<u>M'Pai Bei Community</u> <u>Protected Fishing Area</u>



Environmental, demographic and socio-economic report

September 2010



1 - Renovating boats during the rainy season

In Partnership With:



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List of Abbreviations and Acronyms

CFA	Community Fishing Area				
CPFA	Community Protected Fishing Area				
CPUE	Catch per Unit of Effort				
FAO	Food and Agriculture Organization				
FiA	Fisheries Administration				
GIS	Geographic Information System				
ICM	Integrated Coastal Management				
KRS	Koh Rung Samloem				
MCC	Marine Conservation Cambodia				
MCPA	Marine Community Protected Area				
MPA	Marine Protected Area				
PEMSEA	Partnership in Environmental Management for the Seas of East Asia				
RFLP	Regional Fisheries Livelihoods Program				
TUFs	Tourism-based User Fees				
WTP	Willingness-To-Pay [survey]				
ZMP	Zonal Management Plan				

Introduction

The Community of M'Pai Bei (Village 23) has been achieving conservation around the Islands of Koh Rung Samloem, Koh Rong and Koh Koun since 2007, through the support of the Fisheries Administration (FiA), relevant local authorities (local fisheries committee, Sangkat and local police) and partner organization Marine Conservation Cambodia. The introduction of the Community Fishing Area (CFA) has had a great influence on the protection of reefs and surrounding habitats. The monitoring is beginning to show the effectiveness of the Community protection.

This report aims to provide information on the environmental, demographic and socioeconomic situation of Koh Rung Samleom and M'Pai Bei Community Protected Fishing Area (CPFA). Based on our knowledge of the local environment, ideas concerning the management of the marine areas are also suggested. We hope that this compilation of recent data will help relevant stakeholders designing an optimal Management Plan and Zoning of the Community Protected Fishing Area.

Please note that the information included in this document is constantly being updated. Regular reports on the Community's activities can be obtained from Marine Conservation Cambodia.

PART I

Background and overall situation

I. Background and overall situation

a. The Community: background and present situation

The M'Pai Bei community fisheries was established with an initial founding congress in July 2009 and entered into a Community Fishing Area Agreement in early 2009.

The M'Pai Bei community fisheries is located in M'Pai Bei (Village 23), Koh Rung Samloem commune, Mittapheap District, Preah Sihanouk province (*Figure 1*), and has over 180 members (83 women), and 9 committee members (2 women). The total number of households is 38.



Figure 1 : map of the Community Fishing Area, courtesy of FiA

The first settlers of M'Pai Bei community arrived around 1996, attracted by the abundance of fishing opportunities in the surrounding waters while looking for a safe and peaceful place to live, away from the social and political troubles that were happening at that time. However, rampant anarchic fishing and encroachment from neighboring fishing fleets quickly increased, causing serious conflicts with local fishers. As such a number of local fishermen were compelled to give up their activities or to change to even smaller scale inshore fishing for



2 - Community patrol apprehending a trawling boat (07/11/2009)

safety reasons. The number of larger fishing vessels trawling the inshore areas has increased in recent years despite this practice being forbidden by the national fisheries law. This increase in fishing



3 - Seahorses confiscated from a trawler illegally fishing in the area (10/09/2009)

vessels has caused a serious impact on inshore fish stocks and marine habitats. M'Pai Bei community has faced a substantial decrease in the yield of fish, crab and squid caught and this reflects in the decreased livelihoods of the fishers within the community. Many fishers had to give up on crab fishing, due to their expensive gear being destroyed by illegal trawling (*Picture 2*), they turned to squid fishing on long-tail boats or small polystyrene paddle-boats to avoid rising gasoline expenses.

On another hand tourism is bringing alternative livelihoods, but this is also potentially under threat as whole dive sites have been lost to illegal trawling, dynamite and cyanide fishing. The main seahorse sites were decimated by illegal Vietnamese fishermen who came specifically to target the breeding grounds in search of the seahorses (*Picture 3*). In 2008, a team of divers, understanding that the need for constant protection was immediate and urgent, created Marine Conservation Cambodia (MCC) in close communication with the FiA (Fisheries Administration) and with the support of the M'Pai Bei community.

The Community has since been working side by side with MCC and the FiA not only in assisting in the protection of the area but also in setting up a proper Integrated Coastal Management (ICM) plan of the area that would enable a sustainable development of the Community, insuring an increase in livelihood by using marine resources in a sustainable manner and developing responsible tourism.

Through these efforts, the Community itself was registered as an official Community Fisheries allowing it to manage and protect its own designated marine area under the direction of the Fisheries Administration (FiA).

b. Koh Rung Samloem and the Community Fishing Area : environmental overview

i. Terrestrial ecosystem

The islands of Koh Rong Samloem, Koh Koun and Koh Rong are located approximately 20 km west of Sihanoukville (*Figure 1*). Koh Rong Samloem, home of the M'Pai Bei community, is an irregularly shaped island, roughly oriented NW-SE, and located south of Koh Rong and Koh Koun. It is approximately 6 km long by 3 km at its widest point, with a land area of 25.8 km² (2,580 ha). Stretches of land form a protected bay of almost 4 km wide on the eastern side. Another bay, over 1 km wide, locally known as Vietnamese Bay, is located on the northernmost part of the island, where M'Pai Bei Community is established.



4 and 5 - Many species of orchid can be observed in Koh Rung Samloem

Koh Rong Samloem is predominantly covered by dense humid forest where a rich biodiversity can be observed. Among the most significant species (flora and fauna): orchids (25 species identified so far) (*Pictures 4 and 5*), water dragons (*Physignathus cocincinus*), monkeys, and Hornbill. Until recently, only three hornbill species were known to occur in Cambodia: Great Hornbill (*Buceros bicornis*), Wreathed Hornbill (*Aceros undulates*), and Oriental Pied Hornbill (*Anthracoceros albirostris*). Oriental Pied Hornbill was historically common throughout much of Cambodia (Tan

Setha, 2004): we believe that it is the one that can be observed on the island of Koh Rung Samleom (*Picture 6*).



6 - Oriental Pied Hornbill photographed in Koh Rung Samloem (left)

Many species of snakes (*Picture 7*) are also encountered, as well as an infinite numbers of insects, arachnids and invertebrates.



7 – Local Snakes and scorpions, KRS

The island has been leased for development to Hong-Kong based firm LimeTree Capital and will eventually start a Master Plan that is currently being reviewed by the Cambodian government.

ii. Marine ecosystem

M'Pai Bei protected Community Fishing Area surrounds the island of Koh Rong Samloem, Koh Koun, and stretches to the southern shores of Koh Rong. The tropical reefs, mainly fringing reefs, provide a unique marine environment which allows the presence of a great biodiversity (*Pictures 8 and 9; See part III.b*). Benthic habitats such the Corral (*Figure 6*) are also to be found as they constitute an extremely fundamental part of the marine ecosystem where a range of macro life can be observed.



8 and 9 - Fan-bellied leatherjacket (Monacanthus chinensis) (left) and Red Lionfish (Pterois volitans), KRS area

The area also encompasses seagrass (*Pictures 10 and 11*) and mangrove ecosystems therefore contains representative habitats of whole shore to intertidal environments and from coral reefs to deep water environments. More details on fisheries resources will be reviewed in part III.



