of fresh water that is used by all villagers and sold by business people to other villagers during the dry season.

Although these plant species show us what is in the upland forests of Koh Sralao, further research needs to be conducted on lowland and upland growing species in other parts of PKWS.

The use of mountainous forests in PKWS includes:

- ❑ construction materials for residences, and fence posts;
- ❑ traditional medicines;
- ❑ fishing gear (example, *Phong Phang* posts, fish and squid traps);
- ❑ fuel wood;
- ❑ charcoal⁴⁷.

FRESH WATER

A lack of fresh water is a serious issue facing many villages in PKWS. Fresh water sources include wells, ponds and rainwater. For those villages with land, there is often a constant water supply. During the rainy season all villages use rainwater, collecting the water in large buckets. What becomes an issue is water storage: not all villages can afford to buy large containers for water storage. Koh Sralao, Koh Cherokee, Preaek Po Peel and Toul Koki are fortunate villages because they have continuous access to fresh water. However, even those villages with access to a fresh water supply find themselves rationing their water supply towards the end of the dry season.

For mangrove fishing villages, there is no supply of fresh water. These villages must buy or fetch their water from other villages. Fetching water is normally free in small amounts; however, this is a time consuming task, often delegated to women and children. Moreover, families often lack adequate storage containers and are forced to make many trips by boat to collect water. Many water storage containers remain uncovered in villages, thus serving as breeding grounds for diseases. And, for those that have no boat, they are forced to buy water with money that they often do not have. Indeed, during the dry season poor villagers are forced to bathe in the ocean and can only rinse with fresh water.

Below is a Table 1 illustrates the use of fresh water of PKWS villages and communes in dry and rainy seasons.

USE OF FRESHWATER IN PKWS

VILLAGE	DRY SEASON	WET SEASON
KOH SRALAO	Use water from village wells; SELL water;	Rain water
PEAM KRASAOP	BUY WATER from Backlog market or Tach Tat village;	Rain water
KOH KAPIC	BUY WATER from Koh Sralao village;	Rain water
TOUL KOKI	Use water from village wells;	Rain water
KOH KANG	BUY WATER from Tach Tat or Koh Sralao village.	Rain water

⁴⁷ Until late 1999, charcoal was almost always produced from mangrove wood. However, since the DoE has begun strictly enforcing charcoal production and has banned middlemen from buy and selling charcoal, families have resorted to using upland wood for subsistence production. Villagers now burn this wood in small, soil kilns which are more difficult to detect.

For villagers in Koh Sralao, everyone has access to common wells. However, if someone wants water pumped directly to their house, there is an additional charge. Most villagers in Toul Koki and Tach Tat have access to a water supply, either through their own well or through a neighbour's well. The price of buying water in any village appears to be the same. It costs 7 Baht for 30 litres of water and 30 Baht for 200 litres of water. The PMMR team is currently undertaking a case study on water supply issues.

CHAPTER IV: FURTHER DETAILS OF RESOURCE USE PATTERNS AND SOCIO-ECONOMIC STATUS IN PKWS

PEOPLE'S OCCUPATIONS

GENERAL LIVING

Villagers of PKWS are engaged in subsistence and market activities. Generally, families undertake a series of paid jobs to survive. Such tasks can include: fishing, charcoal production, rice farming, upland agriculture, animal husbandry, wine making, water selling, good selling, middle person for fishing or charcoal, green mussel culture, shrimp farming, fixing fishing nets, weaving thatch and / or selling ones labor. This list is by no means conclusive as people are resourceful, finding paid labour opportunities in different forms whenever possible. This list does not include the numerous tasks undertaken, mostly by women, in the form of unpaid labour. Such activities can include cooking (a lengthy task), water collection, child rearing, fuelwood collection and cleaning. Unpaid labour contributions enable and support the wage earner in the house and cannot be diminished.

The following chart illustrates how difficult it is to classify occupations based on wage earnings, resource sector activities and how such charts give no consideration to the work of women. Three of the four villages are predominately fishing villages, which is reflected in the information gathered. What is not reflected is the variety of tasks that villagers will undertake to earn money. For example, in fishing families the husband will fish while the women might try to sell goods or fix fishing nets. Perhaps the family also processes wine or raise chickens. Rice farmers (men and women both participate in rice farming) might also fish for subsistence purposes and / or undertake upland farming. Charcoal production is a significant activity but, since it is illegal, its numbers are not accurately reflected in such a report. For example, it is well known that in 1998 there was a significant portion of the population in Koh Sralao that produced and / or sold charcoal. The PMMR team has never undertaken a village wide census by occupation, although a series of PR activities have been undertaken to indicate the variety of tasks that people do undertake.

PAID LABOUR OPPORTUNITIES IN PKWS

Villages	Occupation by %							
	FISHER	CHARCOAL	FARMER	SELLER	CULTURE	LABORER	GOV'T	OTHER
Koh Kapic	70	2		4				24
Koh Sralao	60	15	8	8				9
Peam Krasaop	85			3		7		5
Toul Koki	7		80	3	1			9

Source: PKWS village / commune report, 1998

GENDERED ACTIVITIES

In Cambodian society, the roles and responsibilities of men and women are generally determined by gender i.e. task delegation is by gender. Various activities provide different interests and values⁴⁸.

In general, men act as the household leader, responsible for 'hard' work (or the illusion of hard, physical labour at least!) and often work outside of the home. Men's work includes:

⁴⁸ It should be noted that the PMMR team is an all-male team (except for one of the project advisors), thus shaping the team's gender stance and perspective. It is strongly recommended that the PMMR team re-think its gender strategies to include more women within all levels of the project.

- ❑ Fishing;
- ❑ Land preparation for crop production;
- ❑ Trading outside the home;
- ❑ Boat repair, some fishing gear repair;
- ❑ Mangrove cutting and charcoal kiln construction;
- ❑ Hunting.

Men occupy a greater social space and status in Cambodian society than that enjoyed by women, although women do occupy a special status within the home. Men are afforded far more privileges in terms of access to education and have a stronger political voice than Khmer women.

Women are responsible for the household and undertaking 'lighter work' (again, it is questionable if this work is really 'lighter' considering she is working all day long) around the home. Her work includes:

- ❑ Child rearing;
- ❑ Housework and meal preparation;
- ❑ Small-scale selling;
- ❑ Weaving thatch;
- ❑ Water collection;
- ❑ Fish processing (selling crab and shrimp meat, making prohoc)⁴⁹;
- ❑ Repairing small fishing gear;
- ❑ Fishing near the home, shell collection.

THE ROLE OF THE MIDDLE PERSON⁵⁰

The middle person often plays an important role in the lives of poor people, whether for charcoal production, fishing or water selling. The middle person provides access to gear, supplies and cash in emergency situations. In return, the product is sold to the middle person. The PMMR team spent time in various villages talking to fishers and charcoal producers who were in debt to a middle person as well as middle person's themselves. It was difficult to find charcoal middle persons as this activity is illegal and has been seriously curbed. However, there are fishing middle persons in all of the villages. Most middle persons work with 10 – 15 families, although large middle persons are reported to have 60 families.

Many fishers borrow money from a middle person, in order to buy materials, food and gear. Often the middle person supplies fishing gear and fuel i.e. not direct cash rather borrowing capital, although the middle person also supplies cash when requested. Many families are in debt to the middle person anywhere from 3000 – 11 000 Baht (US\$ 79 – 289). Indeed, one middle person of Koh Kaptic village stated that a total of 99 000 Baht (US\$ 2605) was owed to him.⁵¹ Other middle persons are in greater debt. Fishers pay back their loans either in direct cash, about 40 % of their net earning when possible, or by selling their product to the middle person at a reduced price.

Although the middle person prevails over the fisher, relationships are often formed. Therefore, the middle person often helps the fishers out, especially if there is a strong relationship. It appears that all middle persons are buying products for the same price in PKWS, prices being dictated by the Thai market force. The middle person is dependent upon the fishers for their product, so in many ways the relationship provides mutual benefit to both parties.

⁴⁹ Prohoc is a fish paste made from dried krill, garlic and chillies with a particularly strong odour. It is used like a dip for meats and vegetables.

⁵⁰ The PMMR team just learned of one middle woman who buys shrimp from about 10 fishers in Koh Kaptic village.

⁵¹ It is rumored that this middle person is the strictest about repayment. Now, he has stopped lending money to fishers given the recent decline in fisheries resources.

For those who cannot fish because of a complete lack of capital or engagement in other work, they can hire out their labor to fishing boats or by constructing fishing gear i.e. women often make crab traps or fishing nets. Unfortunately, such work is never stable, dependent upon the season, production and the local demand. These days, being a middle person, fisher or laborer is not easy.

Consider the following:

My name is Chantha, and I am a shrimp fisher in Koh Kaptic village. I am supported by the middle person who supplies me with fishing gear (nets, boat) and lends me money for repairs. Although it is good that I can depend on the middle person for cash, I now owe him 10 000 Baht (US\$ 263). The problem is that I can only catch shrimp by shrimp net during the rainy season and the production has decreased significantly i.e. 4 –5 kg / night in 1998 and 2 kg / night in 1999. I will be forced to return my boat soon if I cannot find a way to increase my income.

Or,

I am a middle woman in Koh Kaptic village. Before this I earned money through hiring labor to process crab meat and through cake selling; however, now I earn money from buying shrimp. I provide 30 fishers with gear, and they sell their product to me. I am owed 200 000 Baht (US\$ 5263) which I am not sure I will be able to get back considering how the shrimp catch has significantly decreased. For example, I could buy more than 500 kg of shrimp per day and now I can only buy 100 kg of shrimp per day. The decline in shrimp is affecting everyone. I then sell my product to the main middle person in Koh Kaptic who takes the product to Thailand. If I cannot begin to earn money, I am considering returning to my home province.

Fishing middle persons live in Koh Kaptic, Peam Krasaop and Koh Sralao. Charcoal middle persons⁵² live in Koh Sralao and Koh Kang. Until late 1999, there were 7 – 10 middle persons Koh Sralao village and 6 middle persons in Koh Kang. Most charcoal producers are also in debt to a middle person; however, the debt system for charcoal production can be different from that for fishing (it can also follow the pattern of borrowing money and slowly paying this back, often at a reduced price). For example, the charcoal kiln laborer can rent a charcoal kiln from the middleman or the charcoal laborer and the middle person can share the profits made from the charcoal kiln (50 / 50).

Consider the case of Loeoung. He produced charcoal for 8 years, making around US\$ 21 – 24 per month. He owed the middle person one-month of salary or US\$ 26. However, the middle person fled when his kilns were destroyed by the DoE last year. This is a common story - many former charcoal middle persons left PKWS when their kilns were destroyed. Often only those with few choices remained. While this cleared charcoal producers of their debts, it also left them in a vulnerable situation without anyone to borrow cash from. Where possible, many people switched to crab trapping, beginning a new debt cycle with a fishing middle person. Unlike shrimp, people have reported a significant increase in crabs this season making such a transition easier (at least until the crabs decline).

Life continues to become more difficult for former charcoal producers and fishers in PKWS. As charcoal production has diminished, fishing has increased. At the same time, fishery resources are significantly depleted. Although fishers talk about a decline throughout the 1990's, it appears that the last year has been significantly poor. Only in early 2000 did fishers talk about a significant increase in crab numbers⁵³. Since the number of fishing middle persons have not decreased, no one is

⁵² In the case of charcoal production, the middle person is always male.

⁵³ Crab numbers fluctuate from year to year, sometimes being quite abundant and at other times being quite rare. This is difficult for those who try to make their living from crab trapping.

making excess profit these days. Since fishers can sell their product to any middle person for the same price, it becomes a question of whether the fisher is in debt or not. When a fisher is in debt, then they do not get a good price for fish when they cannot put payments down towards their loan. Many poor families are dependent on the middle person for survival and this then begins a debt cycle that is difficult for either party to withdraw from, obviously more difficult for the fisher!

MARKETS

FISH MARKET

Middle persons live in each village, buying fish products to sell in Thailand. Fishers are linked to the middle persons: some fishers are in-debt to the middle person; others are merely dependent upon the middle person for the export of their products. Some fishers sell their product themselves, either to Khmer or Thai markets.

Generally, it is high quality fish products that are sold to Thailand. For example, swimming crab and mangrove mud crab; crab meat from the swimming mud crab; squid and octopus; various fish species i.e. grouper, snapper, sea bass and spanish mackerel; live grouper seeds (for culture); live blowfish seeds; green mussels and processed shrimp. However, some poorly priced fish are also exported i.e. short-body mackerel. Fish that has little economic value is used for daily consumption or sold in domestic markets i.e. Backlong or Dongtong markets.

CHARCOAL MARKETS

About 80 % of PKWS's charcoal production is exported to the Thai market of Klong Yai in Klong Song near the Cambodian border. The rest is used for subsistence purposes or sold within PKWS and Koh Kong town.

MOVING AND ACCESSING GOODS

There is no proper market within PKWS; however, small-scale stalls are found within each village. Goods sold at such stalls include: cakes, rice, fish sauces, salt, canned goods, a few vegetables, pork, beef, domestic materials, fishing gear, fuel oil, and medicines etc. Owners stock a variety of goods depending upon their access to the market. See Appendix F for a list of goods and prices of items sold in Koh Sralao village in 1999.

Goods that are imported into the villages are bought from Backlong or Dongtong markets or come from Thailand or Kampot province. A large wooden boat travels monthly from Kampot through the coastal communities selling goods in all the villages. Since it is so difficult to access these villages, the price of goods is higher than in market areas.

WHERE DO PEOPLE FISH?

Different fishing grounds and types of gear are used in each village. It seems that fishing grounds are open access, theoretically enabling anyone to fish anywhere. However, those with biggest boats have access to the best fishing areas. The biggest fishing boats are Thai; indeed, local communities all complain about illegal trawling activities near villages by Thai trawlers. Offshore fishing affects the livelihood of local fishers. In the case of green mussel culture, villagers complained that they were not able to culture green mussels because those villagers who held the most 'power' in the village had access to the best spots for the pole culture. Villagers fish in specific areas according to gear types. Although not included in this Technical Report, the PMMR team has worked with villagers to produce a series of maps that illustrates where people fish in each village and by which gear type. More research needs to be undertaken relating to who has access to different fishing grounds,

perhaps it is not as open access as villagers initially suggest. This topic could be researched as a future case study for the PMMR team.

LAND USE

There are many resources to be potentially tapped into within PKWS: fishery resources, wild animals, mangroves, and land for agriculture. Unfortunately, creative resource usage is not encouraged by local authorities or DoE / MoE staff who prefer that less people live in PKWS - promoting the idea of relocation. There is a range of potential livelihood activities to be yet explored. This is understandable given that the knowledge and awareness of government staff and villagers of the potentials to be offered by the mangrove environment is low. Also, the relationship between government staff and villagers has focused on enforcement of illegal activities.

People living within PKWS (a.k.a. insiders) and those residing outside PKWS (a.k.a. outsiders) all access natural resources for one purpose or another.

Natural resources used by insiders are:

- ❑ land: owned land and public / state land;
- ❑ mangrove resources;
- ❑ fishery resources;
- ❑ bird and animal resources; and
- ❑ water resources.

Natural resources used by outsiders are:

- ❑ fishery resources;
- ❑ mangrove resources;
- ❑ bird and animal resources;
- ❑ water resources.

Land can be divided into state land and private land.

1. State owned land or public land: This type of land is used for the public interest; for instance, road construction, schools, pagodas and so on, and for the "conservation" of natural resources, such as hill forests, wildlife habitats, and freshwater sources. People may use public land and waters for mussel culture, fish cage culture, shrimp cage culture, or fishing installation. However, they do not have the right to claim such land as their own. Therefore, villagers living in the area prior to 1993 have land user rights. According to the draft *Sub Decree on PA's Management*, no new villages are allowed to form in the PA;
2. Private owned land: This type of land is legally owned, used and maintained as continuous heritage ownership by the people or a family. Private owned land consists of two types, for location and farming lands. Although a few families do have land title in PKWS, this is illegal according to the draft *Sub Decree on PA's Management* - people are only entitled to land user rights, not land title. There has been confusion over this issue between the MoE and the Department of Land Title, Ministry of Urbanization and Construction. The provincial land title department has issued land title to some residents in PKWS, even though the MoE would argue that this is illegal.

Land use issues are only beginning to be considered for PA's. For example, according to the Cambodian constitution, all people have the right to own land yet the draft sub-decree on PA management suggests that individuals can only have land user rights in PA's. So, when individuals no longer have the right to own land because of national planning, does this constitute a human rights violation or is this justified within the national interest?

On the other hand, if MoE were to give land title within PA's, this would be expensive and would have to follow the same method that the Ministry of Urbanization and Construction takes. According to the Finnmap project, it will cost over 100 million dollars to do a systematic land title registration system in Cambodia, not including PA's⁵⁴. Where will the MoE get the cash to implement a parallel system, considering that PA's cover 20 % of Cambodia?

MAPPING

It has taken time and energy for the team to learn about mapping and then to consider the mapping needs of the project. Fortunately, the Project Advisor to the GIS Unit of the Department of Forestry / GTZ project spent significant time explaining the different image options and suggesting the best options for the project. In many situations, mapping would be beyond the scope of a low-budget project since satellite imagery is particularly expensive. However, this GIS Unit is interested in sharing mapping information and in fostering capacity building between Ministries.

The following depicts different types of imagery available, and its usefulness in PKWS.

- ❑ There is no up to date reliable map of Koh Kong province. For example, the 1:50 000 topographic map is based on 1960 / or 1970 data and as a result many of the villages are not included in this map.
- ❑ In the mid-1990's, Wetlands International and ETAP produced a series of land-use maps of PA's, including Koh Kong province at 1: 50 000 scale. The imagery was based on 1995 aerial photography, excellent at the time, but now out of date. There have been many land use changes,

⁵⁴ Personal communication, Wayne Gum, Consultant, Ream National Park.

especially in the last five years in PKWS. Also, these maps were not geo-referenced i.e. coordinates were not placed on these maps and images were not worked to compliment each other. No further aerial work has been done in the Koh Kong area.

