Integrating people in conservation planning

An integrated assessment of the biodiversity, livelihood and economic implications of the proposed special management zones in the Stung Treng Ramsar Site, Cambodia

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IUCN Species Programme

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IUCN Red List Categories used throughout this report

Unless otherwise stated, all assessments are at the global level i.e. are not assessments made at the country or regional scale using the Regional Assessment Guidelines. For more information see: http://www.iucnredlist.org/

NE	Not Evaluated	Not assessed according to the IUCN Red List criteria
DD	Data Deficient	There is inadequate information to make an assessment of the risks to this species.
LC	Least Concern	There are no current identifiable risks to the species.
NT	Near Threatened	The species does not meet any of the criteria that would categorise it as risking extinction but it is likely to do so in the future.
VU	Vulnerable	The species is facing a high risk of extinction in the wild.
EN	Endangered	The species is facing an extremely high risk of extinction in the wild.
CR	Critically endangered	The species is in imminent risk of extinction in the wild.
EW	Extinct in the Wild	Known only to survive in captivity or as naturalised populations well outside its previous range.
EX	Extinct	No reasonable doubt that the last individual has died.

Some species were assessed using an earlier set of the IUCN Red List criteria. Species assessed using this system have the following instead of Near Threatened and Least Concern categories:

LR/cd	Lower Risk/conservation dependent	Species which were the focus of conservation programmes and may have moved into a higher risk category if that programme was discontinued.
LR/nt	Lower Risk/near threatened	Species which are close to being classified as Vulnerable but are not the subject of conservation programmes.
LR/lc	Lower Risk/least concern	Species for which there are no identifiable risks.

Abbreviations

CEPA	Culture and Environment Preservation Association
CNMC	Cambodian National Mekong River Committee
CPR	Common Property Resource
DEFRA	Department for Environment, Food and Rural Affairs (UK Government)
DoF	Department of Fisheries (Cambodia), now Fisheries Administration, FiA
DNCP	Department of Nature Conservation and Protection (Cambodia) (now General Department of Administration for Nature Conservation and Protection, GDANCP)
hh	Household / households
GEEP	Global Economics & the Environment Programme of IUCN
IUCN	International Union for Conservation of Nature
MoE	Ministry of Environment
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoWRAM	Ministry of Water Resource and Meteorology
M-POWER	Mekong Program on Water, Environment and Resilience
MRC	Mekong River Commission
MWBP	The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme was a four-year (2004-7) initiative working in the four Lower Mekong countries (Cambodia, Lao PDR, Thailand, and Viet Nam). It was a joint UNDP/IUCN/Mekong River Commission (MRC) managed programme.
NTFP	Non-Timber Forest Products
ODG	Overseas Development Group (University of East Anglia, UK)
PA	Protected Area
SMZ	Special Management Zone (of a protected area)
WDPA	World Database on Protected Areas
USD	American dollar

Local terms

Khmer	Alternate	English
Anlong	*Anlung*	deep pools
Anlong	*Bung*	deep water body, but not so deep as *anlung*
Chamkar		farming i.e. non-rice cultivation of crops such as corn, tobacco, banana, water melon, and so on
Koh	*Kaoh*	island
Moys		client (mostly relations between dealers, sellers, producers)
O'	*Stung*	stream or small river, tributary
Phnum	*Phnom*	hill / mountain
Phoum	*Phum*	village
Pra hok	-	fermented fish
Prek	-	creek
Riel	-	Cambodia currency (Unless otherwise stated, 4,000 *Riel* = 1 USD)
Sala Phoum	-	literally 'village study'
Srok	-	district
Trapeang	*Trapaeng*	pond or small water body
Trey	*Trei*	*fish*
Trey Riel	-	A key fishery, of great importance to local wetland livelihoods. Local people in Cambodia use the term to collectively refer to small cyprinids of the *Henicorhynchus* genus, differentiating slightly between them as follows. Local fishers reported that these species are normally found in the same group with the same habitat and migrate at the same time in Ramsar Site: Trey Riel: *Henicorhynchus caudimaculatus* Trey Riel awng kam: *Henicorhynchus cryptopogon* Trey Riel tob: *Henicorhynchus siamensis* The term occasionally also includes other small species such as *Amblyrhynchichthys truncatus, Cirrhinus caudimaculatus,* and *Cirrhinus jullieni*.
Veal	-	grasslands (small, usually moist or wet) or open forest
Veun	*Vean*	large-deep pool water body with still water

Terms used in this Study

Biodiversity	biological diversity - the variation of life forms within a given ecosystem, biome or for the entire Earth.
Governance	The exercise of public power, i.e. policy and decision processes, bureaucratic practices, local government and so on
Income	goods and cash generated from livelihood activities
Livelihood	a person or household's means of supporting themselves.
Pro-poor	policies or activities which particularly favour poorer groups
Wetland	a group of aquatic habitats representing a variety of shallow, vegetated systems such as bogs, marshes, swamps, floodplains, and coastal lagoons that are often transitional areas and can be seasonally or intermittently flooded (Groombridge and Jenkins 1998)

Authorship

This assessment is based on primary data gathered by the project's survey consultants Alvin Lopez and Mark Dubois, with assistance from Kong Kim Sreng, Thuon Try and many others too numerous to mention but to whom we are most grateful. The initial work of the survey consultants was conducted while employed by the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP), a project partner until the MWBPs closure in late 2006. A large part of the additional secondary data utilised was sourced from previous work undertaken by MWBP. The final report has been compiled and edited by Oliver Springate-Baginski, William Darwall and David Allen.

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This study of the Stung Treng Ramsar Site has been coordinated by Mr. Kim Kong Sreng, the project officer of the IUCN Cambodia Country Office.

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Key messages

- The Stung Treng Ramsar Site has been confirmed to be an area of outstanding biodiversity value, with a number of globally and regionally threatened species.
- Local livelihoods at the site are complex and highly dependent upon the utilisation of the wetland's natural resources, particularly for the poor and poorest.
- Threats to the Site are mainly external (wildlife trade, dams, external fishers), and major benefits from resource extraction accrue to outsiders.
- Many species, including some of conservation concern, are highly utilised, sometimes involving destructive harvesting practices, especially by outsider fishers.
- Biodiversity / conservation management in areas of livelihood use must acknowledge livelihood dependency and seek to work with local people as allies.
- Effective resource governance has emerged as a central issue for conservation and livelihood development here. Improving weak governance, reflected in difficulties in regulating outsider's over-exploitation of the resource, is proving the key challenge.
- The government currently lacks the effective capacity and resources to enforce current legislation and management objectives, and therefore management should focus on developing co-management opportunities. Whilst some co-management practices have been introduced, the implementation and capacity are as yet weak.
- Leadership is required from top levels of government to prevent corruption and ensure fair and effective implementation of existing legislation.
- Decision-making over hydroelectric development does not seem to have reflected either the democratic aspirations of the local communities for livelihood security or the full range of values of the resource in its current state to the range of users.
- The integrated multidisciplinary approach used in this study has helped reveal a more complete picture of the full value of wetlands, and identify management options that better reconcile the needs of the poorest communities and conservation. This approach has been valuable in refining the spatial zoning of conservation interventions.
- The work done here has enabled the testing, evaluation and development of a Good Practice Toolkit for implementing the cross-disciplinary approach.

Recommendations

- The Ramsar boundary should be extended to include the Anlong Chheuteal transboundary Mekong dolphin pool, which, contrary to the World Database of Protected Areas (WDPA) boundary (see Map 2), currently it does not.
- Total exclusion is not a viable option for managing Ramsar Site zonation due to the negative impacts on the livelihoods of those using these areas.
- Transboundary collaboration should be promoted between Cambodia and Lao PDR and other upstream countries.
- Participation of communities in conservation planning for the Site should become institutionalised.
- The government should strengthen support to community-led fisheries conservation initiatives, improve monitoring of fishing activities by external commercial fishers (including companies) and better enforce the existing regulations in relation to their activities.

Summary

Context
Wetlands are amongst the most threatened of global ecosystems; they are being lost or degraded across the world, with more than 50% of global wetlands lost in the last 100 years. A major cause of this has been the poor information available to development planners, decision makers and legislators, and limited consideration of existing data, with the result that decisions that impact upon wetlands have often been informed by limited economic arguments. The project '*Strengthening pro-poor wetland conservation using integrated biodiversity, livelihood and economic assessment*', funded by the UK Darwin Initiative, has sought to improve the information base for wetland sites by developing generic tools to gather information on the full livelihoods, environmental and biodiversity values of wetland sites. The integrated assessment of the Stung Treng Ramsar Site was one of two case study assessments undertaken through the project (the second was undertaken in Tanzania; see: Kasthala *et al.* 2008), in order to test the integrated methodology and inform the development of a *Toolkit*, a good practice manual to undertaking integrated assessments of wetlands.

The stretch of the upper Mekong River in Stung Treng Province, Cambodia, north of Stung Treng town was designated as a Ramsar Site in 1999. Nearly 40 km long, and covering an area of about 14,600 hectares, the Site encompasses some of the remaining areas of high quality riverine and riparian habitat once typical of this area of the Mekong, and includes a large number of deep pools, produced and maintained by the scouring action of wet season floods, which provide key habitat for a wide range of fish species. Many people, in both settled and migratory communities depend upon the biodiversity of the Site to support their livelihoods.

A range of threats currently threaten the Stung Treng Ramsar Site. These include clearance of the riparian and river channel vegetation, especially of the gallery forest, urban and agricultural developments, and the construction of dams. A key potential threat to the biodiversity and its dependent livelihoods of the entire Site is posed by plans to dam the Mekong and its tributaries under several proposed new projects; more than seven dams have been proposed for the mainstream of the Mekong within Cambodia alone. Whilst a number of dams have already been built in Mekong tributary rivers (e.g. the Yali Falls dam on the Sesan River), the hydropower potential of the Mekong mainstream has not as yet been developed (mainly as it has previously been viewed as too great a threat to the hydrological regime). However, there are now a number of dams proposed on the Mekong itself, the most significant of which, in terms of affecting the Stung Treng Ramsar Site, is the proposed Don Sahong dam at the Khone Falls in Laos. This 240 Megawatt dam, still in the feasibility assessment phase, would be located just over 1 km north of the Site. The proposed dam could have potentially serious impacts on river flows and fish migrations through the Site, and affect a key habitat of the Critically Endangered Mekong population of the Irrawaddy Dolphin *Orcaella brevirostris,* the transboundary pool at Anlong Chheuteal, just to the north of the Site.

Study aims and method
This study comprised a two-stage process whereby MWBP consultants contributed survey data (especially the outputs of the *sala phoum* process) and a team of national and international consultants then undertook an integrated assessment to review the proposed implementation of the conservation management zoning recommendations of Timmins (2006) in the Stung Treng Ramsar Site, Stung Treng Province, Cambodia. A multi-disciplinary team of experts was assembled to undertake a series of literature and field studies relating to the biodiversity, livelihoods and economic values of the wetland. Fieldwork for the second stage of the project was conducted during January and February 2007.

Main biodiversity findings
The Stung Treng Ramsar Site in the Lower Mekong supports a globally distinct type of seasonally-inundated riverine forest, not found above the Khone Falls in Laos, nor further downstream. There are remnant areas of tall riparian forest, and significant reed beds. One of the main populations of Irrawaddy Dolphins in the Mekong breeds close to the Site in the Anlong Chheuteal transboundary deep pool. At least four globally threatened birds species have been recorded, including the Green Peafowl, White-Shouldered Ibis, Spot-Billed Pelican and the Lesser Adjutant, as well as a large number of globally Near Threatened and Regionally Threatened bird species, and for some of these, the populations within the Ramsar Site represent a significant proportion of their overall population. The Critically Endangered Siamese Crocodile *Crocodylus siamensis* occurs within the Site in the proposed Anlong Rusei Core Zone.

Global conservation status of threatened species known to be present in the Stung Treng Ramsar Site.
This is an incomplete list, and further survey is required. For example, aside from *Amyda cartilagenea*, no turtle or tortoise species are included here; more are likely to be present within the Site, but all are heavily hunted and globally threatened.

English Name	Scientific Name	Conservation Status
Green Peafowl	Pavo muticus	VU
Oriental Darter	Anhinga melanogaster	NT
Grey-headed Fish Eagle	Ichthyophaga ichthyaetus	NT
White-shouldered Ibis	Pseudibis davisoni	CR
Spot-billed Pelican	Pelecanus philippensis	VU
Lesser Adjutant	Leptoptilos javanicus	VU
Mekong Wagtail	Motacilla samveasnae	NT
Long-tailed Macaque	Macaca fascicularis	NT; CITES II
Eld's Deer	Cervus eldii	VU; CITES I
Smooth Otter	Lutrogale perspicillata	VU; CITES II
[Siamese Crocodile]	Crocodylus siamensis	CR; CITES I
[Asiatic Softshell Turtle]	Amyda cartilaginea	VU; CITES II
Irrawaddy Dolphin	Orcaella brevirostris	CR; CITES I (Mekong subpopulation)
[Trey Bobel]	Himantura chaophraya	VU
[Trey Kbork]	Tenualosa thibaudeaui	EN
[Seven-striped Barb]	Probarbus jullieni	EN; CITES I

[…] indicates that the species was not directly observed during the current survey; inclusion based on secondary reports

At least 130 species of fish have been recorded by this survey (MWBP 2007), including three globally threatened species, although the number of fish species known to be present is likely to increase with further survey, and there remain a number of unidentified fish. Recent work revealed more than 207 species (including a number of unidentified species) in trade at Stung treng market (Chavalit Vidthayanon, unpublished data). The conservation status of the vast majority of fish, Odonata, molluscs and aquatic plants has not as yet been assessed. This should be considered a priority due to the high economic and livelihoods value of many of the species, especially fish, within the Site, and the high level of potential threat to aquatic species presented by the current plans for hydroelectric dam developments within the region.

The biodiversity of the Site is vital in supporting the livelihoods of local communities, both settled and migratory, and is economically important locally, nationally and regionally. Many species and products (including food, skins, and medicinal products) from the Site are traded to neighbouring countries (Boonratana *et al*. 2005). Assessing the full conservation impacts of this trade is beyond the scope of this report, but it is clear that a large number of regionally or globally threatened species that are traded are sourced from within the Ramsar Site. As the table below shows, a number of species of conservation concern are available in the markets close to the Site, and are likely to be traded across the border into Lao PDR.

	Stung Treng – town	**Veun Kham border crossing**
Globally-threatened species (IUCN Red List)	**15**	**3**
CITES-listed species (App. I-III)	**15**	**2**

Note: The following locations were surveyed in Stung Treng town; Stung Treng market, 6 restaurants, 1 specialist wood market. Summarised from Boonratana *et al.* 2005

At present, the Ramsar Site is relatively unimpacted by development, though there has been significant clearance and degradation of the riverine gallery and semi-evergreen forest and bank-side perennial vegetation (Timmins 2006); the primary driver of the ongoing clearance of these habitats (often by deliberate fire) is for agricultural land. Logging is a minor threat in the area (probably because many of the commercially valuable trees have already been removed). The key future threat, especially to the aquatic habitats and their dependent species and livelihoods, is the development of the basins' hydropower potential. Many dams have already been constructed, and a large number are currently in

the feasibility or development stage, both on the mainstream of the Mekong and on its tributaries. Likely impacts, amongst many, include decreased dry season flows and decreased flooding events, changes in sedimentation rates and sedimentation of deep pools, and severe impacts on fish migrations. Alterations to the flooding regime, including the velocity of flows will impact upon the characteristic channel vegetation structure thus have potential impacts on their dependent species communities.

The growth of algae, possibly resulting from input of nutrients higher upstream has emerged as a growing problem in recent years, with dense mats of algae impacting upon fishing and transport activities, and with currently unknown impacts on biodiversity.

Main livelihoods and economic valuation findings
The main livelihood practices do not necessarily have an adverse impact on biodiversity in the area; agriculture, fishing and non-timber forest product collection can be sustainable if practices are regulated. However, a range of factors have led to a very weak governance and regulatory environment in which traditional customary mechanisms have been undermined and new decentralised governance mechanisms have not yet become effective. These factors include the political turmoil of recent decades, centralised administration, and rapid societal changes, such as in- and out-migrations from rural areas. In this weak governance context some livelihood practices are having a negative impact on biodiversity. These include destructive fishing practices (particularly during the spawning season), and the collection of wildlife. Such practices are not however core to households' food security, and so could be addressed in a relatively straightforward manner: from group discussions the commitment of local people to improve practices is clear.

There are a range of growing pressures on the fishery resource within the region – a key pillar of many people's livelihood strategies; these include overfishing both by residents and non-resident fishers, and other factors such as land use change, hydrological flow changes caused by climate change and dams, and disruption of fish migrations. Further work is required to understand the complex interactions between these factors. Overfishing is closely linked both to the livelihood security of local households and also to profits of outside traders. Outsider traders are apparently receiving tacit patronage and protection of public servants and are thereby able to over-exploit the resource with impunity. The situation is a typical 'tragedy of the open access commons' scenario in which local households are unable to defend local resources they depend on from profit-maximising outside traders through traditional customary mechanisms, yet the new local government structures are not yet effective. Consequently no-one has an incentive to conserve and there is a 'race to the bottom' in which everyone seeks to privatise whatever they can of the resource before others do. Whilst in some communities, traditional resource governance structures still function, in others they have collapsed, and further research could reveal the reasons for differing responses to change, and produce lessons for strengthening community ownership of resources.

The increasing trend in population and in-migration means that there is likely to be an intensification of these issues, and it is therefore urgent that they are addressed at the earliest through strengthening local communities' powers and capacities.

PART I: INTRODUCTION TO THE STUDY

1 Introduction: strengthening pro-poor wetland conservation using integrated biodiversity, livelihood and economic assessment

1.1 The project

The project *'Strengthening pro-poor wetland conservation using integrated biodiversity, livelihood and economic assessment'* has been funded under the Darwin Initiative of the UK Department for Environment, Food and Rural Affairs, and has run over the period October 2005 to September 2008.

The project goal is that pro-poor approaches to the conservation and sustainable use of threatened wetlands are strengthened through improved capacity, awareness and information on both the biodiversity and livelihood values of aquatic ecosystems. A weak appreciation and lack of accessible information on the links between wetland biodiversity, economic status and livelihood security, and especially of the importance of wetlands to the poorest, remains one of the most important factors leading to wetland degradation and loss. The project is founded on the recognition that developing sustainable, effective and equitable approaches to wetland conservation requires a thorough understanding of the interlinkages between socio-economic and biophysical status, influences and threats. This requires that the methodologies used to assess wetlands and to inform management responses are integrated, in order to address biodiversity, livelihood and economic aspects. The project therefore aims to:

- assess the current conservation status of biodiversity and threats to that biodiversity
- assess the role of biodiversity in local livelihoods, and
- quantify the economic value of the goods and services yielded by that biodiversity.

At the same time, there is a need to ensure that such information and insights are practical and policy-relevant, and are geared towards addressing real-world issues and concerns in wetland management. While techniques exist, and have long been used, to assess wetland biological, economic and livelihood values and trends separately, there are a lack of available methods to integrate these approaches in a way which informs on the interdependence of the ecological health of wetlands and wetland dependant economies and livelihoods. Current techniques are also unable to express this information in a form and with a focus that can inform and influence real-world conservation and development planning.

The project aims to overcome these methodological and informational constraints through the development and application of integrated assessment methods that can generate planning and decision support information to strengthen pro-poor approaches to wetland conservation. To these ends, activities being carried out under the project include the development of an integrated wetland assessment methodology and field protocol, the production of a Toolkit outlining this methodology and an evaluation of the approach and methods in two case study field sites: Stung Treng Ramsar Site in Cambodia and Mtanza-Msona Village in Tanzania.

Work at each of these two field studies has involved the application of integrated assessment techniques to address a specific management issue which relates to the interaction between wetland conservation and sustainable development in that Site, thus generating practical and policy-relevant information for planners and decision-makers who are engaged in wetland management. The studies have also provided an opportunity to work with national and local partners to develop, field-test and refine the integrated assessment methodology and toolkit being prepared under the project.

1.2 Aims of this study

The Stung Treng Ramsar Site was chosen as one of the two pilot field sites for this project because it is an area of critical biodiversity significance with local reliance on wetland resources, in particular by the poorest members of the community. Nominated as a Ramsar Site (a Wetland of International

Importance) in 1999 for its ecological significance, the government of Cambodia has continued to show interest in improving management and wise use of resources within the Site. A management planning process was initiated as part of the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP). Part of this process involved biodiversity assessments and ecological characterisation of the Ramsar Site.

Critical management issues affecting the ecological character of the Stung Treng Ramsar Site have already been identified in the earlier work. The most important task during this study has been addressing those issues and proposing practical management responses. The approach that we adopted was to test application of the toolkit (Springate-Baginski *et al. 2008*) through an integrated assessment of the implications of the proposed management zones within the Ramsar Site on local livelihoods. A particular emphasis was placed on the Lower and Upper Island Core Zones (termed Lower and Upper Island Zones in this report), and especially the Anlong Rusei and Preah Sakhon Core Zones (termed 'Sanctuaries' in Timmins 2006).

In addition to the proposed management zones, this study also included a rapid assessment of the Anlong Chheuteal transboundary pool inhabited by the threatened Mekong River Irrawaddy Dolphin *Orcaella brevirostris*, the primary purpose being to determine the level of success of the 'total protection' measures.

This report presents the findings of the integrated assessment and provides feedback on the field application of the toolkit. The geographical areas of concern are discussed separately in dedicated chapters. The chapter on the proposed Upper Island Zone provides a broad overview of biodiversity, economic and livelihood issues in the Upper Island area within which the other proposed Core Zones are situated.

2 Setting the scene: the Stung Treng Ramsar Site

This chapter provides a brief overview of the Site, including the settlement pattern, descriptions of climate, land use, vegetation, human populations, livelihoods, biodiversity importance and resource management practices.

2.1 Location and conservation designation of the Stung Treng Ramsar Site

Stung Treng Ramsar Site, one of only three Ramsar-designated wetland conservation areas within Cambodia, covers approximately 37 km of the Mekong River in Stung Treng Province, northern Cambodia (see Map 1).

Map 1: Location of the Stung Treng Ramsar Site within the region.