10 and 11 - Seagrass, Cymodocea serrulata & Halophila ovalis

Koh Rong Samleom area has recently become the focus of Sihanoukville diving industry as dive operators now use the area all year long. Indeed, diving and snorkeling here provide people with the opportunity to learn about a wide variety of species and understand a part of Cambodia's natural history.

PART II

Demography and socio-economics

II. Demography and socio-economics

a. Methodology

A survey was conducted through M'Pai Bei community on March 2010, focusing on household structure, occupations and fishing habits. The methodology was simple: going from house to house with a short but precise questionnaire. As people would not necessary appreciate an intrusion in their private life, we had to maintain a certain level of restraint and keep the questions as simple as possible. A member of the Community was present to help with translation issues.

People were very cooperative; the results proved to be quite interesting and allowed us to obtain a good estimation of the number of people actually living in the village. We also asked people's opinion concerning the evolution of the catch following the introduction of the protected area. The results concerning fishing gears and fishing habits will be viewed in *part IV*.

Note: It must be remembered that when stating the word household, within such communities, a household is commonly multigenerational and consists of a nuclear family¹ and their extended family² members.

b. The people

The survey conducted in March 2010 counted 35 households, for a total number of people in the community fisheries of 166, including:

- 83 males (36 under 18 years old)
- 83 females (40 under 18 years old)

We were unfortunately unable to survey 3 of the households, due to them being away at the time. Giving the average size of a household, this should bring the numbers up to 180 people living in the Community, with a total number of 38 households. Also, numbers can fluctuate between the dry and the rainy season, when some people return to the island after a few months spent working elsewhere in Cambodia. All of the following results of this document will not include the 3 missing families. The majority of the people in the community are Buddhist, except for one Muslim household. Thus, Buddhism is here the main religion.

¹ A family composed of spouses and their children

² A family consisting of the nuclear family and their blood relatives

Among the members of the community fisheries members, 78 people are literate, including:

- 47 males (8 of which mentioned they could write and read "a little")
- 32 females (5 know "a little", 1 can read and write Vietnamese)

The children attend Khmer school during the week from 9am to noon (*Pictures 12 and 13*); English lessons are given every evening by MCC volunteers to children and teenagers.



12 and 13 - Education in Koh Rung Samloem

c. Occupations

Out of 35 households, 28 have (or used to have) an activity related to marine resources. Among them:

- 5 have a member who used to be a fisher
- 6 are involved in the making of fishing gears (*Picture 14*)
- 27 adults are fishers, knowing that this number is increased due to the teenagers and children fishing with paddle-boats if they were to be included.



14 - Making of squid traps: a family activity

Figure 2 shows the main occupations of people in the Community. As one's activity benefits to the whole family, the results have been treated at a family scale rather than at an individual scale. For instance, they are 27 fishers in the Community, which means that 27 households are involved in fishing. Furthermore, it is quite difficult to distinguish one person's occupation from the household's occupation, as individual family members will most often help out the others. For instance, after school, children will often assist their parents making squid/fish traps, selling goods in the shop or going fishing. Similarly, the households in charge of recycling/village cleaning will often be helped by their kids.



Figure 2: household activities in M'Pai Bei Community (March 2010)



15 - Cooking in the family shop



16 - Plastic recycling, Koh Rong Samloem

Besides, small scale freshwater fish farming has been observed, not for trade but for own consumption during the rainy season, when fishing is limited by the weather. A freshwater pond (*Pictures 17 and 18*) was dug, approximately one meter deep; freshwater fish were added, some caught in the nearest water streams, and other "good quality" ones bought in Kampong Som for breeding purposes.



17 and 18 - Small scale freshwater fish farming

As the construction of the pond induced a significant costs for the household concerned (between 200 and 300 USD – mostly for the digging), there is a great satisfaction in observing how the money brought by recent flows of tourism is used by the people themselves to improve their livelihood.



19 – Community gardens

There is no agriculture or rice farming on the island; however, an increasing number of households are now starting to grow their own vegetables and fruits (cucumbers, eggplants, squashes, pineapples, etc.) (*Pictures 19, 20 and 21*). There is also a coconut plantation that was established a few years ago, several hundred meters from the village.



20 and 21 - Community gardens

PART III

The Community Fishing Area and fisheries resources in the Community Fishing Area

III. The Community Fishing Area and fisheries resources in the Community Fishing Area

a. General description of the site (*Table 1*)

Attributes	Description				
Name and alternatives	M'Pai Bei Community Fishing Area				
Location	Located in the bay of Kampong Som, approximately 20 km West of Sihanoukville				
Area of site (ha)	9491 hectares				
Administration status A Community Fishing Area since early 2009 administered by the Fisheries Administration					
Conservation status	Currently 22 hectares included in the CFI Map and an area of 300m from the shore line of Koh Koun by order of the Koh Rong District Sangkat.				
Demarcation of the site	Stretches around the islands of Koh Rong Samleom and Koh Koun until the northernmost part of Koh Rong. The area currently has few visible demarcations as initial markers were stolen or removed.				
Reason for designation	Area of great ecological importance; breeding grounds for seahorses; area of great socio-economic importance for the livelihood of local communities;				
Brief historical description	CFA established in 2008-2009				
Brief ecological description (key features)	An area mainly composed of fringing reefs, providing the habitats for a wide variety of species, the most popular being the diversity of Seahorses (Hippocampus sp.) and Nudibranch (small, brightly colored sea slugs). The average depth is shallower than 20 meters; a few shallower areas between 10 and 15 meters; depth scarcely goes down to 30 meters in very few confined areas. The area has previously been reported as a rich reef area where species such as bamboo sharks, seahorses, pipe fish, and blue spotted rays were frequently sighted. These species have declined in recent years due to illegal and destructive fishing techniques. However, the creation of the CFA has allowed the return of these species and the populations to increase again.				
Human uses of the site (key features)	Dive operators from Sihanoukville use the reef for diving and snorkeling; fishermen from the Community use the area for subsistence and small commercial (squid) fishing; fishermen from outside the Community use the area for commercial and subsidence fishing.				
Biodiversity values (Plants and animals)	 Great diversity of coral reef including many colonies of Hard Coral (<i>Porites antennuata sp.</i>), Lobe Pore Coral (<i>Porites lobata sp.</i>) and their Christmas Tree Worm (<i>Spirobranchus Giganteus sp.</i>), Tube Corral (<i>Tubastraea faulkneri/micrantha</i>) or barrel sponges (<i>Xestospongia testudinaria sp.</i>). The area is popular for the observation of Seahorses and Nudibranch (Bornella, Flabellina and Philladidae family being the most common). Batfish (<i>Platex sp.</i>), shoals of barracudas (Sphyraenidae sp.), Kuhl's Stingray (<i>Dasyatis kuhlii sp.</i>) moray eel (<i>Muraenidae sp.</i>) and even Cobia (<i>Rachycentridea sp.</i>) have been recorded. Bamboo sharks (<i>Chiloscyllium punctatum</i>) are increasingly returning to the area. 				
Main threats / issues	Illegal and destructive day/night fishing (trawling, crab netting); Anchoring; Irresponsible diving / snorkeling; Pollution; Bleaching				
Listing of management actions that have been taken at the site	Community patrols; Community Capacity Building (scuba-diving and rescue/emergency response training); Environmental education; English courses; Monitoring				
Most important management actions proposed for the site	Management Plan; Zoning to protect sensitive areas; Code of Practice to ensure all use is sustainable; User fees; Research & Monitoring; Artificial Reef project; Waste Management project				
	Table 1: Summary of the main characteristics of M'Pai Bei CPFA				

b. Ecosystem

The tropical reefs in the protected Community Fishing Area surrounding Koh Rong Samloem are mainly fringing reefs. These reefs, in warm waters, are diverse ecosystems providing the habitats for a wide variety of species, including many fish families, invertebrates, corals and sponges. An inventory list of over 2000 marine species is being constantly updated by MCC teams and is available on request.