- ❑ Satellite imagery does exist for Cambodia. There is 1991 and 1998 LANDSAT imagery (1: 50 000), purchased by several donors (in the GIS Unit, Department of Forestry, Ministry of Agriculture). LANDSAT imagery is particularly useful for considering land use changes over time i.e. loss of mangroves.
- ❑ The DANIDA-CZM project purchased a piece of RADARSAT imagery, which includes PKWS. Although RADARSAT can be useful for close-up imagery, such imagery is expensive and takes manipulation. Also, RADARSTAT may not be very suitable for mangrove waterways because the radar signals will be reflected from the trees before reaching the water.
- ❑ Indian Remote Sensing (IRS) imagery is another satellite-driven photo that gives one a closer picture of an area i.e. one can see houses and fields because of the 3m resolution / pixel. The Department of Forestry has IRS images which are accessible to others (can be blown up to 1:25 000).

PKWS MAPPING NEEDS

After serious consideration, the PMMR team decided that it had two real mapping needs.

1. To show changes in resources over time i.e. to compare the environment and to notice changes such as shrimp farms, cut mangroves, agricultural land. This could be used as an environmental education tool with villagers;
2. A map suitable for boundary demarcation considerations, and further down the road, for zoning purposes. In-depth photography is not necessary as only ecological areas need to be distinguishable.

Rather than purchasing imagery, it was decided that the imagery available within the Department of Forestry met the project's mapping needs. To begin with, these maps will be used for boundary demarcation.

BOUNDARY DEMARCATION

Although boundary areas have been defined in the Royal Decree, PA boundaries have not yet been ground truthed or demarcated in the field⁵⁵. Since the Royal Decree gives specific surface areas for PA's, accompanied by an A4 map (difficult to interpret). There are now a series of boundaries floating around for each PA depending upon who did the map work and in which Ministry. The PMMR team decided to return to the Royal Decree and re-input this data and demarcate this boundary again on the map to ensure accuracy and to illustrate how difficult it is to interpret this decree.

In February 2000 the GIS Unit of the Department of Forestry was contracted to produce a series of maps for PKWS with the original Royal Decree boundary on them. This process makes it quite clear that

⁵⁵ Ream National Park has demarcated the core zone, buffer zone and community development zone, they have not yet undertaken boundary demarcation. WWF is working in Virachey Park, Rattanakiri and have developed a series of maps which could also be used for a boundary demarcation process. Further discussion with WWF would be useful in terms of approaches for boundary demarcation.

further work must be done to re-define these boundaries so that they follow ecological borders and make sense at a field level.

The team is supporting staff from the GIS Unit in the Ministry of Environment to learn more technical skills from the GIS Unit in the Department of Forestry, and has hired one MoE GIS staff to undertake the technical work necessary for boundary demarcation. In April 2000 the PMMR team worked with MoE's GIS Unit to ground truth the Royal Decree boundary and to determine where the borders of PKWS should exist. This is the beginning of a process that will eventually become political, when gaining acceptance from all Ministries for the PKWS boundary.

1998 Landsat satellite image of PKWS with three of the different boundaries mapped for PKWS.
Map produced by the Department of Forestry, Ministry of Agriculture. February 2000

FACILITATING A PROCESS: BEGINNING FOR PA MANAGEMENT

The PMMR team has initiated a series of workshops in the past two years that focus on planning and management

issues in PKWS. Local authorities, provincial authorities, technical departments have joined together to discuss their various roles and responsibilities in management of the PA. The PMMR team has initiated a mapping process that will enable the boundary of PKWS to be agreed upon on the ground, and then demarcated. The idea being, that if people do not know what it is they are protecting, it is difficult to encourage any sort of management regime. Boundary demarcation is only one of a series of steps necessary when working towards PA management; however, it is an important initial step especially in Cambodia where no PA boundary has yet been demarcated on the ground⁵⁶.

OTHER TYPES OF MAPPING

Village resource mapping was undertaken as a tool to increase local understanding of the villager's own environment. The villagers learned how to produce sketch maps of their village, and were able to teach each other and the research team about the village environment. Mapping work allowed for greater discussions surrounding environmental change i.e. producing maps of what resources would have looked like 20 years ago versus now. Various mapping exercises were undertaken several times, and each time maps became further enriched with details as facilitators and participants became more confident and comfortable with this tool.

The Chief of Koh Sralao village said,

"I really enjoyed learning how to draw the maps of my village. It is now easy for me to explain my village and its surroundings to other government authorities. I can now draw a map of the village myself, as can those villagers who participated in these exercises."

Fishing location mapping was undertaken with groups of fishers and the PMMR team in an attempt to understand people's access to fishing resources. This was a useful exercise for understanding where people in each village actually fish, and to informally discuss people's access to such resources. Awareness of village-level access to fishing grounds is essential for any management planning or zoning initiatives. Such information needs to be shared between the villages. This will strengthen their case for protecting village grounds from 'outside' fishers i.e. large trawlers or Thai fishing vessels.

⁵⁶ For specific details on boundary demarcation and people's perspectives on planning and management for PKWS, see the *Workshop on Participatory Planning and Management of PKWS*.

EDUCATION

As PKWS is considered an isolated, relatively unpopulated area, the RGC has provided little support for education. Class 4 is the highest class that any of the schools offer. Most schools are old, lacking tables, black boards and other necessary equipment. There are an inadequate amount of teachers, no regular study time and no support to develop this sector.

SCHOOL STATISTICS IN PKWS

Villages	# of Schools	Class levels	Quality of School*
Peam Krasaop	01	First to Second	Medium
Koh Sralao	01	First to Fourth	Poor ⁵⁷
Koh Kapic	01	First to Fourth	Medium
Koh Kang	01	First to Second	Poor
Toul Koki	01	First to Second	Poor

Source: PMMR team, 1999

* Quality of school is based on the PMMR's assessment of the school infrastructure i.e. building quality and equipment.

According to the Ministry of Education, Youth and Sports, children who are six years old and above are entitled to a basic education. Teachers in the school system must have a recognized teaching certificate. Teachers are supported by the RGC, as is the infrastructure and the study materials. Those students in Koh Sralao village or Koh Kapic village who finish the fourth class, can continue to study in schools outside of PKWS⁵⁸ if their parents can afford this option. However, most families are poor and cannot afford to send their children to school past what is offered in the village.

Since access to education is so limited, some families who can afford to do so choose to supplement their child's education with lessons or by enrolling them in a private school. For example, in Koh Sralao, there is one private grade one class with 21 pupils. Each pupil is required to pay 10 000 Riels or US \$ 2.6 per month. Teachers often offer private lessons to supplement their meager incomes.

Far greater education opportunities are necessary for villagers of all ages. The PMMR team has undertaken a series of environmentally-focused sessions in all the villages, providing basic environmental education, specific technical advice and opportunities for the villagers to begin a process of working together to manage their resources in the future. However, far more work needs to be done. For example, villagers need to learn more about waste management, health care, water sanitation, aquaculture techniques, management options, mangrove medicines and fishing techniques. People must be given options so that they can make choices themselves regarding their livelihood and resources.

GENERAL KNOWLEDGE

Unfortunately, most people in PKWS have little formal education. Moreover, because so many people are newcomers, local environmental knowledge is difficult to access and, therefore, to pass on. Many

⁵⁷ The RGC is in the process of funding a new school, worth \$ 20 000, which is far better sited and equipped. The school is expected to be finished in mid-2000.

⁵⁸ Students can study in Dong Tong or Backlong commune i.e. Koh Kong town.

people in the villages have little education or are illiterate. The Chief of Koh Sralao suggested that 66 % of the villagers either had minimal education or were illiterate and, perhaps 34 % held a medium education level (more than grade 2). Unfortunately, many people did not have access to education during the war and the KR time-period. For children coming into PKWS, unless young, there is no chance to go to school.

RELIGION, ETHNICITY AND CULTURE

Most people in PKWS are Buddhist, although a few families are Muslim or Christian. Most villages have a pagoda for Buddhist people to visit, and there is a small Mosque in Koh Sralao for the Muslim population.

In terms of activities divided by ethnicity:

- ❑ Most of Khmer and Thai-Khmer are fishermen and charcoal producers;
- ❑ Most of Khmer-Muslims are fishermen;
- ❑ Most of Khmer-Chinese are sellers or middlemen.

People speak both Thai and Khmer within PKWS, although Khmer is the official language and more predominant in most villages (except in Peam Krasaop and Toul Koki as these villages have retained a significant long-term population). In the past, many people spoke Thai. This is because people were influenced by Thai culture when Koh Kong territory was taken and controlled by Thai soldiers. Moreover, there has always been an economic relationship of people in PKWS with Thailand. Given the proximity to Thailand, and the isolation from Phnom Penh, this relationship is hardly surprising.

For those villagers following Thai customs, family and friends gather together to celebrate and to honor the dead. Perhaps this is contrary to the Khmer custom where the gathering at the funeral is a more serious affair⁵⁹. During the Khmer New Year, Buddhist people prepare food and go to the pagoda to pay sacrifices to their dead relatives.

HEALTH ISSUES

HEALTH CARE

Villagers have very little access to health care, both formal or informal.

Informal systems, such as using a medicine person, 'Kruu Khmer', are used by elders but are not so popular among young people. Unless a medicine person has resided in the area for a long time, they are not familiar with the mangrove plants that can be used for medicinal purposes. This is why upland plants tend to be utilized rather than mangrove plants for medicinal purposes. There are only two elders left in PKWS that know the medicinal value of mangrove species. Discussions with these elders suggest that mangrove species are often combined with a series of upland species for cures.

For more 'modern' health services, people visit the one clinic in Koh Sralao established by the European Union during UNTAC. This is staffed by two traditional midwives and a nurse. Many buy medicines from

⁵⁹ These differences are mere speculation as no one on the team is Thai or knows Thai funeral traditions. Moreover, the noise level in a Khmer funeral is just as high as the noise level at a Thai funeral. Khmer funerals are traditionally loud to draw attention to other villagers that there has been a death. Perhaps the attitude and type of celebration are different, perhaps it merely appears different.

this clinic or from people in each village who have a few pills for sale. However, for any serious illness, villagers must be sent to the provincial hospital in Koh Kong town. Hence, basic medical care is out of reach for most villagers. There is no doctor in PKWS, and it takes time and is expensive to transport someone to Koh Kong town.

In Koh Sralao, a number of families have been observed to be growing opium. This drug is used for a series of ailments. For example, opium resin is used for tooth aches (placed on the aching tooth) and people mix the resin with hot water to cure stomach aches and diarrhea. For malaria, people boil the opium leaves and then drink this concoction.

Marijuana has been observed growing near the 'new village' of Peam Krasaop. Here, villagers use this drug as a relaxant or to relieve stress.

The following is a list of the main illnesses found in PKWS:

- ❑ DIARRHEA often occurs in the dry season in most villages of PKWS. Without proper re-hydration or access to clean water or food, this can be a serious illness for villagers;
- ❑ MALARIA seems to be on the increase in PKWS (or perhaps the PMMR team is merely in more contact with people who have malaria?). Before, villagers suggested that only those villagers who spent time in the mountains (loggers or sandalwood collectors) were affected by malaria; however, more and more coastal people are now contracting malaria;
- ❑ TYPHOID;
- ❑ Colds and fevers often occur in the rainy season.

Since there is no access to proper medicine, and people are not in the best state of health in these poor, isolated villages, immune systems are often run down and people have difficulty in fighting various diseases or simple colds. Children are especially vulnerable. Many children's stomachs are bloated, a classic sign of malnutrition or a bad case of worms combined with poor nutrition.

WASTE MANAGEMENT

The PMMR team in cooperation with local people and authorities conducted a "Waste Management Day" in Koh Sralao because there is so much garbage and waste in and around the villages. Since health is directly related to waste management, the team wanted to teach people about reasons to keep one's environment clean. People were taught about waste management issues and shown how to take care of their waste i.e. take waste to the dump. Although the participation was high on this day, people still do not take their garbage to the dump. In Koh Sralao, one finds garbage dumped in and around the dump or near homes as people are afraid of the snakes in the high grass near the dump (when it was suggested that the grass be cut down, no one followed up on this suggestion).

Koh Sralao village is not unique in its waste management difficulties. Domestic wastes, abandoned fishing gear, crab shells, mussel, snail shells, fish wastes, plastics and other liquid and solid wastes are disposed of or discharged into the streams. There is a lot of work that needs to be done in the area of waste management.

Local authorities recognize the need to do something about wastes. They have suggested that far greater, more intensive education is necessary. It is expensive to ship wastes into Koh Kong town, so local solutions need to be found for waste management problems. For example, villagers could burn their plastic waste and compost or throw only organic wastes into the water. This still leaves the issue of

waste oil, glass etc. For a more detailed look at waste management issues in PKWS, see the January 2000 *Participatory planning and management of PKWS Workshop Report*.

TRANSPORTATION AND TELECOMMUNICATIONS

Transport systems in PKWS include:

- ❑ **INTER-VILLAGE TRANSPORTATION:** Villagers move between houses through a series of mud paths and wooden boards. In fishing villages, people either walk or take a boat to visit each other. In farming village, most people also walk although a few bicycles have also been observed.
- ❑ **INTRA-VILLAGE TRANSPORTATION:** People use the waterways to communicate between villages. Either rowboats, small motor boats or speedboats are used. Toul Koki village is the exception, in that this village can be accessed from Koh Kong town by road, only taking a small boat trip across the waterway to reach this village. Other villages are quite distant from Koh Kong town.

Although Khmer television is received in Koh Kong town, those villages with a generator are only able to receive Thai television channels. People can listen to Khmer radio. Villagers use ICOM radios to connect between villages (there is at least one ICOM radio in each village). Otherwise, people send letters or oral information through the waterways.

CHAPTER V: INSTITUTIONS AND LEGISLATION

The following chapter discusses the roles and responsibilities of government authorities and technical departments at the national, provincial and local levels⁶⁰. As one is reading this section, remember that government departments have great difficulty in implementing most of their mandate. From here, a brief summary of legal instruments pertaining to the environment is given, along with an analysis of why planning and management is so difficult within PKWS.

ROLES AND RESPONSIBILITIES AT THE NATIONAL LEVEL

Some major institutions, whose mandates relate to the use and management of natural resources in PKWS are as follows:

MINISTRY OF ENVIRONMENT

The Ministry of Environment was established in 1993, soon after the UN-sponsored elections, with the mandate to solve problems relating to management, conservation and environmental protection throughout Cambodia. Thus, the planning and management of protected areas and, in particular, the supervision and coordination for environmental protection in PKWS is under direct control of the Ministry. Referring to article 3 of the *Sub-decree on the Organization and Functions of the Ministry of Environment*, its main responsibilities are as follows:

- ❑ Implement environmental policy;
- ❑ Advise relevant Ministries / agencies regarding conservation, development, management of natural resources and PA's and propose the incorporation of new PA's into the PA system;
- ❑ Prepare inventories on environmental pollutants; mitigate and control such pollution;
- ❑ Compile, analyze and manage environmental data;
- ❑ Initiate and prepare proposals enabling Cambodia to participate in international agreements, conventions and MoU's concerning environmental protection, and ensuring compliance;
- ❑ Cooperate with IO's, NGO's foreign governments and local communities in order to ensure the environmental protection in Cambodia.

MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES

The Ministry administers the exploitation of and production of natural resources i.e. agriculture, forestry and fisheries resources throughout Cambodia. In particular, the Ministry is responsible for managing and controlling the use of natural resources. For example, until 1993, the Ministry of Agriculture was responsible for mangrove forest and fishery resources in what is now PKWS.

MINISTRY OF RURAL DEVELOPMENT

The Ministry is obliged to ensure and assist the development of rural areas. In particular, this Ministry is responsible for socio-cultural data collection, preparing development plans, seeking markets for local products and in creating development commissions that enhance people's livelihood.

⁶⁰ For more specific details into thoughts that technical departments and government authorities have regarding roles and responsibilities for management and planning in PKWS, see the January 2000 Workshop Report on *Participatory Planning and Management of PKWS*.

ROLES AND RESPONSIBILITIES AT THE PROVINCIAL LEVEL

PROVINCIAL AUTHORITIES

Provincial authorities in Koh Kong follow the Ministry of Interior and the Governor who is responsible for administering and managing political and administrative affairs. It is the responsibility of the Governor and, subsequently, provincial and local authorities, to maintain public order and security and to support development that enhances people's livelihoods throughout the province. According to the *Sub-decree on the Competence of Provinces / Municipalities*, 12 April, 1999, the main responsibilities of provincial authorities include:

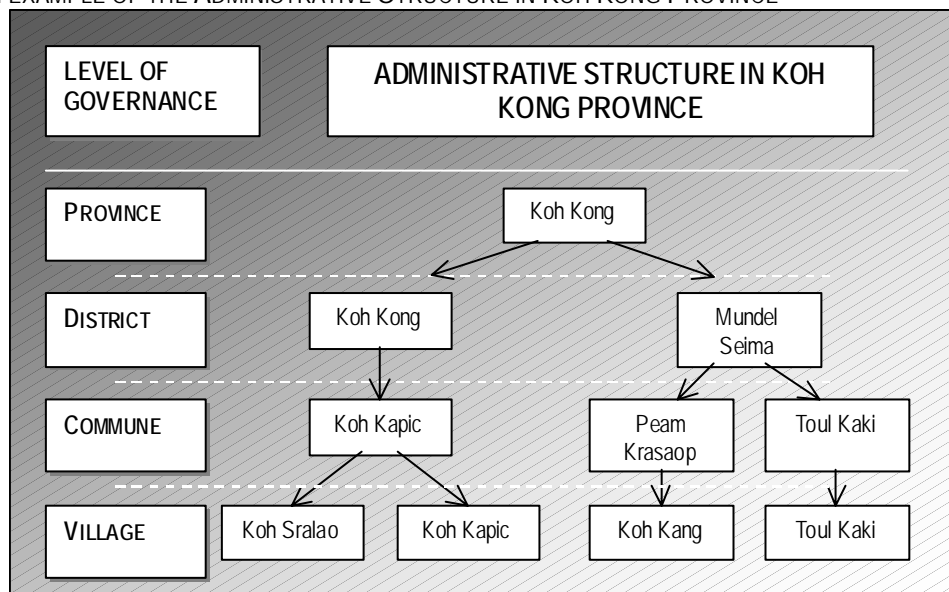
- ❑ Preparation of plans and development programs;
- ❑ Land management, urbanization and construction;
- ❑ Prepare certificates for land ownership i.e. land title;
- ❑ Public works;
- ❑ Public services;
- ❑ Water supply;
- ❑ Waste management.