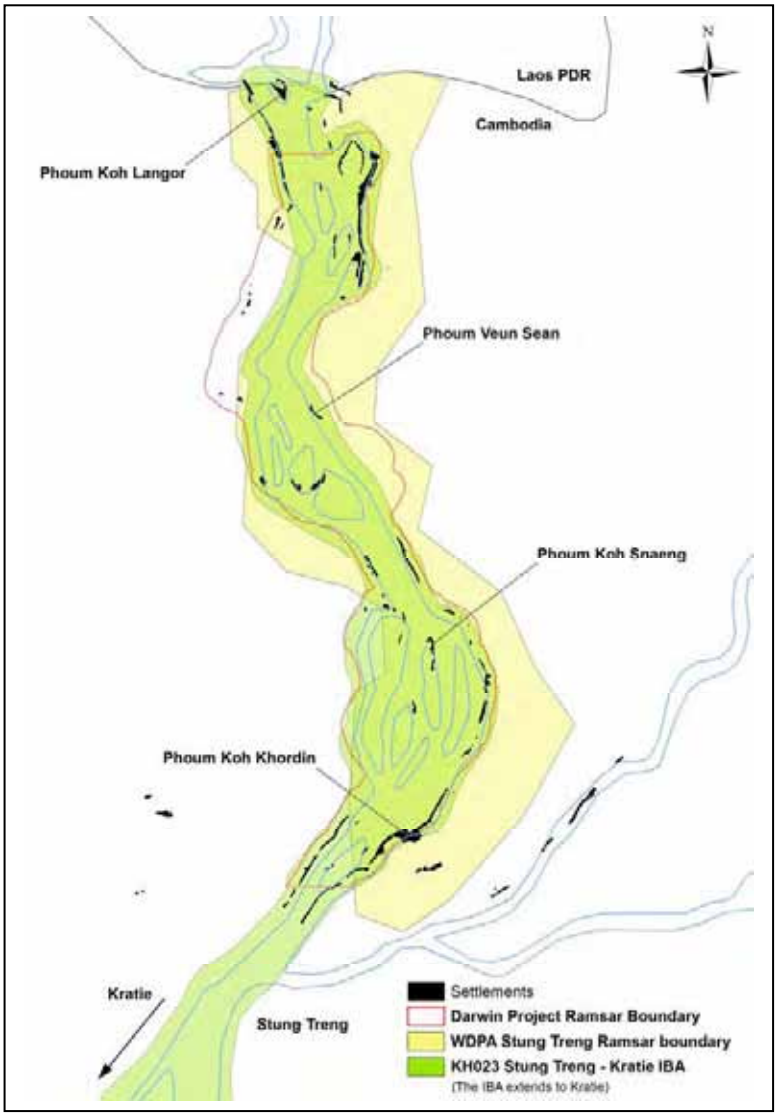
The lower boundary of the Site is approximately 3-4 km upstream from Stung Treng town, extending upstream to within 2-3 km of the border with Laos. The total area of the Site is estimated as 14,600 hectares. The official boundary of the Site has not as yet been defined and mapped, and the boundary demarcation on the ground is not yet in place. For the purpose of this assessment, the on-ground boundary was treated as extending to a distance of 500 m from the dry season riverbanks (Map 2). A notional Site boundary is also held within the UNEP World Database of Protected Areas; however, the source of this boundary is not certain. The WDPA boundary extends to the Laos-Cambodia international boundary, but does not cover the entirety of the transboundary dolphin pool.

The Site was officially designated on the basis of the Criteria shown in Table 1.

Table 1: Designation Criteria for Ramsar Site 2KH003: Middle Stretches of Mekong River North of Stung Treng - Revised Ramsar Criteria (1999)

Criterion 1	A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.
Criterion 3	A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.
Criterion 4	A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Source: http://www.wetlands.org/RSIS/_COP9Directory/ENG/Criteria.htm accessed on 11/02/2008



Map 2: Stung Treng Site boundaries

The map illustrates:
(i) the Stung Ramsar boundary as defined by the Darwin project (red line);
(ii) the WDPA Ramsar boundary (yellow shading);
(iii) the Stung Treng – Kratie Important Bird Area (IBA -green shading) which extends from the Laos PDR border to Kratie. The majority of the Site is encompassed within this IBA.

Seasonal flooding inundates large areas of land beyond the dry season banks. This flooding is vital for the many species of fish that migrate from the river channel to breed and feed in these shallower waters and it brings important nutrients to the rice fields and the riverbanks that are used for farming (see Plate 1 below). The Site is extremely important for fisheries and transport as there are few roads in the area. The seasonally-inundated forest, a unique feature of this Site, provides refuge for many species including fish, dolphins and birds.

Plate 1: A riverbank garden in Stung Treng Ramsar Site.

Communities within the Ramsar Site make use of nutrient-rich deposits on the riverbanks to cultivate food crops. The river plays many key roles in the lives of the people within the Ramsar Site; for example, through the provision of firewood and for transport, as shown here.

Timmins (2006) states that the Stung Treng Ramsar Site is the highest value riverine biodiversity conservation wetland site in Indochina. The Site benefits from good representations of key vegetation types (Table 2), such as the channel woodlands, which remain in a largely intact natural state. Many fish species, including those making up the nationally important Tonle Sap fishery, migrate to or through the Ramsar Site to spawn, and the deep pools within the site represent vital dry season refuges for numerous species. Given that the majority of the region's protected areas are focused on forests, this Site is exceptional in that the main focus is on protection of wetland systems. Only the Tonle Sap Biosphere Reserve exceeds it in size (Timmins 2006). The Stung Treng Ramsar Site is currently one of the most substantial wetland protected areas within the Mekong river system (others include the Mekong delta wetlands, the Tonle Sap Biosphere Reserve and the Koh Kong mangroves).

2.2 Natural environment

The Mekong River at the Stung Treng Ramsar Site is relatively wide in the southern and northern sections, with the main channel reaching up to 1 km in width in places, and nearly 4 km if the large islands and narrow braded channels are included. In the central section, the river is braided into several channels which run through a mosaic of rock outcrops, sand bars, mudflats and islands with seasonally inundated vegetation. The scattered rocky islets are covered with a distinct shrubby vegetation type. The flow of water is relatively slow in the southern section whereas several rapids occur in the northern section where the riverbed is shallow. Natural rocky embankment is present in a few locations in the central section, interspersed with exposed vertical banks. It has a mean elevation of 50 m falling by around 10 m between the northern and southern boundaries.

There have been limited detailed vegetation surveys in the Stung Treng Ramsar Site. Timmins (2006) provides the most recent ecological characterisation of the vegetation features (Table 2) and the information presented in this section is primarily from Timmins' survey. The woodlands and other vegetated channel mosaic features that occur in the main river channel are a localised habitat type, such as the seasonally inundated wood and scrubland. In contrast, some of the other channel habitats, such as degraded riverbanks, open water channels, open sand features, and the terrestrial habitats that occur on both banks and on the islands, are more widely represented within Cambodia and throughout the wider region (Timmins 2006).

Timmins (2006) categorised wildlife habitats in and adjacent to the Ramsar Site into three broad, physically and geographically definable categories of habitat; namely:

1. habitats of the river channel i.e. excluding island habitats
2. habitats of riparian areas in the direct influence of the Mekong's hydrology
3. habitats of terrestrial areas not directly influenced by the Mekong's hydrology

Timmins also remarked that the habitats in the river channel are most noteworthy in the context of the Ramsar Sites' biodiversity significance. Plates 1 and 2 provide an illustration of a few of the main habitat features within the Stung Treng Ramsar Site. Table 2 lists the main vegetation classifications

used in this report (as used by Timmins 2006) with further details of the various habitat categories given in Annex 1.

Table 2: An overview of the vegetation classifications found in the Stung Treng Ramsar Site, as used by Timmins (2006).

Habitat descriptions used by Timmins	
Channel habitats	
Dry season aquatic habitats	Riverine River Perennial
Main channel swift	Riverine River Perennial Natural Channel
Main channel pool	
Main channel shallow	
Subsidiary rocky channel	Riverine River Perennial Rapid/riffles
Dry season pools	Riverine River Perennial Pool / Riverine River Seasonal Pool
Channel woodland	Seasonally inundated forest
Anogeissus woodland	*Acacia—Anogeissus* Zone
Mixed channel woodland	*Acacia—Anogeissus* Zone
Acacia—Anogeissus-less woodland	
Channel bushland	
Phyllanthus bushland	
Telectadium bushland	
Mixed dry bushland	
Sand and grass	Sand bars
Channel mosaic	
Channel banks	
Agriculture	
Riparian habitats	
Riparian forest	
Floodplain tall grassland	
Agriculture / secondary growth	
Terrestrial habitats	
Mixed Deciduous Forest	
Deciduous Dipterocarp Forest	Deciduous Dipterocarp Forest / Savannah Woodlands
Semi-evergreen Forest	
Veals (wet grasslands)	Palustrine Perennial Marsh/Palustrine Seasonal Wet Grassland /Marsh/Perennial Natural Pond / Seasonal Natural Pond
Trapaengs (shallow/seasonal pools)	
Agriculture / secondary growth	

The Site also hosts a number of regionally and globally threatened species (Timmins 2006; Bambaradeniya *et al.* 2006) and many species of value to local livelihoods. Although a detailed listing of these species was beyond the scope of this assessment many such species are discussed in the context of the zoning implications in the relevant chapters of this report, in particular in Part III.

Threats to the Site are high in the context of impacts from activities within the wider catchment, in particular those developments which alter river hydrology and which impede fish migration routes.

2.3 Hydrological characteristics and related management issues

The Lower Mekong Basin (Thailand, Laos PDR, Cambodia, and Viet Nam) has an overall catchment area of 611,000 km^2. Hydrological flows are characterised by a tropical monsoonal climate resulting in distinct dry and wet seasons of more or less equal length. Approximately 80% of the Mekong's annual flow occurs in the wet season between June and November. The start of the annual monsoonal rains in May mark the beginning of increasing water levels in the mainstream Mekong and its tributaries. As the rainfall becomes regular, river flow increases in volume and speed, usually peaking around September or October (Chantawong 2005). Water levels in the main flood can be more than ten metres higher than dry season levels. These floodwaters inundate much of the surrounding floodplain forests, grassland and agricultural land. In addition, the high water levels in the main Mekong channel may lead to backing up of water flows in the tributaries adding to flooding in the surrounding areas.

The extent of the seasonal inundation is highly variable, but many vegetation types, habitats, species and livelihoods are dependent on these seasonal flows. As such, they are vulnerable to upstream alterations to river flow as results from land use change and dam construction. Decreased water flows and a lowered incidence of flooding could lead to a number of significant changes in the Stung Treng wetland system. For example, vegetation structure would likely change, particularly for the important wet grassland *veals* associated with the seasonal *trapaengs* (ponds). The deep pools are important for fish as spawning areas and as dry season refuges. If they become subject to increased sedimentation the water could become turbid, thus reducing the water quality and leaving some the pools vulnerable to drying out.

The development of dams for the generation of hydroelectric power and irrigation is now becoming a major issue in Cambodia and surrounding countries in the Lower Mekong[1], threatening major changes to the hydrological regime of the Mekong and also threatening to obstruct fish migrations, amongst many other serious implications. To date, two major hydropower projects have been approved for construction in Cambodia and feasibility studies are known to be under way for at least a further six projects. The proposed Sambor dam in Kratie (on the Mekong downstream of Stung Treng) and Don Sahong (1 km from the Stung Treng Ramsar Site in Laos) is likely to have severe impacts on the ecosystem within the Stung Treng Ramsar Site, with significant environmental and economic consequences that include the blocking of commercially important fish migrations and the degradation of deep pool habitats (Middleton 2007).

Feasibility studies for the proposed Lower Sesan 1 (90 MW capacity) and 2 (420 MW capacity) dams in Stung Treng province were approved in June 2007, and a further dam (Lower Sesan 3, with a capacity range of 180 to 375 MW) has been proposed. TA further 3 dams are proposed on tributaries of the Sesan; Prek Leang 1 (50.6 MW capacity), Prek Leang 2 (with 48 MW capacity), and Preah Leang 1A (with 22.5 MW capacity). These would further compound the impacts already suffered by communities living along the Sesan River following construction of a hydropower dam on the river upstream in Viet Nam. An additional eight dams are planned for the Sekong River, mostly upstream in Lao PDR, of which six are planned for construction on the mainstream river channel. On the Sre Pok River, there are three more dams under consideration: Lower Sre Pok 2 (222 MW capacity, with an estimated budget of USD 339 million), and Lower Sre Pok 3 and Sre Pok 4.

2.4 Human environment and livelihoods

Stung Treng province has experienced rapid economic transformation in recent years, largely due to the Mekong River which flows through the province and meets with three major tributaries here: the Sekong, Sesan and Sre Pok. The confluence of these rivers has created a vast wetland ecosystem rich in biodiversity upon which an estimated 90% of the provincial population is dependent.

The total population of Stung Treng province is estimated at 95,184 people, comprising 47,219 males and 47,966 females (Vannara 2003). The province consists of 5 districts (Stung Treng, Talaborithvat, Sesan, Siempang and Siembok district), 34 communes and 128 villages, of which there are approximately 21 officially within the Ramsar Site, with a total population of more than 10,000 people (Timmins 2006) as listed in Table 3. In addition to the permanent settlements there are a number of pioneer settlements, populated by landless people from Stung Treng Province, elsewhere in Cambodia and beyond, and a range of temporary or semi-permanent camps. Migratory fishers establish longer-term camps on the larger islands, especially during the seasonal *trey riel* fish migration, and individual households or household members may establish temporary camps to allow them to fish and exploit other natural resources some distance from their homes.

It is likely that growing pressure on land and resources in more populated areas of Cambodia, together with a low rate of economic growth, will result in increased settlement within the Stung Treng Ramsar Site in the future.

[1] Source: Data sourced from the Rivers Coalition in Cambodia, 2007.

Table 3: Communes and villages in the Stung Treng Ramsar Site

District	Commune	Village	Families	Male	Female
Stung Treng	Samamki	Thmey	145	438	398
		Koh Kordin*	118	349	308
		Kham Phann	73	201	206
		Khe	-	-	-
Thalaborivath	Koh Sneng	Koh Sralao	79	228	215
		Koh Sneng*	169	493	458
		Koh Key	59	162	172
		Chham Thom	58	193	182
	O'Svay	Koh Heap	75	163	148
		Veun Sean*	33	79	73
		O'Run	136	362	346
		O'Svay	152	281	279
		Koh Phnov	86	207	175
	Preah Rumkel	**Koh Langor***	68	179	163
		Loeur	104	267	276
		Kandal	164	246	362
		Krom	125	397	368
		Krala Peas	117	465	319
		Anlong Svay	105	254	227
		Koh Chheuteal Touch	98	236	219
		Koh Chheuteal Thom	95	296	227
Total	**4**	**21**	**2059**	**5496**	**5121**

Source: MWBP

**Note:* The highlighted villages, one from each commune, are the study villages selected by the MWBP Sala Phoum process, and became a focus of the Darwin Initiative survey.

2.4.1 Wetland based livelihoods

Wetlands are diverse and dynamic systems primarily governed by the hydrological changes of flood and recession. They support a high species diversity adapted to these seasonal changes. Many economically and nutritionally important fish species' migrations (e.g. Trey Riel *Henicorhynchus spp.*[2]) are triggered by seasonal hydrological changes. Thus, in order for wetland-based livelihoods to keep pace with and benefit from these seasonal changes, they must reflect the dynamism and diversity of the wetland species upon which they depend.

Wetland livelihoods are characterized by the limited availability of cultivable land but an abundance of aquatic species. Thus livelihoods are typically adapted to use a wide range of resources, and their viability and sustainability relies upon this availability and the ability to effectively harvest and use these resources. Whilst rice based agriculture forms a vital component of food and nutritional security in the region, and is the main income source, it is typically only one component of livelihoods. Other cash and food crops are also commonly grown, including tobacco, eggplant, sugar cane, chilli, green leaf vegetables, banana and other fruits. But it is fish and other aquatic species that are the major source of protein for most households in the region. The traditional abundance and diversity of aquatic animals and plants plays a key role in the livelihoods of wetland communities: as well as providing the main source of animal protein in protein-poor diets, aquatic animals are also used to compensate for shortages of rice by being captured for sale or barter. Households that routinely suffer from food insecurity in the form of insufficient rice, often depend on wild aquatic resources to compensate for this deficiency (Friend 2007). It is this abundance and valuable contribution to livelihoods that conservation measures are intended to sustain, alongside the conservation of species and habitats.

[2] *Trey riel* usually refers to a grouping of similar species that include *Henicorhynchus caudimaculatus*; *H. cryptopogo;* and *H. siamensis.*

Box 1: Wetland livelihoods characteristics in brief

Diverse: Wetland livelihoods employ a wide range of resources and encompass a broad range of strategies at different times of the year. These include a range of farm and non-farm activities such as; cultivating crops, fishing, hunting, collecting non-timber forest products (NTFPs), as well as selling labour nationally and internationally. These diverse strategies are not driven simply by available assets. Rather, people do what they do as a result of a range of seasonal, environmental, cultural, political, financial and social conditions. Different households tend to follow different livelihood strategies depending on their cultural background, skills and assets.

Dynamic: Wetland livelihoods reflect the dynamism seen in nature with special connection to the seasonal patterns of flooding and recession.

Adaptive: Utilising local knowledge as the foundation of livelihood thinking and thus livelihood strategies, wetland livelihoods exhibit a remarkable degree of adaptability to annual and seasonal changes as well as considerable innovations in adapting these conditions to suit their needs.

Inclusive: All sections in society are involved in employing assets in various ways through a range of livelihood strategies. Gender and generational contributions to household and community well-being permeate the rich and diverse range of livelihood strategies employed by wetland residents.

2.4.2 Fishing and related governance issues

In Cambodia, fisheries play a central role both in the daily life of people as well as in the national economy. Fisheries contribute between 75 and 85% of the total protein intake of Cambodians. As one of the leading freshwater fish producers in the world, Cambodia's fisheries also make a major contribution to the country's Gross Domestic Product (GDP). Estimates vary over both the total catch and the contribution to GDP; Van Zalinge *et al.* (1998) suggest a catch of between 290,000-430,000 tons per year, generating USD150-250 millions annually. Degen *et al.* (2000) see this as an underestimate, and believe the total catch "might easily be 500,000 tons or higher", with an estimated value of USD300 million per annum. This equates to approximately 10% of official GDP. If so, this would make Cambodia's freshwater fish capture the fourth largest in the world after China, India and Bangladesh (Van Zalinge 2003).

The fisheries' richness stems from the complex hydrological regime of the Mekong River and the Tonle Sap Lake: a vast inland water system, comprising numerous rivers, streams, deep pools[3] and lakes extending into flooded forest, grassland, rice fields, and swamps (Thuok and Sina 1997). The water system contains a highly abundant fishery resource which has historically provided both primary livelihood needs and a surplus for trade, thereby shaping the pattern of human settlement and trade in the region for millennia (Hirsch 2000).

The Mekong River from Kratie up to Stung Treng is known as the Upper Mekong in Cambodia and includes rapids, seasonally flooded forest and hundreds of deep pools. Stung Treng province itself contains the confluence of the Mekong River with three major tributaries: the Sekong, Srepok and Sesan, which creates a vast area of flooded forests, floodplains, creeks, streams, and many deep pools which supports fish migration and spawning (Vannaren 1999).

Thus fishing forms a major part of the livelihoods of many households in the area, both for consumption and also for generating significant incomes. The Upper Mekong has historically been an extremely productive fishery, providing crucial protein inputs to compliment the staple rice of the Cambodian diet. Fishing households typically have simple fishing boats and nets and seasonally engage in fishing, selling to local markets. The fish sold to *moys* (fish traders or fish client) comes from diverse ethnic groups involved in fishing, the major groups being: Khmer-Lao (Cambodian fishers), ethnic Vietnamese, and Chams.

3 A deep pool is a confined, relatively deep area within a river channel, which acts as a dry season refuge for a number of important fish species, as a permanent habitat for other species or as spawning areas of some other fish.

Small-scale fishing economy involves farmers, fishermen, and a few small traders. In the small-scale and face-to-face communities, individuals, neighbours and friends interact not merely in economic terms as producers, consumers, owners, and coordinators of production, but also as actors embedded in social networks with a more 'personal' and 'social' content. Thus networks that relate this local scale to outside groups form the basis of market relationships trading in surplus fish catch.

Vietnamese groups monopolise intermediary trading in fish in the area. Ba Chong village has been settled by over 200 Vietnamese families and is a major trading village for fish. The village name derives from an old Buddhist temple at the confluence of the Sekong and Mekong rivers, and the village has been a trading centre from at least the 19th century French colonial period. The Vietnamese households here are occupied full-time in fishing, and additionally engage in pig rearing and fish aquaculture in the Sekhong River. Previously they had no land but are now gradually acquiring it. They are very skilled fishers, fishing with well equipped boats and gear and are visiting all Stung Treng areas. They have excellent knowledge of fish migrations and can catch >200 kg in a day, often using floating fishing net methods. Because they use house boats they can go out for several days following the fish migration patterns. When they get a large catch they can get double the price as they have more bargaining power. If they don't achieve their target price they may dump the fish rather than accept what they consider exploitative rates.

Cham (Muslim) groups came from the Champa Kingdom (Hue: now central Viet Nam) which was closely connected with Malay archipelago society at that time. They emigrated when the Dai Viet kingdom invaded in the 14th century. These fishers come from Kampong Cham province and Phnom Penh (*Chraing Chamres*). Most lack land and are full time fishers migrating to follow the fish migration. They are skilful and knowledgeable about this movement and therefore catch a great deal of fish.

Other groups present include Lao people who seasonally come to fish on the Cambodia side, mostly within the Ramsar Site and O'Talas.

Because Stung Treng is considered an important spawning habitat it has therefore been designated as a fish sanctuary and conservation area, where large-scale fishing is not allowed. In Stung Treng, fishing practice therefore falls into the second and third types: family scale and medium scale. Small scale fishing is carried out throughout the year (according to the Fiat Law of Fisheries 1987).

2.4.3 Seasonal fish migrations and livelihood fishing

The seasonal patterns of fish migration are central to the abundance of the Mekong fishery. Many fish species spawn in the many deep pools around Stung Treng during the dry season. When the rainy season starts they then migrate downstream to Tonle Sap, where they mature (Ahmed *et al.* 1998). At the end of the rainy season, when the waters start to recede, they migrate back to the upper Mekong (Kratie and Stung Treng provinces) to repeat the cycle.

The activities of fishers in Stung Treng are strongly determined by this seasonal cycle of fish spawning and migration. Local communities along the rivers and tributaries traditionally depended upon the fish migrations, and often identify themselves as seasonal and mobile fishers. The seasonal migration of fishers themselves is a traditional practice for fishers from both inside and outside the province, drawing large kinship groups together in certain places. For instance, in O'Talas, a seasonal stream of the Mekong, people settle in temporary huts to fish from September to January, drawing large groups of Lao, Chams, and Vietnamese. This movement of fishers' livelihood activities follows the environmental choreography of fish movement and hydro-ecological change.

During the ***open season*** (from November to May) when water in the tributaries and creeks starts to recede, the fish move to the main rivers and deep pools. Some fish species started to migrate upstream from different tributaries (Sekong, Sesan, Sre Pok) to the Mekong mainstream and also migrate from Tonle Sap Lake to the Khone Falls on the Cambodian-Lao border, which at about 23 m high forms a natural barrier beyond which most of the fish cannot migrate further. Fishers from outside the area settle along the riverbank, the channels, and the island 'corridor' in the commune.

Box 2: Legal provisions for fishery governance in Cambodia

1987 Fiat-Law of Fisheries
This law defined three tiers of fishing activity:
- large-scale or commercial fishing,
- medium-scale or licensed-fishing,
- small/family scale or non-licensed fishers.

Both large and medium scale fishing provide national revenue. They are only permitted during the 'open season' (November to May). Medium-scale fishing gear has to be licensed and registered by the fishers or the group of fishers every year. Family fishing gear, in contrast, can be operated anywhere during the entire year. Medium and large-scale fishers are required to ask permission (sometimes through licences) for fishing, while non-licence refers to small-scale or family scale fishers who can fish year round with no license.

1987 Proclamation of the Ministry of Agriculture, Forestry and Fisheries (*MAFF*)
This defined all deep pools along the Mekong River in Sambor district, Kratie and Stung Treng provinces as fish sanctuaries (or protected fishing spawning grounds) in which commercial fishing or fishing lots are not allowed. However, this has not been effectively enforced because of inadequate surveillance by fishery officers.

1999 Fishery Law
This divided fishing grounds into three types:
- open access fishing grounds - where everyone can fish,
- fish spawning grounds and migration areas – where fishing is restricted to certain types of fishing gear and seasonal fishing practices, and
- protected fishing grounds - where fishing is strictly prohibited (Try and Vannara 2005).

2006 Fisheries law
This has been recently approved by the government, but not yet fully disseminated throughout the country.

During the ***closed season*** (the wet season, from May to October) the seasonal fishers return home to cultivate rice. From May to July, some fish species start spawning, and fingerlings drift downstream to the Tonle Sap Lake, into flooded forests and some of the tributaries along the Mekong River system and Basac River floodplain.