22 and 23 - Batfish (Platex sp.) and nudibranch (Bornella Stellifer)

Within the current boundary of the Community Fishing Area, there are a large number of popular dive sites which provide divers with interesting and sometimes rare species to be seen and photographed. Among these are batfish (*Platex sp.*) (*Picture 22*). which play with divers' bubbles and get close to the divers, shoals of barracuda (*Sphyraenidae sp.*), the occasional moray eel (*Muraenidae sp.*) and even sometimes Cobia (*Rachycentridea sp.*) which live in a school of up to 12 animals and exhibit behaviour that is not known for their species – they seem to hunt aggressively rather than acting as scavengers.

One of the biggest attractions of the area are the large numbers of Nudibranch (*Picture 23*), small, brightly coloured sea slugs which can be found both on the reefs and on the sandier dives. The main species in Cambodia are the Bornella family, Flabellina and Philladidae.



24 - Seahorse (*Hippocampus sp.*)

As well as a number of coral reefs there are also large, sandy benthic habitats such as the Corral, which has a sandy bottom that slopes away from Koh Koun and plateaus at a depth of 10 meters. The benthic habitats are an extremely fundamental part of the marine ecosystem. There is a range of macro life to be seen here – octopus, nudibranch, sea shells, and various fish species and in particular, a wide variety of Seahorses (*Hippocampus sp.*), the Corral being recognized as one of their breeding grounds. Seahorses (*Picture 24*) are

elusive benthic creatures which spend their life on the sea floor. They are a carnivorous predator which feeds upon baby fish, crabs and shrimp (Kuiter 2009). There are three species confirmed in Cambodia currently (*Hippocampus Spinossissimus; Hippocampus Trimaculatus; Hippocampus...*) but it is suspected that there could be as many as nine different species in Cambodian waters. These unique creatures are very popular for divers, especially people taking underwater photos, as well as the possibility for research into their habits; which seem to be different in Cambodia to other places in the world.

c. Fisheries resources

The Community's main catches are squids and crabs: those can be listed as "commercial species". However, many villagers, adults and/or children, fish for subsistence. An increase in Grouper (*Epinephelus sp.*) and other commercial fish species has been seen in recent months, by fishers using fish traps since the implementation of the conservation area.

In June 2010, we attempted to follow the catches in order to make an inventory of the species caught for subsistence using traditional fishing techniques. The method consisted of going fishing with the local people, identifying the different species caught and estimating the quantities. The results of this survey are reviewed in *part IV.b.*

This very basic monitoring is an essential step for the design of a proper fisheries monitoring program (*see part V.c.4.ii*). The identification of the catch composition (species and/or families harvested) will allow us to make the questionnaires more specific by focusing on the main species caught, thus making the surveys more effective. Added to data on fishing effort (type, duration and location of fishing operation) and costs and revenues (mainly those of fish prices, fuel, gear costs and wages), it shall be possible to estimate catch rate, or Catch per Unit of Effort (CPUE).

d. Incomes generated through fishing

i. Local / Community scale

As we already mentioned above, most of the fish catches are kept by the individual households. However, when the catch is good, it is sometimes sold between members of the Community. Average sized fish are sold, regardless to the species, between 1500 and 3000 riels per

kilo. Larger, and hence more valuable fish, are sold to the Chief, in this case the price depends upon the species.

ii. Squid trade

M'Pai Bei's main catches are squid (*sepia. sp*) and related species (cuttle-fish, octopus). Fishermen sell their catches to the Chief who then sell them to Kampong Som wholesalers. Exact quantities and incomes generated through squid business are currently unknown; a proper catch monitoring program should allow for clear data collection.

PART IV

Fishing

IV. Fishing

a. Occupations related to fisheries resources within the Community

As it has already been mentioned in *part II*: out of 35 households (166 people), we found out that:

- 28 of them practice an activity related to marine resources;
- Among them, 5 have a member, usually the head of the household, whose past activity used to be fishing: 2 of them reconverted their activity towards the making of fishing gears;
- 6 households are now involved in the making of traditional fishing gears (squid and fish traps) which are either sold to Kampong Som (*Picture 14*, sold 6000 riels/unit) or for personal use (*Pictures 25 and 26*);



25 and 26 - Towards sustainable fishing: making of traditional fishing gears

• Around 27 adults are actual fishermen: the numbers will be slightly increased as there are several teenagers and children who go fishing for squid with paddle-boats (*Picture 27*). Among them, 7 mentioned that they first used to fish crabs but they all stopped between 8 and 5 years ago and switched to squid fishing. The main reason cited was the destruction of fishing nets by trawling boats, which were indeed in their highest peak of activity in the area at that time;



27 - Child fishing squid on a paddle-boat

When we conducted the survey in March 2010, the last question we asked dealt with the evolution of the catches (in quantity). We made a mistake by not specifying the time frame of the question and ended with several inconsistencies as two neighboring households would have totally opposite answers. Thus, we decided to ask two different questions related to different time frames and events: the first one would compare the amount of fish caught between the first time the person started fishing in the area and nowadays; the second question would ask for the same information but the time frame being between summer 2009 (introduction of the Community Fishing Area and protection of certain reefs and areas) and today. The following results were much more conclusive:

- All fishermen agreed on the fact that the catches were greater in the late 90's.
- The majority of them also agreed on saying that the situation had been improving since last year. At the time of the survey, in March, the average squid catch per boat per fishing trip was 2 to 3 kg. Since then, a continuous increase has been observed.

b. Fishermen member of the Community Fisheries : types of fishing, fishing habits and catches

1. Fishing gears used in M'Pai Bei Community (Figure 3)



Figure 3: Fishing gears used by the Community within the CFA (survey March 2010)

Squid lines (troll lines & long lines) are the most used. Traps come in second; we recently observed an increase in the use of traps, as people now realize the benefit of this sustainable way of fishing and many gave up on using nets.

In March 2010, we counted 17 long-tail boats and 13 paddle-boats. As for today (August 2010), we counted 4 more long-tails that have been renovated during the rainy season, increasing the numbers to a total of 21 long-tail boats. Paddle-boats are constantly being built and repaired; thus it is difficult to keep the numbers updated.