There is no direct budget transfer from ministries to provincial departments. The budget the province intends to use is via the national treasury. In this regard, provincial authorities propose their budget to the department of Economics and Finance, who then send it to the Ministry of Economic and Finance after obtaining the Governor's signature.

The provincial authority is further divided into district, commune and village levels. At the provincial level, its operational mechanisms are:

- ❑ Cabinet;
- ❑ Administration;
- ❑ General Secretariat;
- ❑ Land-title, human rights issues;
- ❑ Financing Unit;
- ❑ Inspector Unit;
- ❑ Monitoring.

AN EXAMPLE OF THE ADMINISTRATIVE STRUCTURE IN KOH KONG PROVINCE



Source: Marschke, 1999.

DISTRICT AUTHORITY

The district authority acts as a central administrative authority of the province and of the communes and villages. There is a district governor and two vice-governors. The main roles of the district are to ensure security within the communes, and to protect people's property rights and dissemination of relevant laws and sub-decrees. The district also has authority over financial affairs, public construction, health and hygiene, culture and religion.

COMMUNE AUTHORITY

The commune authority is chaired by a chief and two vice-chiefs. The commune authority has a similar mandate to the district authority, overseeing the general situation within the commune. Commune officials cooperate with police to prohibit illegal activities, and take necessary measures to maintain public security and order. Commune chiefs may share knowledge (if not too busy making money) i.e. the commune chief educates people and encourages their involvement in reforestation schemes and other management initiatives.

ROLES AND RESPONSIBILITIES OF PROVINCIAL TECHNICAL DEPARTMENTS

Although an in-depth look at each department mandate versus what they are actually able to implement would be useful, for the purposes of this technical report, the roles and responsibilities of key departments that have a mandate within PKWS and Koh Kapi Ramsar site are briefly considered. Although departmental mandates are briefly outlined, at this point little can be carried out or implemented.

DEPARTMENT OF ENVIRONMENT

The Koh Kong department of Environment (DoE) was created by the declaration No 338 MoE date of June 1994. The DoE is responsible for environmental management in Koh Kong on behalf of the MoE. The Department's main responsibilities are as follows:

- ❑ Understanding the geographical environment of Koh Kong, and determining the boundaries of PA's in Koh Kong;

- ❑ Research, data collection, and inventory preparation for animal and plant species;
- ❑ Cooperation and coordination with relevant institutions and communities on natural resource protection initiatives;
- ❑ Disseminate information about relevant laws and sub-decrees to concerned ministries, especially regarding PA's;
- ❑ Cooperation with national and international research organizations, especially for PA research;
- ❑ Conduct socio-economic research within and near PA's;
- ❑ Prevention and suppression of illegal activities through regular patrols within PA's;
- ❑ Undertake research, manage and prevent environmental pollution caused by industrial activities, either legally or illegally invented;
- ❑ Environmental education for relevant department officials.

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

According to circulation No 37 on the roles and responsibilities of the Department of Agriculture, the main functions are:

- ❑ Administer technical aspects of agriculture i.e. provide inputs into agriculture in PA's⁶¹;
- ❑ Promote agricultural production dependent upon the Government's policy, progress and plan;
- ❑ Planning for agriculture, forestry and fisheries sectors;
- ❑ Protect natural resources such as forests, water, and fisheries in cooperation with concerned agencies;
- ❑ Prepare projects for a zoning of areas for agriculture, forestry and fisheries up to district level.

DEPARTMENT OF RURAL DEVELOPMENT

The Department of Rural Development is responsible for rural development at the family, village and commune levels in order to enhance livelihoods and quality of life for rural people, alleviating poverty through rural infrastructure improvement, and to promote health care, rural agricultural development and rural loans. This Department is also responsible for the development of human resources, rural community and government officials and the organization of training programs and facilitation. Employment opportunities for the rural poor are supposedly a key strategy within this Department. This large mandate is, unfortunately, not fulfilled.

DEPARTMENT OF EDUCATION, YOUTH AND SPORTS

The department plays a very important role in promoting the operations of kindergarten school, elementary school in all the districts of Koh Kong province, particularly in PKWS, and night school in the provincial town. When the Department of Environment is undertaking any education initiative, within or out of PA's, they should cooperate with the Department of Education.

DEPARTMENT OF WOMEN'S AFFAIRS

This department is responsible for the management of all affairs related to women in the province. The department's responsibilities include: dissemination of laws, sub decrees and other information relating to

⁶¹ This is a sensitive issue between MoE staff and Department of Agriculture. Although the Department of Agriculture staff is better equipped and trained to work on agricultural issues, this becomes a question of jurisdiction and authority. In the January 2000 planning workshop, both DoE staff and Department of Agriculture staff agreed that more cooperation was necessary within PKWS on issues such as agriculture, fishing and mangrove replanting.

the rights of women and children, reproductive and health care training, AIDS awareness and the prevention against sexually transmitted diseases and harassment of women and children. This department also cooperates with other organizations to conduct research on abuse and trafficking of women and children.

DEPARTMENT OF HEALTH

This department is responsible for health care. They educate people about health care, the consequences of diseases i.e. AIDS or malaria, and how to prevent the transmission of various diseases. The department cooperates with other technical departments to ensure that information is disseminated.

DEPARTMENT OF PLANNING

The department prepares and develops a population census for each village, commune and district throughout Koh Kong province, and prepares plans and programs that will enhance people's livelihoods in cooperation with other responsible departments.

DEPARTMENT OF PUBLIC WORK AND TRANSPORT

The department is obliged to develop and expand communication systems i.e. roads, waterways and to construct and repair bridges or repair infrastructure relating to transportation. This department is also responsible for information dissemination.

DEPARTMENT OF TOURISM

The department is assigned to promote the development of recreational resorts, restaurants and other natural entertainment places that will generate a revenue flow. Tourist education and development falls within this department's mandate in cooperation with competent authorities, investors and other organizations.

DEPARTMENT OF INDUSTRY, MINES AND ENERGY

This department promotes industrial development, management and controls water supply and works to increase electricity supplies to the people. Also, this department works closely with investors and responsible authorities.

LEGISLATION⁶²

Many new laws and sub-decrees are pending that will affect PA management. These include the following: *Land Law* (passed by the Council of Ministers, Friday July 21); *Fisheries Law* (draft, provisions for community co-management); *Forest Law* (draft – community management and transparent concession allocation); *Sub-decree on Systematic First Registration* (outlines a process for land title which the MoE would have to also follow should it decide to implement land title (since PA's are state land, land title might not be legal); *Sub-decree on Establishment on Community Forestry* (sitting with the Council of Ministers, contains provisions for community forestry in PA's); *Sub-decree on PA Management* (just submitted to the Council of Ministers)⁶³.

A brief description of the laws, sub-decrees and other legal instruments that relate to the management of PKWS is detailed.

⁶² See Siphana, S. and Sarin, D. 1999. Laws and Regulations on Environment Biodiversity, & Protected Areas. CLRDC: Phnom Penh for a discussion and insights into Cambodia's environmental laws and actual legislation (up until early 1999).

⁶³ See Gum, W. 2000. Draft Report: ADB 5712-Reg.

CONSTITUTION

Cambodia's constitution was passed by the National Assembly on the 22nd of September, 1993. Article 59 of the Constitution states that:

The state shall protect the environment and balance of abundant natural resources and establish a precise plan of management of land, water, air, wind, geology, ecological system, mines, energy, petrol and gas, rocks and sand, gems, forests and forestial products, wildlife, fish and aquatic resources.

This article established the framework for environmental protection in Cambodia.

LAW ON ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES MANAGEMENT

The *Law on Environmental Protection and Natural Resource Management* came into effect in 1996. This law establishes the basis for environmental legislation in Cambodia, and there are a number of important purposes to this law including:

- ❑ To protect and promote environmental quality and public health through prevention, reduction, and control of pollution;
- ❑ To encourage public participation in environmental protection and natural resource management; and,
- ❑ To ensure the sustainable conservation, development, management and use of resources.

This law relates to protecting, conserving and managing natural resources and provides an excellent base for sub-decrees and *Prakas* (regulations) to prescribe the means for implementing the law.

ROYAL DECREE ON CREATION AND DESIGNATION OF PROTECTED AREAS

The Royal Decree, dated 01 Nov 1993, established a system of 23 protected areas (PA's) in Cambodia. This decree details the roles and responsibilities of the MoE for management planning, conservation and development in PA's in cooperation with subject ministries and agencies. It is the Royal Decree that designates the specific classification and size of each PA. The Decree outlines specific areas that are to be protected, stating that specific boundaries need to be demarcated on the ground and then submitted for approval to the MoE.

THE DRAFT SUB-DECREE ON PROTECTED AREAS

This sub-decrees' main objective is to determine the management, maintenance, protection and conservation of natural resources within designated PA's to ensure their sustainable use and development.

Chapter 2: management of protected areas

- ❑ MoE is responsible for the management and protection of PA's;
- ❑ A core zone, buffer zone and community management zone shall be established in each PA;
- ❑ MoE shall prepare boundaries for PA's;
- ❑ Changes to boundaries of PA's shall be defined by MoE;

- ❑ MoE shall develop and implement strategic management plans and guidelines for each PA that encourage sustainable use of natural resources;
- ❑ MoE shall encourage community participation in the management of PA's through encouraging CBNRM strategies.

Chapter 3: rights for sustainable natural resource use

- ❑ Private land title shall not be recognized in PA's;
- ❑ Land user rights shall be given for PA's.

Zoning will have a significant affect on the communities of PKWS, especially if zones are strictly regulated by Park Rangers. The core zone refers to areas that most promote the significant values or features of the PA: any development or exploitation is prohibited. The buffer zone refers to an area which is ecologically significant but which people can use sustainably. The community development zone refers to the village area, and in these area's community development activities can continue. These are general definitions, and specific guidelines will have to be developed for each PA. Where zoning becomes complicated is when considering all those families who do not live in a village. Technically, they should be part of a community zone, not a buffer zone.

Ream National Park is currently beginning their zoning process. The PMMR team can learn many valuable experiences from Ream's experience with zoning, and should keep in close contact to ensure a better understanding of zoning issues before beginning this process in PKWS. Although PKWS is a Wildlife Sanctuary, not a National Park, for all intents and purposes the *Sub-decree on PA's Management* treats these areas as the same type of designated PA.

OTHER SUB-DECREES⁶⁴

In 1999, a series of sub-decrees relating to environmental protection were submitted to the Council of Ministers and adopted. For example, the *Sub-Decree on Water Pollution Control*, adopted in 1999, was established to prevent water pollution and ensure public health. *The Sub-Decree on Waste Management*, also adopted in 1999, establishes guidelines to ensure safe-practice waste management initiatives and to prevent the selling and buying of toxic hazardous waste products. Finally, the *Sub-Decree on Environmental Impact Assessment (EIA)* establishes a framework for EIA. Unfortunately, it will be some time before provincial authorities and relevant technical departments will have the capacity to implement and enforce such sub-decrees; yet, this establishes a framework, and provides a strong legal base for the future.

THE FISHERIES LAW

The Fisheries Law passed by the State Council, No 33, in 1987, prescribing fishing sectors, fishing areas and a government taxation system for all fish, except for small-scale fishing. Pertaining to PKWS, it is illegal to trawl in waters less than 20 meters in depth. The law also addresses gear restrictions, seasons and prohibits the fishing of certain species.

A new draft fisheries law, which came out in early 2000, regulates both living and non-living species. It also establishes the legal framework for creating marine protected reserves. The PMMR team has not

⁶⁴ For more details on these sub-decrees as well as the difficulties in implementing them in Koh Kong, see the January 2000 Workshop Report on *Participatory Planning and Management in PKWS*.

yet had time to read the new fisheries law or to understand its implications for fisheries management in and around PKWS.

THE FORESTRY LAW

The draft forestry law is not yet complete. However, the *Sub-decree on Concession Forests* was submitted to the Council of Ministers in 1999 and determines forest species / types, reserve forests, concession forests and forests to be protected and conserved. This sub-decree provides for the protection of watersheds within Forest Concession areas. This relates to the Tach Thai waterfall⁶⁵, just outside of PKWS that is in a forest concession area. Thus, the *Sub-decree on Concession Forests* can be used to protect this area if it cannot become part of PKWS. Also, according to the Forestry Law, hunting for endangered species is strictly prohibited.

DECLARATION ON MANAGEMENT AND MITIGATION MEASURES FOR FOREST ANARCHY

This declaration came into force in January 1999, established by the RGC. This law states that the government must implement the *Forestry Law*, the *Royal Decree on the Creation and Designation of Protected Areas* and the *Law on Environmental Protection and Natural Resource Management*. This Declaration consists of 17 measures that prevent and stop illegal exploitation of wood; buying or selling, transporting or hunting wild animals; and the encroachment of forestland into a PA.

DECLARATION ON MANAGEMENT AND MITIGATION MEASURES FOR ANARCHY IN FISHERIES SECTOR

This early 1999 RGC declaration applies to the fisheries sector, and prescribes measures to prevent and mitigate fisheries abuses. Included in these measures are stopping: fishery violations, especially in closed seasons; and exportation of fish larvae and seeds. Searching for violators, especially from foreign fishing vessels, and promoting incentives to those who discover these violators are also presented in this declaration.

PLANS RELATING TO THE ENVIRONMENT

The RGC has developed some plans and programs, aiming at ensuring the rehabilitation and development of Cambodia's economy and enhancing people's livelihoods, as well as protecting, conserving and managing natural resources and the environment. Consider the following:

NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP),

This plan was adopted by the Council of Ministries in 04 December, 1997, and was prepared by the MoE in cooperation with concerned agencies and NGOs. Its aim is to provide strategy guidelines in order to incorporate environmental concerns into national development policy, and to act as a basis for decision making surrounding economic development and other investment planning.

The key components related to PKWS are forest policy, marine fishery management, biodiversity and PA's and the environment. Both PKWS and Koh Kapic Ramsar site are listed as priority areas in this plan.

⁶⁵ Tach Thai waterfall is a gorgeous waterfall, just outside of the boundaries of PKWS. There are many arguments to be made for its incorporation; however, it stands in a forest concession area and is near forest roads. It will take some negotiation with the forest concession to determine if the area could be included in PKWS or if it is better to use the Forestry Law to protect this area.

WETLAND ACTION PLAN

The draft National Wetland Action Plan provides an entry point for environmental protection while considering cultural significance and economic development. PKWS and Koh Kapic are classified as “*wetlands of international importance*.” The plan aims at promoting management, the use of natural resources and sustainable economic development within wetland areas, with cooperation and coordination among national and international agencies.

AN ANALYSIS OF RESOURCE MANAGEMENT

MANAGEMENT CONSTRAINTS

The protection, conservation, development and management of natural resources in PKWS falls under the jurisdiction of the MoE, specifically, the Department of Natural Conservation and Protection. There is a need for close cooperation between Ministries and provincial technical departments, especially the MoE, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Rural Development, and their related provincial departments. Techniques and experiences need to be shared more often. For example, until 1993 the Department of Agriculture, Forestry and Fisheries was responsible for the PKWS area. Although the provincial level created a committee to prevent and mitigate anarchical activities on mangrove resources, it is still difficult to implement resource protection measures. The following list details constraints to the protection, conservation and development of resources in PKWS:

- ❑ Lack of human resources among public servants and local people, especially those who will perform the tasks of protection and conservation of the natural resources;
- ❑ Lack of appropriate employment and creativity used in finding new occupations that will not destroy the environment;
- ❑ Lack of means i.e. equipment, funding and materials to control fishery abuses, mangrove deforestation and hunting;
- ❑ Lack of cooperation to avoid duplication of work between responsible authorities; for instance, armed forces could control illegal fishery and forest activities for the relevant authority;
- ❑ Lack of participation in resource management initiatives by local people. Although a few locals do participate in protection measures, others are poachers or undertake illegal activities for their own benefit;
- ❑ There is no officially established local committee yet to protect its common interest in PKWS; and,
- ❑ Poverty.

LAWS AND LEGAL INSTRUMENTS

Cambodia is slowly establishing a legal framework for environmental protection. Some legal measures cannot yet be implemented, and others are difficult to enforce. Although some laws, sub-decrees and declarations do work to protect and conserve the natural resources of PKWS, there is a serious lack of understanding of various laws and a lack of enforcement. For example:

- ❑ The *Fisheries Law* was just re-written because the former law was not adequate to meet fishery needs. This also holds true for the *Forestry Law* is currently be re-vised;
- ❑ Laws such as the *Law on Environmental Protection and Natural Resources Management* merely provide an overall framework for environmental protection, not specific standards. The *Sub-decrees on Waste Management* and *Water Pollution Control* give further details on the implementation of the law but Prakas are still needed for enforcement. Another sub-decree

outlining procedures for public participation and one for penalties and fines need to be written and implemented by the MoE; however, this takes time;

- ❑ The *Royal Decree on the Creation and Designation of Protected Areas* dated November 1993, incorporated large land areas that were once under the jurisdiction of the Ministry of Agriculture, Forestry and Fishing. This has created some problems, as MoE staff do not necessarily have experience with fishing and forestry issues. Moreover, this has sometimes created conflicts between the Ministries. Another weakness of this Royal Decree is that it does not set up strict legal actions, such as fines and punishments to those who are found breaking the law. The 1996 *Law on Environmental Protection and Natural Resources Management* was passed to establish an overall legal mechanism for environmental protection (as already stated, specific sub-decrees that will enable fining still need to be drafted);
- ❑ In general, laws and related legal instruments have no legal precedence. That is, a body of common law has not yet emerged from these legal instruments, and laws are largely interpreted according to how it suits a department. The spirit of intent behind a law is often missed;
- ❑ In general, existing laws do not delegate enough power to local authorities or local people to prevent illegal activities from taking place.