Fishers in the province use a range of equipment according to the season and location including; *Morng* (gill nets), *Lorp* (cylindrical drum trap), *Saiyoen* or *Ourn* (seine net) *Sam Nanh* (cast-nets), *Chann* (drop-door trap), *Santouch* (long-line-hooks), *Tom* (vertical vase trap) and *Paong* (vertical hanging vase trap for small fish). The use of large mesh monofilament gillnets (20-35 cm) has increased dramatically in recent years and has led to the decline of many large species (Try and Vannara 2005). In addition, it has been estimated that approximately 8,000 explosive charges per year were used by armed forces and local people during 1993-1997 to catch fish in the pools in the dry season (Vannaren 1999; 2002). These activities are believed to have severely affected the fisheries and habitats.

Fishers can be categorized by legal status into non-licensed and licensed fishers.
- *non-licensed fishers* - are not only those from inside the village who depend on both agriculture and fishing, but also seasonal fishers. These fishers use smaller boats to collect fish from their traps and gill nets around evening or early in the morning at the edge of the inundated forest or along the deep pools. Commonly they have a link to *moys* (fish buyers or dealers) who come to buy their fish from them on the spot. However, they may bring their fish to the market themselves if they have to go there for additional purposes. Seasonal fishers tend to divide labour by gender, men fishing along the river channels, island corridors, and deep pools, and women staying in huts, rearing children, and making foodstuffs, clothes, and nets, additionally doing some gutting of the caught fish, and / or operating as small-scale vendors of cigarettes, wine, or beer.
- *licensed fishers* – these include the mobile seine net fishers, the drifting gillnet fishers and the nomadic Cham fishers. This group can catch more fish with their advanced equipment and the necessary organized labour force to operate it. For example, ten people are needed to work the seine nets. They most often work at night, preferring this time because it is the time when large fish

that stay in deep pools and flooded forest areas emerge to feed and migrate In addition, there are fewer boats and it is quieter.

2.4.4 The recent history of fishery governance

Historically household fishing has been a significant element of livelihoods here. But over the last decade and a half the major changes in Cambodia's political situation has seriously affected resource productivity and use at the Stung Treng Site. During the Khmer Rouge period, when virtually no one lived in the area, trading was limited and it wasn't safe to visit O'Talas. Therefore local people said the area became a 'kingdom of crocodiles and otters'. This situation gradually changed with the peace process, as discussed in Box 3.

Box 3: Timeline of Cambodia's peace process

1992	Integration began: the countries four main parties started working together.
1993	First national election, with assistance from UNTAC (United Nations Transitional Authority in Cambodia)
1994-1998	Khmer Rouge gradually defected and integrated with government. 1998 was the last defection of Khmer Rouge soldiers in Cambodia; they were not defeated by the government soldiers even with the support from Vietnamese solders. Peace was established and companies began to come to the area. A national company was licensed as the sole inter-district trader, checkpoints were established and local middlemen breaking the new regulations were arrested.
1998	Second national election: access to rural area improved leading to rapidly increasing fishing.
2002	Decentralisation

The concept of decentralisation was introduced in Stung Treng in 2002, at which time the commune chief was elected and was assigned the right to manage local resources. Fishing communities have subsequently been organised into communes, who seek to assert exclusive access to fishing pools in the dry season. However, they have limited legal powers (but which do include the right to create bylaws) to regulate access by outsiders and challenge illegal practices, and can only report transgressions to the Fishery Administration or the Ramsar authority. They have no legal power to apprehend the suspects or confiscate their gear. Thus local fishery regulation in Stung Treng remains weak and illegal fishing occurs.

Commercial fishers have to request permission to fish from both the provincial authority (Fishery Administration) and the commune, and need to pay both. However, the amount paid is not disclosed and it is alleged that it may involve 'under the table' payments to the commune chief. The process creates difficulties for customary users of the resource, because in the past commercial fisheries gave some of their catch to local people (i.e. 10-20 kg) as a reciprocal gesture. This has now been replaced by permission payments to the commune chief. Historically there was greater social cohesion and collective action, but the current system divides the affiliation of the leaders. It has therefore become very difficult to ensure that government structures enforce fishery rules. When community byelaws are broken the government tends to take no action. On the other hand if local people could get effective legal backing they are likely to be much better motivated to respect and manage the resource effectively and apprehend rule breakers.

Under financial and technical support from the MWBP, the Culture and Environment Preservation Association (CEPA), a local NGO, established an action research programme with communities in the Stung Treng Ramsar Site in order to build institutional learning capacity to ensure a successful decentralization process. Called *Sala Phoum,* this research project was modelled on and adapted from the *Thai Bahn* research technique and methodologies developed in Thailand, and involved technical support from the *Thai Bahn* team. A key output was a participatory fish survey and the resultant fish photoguide (MWBP 2006). Yet despite promising progress, with the withdrawal of the MWBP project, the network now urgently needs external support if it is not to stagnate.

The fish market in Stung Treng, the provincial town, opens around sunrise and continues until 8 or 10 in the morning. Fish at the market are categorized according to their type, size and grade (1, 2 and 3), and command differing prices according to the grade. However, most of the fishermen are now obliged to

sell to the *moys* whose fish stations are in the provincial town and in every district office, and who deal particularly in large and valuable fish. The *moys* receive exclusive rights from the provincial office and the Ministry of Agriculture, Forestry and Fisheries in Phnom Penh to run their fish-buying companies. In many cases these companies create conflict with the local fishermen by setting low prices for the catch compared to the market prices in other markets such as Veun Kham in Laos.

2.4.5 Fish processing

During periods of abundance and as a means of preserving fish for later consumption and or sale, local people use a number of preservation methods, such as smoking or fermentation. *Trey riel* is one of these. The *trey riel* season is from May to July, and fishers, usually travelling in boats with family and friends, consider it a vital component of livelihoods, and an occasion to share natures' abundance with family and the wider community. The abundant, but low value *trey riel* species are traditionally fermented to produce *pra hok* fish paste. It is important economically, nutritionally and culturally. Villagers utilise *pra hok* mainly in the wet season when they spend most of their time on wet rice cultivation, and have less time for fishing. *Pa khem* is a type of processed fish paste mostly used by those of ethnic Lao origin in the province, similar to *pra hok*.

Other types of fish processing include salted and smoked fish. Fish smoking is mainly practiced during the peak migration of fish from the tributaries to the Mekong mainstream when fish catches are high. Smoked fish can be kept longer for later sale or for sale to middlemen who buy fish at the site. Smoked fish are mostly sold at O'Talas from where they are sold on across the Lao border or to provincial towns.

2.4.6 Wetlands and nutrition

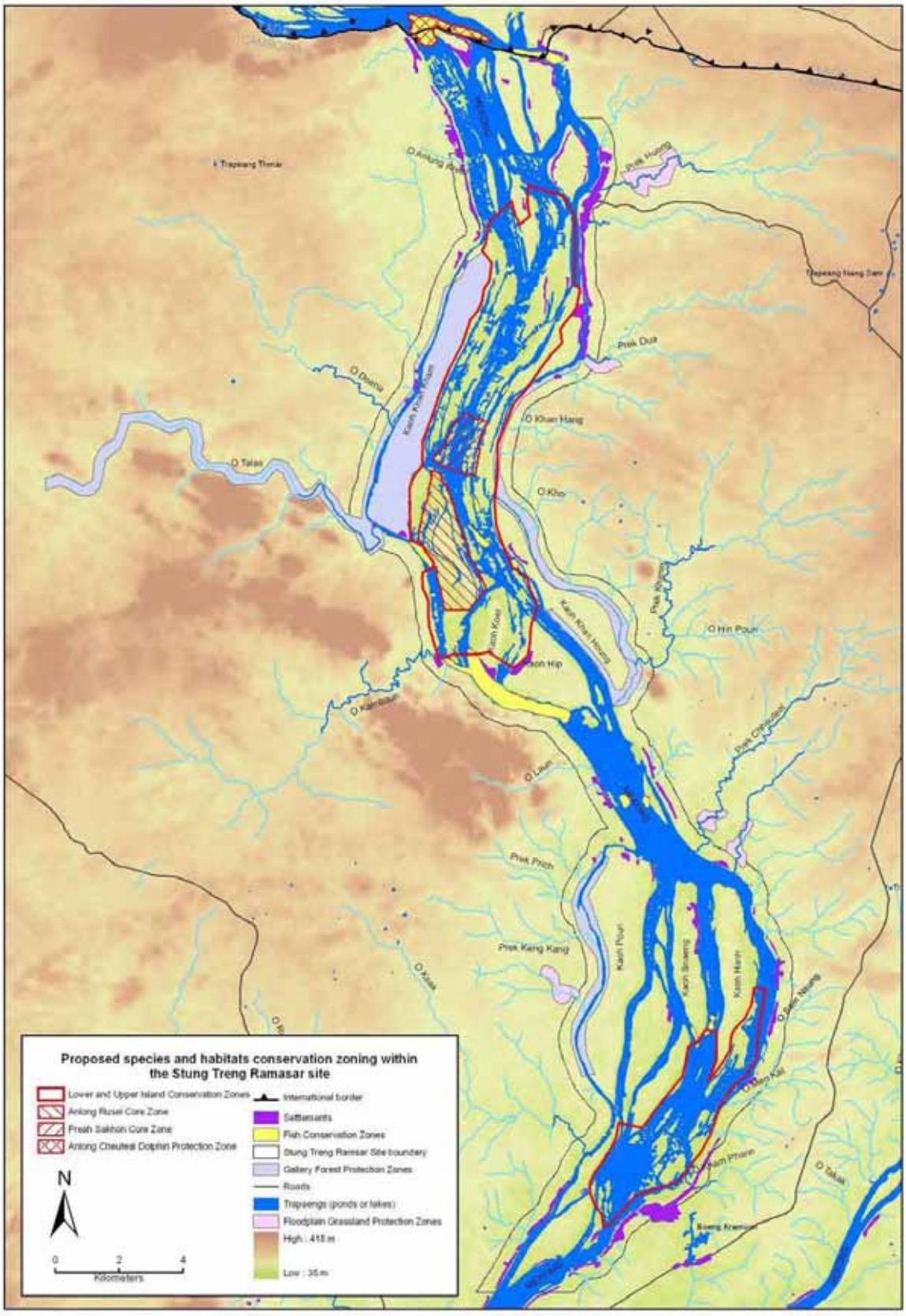
Wetland resources are particularly important to the poor as, critically, many wetland resources are common property resources and therefore accessible to those who lack adequate private resources. Aquatic animals in particular are the nutritional corner stone of poor peoples' diets and additionally, provide buffers to shocks and vulnerability. A recent health and nutrition survey conducted in three villages in the upper island core zone (Health Unlimited 2006) showed that of the animal protein sources consumed in rural households, aquatic resources contribute more to local diets than domestic animals or wild animals hunted in the forest. The team found that all monitored children ate fish or fish products daily, whereas the highest number of responses for other sources of animal protein was just once a month.

2.4.7 Wetland livelihood status and threats

Wetland resources in the Ramsar Site provide virtually everything its residents require: fuel wood for cooking and heating, plants and wildlife for traditional medicines, timber for housing, furniture and construction, foods such as rice, meat, fruits and vegetables, water for washing and horticulture, sands and gravels for building, waterways for personal and commercial transport, and recreation. These resources provide the immediate day-to-day needs and many can also be sold to provide cash for clothes, household goods, fishing equipment, school fees, boats etc. For the great majority of villagers the Ramsar Site is the only source of livelihood available (Try and Chambers 2006). Incomes and living standards are low however and the great majority of the Ramsar Site residents are poor and vulnerable to any reduction in the availability or quality of the natural resources.

During the survey, a number of issues were observed to be making local people increasingly vulnerable. Threats to the status of wetland resources, and to rural people's ability to access them occur at local, national and regional levels:

- At the local level, sustainable management of common property requires that local people regulate extraction levels and practices, but this is proving difficult. Activities such as the use of destructive fishing practices, conversion of wetland habitats for intensive agriculture, and riverine logging need to be controlled.



Map 3: The Stung Treng Ramsar Site including locations of the proposed Lower and Upper Island Conservation Zones, the Preak Sakhon and Anlong Rusei Cores Zones

- At the national level changes to policies and institutions, such as privatisation of common property resources, trading arrangements which favour commercial elites over local people and capture regulations and governance through for example, community fishery groups, are weakening local people's control of and benefits from the local resource.
- Some of the greatest threats to wetland resources and their sustainable use occur at the regional scale; where large-scale water resource infrastructure development, land conversion and navigation projects all impact on hydrological regimes and the functionality of flood plains.

Efforts to manage wetland resources for sustainable livelihoods therefore need to be directed at each of these levels.

2.5 Environmental governance

The Stung Treng Site was designated as a Ramsar Site on 23 October 1999, when Cambodia became a signatory to the Ramsar Convention. Despite management responsibilities having been allocated, authority and responsibility for the management of the Ramsar Site is currently surprisingly unclear. Whilst Ramsar Sites come under the jurisdiction of the Ministry of Environment (Department of Nature Conservation and Protection, DNCP), the Department of Fisheries and the Ministry of Water Resources and Meteorology (MoWRAM) also have an interest in the management of wetlands. In early February 2008 the Protected Area Law was approved, which clearly states that Ramsar Site is under the responsibility of Ministry of Environment (MoE). Additionally the DNCP has been promoted to General Department of Administration for Nature Conservation and Protection (GDANCP) and staffing restructured. There are now five GDANCP departments:

1. Department of Administration Planning Accounting and Finance (APAFD)
2. Department of National Park and Wildlife Sanctuary (NWD)
3. Department of Research and Community Protected Areas Development (RCPD)
4. Department of International Conventions and Biodiversity (ICBD), and
5. Department of Wetland and Coastal Zone (WCD).

The capacity to manage the Ramsar Site and enforce conservation measures is currently limited. In 2005 there were 10 rangers stationed within the Ramsar Site, under the direction of the Provincial Department of Environment (Timmins 2006). They were reported to be poorly equipped, with no office and a single boat with no money for fuel, and requiring training to be fully effective. Each of the Ramsar Site's 21 official villages has a community fisheries committee to manage their local fish resources by, amongst other measures, restricting fishing activities in deep pools and other important sites.

2.5.1 Threats and their management

A range of diverse 'drivers of change' threaten the ecological integrity of the Ramsar Site and the ecosystems services it provides. These include:

- Land use modification
  This is mainly due to increasing in-migration to the area and extension of cultivation and exploitation of forest.
  - Loss of gallery forest and riverine vegetation.
  - Conversion into agricultural areas (private agricultural industry).
  - Land speculation by locals and outsiders.
  - Sedimentation from upstream and local landuse modifications.

- Over-harvesting and exploitation of local species

These threats relate to both unscrupulous fishing methods, and also opportunistic harvesting practices. Regulating outsider's fishing practices has proved difficult because of the non-transparent nature of regional fishing regulations, and the prevalence of bribery and corruption.

- Illegal fishing activities by outsiders.
- Wildlife excessively hunted for subsistence and trade.
- Destructive methods: Explosives or poisons; use of small mesh nets across the width of tributary rivers to catch migratory fish; over-fishing.

- Economic (trade, market and policy framework)

- Pro-elite fish trade policies (either formal or informal).
- Lack of enforcement of fishing regulations.

The regulation of commercial fishing is proving to be highly problematic. Short term licenses granted by the local government create incentives for maximising short-term catches regardless of sustainable offtake levels. The entry of major commercial interests to regional fisheries, particularly those who seek to maximise short-term profits from 'mining' fisheries, seem to be having a very serious negative impact on the sustainability of the fishery. The current system is failing to protect food security for the poor and the sustainable livelihoods of the main population, but is favouring the profits of elite commercial interests. Corruption and rent-seeking by officials is apparently also a major contributory cause of the poor enforcement regime. The environmental governance implications are that enforcement of a more livelihood-oriented regulatory environment is needed to avoid marginalising the poor.

- Infrastructure development

Dams represent perhaps the most fundamental threat to the integrity of the habitat and ecosystem. Planning decisions are heavily influenced by commercial and geo-political factors such as investment, commissions and profits. The extent of environmental impact seems to be 'externalised' in calculations or may not be considered at all. As summarised by McCartney *et al*. (2001);

> *Dams have impacts on both upstream and downstream ecosystems. They constitute obstacles for longitudinal exchange along rivers and disrupt many natural environmental processes. Flooding upstream of dams results in the permanent destruction of terrestrial ecosystems through inundation. All terrestrial plants and animals disappear from the submerged area. Reservoirs trap waterborne materials including sediment and obstruct migration pathways for some aquatic species. Downstream there are changes in flow regime, sediment transport, and water temperature and quality. Many of these changes are immediate and obvious. However, others are gradual subtle and more difficult to predict. For example, changes in thermal regime, water quality and land-water interactions result in changes in primary production, which in turn has long-term implications for fish and other fauna higher up the food chain. Dams may cause changes in ecosystems at great distances from the dam. For example, changes in sediment transport result in changes in river, floodplain and even coastal delta morphology sometimes many hundreds of kilometres from the site of the dam.*

Of the upstream countries, more than 75 dams are either operating or are in some stage of planning in Laos alone at the time of the survey. With regards to the Stung Treng Ramsar Site, the Don Sahong hydropower project in Lao PDR at Khone Falls is likely to pose the most immediate threat through alteration of dry-season flows, and impacts upon fish migration patterns and the deep pools within the Ramsar Site through decreased water flows and increased siltation rates. Although the dam is to be "run-of-the-river" with no significant upstream impoundment, the impact on fish migrations and downstream habitats is yet to be evaluated.

- Invasive Alien Species

Invasive alien species are recognised as one of the major threats to freshwater biodiversity. A number of such species have been identified in the site, including the following:

- Giant Mimosa (*Mimosa pigra*) is present throughout the Ramsar Site. *M. pigra* is an invasive weed, especially in parts of South East Asia and Australia. It reproduces via buoyant seed pods that can be spread long distances in flood waters. *M. pigra* has the potential to spread through natural grassland floodplain ecosystems and pastures, converting them into unproductive scrubland only able to sustain lower levels of biodiversity. In Thailand *M. pigra* blocks irrigation systems that supply rice fields, reducing crop yield and harming farming livelihoods. In Viet Nam it has invaded unique ecosystems in protected areas, threatening the biodiversity of seasonally inundated grasslands.
- An invasive algae (reported as *Hydrodictyon* spp. by Bambaradeniya *et al.* 2006) poses an increasing problem. The reasons for the increase in the algae are not clear but the impact is already being seen with transport along the river impacted and the fouling of fishing nets becoming a significant problem. Ecological impacts are also likely to arise but to date these have not been evaluated.

Box 4: The specific impacts of dams and associated storage reservoirs on biodiversity

This has been summarised by McAllister *et al*. (2001) as including the following negative and positive issues:

- Blocking movement of migratory species up and down rivers, causing extirpation or extinction of genetically distinct stocks or species.
- Changing turbidity/sediment levels to which species/ecosystems are adapted in the rivers affects species adapted to natural levels.
- Trapping silt in reservoirs deprives downstream deltas and estuaries of maintenance materials and nutrients that help make them productive ecosystems.
- Filtering out of woody debris which provides habitat and sustains a food chain.
- Changing conditions in rivers flooded by reservoirs: running water becomes still, silt is deposited, deepwater zones, temperature and oxygen conditions are created that are unsuitable for riverine species.
- Possibly fostering exotic species which may displace indigenous biodiversity.
- Reservoirs may be colonised by species which are vectors of human and animal diseases.
- Flood plains provide vital habitat to diverse river biota during high water periods in many river basins. Dam management that diminishes or stops normal river flooding of these plains will impact diversity and fisheries.
- Changing the normal seasonal estuarine discharge can reduce the supply of entrained nutrients, impacting the food chains that sustain fisheries in inland and estuarine deltas.
- Modifying water quality and flow patterns downstream.
- The cumulative effects of a series of dams, especially where the impact footprint of one dam overlaps with that of the next downstream dam(s).

\+ Providing new habitats for waterfowl which may increase their populations.

  - The Golden Apple Snail (*Pomacea* spp.) is widely present throughout the Ramsar Site. Golden Apple snails have a voracious appetite for water plants including lotus, water chestnut, taro, and rice. Introduced widely from its native South America by the aquarium trade and as a source of human food, it is a major crop pest in Southeast Asia (primarily in rice) and Hawai'i (taro), and poses a serious threat to many wetlands around the world through potential habitat modification and competition with native species. Although this species is often collected for local consumption it must be considered a potential major threat to the area. Koh Sneng villagers reported that the species was introduced into the Ramsar Site more than five year ago. They believe that it floated down the Mekong during the seasonal floods and has since become resident. Surprisingly, to date most villagers do not see the snail as a threat and view it more as another useful source of food. In some cases villagers actively collect the snails from the main river and introduce them to their fish ponds and nearby trapaengs for later collection. In one case villagers have identified the snail as damaging their rice fields adjacent to Trapeang Ytha.

- <u>External inputs (fertilisers etc.)</u>

Algal blooms shown in Plate 2 are possibly due to increased nutrient input but the causes require further investigation.

- <u>Policy issues</u>

The protection and integrated management of the Ramsar Site faces several problems at the policy level. It is essential that these are addressed urgently if site management is to become effective. Some of the issues include:

  - There is no coordinated national wetland policy.
  - There is no multi-sectoral implementation mechanism.
  - There is a poor understanding of the implications of Ramsar Site designation.
  - The boundaries of the Ramsar Site are not clear on the ground.
  - Ramsar Site villagers lack livelihood options where resource use may become restricted.

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Plate 2: Algal blooms have increased in some areas of the site. The dense mats of algae impact on river transport and foul fishing gears.

2.6 The Stung Treng Ramsar Site management planning process

The management planning process for the Stung Treng Ramsar Site was initiated in 2005. At the same time the MWBP also initiated a Stung Treng Ramsar Site management assessment in order to contribute to the government process by seeking to improve understanding of the range of management threats and issues. From this review, critical management issues were identified and management responses proposed. One output from this process was the development of a number of proposed management zones (see Table 5) within the Site (Timmins 2006). In November 2006 a meeting was held to discuss the proposed zones with all relevant stakeholders including commune heads.

As a contribution to the ongoing process, this project conducted an integrated assessment to evaluate implications of the proposed management zones for the conservation of biodiversity and local livelihoods within the Ramsar Site, with a particular emphasis on the 'sanctuary' areas and to a lesser extent the 'core zones'. Table 4, below, provides an overview of the management planning process in Stung Treng and highlights where the assessment conducted through the Darwin Initiative project fits into the overall process.