2. Traditional line fishing

i. Techniques

Traditional fishing uses the simplest technique, that's to say a line and 1 to 3 hooks baited with squid. The survey was conducted by going fishing with local people and children (*Picture 28*). Species were identified; quantities and sizes were taken into account; people are taught to release small fish back into the water.

On average, we observed that each individual could catch up to 3, 5 kg of fish on a 4-hour fishing trip. We noticed that the quantities caught have been exponentially increasing over the past months, along with an efficient protection of the area. Kids on paddle-boat can now catch decent



28: Traditional line fishing

sized fish without having to go too far away from the shore, which also reduce the risks associated with changing weather patterns, especially during the rainy season. However, it is difficult to establish a general rule: the quantities caught vary also according to other factors such as weather conditions, currents, and good luck!

ii. Most common catches

These are the most common catches that we identified when going fishing with members of the Community. A more extensive list is given in *Appendix 1*.









Picture credits (page 30-31): M. Skopal

3. Squid fishing

i. Fishing techniques

• Using long-tail boats

Fishermen use troll lines attached to bamboo poles placed on each side of the boat (*Picture 29*). Each line generally has 6 to 7 lures; 4 lines can be used at a time.



29 – Squid fishing boat

• Using paddle-boats

Paddle-boats, made of wood and polystyrene, are mostly used by children but also sometimes by men and women (*Pictures 27, 30, 31*). Paddle-boats are an economic alternative to long-tail boats as they avoid gasoline expenses. However, they do not allow people to go as further out thus the catches are less significant (2 to 3 kg). Furthermore, this type of fishing is restricted during the rainy season when the weather can change suddenly and strong winds can become dangerous.

Paddle-boats are primarily used for squid fishing, but fish and small quantity of shellfish are sometimes caught. Long lines and lures are used to catch squid. A long line with one lure and 1 or 2 fish hooks is quite common, as it allows catching both squid and fish.



30 and 31 – Making of a paddle-boat; underwater view

There is no real season for squid fishing; it all depends on the weather. According to the survey we conducted last March, it seems like night fishing is preferred to day fishing, but again it depends on the weather and the moon. According to the same survey, the average quantity of squid caught was 2.7 kg (long-tails and paddle-boats confounded).



ii. Species caught



What is not sold to the Chief is kept by households to eat or dried and saved for later (*Picture 32*).



32 - Squid and fish drying process

4. Crab fishing

i. Fishing techniques

Crabs are caught using traditional or collapsible (metal) traps ("lop kdam") (*picture 33*). The use of crab nets is restricted to outside of the conservation area CFA as they are highly destructive to the marine environment (*part IV.c.1*).



33 - Collapsible crab trap (Source : www.haverford.com.au)

In March, the quantities caught were still quite low, giving the number of traps being used: 2 to 3 kg of crabs per day using 150 collapsible traps.



ii. Species caught

The Blue swimmer crab has a significant economic value: it is sold 10,000 riels per kilo to 12,000 riels per kilo, and then sent to Kampong Som.

5. Fish traps

Fish traps are not widely used within the Community. Two families make them: one sells them to Kampong Som; the other keeps them for personal use (20 traps). However this number has been seen to be increasing.

c. Illegal and destructive fishing

1. Types of gears and impacts on the ecosystem / resources

TYPE OF GEAR	IMPACTS
Trawling nets / Trawling boats	
	Trawl gear effects the environment in both direct and indirect ways. Direct effects include scraping and the substrate being ploughed, sediment re-suspension, destruction of benthos, and huge incidental by-catch. Indirect effects include post-fishing mortality and long- term trawl-induced changes to the benthos.



A trawling boat has the capacity of devastating an entire ecosystem in a few hours, leaving only sediments in an area that will then need years to recover. Seahorse populations are particularly concerned by the removal of their microhabitats; if not caught by the same nets, they

are left defenseless without protection from natural
predators and strong currents. The removal of sea
urchins (Cidaridae) and other microhabitats has been
damaging to the entire unique ecosystem of the Corral.

Crab nets				
(Mong Kdam)				
(ining inum)				
	They have a significant impact on the ecosystem as they collect not only crabs, but also corals, undersized fish and endangered species such as seahorses.			
Crab nets are bottom weighted nets that can be several kilometers long.				
	Ghost nets (nets that have been lost accidentally, deliberately discarded, or simply abandoned at sea) constitute a real threat to marine life as they move according to the currents and tides, continually fishing indiscriminately, not only catching threatened species but undersized and protected fish as well.			

Air supplied fishing & coral harvesting



There is an unfortunate trade in black whip coral which is often sold for jewellery. Boats have been caught within the Community Fishing Area complete with supplied air hoses and hacksaws with several bundles of black whip coral.





Coral harvesting negatively impacts the reef as the fishermen select only this one specific species, not allowing the reef to diversify. They also acquire it by walking on the reef, destroying all the substrate they tread on, including neighboring corals, sponges and other benthic species. Coral is not normally the only species these fisherman collect, they also pick up shells such as abalone, pen shells and murex (*Muricidae*).



Cyanide fishing

A few tablets of sodium cyanide are mixed up with some water in a plastic bottle. Then it is simple: find your fish and squirt. With a little care, the mixture will stun the fish without killing it.



Anchoring on the reef



The lingering cyanide in the water kills the coral and the algae on which the fish feed: every fish caught this way destroys approximately a square meter of reef (Fred Pearce, CDNN). A great majority of the catch does not make it alive to the buyer and is often damaged by the use of the chemical (burns).



When boats anchor on coral, be it to fish, dive or to shelter from bad weather, the anchors often get stuck between two pieces. In attempting to

remove the anchor, the boat will often move back and forth in order to violently jerk the anchor free. Doing this, the anchor will often snap off large sections of coral (Chou et al., 2002). On occasion, the coral can re-establish itself through



this fragmentation and help the reef to grow. Unfortunately in the main, the coral will die from this stress leaving nothing but a skeleton.

Picture credits (page 35 to 39): if not properly referenced, pictures were taken within M'Pai Bei CFA by P. Ferber

2. Evolution and current situation in the area

Illegal fishing encompasses many illegal activities such as dynamite fishing, cyanide fishing, illegal bottom trawling in inshore areas, use of illegal fishing gears, dumping of hazardous substances, anchoring directly over coral reefs, collection of endangered species such as seahorses, destruction of coral reefs and sea-grass beds through destructive fishing techniques (*Figure 4*).