POLICY AND PLANNING

In terms of policy or planning for PKWS, little work outside of the PMMR team has been undertaken. The draft *Sub-decree on Protected Areas Management* suggests an overall framework for planning in PA's and then designates specific PA's to draft their own management guidelines.

- ❑ The government's policy on the management of people, especially those who are displaced, is limited. Many displaced people live within Koh Kong province, particularly in PKWS where they can benefit from resource extraction activities. The government has made few attempts to control this net in-migration;
- ❑ There is no specific policy or guidelines relating to planning and management in PKWS. According to the draft *Sub-decree on PA's Management*, specific guidelines for each PA will have to be drafted;
- ❑ Planning needs to take into consideration potential livelihoods for local people, local environmental knowledge, the mangrove and fisheries eco-system and market demands. Somehow, there needs to be enforcement of illegal activities in a manner that the poorest of the poor are not always hit.

CHAPTER VI: EVALUATION AND ANALYSIS⁶⁶

The following chapter provides a project analysis and evaluation on several levels: an analysis of issues faced within the PMMR team, a summary of project activities and an analysis of specific project components.

AN ANALYSIS OF THE PMMR TEAM AND ISSUES AFFECTING RESEARCH

PMMR TEAM CAPACITY

The team is inter-departmental: different staff from different departments cooperate together through working on the PMMR project, and learn about each others' work and from each others' skills. The team plans activities together, carries out the work plan and then determines the direction of the project. A strong working relationship within the PMMR team makes it easy to coordinate with other institutes, commune and village level authorities and local people in PKWS. The PMMR team has focused on building team skills and in sharing both skills and knowledge with villagers in PKWS. This is a 'learning-by-doing' project. One of the implicit goals of this project is to build analytical and research skills within the team, and this process is facilitated through planning, learning from and analyzing different activities. Over half of the team is based in Koh Kong, and this facilitates connections with the provincial authorities and local villages. A series of training courses and study tours have benefited both the PMMR team and local villagers (see Appendix A).

It has taken time to build environmental awareness and capacity within the PMMR team. For example, it was difficult for the team to plan research without the help of an Advisor in the beginning of the project. The team is now comfortable establishing guidelines for their research, merely bouncing ideas off of the Advisor or Team Leader. It still takes time to explain objectives of studies and to explain new information. As a result, progress is slow and steady. Planning skills within the team have greatly improved over the past two years. Sometimes team members find it difficult to work independently, preferring to work in two's and three's. This is also cultural, and further guidance needs to be provided in this area to encourage individual as well as group responsibilities within the PMMR team. The team is weak in gender issues, in part because there are so few women working within government departments within Cambodia. However, the PMMR team can change this if they so choose. The Advisors need to encourage far greater gender discussions, emphasizing the importance of gender both in discussions and in practice. Having a female project Advisor, who is considered an honorary male, is not enough. More women need to be included in all aspects of the project.

TECHNICAL SKILLS

CBCRM is new in Cambodia. The research team had never heard of CBCRM or PR prior to the projects inception i.e. these are new concepts for the entire team. Through extensive training opportunities, team members (mostly national level) have learned and shared their experiences with the team. Further technical skills training is needed to carry out further work in the sustainable livelihood component of the

⁶⁶ For more details on analysis and evaluation used within the PMMR project, see Carson, T. 2000. *Participatory Monitoring and Evaluation: Reflections on the opportunities and constraints of the PMMR project in Cambodia*. Toronto: York University.

project, especially considering that the mangrove ecosystem is a new environment for most of the PMMR team.

Some team members have solid computer skills, while others are still learning. Although the team's skills are good, it takes time to learn new programs or to fix little problems. Data input is often time consuming.

LANGUAGE AND LOCATION

The team is working in two languages because the Advisor is not fluent in Khmer and all reports submitted to IDRC must be in English. Sometimes it is difficult to translate words directly or properly from English to Khmer and vice versa. Often the team misunderstands each other if English is spoken too quickly or if people are not honest about what they do and do not understand.

Koh Kong is difficult to access: it is far from Phnom Penh and takes an entire day to reach by boat and taxi⁶⁷. During the rainy season (especially July, August and September), there are many big waves and storms in the region making it difficult to come and go from Koh Kong town or to go to the field. The rains are very strong during this season.

ISSUES IN KOH KONG

Security in Koh Kong has improved recently. Before, there were many places that the team could not visit and it was necessary to inform the proper authorities of field visits. This all took time to organize. Now the team can travel throughout PKWS to visit various sites and villages without any problems.

In Cambodia, the military navy is very influential along the coastline. For example, in Koh Kong they control all islands in the sea, including Koh Kong Island, and the open sea. Therefore, the Department of Fisheries, who are legally in charge of off shore fisheries, cannot control the number of boats and equipment used in the open sea. The Navy reaps a benefit from fishery resources while small-scale fishers find their yields declining. Most probably, the military navy plays a heavy hand in illegal logging activities, transporting logs through PKWS at night.

Some police in the area are supporting small-scale illegal activities i.e. charcoal production and logging. On the other hand, some police are working with DoE Checkpoint staff to protect resources in PKWS.

Recently, a new governor was appointed to Koh Kong who is quite supportive of the work of the PMMR team and is interested in resource protection. However, he has no control over Koh Kong Island which is controlled by the military navy.

AN ANALYSIS OF PROJECT COMPONENTS

A list of each objective, followed by expected outputs that are compared with actual outputs is given in the following tables. These were prepared in February 2000 as part of a larger internal evaluation for the PMMR project.

⁶⁷ Plane service to Koh Kong resumed in mid-February 2000 after two and a half years of no plane service.

OBJECTIVE 1	EXPECTED OUTPUTS	ACTUAL OUTPUTS
Resource Use Patterns	<p>Data on resource use, sources of income and their distribution within the village.</p> <p>Data on the sources and seasonality of food and income in selected villages</p> <p>Enhanced environmental awareness of the people in the project through a participatory analysis of their resources use and dependency</p>	<ul style="list-style-type: none"> ❑ Mangrove use survey ❑ Fishing gear / grounds work ❑ Charcoal production case study "Smashed Livelihoods" ❑ Markets ❑ Water resource uses, beginning a case study on water supply ❑ Historical resource changes i.e. perceptions of resource changes over time.

The PMMR team, through extensive village work, has begun to understand how resources are used in PKWS. Through PR exercises, villages contributed significantly to this component, especially elders and long-term residents who were able to share their knowledge with others during group exercises. More market survey and analysis research needs to take place, along with a further analysis of food sources and seasonality. However, there is now a solid knowledge base of how resources are used in PKWS, and the factors affecting resource usage.

OBJECTIVE 2	EXPECTED OUTPUTS	ACTUAL OUTPUTS
Institutional Analysis	<p>Identification of the user groups in Koh Sralao and their formal and informal institutional arrangements.</p> <p>Data on the stakeholders in the area and on the control of the means of production for certain commodities, e.g. Charcoal and fisheries.</p> <p>Updated documentation of the policies and plans of the commune, provincial and central governments for the Peam Krasaop Wildlife Sanctuary and Koh Kapic Ramsar site .</p> <p>An analysis of the responsibilities and expectations of various levels of government and the local community with respect to resource management within and around the protected areas.</p>	<ul style="list-style-type: none"> ❑ Role of PMMR research team ❑ Role of middlemen and local people for fishers and charcoal producers ❑ Roles and responsibilities of national level and provincial level authorities and technical departments; ❑ A summary of environmental laws, Royal Decrees, sub-decrees and prakhas affecting PA's and resource management; ❑ Environmental planning workshops at the local, provincial and national level.

A lot of work was undertaken to understand the various laws related to PA's and the roles and responsibilities of different government and technical authorities. By the end of the two years, the team was beginning to examine the informal networks that govern resource use in PKWS i.e. significant role of middleperson. It would be useful to further understand village dynamics at a local level.

The PMMR team has tried to influence the PA's sub-decree by providing local insights into the national level. Moreover, a series of workshops and mini-visits were facilitated by the PMMR team that included both national staff and local people.

OBJECTIVE 3	EXPECTED OUTPUTS	ACTUAL OUTPUTS
Draft Guidelines for Participatory Management Planning	<ul style="list-style-type: none"> ❑ Draft management plans for the Ramsar site and Wildlife Sanctuary which include the participation of local communities and have the support of the provincial government and Ministry of Environment. ❑ Improved capacity of local community to participate in stakeholder consultations on resources management as evidenced by increased awareness of issues and participation in round-table discussion 	<ul style="list-style-type: none"> ❑ Village maps and resource use mapping (village perspective); ❑ Fishing grounds mapping (done by PMMR team with villagers); ❑ Land use map (done by IRIC with 1995 aerial photography) ❑ Satellite Image – Landsat from Nov 1991 and Jan 1998 (taken from Department Forestry and Wildlife); IRS 1998 imagery.

Although no draft management plans were completed during this phase of the PMMR project (this objective was to be supported by CEMP who was closed down by USAID after the 1997 Coup), further work will continue on this objective. A general understanding of resource use patterns as well as basic mapping has already been done for the area. So, the groundwork is laid for working with communities and government authorities in establishing relevant management guidelines.

Certainly the role that local communities have in resource management is far better understood than two years previously. The Minister of Environment specifically emphasized this role in all of his meetings with local people and government officials during his March, 2000 visit to PKWS.

OBJECTIVE 4	EXPECTED OUTPUTS	ACTUAL OUTPUTS
Resource Inventories and Analysis	<ul style="list-style-type: none"> ❑ Map and reports documenting the local and status of natural resources around the Peam Krasaop Wildlife Sanctuary and Koh Kapi Ramsar site. ❑ Map and reports on the location and composition of human settlements and activities in and around the Peam Krasaop Wildlife Sanctuary and assessment of threats to sustainable livelihoods. 	<ul style="list-style-type: none"> ❑ Mangrove species survey; ❑ Bird species survey (from a local perspective); ❑ Coral reef and sea grass (preliminary research); ❑ Fish species survey (preliminary research); ❑ Up land tree survey; ❑ Community resource use mapping.

There is now a fair bit of base-line data existing on the resources found in PKWS. Significant time has been spent with local people to document their understanding of resources in the area. The team has learned about and documented mangrove resources and their uses in PKWS. For some survey work, data will need to be analyzed by mangrove experts to compliment the work done by the PMMR team. A greater understanding of fish species and coral reefs and sea grasses in the area is necessary.

OBJECTIVE 5	EXPECTED OUTPUTS	ACTUAL OUTPUTS
Sustainable Livelihoods	<ul style="list-style-type: none"> ❑ Analysis and assessment of livelihood options for selected villages ❑ Experimental testing of livelihood options for selected villages ❑ If possible, demonstration projects of improved or alternative income sources in selected villages 	<ul style="list-style-type: none"> ❑ Health and sanitation workshop; ❑ Green mussel culture testing (Koh Kang village); ❑ Grouper culture (Koh Sralao village) ❑ Snapper testing; ❑ Shrimp and crab culture advice; ❑ Mangrove replanting.

This objective is perhaps the most complicated. The team could not really begin 'pilot testing' until the second half of the project as the team was just learning about the resources and issues of PKWS themselves. However, an attempt was made to begin grappling with livelihood issues and to teach the team and to work with local people more about different potential aquaculture methods that might work in PKWS. Perhaps aquaculture training can be undertaken as part of the environmental education component of the next phase of this PMMR project.

AN ANALYSIS OF SUSTAINABLE LIVELIHOODS

The PMMR team recognizes the complexities involved with the term 'sustainable livelihood'. Livelihoods in PKWS are dependent on many factors: external markets, government policy, illegal activities, local initiatives. However, this complex issue is worth tackling if the next generation is to benefit from resources in PKWS.

What the team realizes is that 'sustainable livelihood' options take time to understand. One must consider how natural resources are used, market conditions, indigenous knowledge and customs and how local people can really be involved in such options. For example, there are many small-scale aquaculture initiatives that would most probably work if sited correctly; however, people are forced for security reasons to try aquaculture initiatives near their homes. Therefore, water contamination from household wastes becomes an issue. Similarly, there is an excellent area for crab culture near Koh Kong island but transportation to this area is an issue and no one outside of the military is allowed be in this area.

Therefore, it has taken the PMMR team time to find potential options for the 'sustainable livelihood' component of our project. The team began by focusing on resource assessments and resource use patterns. Through this work, the team has a better understanding of resources in the area and of what small-scale aquaculture techniques might work. Planting poles for green mussel culture has enabled the team to understand more about aquaculture techniques. More work can be done on this component in phase 2 of the project. Perhaps, in the future, the PMMR team can also work with the DoE to encourage small-scale silviculture techniques for subsistence charcoal production.

Through facilitating a series of study tours to Thailand with local authorities, the PMMR team is fostering a process of awareness. Villagers were able to see mangrove communities in other locations to understand how they tackled issues. The response to such training was the 'new village'. The idea of Chup Tit, Peam Krasaop commune chief, was to create an 'ideal' village where people would be using

resources in a sustainable manner. Unfortunately, the village was poorly sited and villagers quickly became dependent upon Chup Tit⁶⁸.

In the future, the team plans to implement training programs and pilot projects in the villages on specific aquaculture techniques that villagers want to learn more about. For example, the Department of Women's Affairs indicated that they would like to have training in the villages and the Department of Fisheries has recommended doing grouper culture. These types of initiatives should be supported by the PMMR team.

⁶⁸ For a further analysis of this situation, see *Smashed Livelihoods: life as a charcoal producer in PKWS*.

CHAPTER VII: CONCLUSIONS AND PHASE 2 OBJECTIVES

CONCLUSIONS

This report compiles significant data from two years of PMMR research. A lot has been learned from both an ecological and a socio-economic perspective. Moreover, villagers are expressing a greater interest in learning about resource conservation and management mechanisms. Government authorities are recognizing the importance of local resource management initiatives, and are lending support to the PMMR team and to local initiatives. Considering that the team began its work in Koh Kong when resource extraction activities by most government officials were rife, this is no small feat.

In spite of the difficulties of working in an isolated area on issues new to the PMMR team, significant research and training opportunities have taken place. The PMMR team is better able to carry out PR research, write case studies, plan and organize training sessions and workshops and analyze research data. Equally important, villagers are interested in participating in the research and in study tours and have begun trying different CBCRM strategies for themselves. This is the beginning of a process of encouraging villagers to manage and to protect their resources within PKWS.

Facilitation between different players or stakeholders has been integral to the work of PMMR. It takes time to build relationships and an understanding of resource conservation issues. There are no easy solutions to be presented; however, when players begin to listen to each other and to understand local realities, possible solutions can be worked towards. Importantly, since this project has been largely driven by the PMMR team, a PR process that works in Cambodia has emerged. Although Project Advisors help to influence the project, ultimate ownership and responsibility for the process lies with PMMR. Ownership over a process is essential – the team is in a position to learn from its' mistakes and to further focus and steer the project. Ultimately, the research, planning and analytical skills can be applied by each PMMR team member in whatever job they do in the future. The PMMR team must continue facilitating a process that works towards village ownership of resources. Then, the real resource protection work can begin!

RECOMMENDATIONS AND STRATEGIC PLANNING FOR PHASE 2

The following are the OBJECTIVES FOR PHASE 2 of the PMMR project:

Objective 1:

TO FACILITATE PARTICIPATORY PLANNING AND THE DEVELOPMENT OF MANAGEMENT STRATEGIES FOR PKWS AND KOH KAPIC RAMSAR SITE, BASED ON RESOURCE USE PATTERNS, INSTITUTIONAL ANALYSIS AND PARTICIPATORY RESOURCE ASSESSMENTS AND MAPPING.

Objective 2:

TO EVALUATE FORMS OF ORGANIZATION BY WHICH LOCAL PEOPLE CAN PARTICIPATE IN THE MANAGEMENT OF PKWS.

Objective 3:

TO ASSESS SUSTAINABLE LIVELIHOOD OPTIONS FOR COMMUNITIES HIGHLY DEPENDENT ON THE MANGROVE ECOSYSTEM AND TO CONTINUE TESTING AND DIVERSIFYING OPTIONS FOR FOOD PRODUCTION AND INCOME GENERATION.

Objective 4:

TO PROMOTE THE PARTICIPATION OF COMMUNITIES IN THE PROTECTION, CONSERVATION AND MONITORING OF MANGROVE AND FISHERY RESOURCES IN PKWS THROUGH ENVIRONMENTAL EDUCATION.

Objective 5:

TO BUILD THE CAPACITY OF THE PROJECT RESEARCH TEAM, LOCAL PEOPLE AND RELEVANT INSTITUTIONS TO ADDRESS ISSUES OF COMMUNITY-BASED COASTAL RESOURCE MANAGEMENT AND TO STRENGTHEN LOCAL, NATIONAL AND INTERNATIONAL INSTITUTIONAL LINKAGES.

A FINAL NOTE

Phase 2 of PMMR was officially approved by IDRC on July 1st, 2000 with funding available for the next three years. PMMR remains active in Koh Kong province, with more and more time being spent by provincial staff with village counterparts. This is a dynamic project, and documentation of PMMR's experiences is on going.

Currently, community-based resource planning is being carried out in Koh Sralao and Koh Kang village. Villagers and the PMMR team are preparing draft management guidelines which, hopefully, will be approved by relevant institutions. Additionally, PMMR is cooperating with DANIDA CZM in working on 'sustainable' or small-scale enhanced livelihood options with villagers. For this season, crab fattening and raising will be undertaken.