Table 4: Timeline of the Stung Treng Ramsar Site management planning process

Date	Description	Main outcome
Pre-1999	Wetland inventory and workshops	Wetland zone identification in Cambodia
Oct. 1999	Stung Treng Ramsar Site created	
Feb 2005	Management Plan Inception Meeting	Jointly identified critical Site management issues Identified priority ecological and other assessments Developed workplan for various assessments Provided overview of management planning process to key stakeholders
June 2005 – Sept 2006	Implementation of the various assessments within the Stung Treng Ramsar Site including the biodiversity assessments.	Assessment reports completed but no particular integrated assessment conducted. Timmins (2006) provides a detailed report on the biodiversity significance of the Ramsar Site and proposes special zones of restricted use for the conservation of critical biodiversity. Wetland vegetation complexes mapped.
29 Nov-Dec 2006	Stakeholder consultation workshop in Stung Treng – presentation of the management plan outline and discussion of the proposed zones recommended for critical biodiversity.	Key stakeholders (especially representatives from villages) indicate that there are some possible issues in relation to the proposed zones and an additional assessment is required to understand the impact of these proposed zones on their livelihoods.
Jan-Feb 2007	Field assessment - Implications of the proposed biodiversity management zones on resource use and livelihood strategies of key stakeholders particularly the poor (carried out by the Darwin team)	Integrated assessment report with recommendations on issues to consider if/when establishing the proposed zones and possible options for managing these zones for the benefit of biodiversity and livelihoods.
9 Feb 2007	Stakeholder consultation workshop	Report with recommendations on issues to consider and possible options for managing these proposed management zones for the benefit of biodiversity and livelihoods.
25 May 2007	Further consultation and feedback discussions with the various affected people discussing zoning options	DNCP has provided their recommendation and agree on the proposed zones by integrated assessment (Personal and informal individual meeting with DNCP Director during the press release #1 after the ST integrated assessment)
11-12 Feb 2008	National Dialogue and Consultation Workshop (facilitated by the Darwin team)	Darwin team presented the results of the field assessment and recommendations relating to the proposed zoning plan. Recommendations for further development and implementation of the approach were put forward. *DNCP provided their recommendations and agreed on the proposed zones by integrated assessment*

2.6.2 Proposed zoning and their biodiversity significance

As part of the management planning support process initiated by the MWBP, Timmins (2006) undertook a biodiversity survey of the Ramsar Site. The report identified the key regional and globally significant species present within the Site, and proposed a range of conservation management zones for the Site. For the purposes of the current assessment the terminology used was aligned with that used in the Draft Law on Protected Areas (*see* Table 5). The proposed locations of the management zones are shown in Map 4.

The **Lower and Upper Island Conservation Zones** are large areas and implementing them as Conservation Zones would have a range of implications. The timeframe available in this survey did not permit for complete assessment of the implications of 'Conservation Zone' designation. Both Anlong Rusei and Preah Sakhon are situated within the proposed Upper Island Conservation Zone. This is an area of significant biological diversity from both a species and a habitat perspective. The implications of

imposing the regulations associated with the designation of the 'Upper Island' as a Conservation Zone are discussed below.

Table 5: Proposed conservation zonation within the Stung Treng Ramsar Site.

Timmins (2006)	This report
Lower Island Area Core Zone	Lower Island Conservation Zone
Upper Island Area Core Zone	Upper Island Conservation Zone
Anlong Rusei Sanctuary	Anlong Rusei Core Zone
Preah Sakhon Sanctuary	Preah Sakhon Core Zone
Fish Sanctuaries	Fish Core Zones
	Anlong Chheuteal Dolphin Protection Zone

The proposed **Preah Sakhon Core Zone** is one of the most remote areas within the Ramsar Site. There are no permanent settlements in this area, though migratory and seasonal fishers camp on islands within the Core Zone. Timmins (2006) reported that Preah Sakhon has one of the lowest levels of human use, appears to be the area with the highest concentration of breeding River Terns, and is also one of few areas, if not the only area, where cormorants and darters breed. Access to the area by dogs is difficult without the aid of a boat. Timmins recommended that, if designated as a Core Zone, fishing camps should not be allowed, and that human access to the area should be restricted (if possible it would be essentially a 'no-go' area), and dogs totally excluded. It was also proposed that areas within the Zone be designated as Fish Core Zones (in the dry season it has small pools, small channels and a few larger pools).

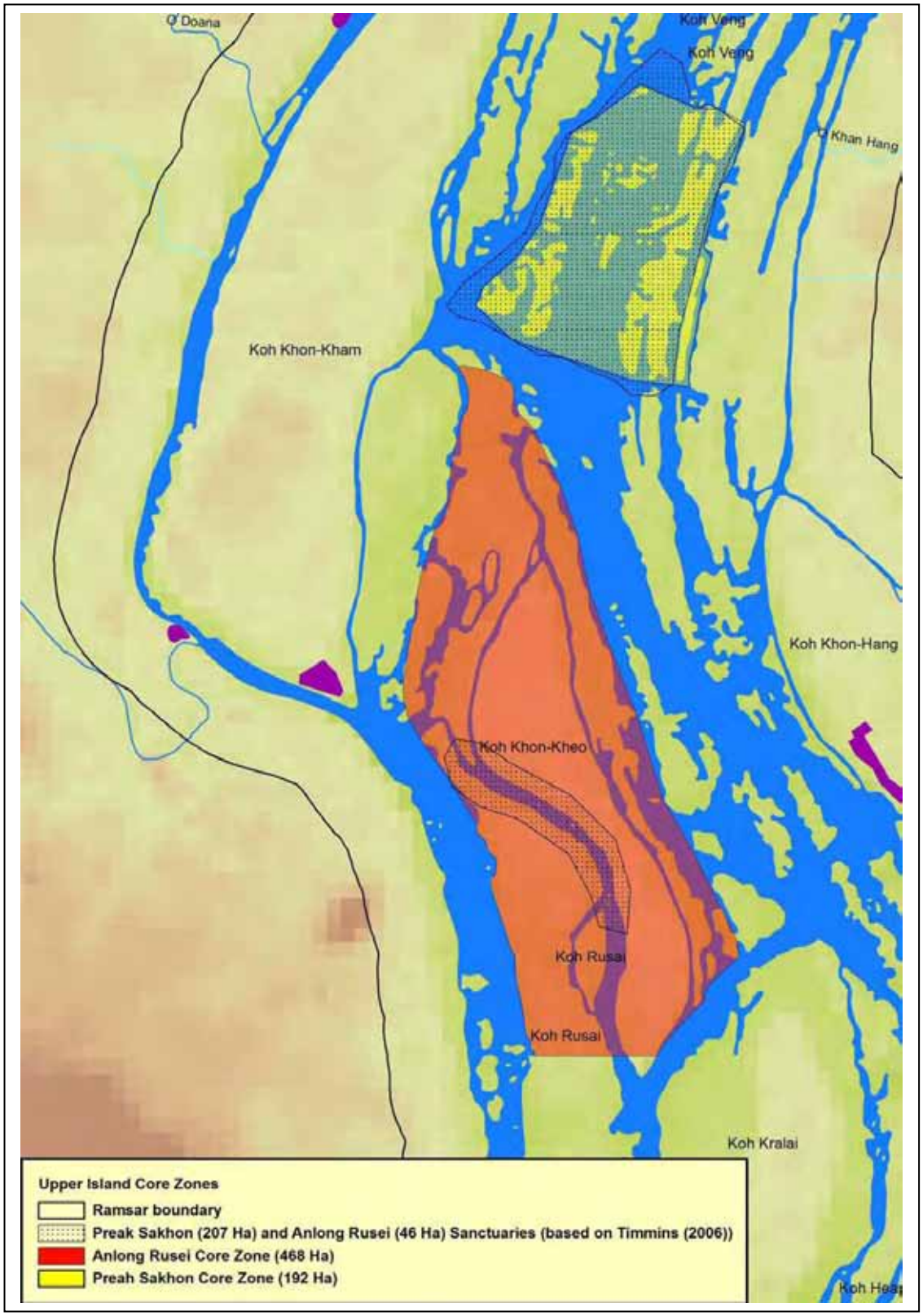
The entire **Anlong Rusei** area (c.468 ha) is proposed as a Core Zone to protect the Critically Endangered Siamese crocodiles found there. The Darwin project proposed significantly increasing the area of the Anlong Rusei Core Zone to encompass more of the potential crocodile habitat. Timmins (2006) noted that families currently farm in this area and suggested that community based crocodile conservation initiatives be explored. For the purposes of this study, the area surrounding Anlong Rusei i.e. Koh Kankeo and Koh Rusei was also assessed for its biological and socio-economic significance.

Anlong Chheuteal Dolphin Protection Zone currently lies outside the Ramsar boundaries. It is a critical habitat for the Mekong River Irrawaddy Dolphin and is a designated fish core zone. One of the MWBP site villages (Koh Langor) is situated adjacent to this dolphin protection zone. Anlong Chheuteal serves as an interesting case study for the implications of zoning given the transboundary natural resource management issues for this site. Various efforts have been made here to establish trans-boundary dolphin and fisheries management initiatives but these have had varying degrees of success (*see* Lopez 2005)

O'Talas, a tributary adjacent to Koh Khan Kham is also reported to be highly significant for wetland biodiversity (Timmins 2006). Currently, only a small section of O'Talas (close to the confluence with the Mekong) lies within the Ramsar Site boundary. The Darwin project attempted (to a lesser extent) to identify the significance of O'Talas from the socio-economic and livelihood dimensions and to identify the likely implications of a possible extension to include this area as part of the core zone.

The Ministry of Environment Protected Area Law (2007) defines specific management criteria for each of the proposed zones, shown in Box 5.

In conclusion, this study aimed to clarify, through conducting an integrated assessment, the costs and benefits – to livelihoods and biodiversity – of the special management zoning of the Stung Treng Ramsar Site, as proposed by Timmins (2006).



Map 4: Map showing the Preah Sakhon and Anlong Rusei sanctuary boundaries, as proposed by Timmins, and the Core Zone boundaries as proposed by this project.

The Anlong Rusei Core Zone has been significantly expanded (from c.46 ha to 468 ha) to encompass more habitat suitable for the Critically Endangered Siamese crocodiles that are only found in this area of the Ramsar Site. The boundary of the Preak Sakhon Core Zone has been adjusted slightly to align with river channels and thus make navigation and enforcement easier.

Box 5: Ministry of Environment protected area zoning regulations

The following are the protected area definitions as defined in the draft Ministry of Environment Law on Protected Areas (2007):

Core zone: management area(s) of high conservation values containing threatened and critically endangered species, and fragile ecosystems. Access to the zone is prohibited except by Nature Conservation and Protection Administration's officials and researchers who, with prior permission from the Ministry of Environment, conduct research for the purpose of preservation and protection of biological resources and the natural environment. National security and defence sectors are exempted.

Conservation zone: management area(s) of high conservation value containing natural resources, ecosystems, watershed areas, and natural landscapes adjacent to a *core zone*. Access to the conservation zone is allowed only with the prior consent of the Nature Conservation and Protection Administration (national security and defence personnel exempted). Small-scale community uses of non-timber forest products (NTFPs) to support local ethnic minorities' livelihood may be allowed under strict control, provided that they do not result in serious adverse impacts on biodiversity within the zone.

Sustainable use zone: management area(s) of high economic value for the national economy, local community or the indigenous ethnic minorities' livelihood, development and management. After consulting with relevant ministries and institutions, local authorities, and local communities in accordance with relevant laws and procedures, the Royal Government of Cambodia may permit development and investment activities in this zone on request by the Ministry of Environment.

Community zone: management area(s) for socio-economic development of the local communities and indigenous ethnic minorities and may contain existing residential lands, paddy field and field gardens or swidden (*chamkar*). Issuing land title or permission to use land in this zone is subject to prior agreement from the MoE in accordance with the Land Law. This management area does not cover the Apsara authorities and other authorities designated and management area(s) to which the Royal Government has allocated the tasks. *Source: MoE 2007*

3 Assessment method

3.1 The principles of integrated wetland assessment

The field assessment followed the methodology detailed in the toolkit produced under this project (Springate-Baginski *et al.* 2008). One aim of both the Stung Treng and the Mtanza-Msona (Tanzania) assessments was to field-test the integrated wetland assessment methodology and approach.

The full background and approach to integrated wetland assessment is detailed in the draft toolkit[4]. It is founded on the premise that an integrated approach to assessment is necessary in order to generate information that is practically useful and policy relevant for wetland planning and management. As both wetland values and threats encompass biological, ecological, economic and livelihood aspects and wetland management responses must simultaneously address and react to each of these factors, a thorough understanding of all - and of the interlinkages and interconnectivity between them - is required. The main components of integrated wetland assessment are seen as species and habitat-based biodiversity assessment, economic valuation, and livelihoods analysis.

The Darwin Integrated Wetland Assessment Toolkit describes a framework for assessment that consists of the following stages:

- **Defining management objectives:** recognising and balancing both conservation and development goals and promoting a pro-poor approach to wetland management, is a process that requires broad consultation and awareness of a wide range of issues. Developing a shared vision and rooting the assessment in real-world management goals and objectives are both essential to give purpose to the assessment process and to identify relevant management and policy-related questions for the assessment to tackle.

- **Conducting the assessment:** documenting the state of wetland biodiversity, identifying development and conservation pressures and threats, identifying economic and livelihood dependence on wetland biodiversity, and understanding past, current and future management and policy responses requires the co-ordination of data collection, survey and review, across all relevant disciplines and methods.

- **Carrying out integrated analysis and presentation:** analysing the data generated to address needs for management and policy information, to emphasise the inter-linkages and connectivity between biodiversity, economic and livelihood factors, and to ensure that information is presented in a practical and policy-relevant form which is both appropriate and useful for planners and decision-makers in conservation and development sectors.

The guiding principles supporting the Toolkit are therefore that wetland assessments should:

- Be **integrated** across disciplines and themes.

- Be geared to address a particular **management** issue or question.

- Generate information that can be used to support and improve the **planning** of on-the-ground wetland management, and provide information to make better **decisions** about how to use and allocate investment funds, land and resources in and around wetlands.

- Work to **strengthen** existing wetland management process.

- Serve to **sustain** wetland values, with a particular focus on ensuring the continued generation and equitable access to wetland goods and services, particularly for **poorer** and more vulnerable human groups.

The model proposed helps wetland conservation and development stakeholders to move away from a situation where they are making decisions on the basis of a series of biodiversity assessments,

[4] The toolkit is available from http://www.iucn.org/

economic valuations and social development reports that have been carried out by different groups of people, who were commissioned separately by programme or project planners, did not consult one another, worked in different places and at different times to each other, using different methods, analytical tools and scales of working, and were each able to provide only a part of the information required and who left gaps which had to be filled by information derived from guesswork, inapplicable generalisations or vested interests.

The integrated assessment model, applied in the case of Stung Treng, cannot be applied for all stages, such as for planning of the management objectives, as much of the planning and data collection had already been completed through the MWBP prior to initiation of the project. For example, the zoning plan already proposed was largely based on a focus for biodiversity conservation with less detailed information collated to inform on the importance of the areas to peoples livelihoods. In this study the focus was therefore on conducting an integrated assessment for only a few villages in the Site and the integrated collation and analysis of the existing data sets with those new findings from the integrated field survey.

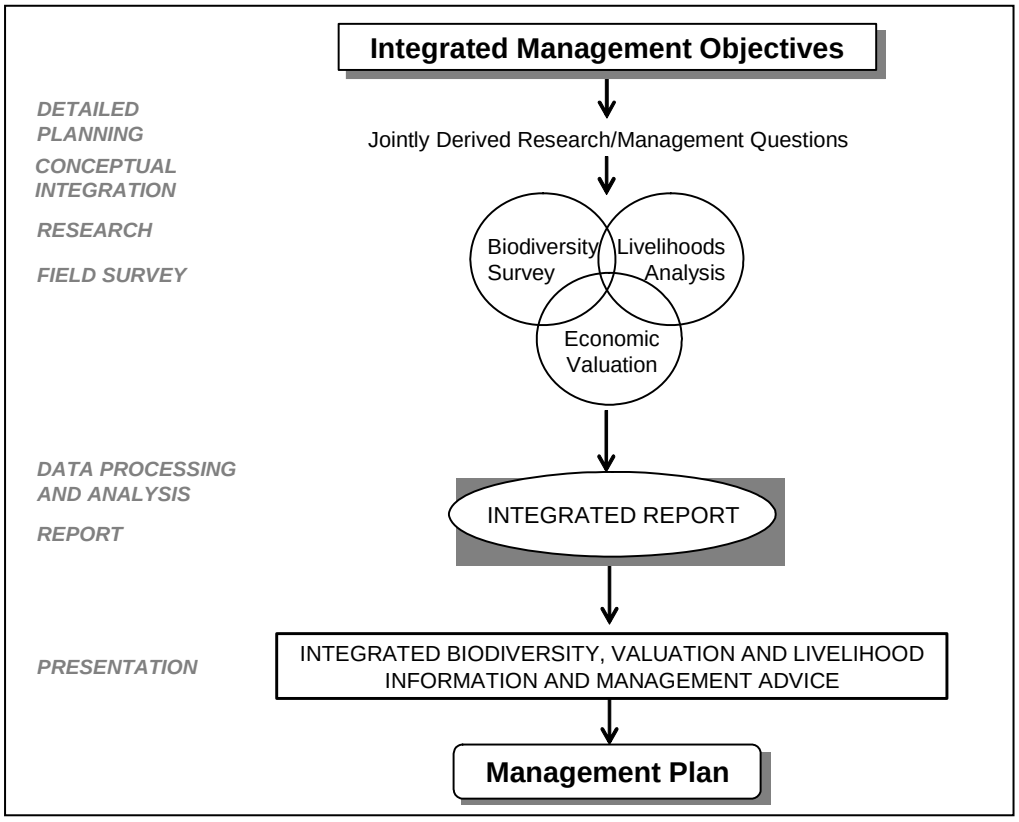


Figure 1: The integrated approach to wetland assessment.

Source: Springate-Baginski *et al.* 2008

3.2 Defining the management objective

The Darwin Integrated assessment toolkit proposes an approach to be used in an integrated assessment as follows:

> ***Defining management objectives:*** *achieving integrated conservation with development is a process that requires broad consultation and awareness of a very wide range of issues. Developing a shared vision and management goals and objectives are essential to give purpose to the assessment process and develop relevant management and policy-related questions for the assessment to resolve.*

This refers to the overall and specific management objectives of the Stung Treng Ramsar Site as a whole. These had already been defined as part of the management planning process ongoing prior to the initiation of this project. The agreed overall management objective is:

Maintenance and enhancement of the ecological character of the Stung Treng Ramsar Site to enable continued provision of the range of ecosystem services for human well-being at all scales.

The Toolkit proposes an assessment based on a management issue (see Figure 8 below). The 'issue' at hand is actually a 'management solution' in the context of this assessment – i.e. the implications of zoning on biodiversity, economics and livelihoods.

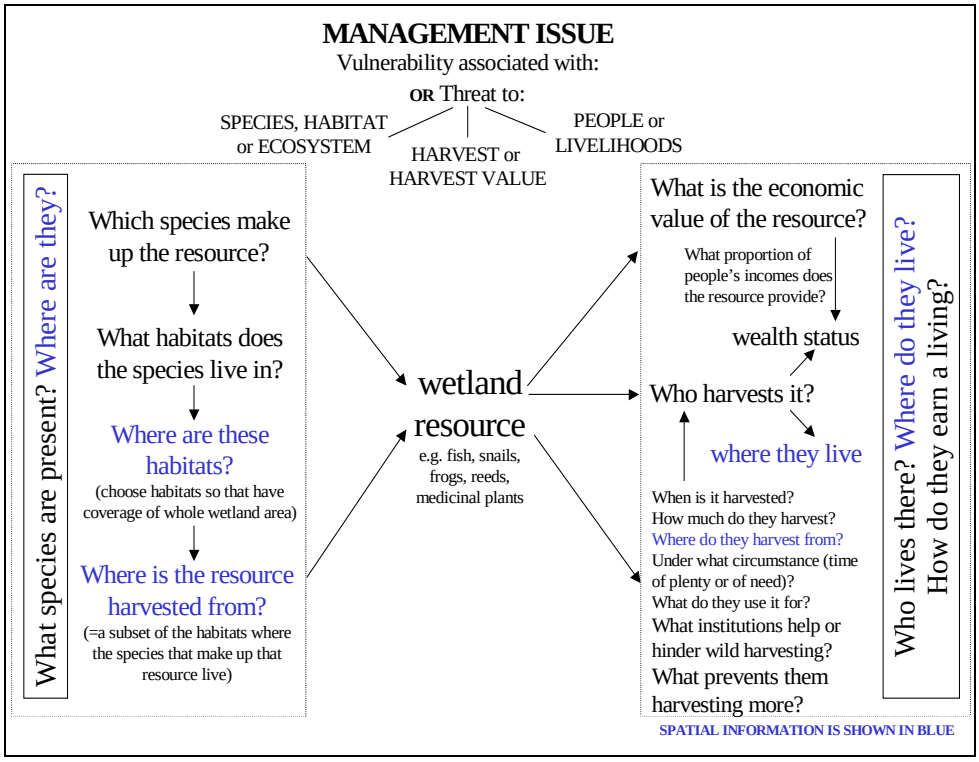


Figure 2: Interrelated information requirements for conducting an integrated assessment. (Source: Springate-Baginski *et al. 2008*).

The Darwin Toolkit defines the generic purpose of assessment as following:

To document the state of wetland biodiversity, identifying the pressures on conserving that biodiversity and understanding past, current and future livelihood, management and policy responses to changes.

In the Stung Treng Ramsar Site, through the MWBP, numerous assessments (biodiversity, economics and livelihoods) had already been conducted. This integrated assessment does not attempt to conduct a general biodiversity, livelihoods and economics assessment but rather focus on the specific issue of the proposed management zonation of the protected area.

An evaluation of feasibility and potential implications of the proposed draft zoning plan for the Stung Treng Ramsar Site in terms of local livelihoods, socio-economics, and conservation of biodiversity with an emphasis on the poorest in the communities.

1. Implications of different levels of protection in the proposed special management zones (Anlong Rusei and Preah Sakhon proposed Core Zones and the proposed Upper Island Conservation Zone).
2. A rapid assessment of the Anlong Chheuteal Dolphin Protected Area.

From the management objectives the following overall research question was derived, as well as detailed specific research questions (detailed in Box 3):

Overall research question:

What are the implications for establishing special management zones for critical biodiversity conservation to current resource use and livelihood strategies of key stakeholders particularly the marginalized/poor?

Box 6: Specific research questions

As part of the planning process for the fieldwork, the Darwin team jointly formulated specific research questions to be addressed during the fieldwork, outlined below:

Biodiversity related

- What additional biodiversity significance do the proposed management zones have?
- When are the key breeding periods for the selected critical species (river birds, fish, turtles, amphibians) and how does this coincide with local/ outsider use of the area?
- What importance do the sites have for other wetland biodiversity (not already known from the past assessments), and their status in the Ramsar Site as a whole?
- What is the status of the wetland habitats and are there any apparent new threats in the proposed zones?

Livelihood related

- What impact has strict protection had on Dolphin Conservation in Anlong Chheuteal? – Impacts on species and livelihoods.
- What are the major wetland resources harvested and used (or traded) by the communities surrounding the proposed Ramsar management zones? What are the main socio-economic activities? (key resources only).
- What is the economic contribution to the main user groups of biodiversity resources obtained from these areas?
- Which groups/individuals currently or previously used the proposed Special Management Zones: when, for what, why etc.
- Who are most adversely impacted by the proposed zoning, who fishes/harvest products, coping strategies, dynamics between household, community and government.
- Who are the most vulnerable people and their resource use areas and causes of vulnerability in relation to the use/management of Ramsar Zone? (Literature review and field work)
- Where are the targeted sites for harvesting/ collecting? (Identify overlap with management zones)
- What are the temporal dimensions of access to resources?

Institutional related

- What traditional rules exist within the zones (e.g. access to common property resources)?
- What are the nature and extent of impacts associated with the proposed Ramsar Site zoning? (ecological, socio-economic and livelihood implications; and both positive and negative affects of the proposed zoning)
- What are the factors that determine adoption of and adaptation to the proposed zones and its associated regulations?
- What management, access and tenure arrangements exist now and in the recent past?

Other

- How much of the existing information can be geo-referenced and linked across disciplines?

3.3 Survey methods

The assessment was implemented over a period of two months (January and February 2007) inclusive of preparation, training, fieldwork, analysis, organising of a provincial level workshop, presentation of findings to key stakeholders. The team applied the integrated research approach, focussing on the following locations:

- Upper Island proposed Conservation Zone (includes both proposed Core Zones above, Koh Khan Kham and O'Talas)
- Preah Sakhon proposed Core Zone
- Anlong Rusei proposed Core Zone
- Anlong Chheuteal Dolphin Protection Zone

The research team placed particular emphasis on studying the Preah Sakhon proposed Core Zone in order to develop and demonstrate the integrated approach.