Illegal fishing has significantly declined within the CFA for the past 2 years as the local patrols, supported by the local authorities (local fisheries committee, military, Sangkat and local police) and the FiA, have helped to stop the vessels witnessed



Figure 4: Illegal fishing and habitat destruction observed from September to November 2009, trawling excluded (C. Atkins et al., 2009)

"In [July this year], a few fishing boats were brought in by the community patrols and explained the location of the Community conservation area. There was no illegal fishing activities witnessed, in all cases it was just a matter of talking to the fishermen involved, educating and reminding them of the community fishing area and the fishing regulations of that order. One community member was made to sign a document explaining the conservation area rules due to continued fishing within the Community's conservation zone; this has been an ongoing problem with just one individual from the Community not respecting the conservation zone" (C. Atkins et al., 2010).

d. Other resource use conflicts

"As marine resources become more developed economically, the externalities associated with commercial development also increase, potentially contributing to the decline of coral reef health and increasing degradation of the reef environment" (J.M. Brunschweiler, 2009). "The tourism industry is based on diving and other recreational activities that depend on the high quality of the marine environment. The islands on which resorts are established are subject to many threats from degradation of both marine and terrestrial ecosystems. The tourism industry is therefore highly dependent on the future health of the environment on which it is based" (M. Skopal, P. Ferber, S. Fairclough, 2010).

When different stakeholders compete for the same resources, environmental impacts can be feared: terrestrial runoff, related to logging, soil compaction and surface sealing; waste discharge, reef deterioration through the impact of high levels of tourism usage (careless divers, pollution and other ecosystem impacts from recreational vessels), etc. This will eventually impact the marine ecosystem and resources, which will in turn lead to social and economic issues.

Resource use conflicts can also lead to safety issues: boat traffic surcharge (dive/cruise operators, private boats) could both lead to environmental issues (anchoring on the reef, pollution, noise) and safety issues: speed boats are a real threat to divers (but also swimmers and snorkelers) as they cannot see them surfacing when driving at full speed.

"A proper management plan, including a well-thought zoning plan, should resolve such conflicts. Speed limits shall be implemented and the circulation of certain types of sport boats, such as jet skies, shall be strictly regulated and/or banned from use within the area. Mooring buoys shall be envisaged in order to avoid heavy reef damages" (M. Skopal, P. Ferber, S. Fairclough, 2010).

PART V

Suggestions for a Community Fishing Area Management Plan

V. Community Fishing Area management plan

a. Vision

M'Pai Bei protected CFA aims to become an area which illustrates best practice of community protection, an area used in a sustainable manner, an area known for its rich ocean floor, an area reserved for traditional and sustainable fishing and an area where a user fee is levied from users.

The management of M'Pai Bei protected CFA should involve the following main considerations:

- Management should be considered in the context of a future development of the surrounding islands (Koh Rong in particular) and Koh Rung Samloem itself, since the activities throughout the area will have impacts on the site (e.g. the development of new resorts, arrival of new technologies);
- The management goals for M'Pai Bei CPFA should be set for the long term, but must recognize that change in inevitable (particular attention must be given to the issues of climate change). People, especially the communities of the related islands, developers and government agencies should be at the heart of setting those goals;
- Management should be decentralized to the lowest appropriate level and must involve all key stakeholder groups, particularly local communities, both at planning and implementation stages;
- The conservation of ecosystem structure and functioning to maintain the ecosystem services provided by the site should be a top priority;
- An appropriate balance needs to be set between the conservation and sustainable use of the natural resources of the area, based upon the capacity of the system. Management measures should recognize current use of the site by the communities and should assess and anticipate potential livelihood impacts of management;
- Management should be evidence-based, including traditional local knowledge from longestablished Community members.

Finally, a last key element is that management will only succeed if people understand the reason for the area being protected, and the management proposed. The purpose and methods of collecting data (e.g. catch monitoring) should be properly explained, if feasible, by representatives of relevant government agencies so that there is no misunderstanding or fear on how the data collected will be used. Raising public awareness, particularly among M'Pai Bei Community members and the communities of related islands, must therefore be given high priority.

b. Objectives

1: Best practice management as a dive site

- Establishing a Management Office;
- Appointing wardens to implement this management plan;
- This office will be responsible for raising awareness and gaining support of all stakeholders of the protected area, enforcement of regulations and management measures and reporting on implementation.

2: Best practice management for the conservation and enhancement of the ecosystem structure

- Development and implementation of codes of practice to stop all forms of extractive uses inside the CPFA;
- Fishing is limited to traditional techniques; promotion of sustainable fishing techniques shall be undertaken;
- Ensuring sustainable activities in areas previously determined by a well-thought Zonal Management Plan;
- Monitoring of biodiversity and catches will be undertaken according to a standardized protocol.

3: Equitable benefits

- Support sustainable use of, and equitable benefits from, the protected area according to the principles of the ecosystem approach;
- Human use is largely limited to diving and snorkeling by visitors. It will therefore be important to ensure that maximum benefits are delivered to the local communities. Potential livelihood opportunities may include employment as dive guides and wardens;
- Tourists shall be charged fees for access to the site.

c. Community Fishing

1. Zonal management (*Table 2-3 & Figure 6*)

"To prevent any resource use conflict, a Zonal Management Plan (ZMP) should be designed for M'Pai Bei CPFA, with basic conservation criteria principally emphasizing on fishing practice and specific gear restriction, fishing period regulations and protected/conservation zone and its critical corridor which fish and other animals use as the pathways for moving from one habitat to another, according to its biological pattern; well defined/complex fish sanctuaries need to be reviewed and reestablished to ensure that the aquatic ecology based reproduction cycle of aquatic animals (coral reef habitats, sea grass bed, rough and wavy sea floor etc.), including fishes, seahorses, and other such animals attractive to tourists will be understandable and well protected by all stakeholders, especially the FiA and the rangers from the community" (M. Skopal, P. Ferber, S. Fairclough, 2010).

✤ <u>Purpose</u>

A "zonation" is a spatial or temporal allocation of specific uses and activities to well-defined areas within a larger area, which is, in our case, the M'Pai Bei Community Fishing Area as georeferenced by the FiA (*Figure 1*). Nowadays, many Marine Protected Areas (MPAs) with zonation schemes are called "marine parks": it is the case within the large Bunaken National Marine Park in Indonesia and the Great Barrier Reef Marine Park in Australia.

The advantage of zoning a CPFA is that it can reduce competition and conflicts between human uses of the area (subsidence vs. commercial fishing; professional vs. recreational activities; exploitation vs. protection of the resources, etc.) while still allowing for conservation. Although it is difficult to deal simultaneously, all in one area, with the needs and interests of the local community, the increase of tourism development and the needs and objectives of species and habitat conservation, many examples around the world have proved that a well-planned and implemented 'zonation' area can work.

Multiple-use zoning design

Many examples of multiple-use zoning schemes have to be considered before designing a new zonation within a MPA or CPFA. One basic principle for zoning is to have one or more areas within the MPA strictly protected, buffered by areas with fewer restrictions. For instance, one generalized zoning model for MPAs is to have a core "no-take area", often called "sanctuary", surrounded by one or several "buffer zones", each of them allowing specific and/or regulated activities.

Besides, one thing to remember is to be realistic about what is possible for a certain MPA. Although M'Pai Bei CPFA is large, it would be difficult to divide it into a multitude of smaller areas. Creating many zones within the CPFA would lead to confusion and would eventually be ineffective. Yet, by providing a gradation of restrictions, a balance of uses of the marine environment that satisfy the requirements of many resources-users, a multiple-use zoning plan could be easier to implement and enforce than to manage large restricted areas.