For more information, please drop by PMMR's office located in the Ministry of Environment in Phnom Penh or visit our office in Koh Kong town, Koh Kong province. You can email us at pmmr@bigpond.com.kh.



APPENDIXES

APPENDIX A: WORKSHOPS, TRAINING AND STUDY TOURS

The following provides a description of study tours, training opportunities and workshops held and attended by the PMMR team from December 1997 until February 2000.

Coral Reef and the Environment, Kampot, Cambodia; DANIDA

- ❑ Nong, Vanntha attended this 5-day training course along with 28 participants from the coastal provinces and concerned institutions;
- ❑ The objectives included: teaching about the importance and bio-diversity found in corals and discussing environmental impacts to coral reefs;
- ❑ Methods included: lectures, hand-outs, group discussions and fieldwork;
- ❑ Results of this training included: an understanding of types of corals, coral ecology and the importance of corals towards eco - tourism development.

Mangrove Forest, Fishery and Aquaculture, Koh Kong, Cambodia; IDRC / DANIDA

- ❑ This two-week training course included 63 participants from national level MoE staff to the local level in PKWS;
- ❑ The objectives included: to provide mangrove and fisheries ecology and management training; to assess mangrove and fishery resources in PKWS;
- ❑ Methods included: lectures, slides, field studies and survey's, local interviews;
- ❑ 80 % of the participants evaluated the training as good.

Mangrove Management in Thailand, AIT, Thailand; DANIDA

- ❑ This 12 day study tour course was attended by the PMMR team leader, and other Cambodian coastal delegates;
- ❑ The objectives were: to increase knowledge of CZM; to discuss coastal issues and planning; to understand research activities and the relationship of local people with their resources;
- ❑ Meetings, lectures, fishing visits within Thailand, village discussions;
- ❑ Cambodian delegates increased their understanding of CZM in Thailand, environmental impacts and the roles and responsibilities of local people and authorities.

PARTICIPATORY RESEARCH (PR), KOH KONG; CoRR

- ❑ This 7 day training course was attended by 23 participants including: the PMMR team, other MoE staff, villagers and provincial departments;
- ❑ The objective of the training was to teach people about PR, PR tools so that local people can participate in planning for resource protection, and key resource issues facing local people;
- ❑ Methods used included: lessons, PR exercises, fieldwork;
- ❑ Participants learned PR tools including: mapping, seasonal calendar's, daily activities, problem ranking and problem trees.

Southeast Asia CBCRM Case Writing Project, Hue, Vietnam; CoRR

- ❑ This 5-day workshop, attended by Nong and Vanntha, focused on finding a way to make another book, Seeds of Hope 2. Twenty-three participants from Canada, Vietnam, Cambodia, Indonesia and the Philippines participated;

- ❑ Main activities included program activity sharing, and formulating a framework and approach for case study writing;
- ❑ Results included: learning principle of CBCRM; and an introduction to case study writing.

Management of Fisheries, Coastal Resources, and the coastal Environmental in Cambodia: Institutional, Legal and Policy Perspectives, Southern Thailand and Malaysia; ICLARM

- ❑ Nong, Vanntha and Toby attended this 10-day study tour, organized by ICLARM, with an institutional analysis and fisheries management focus;
- ❑ The objectives included: identifying problems and issues faced in local communities, which need to be considered for future development and projects in Cambodia; For example, water pollution from shrimp farms were studied, marine parks and forest reserves were visited;
- ❑ Results included an increased understanding of issues surrounding PA's.

Participatory Management of the Buffer Zone in Protected Areas, Bokor National Park; ETAP/UNDP, SPEC, IDRC, WWF.

- ❑ Nong and Vanntha attended this workshop which included MoE staff and park rangers from Bokor, Ream, Kirirom and Virachaey;
- ❑ The objectives of this workshop were to discuss PA's and to discuss buffer zones; to train in PR methodology and to exchange experiences; Main topics included: gender, biology, participation, land tenure and natural resources
- ❑ The methods used: included lectures, role playing and group discussions;
- ❑ Results included an increased knowledge of participatory management of PA's, the concept of boundary demarcation and how to manage a buffer zone.

The Second Workshop of the Southeast Asia CBCRM Case Writing Project, Lagos del Sol, Caliraya, Laguna Philippines; CoRR

- ❑ Nong and Vanntha attended this 5-day workshop with 25 participants from the region;
- ❑ The objectives included: reviewing documented experiences of CBCRM to disseminate and draw out lessons for the region;
- ❑ Workshop activities revolved around sharing program activities and formulating a framework approach towards case study writing.

Environmental Education and Mangrove Resource Protection through Local Community Participation, Koh Kong; PMMR

- ❑ This 3-day training course was facilitated by the PMMR team, held with 41 local PKWS participants;
- ❑ The objectives included: fostering a discussion of natural resources; considering resource changes over time; encouraging village-level communication of resource management issues; basic environmental education;
- ❑ Methodology included: PR activities, group discussions and game playing;
- ❑ The results included: increased communication between villages, increased understanding of the village-level environment and increased environmental understanding.

Participatory Protection and Conservation of Mangrove Forest Resources in PKWS, Koh Kong; PMMR

- ❑ This 2-day training course was held with 31 participants from technical departments, local authorities, provincial departments and national MoE staff;
- ❑ The objectives included: to foster discussions regarding mangrove degradation, mangrove protection and to work together to find solutions to such degradation;

- ❑ Methodology included: district-level presentations, slides, brainstorming and classification methodology;
- ❑ The results of the workshop included a basic analysis of provincial management capacity regarding mangrove management i.e. strengths, weaknesses, strategies.

Integrated Coastal Zone Management, Songkla Province, Thailand

- ❑ This 8-day study tour was undertaken with the PMMR team and village chiefs;
- ❑ The objectives included: an understanding of the loss of natural resources and to improve management capacity; to learn how to develop and implement a plan for a mangrove reserve; to learn from the experiences of pilot projects done in Thai communities;
- ❑ Methodology included: visiting different study sites, meeting with local people and learning about the environment and how the community was organized;
- ❑ The PMMR team was able to learn the basic principles of management and conservation in Thai communities; and learned about the importance of participation from local communities and were able to see, first-hand, the consequences of mangrove loss.

Evaluation and Planning for the Implementation of CBCRM in South-East Asia, Quezon, the Philippines; CoRR

- ❑ Nong and Vanntha participated in this 3-day evaluation workshop with other CoRR participants;
- ❑ The objectives of the workshop were to familiarize participants with evaluation planning and issues of implementation and to develop an evaluation framework for CBCRM's 7 coastal resource projects;
- ❑ Methodologies included group discussions and brainstorming of ideas;
- ❑ Participants gained a little understanding on evaluation and project implementation.

Mangrove and Aquaculture Friendship, Vietnam;

- ❑ An took part in this 12-day training course with other southeast Asian participants;
- ❑ The objectives of this training course were to share experiences and to discuss ways that once can sustainable do aquaculture within mangrove forests;
- ❑ A new technique was learned to ensure the preservation of the environment while enabling one to earn a livelihood.

Community Meetings in PKWS, local villages; PMMR

- ❑ The PMMR team organized day-long village meetings in 4 villages to discuss resource management with local villagers; in total, 184 people attended;
- ❑ The general objectives were to understand local communities needs with regards to management planning

In the Hands of the Fishers, Trang Province, Thailand

- ❑ Vanntha lead a Cambodian delegation (3 village chiefs, two CEPA staff) to participate in this 5-day community-level workshop with participants from Sri Lanka, Thailand and Cambodia;
- ❑ The objectives were to share experiences of coastal management in each of the countries; to promote and support CBCRM management and initiatives;
- ❑ Methodology included country presentations, small group discussions, field trips and evaluation;
- ❑ This was an introduction to Cambodian participants regarding community organizing and mangrove protection.

Summer Institute 2 on Participatory Research for CBCRM, Halifax, Canada; CoRR

- ❑ Nong, An, Toby and Melissa participated along with other Canadian, Filipino, Vietnamese and Canadian participants in this two-week PR workshop;
- ❑ The objectives of this workshop included: sharing experiences with CBCRM; understanding different project experiences and discussing how to improve our PR research;
- ❑ Methodology included large and small group discussions, group presentations and small working groups;
- ❑ Results included a greater understanding of the complexities of PR in different contexts.

Wetlands and Indigenous Knowledge, Phnom Penh; CEPA / Wetland Mekong Program

- ❑ Vanntha participated in this three-day workshop with other Cambodian, Japanese and Mekong River country participants;
- ❑ The purpose was to understand the values of resources in wetlands, to share experiences of planning and management in the Mekong River;
- ❑ Methodology included: country discussions, mixed group discussions on wise-use methods of wetlands and presentations on how to improve wetland management;
- ❑ Results included a greater understanding of wetlands and their importance for national economic development; and understanding the roles that communities play in the wise use of wetlands.

Study Tour to FAO Project, Siem Reap

- ❑ Nong, Vanntha, An and Melissa participated in a three-day study tour to the FAO Siem Reap project to understand their experience with community organizing and resource management and protection;
- ❑ This was a chance to exchange ideas with FAO staff and villagers regarding community organizing, resource protection and environmental education;
- ❑ Results included: seeing a concrete Cambodian example of resource protection and good cooperation between IDRC and FAO.

GPS Training, Koh Kong; Aruna Technology

- ❑ The PMMR team participated in this three-day training course, specifically designed around the team's needs;
- ❑ The course objectives were: to learn GPS and to understand how to use GPS in the process of boundary demarcation;
- ❑ The course included a series of lectures, map reading exercises, GPS exercises and field work;
- ❑ The team now understands the basics of GPS work, and can use the GPS in field work.

Community Forest (CF) in PA's, Sihanoukville; Concern / ADB

- ❑ The team participated in this two-day workshop was organized with environment and forestry staff participating in community forestry in Cambodia;
- ❑ The objective of this workshop was to establish draft guidelines in CF in PA's;
- ❑ A series of lectures and small-group discussions with larger group presentations;
- ❑ This workshop enabled participants to discuss experiences with CF and to draft guidelines that could potentially work in Cambodia.

Ream National Park Study Tour, Sihanoukville; Ream Project

- ❑ The PMMR team spent the day with Park Staff from Ream to discuss community fishing organizing, to see the shrimp pond siting in Ream and to learn more about park management in Ream;
- ❑ The team was able to get a better sense of issues in Ream (some similar and some different from PKWS) and to discuss community organizing strategies that the park staff were beginning to undertake.

APHEDA Mangrove Replanting, Kampot

- ❑ The PMMR team spent the day visiting an abandoned shrimp farm that had been re-planted 4 years ago by the APHEDA project. Department of Fisheries staff spent time with the team to explain the replanting, looking at what species had worked and had not, and illustrating the health of the eco-system. This was an excellent exchange of technical skills.

Participatory Management and Planning in PKWS, Koh Kong; PMMR

- ❑ The PMMR team organized a three-day workshop with 38 participants from provincial authorities and technical departments, national level staff and village leaders;
- ❑ The objectives of the workshop were to: provide follow-up training to the previous workshop; to foster collaboration and understanding of different roles and responsibilities pertaining to mangrove protection and to disseminate relevant information regarding environmental laws;
- ❑ Lectures, small and large-group discussions with some PR exercises;
- ❑ Participants understanding of environmental laws increased, understood and supported the need for boundary demarcation and were able to better understand different roles and responsibilities regarding management of PKWS.



APPENDIX B: POPULATION STATISTICS

YEAR	POPULATION	
	PEOPLE	FEMALES
1986	29,319	16,112
1987	30,140	16,562
1988	30,984	17,027
1989	31,852	17,505
1990	32,744	17,994
1991	33,563	18,443
1992	34,402	18,904
1993	35,262	19,377
1994	71,430	34,424
1995	79,238	40,531
1996	98,540	49,955
1997	110,976	55,412
1998	127,554	64,014
1999	NO INFORMATION	NO INFORMATION
2000	NO INFORMATION	NO INFORMATION

Source: National Institute of Statistics, Ministry of Planning, 1996

POPULATION STATISTICS IN PKWS, KOH KONG PROVINCE, MARCH 1998

NAME OF AREA	Families	Number of People			% Females
		Males	Females	Total	
Mondul Siema District					
1. <i>Backlong Commune</i>	87	248	221	469	
- Beung Kachang village	87	248	221	469	47.12%
2. <i>Peam Krasaop Commune</i>	262				
- Peam Krasaop 1 Village	76	723	572	1,295	
- Peam Krasaop 2 Village	186	219	167	386	43.26%
and Koh Kang village		504	405	909	44.55%
3. <i>Toul Koki Commune</i>					
- Koh Teak Village	218	492	501	993	
- TA Chat Village	40	94	83	177	46.89%
- Toul Koki Ei Village	79	172	187	359	52.18%
- Toul Koki Chrome Village	54	116	113	229	49.34%
	45	110	118	228	51.75%
Koh Kong District					
1. <i>Koh Kapi Commune</i>	590	1,556	1,434	2,990	
- Koh Kapi 1	61	184	183	367	49.86%
- Koh Kapi 2	49	114	106	220	48.18%
- Koh Kapi 3	111	273	242	515	46.99%
- Koh Kapi 4	88	278	233	511	45.59%
- Koh Sralao Village 1	157	364	357	721	49.51%
- Koh Sralao Village 2	124	343	313	656	47.71%
2. <i>Tach Tai Commune</i>	212	516	432	948	
- Koh Andet village	55	155	142	297	47.81%
- Anlongvat village	157	361	290	651	44.54%
Smach Mean Chey District					
1. <i>Steung Veng Commune</i>	514	1,205	1,252	2,457	
- Steung Veng village	423	1,001	1,056	2,057	51.13%
- Prey Svay village	91	204	196	400	49.00%
Total	1,883	4,740	4,412	9,152	48.20%

SOURCE: CENSUS PROGRAM IN CAMBODIA 03, 1998, PROVINCIAL DEPARTMENT OF PLANNING

NOTES:

- ❑ PKWS covers 3 districts: some communes within these districts are in-side PKWS and some are out-side PKWS. These are specific statistics for those living within PKWS.
- ❑ Especially between 1993 to 1998, there was a net in-migration into PKWS; however, many newcomers did not register with their commune of village. Therefore, statistics are not necessarily

accurate from this time period (security was also an issue, making it difficult to access these isolated villages).

APPENDIX C: MANGROVE SURVEY OF LOCAL PERCEPTIONS

#	KHMER NAME	KHMER SOUND	SCIENTIFIC NAME	FAMILY	DENSITY	LOCATION	LOCAL USES
1	ត្រឡៀកក្រាញ់ ស្លឹក វែង ឬត្រឡៀក ក្រាញ់ផ្កាពណ៌ស	Trohjiek cragn slekweng/tr ohjiekcragn pkapor sar	Acanthus ebracteatus (shrub)	Acanthaceae	abundant	upland and wetland / tidal area / hard mud / edge of stream	use leaf to boil in water and use vapour to steam face / use leaf and mix with other mangrove species (Clerodendrum inerme and Premna obtusifolia) and upland forest species (don't know which) and boil with water to take a bath to relieve itchiness
2	ត្រឡៀកក្រាញ់ ស្លឹកបន្លា ឬ ត្រឡៀកក្រាញ់ ផ្កា ពណ៌ស្វាយ	Trohjiek- cragn- slekbantla/ trohjiek- cragn pkapor svay	Acanthus ilicifolius (shrub)	Acanthaceae	abundant	edge of stream / near fresh water / near rear mangrove (where tide doesn't always reach) / along rice field	Medicine
3	ត្រឡៀកក្រាញ់ ស្លឹកឥតបន្លា	Trohjiek- cragn-slak- eit banla	Acanthus vulubilis (shrub)	Acanthaceae	rare - medium	upland areas / attaches to another tree / grows in big forests and streams	medicine
4	ប្រង់	Brong	Acrostichum aureum (fern)	Pteridaceae	abundant	tidal areas / hard mud (harder than Rhizophora species) / concentrated growing	eat short leaves with kapi; branches used for brooms; medicine helps with diarehea (for babies place on tongue) / spores are fried with other plant species to relieve spots on the tongue and sores on gums
5	ប្រង់/ ខ្នាញ់	Brong/khna gn	Acrostichum speciosum (fern)	Pteridaceae	medium	upland areas without tides / rice field / hard mud and climbs trees / small species / near fresh water	eat short leaves with kapi; branches used for brooms; medicine helps with diarehea (for babies place on tongue) / spores are fried with other plant species to relieve spots on the tongue and sores on gums
6	ស្មែរ	Smair	Aegialites rotundifolia (tree)	Plumbaginaceae	medium	in the sand and upland of hill / near Koh Kong island and near Bang KaChaeng	firewood / protect from storms and erosion / wildlife habitat
7	???		Aegiceras corniculatum (tree)	Myrsinaceae	rare	near mangrove forest (along streams), where no flooding	animal habitat
8	??		Amoora cucullata (tree)	Meliaceae	rare	hard soil / tide reaches this area	make gunnels of boat / house pillars , termites do not eat