In order to understand the potential implications of the proposed zoning it was critical to consider the seasonal perspective both in terms of resource use and importance for key biodiversity species at various stages of their life cycle.

The following section provides more detail of the methods and approaches employed.

3.3.1 Biodiversity assessments

Biodiversity assessments did not attempt completion of any systematic, representative sampling, but rather sought to check prior assessments and link them into the livelihood assessment. In many cases the information was obtained from secondary sources, including resource users' reports. Biodiversity assessments focused on answering the main research questions above employing the following range of techniques.

- Georeferencing of the boundaries of proposed zones, for production of electronic maps, using a GPS (Garmin GPS 76).
- Focus group discussions were held with key resource users and semi structured interviews with key informants. The livelihoods specialists identified the actual resource users and conducted a wealth ranking exercise.
- Discussions focused on understanding trends in wetland species, key species harvested, and occurrence of any species of conservation concern at critical stages of their life cycle within these zones. The biodiversity team also attempted to determine key resource user options for biodiversity management within the proposed management zones (primarily Preah Sakhon and Anlong Rusei and to a lesser extent in O'Talas). The biodiversity data collection sheet in the Darwin Toolkit (Springate-Baginski *et al*. 2008) was used where appropriate.
- Direct observations were made on status, distributions and types of wetland habitats and species (birds, mammals, reptile, amphibians, mollusc and vegetation). Techniques employed included boat-based surveys and foot surveys. Secondary information from previous surveys (e.g. Timmins 2006; Sreng 2006; Bambaradeniya *et al.* 2006; Sarinda 2006; Boonratana *et al*. 2005 were used where relevant. Field guides (Robson 2006; Chan-Ard 2003; MRC 2006; Stuart *et al*. 2001; Setha and Poole 2001; Hamalainen and Pinratana 1999; Soriyun *et al.* 2000) were used to assist with species identifications.
- The conservation status of species, according to the IUCN Red List Categories and Criteria, was recorded where species had already been assessed.
- Photographs of vegetation were taken and local name recorded. Herbarium specimens were prepared.
- Observations were made of occurrence of invasive alien species and discussions were held with villagers in an attempt to understand the impacts of these species on biodiversity and livelihoods. All information recorded was georeferenced.
- Ecological characterization and description of the vegetation formations within the Ramsar Site follows Timmins (2006).

3.3.2 Livelihood assessments

Livelihoods assessments employed a range of participatory qualitative and quantitative tools and techniques. Using the Darwin Toolkit as the source method the livelihoods team collected data across gender, generational and wealth groups. Tools and approaches were adapted accordingly and outlined below.

- *Village research process and methods.* At each if the four village sites studied a process was followed to ensure the local people understood the research and were engaged.
  - Initial introduction of the team and statement of objectives to village administration (village head, party representatives, elders etc).
  - Collection of basic village statistics and identification of key informants.
  - Relationship building through sharing food and informal discussion. These activities were key to allowing villagers to feel comfortable and willing to share their information.

  - Wealth ranking with a small group of key informants using a slightly adapted card sort method as outlined in the toolkit. This was enriched by discussing causes or 'drivers' of movement between the wealth groups.
  - Discussion of village stories and village livelihoods and livelihood issues at the village meeting.
  - Focus groups disaggregated along wealth and gender lines. A variety of activities and discussions were conducted, including: resource and social mapping, migration or movement mapping, matrix ranking, and seasonal calendars.
  - Small (2-4 people) *ad hoc* focus group discussions.
  - Household interviews including piloting the Darwin household survey forms.
  - Key informant interviews.
  - Informal discussions and *ad hoc* largely unstructured interviews.
  - Transect walks.
  - Direct and participant observation.
- *Resource based approach.* Outside of the study villages, livelihood data were also collected in wetland directly from resource users (including non-village residents) as they accessed the wetland, using opportunistic approaches stopping and talking directly with them. Interviews were often conducted from boat to boat with little chance for any formalities. Tools and approaches included:
  - *ad hoc* small (2-4 person) focus group discussions.
  - Informal topic led unstructured discussions and interviews.
  - Transect walks.
  - Direct and participant observation.
- *Pioneer approach.* We sought to interview the pioneer communities. However, given the problematic legal and administrative status of pioneering communities every effort was made to build relationships quickly through working with local people on joint activities such as collection of aquatic products and fruit processing and gathering information opportunistically. Data collection included:
  - Semi structured interviews
  - Focus group discussions
  - Household interview.
- *Fishing camp surveys.* The economics specialists visited three different fishing camps in and around the Preah Sakhon SMZ to collect information on fish catch per trip (by month), overall fishing effort, average fish prices and the fish trading practices.
- *Key informant interviews.* While in the village interviews with individual key informants were carried out at each of the sites visited during the field survey including, Veun Sean village, fishing camps (close to southern boundary of proposed Preah Sakhon Core Zone), Koh Chheuteal Touch, Krala Peas, and Koh Langor.
- *Direct observation.* Direct observations were made of fish collection and fish trading. Trading of other commodities was also observed.
- *Fish trade survey.* Consultations were held with the fish traders at Veun Sean village, three fishing camps, Koh Chheuteal Touch, and at the fish market site. A rapid assessment was made of the structure and trading routes within the fish market, and trading efficiencies and price differences. Constraints in fish marketing were also assessed.

3.3.3 Economic assessments

The aim of this part of the assessment was to determine socio-economic implications of the proposed special management zones (SMZ) to the households and communities affected and the society at large. The economics assessment was thus largely integrated into the livelihoods assessment. For this, field information was obtained on the general scale and level of resources use within these zones. Following this an attempt was made to quantify that information. In addition, detailed economics data were obtained from an earlier study conducted by IUCN on the economic value of wetlands resource use in Stung Treng Village (*see* Chong 2005).

Box 7: Who are the resource users? Beyond a village-centric focus

Areas of key biodiversity significance are often remote and distant from village settlements. However livelihood assessment methodologies conventionally adopt a village focus. A major challenge to the integrated assessment team in this instance was to engage resource users camped out or pioneering land in 'illegal' settlements with no administrative structure or land tenure rights. This raised a set of issues more akin to a conflict setting, where users lacked rights, were fearful of those in authority, and were entirely lacking in basic services. A flexible, reactive and sensitive approach was required when working in this context. The livelihoods specialists initiated discussions, the team was small, included a woman, and the international expert spoke Lao language, allowing them to communicate with both the Khmer and ethnic Lao speakers who formed the majority in these areas. Informal 'heads' (respected original settlers/pioneers) assisted the team in organising focus group discussions and household interviews. Without the usual village structure and resource use dynamics a considerable amount of time was spent walking to where settlers were camped or working and the whole approach had to be tailored accordingly.

3.4 Implementation of the field assessment

The following section provides an overview of implementation of the main field assessment. This work builds on additional fieldwork undertaken over the course of the previous year by individual members of the assessment team. Additional data collated after the period of the main field assessment has also been incorporated.

Table 6. Stung Treng integrated wetland assessment – fieldwork timing

Timeline (2007)	**Key Steps in the Study**
1-15 January	Preparation for fieldwork
17-23 January	Preliminary fieldwork
26 Jan-5 Feb	Main fieldwork
6-8 February	Compilation of data
9 February	Stakeholder feedback - initial data presentation

3.4.1 The integrated assessment team

The integrated assessment team included of the following eleven members:

Biodiversity

1. Alvin Lopez, Regional Wetland Ecologist and Biodiversity Specialist
2. Kong Kim Sreng, National Wetland Ecologist and Biodiversity Specialist
3. Keo Chorm, Stung Treng Ramsar Ranger

Livelihoods

1. Mark Dubois, Regional Livelihoods Expert
2. Chea Seila, Research Assistant, CEPA
3. Uy Sopheap Virak, Research Assistant, CEPA

Economics

1. Madhusudan Bhattarai, Regional Environmental Economist
2. Thuon Try, Cambodian expert on wetland livelihoods and economics
3. Mao Sothyrith, Research Assistant, CEPA
4. Tum Nyro, Officer, Provincial Fisheries Department

Boat Driver and village liaison

1. Mr. Suos Champha

3.4.2 Preparation phase (1-15 January 2007)

This involved preparation of a detailed research plan, clearly defining the objectives, scope, research questions and the proposed methodology to address those questions. Other activities included:

- A review of the main existing literature.
- Identification of any preliminary field work to facilitate the full field assessment.
- Preparation of field equipment checklist.

- Preparation of a briefing note on the purpose of the assessment to inform relevant national and provincial counterparts while seeking their involvement in the fieldwork. This helped to facilitate local the ownership of the process.
- Incorporation of all available spatial information on resource use and species status and distribution and for compilation of maps to be used in the field.

3.4.3 Preliminary field work (17-23 January 2007)

A team of 3 staff from a local community based natural resource management organization CEPA (Culture and Environment Protection Association) and the IUCN Cambodia national wetland ecologist gathered preliminary data to facilitate the implementation of the main fieldwork. This preliminary work included:

- Collection of basic socio-economic information on resource utilisation within the proposed management zones. A general questionnaire was developed and the Cambodian team set out to collect this information. A preliminary wealth ranking exercise was also conducted.
- Temporary field demarcations were made of the estimated boundaries of the proposed zones. This was completed in collaboration with villagers and a Ramsar Ranger and served as a useful awareness raising activity on the purpose of the assessment. Village level representation in the temporary demarcation of the proposed zones was also intended to ensure that the village level perspective of the geographic area was captured.
- Initial preparation of data for generating electronic maps of the proposed management zones.

3.4.4 Main field work (26 Jan - 5 Feb)

Planning meetings were held over for 2 days (26-27 January) in Stung Treng town with key team members and provincial counterparts. The following activities were implemented at these meetings:

- Assessment of the information gathered from the preliminary fieldwork. This was conducted by members of the assessment team using several PRA tools such as resource use mapping and seasonal calendars. This exercise also served to provide Cambodian research assistants with on-the-job training for use of these tools prior to the main fieldwork.
- Development of a detailed itinerary and selection of priority target villages and settlements.
- Participatory development of a code of conduct for working in the field.

To ensure a truly pro-poor approach it was important to identify and speak to the right people. With limited time in the field and almost everyone being a resource user in the key biodiversity areas (ranging from those who spend 8 months a year in these zones to those who only visit occasionally), the challenge was to track down key informants for interview. It was then necessary to identify the wealth status of these main resource users using a simple and rapid participatory wealth ranking exercise. Having then identified the poorest and greatest resource users the economics and biodiversity work could begin, according to the methods discussed above.

3.4.5 Compilation and presentation of data (6-8 February)

On return from the field to the provincial capital the field team spent the next 2 days compiling the data and conducting a preliminary analysis of the results. Notes were translated from Khmer to English.

3.4.6 Stakeholder feedback meeting (9 February)

A stakeholder meeting was organized in Stung Treng on 9 February to present the preliminary findings of the assessment and to obtain feedback. Key participants invited to this meeting included representatives from the relevant villages and communes. The meeting was also attended by government departments at the provincial and national level, and by a number of NGO representatives.

3.5 Data management

All data will ultimately be collated within the IUCN Species Information Service (SIS) which is able to link information on species threatened status, ecology, and location (digital maps) with it's use by people, economic value, and role in people's livelihoods.

PART II: OVERVIEW OF FINDINGS

This section presents the findings from the biodiversity, livelihoods and economic valuation aspects of the study.

4 Overview of Biodiversity Findings

Stung Treng was originally proposed as a Ramsar Site in 1999 due to its unique wetland ecosystem (the seasonally inundated riverine forest) and the number of important plant and animal species, many of which also have socio-economic importance. At the time of designation information on the biodiversity of the Site was quite limited and the area was in need of more detailed survey in order to identify and effectively manage the full diversity within the Site. A number of species were specifically mentioned, such as the tree species *Barringtonia, Eugenia, Acacia*, a strangling fig, *Ficus* sp. and the common shrub species known as *Morindopsis* sp. Noteworthy fauna mentioned included the Irrawaddy Dolphin, at least 120 species of fish, of which at least 50 are of socio-economic importance, with many more awaiting identification. High concentrations of Oriental Darters *Anhinga melanogaster,* River Tern *Sterna aurantia*, Small Pratincole *Glareola lactea*, and at least five Great Thick-knees *Esacus recurvirostris* and a White-bellied Sea-eagle *Haliaeetus leucogaster* were also recorded.

More recently, a survey of the Sites' biodiversity was commission by the Mekong Wetland Biodiversity Programme and conducted by Timmins (2006). This survey mainly focused on terrestrial flora and fauna and served to further confirm the Site as important for its biodiversity. Large mammal populations have already been impacted by hunting pressure and loss of suitable habitats; Timmins reported low populations of riparian primates (including Long-Tailed Macaque *Macaca fascicularis* (LR/nt) and Silvered Leaf Monkey *Trachypithecus cristatus* (NE)), as well as Eld's Deer *Cervus eldii* (VU). Birds were found to be less impacted than mammals in general, but some species (such as Green Peafowl *Pavo muticus* (VU), Wreathed Hornbill *Aceros undulatus* (LC), *Buceros bicornis* (LC)), declined as a result of hunting (of eggs, chicks and adults) for food or trade, and disturbance from humans and domesticated dogs. Most species of birds face the same pressures. Timmins reported regionally significant populations of River Tern *Sterna aurantia* (LC), Grey-Headed Fish Eagle *Ichthyophaga ichthyaetus* (NT) and of Darters and Cormorants (Oriental Darter *Anhinga melanogaster* (NT), Great Cormorant *Phalacrocorax carbo* (LC), Indian Cormorant *Phalacrocorax fuscicollis* (LC), and Little Cormorant *Phalacrocorax niger* (LC)), and recorded one sighting of the Critically Endangered White-Shouldered Ibis *Pseudibis davisoni*. The site represents one of the four most important sites for the White-Shouldered Ibis, and is also a globally significant site for the Mekong Wagtail *Motacilla samveasnae* (LC); the site is regionally significant for a number of bird species, including the River tern. No observations of turtles (other than captive animals) or tortoise were made; adults and eggs of both are heavily predated by local communities for both food and trade.

Plate 3: The Critically Endangered White-shouldered Ibis *Pseudibis davisoni*

Plate 4: Siamese crocodile *Crocodylus siamensis,* Critically Endangered

The hydrological regime of the Mekong within the Site strongly influences the fish community present; a high variation in water levels as a result of seasonal floods and a large number of deep pools characterise the Site, with the deep pools providing key low-flow refuges for many fish species. High fish diversity together with migratory flows of populations support the fish-based livelihoods of the settled and migratory human communities within the Ramsar Site; the *trey riel* fishery for example, mainly based on the *Henichorhynchus spp.* migration flows, provides a key cultural, nutritional and income input to local livelihoods. Surveys of the fish fauna identified more than 130 species of fish (MWBP 2007) many of which contribute to fisheries supporting the livelihoods of people within the Site and its surrounding areas. Indeed, one recent survey of the Stung Treng town market reported more than 190 species of fish (Vidthayanon, C. pers. com.). This level of fish diversity ranks as one of the highest known in river systems both regionally and globally (with the exception of the Congo and Amazon systems). Knowledge of invertebrate diversity in the Stung Treng Site was particularly limited although mollusc diversity in the Mekong system itself had been reported as being unusually high with an extensive species flock of gastropod molluscs recorded (Dudgeon *et al.* 2006)

The two field surveys conducted as part of this current project served to confirm and build on many of these previous findings. Locations of many species were recorded in order to build digital maps of species distributions across the Site for use in conservation planning and for input to discussions on the proposed zonation of the Site for different levels of protection and use.

Mammals
The presence of the Smooth Otter *Lutrogale perspicillata* (VU) *w*as confirmed through a direct sighting.

Birds
The presence of many bird species were confirmed (see Annex 2) and the results have helped to inform management reccomendations for some key species:-

	Status	**Threats**	**Recommendations**
White-shouldered Ibis	Breeding site (not only feeding site)	1. Egg and Chick collecting. 2. Human disturbance (Forest fire, New human settlement and fishing Camps). 4. Illegal tree cutting 3. Illegal fishing (use of poisons, electro-fishing and use of explosives) 4. There is no evidence related to the effect of dam construction on this species.	1. Further research on specific habitat use and threats of this species. 2. Bird nest protection by involvement from the local people (Conservation payment). 3. Education awareness. From the relevant agencies to village level. 4. Set up monitoring system to control this species if available.
Sand bar nesting species: **River tern** **River lapwing** **Great Thick-knee**	The species are using the Ramsar Site as a breeding site	1. Chicks and egg collecting (dog hunting) 2. Human disturbance (fishing camps on the sandbar, dogs)	1. Father research on specific habitat use and threats of this species. 2. Control use of dog hunting and prevent access of dogs. 3. Education awareness. From the relevant agencies to village level. 4. Set up monitoring system to control this species if available.
Cormorant and Darter Roosts	These species use the Ramsar Site as a feeding site in dry season (Timmins 2006). They probably migrate from the site during the wet season (Sreng and Lopez in prep.)	1. Hunting by snare and traps. People put snares and nets for catching these species on roost trees (Sreng and Lopez in prep.) 2. Illegal fishing (use of poisons)	1. Further research on specific habitat use and threats of this species. 2. Education awareness. From the relevant agencies to village level. 3. Set up monitoring system for these species.

Reptiles
New evidence was obtained for the continued presence within the Site of the Critically Endangered Siamese crocodile and of softshell turtles (possibly *Amyda cartilagenea* (VU)).

Amphibians
Six species were recorded in the recent survey. Most of frogs were found in the wet margin about three to four meters around the water body with contained the grass and small wetland vegetations. However,

besides the 2 survey areas mentioned above, no frogs were found in the survey areas along the Mekong River. Local guides indicated that during the flooded season frogs escape from wet margin areas to the upland rice fields or to *trapaengs*, to escape fish predators (Sreng and Lopez 2006). Froglets of one particular species (provisionally identified as *Occidozyga* spp.) were very common on the edge of islands, and also around pools and puddles in seasonally inundated forest areas (Bambaradeniya *et al.* 2006).

Molluscs
Eleven species of molluscs were found during the survey, these are probably the first mollusc records in the ST Ramsar Site. Khao Ksach and Kao Thmore species were very common in the channel woodland and sand bar. Golden Apple snail and Kchao Romors are very common, found in trapaengs.

Odonata
Ten species of dragonflies were recorded during the. *Orthetrum sabia* was the most common species found at almost every survey site, followed by *Crcothemis sevilia*, *Diplacodes trivialis* and *Orthetrum sabia* (Sreng and Lopez in prep. 2006). A preliminary list of mollusc and odonate species was compiled to give the first indications for invertebrate diversity within the Site. The species found are commonly associated with river margins throughout the region; a wider range of species would be expected to be present within other habitats present within the Ramsar Site e.g. wet forest, minor streams and trapaengs.

Invasive species
Two species of invasive alien plants (Giant Mimosa *Mimosa pigra*, and a filamentous algae commonly referred to as 'Water Net' *Hydrodictyon* spp.) were observed to be spreading in the Ramsar Site. Dense stands of Giant Mimosa were more prevalent in riverbanks subjected to the cultivation of vegetables, in the northern part of the Ramsar Site. This species had also invaded into the seasonally inundated riverine forest islands, and sand bars. The filamentous algae was more common in braided and shallow areas of the river with channel mosaic habitats such as *Homonoia retusa* shrublands, in the central and northern parts of the Ramsar Site. The algae forms dense mats. According to local fishermen, the algae started to proliferate in Stung Treng about three years ago (Bambaradeniya *et al.* 2006).

Sreng and Lopez (2006) reported that the local people in Koh Sneng village that the Golden Apple snail is not an invasive alien species and that it does not damage their rice fields or plantations, though at least one other village did so. Moreover, some local people in Koh Sneng and Phoum Krom villages collect this species from the Mekong River and release into fishponds and trapaengs near their villages to make it more available and easier to collect in the future.

Overall, the Site was confirmed to be important in terms of both its overall high diversity of species and the presence of a number of regionally and globally threatened species. A number of specific sites were confirmed to be important for these threatened species and for socioeconomically important fisheries, including *trey riel*. These sites include the areas within the Anlong Rusei and Preah Sakhon Core Zones, where key species such as Siamese crocodile, Smooth otter, and the White-Shouldered ibis were recorded. The numerous deep pools found throughout the river channel, provide dry season refugia for fish and other aquatic species, and are important fishing sites.

A brief study was undertaken of the transboundary Anlong Chheuteal deep pool and its population of Irrawaddy Dolphin. The Mekong River sub-population is Critically Endangered; the global conservation status of the dolphin was last assessed in 1996 as Data Deficient and is due for re-assessment.

Further biodiversity survey-related activities recommended for the Stung Treng Ramsar Site

1. Further research / survey on the abundance, specific habitat, seasonal use and threat of each species.
2. Education awareness related to significant importance of biodiversity and sustainable use natural resources.
3. Boundary demarcation of the Ramsar Site
4. Set up biodiversity monitoring programme to control and manage the resources in Ramsar Site Stung Treng.
5. The bird nest protection scheme should be use to protect the birds in Ramsar Site.
6. If available, a law enforcement team (Ramsar Ranger, PDoF or Provincial police) should be set up in the Ramsar Site.

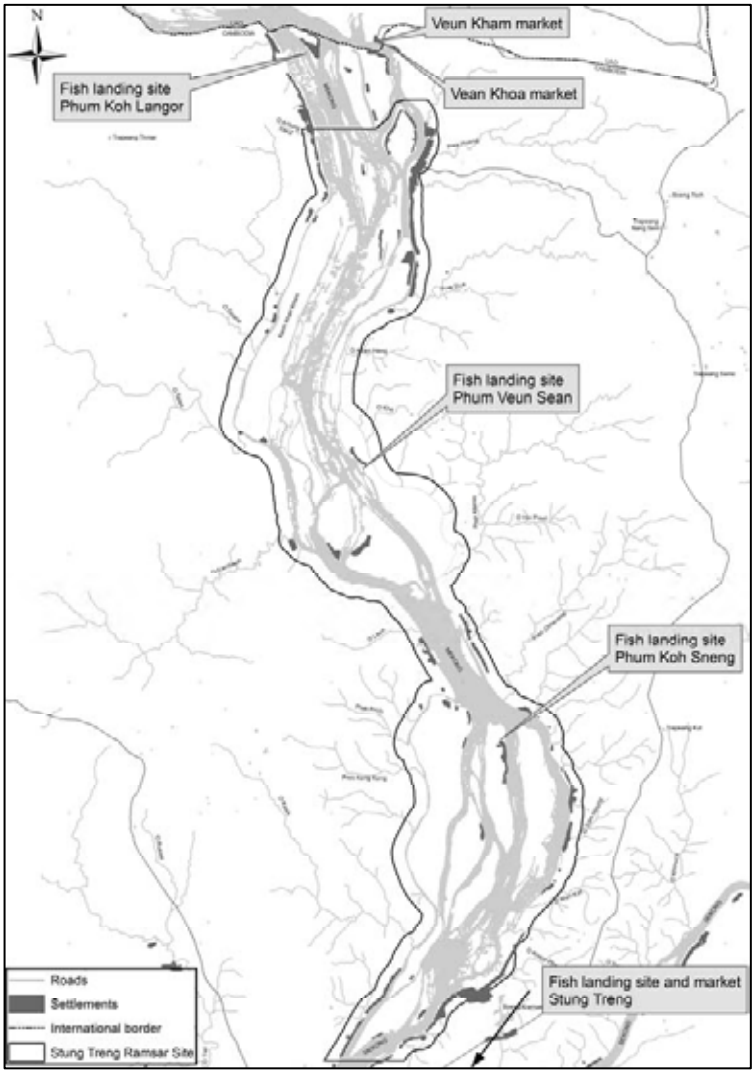
5 Overview of Livelihood Findings

This section presents analysis of the livelihoods of the inhabitants of the Stung Treng Ramsar Site and the ways their livelihoods intersect with the biodiversity of the Site. There are an estimated 2,059 households (a population of c.10,617) living within the Site, in at least 21 settlements. As mentioned above, four of the villages were assessed in detail by the MWBP and during the later rapid assessment undertaken by this Darwin project. Note that the data presented here is based on rapid rural appraisal methods and so should be treated as indicative only. More precise and corroborated data would require a more lengthy and focussed research programme.