<u>Suggestions for a multiple-use zoning design</u>

The area presented here represents the most actively protected part of the CFA as it is easily reachable by the patrols (*Figure 5 and 6*). Five types of zone could be recommended for the area and applied to the entire CPFA:

o General Use Zones

All fishing activities may be undertaken, as regulated by the Community Fisheries' Internal Rules. Anchoring is allowed; diving is made possible but snorkeling is forbidden for safety reasons.

• Special Purpose Zones

These zones correlate to needs related to fishing activities: area where to anchor/moor, pier building, boat fixing, etc. Higher boat traffic shall need speed regulations for safety reasons. Fishing is very limited as it mostly concerns children fishing on paddle-boats whom we cannot deprive of their daily subsidence catch.

o Limited Use / Buffer Zones

A buffer zone aims to provide a transition space between a highly protected area (here Conservation & Replenishing and Sanctuary zones) and surrounding zones (General Use Zone) where heavier activities are allowed, as well as between the CPFA and areas outside the CPFA that are less managed and controlled. Fishing activities within the buffer zone are moderated, anchoring is forbidden while snorkeling and diving are allowed to attract tourism.

In our case, the creation of such buffer zones aims to anticipate and avoid potential conflict between subsidence fishing (traditional fishing with long lines) and commercial fishing (crab traps, especially). Indeed, it has been noticed that at some peak period of crab fishing, people fishing with lines would get tangled or caught at the bottom by the traps. This resulted in the loss of many lines, hooks and weights, sometimes forcing people to lift up the traps. Damages on traps or even stealing (catch or equipment) have to be considered, anticipated and be avoided by the use of a buffer zone.

• Conservation & Replenishing Zones

Areas closed to fishing, even temporarily, to increase the productivity of the area and the surroundings zones (here, Buffer and General Use Zones): this is called the spillover effect. Indeed, conservation and replenishing zones allows fish to grow older and bigger, which means that they should produce more eggs and juveniles. Fish density with the zone will increase, with the overall effect of export of larvae and movement of adults to the other zones or even eventually outside the CPFA. Also, these areas where fishing and collection are excluded are meant to attract snorkelers, and divers who can appreciate a rich ecosystem undisturbed by human activities. Anchoring is strictly forbidden.

o Sanctuary Zones

Areas set aside for their high ecological importance (vulnerable habitats, endangered species, breeding grounds), shall be undisturbed and kept for scientific research and activities.

The purpose of the sketch presented below (*Figure 6*) is to give an idea on how a multiple-use zoning could be designed. A lack of base material (in particular a recent, high quality and properly georeferenced base map of the coast of Cambodia including the islands) has stopped us from making a proper GIS map and draft zoning of the area. Thus, the scale and boundaries of the sketch are indicative only even though they are based on recent GPS measurements. Proper GIS is a very important issue to be addressed in the near future as it is most needed in for the monitoring of the Community projects.

Besides, a GIS specialist intern recently arrived in the MCC team. As we are now working together, we are hoping to design a solid GIS project which could be up and running in the within the next couple of months.



Figure 5: Most effectively protected area (purple dotted line)



Figure 6: Sketch of a ZMP that could be applied to M'Pai Bei CPFA

Limited Use Zone / Buffer Zone	Conservation & Replenishing Area	Sanctuary	Special Purpose Zone	
Back Door et Corner Bar – Reef area ; 200 meter wide buffer KC Reef – Reef area & very vulnerable habitats	100 meter wide buffer around Koh Koun (reef) Back Door – Reef area	The Corral – Seahorse breeding ground	Morring / Anchoring areas ; piers ; fishing activities limited to paddle-boats.	
House Reef et Vietnamese Bay – Reef area	Vietnamese Bay - Mangrove / Reef area			
A, B et C – Reef area; kept for traditional line fishing ; restriction on number of traps per fishing unit				

 Table 2: Reasons for choosing the delimitation of the different zones

ACTIVITIES		General Use Zone All activities may be undertaken	Limited Use Zone / Buffer Zone A limited number of allowed activities may be undertaken	Conservation & Replenishing Area A limited number of activities may be undertaken	Sanctuary Human activities strictly limited	Special Purpose Zone A limited number of activities may be undertaken
Day squid	Troll line	\checkmark	×	×	×	×
fishing	Long line	\checkmark	\checkmark	×	×	\checkmark
Night squid	Troll line	\checkmark	×	×	×	×
fishing	Long line	\checkmark	\checkmark	×	×	\checkmark
Traditional bait fishing*		\checkmark	\checkmark	×	×	\checkmark
Collecting shells**		\checkmark	\checkmark	×	×	×
	Squid trap	\checkmark	×	×	×	×
Traps	Crab trap	\checkmark	×	×	×	×
	Fish trap	\checkmark	\checkmark	×	×	×
Anchoring ¹		\checkmark	×	×	×	\checkmark
Diving ²		~	\checkmark	\checkmark	\checkmark	\checkmark
Snorkeling ³		×	\checkmark	\checkmark	×	\checkmark
Research	n and scientific tivities ²	~	~	~	~	~

Table 3: Regulation on activities within determined zones of the ZMP



- * Traditional bait fishing stands for long lines with 1 to 3 simple hooks, sometimes one squid lure added, baited with squid
- ** Species and Total Allowable Catch (TAC) to be determined
- ¹ Exception made in case of emergency / safety reasons
- ² May require special permit
- ³ Risk must be evaluated by the user, especially in area of important boat traffic (e.g. Special Purpose Area); the Community Fishery shall not be held responsible for any accident

Note: Depending on the zone, a maximum number of allowed gears per fishing unit is to be determined. Refer to "Plan for use of fishing gears" (*Part V.c.2*)

The following activities are prohibited for all protected areas:

- Net fishing
- Rubbish / waste dumping
- Fishing of any kind (except traditional bait fishing and trap fishing as defined by the Community Fisheries' Internal Rules)
- Removal of any natural object or living creatures
- Any other activities which may cause damage to the area or its associated marine life

2. Plan for use of fishing gears

The use of fishing gears shall follow zones labels; the number of fishing gears is limited according the type of gears and giver per fishing unit. A fishing time period / fishing season may be applied to certain gear.