9	???		Atalantia monophylla (tree)	Rutaceae	medium	sea side	use for making handles
10	ក្បាញស/ស្ពាន មួយរយស្រទាប់	Kbagsor / Sman / mouroujsrot orb	Avicennia alba (tree)	Verbenaceae	abundant	edge of Peam Krasaop towards Koh Kapic / tidal area / soft mud / near stream and upland	peel fruit to boil, place in water 3 days (to release poison from the fruit). This is made into a sweet that tastes like green bean / house pillars, barnacles cannot destroy but the wood is not so strong after time in the water / use hard wood of trunk, mix with another plant to bring down fevers and to relieve stomach aches during cold weather / wildlife habitat (waterfowl, aquatic life) / protect from typhoon
11	ក្បាញ ស្ពង់ មួយរយស្រទាប់	Sporng / mouroujsrot orb / Kbagn	Avicennia marina (tree)	Avicenniaceae	abundant	edge of Peam Krasaop towards Koh Kapic	peel fruit to boil, place in water 3 days (to release poison from the fruit). This is made into a sweet that tastes like green bean / house pillars, barnacles cannot destroy but the wood is not so strong after time in the water / use hard wood of trunk, mix with another plant to bring down fevers and to relieve stomach aches during cold weather / wildlife habitat (waterfowl, aquatic life) / protect from typhoon / bees like the flower nectar
12	ក្បាញខ្មៅ / ស្ពង់	Kbagnkmao / Spong	Avicennia officinalis (tree)	Avicenniaceae	abundant	edge of Peam Krasaop towards Koh Kapic / near stream and in upland	peel fruit to boil, place in water 3 days (to release poison from the fruit). This is made into a sweet that tastes like green bean / house pillars, barnacles cannot destroy but the wood is not so strong after time in the water / use hard wood of trunk, mix with another plant to bring down fevers and to relieve stomach aches during cold weather / wildlife habitat (waterfowl, aquatic life) / protect from typhoon / big trees are used as planks for floors
13	ដើមត្រចៀក ប្រើស ផ្នែកទឹកប្រៃ	Dawm- trojiekbres / pchek tekbray	Barringtonia racemosa (tree)	Lecythidaceae	rare	in sand / can find near upland areas	used for boat construction : paddles and gunnels
14	???		Brownlowia tersa (shrub)	Tiliaceae	rare	upland areas near stream	bark and leaf (sap) used to relieve itchiness and irritation of skin boils
15	បាសាក់ / អំឡាន	Basac / Omlann	Bruguiera cylindrica (tree)	Rhizophoraceae	medium	upland areas with shrubs / land higher than Rhizophora /	CHARCOAL firewood / house construction / wildlife habitat

						species grow together / near stream	
16	បាសាក់ក្រហម	Basac-kroahom	Bruguiera gymnorrhiza (tree)	Rhizophoraceae	medium	in soft and hard mud / mixes with Rhizophora	CHARCOAL construction / can eat this fruit rather than rice / peel fruit and boil, keep in water and grind into a powder or cut into small pieces to eat like rice soup
17	បាសាក់ស	Basacsor	Bruguiera sexangula (tree)	Rhizophoraceae	medium	deep in mangrove forest / hard mud near edge of stream (tide does not necessarily reach)	CHARCOAL construction / can eat this fruit rather than rice / peel fruit and boil, keep in water and grind into a powder or cut into small pieces to eat like rice soup
18	???		Caesalpinia crista (shrub or climber)	Leguminosae - Caesalpinoideae	medium	upland / near edge of stream	
19	???		Calycopteris floribunda (climber)	Combretaceae	rare	upland / after mangrove area / sometimes tide reaches	
20	ដើមជើងទា / ពិលពេជ / ជំពូក្រៃ	Dawm-cheungtia / Pilpicht / Chompou-prey	Cerbera odollam (tree)	Apocynaceae	medium	near beach and upland / after the mangrove area / sometimes the tide reaches	CHARCOAL use flower for Khmer New Year and many ceremonies / women eat after having babies / use as a medicine when have broken limbs / leaf used as a medicine i.e. after women have given birth, and when they want their stomach to shrink, people use this leaf on the stomach along with a hot stone to release the energy in the stomach / use leaf to relieve cramps i.e. make leaf hot and use on cramped muscle or to get blood flowing / boil leaf, take bath to relieve itching
21	ស្ពៃស	Smaisor	Ceriops decandra (tree)	Rhizophoraceae	medium	upland / edge of stream	CHARCOAL house construction, very strong with salt water / use bark as a dye / use for firewood / can cut trunk to burn in fire until it is red hot and place hot embers in water, children take a bath that sweat a lot during the night time
22	ស្ពៃក្រហម	Smer-krohorm	Ceriops tagal (tree)	Rhizophoraceae	medium	upland areas	house construction / use bark as a dye / use like firewood
23	ដើមឆ្អឹងពស់	Dawm-chheongpurs	Clerodendrum inerme (shrub)	Verbenaceae	abundant	find in sandy areas; also in hard mud / near edge of stream	use tree (small tree, can use leaf and trunk together) and mix with another plant to relieve itchiness / wildlife habitat

24	???		Combretum tetralophum (??)	Combretaceae	medium	upland areas	
25	ដើរហាត់	Dyrehatt	Cordia cochinchinesis (tree)	Boraginaceae	medium	upland areas / hard soil	can eat the fruit / wildlife habitat
26	???		Derris trifoliata (climber)	Leguminosae - Papilionoideae	abundant	near streams or estuaries	vine used as a string for tying / take entire tree to boil and drink as a medicine for constipation
27	តាម៉ុ ឈើដំរ	Tatom / chheu chhor	Excoecaria agallocha (tree)	Euphorbiaceae	medium	upland areas	take leaf to steam face for women who have just had children / poisonous sap causes blindness and diarrhea / if people drink water with this juice, people can die / juice itches when touches skin
28	???		Finlaysonia maritima (vine)	Asclepiadaceae	medium - rare	grows with rear mangroves in hard mud / vine climbs trees	
29	ផ្កាអណ្តើក / វិល្លិវេ	Pdao-ondawk / vorre	Flagellaria indica (climber)	Flagellariaceae	abundant	hard mud and upland areas	use bark of tree as a string with woven goods / use in house thatching / use root to make medicine i.e. mix with another plant to cure fever
30	កាន់កែ / ដើមក្លាយ សិរមាន់សមុទ្រ	Kann-kai / Dawm-klai / semornsak mot	Heritiera littoralis (tree)	Sterculiaceae	rare - medium	upland areas in hard mud	use root for boat rudder and handle / use stem for stirring spoon / use as medicine for hypertension / eat bark with beetle nut / fishers use as a floating buoy for crab and fish traps / boil bark in water, mix with pepper and garlic, CaCO ₃ an drink to release stomach ulcers / wildlife habitat
31	ដើមបើស / កប្បាស់ព្រៃទឹក ប្រៃ	Dawm-beus / Kab-baspreyau kbray	Hibiscus tiliaceus (tree)	Malvaceae	medium - abundant	sand and hard mud / can find near upland areas / near edge of stream	big tree can be used for boat gunnels and paddles / use as a floating buoy / flowers used in ceremonies / bark used as string to tie crabs and as thatch / leaf used to wrap deserts
32	ក្រកោះទឹកប្រៃ ក្រញូងទឹកប្រៃ	Krokos-teukpray / krogngungle ukbray	Intsia bijuga (tree)	Leguminosae - Caesalpinoideae	rare	upland areas in hard mud	wildlife habitat / boat gunnels / house construction and furniture
33	???		Kandelia candel (tree)	Rhizophoraceae	rare	upland areas in hard mud	firewood
34	ក្រញូបផ្កា ក្រហម ក្រញូបក្រហម	Krognyep-pka-krohoh / krognyep krohom	Lumnitzera littorea (tree)	Combretaceae	abundant	mud / concentrated growing in forest	CHARCOAL house pillars / construction / floor boards / use for fence / use for fishing gear / firewood
35	ក្រញូបផ្កាស ក្រញូបស	Krognyep-pkasor / krognyep sor	Lumnitzera racemosa (tree)	Combretaceae	abundant	concentrated growing in forest / find in hard mud	CHARCOAL house pillars / construction / floor boards / use for fence / use for fishing gear / firewood

36	ចាក	Chark	<i>Nypa fruticans</i> (palm)	Palmae	medium	living in soft mud along the stream edge	leaf used for roof construction, for mats, to hold sweets and used to roll tobacco / wall construction / eat fruit and make juice which produces sugar / use root and bottom of <i>Nypa</i> stem to make medicine i.e. take root, mix with soil and take some clay and boil for drinking when cannot adapt to new location (mini-flu perhaps caused by different bacteria in new locations)
37	ប៊ុង	Peng	<i>Phoenix paludosa</i> (palm)	Palmae	medium	inland in hard mud	GREEN MUSSEL POLES use 'heart' of the trunk (at top) to cook in soup / trunk used as pole for green mussel culture and house construction
38	???		<i>Premna obtusifolia</i> (tree)	Verbenaceae	rare	inland in hard mud	use leaf, mix with another plant and boil to take a bath to relieve itchiness
39	កោងកាងស្លឹកតូច	Kongkang-slektoch	<i>Rhizophora apiculata</i> (tree)	Rhizophoraceae	abundant	soft mud, near edge of stream	CHARCOAL house construction / good quality of charcoal / firewood / protect from typhoons, storms erosion / wildlife habitat / end of root is ground and mixed with lemon juice and used when pricked from fish to relieve pain
40	កោងកាងស្លឹកធំ	Kongkang-slekhom	<i>Rhizophora mucronata</i> (tree)	Rhizophoraceae	abundant	soft mud, near edge of stream	CHARCOAL house construction / good quality of charcoal / firewood / protect from typhoons, storms erosion / wildlife habitat
41	??	??	<i>Sapium indicum</i> (tree)	Euphorbiaceae	rare	hard soil	house and boat construction / use for medicine i.e. use leaf or part of tree, mix with white sand from bottom of stream and boil with water for release itching / wildlife habitat / cannot eat this fruit
42	អំពូជ្ច / រំពេរឈើ	Ampouthmar / Rompeachheu	<i>Sonneratia alba</i> (tree)	Sonneratiaceae	rare	soft mud with sand / wetland areas / growing at edge of stream	used to make boat gunnels / wildlife habitat / sour fruit is eaten like mango and used to make sour soup / stem is boiled with water and mixed with salt and keep in mouth to reduce tooth aches / used to relieve pink eye
43	អំពូជ្ចហម	Ampoukrohohm	<i>Sonneratia caseolaris</i> (tree)	Sonneratiaceae	rare	soft/hard mud with sand / wetland areas / at edge of stream	fish and wildlife habitat / children use flower / eat this sour fruit
44	អំពៅ	Ampea	<i>Sonneratia griffithii</i> (tree)	Sonneratiaceae	medium	soft mud with sand	fish habitat / eat sour fruit and cook to make sour fish soup

45	អំពៅ	Ampea	Sonneratia ovata (tree)	Sonneratiaceae	medium	soft / hard mud	eat fruit / pregnant women like sour taste / cook to make sour fish soup
46	ពោធិទឹកប្រៃ	Porhteukpr ay	Thespesia populnea (tree)	Malvaceae	rare	upland areas with sand	
47	តាបូនស	Tabonsor	Xylocarpus granatum (tree)	Meliaceae	medium	hard mud in the forest at the edge of the stream	construction / wildlife habitat / bark used for boat gunnels / inside of the tree is hollow so can grow flowers inside / fruit is a bowl shape, take seeds from fruit and grind with stone to make a powder and mix with CaCO3 water to put on wounds
48	តាបូនខ្មៅ	Tabonkmao	Xylocarpus moluccensis (tree)	Meliaceae	medium	edge of stream in mangrove forest	house pillars / wildlife habitat
49	តាប៉ាន់??	Tabann	Xylocarpus rumphii (tree)	Meliaceae	rare		
50	កន្ទ្រានខែត្រសមុទ្រ	Khontrianke t-sahmot	(fern / herb ??)		medium	deep and high in mangrove forest / sometimes the tide reaches	the bud (sprout) is used like a herb / medicine used for growth that occurs on the bottom (clears growth)
51	វល្លិត្រកូនទឹកសមុទ្រ	Voaltrohkhunteck-sahmot	(vine)		rare	deep and high in mangrove forest / sometimes the tide reaches	boil vine in water and bathe in this solution to relieve itchiness
52	វល្លិសណ្តែកខ្មោច	Voalsandek-kmouch	(vine)		rare	deep and high in mangrove forest / sometimes the tide reaches	eat seeds (like bean seeds) like fruit and young leaves are eaten with kapik
53	ននោងសមុទ្រ	Nonung-sahmot	(vine)		rare	grows in rainy season; dies in dry season / deep and high in the mangroves / sometimes the tide reaches	
54	វល្លិតាងិត	Voaltadet	(vine)		rare	deep and high in mangrove forest / sometimes the tide reaches	fruit is used to make sour soup / root of this vine used as medicine: to cure stomach aches and to relieve abscesses (growth on bottom)
55	រំបេកសមុទ្រ	Rhumjeik-samot	Pandanus tectorius (palm / tree)	Pandanaceae			
56	??		Scaevola taccada (shrub)	Goodeniaceae			
57	វល្លីព្រឿង	Voaprieng	(vine)		rare	grows in hard mud; sometimes tides reach	

58	ពុទ្ធរាសមុទ្រ	Phut-tria samot	(tree / shrub)		rare	grows in hard mud; sometimes tides reach	eat fruit, has sour taste
59	តសាយ	Thaw-sai (thai)	?		rare	grows in hard mud; sometimes tides reach	use as medicine / leaf is shaped like a three-leaf clover
60	ឡូប៊ីតថ្មឡើ	Lam-bit thalay (thai)	?		rare	grows in hard mud; sometimes tides reach	construction
61	ផ្លែសែ	Phosai (thai)	?		rare	grows in hard mud; sometimes tides reach	
62	ទូកកែ	Thuk-gai (thai)	?		rare	grows in hard mud; sometimes tides reach	
63	ផាក់យាយ៉ាន់	Phat-yanman (thai)	?		rare	grows in hard mud; sometimes tides reach	
64	ឡូងក្រសា	Lang-katsaa (thai)	?		rare	grows in hard mud; sometimes tides reach	can eat fruit or use as medicine
							<i>These comments include a combination of local perceptions of what each species can be used - ideas varied between people.</i>

Notes:

This mangrove survey is not yet complete; however, it gives an indication of species found in PKWS and local usage of such species. Follow-up work will be undertaken to verify those species not yet identified by the PMMR team and to learn more about traditional medicinal uses of mangrove and upland species.

APPENDIX D: CHARCOAL IN PKWS

ACTIVITIES	Brick Kiln		SOIL KILN
	Medium Size	Small Size	
Size of charcoal kiln	D = 3.5 – 5 m H = 2.5 – 3.5 m	D = 2 – 3.5 m H = 1.8 – 2.5 m	D = 2 – 3.5 m H = 1.8 – 2.5 m
Construction material	Clay & Solid brick	Clay & Solid brick	Clay, thatch & small tree for roof structure
Construction costs	7,000 – 15,000 B 190 - 405 US\$	4,000 – 7,000 B 19 US\$ - 40.5 US\$	Use trees and clay; don't need to buy materials
Life span	4 – 6 years	4 – 5 years	1 year
Location of Kiln	Highland areas, rear mangrove	Highland areas, rear mangrove	Inside mangrove forest
Amount of mangrove tree in the kiln	from 9 – 17 m ³	from 3 – 9 m ³	from 1,5 – 3 m ³

Size of mangrove tree	$8 \leq \varnothing \leq 30$ Cm (diameter after barking) $H = 1 - 1.2$ m	$8 \leq \varnothing \leq 30$ Cm (diameter after barking) $H = 0.8 - 1.2$ m	$8 \leq \varnothing \leq 20$ Cm (diameter after barking) $H = 0.8 - 1$ m
Amount of charcoal produced per burning	2,500 – 5,500 Kg	1,000 – 2,500 Kg	500 – 1,000 Kg
Firewood needed	from 3 – 5 m ³	from 1 – 3 m ³	from 0.5 – 1 m ³
Time of seeking firewood	from 8 – 15 days	from 4 – 8 days	from 2 – 4 days
Time for putting firewood into charcoal kiln	from 3 – 5 days	from 2 – 3 days	from 1 – 2 days
Time of burning	from 20 – 31 days	from 15 – 20 days	from 10 – 15 days
Closing the mouth of kiln	from 5 – 10 days	from 3 to 5 days	from 2 – 3 days
Kiln owners	Most kiln owner are medium people	Most kiln owner are poor people	Most kiln owner are very poor people
Labor	from 3 – 6 persons	from 2 – 4 persons	from 1 – 2 persons
Labor fee	1,000 B / month 27 US\$ / month	1,000 B / month 27 US\$ / month	Self employed
Equipment & material used for charcoal production	Boat 5 H.P. machine ax and saw	Boat 5 H.P. machine ax and saw	Ax and saw
Charcoal price	from 1.4 – 2.5 B/Kg or 0.04 – 0.07US\$/Kg	From 1.4 – 2.5 B/Kg or 0.04 – 0.07 US\$/Kg	from 1.2 – 2.3 B/Kg or 0.03 – 0.06 US\$/Kg
Charcoal price in market	from 2.5 – 3 B/Kg or 0.07 – 0.08US\$/Kg	From 2.5 – 3 B/Kg or 0.07 – 0.08 US\$/Kg	from 2.5 – 3 B/Kg or 0.07 – 0.08 US\$/Kg

Source: People who make charcoal kilns and produce within PKWS, 1999.