Table 7: Study villages

Study village	Number of households (from field survey)	Comment
Site 1: Koh Khorndin	130	Close to Stung Treng town
Site 2: Koh Sneng	186	Mid-site
Site 3: Veun Sean	33	Mid-site
Site 4: Koh Langor	68	Close to Laos border

Note: the actual household numbers for sites one and two were found to be 5-10% higher than reported by MWBP.



Map 5: Study village location within Stung Treng Ramsar Site

Households living within the Site depend for their food security and income on a varying combination of four main activities: rice cultivation, cultivation of other crops, fishing and collection of other products from the wild. A small number of households also engage in business, artisanal production like boatbuilding, and labouring. Some households have good food security base on cultivating larger land holdings. However most are land poor and so subsist by closely adapting their livelihoods to the ecological niche that the wetland offers. In this section we look in detail at the four villages that were the study sites of the work by MWBP (and to a lesser degree a focus of the Darwin project survey team), and then consider governance of the fishery as a focal livelihood/conservation issue.

5.1 Site 1: Koh Khorndin Village

Koh Khorndin village, comprising about 130 households, is situated only about 5 km upstream from Stung Treng provincial town. The village illustrates the heavy dependency of households on rice cultivation and fishing with complimentary wetland use, particularly for poorer households. Table 8 below shows a seasonal calendar of village livelihood activities.

Table 8: Seasonal Livelihood Activity Calendar of Koh Khorndin Village

Activities	When												Where	Remarks
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*		
Wet season rice													Around Koh Khorndin village and around Beung Thom	
Upland rice (*Cham Kar*)													Around Beung Thom and forests surrounding village	
Cultivation of other crops													Mostly rice fields in village, Boung Thom, riverbanks.	
Corn														
Beans														
Water melon														"Pek Kouk" *Pachtizuserosus* & "Trorsork Srov" *Cucumis melo*
Other														Vegetables, chillies, tobacco & sugar cane.
Fishing													In and outside village Koh Sneng village zone.	
Wet season													River banks, streams & ponds (e.g. O'Kham Phan, O'Tamor & O'Khorndin, O'Talas)	Methods: hook line, chan (drop-door trap), bamboo traps and fishing nets
Dry season													Main Mekong river & lakes (Beung Kramoun)	
Livestock-keeping													In the village	Cow, buffalo, chicken: for agriculture and own consumption
Forest product collection														
Hunting with dogs													Between Mekong & Sekong esp. Prey Chass to Lao border	Species include lizard, turtle, porcupine, wild pig, muntjac.
Chick collection													In deciduous Dipterocarp forest around the village, channel woodlands & sand bars	All chicks found are collected. Targets include: Alexandrian Parakeet, Red-breasted Parakeet and Hill Myna. Also opportunistic collection of large birds.
Frog hunting														For own consumption and sale to Stung Treng market
Wet season													Uplands around village, rice fields, small streams, pond	Frog are common and easy to catch when rainy season starts
Dry season													River banks of main Mekong, sand bars and some *Trapaeng*.	
Cricket collection													Sand bars, river banks, and rice filed a round village	For consumption and sale to Stung Treng market.
Molluscs collecting													Ponds, channel woodlands, *Trapaeng* & sand bars	For consumption and sale to Stung Treng market.
Wild fruit collecting													Between Mekong & Sekong esp. Prey Chass to Lao border	
Wild vegetable collecting													Between Mekong & Sekong esp. Prey Chass to Lao border	
Labouring													Stung Treng and Phnom Penh	
Motor-taxi													Koh Khorndin & Stung Treng	Only a few families do this

The livelihoods of almost every household are based around wet season rice cultivation, which provides the staple diet. Around 30 households also practice dry season upland rice cultivation, and many cultivate other produce, including corn, fruits and vegetables. Fishing is the second most frequent livelihood activity, with 125 households engaging in it at some time in the year. Of these, 69 households

fish daily, about 30 families being strongly dependent on fishing. Livestock are kept by a smaller number of households: 5 families have about 40 cows in total, and a further five families have about 30 buffalos between them. Fuelwood is regularly collected by all households, although collection of other forest and wetland products is done to a much smaller extent. A small number of households follow different livelihood strategies: 6 families have local businesses, 3 families act as intermediary traders. Some individuals go out of the village for labouring and other work opportunities.

5.1.1 Rice Cultivation

Almost all families cultivate 1-2 ha for wet rice from May to July. There are about 214 ha in total under cultivation, and average yields range from 1.5 to 2 t/ha. This gives an approximate total annual yield for the village of 374.5 tonnes, equivalent to 2.9 tonnes per household. Much of this provides food security for the household, although surplus rice trades for about 500-600 *Riel*/kg. Upland rice cultivation is much less prevalent, with only about 30 families cultivating about half a hectare each, yielding about 1-2 t/ha. There have recently been some pest problems with insects (*sreung*) destroying rice.

5.1.2 Cultivation of Other Crops

A range of other crops are cultivated, including maize, cucumber, vegetables, water melon and soybeans, in both wet and dry seasons for both own consumption (mainly vegetables) and sale for cash income. Table 9 below gives further details.

Table 9: Non-rice crop cultivation in Koh Khorndin village.

Agricultural crops	**Wet season (June – Sept)**	**Dry season (October – June)**
Maize	20ha cultivated. 1m^2 produces 7 plants yielding about ten corns. A corn sells for about 50-200 *Riel*	-
Cucumber	30% of households are cultivating these	-
Vegetables	Mainly for own consumption. Planted around homesteads, along riverbanks and on the island	Including pumpkin, bean and long bean, mostly for home consumption. 2 ha are under green bean producing 200-400 kg/ha which sells for 1100 –1200 *Riel*/kg.
Water melon	30 families keep 3 ha under watermelons, yielding about 10,000 melons in total, worth about 5 million *Riel*	5 ha of water melon
Soybean	-	1.5 ha is under soybean, which yields about 400 kg/ha. In the market 1 kg sells for 2,000 *Riel*

5.1.3 Fishing

Table 10 below gives information on the seasonal variations in catch and prices. The price for fish varies widely depending on location: in the village it ranges between 2,700-5,500 *Riel*/kg, but this can double at the provincial market. On average these households have a gross income of about 6,162,200 *Riel*/year. Labour, gasoline and daily expenses are around 1,546,238 *Rie*l per year, and so the estimated net income per year per fisher household is 4,615,962 *Riel* (USD1,154/year). Based on these figures for the 69 households, we can estimate an annual gross income to the village from fishing alone of at least USD79,625. These aggregated figures need to be treated with caution as they likely hide a wide range of individual household incomes which would require further survey to reveal.

The complex geography of the riverine area poses difficulties to the local fisher community who try to patrol the area to stop illegal fishing practices. Some individuals from neighbouring and more distant villages engage in destructive fishing practices, included bomb fishing, electro fishing and poisoning in some small ponds and dry streams during the dry season.

Table 10: Estimated mean household fish catches in Koh Khorndin village (for the 69 regular fishing households).

Months 2005-2006	**Mean household fish catch** (kg/month/hh)	**Mean Fish Price** (*Riel*/kg)	**Gross household income** (*Riel*)	**Gross household costs** *(Riel)*
Oct 2005	56	5,000	280,000	121,666
Nov	100	4,500	450,000	121,666
Dec	260	4,500	1170,000	121,666
Jan 2006	260	4,500	1170,000	304,000
Feb	42	5,000	210,000	304,000
March	152	2,700	410,400	304,000
April	224	2,700	604,800	60,800
May	200	2,700	540,000	60,800
June	20	5,500	110,000	60,800
July	42	5,500	231,000	26,040
August	96	5,000	480,000	30,400
Sept	92	5,500	506,000	30,400
Total			**6,162,200**	**1,546,238**

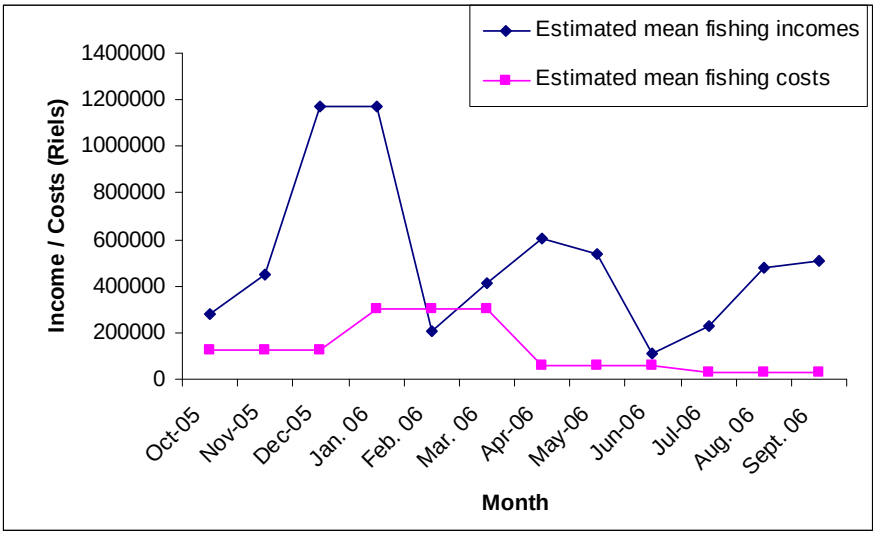


Figure 3: Koh Khorndin fishing households' estimated mean annual income and costs from fishing.

5.1.4 Forest and wetland product collection

Koh Khorndin households engage in a number of complimentary livelihood activities. Most collect fire-wood from the forest areas around their village (mainly the flooded forest along the channels). They also cut trees from the areas between the Mekong and the Sekong to the Cambodia-Lao border, especially from the forest concession (most of the forest adjacent to the Site is now converted into land concessions). This is usually to build or repair houses, although some of this harvested wood may be sold to other people in the village.

Some households earn extra money selling a range of wildlife and wildlife products to traders from Stung Treng town and from Laos and Thailand. This activity is illegal; the capture and trade of endangered wild species is prohibited through Cambodia's membership of CITES, and is also covered by protected area legislation and the forestry administration law. External traders employ local people as guides. Main species traded include Banteng *Bos javanicus* (EN), Sambar deer *Cervus unicolor* (LC), Barking deer *Muntiacus spp.*, red Muntjac deer *Muntiacus muntjac* (LC), Wild pig *Sus scrofa* (LC), Porcupine *Hystrix brachyuran* (VU), lizards, Alexandrine Parakeet *Psittacula eupatria* (LC), Hill Myna

Gracula religiosa (LC), and Crab-eating macaque *Macaca fascicularis* (NT). Values of some of these are listed in Table 11, below.

Table 11: Main species hunted in Koh Khorndin

Species	Livelihood Value	IUCN Red List Conservation status
Barking Deer *Muntiacus spp.*	1 carcass can sell from 50,000 to 70,000 Riel	Several potential species; all either DD or LR/lc
Wild pig *Sus scrofa*	1kg of meat can sell from 4,000 - 5,000 Riel.	NE
Lizard *spp.*	1 lizard (around 1 kg) can sell from 7,000 - 20,000 *Riel*	-
Porcupine *Hystrix brachyura*	Its meat is eaten in the village. The stomach sells for 15,000 - 20,000 *Riel* as a traditional medicine.	VU
Alexandrine Parakeet *Psittacula eupatria*	Marketed as a pet 1 chick can sell for up to 20,000 *Riel*.	LC
Hill Myna *Gracula religiosa*	Sold for pet trade. 1 chick can sell for up to 70,000 *Riel*.	LC

Local people reported that most of the mammals were hunted outside the Ramsar Site although the Crab-Eating Macaque was also hunted within the Site. Most of the water bird adults, eggs, and chicks collected are taken from within the Ramsar Site. The threat level is largely dependent on the species' value and the consequent demand for it by wildlife traders, although it is difficult to establish the volume of this trade.

5.1.5 Summary of community issues

Local people identified the following key issues;

Main constraints to livelihood improvement

1. No market in Koh Khorndin: local people have to travel to Stung Treng town for trade.
2. Lack of irrigation systems means the dry season rice crop is poor and so most families cultivate only wet season rice.

Main livelihood-related threats to biodiversity

1. Illegal fishing: bomb fishing, electro fishing and poisoning in some small ponds and dry streams in the dry season.
2. Illegal tree felling: for fuelwood or construction timber.
3. Wildlife hunting; including egg and chick collection.

The community expressed a willingness to introduce better resource management to address these issues, particularly through commune-level development planning. However they expressed the need for support.

5.2 Site 2: Koh Sneng village

This village also shows livelihood dependency on cultivation complemented by fishing. About 186 families here are engaged in a mixture of cultivation, mainly wet season rice and other crops on 210 ha of crop land, fishing and other activities. As well as cultivating around the village they also have '*plantation'* plots on river islands. They have access to markets in Laos and Thailand. Some households build boats for a living and some individuals go outside the village in search of work in towns. Table 12 below illustrates the main livelihood activities by season.

5.2.1 Wet season rice production

Only wet season rice cultivation is practised here: almost all families are cultivating 1-3 ha. Each hectare can produce 3,000-4,000 kg of rice in one season, depending on rainfall, although 1 ha of *plantation* rice field, having poorer soil quality and requiring different rice species, produces only 1,000-2,000 kg. During rice cultivation customary mutual labour exchange occurs within the village for tasks

such as weeding, harvesting, threshing and ploughing. Some people in the village may be busy with the other jobs and so hire day labourers in the village, at the rate of 4,000-5,000 *Riel*.

Table 12: Seasonal Livelihood Activity Calendar of Koh Sneng

What they do	**When**												**Where**	**Remarks**
Livelihood Activity	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*		
Wet season rice													Uplands of Koh Sneng, Koh Tonle Mouy, Koh Han, Koh Kandol & Koh Sambou	
Plantation crops													Uplands of Koh Sneng, Koh Tonle Mouy, Koh Han, Koh Kandol, Koh Sambou & river banks	For consumption and village sale: Corn, tobacco, sesame, chilli, "Pek Kouk" (*Pachtizuserosus*) & "Trorsork Srov" (*Cucumis melo*), other vegetables.
Fishing													Within and outside village zone	
Dry season													In the main Mekong river, deep pool, Tonle Mouy	For consumption & sale of surplus to village traders
Wet season													Close to river banks, channels, streams & along channel woodlands (O'Thmor Kambor, O'Krabao Thom, Touch, O'Pring, O'Kbal Chour, O'Korng Keng & O'Talas)	Some people from Koh Sneng fish at O'Talas, spending 5-10 days on one fishing trip.
Livestock													In Koh Sneng (Cattle, pig & duck) & plantation camps (Chicken)	Cattle for agriculture. Chicken & duck for consumption & sale.
Forest product collection														
Resin collection													O'Talas	2-3 families from Koh Sneng do this when boat access possible
Frog collection														
Dry season													Along river banks and *Trapaeng*	
Wet season													Uplands, rice fields and *Trapaeng*	Collectors get up to 30kg / night when the rainy season starts
Mollusc collection													Low water areas and sand bars, *Trapaeng,* Rice fields	*Kyong Chorpon* & *Kyong Mort Thom, Kchao* and *Leas.*
Cricket collection													Riverbanks, sandbars, rice field	
Hunting with dogs													O'Talas, Koh Han, Koh Tonle Mouy, O'Kambor and semi-evergreen a long river banks	
Bird snaring													Semi-evergreen forests around the village	
Chick collection													In channel woodlands, Deciduous Dipterocarp Forest (DDF) near rice field, seasonal inundated forest	
Macaque hunting													In the semi-evergreen forest Koh Tonle Mouy & Koh Han	
Boat making													In Koh Sneng	3 families are doing this
Work outside village													In the dry season some people seek work in Stung Treng town, Kratie & Phnom Penh	Subject to availability: If more work was available, they would work for full year

Farmers retain rice seed from the previous season for sowing, and use about 60 kg of seed per hectare. They do not use chemical fertilizers, pesticides or other inputs. Rainwater is the main water source for rice cultivation, although some people hire a diesel pump to irrigate using river water, which costs about 20,000 *Riel* per season per hectare.

Harvesting is generally done using family labour alone: 1 ha takes two people 10 days to harvest. Threshing is traditionally done by buffalos, although mechanical threshers can be hired for a charge of around 6% of the value of the rice produced.

Although most production is for own consumption, surplus rice is traded for 400-500 *Riel*/Kg. Thus local households receive an income of around 1,575,000 *Riel*/ha/season (at 3,500 kg/ha) from their rice fields (excluding costs).

After cultivation the land is left to rest until the next wet season, leaving the rice straw on the fields for buffalos. What is not eaten composts down with the buffalo manure to serve as fertilizer. Post-harvest there can be problems with pests. In 2007, the Golden Apple Snail (*Kyorng Chorpon)* destroyed the rice crop in one field at Trapeang Ytha.

5.2.2 Plantation crops

About 40 families cultivate a range of other crops for both consumption and sale, particularly along the river banks and sandbars. Wet season crops include green beans, maize, water-melon, tobacco, chilli, cucumber and other vegetable. In the dry season, villagers cultivate tobacco, cucumber, water glory, and other mixed vegetables but only on very small patches of land for family consumption. Households use only family labour and spend up to 300,000 *Riel* on chemical fertilizers and pesticides for some crops.

Table 13: Other crops cultivated in Koh Sneng.

Crop	House-holds	Family cultivation	Yield / ha	Sale price	Approx. mean net income	Input costs
Green beans:	70%	Up to ½ ha (35 ha total)	400-500 kg	1,200-1,900 *Riel*/kg	350,000 *Riel*	Low: don't use chemical fertilizer or pesticides
Maize / corn	30%	1 ha	7,000 corns	40 corns = 2,000 *Riel*	350,000 *Riel*/ha	Seed, chemical fertilizer and pesticide
Water melon	30%	Variable		500-1,000 *Riel* per fruit	-	Seed: 1 ha requires 2 cans of seed =40,000 *Riel*
Tobacco	15%	Land along river-bank	100-200 kg	Up to 500 *Riel*/kg	Not sold	Low: don't use chemical fertilizer or pesticide

These crops are mainly sold, other than tobacco which is grown for own consumption and rarely sold due to the declining price.

5.2.3 Fishing

During October and November, many fishers from Koh Sneng travel to O'Talas for 5-10 day fishing trip. With 2 people in one boat they can normally catch up to 20 kg of fish/day (1 kg of fish can be sold for 1000-2500 *Riel* to the middleman who comes from Stung Treng town). There is also dry season fishing around the village and in nearby deep pools.

5.2.4 Livestock

Cattle are kept only for ploughing, rather than for commercial purposes, although they are also used as an asset which can be sold at times of need (e.g. for their children's weddings).

5.2.5 Forest product collection

A wide range of different products are collected from the surrounding forest areas, including wood, resin, frogs and molluscs.

Wood: Koh Sneng people collect fire-wood from the areas around their village, and cut wood from the areas near O'Talas to build or repair their houses. They may also buy wood from the nearby Preah Romkel commune for 4000 *Baht*/m^3 (400,000*Riel)*.

Resin: Tree resin is used in boat building and maintenance. It is only collected in the wet season at O'Talas when boat access is possible to transport the resin out of the forest. Two people go together in a boat and spend 3-7 days collecting, extracting 30 to 60 litres of resin each trip, and also undertake fishing and may snare small mammals for consumption. The resin tends to be for personal use rather than trade, although they may sell the resin to other villagers if there is demand, at the rate of 1000 *Riel/* litre, although they don't sell it outside the village.

Frog collection: Half the Koh Sneng households collect frogs in their spare time for their own consumption and for sale in the village. For about 10 nights a month they spend 2-3 hours catching frogs along the river banks, rice fields and water bodies a round the village. In one collecting trip they collect around 24 frogs. For sale the frogs are tied into 'packages' of 4 to 5 frogs weighing approximately 5 kg, and 1 pack is sold in the village for 500 to 1000 *Riel*.

Molluscs: Fresh water molluscs and snails are only collected in the dry season. There are 4 species of *Krum* (fresh water bivalves) found around Koh Sneng:

Krum Kdorng or Krum Srouch	*Hyriopsis (Limnoscapha) bialatus*
Krum Krahorm	*Pomacea canaliculata*
Krum Pok	not identified
Krum Cham Push Tea	not identified

There are also 5 species of *Kchao* molluscs (small freshwater snails) found around Koh Sneng village:

Kchao Thmor	*Filopaludina martensi*
Kchao Ksach	*Mekongia swainsoni flavida*
Kchao Kra Peu / Kchao Okleangleang	*Brotia costula*
Kchao Romors	*Filopaludina martensi cambodjensis*
Kchao Lving Kdet	not identified

The 10 poorest households (i.e. those who have small rice fields) spend around 15 days a month collecting *Krum* molluscs, mostly for their own consumption, but also for sale. Larger groups of 15 or more people from the village will also go to collect these molluscs together about three times a month for about 2-4 hours each trip. In one trip an individual can collect about 15 litres (1 'water container') which can sell for 300-500 *Riel*.

Three 'milk cans' of the *Kchao* snails can sell for up to 500 *Riel* in Koh Sneng village. The species called *Kyong Hean* in Khmer *(*literally 'the snail who can climb the tree') is collected as fish bait and for a traditional medicine by the Koh Sneng people, and these can sell for 3000 *Riel* per kilo.

Cricket collection: Most of the people in Koh Sneng collect crickets for use as fish bait in the areas around Koh Sneng from late October to January. They are collected mainly on sandbars.

Hunting with dogs: Species hunted include: lizard, monitor lizard, turtle, cobras and pythons.

Bird snaring: This is done by some small boys who mainly target the Oriental Pied hornbill.

Chick collection: This is often done during fishing trips. Target species include: Alexandrine Parakeet, Red-breasted Parakeet, Hill Myna. All chicks found are collected, and there is also some opportunistic collection of adult birds.

Macaque hunting: This is a rare practice. The main target is the Long-Tailed Macaque.

5.2.6 Summary: biodiversity & livelihood issues and threats in Koh Sneng village

The main conclusions emerging from discussions in this village are:

1. There are increasing pressures on the fishery resource.
2. Illegal fishing practices (e.g. bombing, electro fishing and some poison fishing) are used, especially by outsiders.
3. Long-tailed Macaque hunting is occurring, mainly by outsiders guided by a few local people.
4. Chick and egg collecting occurs (Hill Myna, parakeet and large water birds).

The community expressed willingness to help regulate these practices, especially if there is proper backup from the local authorities.

5.3 Site 3: Veun Sean village

Veun Sean is located 2 hours by boat upstream from Stung Treng town. It is very close to the Laos border, only 3 km downstream of Vean Kham market on the Lao side of the border. Compared to the two study villages discussed above it is much more heavily dependent on fishing. There are 33

households in the village, with 45 families and a total population of 197. There are 35 ha of wet season crop lands, most households having up to 1.5 ha. Many households also cultivate a further 2 ha on Koh Keing Kak Island. All households cultivate wet season rice, and many villagers also cultivate upland rice. All households depend on fishing and related activities. Thirteen households also keep livestock (there are 55 buffalos in the village but no cows) and there are 4 shopkeepers in the village.

Wealthier households here, with access to more land and inputs, may make as much as 1.25 million *Riel* from rice cultivation, 1.75 million *Riel* from other agricultural crops (tobacco, beans etc.), and as much as 6 million *Riel* from fishing.