General Use Zone							
	Tradit (woo	tional t d/bamb	raps 000)	Collapsible	Squid lines		Traditional
	Squid trap	Crab trap	Fish trap	crab traps	Long line	Troll line	lines
	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Maximum number of allowed gears per fishing unit							
Time period: From [month] to [month]							
		Limi	ted Us	se Zone / Buffe	er Zone		
	Tradit (woo	tional t d/bamb	raps 000)	Collapsible	Squid	lines	Traditional
	Squid trap	Crab trap	Fish trap	crab traps	Long line	Troll line	lines
	×	×	\checkmark	×	\checkmark	×	~
Maximum number of allowed gears per fishing unit							
Time period: From [month] to [month]							
	(Conse	rvatio	on & Replenish	ing Are	a	
	Tradit (woo	tional t d/bamb	raps boo)	Collapsible	Squid	lines	Traditional
	Squid trap	Crab trap	Fish trap	crab traps	Troll line	Long line	lines
	×	×	×	×	×	×	×
				Sanctuary			
	Tradit (woo	tional t d/bamb	raps 000)	Collapsible	Squid lines		Traditional
	Squid trap	Crab trap	Fish trap	crab traps	Troll line	Long line	lines
	×	×	×	×	×	×	×

Special Purpose Zone							
	Traditional traps (wood/bamboo)		Collapsible	Squid lines		Traditional	
	Squid trap	Crab trap	Fish trap	crab traps	Troll line	Long line	lines
	×	×	×	×	×	\checkmark	\checkmark
Maximum number of allowed gears per fishing unit							
Time period: From [month] to [month]							

Table 4: Plan for use of fishing gears that could be applied to M'Pai Bei CPFA



Not allowed / None

3. Plan for strengthening the capacity of surveillance and control

"Until now, the M'Pai Bei community has been self-financing its project through the help of MCC. Daily patrols are conducted using long-tail boats in order to maintain the protection provided by the CFA. However, patrolling represents a significant cost that consumes the majority of the community's budget. This is why the introduction of Tourism-Based User Fees (TUFs) is so important" (M. Skopal, P. Ferber, S. Fairclough, 2010).

"Recent changes in the organization of the patrols have allowed updating estimation costs. The patrols are now divided into two teams of 5 people, each of them being lead by a Head Ranger. The costs related to the rangers' salaries will be as follow (*Table 5*):

Ranger status	Number of people	Salary per month	TOTAL
		(USD)	(USD)
Head Ranger	2	50	100
Ranger team	8	40	320
TOTAL			420

Table 5: Costs related to the rangers' salaries

Gasoline consumption will also have to be taken into account. Estimations show an average consumption of 290 liters per month, which would cost **326 USD**.

→ Overall, the daily patrols conducted by the rangers M'Pai Bei community represent a cost of 746 USD per month."(M. Skopal, P. Ferber, S. Fairclough, 2010)

A feasibility report and proposal for the introduction of TUFs was already submitted to the relevant government agencies (*see pa V.c.5*). The revenue generated from such a fee system would cover the cost of the patrols and strengthening the capacity of surveillance and control of the area.

4. Plan for the establishment of a community research team & strengthening Community Capacity Building

i. Fish and reef monitoring : diver training

"In preparation for having Khmer lead research teams, currently three community members are undergoing final exams for scuba diving (*Picture 36*). This will ensure that they are officially certified scuba divers and can start to conduct research dives. In addition to studying for diving they are also studying English and marine life/conservation education. In the future data processing and computer skills will also be focused on" (C. Atkins, 2010). Cost estimations related to diver certification have been projected as well as equipment cost related to catch monitoring and data processing conducted by Community Research Team members (*Tables 6 and 7*).

Trainee Certificatio		_	Equipment /	Needed time	Costs (USD)		
Names	(P.A.D.I.)	Purpose	Learning material	to complete / Time frame	Equipment	Certificate	
Thy Dot Ny	Open Water (OW) Diver	Initial Dive Training	PADI OW Book; Scuba Set; Mask; Fins and Certification	Normally 1 week, however due to English limitations and extra academics this is increased	A full dive kit including Tank is around \$990 EACH	\$85 EACH	
Thy Dot Ny	Advance OW Diver	Advanced dive skills	PADI AOW Book	Normally 1 week, however due to English limitations and extra academics this is increased	N/A	\$95 EACH	
Thy Dot Ny	Rescue Diver	Full Rescue Training, scenarios are carried out as well as EFR Training	PADI Rescue Book and EFR Book	Normally 2 week, however due to English limitations and extra academics this is increased	N/A	\$95 EACH	
Thy Dot Ny	Dive Master	Clear understanding of the science involved in diving	Dive Master Packs	6 months for total training	\$250 per pack EACH	\$50 per year EACH	
Thy Dot Ny	Dive Instructor	To bring diving to a wider Khmer public	Full Instructor Packs	1 Month of intensive training	\$3000 all together EACH	N/A	

τοται	13,695 USD
COSTS	for a training period of 12 months
	that is 1,142 USD per month

Table 6: Cost estimations related to diver training over a period of 12 months



34 – Community Research Team: diver training

Trainees Names	Activities / Teaching	Equipment / Learning material	Needed time to complete / Time frame	Costs
Thy Dot Ny	Species identification	Fish ID textbook (English/Khmer version)	On Going Training	\$100
Thy Dot Ny	Fish / Reef survey methodology	Underwater slates	On Going Training	\$50
Thy Dot Ny	Computer skills & Data processing	Laptop	On Going Training	\$400
TOTAL COSTS	550 USD			

Table 7: Cost estimations related to education and training in environmental and marine research

Last July, as part of the Community Capacity Building, MCC held an Emergency First Responder (EFR) seminar for the ranger and research teams from M'Pai Bei Community. They were taught resuscitation (CPR) for both adults and children, how to deal with emergency situations and basic first aid (*Pictures 35 and 36*). Over the next few months training will focus on in water rescue techniques in preparation for a community sea rescue team.



35 and 36 –Emergency First Responder (EFR) seminar, July 2010

ii. Catch monitoring

✤ <u>Purpose</u>

Monitoring of fisheries catches in –and adjacent- to the protected CFA is essential to determine the impact of fishing on the biodiversity within the protected area, and whether it is having an impact on fishery stocks and thus on the livelihoods of coastal communities. In our case, it will also make it possible to evaluate the efficiency of community protection.

Fishing both effects and is affected by the establishment of a protected area. Increased catches, as a result of spill-over from no-take zones and areas of reduced fishing pressure (e.g. the 300 meters buffer zone around Koh Koun and the Corral (the seahorse breeding ground)), can contribute to improve the livelihood of local coastal communities. Collecting information on fishing from within and adjacent to a protected area is thus essential to:

- "Determining the extent to which fishing is having an impact on stocks (or populations), species, and biodiversity within the protected CFA;
- Detecting changes (trends) in the fishery and their causes;
- Estimating the contribution of fish to food security and the economy, and how the CPFA plays a role in poverty alleviation" (IUCN, CORDIO and ICRAN, 2008).

Designing data sheets

A survey was previously conducted through the Community in order to help identifying the number and types of vessels, gears, fishers and fishing habits. The survey made it possible to establish a profile of the fisheries operating in and near the protected CFA; is it an essential step before starting any fisheries monitoring. A fisheries monitoring program should at least include the following:

- "Catch (weight) and catch composition (species and/or families harvested);
- **Fishing effort**, which includes type, duration and location of fishing operations; e.g. number of boat-days, man-hours or gear-hours per month or year;
- **Costs and revenues,** which are mainly those of fish prices, fuel, gear costs and wages" (IUCN, CORDIO and ICRAN, 2008).

Information on both catch and effort will allow estimating catch rate (CPUE) then evaluating whether the area is subject to over-fishing, the recovery or degradation of a fish stock and the effectiveness of management.