Explanation:

Volume of mangrove trees per kiln in average is:

- ❑ Kiln with medium size in average: $9 + 17 / 2 = 13$ m³
- ❑ Kiln with small size in average : $3 + 9 / 2 = 6$ m³
- ❑ Soil kiln : $1.5 + 3 / 2 = 2.25$ m³

Amount of mangrove charcoal produced per kiln in average is:

- ❑ Kiln with medium size in average: $5,500 + 2,500 / 2 = 4,000$ Kg
- ❑ Kiln with small size in average : $1,000 + 2,500 / 2 = 1,750$ Kg
- ❑ Soil kiln : $500 + 1,000 / 2 = 750$ Kg

Volume of mangrove trees used as firewood per kiln in average is:

- ❑ Kiln with medium size in average: $3 + 5 / 2 = 4$ m³
- ❑ Kiln with small size in average : $1 + 3 / 2 = 2$ m³

□ Soil kiln : $0.5 + 1 / 2 = 0.75 \text{ m}^3$

AN ESTIMATION OF MANGROVE TREES USED FOR CHARCOAL PRODUCTION IN PKWS

Type of Charcoal Kiln	# of kilns in 1996	# of production times per year	Amount of Mangrove Trees Used for 1year		Mangrove Charcoal Produced per Year
			Trees for Producing Charcoals	Trees for Using of kiln Firewood	
MEDIUM	90 kiln	8 times	$90 \times 8 \times 13 \text{ m}^3 = 9,363 \text{ m}^3$	$90 \times 8 \times 4 \text{ m}^3 = 2,880 \text{ m}^3$	2,888 T
Small	150 kilns	10 times	$150 \times 10 \times 6 \text{ m}^3 = 9,000 \text{ m}^3$	$150 \times 10 \times 2 \text{ m}^3 = 3,000\text{m}^3$	2,625 T
Soil Kiln	60 kilns	14 times	$60 \times 14 \times 2.25 \text{ m}^3 = 1,890\text{m}^3$	$60 \times 14 \times 0.75 \text{ m}^3 = 630\text{m}^3$	630 T
Total	300 kilns	32 times	20,250 m ³	6,510 m ³	Charcoal Production 6,135 Tons/year
Grand Total	300 kilns	32 times	Amount of Mangrove trees Used = 26,760 m ³		

Source: Charcoal Producers in PKWS, 1999

APPENDIX E: FISHING GEARS, FISHING SEASONS AND FISHING PRODUCTION IN PKWS

PEAM KRASAOP VILLAGE

Type of Fishing Gear	#	People	Hp Boat	Season	Target Catch	Fishing Ground	Production / family / day	
							1989	1999
Swimming crab trap	250-500 traps	3-4	40-100 Hp	All year	Swimming crab, other fish	off shore	50-200 Kg	10-50 Kg
Mud crab trap	40-100 traps	1-2	5-10 Hp	All year	Mud crab, other fish	Mangroves	10-15 Kg	1-3 Kg
Swimming crab gill net	500-1,000 traps	2	5-10 Hp	All year	Swimming crab, other fish	off shore	50-200 kg	10-50 kg
Coastal bag net	2-4 units	2-4	5-10 Hp	Jan-Jun	Shrimp, fish, crab, Cuttlefish	Mangroves	40-60 kg/unit	5-15 Kg/unit
Forefinger thread fin gill net	100-150 m	2	5-10 Hp	All year	Four-finger threadfin, other fish	off shore	50-70 Kg	5-15 Kg
Trawler	2 units	3	16-150 Hp	All year	Shrimp, fish, crab, Cuttlefish	off shore	70-200 Kg	30-70 Kg
Spanish mackerel hooked long line	300-500 hooks	2	5-10 Hp	Oct-Feb	Spanish mackerel	off shore	5-10 Kg	3-5 Kg
Short-bodied	500-	3	5-10 Hp	Oct-Mar	Short-	off shore	-----	70-300 Kg

mackerel gill net	600 m				bodied mackerel, other fish			
Snapper gill net	100-500 m	2	5-10 Hp	Jun-Oct	Snapper, other fish	in shore / mangroves	20-50 Kg	1-4 Kg

Source: Fishers and chief of Peam Krasaop Commune

KOH KAPIC VILLAGE

Type of Fishing Gear	#	People	Hp Boat	Season	Target Catch	Fishing Grounds	Production / family / night	
							1989	1999
Engine push net (shrimp)	1 unit	2	10 -18	Sept – May (night)	Shrimp, and other fish	in shore / mangroves		20 - 30 Kg
Engine push net (krill)	1 unit	2	5-10	Mar - Apr	Krill, and other fish	in shore / mangroves		30 - 60 Kg
Shaped dipnet	1 unit	1	Row boat	Mar - Apr	Krill, and other fish	in shore / mangroves	50-70 Kg	10 - 40 Kg
Mud crab traps	50 -100	2	5	whole year	Mud crab, other fish	Mangrove area	10-20 Kg	2 - 6 Kg
Swimming crab traps	50 –100	2	5	whole year	Swimming crab	off shore	30-40 Kg	10 Kg
Swimming crab gill net	200 - 300 m	2	5-10	Dec – Mar	Swimming crab	off shore	20-30 Kg	5 - 10 Kg
Shrimp gill net	500-600 m	2-3	5-18	Jun – Nov (day)	Shrimp, and other fish	off shore	10-80 Kg	2 - 10 Kg
Trawl	2 units	4	42 –90	Whole year	Shrimp, fish, crab, squid, and other	off shore	70 -200 Kg	20 - 50 Kg
Grey mullet gill net	20-50 m	1	Row boat	Jun - Nov	Grey mullet, and other fish	Mangroves	10 - 15 Kg	2-4 Kg
Short-bodied mackerel gill net	500-600 m	2	5 - 10	Dec – Jan	Short bodied mackerel and other fish	off shore		50-200 Kg
Oyster collection (for meat)		1	-	Jun – Nov	Oyster	Mangrove root	2 - 3 meat	1 – 2 Kg meat
Grouper trap	50-60 traps	2	5	Dec - May	Grouper fry	in shore / mangroves		20 - 60 piece

Source: Fishers in Koh Kaptic Village

KOH SRALAO VILLAGE

Type of Fishing Gears	#	# of Labor	Hp Boat	Fishing Season	Target Catch	Fishing Ground	Production / Family / night	
							1989	1999
Swimming crab trap	200 –300	2	5 - 13	Nov - May	Swimming crab	in shore	40 - 50 Kg	15 - 20 Kg
Mud crab trap	200 –300	2	5 – 13	Whole year	Mud crab	Mangrove area	30 - 40 Kg	2 - 4 Kg
Swimming crab gill net	200 -300 m	2	5 - 13	Nov- May	Swimming crab	In shore mangroves	50 - 90 Kg	20 - 25 Kg
Mud crab gill net	600-800 m	2	5 - 13	Whole	Mud crab	Mangroves	30 - 40 Kg	2 - 3 Kg

				year				
Grey mullet gill net	200 m	3	5 - 13	Whole year	Grey mullet, and other fish	Mangroves	20 - 40 Kg	3 - 10 Kg
Grouper trap	200-300 traps	2	5 - 13	Nov-Jun	Small grouper fish	In shore, near Chrou Brose	-	60 - 80 pieces
Small handled drag net	1 Unit	2		Nov-Jun	Small grouper fish	In shore, near Chrou Brose	-	50-60 pieces
Shaped coastal dip-net	1 Unit	1		Nov-Jun	Small grouper fish	In shore, near Chrou Brose	-	50-80 pieces
Engine pushing net	1 Unit	2	5 - 13	Nov-Jun	Small grouper fish	In shore, near Chrou Brose	-	50-150 pieces
Mollusk scraper	1 Unit	2	5 - 13	May-June	Cockle	In shore, near Chrou Brose	-	10-60 Kg
Hand held crab lift net	30-40 Unit	2	5 - 13	Jun-Sep	Green blowfish	Mangroves – rains	-	70-100 pieces
Oyster collected	-	1		May-Oct low tide	Oyster	Mangroves	-	1-2 Kg of meat
Mangrove snail collection		1		May-Oct	Mangrove snail	Mangroves	3 - 5 Kg	2 - 4 Kg
Coastal handled drag net	30 - 40 m	3	5 - 13	May - Oct	Catfish, snapper, grey mullet	Mangroves	-	2 - 6 Kg
Hooked long line	400 -500	2	5 – 13	May - Oct	Catfish, eel	Mangroves	-	3 - 10 Kg
Spear	1 unit	1		May-Oct low tide	Giant fresh H2O prawn	Mangroves	-	2 - 3 Kg

Source: Fishers in Koh Sralao Village

APPENDIX F: PRICE OF GOODS IN KOH SRALAO VILLAGE

Type of Goods	Sell		Buy		Unit	Size	Place of Production	Other
	Retail	Whole Sale	Retail	Whole Sale				
1. Fish Production								
Small grouper fish		3B	2B		1 fish	5 – 6 cm	Near Peam Krasaop	Export to Thailand
Swimming crab meat		65B	55B		1kg			Export to Thailand
Mud crab		60B	50B		1kg	Up to 0,2kg		Mix Species

Cockle		11B	10B		1kg			Sale to Koh Kong/other provinces
2. Fishing Gears								
Crab trap		50B		45B	1 trap		Thailand	Some trap produce in Village
Crab gill net		85B		80B	1 unit	50 m		
Coastal dip net for catching grouper fry		420B		400B				
3. Mangrove Prod.								
Mangrove charcoal		200B		130B	1 bag	60kg	Near Peam Krasaop	Export to Thailand
Mangrove stems		30B		20B	1 stick		Near Peam Krasaop	Domestic use
4. Agricultural Prod.								
Coconut		15B		12B	1 unit		Village	
Pineapple		5B		3B	1 unit		Thailand	
Banana		10B		8B	Hand			
Cucumber		10B		8B	1kg			
Eggplant		10B		8B	1kg			
Potato		15B		6B	1kg			
Cabbage		15B		12B	1kg			
Water green		10B		8B	1kg			
Gourd		10 B		8 B	1 kg			
Wax gourd		10B		8B	1kg			
Pumpkin		10B		7B	1kg			
Tomato		10B		8B	1kg			
Green garlic		80B		50B	1kg			
Herb		80B		50B	1kg			
Chili		80B		50B	1kg			
Ginger		25B		20B	1kg			
5. Groceries								
Salt		7B		5B	1kg		Kampot	
Rice		10B		9B	1kg		Local	
Sugar		18B		15B	1kg		Thailand	

Sugar palm		25B		20B	1kg		Thailand	
MSG		40B		35B	1	0,5kg	Thailand	
Fish sauce		120B		90B	1 Box	3 liters	Thailand	

Source: Villagers in Koh Sralao, 1999

APPENDIX G: FISHING BOAT STATISTICS

KOH KAPIC VILLAGE 1999

Fishing Boat		# of Boats	Type of Fishing Gear	# & Unit in One Boat	Fishing Place
Horse Power (Hp)	Model				
4	Yanma	17	Shrimp net Trap Crab Fishing Net	400 m 50 traps 700 m	Inshore and offshore Stream in mangroves inshore and offshore
5	Honda	4	Shrimp net Trap Crab Fishing net	500 m 80 traps 40 m	Inshore and offshore Stream in mangroves Stream in mangroves
6	Yanma	6	Shrimp net Trap Crab	500 m 100 traps	Inshore and offshore Stream in mangroves
7	NT	1	Shrimp net	600 m	Inshore and offshore
8	Yanma Kubuta NT	11	Shrimp net Trap Crab Fishing net	700 m 100 traps 1000 m	Inshore and offshore Stream in mangroves Inshore and offshore
9	Yanma	2	Shrimp net	700 m	Inshore and offshore
10	Yanma Kubuta	12	Shrimp net Fishing net	700 m 1000 m	Inshore and offshore Inshore and offshore
11	Yanma Kubuta	3	Shrimp net	700 m	Inshore and offshore
12	Yanma Kubuta	7	Shrimp net Fishing net	700 m 1500 m	Inshore and offshore Inshore and offshore
15	Kubuta	7	Shrimp net Fishing net	800 m 1000 m	Inshore and offshore Inshore and offshore
16	Yanma	3	Shrimp net Trawl	800 m 1 set of trawl	Inshore and offshore Inshore and offshore
18	Kubuta	1	Shrimp net	800 m	Inshore and offshore
25	Nissan	1	Shrimp net Fishing net	800 m 1000 m	Inshore and offshore Inshore and offshore
30	Yanma Nissan	2	Shrimp net Trawl	800 m 1 set of trawl	Inshore and offshore Inshore and offshore
33	Nissan	1	Shrimp net	800 m	Inshore and offshore
35	Guaner	1	Shrimp net	500 m	Inshore and offshore
40	Yanma	7	Trawl	2 set of trawls	Inshore and offshore

42	YANMA	1	Trawl	2 set of trawls	Inshore and offshore
80	Guaner	1	Shrimp net Fishing net	500 m 1500 m	Inshore and offshore Inshore and offshore
90	Hyno	1	Trawl	2 set of trawls	Inshore and offshore

Source: Fisheries Office in Koh Kong Province

The total number of fishing boats are: 89 boats

- ❑ Shrimp net : 60 boats
- ❑ Fishing net : 10 boats
- ❑ Trap crab : 08 boats
- ❑ Trawler : 11 boats

- **Note:** Often boats use two or three different types of fishing gear, depending upon the season and amount of catch available.

TOUL KOKY COMMUNE 1999

Fishing Boat		# of Boats	Type of Fishing Gear	# & Unit in One Boat	Fishing Place
Horse Power (Hp)	Model				
Row boat		2	Small shrimp net	-	Stream in mangroves
3.5	Honda	1	Small shrimp net	01	Stream in mangroves
5	Honda	22	Small shrimp net	01	Stream in mangroves
10	Honda	4	Small shrimp net	01	Stream in mangroves
11	Honda	2	Small shrimp net	01	Stream in mangroves
90	Hyno	1	Small shrimp net	-	Stream in mangroves
270	Nissa	12	Small shrimp net	-	Stream in mangroves

Source: Fisheries Office in Koh Kong Province

- ❑ **Total fishing boats are: 44 boats**
 - ❑ Small shrimp net: 10 boats
 - ❑ 23 boats used for another transport
- ❑ **Note:** Often boats use two or three different types of fishing gear, depending upon the season and amount of catch available.

FISHING BOAT STATISTICS IN PEAM KRASAOP VILLAGE

Fishing Boat		# of Boats	Type of Fishing Gear	# & Unit in One Boat	Fishing Place
Horse Power	Model				
Row boat		3	Crab net Crab trap		Mangroves

4	Yanma	6	Crab net	500 m	Sea and mangroves
5	Kabuta	33	Crab net	250 m	Sea and mangroves
6	Honda Kawasky	14	Crab net	250 m	Sea and mangroves
7	Honda Kawasky	14	Crab net	300 m	Sea and mangroves
8	Honda	1	Crab net	300 m	Sea and mangroves
10	Honda	10	Crab net	350 m	Sea and mangroves
	Kawasak y		Fishing line	250 m	
12	Robine Yanma	5	Crab net	300 m	Sea and mangroves
13	Kabuta	2	Crab net	300 m	Sea and mangroves
15	Robine Honda	2	Crab net	350 m	Sea and mangroves
16	Kabuta Yanma	10	Trawl	1 set of trawls	
17			Crab net	350 m	Sea and mangroves
22	Nissan	1	Trawl	1 set of trawls	
30	Yanma	3	Crab trap	450 traps	Inshore and offshore
		3	Crab net	350 m	Inshore and offshore
			Crab net	500 m	Inshore and offshore
40	Yanma	2	Trawl	1 set of trawls	
			Crab net	450 m	Inshore and offshore
50	Yanma	1	Crab trap	450 traps	
80	Nissan	5	Crab net	450 m	Inshore and offshore
	Isusu		Crab net	500 m	Inshore and offshore
130	Hyno		Crab trap	2 set of trawls	
			Crab net	500 m	Inshore and offshore
			Crab trap	450 m	
150	Hyno	2	Trawl	2 set of trawls	
			Crab trap	500 traps	Inshore and offshore
160		1	Trawl	2 sets of trawls	
300	Hyno	2	Crab trap	500 traps	Inshore and offshore
			Trawl	2 sets of trawls	Inshore and offshore

Source: Fishery Office in Koh Kong Province

❑ Total fishing boat are: 124 boats

- ❑ Crab net : 74 boats
- ❑ Fishing line : 02 boats
- ❑ Trap crab : 06 boats
- ❑ Trawl : 13 boats

- ❑ 29 boat Used for another transportation
- ❑ **Note:** Often boats use two or three different types of fishing gear, depending upon the season and amount of catch available.

FISHING BOAT STATISTICS, 1999, IN KOH SRALAO VILLAGE

Fishing Boat		# of Boats	Type of Fishing Gear	# & Unit in One Boat	Fishing Place
Horse Power (Hp)	Model				
5	Honda	55	Crab net / trap	800 m / 200 traps	Stream in mangroves
6	Honda	26	Crab net / trap	800 m / 200 traps	Stream in mangroves
7	Kawasky	5	Crab net / trap	200 traps	Stream in mangroves
8	Honda	14	Crab net / trap	200 traps	Stream in mangroves
10	Kubuta Robin	5	Crab trap	200 traps	Stream in mangroves
11	Honda	1	Crab trap	200 traps	Stream in mangroves

Source: Fisheries Office in Koh Kong Province

❑ **Total fishing boat are: 106 boats**

- ❑ Crab net : 93 boats
- ❑ Crab trap : 13 boats

- ❑ **Note:** Often boats use two or three different types of fishing gear, depending upon the season and amount of catch available.