5.3.1 Cultivation

Major crops grown in the rainy season include rice (0.5-1.5 ha/family), green beans (about 15 ha), tobacco (two households) and mixed vegetables (10 families). In the dry season there is also upland rice cultivation and home gardening. Other crops are grown, including corn, watermelon, cucumber, chilli, mango, banana, orange, jack fruits, *Sawai Chanti* (cashew nut).

Table 14: Monthly variation of average fish price in Veun Sean village.

Month	Average fish price (Riel/Kg)	Major fish species caught
Oct.	1,500-10,000	Trey Chhdor; Trey Roh; Trey Spin; Trey Krobei; Trey Chkork; Trey Kda
Nov	1,500-10,000	Trey Chkork; Trey Pava; Trey Pase Ee; Trey Krobei; Trey Kropeur; Trey Kya; Trey Kes
Dec.	1,500-10,000	Trey Chkork; Trey Pava; Trey Pase Ee; Trey Krobei; Trey Kropeur; Trey Kya; Trey Kes
Jan.	500-15,000	Trey Riel; Trey Lenh; Trey Pa Kork; Trey Klaing Hay; Trey Sanday; Trey Sveat; Trey Kes
Feb.	4,000 (smoked 6,000)	Trey Kes; Trey Sveat
Mar.	4,000 (smoked: 6,000)	Mixed harvest
April	1,500 - 10,000	Trey Por; Trey Pra; Trey Kray
May	6,000 (smoked fish)	Trey Kaek; Trey Spen; Trey Srokeng; Trey Proul
June	1,500-10,000	Trey Ke; Trey Por; Trey Pra; Trey Spen; Trey Kray; Trey Klaing Hay
July	1,500-10,000	Trey Ke; Trey Spen; Trey Kropue
Aug.	1,500-10,000	Trey Kchueng; Trey Riel; Trey Kray; Trey Kanchos Trey Chlaing; Trey Kaek
Sep .	1,500-10,000	Trey Kes Prak; Trey Kes; Trey Chunrao; Trey Kray

5.3.2 Fishing

All households engage in fishing throughout the year, normally going out twice daily (morning: from 4 am to 8 am in evening from 3 pm to 4 pm). Fishing is done at a range of locations including: Preah Sakhon, and Along Rusei, Kokon Keo; Koh Ten Sai. Fishers use the following methods:

- Gill nets. There are 3 in the village, and their size ranges from 2.5 mm; 6 mm; and 9 mm. two of the nets are 30 metres in length.
- Cast nets. There are 2 in the village: one of 2.5 mm; and another of 6 mm size.
- Line and hook: 300 m lines separated in 3 pieces, with 400 hooks in each piece.
- Bamboo trap (*Lop*): One fisher has 6 traps.

Income from fishing is highest in the wet season, and traders (often women) come to the village every morning to buy directly. The villagers sell fresh fish and also process it by smoking or fermentation for their own use and for sale.

Table 15: Species names for fish caught in Koh Sneng.

Khmer name	Species name	Conservation assessment
Trey Chhdor	Channa micropeltes	NE
Trey Proul	Cirrhinus microlepis	NE
Trey Kray	Chitala blanci	NT
Trey Chkork	Cyclocheilichthys spp.?	NE
Trey Chlaing (Trey Clang)	Hemibagrus wyckioides	NE
Trey Chunrao	uncertain	
Trey Kaek	uncertain	
Trey Kanchos	uncertain (several possible species)	
Trey Kchueng	uncertain	
Trey Kda (Trey Chhkoak Kdar)	Cyclocheilichthys furcatus	NE
Trey Ke	uncertain	
Trey Kes	Micronema spp.	NE
Trey Kes Prak	uncertain	
Trey Klaing Hay (Trey Klanghay)	Belodontichthys dinema	NE
Trey Krobei	uncertain	
Trey Kropeur	uncertain	
Trey Kropue	uncertain	
Trey Kya	uncertain	
Trey Lenh (Trey Linh)	Thynnichthys thynnoides?	NE
Trey Pa Kork	uncertain	
Trey Pase Ee	Mekongina erythrospila?	NE
Trey Pava (Trey Pava mook mee)	Bangana behri	NE
Trey Por	uncertain	
Trey Pra	Pangasius djambal	NE
Trey Riel	predominantly Henicorhynchus spp.	NE
Trey Roh	Channa striata	NE
Trey Sanday	Wallago attu	NE
Trey Spen	uncertain	
Trey Spin	uncertain	
Trey Srokeng	uncertain	
Trey Sveat	uncertain	

Note: Identifications are primarily based on MWBP (2007). The collected data gave only Khmer names, and in a number of cases identification to species level is highly uncertain in the absence of full identification due to variation in transliteration of Khmer names, or in identifications between sources.

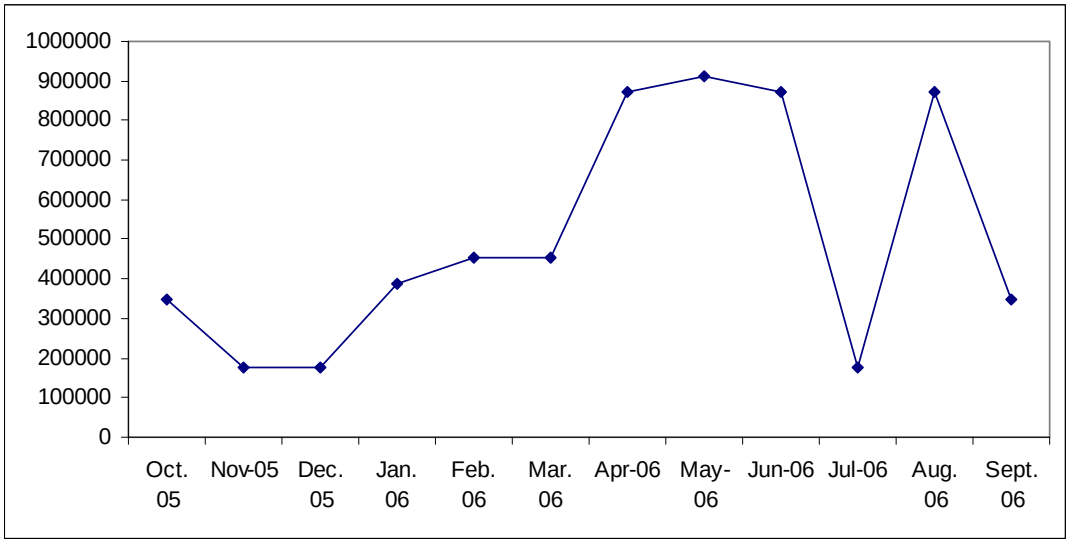


Figure 4: Estimated Monthly Household Gross Income from Fishing for Veun Sean village.

There are major concerns here regarding the use of destructive fishing methods by outsiders (such as electro-fishing and poisoning).

5.3.3 Livestock

Around 30 families from Krala Peas have grazed buffalo here for more than 3 generations. At the time of the survey there were 75 – 100 buffaloes.

5.3.4 Forest product collection

Collection is carried out by all households, and includes hunting and resin collection. Hunting wildlife using dogs is commonly practiced, mostly for household consumption. Table 16 below illustrates the seasonal range of species collected.

Table 16: Seasonal wildlife collection in and around Veun Sean village.

Month	Major wildlife types
October	eel, bobel (*Mekong stingray)*, turtles, tortoise, snail, lobster
November	eel, ansorng, tortoise, Trong, snake
December	ansorng, snake
January	snail, mussel
February	snail
March	snail
April	frog, trakout, tortoise, turtle
May	frog, snail, mussel, trakout
June	frog, snail, mussel, trakout
July	trakout, tortoise
August	eel, ansorng, kantrong, pangolin
September	pangolin

Wildlife hunting for trade seems to be a serious problem. However, together with uncertainty over species identifications, too little data were collected to determine the impact of harvesting on species in general, and few of the species, especially fish, have had their conservation status assessed. A list of some of the species collected is shown in Table 17.

Table 17: Wildlife species collected in and around Veun Sean village and their market values.

Local name	Common name	Species	Conservation status	Market value (Riel/kg)
Andeuk Prich	Elongated Tortoise	*Indotestudo elongata*	EN CITESII	1, 2000
Andeuk Ka Ek Khmao	Black Marsh Turtle	*Siebenrockiella crassicollis*	VU (EN in Cambodia) CITES II	9000
Ansorng	Water Monitor lizard	*Varanus salvator*	NE	4,000
Antung	Eel species[3]			10,000
Chhruk Prey	Wild pig	*Sus scrofa*	LC	10,000
Kantrong	Indo-Chinese Water Dragon Lizard	*Physignathus cocincinus*	NE	-
Kantheay / Romich	Unidentified turtle species[1]	-		8,000
Pong Rool	Malayan Pangolin	*Hystrix brachyura*	VU	80,000
	Sunda Pangolin	*Manis javanica*	LR/nt	
	Chinese Pangolin	*Manis pentadactyla*	LR/nt	
Pos	Snake species			10,000
Trakuot	Bengal Monitor Lizard	*Varanus bengalensis*	NE	4,000

Notes:
[1] A number of turtle species have been recorded from the Lower Mekong; all are heavily utilised and most are threatened.
[2] Price of tortoise at Phnom Penh restaurants is around 40,000 to 60,000 *Riel*/kg
[3] 2 true eels: *Anguilla bicolor, A. marmorata*; 2 Worm eels: *Ophichthus rutidoderma*, *Pisodonophis boro*; two Swamp eels: *Monopterus albus*, *Ophisternon bengalense*; Spiny eels: eight genus Macrognathus; three genus Mastacembelus.

A number of species (birds. turtles and tortoise, as well as some fish) are utilised that are threatened e.g. the Critically Endangered Mekong freshwater stingray *Dasyatis laosensis*. Wildlife hunting for trade especially seems to be a potentially serious problem. A number of species are specifically targeted for trade; these included turtles and tortoise and pangolins which are either threatened or locally extirpated.

5.3.5 Development issues in the village

During the group discussions villagers identified the important development issues in the village.

1. Water:
   - Frequent drought
   - Lack of access to safe water
2. Shortage of food
   - Rice production low
   - Low / declining fish catch
   - Lack of home gardens
3. Poor education
   - Shortage of teaching facilities
   - Poor adult literacy
4. Disease and illness
   - Difficult to access health post
   - Diarrhoea
   - Ear infection
   - Malaria
   - Violence
   - Animal disease

Proposed Intervention: Community-based management. Villagers expressed eagerness to protect the proposed conservation zones through community-based management. They anticipated reducing illegal fishing, wild life trapping and buffalo grazing (which they believed would reduce incidence of disease to the buffalos. They were also enthusiastic about promoting ecotourism here as a livelihood opportunity. In terms of enforcement the villagers said they would be involved through a community conservation committee, but they would need the endorsement, support and back-up of the local authorities.

5.4 Site 4: Koh Langor village

There are 68 families in 56 households (163 men and 178 women) in this small village sited on an island (800 m wide and about 1 km in length), close to the Lao border and the dolphin protection zone. It is only about 1 km to Vean Kham market (which takes about 5 minutes by speedboat or 15 minutes by ordinary boat), but is 65 km from Stung Treng market by road or over two hours by boat. The villagers commonly speak Lao and have strong ethnic and market relations with Lao.

Plate 5 *Trey riel* caught with gillnet in Koh Langor.

Cultivable land is very limited; there is only 25 ha of paddy land, insufficient to support the whole village. Households depend mainly on fishing for their livelihoods. Virtually no families collect NTFPs. There is a strong tradition of cooperation in this village and so there is no wage labour market here. There is also no formal market for agricultural produce, but there is informal exchange between fishers and rice producers. About 20 people work as labourers at Vean Kham market on the Lao border. There are about 98 buffaloes in the village, kept by 25 households, and five households also have retail shops.

5.4.1 Rice and other cultivation

In the rainy season about 25 ha of land is under rice production, and smaller patches under other crops: 1 ha is under maize, 3 ha under green bean and 1 ha under potatoes. In the dry season there is 1 ha under tobacco (river bank cultivation), 1ha under water melon, and about 2 ha under mixed vegetable home gardening. About 23 ha are also cultivated for wet rice outside the island in an area known as Koh Bonteay. The market for watermelon is very informal. Villagers from Preah Romkel sometimes exchange their rice for melons or fish.

5.4.2 Fishing

All households are fishing all year round, even though most of the annual catch is concentrated in the wet season. *Trey riel* are abundant in the wet season as they migrate through the area. They are caught (see Plate 5) but not generally directly sold, used instead for making fermented fish paste p*ra hok* for daily household cooking.

Despite a long term decline trend in catch levels perceived to be due to illegal practices, fish catches are still reasonable for villagers in 2006. This is partly due to the increasing awareness of fishery conservation within the villages.

During the closed season, when many fish species spawn, villagers are still able to fish as according to the Fiat-Law of Fisheries 1987 as they are considered small-scale fishers (using family scale fishing equipments).

Table 18: Mean estimated household fish catch and income in Koh Langor village (2005-6). The figures refer to marketed fish and so exclude smaller fish such as the abundant *trey riel*.

Date	**Household fish catch** (Kg/month/hh)	**Mean fish Price** *(Riel/kg)*	**Mean household income** (*Riel*)	**Total village fish catch / month** *(Kg)*
Oct.2005	8	3,500	28,000	544
Nov.	8	5,000	40,000	544
Dec.	8	5,000	40,000	544
Jan.2006	12	3,500	42,000	816
Feb.	12	3,500	42,000	816
Mar.	12	3,500	42,000	816
Apr.	12	3,500	42,000	816
May	98	3,000	294,000	6,664
June	100	6,500	650,000	6,800
July	100	6,500	650,000	6,800
Aug.	100	6,000	600,000	6,800
Sept.	100	6,000	600,000	6,800
Total / year	***570***	***Mean: 4,625***	***3,070,000***	***38,760***

Source: village focus group survey data
Note: These figures are based on coarse estimates only

The total mean household catch was 570 kg in 2005-6, based on the most reasonable price estimates during the study time, although compared with current prices it might be higher as the price of fish is increasing every year).

During July-September, fishers in Lao catch a great deal of fish migrating from Cambodia by using *lii* fishing equipment (a type of fishing nets similar to seine nets), sometimes as much as 1.5 tonnes per day per team, while the local fishers on the Cambodian side are banned from catching spawning fish using gill nets. Local people felt there should be negotiations between the two countries to harmonise regulations in order to restrict Lao fishers use of *lii* nets.

5.4.3 Forest product collection

Several types of wildlife are collected here for trade, as illustrated in Tables 19 and 20.

5.4.4 Irrawaddy dolphin tourism

Koh Langor village is close to the Anlong Chheuteal deep pool, and the villagers have been involved in organising dolphin conservation activities. During the dry season, villagers used to sell coconuts, watermelons and drinks to the tourists (coconuts are abundant throughout the area). However, the dolphin pool is under local border police control and they have monopolised the sale of refreshments, only allowing their own family members to sell refreshments to tourists. The local police also charge villagers for permission to sell their products across the border to Vean Kham market.

Table 19: Wildlife species collected in and around Koh Langor village.

Species	Name	Conservation Status (Red List; CITES)	Market price
Tortoise (Andeuk)	*Indotestudo elongata* Elongated Tortoise	EN; CITES Annex II	9,000 - 12,000 *Riel*/kg
Turtle*	*Cuora amboinensis* Asian Box Turtle	VU; CITES Annex II	Depends on size: 1-3 kg/head = 20,000 Riel/kg
	Heosomys grandis Giant Asian Pond Turtle	VU; CITES Annex II	4-8 kg = 8000 *Riel*/kg >8 kg = 4000 *Riel*/kg
	Trionyx/Amyda Softshell turtle sp.	CITES Annex I/II	
Freshwater snails	Not specified		800 *Riel*/kg
Bobel	*Dasyatis laosensis* Mekong freshwater stingray	EN	2,500 *Riel*/kg

* No information was obtained on the specific species of turtle found in the location; however, those listed here are recorded as present within the Ramsar Site.

Table 20: Seasonal collection of non-fish aquatic products at Koh Langor village.

Month	Major types	Average Catch	Avg. price of catch
Oct. 2005	Reptile, Tortoise, Turtle, Bobel*	7-8 kg/village/week	20,000
Nov.	Reptile, Tortoise, Turtle, Bobel*	7-8 kg/village/week	20,000
Dec.	'Nutshell'**	2-3 kg/hh/day	na
Jan. 2006	'Nutshell'	2-3 kg/hh/day	na
Feb.	'Nutshell'	2-3 kg/hh/day	na
March	'Nutshell'	3-5 kg/hh/day	na
April	'Nutshell'	3-5 kg/hh/day	na
May	*no activities recorded*		
June	*no activities recorded*		
July	*no activities recorded*		
Aug.	*no activities recorded*		
Sept.	*No activities recorded*		

*Mekong freshwater stingray *Dasyatis laosensis*, Endangered
** Unidentified mollusc

5.4.5 Major community development issues

The villagers highlighted the following major concerns:

1. Lack of paddy field land / shortage of rice.
2. Fishery decline.
3. Drought / no irrigation scheme.
4. Lack of health post.
5. No temple / pagoda.
6. Poor transport access.
7. Poor behaviour of the river guards.

5.5 Fishery governance in Stung Treng

Local people are certain that from a long-term perspective fishing catches are in severe decline although there is no baseline data or research to confirm their belief. Local people said that after 1997, as households began moving back, the fishery was so abundant that just one cast of a net was enough for a families' weekly nutrition. Now the fisheries productivity is felt to be much less. The main cause seems to be a very weak regulatory environment leading to a 'tragedy of open access commons' situation. Local resource users have been unable to assert control of the resource. Without an effective property regime like this it is in no-one's interests to moderate personal extraction because others will undoubtedly benefit. This inevitably leads to over-fishing (especially by outsiders in this case), and the use of poor fishing methods and practices such as fishing in the breeding season.

5.5.1 Current threats to the sustainable management of the Stung Treng fishery

The outcome of a weak regulatory environment has been a growing number of threats to the fishery, summarised here:

1. Destructive fishing techniques. These include:

- Explosive and poison fishing (done by locals and outsiders).
- Torch fishing at night with harpoon, including in the breeding season.
- Pumping out tributary streams (where fish breed) by outside traders.

2. Poor fishing practices: fishing in the breeding season. Fishing in the breeding season compounds overfishing problems by impacting breeding.

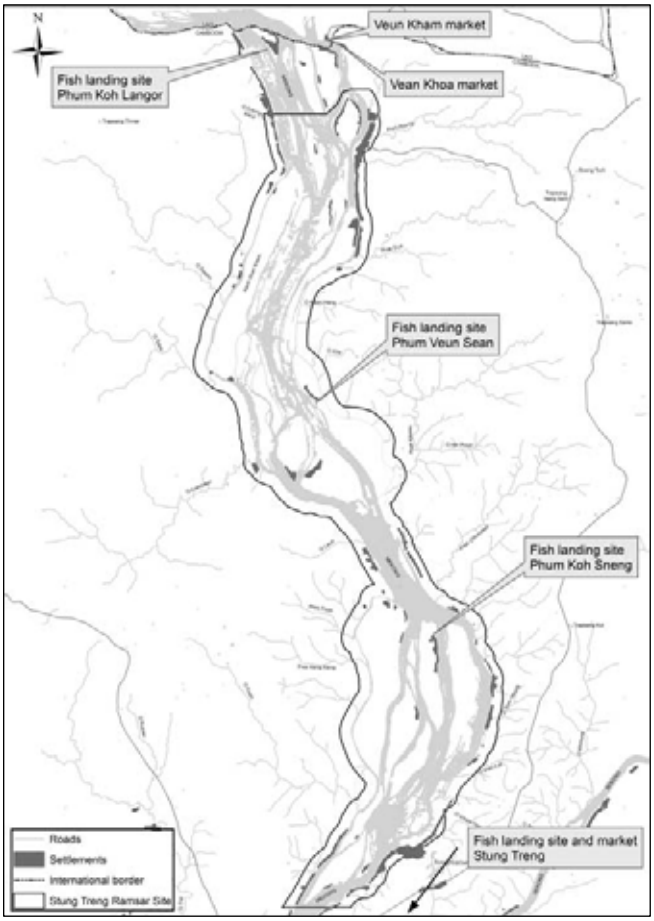
- During the wet season (July – Sept.) the water level increases, filling the tributaries. When in flood the fish migrate upstream to lay eggs in the flooded and deep pool areas. Some fish also migrate downstream.
- When waters recede (Sept. – Oct.) the fish return downstream.

Nationally there is a fishing ban from June – October (the spawning season), as it is well known that fishing (particularly explosive fishing methods) during this period can have major negative effects on numbers. Nevertheless many fishers come to catch throughout this period.

3. Outside traders' unregulated fishing. In Stung Treng only family and medium scale fisheries are allowed. 'Small scale' (family) fishing is allowed all year, but must use specified gear (i.e. large mesh net). A powered boat is needed to fish in the dry season to overcome the rapid river flow. Only those in the village who can afford this can fish at this time. 'Medium scale' must apply for a license from the Fishery Administration office. However, enforcement has not been effective, allegedly due to bribery and rent-seeking, and medium scale enterprises are able to get round regulations and in practice seem to be over-extracting.

Historically there was no settlement in O'Talas, but since the advent of the integrated government in 1997, a new village has developed and there has been rapid forest conversion in the area. The integrated government has improved access into the area and along with new settlers business people have also moved in. Many outsiders are now speculatively claiming whatever land they can get. Increased settlement is leading to habitat disturbance and consequently reduced spawning.

Many outsiders are exploiting the poor regulatory environment to use destructive fishing methods, particularly blocking and pumping out streams to harvest their entire fish population (the practice can yield as much as 3-4 tonnes of fish at a time). Sometimes businessmen even get informal permission to pump out streams from the provincial government office. This practice massively depletes fish stocks as it destroys spawning populations. Local people are complaining that outsiders' use of O'Talas must be stopped, particularly the profit-maximising traders. But the government are not taking action and enforcing the laws and regulations, allegedly due to bribery. In the last 2-3 years local people have apprehended people breaking the rules, but the Fisheries Department are not prosecuting the offenders, and instead are believed to take bribes and use the excuse that they don't have food to feed inmates in prison as a reason for releasing them without charge.



Map 6: Key markets for fish and other wild resources within the Stung Treng Ramsar Site (Stung Treng town market, Veun Khoa and Veun Kham (in Lao) markets).

4. Upstream river management. It is thought that upstream damming has reduced the dry season flow, lowered water levels and increased the extent of rapids. It is also increasing the irregularity of dry season flow. Both effects threaten fish spawning and make fishing more difficult in the pools. With many more dams planned or actually being built, damming is likely to prove the single greatest threat to the Site in the future. In addition to a number of dams planned on the mainstream of the Mekong within China, the proposed Don Sahong dam at the Khone Falls in Laos is a short distance upstream from the Ramsar Site. Whilst the proposed dam, still in the feasibility study stage, is a run-of-the-river dam and is therefore not thought to have a large storage capacity, it is likely to have significant impacts upon downstream water flows (and consequential silt deposition and scouring within the crucial deep pools within the Ramsar Site) and, more seriously, on fish migrations through and into the Ramsar Site. The Don Sahong channel at the Khone falls is one of the key dry-season channels for upstream migrations, and the proposed dam would block this vital route for fish movements at times of low water flows. This is likely to impact directly on fish-based livelihoods within the Site though decreased recruitment to the fish population caused by disrupted breeding patterns, and also through reducing or stopping the movement of some species through the Site. Evidence for these likely impacts has been gained from studies of existing dams within the region (e.g. Schouten 2003).