From there, it is then possible to evaluate whether the area is subject to over-fishing (continuing decline in CPUE) or whether a fish stock is recovering (increased CPUE), that's to say the degree of management effectiveness. However, we have to keep in mind that the relationship between CPUE and stock abundance is not that simple as it is also conditioned by changes or evolution in gear efficiency, changes in fishers' behavior and habits, and by schooling or seasonal migrations of fish. "Interpretation of CPUE trends should thus be cautious; however, if both CPUE data and independent survey data on fishery populations are used, it should be possible to assess the impacts of the MCPA on a fishery" (IUCN, CORDIO and ICRAN, 2008).

In practice, in order to optimize the data collection and its accuracy, other elements have to be taken into account, related to the local social and cultural context: level of literacy; general feeling/willingness to answer questionnaire; availability of the person, etc.

A consultation between RFLP/FAO and MCC made it possible to design a daily catch monitoring program (*Appendix 2*). The daily catch monitoring program would be carried out alongside a weekly/monthly survey, which would provide more comprehensive results, and could be conducted by local Community teams.

- Daily survey A daily questionnaire, designed by the RFLP/FAO in collaboration with MCC. Kept as short and as simple as possible, it is designed in a way that makes it very easy and quick for the people to fill in: very few questions with boxes to tick in (no need to write, unless having some additional comments). This first survey is designed as a monthly calendar: a first esthetic page; personalized, (e.g. picture of the Community) will encourage the families to hang the calendar in their house, thus making it easier to remember to fill it in every day and avoiding paper loss. The daily survey shall mainly focus on catches (weight, composition) and fishing effort. This format data sheet could then be used as a template which then would allow creating a specific one for each target community fisheries. This would encourage Community members to use it and as it would make them feel entirely integrated to the project. The calendars shall be collected, the first day of every month, by a member of the Community Research Team who will also be in charge of processing the data.
- Weekly survey More comprehensive and detailed than the daily one, shall be conducted by a member of the Community Research Team on a given day of the week. The survey will include questions related to fishing gears, catches, but also habits and fishing zones, as well as potential resource use / fishing conflicts.
- Monitoring & Georeferencing Another type of survey that would involve the younger members of the Community, Community Research Team members and MCC volunteers could be undertaken. This one would emphasize on the evolution of the marine resources in specific areas and need the use of a GPS. Indeed, it has been noticed, by going fishing with Community members, that people always return fishing to the same areas in order to catch their favorite species (breams, snappers, groupers). Thus, by returning to the exact same place once or twice a week, georeferencing it and monitoring the catch for each location (species, quantities, sizes), we should be able to map the evolution (increase / decrease) of certain marine species, thus optimize the management of the area. Involving the younger members of the Community would significantly help improving Community Capacity Building. While bringing back fish for their family to consume, they would:
 - Learn basic methodology of catch monitoring;
 - Gain knowledge about species, sustainable fishing and become aware of the benefits of marine conservation and protection;
 - Learn Geographic notions by using GPS and learn how to read maps;
 - Improve their English skills.

Environmental education is fundamental for the success of the project. Involving the younger members of the Community today will insure a follow-up for conservation of the marine environment in the years to come.

5. Plan for revenue generation for relevant government stakeholders

A feasibility report and proposal for the introduction of TUFs (Tourism-Based User Fees) for M'Pai Bei CPFA and other coastal areas was recently provided to the FiA, Sihanoukville provincial costal management team and the FAO (*see References page 61*). Extensive tourism and business surveys were conducted in Sihanoukville over the previous six months and the results showed a general interest in protecting the marine environment and a willingness to pay for participating in conservation initiatives. An optimal fee pricing was calculated and future trend scenarios were elaborated.

We hope that this document will help to demonstrate that the introduction of TUFs for M'Pai Bei CPFA would benefit both the local community and all involved stakeholders on a long term basis, by ensuring the sustainable use of the marine environment around Koh Rung Samleom, Koh Koun and Koh Rong. Finally, we hope that by making this program successful, it could then be used by relevant stakeholders and generate sustainable funding for Sihanoukville ICM Program.

Conclusion

By the end of this report, we hope that the reader will have gained useful information on the Community's background and its evolution following the introduction of the Community Fishing Area.

Although M'Pai Bei CPFA constitutes a unique case due to its localization, sociodemographic and economic context, we believe that it could be set as a model and be locally readapted to the entire Cambodian Community Fishing Areas' network to insure a sustainable development of coastal communities.

M'Pai Bei CPFA's Environmental, Demographic and Socio-Economic Report demonstrates the ongoing effort and the ability of national, provincial and local stakeholders to work together to bring positive and sustainable changes to the livelihoods of coastal communities.

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Appendix

1 – M'Pei Bei Community Fishing Area – Catch Monitoring Program – Most Common Catches62

2 – Daily Catch Monitoring Program – DRAFT ONLY65

APPENDIX 1

M'Pei Bei Community Fishing Area – Catch Monitoring Program – Most Common Catches



MPai Bei Community Fishing Area

Catch monito program

Most Common Catches

M'Pai Bei Community Protected Fishing Area

	1. Tr Red C Sargocentre	rey Coat on rubrum	2. Trey Contrap Narrow-Banded Sergea Abudefduf bengale	o nt Major ensis	3. Trey Sa'weign Paradise whiptail Pentapodus paradiseus		
4. Trey Gontang Golden spotted s	Pleuong	5. T Brown	rey Anglueng stripped snapper		6. Trey At'oy Blacktail snapper	Ch	7. Trey leckered snapper
Siganus gutt	tatus	Lu	itjanus vitta		Lutjanus fulvus	Lut	janus decussatus
						Corker .	
			8 Trey 7	Feukai			
			Grou	per			
			Epinephé	elus sp.			

9. Trey Gontang Tmor Streaked spinefoot Siganus javus	10. Trey Grop kn Pinkear empero Lathrinus lentja	1a0)r 1n	11. Trey beloua Trumpeter Sillago sp.	
12. Trey Atóy Rainbow Monocle Bream Scolopsis monogramma	13. Trey Graom Forktail threadfin bream Nemipterus furcosus	14. Trey Pearly Monocle Bream Scolopsis margaritifer		15. Trey Gontrap Monocle bream Scolopsis torquata
16. Trey Jow17. Trey KamgoitYellow-spotted trevallyGolden trevallyCarangoides orthogrammusGnathanodon speciosus		, Scombe	18. Trey Balang Talang queenfish proides commersonnianus	19. Trey Oangray Great barracuda Sphyraena barracuda

M'Pai Bei Community Protected Fishing Area

20. Trey J're-moh J'rook	21. Trey Bawbel Moa-un	22. Trey Bawbel S'baik	23. Trey chhlarm chkouyt
Brown Sweetlips	Scaly Whipray	Blue-spotted Ribbontail Ray	Bamboo Shark
Plectorhinchus gibbosus	<i>Himantura imbricata</i>	<i>Taeniura lymma</i>	ChiloscyIlium punctatum
24. Meuk Sno	25. Meuk Hoysai	26. Meuk Bpeeng Bpee-ung	27. Kdam tmor
Cuttle fish	Squid	Octopus	Blue swimmer crab
Sepia latimanus	<i>Sepia sp.</i>	Octopus marginatus	Portunus pelagicus

APPENDIX 2 Daily Catch Monitoring Program – DRAFT ONLY