APPENDIX H: CORAL, FISH AND UPLAND SPECIES FOUND IN PKWS

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Ek3rtMbn'EdnCMrkst4\RBjmRkesab

CORALS IDENTIFIED BY LOCALS IN PKWS

I,r	eQ`aHCaPasaGg'eK7s CORAL NAME	eQ`aHviT2asaRs1 FAMILY NAME
1.	Spiny star coral	Acanthastrea sp.
2.	Staghorn coral	Acropora aspera
3.	Staghorn coral	Acropora brueggemanni
4.	Table coral	Acropora clathrata
5.	Tabulate coral	Acropora cytherea
6.	Staghorn coral	Acropora danai
7.	Corymbose coral	Acropora divaricata
8.	Bottlebrush coral	Acropora elseyi
9.	Table coral	Acropora granulosa
10.	Staghorn coral	Acropora horrida
11.	Corymbose coral	Acropora latistella
12.	Bottlebrush coral	Acropora longicyathus
13.	Digitata coral	Acropora pulchra
14.	Staghorn coral	Acropora robusta
15.	Corymbose coral	Acropora selago
16.	Bottle brush coral	Acropora subglabra
17.	Table coral	Acropora subulata
18.	Corymbose-tabulate coral	Acropora valida
19.	Fine branched coral	Anacropora matthaii
20.	Starflower coral	Astreopora sp
21.	Shallow groove brain coral	Australomussa rowleyensi
22.	Honey comb coral	Coeloseris mayeri
23.	Spiny cup coral	Cynarina lacrymalis
24.	Tree coral	Denderopphyllia micranthus
25.	Spiny encrusting coral	Echinophyllia aspera
26.	Spiny pores coral	Echinopora horrida
27.	Ring coral	Favia favius
28.	Ring coral	Favia sp
29.	Ring coral	Favia stelligera
30.	Larger star coral	Favites sp
31.	Mushroom coral	Fungia fungites
32.	Galaxy coral	Galaxea fascicularis
33.	Gardiner's coral	Gardineroseris planulata
34.	Anemone coral	Goniopora sp
35.	Boomerang coral	Herpolitha limax
36.	Jack fruit spined coral	Hydrophora exesa
37.	Crust coral	Leptastrea sp

38.	Spiny cabbage coral	<i>Merulina ampliata</i>
39.	Fire coral	<i>Millepora tenella</i>
40.	Fire pore coral	<i>Montipora digitata</i>
41.	Fire spined coral	<i>Montipora hispida</i>
42.	Lettuce coral	<i>Mycedium elephantotus</i>
43.	Brain coral	<i>Oulophyllia crispa</i>
44.	Serpent coral	<i>Pachyseris speciosa</i>
45.	Flower coral	<i>Pavona cactus</i>
46.	Flower coral	<i>Pavona venosa</i>
47.	Tipped bubblegum coral	<i>Physogyra lichtensteini</i>
48.	Brain coral	<i>Platygyra daedalea</i>
49.	Brain coral	<i>Platygyra pini</i>
50.	Cauliflower coral	<i>Pocillopora damicornis</i>
51.	Boomerang coral	<i>Polyphyllia talpina</i>
52.	Mountain coral	<i>Porites lobata</i>
53.	Wrinkle coral	<i>Porites (synaraea) rus</i>
54.	Hood coral	<i>Stylophora pistillata</i>
55.	Orange cup coral	<i>Tubastraea coccinea</i>
56.	Dise coral	<i>Turbinaria reniformis</i>

Source: Wayne Som Sak, Koh Sralao, PKWS

tarageQ`aHeQI\RB P~M PumiekaHRseLA

UPLAND SPECIES IN KOH SRALAO, PKWS

l,r	eQ`aHEx`r	eQ`aHLat aMg KHMER SOUND	eQ`aHviT2a saRs1 SCIENTIFIC NAME	GMbUI FAMILY NAME
1	ep1ok	Phdeak	Anisoptera glabra	Diptérocarpac ées
2	p)-g	Pha ong	Callpghyllum Sp.	Guttifères
3	Rtesk ëRtaMkgí	Tra sek	Peltophorum fvverrugineum	Caesalpinées
4	RB s	Plrous	Garcinia ferrea	Guttifères
5	RtEmg	Tra meng	Carcinia lucida	Rhizophoracé es
6	RtmUg	Tra moun	Garcinia schomburghiana	Guttifères
7	s`aRkbl	Sma kra bey	Knema corticosa	Myristicacées
8	kMBIgraC ësËní	Kom ping reach	Sandoricum indicum	Méliacées
9	el6og	La ngeang	Cratoxylon ournifolium	Gypéricaées
1 0	sMB>r ës5>rí	Som por	Artocarpus sempervirens	Urticaées
1 1	BJIEx	Por pealkehe	Terminalia bialata	Combrétacées
1 2	Rkj g	kra nhoun	Dalbergia cochinichinensis	Pepilionacées
1 3	Rkays	Kray sor	Albizzia thorelli	Mimosées
1 4	eQITaITwk	Chheu teal teuk	Diptérocarpus alatus	
1 5	F7k	Thlok	Parinarium annamensis	Rosacées
1 6	RBIgRKab' Ebk	Pring krabek	Eugenia Sp.	Myrtacées
1 7	s`ac'edam	Smah dorm	Eugenia zeylanica	Myrtacées
1 8	raMgP~M	Raing phnom	Pentacme siamensis	Diptérocarpac ées
1 9	Gg#t'ex`A	Ang kort kmou	Diospyros bejaudi	Ebenacées

20	s4ay\RB	Svay prey	Mangifera indica	Anacardiacees
21	KKlrP~g	Koki phnong	Shorea hypochra	Dipterocarpacees
22	KKlrx!ac'	Koki ksach	Hopea pierrei	Dipterocarpacees
23	dUgEcm	Dong chem	Tarrietia javanica	Sterculiacees
24	VyrvaMg	Bay ro vang		Meliacees
25	BBUI ëeP~lí	Po pol	Vitex Sp.	Verbenacees
26	nagEdgeQ ITalbg{+y	Neang deng	Dipterocarpus costaus	Dipterocarpacees
27	Rcma"s'	Chra mas	Vatica astrotricha	Dipterocarpacees
28	sMBg' ës5g'í	Som pong	Tetrameles nudiflora	Datiscacees
29	nagEp)mG aTit2	Neang phaem atet	Hassia cuneata	Lauracees
30	eClgcab	Cheuk chab	Dasymachaion lamentaceum	Anonacees
31	RTak	Treak	Livistona cochinchinesis	
32	can's	Chan sar	Cassia garretiana	Caesalpinicees
33	edlmnl	Deum ni		
34	RtyUg	Tra yang		
35	rug	Rong	Garcinia hanburyi	Guttiferes
36	s#-m	Skom	Payena elliptca	Sapotacees
37	kMP7a ëBJ7í	Kam phlea	Grewia paniculata TOXB	Tiliacees
38	esman'	Se morn	Nephelium xerospermum	Sapindacees
39	kn8+t\RB	Kan ntout prey	Phyllanthus emblica L	Euphorbiacees
40	m#ak"\RB	Mkak prey		
41	eP7Acin	Plau chin		

4 2	RkaMg	Kraing	Lithocarpus elephantum	Fagacées
4 3	Ús!\RB	Res sey prey	Bambousa arundinacea	Graminées
4 4	P7+r	Phou	Dillenia ovata	Dilléniacées
4 5	cMbk	Cham bak	Íringia malatana	Simarubacées
4 6	em!"ARs v	Msau srauv		
4 7	ekAsUË	Kao sou	Hevea brasiliensis	
4 8	kn8-yev"	Kon tuve		
4 9	eTB!r"U	Tepirol	Cinnamomum cambodianum	Lauracées
5 0	ma"k'RVg\ RB	Mak brang prey		
5 1	Ex7gKg	Kleng kong	Holarrhena antidysenterca	Apocyncées
5 2	Em!r GEn!r	Am ser	Crayota urens	Palmoers
5 3	ep1Aesam	Phdau sam	Calamus Sp.	Palmiers
5 4	bwug	Peung	Phoenix palidisa	Palmiers
5 5	ejj	Nheng	Melastoma villosum	Mélastomacée s
5 6	BYc	Pouch	Rhodamnia trinerva	Myrtacées
5 7	BYcGYI	Pouch oul		
5 8	cinecalRkd as	Chin chorl kra dass		
5 9	sMbukman ,	Som bok morn		
6 0	rMdYI	Rom duol	Popowia aberans	Anonacées
6 1	Gn8g's	An tong sar		
6 2	em1jmas	Mdenh meas	Elaeocarpus Sp.	Elaéocarpacée s
6 3	Tn'etot	Toun teath		

6 4	edImxus	Deum khos	Quercus Sp.	Fagacées
6 5	sRmg	Som rong	Sterculia lychnora	Sterculiacées
6 6	eQIEGm	Chheu em		
6 7	Eq#ERsg	Chhke sreng		
6 8	keJI9bldac	Kan cheu bedach	Capparis micrantha	Capparidacées
6 9	l4a	Lvea	Dillenia pentagyna	Dillénacées
7 0	vay	Viey		
7 1	\RC	Chreiy	Ficus maclellandii	Moracées
7 2	elob	Leab		

Source: Upland farmers in Koh Sralao, PKWS 1999

tarageQ`aHClst4 Edlmank~--
 gtMbn'EdnCMrkst4\RBjmRkesab
 ext1ekaHkug
 FISH SPECIES IN PKWS

l, r	eQ`aHC aPasaEx `r KHMER NAME	eQ`aHLata Mg KHMER SOUND	eQ`aHCa PasaGg'e K7s SCIENTIFIC NAME	eQ`aHviT2a saRs1 FAMILY NAME
1.	Rtl5G'GuCE x`A	Trey spong och khmao	Russell's snapper	Lutjanus russelli
2.	RtlGaMgk WyRkhm	Trey angkeuy Krohorm	John's snapper	Lutjanus johni
3.	RtlRkhm	Trey krohorm	Malabar red snapper	Lutjanus malabaricus
4.	Rtl5g's	Trey spong sar	Giant sea perch	Lates calcarifer
5.	RtlRBIYtq~ t	Trey proluos chhnaut	Trumpeter sillago	Sillago maculata
6.	RtlRBIYt	Trey proluos	Silver sillago	Sillago sihama
7.	RtlSaDln	Trey sadine	Smooth-scale rainbow sardine	Dussumieria elopsoides
8.	Rtlkar"avs	Trey karav sar	Four-finger threadfin	Eleutheronema tetradactylum
9.	Rtlcg# mbI	Trey changkom bei	Tiger-toothed croaker	Otolithes ruber
10	Rtl5MeVeh o manrMGilí	Trey somborhear mean roneul	Common ponyfish	Leiognathus equulus
11	Rtl5MeVeh o K`anrMGilí	Trey somborhear kmean romeul	Toothed ponyfish	Leiognathus equulus, Gazza minuta
12	Rtlep8agp# a	Trey phtong phka	Spotted halfbeak	Hemirhamphus far
13	Rtlep8agR B>tex`A	Trey phtong prort khmoa	Square-tail long tom	Tylosurus leiurus
14	Rtlep8agR B>texov	Trey phtong prort kheiv	Barred long tom	Ablennes hians

15	RtlkakWm	Trey ka keum	Commerson's anchovy	Stolephorus commersonii
16	RtlebkaGu Cex`A	Trey beka-och khmoa	Indo-Pacific spanish mackerel	Scomberomorus guttatus
17	Rtlkam"ug	Trey kamong	Short-bodied mackerel	Rastrelliger brachysoma
18	q7amRt+ye x`A	Chram trouy khmoa	Walbechm's sharp-nosed shark	Scoliodom welbeehmi
19	RtlGEN1gb "uy	Trey angdeng phuy	Striped sea catfish	Plotosus anguillaris
20	Rtlkuk	Trey kok	Largehead hairtail	Trichiurus lepturus
21	RtlkRn1aM gePI7g	Trey kontang phleung	Whitespotted spinefoot	Siganus canaliculatus
22	RtlkRn1aM gf	Trey kontang tmar	Streaked spinefoot	Siganus javus
23	RtlkRn1b'x 7a	Trey kontrorb khlar	Damsel fish	Dascyllus aruanus
24	Rtlk3kx`-k	Trey kbork kmuk	Diamond-scaled grey mullet	Liza vaigiensis
25	Rtlk3kGRg #am	Trey kbork angkam	Bluespot grey mullet	Valamugil seheli
26	RtlRKab'x~ -r	Trey krorb khnor	Starry emperor	Lethrinus nebulosus
27	Rtlkn8- yRkblk3aIR s+c	Trey kontuy krobe kbal sruoch	Spotted flathead	Thysanophrys crocodilus
28	RtltukEkex` A	Trey tokke-khmoa	Greasy grouper	Epinephelus tautina
29	RtltukEkf`	Trey toke-tmar	Yellow grouper	Epinephelus awoara
30	Rtlcabex`A	Trey chab-khmoa	Black pomfret	Parastromateus niger
31	Rtlcab s	Trey chab-sar	Silver pomfret	Pampus argenteus
32	Rtlkn8-yrwg	Trey kantuy-reung	Gardtail scad	Megalaspis cardyla
33	RtlRBuyEv g	Trey pruy-veng	Longfin mojarra	Pentaptrion longimanus
34	RtlMV"n'	Trey sompane	Yellow queenfish	Scomberaides lysan
35	RtlGERg	Trey anger	Obtuse barracuda	Sphyracna obtusata
36	RtlIdUrGg#r	Trey do-angkar	Whipfin mojarra	Gerres filamentosus
37	RtlS7wkbws	Trey sleuk-beus	Spotted sickle fish	Drepane punctata

38	RtlYncan' ...RkLg'	Trey nuonchan / Trey kralang	Milk fish	Chanos chanos
39	RtlkUnKM	Trey kon kom	Banded crevalle	Atule mate
40	RtlRtecokd Mrl	Trey trocheak domrei	Spade fish	Ephippus oprbis
41	RtlGN1atE q#	Trey andat chhke	Large-scale tongue sole	Cynoglossus macrolepidotus
42	RtlKUn	Trey kone	Roundbelly sardinella	Amblygaster clupeoides
43	RtlGN1atR kbl	Trey andat krobei	Large tooth flounder	Pseudorhombus arsius
44	RtlkaMkYc	Trey kamkach	Golden toothless trevally	Gnathanodon speciosus
45	Rtlecar	Trey chor	Dusky jack	Caranx sexfasciatus
46	Rtlecarx7+ nmUI	Trey chor khluomoul	Barebreast jack	Carangoides gymnostethoides
47	RtlmgÜ-t	Trey monkhut	Grey large-eye bream	Gymnocranius griseus
48	RtlRkL vbU v	Trey kralauvbauv	Longfin cavalla	Carangoides ciliaris
49	Rtlep8agRk bl	Trey phtong krornbie	Black-spot long tom	Tylosurus strongylurus
50	q7amRkYc	Chhlam truoch	White-spotted shovelnose ray	Rhynchobatus djiddensis
51	RtlkaCl	Trey kachi	Painted sweetlip	Plectorhynchus pictus
52	Rtlkam"y	Trey kamoy	Chacunda gizzard- shad	Anodontostoma chacunda
53	Rtlp8k'smu RT	Trey phtuok sakmut	Cobia	Rachycentron canadus
54	ep!at k3alRtegal K`anRBuyx ~gí	Phsort	Finless porpoise	Neophocaena phocaenoides
55	bEblEx7g	Borbel khleung	Spotted eagle ray	Aetobatus nurinari
56	bEbls5an'	Borbel sporn	Imbricated sting ray	Dasyatis imbricatus
57	bEblruy	Borbel ruy	Banded whip-tail stingray	Dasyatis gerrardi
58	ep!at ëmat'Rs+cí	Phsort	Bottle-nosed dolphin	Tursiops aduncus

59	ep!at k3alRtegal manRBuyx ~gí	Phsort	Irrawaddy dolphin	Orcaella brevirostris
60	mwkBlgJg	Meuk pingang	Dollfus octopus	Octopus dollfusi
61	mwks~ k	Meuk snauk	Rainbow cuttlefish	Sepia pharaonis
62	mwkeck	Meuk chek	Splendid squid	Loligo formosana
63	k1amf`exl8 y	Kdam tmar khteuy	Spiny rock crab	Thalamita crenata
64	k1amp{rlan'	Kdam phkormorn	Hairy rock crab	Eriphia sebana
65	k1amf`exov	Kdam tmar khiev	Serrated mud crab	Scylla serrata
66	k1amesHR kLa ...V"ra"	Kdam ses krora / Kdam phara	Mud crab	Charybdis cruciata
67	k1amesH	Kdam ses	Blue swimming crab	Portunus pelagicus
68	k1amp#ay	Kdam phkay	Three-spot swimming crab	Portunus sanguinolentus
69	k1ams7wke QI	Kdam sleukchheu	Green tidal crab	Varuna litterata
70	k1amkab'd av	Kdam kabdav	Fiddler crab	Uca vocans
71	k1amC>rde g#obRkkm	Kdam chor dangkeab krohom	Meder's mangrove crab	Sesarma mederi
72	k1amBlgJg	Kdam pingpeang	Spider crab	Dorippe dorsipes
73	RbLaMgka s	Brolangkas	Triangular-tail horseshoe crab	Tachyplesus gigas
74	x2gEdkeKa l	Khchang dekkaul	Telescope creeper	Telescopium telescopium
75	gavPk'	Ngeav phuok	Hard clam	Meretrix sp.
76	ERkgQam	Kreng chheam	Cockle / ark shell	Arca granulosa
77	ERKgTwke RCA	Kreng teuk-chhroav	Labiased cowl shell	Cucullaco labiata
78	x2gtadit	Khchang tadet	Mangrove oyster	Crassostrea sp.
79	x2gcak'ERc g	Khchang- chakcherng	Mangrove snail	Cerithidea sp.
80	x2gcMBuH Ta	Krum chompustea	Green mussel	Perna viridis
81	gavkMb"uk	Ngeav komphuk	Horse mussel	Musculus senhousia
82	kN1 besH	Kandaub ses	Mantis shrimp	Oratosquilla nepa

83	bg{aTwkEP ~k	Bangkea-teukphenk	Greasy-back shrimp	Metapenaeus ensis
84	bg{acg4ar ëbg{ab"ukí	Bangkea changvar	Common snapping shrimp	Alpheaus euphrosyne
85	bg{ax7wg	Bangkea khleung	Giant tiger shrimp	Penaeus monodon
86	bg{akugLay k7ay	Bangkea konglay klay	Green tiger shrimp	Penaeus semisulcatus
87	kMRbUn	Kon braune	Dwarf prawn	Macrobrachium equidens
88	bg{anIL-g	Bangkea nilong	Blue-tail yellow shrimp	Penaeus latisulcatus
89	kaMRbma	Kam Brorma	Blue-spotted sea urchin	Diadema setosum
90	RkeBITwk\ Rb	Kroper teukbray	Saltwater crocodile	Crocodilus porosus
91	bg#g	Bang kang	Giant freshwater prawn	Macrobrachium rosenbergii
92	kMBws	Kom peus	Lanchester's freshwater prawn	Macrobrachium lanchesteri
93	kMBt ëTwksabí	Kom pot	Green blowfish	Tetraodon leirus
94	RtIsMeJF	Trey som paut	Mud skipper	Periophthalmus chrysopilos

Source: Local Fish Survey, PKWS