5.5.2 Fishery marketing issues

There are two main household fish marketing cycles: a daily and a several day cycle. For the first fishers typically put out their nets and lines in the evening and in the morning collect the catch and sell it. For the later fishers catch over several days and retain it in a keep net before selling the whole catch in bulk. There are several options for local fishers and collectors to sell, depending on where they are in the area between the Laos border and the Stung Treng market.

1. *Sell within village:* to intermediaries who come to the villages and fisher camps to purchase.
2. *Export to Laos:* villagers used to do this themselves but restrictions have increased and now a border guard's wife is the only person who can export through the police border post. If they bring to the border they may get 500-1000 *Riel*/kg may get 500-1000 *Riel*/kg higher than on Cambodia side.
3. *Sell at Stung Treng town jetty:* people living close to the provincial town normally bring wetland products here at daybreak.
4. *Sell at Stung Treng town market*: setting up a stall is more time consuming but selling direct to consumers brings a higher price.
5. *Try to export to Phnom Penh market:* fishers cannot export fish themselves out of the district so must sell to traders. Transporting fish out of district is now subject to monopoly license; one company secured the license for fish marketing in the province in 2002 (to buy and transport fish from Stung Treng). Because they may loose the license the following year they seek to maximise immediate profit.

Selling fish at Stung Treng town has undergone major changes in recent years, as illustrated in Box 8. At the provincial level two fish buying companies have been dominating trading. In 2003, Sambomaline Import and Export Co. Ltd,. received exclusive rights over fish buying and supplying in the province. The company won the bidding process to operate exclusively in four provinces: Kratie, Mondulkiri and Ratanakiri and Stung Treng where the main stations are based. The target fish species for purchase and export are mainly Trey Kes, Trey Kya, Trey Krobey, Trey Krai, Trey Slat, Trey Chdor, Trey Pra, Trey Promar, and Trey Sanday. However, the company has allegedly been buying and exporting fish species considered endangered such as Trey Reach (*Pangasianodon gigas*), Trey Trawsak (*Probarbus labeamajor*), Trey Koul Reang (*Catlocapio siamensis*), Pa Se Ee (*Mekongina erithrospila*), and Trey Pava (*Labeo behri/Osteochilus tatumi*). All of these fish species are considered highly threatened and need to be protected by the Cambodian Government. Second, the company has lowered the fish price received by local fishers. For example, the market price for some fish is 8,000 *Riel*/kg, but the company has been offering only 3,000 *Riel*/kg. There is little, if any, control on the amount of fish traded.

Box 8: Key historical developments in the local fish trade

The recent history[5] on fish trade within the Stung Treng Ramsar Site is summarised below. This chronology of events on the regulation of fish trading in Cambodia provides a snap shot of the issues affecting the fish trade and therefore livelihoods of the fishers.

1987	Fisheries law: This fisheries law clearly defines and differentiates between small-scale and medium scale fisheries based on factors such as the size of net allowed and the maximum catch allowed per day.
1999	Export restriction: The Ministry of Commerce (Cambodia) introduced a licensing system for fish export of more than 2 kg.
1999-2000:	Two companies obtained licenses to export fish from Stung Treng to Phnom Penh market.
2003	Veun Khao market was established at the Cambodia side of the border in late 2003. It was intended that the fish trade would be routed through Veun Khao market instead of the Veun Kham market.
2004	Unwritten policy established that local fish traders from Cambodia must sell fish at the Veun Khao market. Sale of more that 2 kg/person/day to Veun Kham were considered illegal.
2005	Several fish traders abandoned their business as they could no longer sell directly to the Lao market which was more profitable.
2006	Provincial government issues a ban on fish trade from Cambodia to the Lao market.
2007	The difference in the price of fish in Veun Khao and Veun Kham was about 2000 *Riel*/kg (for the same species) in February 2007.

A second trading company, Try Pheap[6] Co. Ltd obtained the right to operate from March 2003 to March 2009. The license gave the company the right to buy all fish in Stung Treng and Kratie Provinces in order to help meet the needs of people throughout Cambodia with the surplus being exported to Lao PDR. Export taxes should be paid according to the quantity of fish traded (Try 2004). The exact income received from tax on exported fish was not reported on the export license.

The official fish catch statistics provided by the government fishery office from 1995 to 2002 showed catches generally increasing: 1995 - 515 tonnes, 1996 - 469 tonnes, 1997 - 455 tonnes, 1998 - 900 tonnes, 2000 - 1,460 tonnes, 2001 - 1,285, and 2002 - 1,320 tonnes. Since the two companies obtained their legal licenses to trade, all small and middle-size fish buyers are now considered illegal and are thus excluded from official fish catches figures. These local traders now act as middlemen requiring permission from the two main companies and sell fish mostly to these two companies. However this practice created chaos in 2004 and in response the State abolished monopoly trading rights. Small-scale capture fisheries and trade are once again widespread and form a vital component of livelihoods in the Ramsar Site in Stung Treng. The increase in fish trading regulations, reported reduced fish catch in the area, and increase in fuel prices have all adversely affected the fish trading operation of small-scale fishers in the Upper island Conservation Zone.

Fish price at different markets depends on many factors, particularly quality, supply and demand conditions and season. In general the more urban the market the greater the price becomes. Estimates of retail price per kilogramme of the same fish at different locations are:

Local village:	2000 *Riel*
Regional market:	6000 *Riel*
National market:	12,000 *Riel*

Fish at the market are categorized according to their type, size and grade (1, 2 and 3), and command differing prices according to this. However, most of the fishermen are now obliged to sell to the *moys* whose fish stations are in Stung Treng and in every district office, and deal especially in large and valuable fish. Marketing fish at the border is a popular alternative. Interviews of three major fish buyers at Veun Kham market at the Khmer-Lao border indicates that between them they traded at least 71,490

[5] Some of these major events on the fish trade in the Stung Treng are taken from earlier fish market project report in Stung Treng by Singh (2006). In addition, other details on fish trading issues at the Cambodia- Lao market are supplemented from the field survey finding from the Darwin field survey work in the Ramsar area during January – February 2007.

[6] The total capital of this company is not mentioned in the requested letter, but only that they are capable to operate the business.

kg of fish in 2007. Note that fish prices at the Veun Kham market normally range from 10,000-14,000 *Riel*/kg.

Table 21: Variation of fish volumes purchased by three traders at Veun Kham border market in 2007.

Month	Mean fish purchased per day per trader (kg/day)	Total fish purchased by all three traders per month (kg/ month)
January	150	13,500
February	40	3,480
March	60	5,400
April	20	1,860
May	150	13,500
June	150	13,500
July	35	3,150
August	20	1,800
September	20	1,800
October	50	4,500
November	50	4,500
December	50	4,500
Total		***71,490***

*Major fish species sold at this market include:

Species	***Conservation status***
Chitala ornata	*Not Evaluated*
Phalacronotus apogon	*Not Evaluated*
Bangana behri	*Not Evaluated*
Labeo erythropterus	*Not Evaluated*
Hemibagrus filamentus	*Not Evaluated*
Cyclocheilichthys enoplus	*Not Evaluated*
Bagarius bagarius	*Not Evaluated*
Hemibagrus wyckioides	*Not Evaluated*
Pangasius conchophilus	*Not Evaluated*
Labeo barbatulus	*Not Evaluated*
Pangasius djambal	*Not Evaluated*
Osphronemus exodon	*Not Evaluated*
Probarbus jullieni	***Endangered***; *CITES Appendix I*
Poropuntius malcolmi	*Not Evaluated*
Belodontichthys dinema	*Not Evaluated*

These figures do not include total fish sold in Laos and then on to Thailand. This trade is carried out in secret through a well established network. Trading arrangements are made by telephone and so the fish are rarely displayed in public places at the border market.

Fish marketing is a critical aspect of fishers' livelihoods, and incomes depend both on catch and price determination. Bargaining power is a major factor. Traders naturally seek to increase their control of the purchase price, and with the establishment of national monopoly trading licenses the regional traders are being squeezed out. There is little that fishers can do to strengthen their position short of threatening to dump their catch. The cooperative model for instance, which has been very successful for supporting farmers in agricultural associations doesn't easily transfer to fishing due to the product heterogeneity, cultural heterogeneity and limited cohesion amongst fishers. Therefore the emphasis for ensuring more secure livelihoods would need to be on locally-based regulated harvesting within sustainable levels.

5.6 Wildlife trade

Whilst many resources (such as molluscs) are consumed within the household, or traded and bartered locally within the settlement, some species, such as fish and fish products, birds (eggs, chicks and adults), and mammals are traded widely within Cambodia and the wider region. In some cases, villagers, especially those with access to boats, such as fishers, will trade directly in the major markets. However, traders (including wildlife buyers from neighbouring countries) also travel opportunistically to villages within the Ramsar Site. Survey team members came across numerous instances (either observed or reported) where species had been opportunistically collected by individuals for potential onward sale to external traders.

A key survey of wildlife present in the markets and restaurants of Stung Treng in 2005 (Boonratana *et al*. 2005) found 15 mammal species, one bird species, four reptile species, one frog species, 39 fish species and 24 plant forms in the market alone; further species were observed in the towns' restaurants and pharmacies. The results of the survey are summarised in Table 22.

Table 22: Summary of wild animal and plant species recorded in trade in Stung Treng, late wet season (September-October 2005).

Number of species recorded in trade	Stung Treng Province – town (all sites)	Veun Kham border crossing
Mammals	17	3
Birds	3	1
Reptiles	4	0
Amphibians	1	0
Freshwater fishes	38	9
Invertebrates	6	0
Plant species/forms	25	6
Species/forms used for food (all groups)	67	15
Species used for medicine (all groups)	8	0
Species used for ornamental display (all groups)	15	4
Total species/forms	94	19
Globally-threatened species (IUCN Red List)	**15**	**3**
CITES-listed species (App. I-III)	**15**	**2**

Note:
The following locations were surveyed in Stung Treng town; Stung Treng market, 6 restaurants, 1 specialist wood market. Source: Summarised from Boonratana *et al.* 2005.

5.7 Summary

Local households are heavily dependent for food security and income on the wetlands. The main natural resource-based livelihood practices do not necessarily have an adverse impact on biodiversity in the area; agriculture, fishing and non-timber forest product collection can be sustainable if use is regulated. However the political turmoil of recent decades has led to a very weak governance and regulatory environment in which traditional customary mechanisms have been undermined and new decentralised governance mechanisms have not yet become effective. In this weak governance context some livelihood practices are having a negative impact on biodiversity. These include destructive fishing practices (particularly during the spawning season), the collection of wildlife, and general encroachment and disturbance (from, for example, the introduction of domesticated dogs with fishing camps). Most of these are not core to households' food security, and can be addressed in a relatively straightforward manner: from group discussions the commitment of local people to improve practices has been clearly forthcoming.

However the serious problem of overfishing is more closely linked both to the livelihood security of local households and also to profits of traders, and in the context of an ineffective regulatory framework is much more difficult to address. The situation is a typical 'tragedy of the commons' scenario in which local households are unable to defend their local resources from rapacious outside traders through normal customary mechanisms, and so there is a 'race to the bottom' in which everyone is seeking to privatise whatever they can of the resource before others do. Outsider traders are apparently receiving tacit patronage and protection of public servants and are thereby able to over-exploit the resource with impunity.

The increasing trend in population and in-migration means that there is likely to be an intensification of these issues, and it is therefore urgent that they are addressed at the earliest through strengthening local communities' powers and capacities.

6 Overview of Economic Valuation Findings

The field study focussed on the zoning proposals and so economic valuation was not a priority research issue. We therefore generated little new data in this area and so here instead give a flavour of the economic valuation approach by summarising insights from an earlier economic valuation study in Veun Sean village conducted by IUCN (Chong 2005).

6.1 Wealth, income and wetlands values in livelihoods

6.1.1 Wealth ranking

Wealth ranking clarifies social stratification and the variations in livelihood dependency on wetland resources. Six individuals (three men and three women) identified the characteristics of different "wealth groups" in the village and then categorised the individual households. This is shown in table 23 below.

Table 23: Wealth Ranking for Veun Sean village

Rich	**Medium**	**Poor**	**Very poor**
Large house with tin roof	Medium house with tin roof	Small house with grass roof	Small cottage
Many paddy fields	Less paddy fields than rich households	Less paddy fields than medium households	Small or no paddy fields
Many *chamkar** fields	*Chamkar* fields (1-2)	Small *chamkar* fields, some left fallow	Small *chamkar* fields, some left fallow
Motorboat	Motorboat	Rowboat	-
Many ducks and chicken Many pigs (5) Many buffalo	Chicken and ducks (3-4) Pigs (1-2) Buffalo (2-3)	Chicken and ducks (2-3) Buffalo (1)	Chicken and ducks (2-3)
Always enough food. Enough rice to sell	Rice shortage for 6 months	Rice shortage for 9 months	Rice shortage for 10 months
Knowledge and skills	Some skills	No knowledge or skills	No knowledge or skills, Illiterate
No debt	No debt	Borrow rice from relatives or rice bank, or buy rice from others	Work as labourer on others' land. Fish and hunt to earn money to buy rice
Rice mill Television	-	-	Many children; Widowed Disabled and / or frequent sickness
4 households	**14 households**	**10 households**	**8 households**

* Chamkar means farming i.e. non-rice cultivation – including cultivating corn, tobacco, banana, water melon, and so on.

The key measure of wealth was consistently identified as a household's ability to grow rice sufficient to meet the needs of the family throughout the year, and access to land and the capacity to cultivate it. Rich families were identified as growing sufficient or excess rice, medium families as facing "rice shortage" for six months, and poor and very poor families for nine or ten months. Poorer households respond to rice shortages by generating income to purchase rice by selling fish and wildlife. They also depend on aquatic animals more as a food source because they are readily available throughout the year, whereas wealthier groups can access other foods.

6.1.2 Income and expenditure

Ratings of sources of income revealed that poorer households have fewer options for generating income, although they are more dependent on generating income to purchase the staple food, rice, and spend a greater proportion of their income on rice. Fish (mostly sold to middlemen) and cash crops are important income sources for all households.

Table 24: Sources of income in Veun Sean

Importance	Poor	Less poor
●●●●●	Fish	Fish, livestock
●●●●	Cash crops	Cash crops, turtles, lizards
●●●	Turtles, lizards, livestock	Cogon grass
●●	Wildlife	Wildlife, vegetables, rice, small shop
●	NTFP, work on other farms	Work outside village, rice, rice milling, bamboo, rattan

Table 25: Types of expenditure in Veun Sean

Importance	Poor	Less poor
●●●●●	Rice	Medicine
●●●●		Petrol, cooking ingredients
●●●	Medicine, clothes	Rice, hospital, school, fishing gear
●●	Hospital, fishing gear, agricultural tools, seeds, petrol, household goods, cooking ingredients, social contributions	Piglets, clothes, seeds, agricultural tools, household goods, wine and cigarettes
●	Fish, livestock meat, weddings, boat purchases, transport	Social contributions, transport, weddings

6.1.3 Relative ratings of wetland values

Rating exercises on the relative values of the wetlands and fisheries resources revealed the variety of wetland functions held to be important to the local communities. Many of these values represented consumptive use of wetland resources, such as fishing, traditional medicines and wildlife. Other services related specifically to consumptive or non-consumptive uses of water: drinking, washing, irrigation and transportation.

The community unanimously rated fish highest, although women suggested that cooking and drinking should be equally rated as most important, pointing out that fish are not valuable if they cannot be cooked. Other wetland values identified as important were construction sand and rock, and fuelwood collected from near the riverbank. Irrigation of vegetable crops was regarded as more important than for floodplain rice growing, because nearly all rice is rain-fed.

Discussions considered some of the key problems faced by households, the underlying causes of these problems, and ways in which households respond. The two major and interrelated problems were seen as health and rice sufficiency. Rice shortage drives poorer households to depend on “wild” resources (fisheries and wildlife) for income. Yet declining fish stocks are reducing the benefits from this. Some of the very poor who do not have access to fishing equipment or boats cannot catch sufficient fish to sell, and so are particularly dependent on “wild” food resources, including aquatic animals collected in rice fields.

6.1.4 Institutional support

Many internal and external institutions were identified in discussions, including local government and NGOs. However, it appears that households rarely have contact with provincial government agencies, and many focal points and working committees within the village, established previously by NGOs, have become inactive. Villagers identified CEPA, an NGO which is currently working on community fisheries and community forestry, as particularly influential.

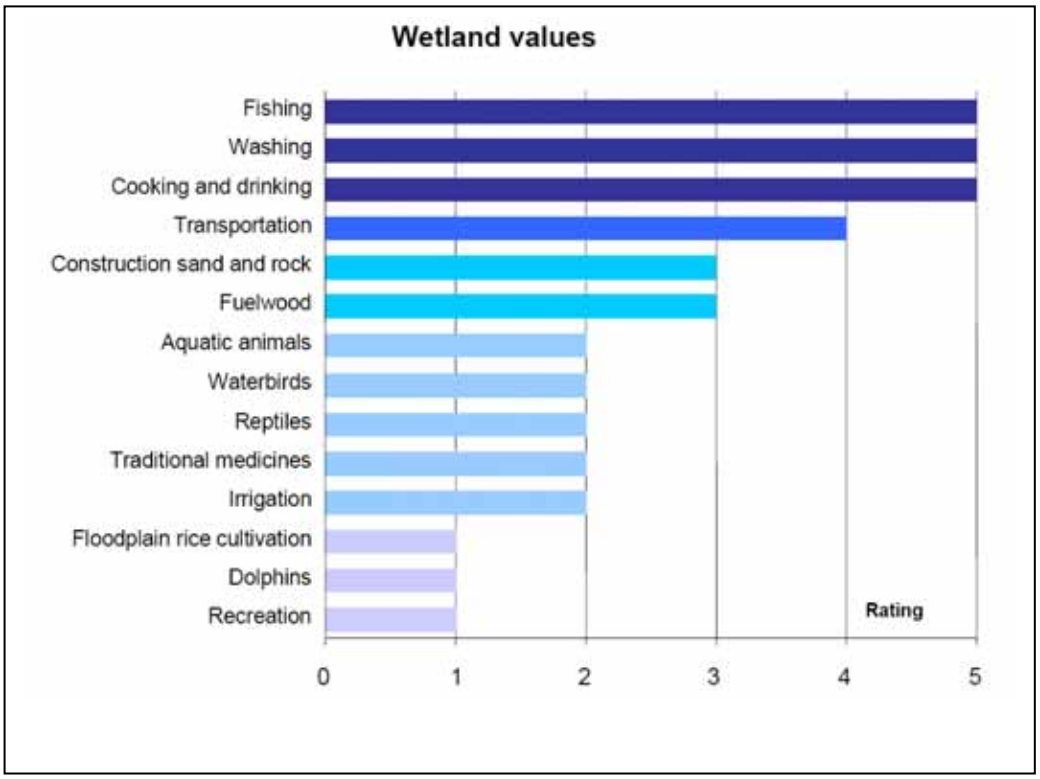


Figure 5: Subjective relative rating of wetland values by Veun Sean villagers. (Source: Chong 2005).

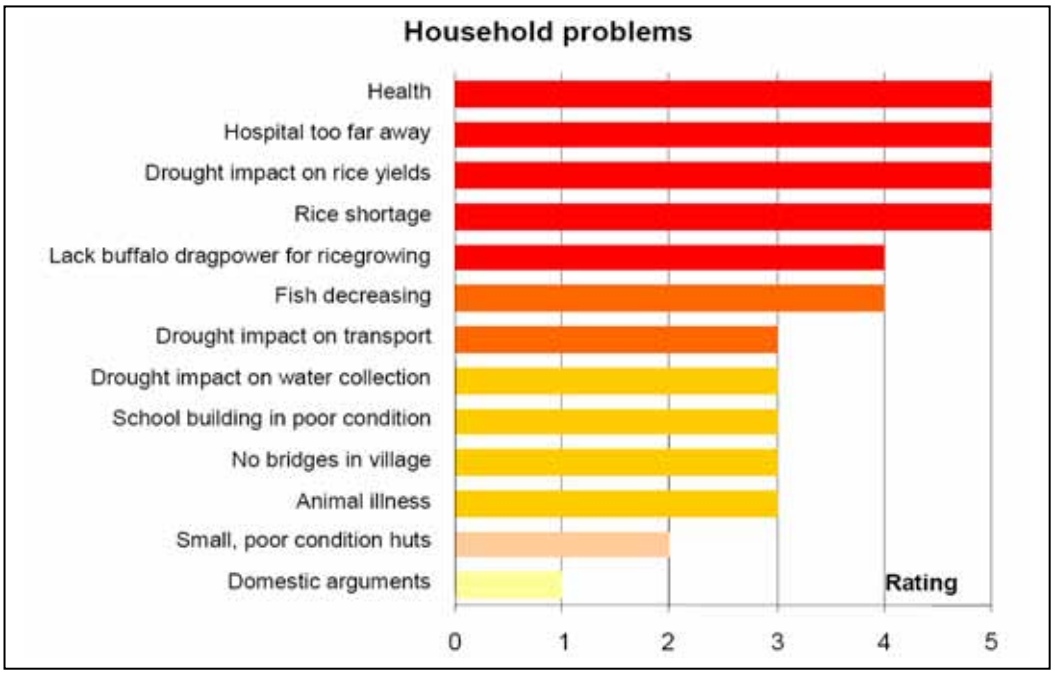


Figure 6: Subjective relative rating of livelihood problems by Veun Sean villagers. (Source: Chong 2005).

6.2 Wetland values – how much?

Targeted household surveys were also conducted to provide quantitative information about the wetland values, especially the value of the fisheries resource. The quantitative assessment confirmed that fisheries are more valuable to poorer households, because of its importance as an income source.

Table 26: Fish value: *Riel* per household per year

Value	Average	Poor	Less poor
Fish consumed	500,000	600,000	500,000
Income from fish	1,200,000	2,000,000 *(77% total)*	600,000 *(56% total)*
Total	**1,700,000**	**2,600,000**	**1,100,000**

The average value of the fisheries resource is 1.7 million *Riel* (USD425) per household per year. However for a poorer household, fisheries are worth about 2.6 million *Riel* (USD650) per year. Much of this value is derived from income earned from selling fish, which is used mainly to purchase the food staple, rice. The value of other wetland uses was then estimated using the relative ratings of different wetland uses.

Table 27: Wetland values: Riel per household per year

Rating	Value	Wetland uses
●●●●●	1,700,000	Fishing, washing, cooking/drinking
●●●●	1,360,000	Transportation
●●●	1,020,000	Construction material, firewood
●●	680,000	Aquatic animals, waterbirds, reptiles, irrigation, traditional medicines
●	340,000	Floodplain rice, recreation, dolphins
Total	**12,900,000**	USD 3,225

Using this method, the average value of the wetland to a household in Veun Sean village was calculated as approximately USD 3,225 per year.

6.3 Summary

Wetland resources are integral to the livelihoods of Veun Sean villagers. In Veun Sean, the value of wetlands is about 13 million *Riel* (USD3,200) per household per year.

Households with greater capacity to grow rice are perceived by other households as wealthy, appear to be less directly dependent on wetland resources for nutrition or income, and have greater capacity to cope with external shocks and stresses. Poorer households are more dependent on wetland resources for providing food security and income. They are also likely to be more vulnerable to losses in fisheries and wetlands resources, particularly in terms of their capacity to deal with shocks and stresses such as poor health, drought, and livestock deaths. Except for the few wealthiest households, many households depend on wildlife caught with traditional methods for income. For the very poor, aquatic resources in paddy fields and small streams are a key source of nutrition.

In addition to providing day-to-day resources on a routine basis, wetlands are also vital in ensuring that households can cope with external stresses and shocks. If stresses affect productive activities, such as cultivating rice and raising livestock, these can to a certain extent be substituted with collection and capture of wild resources such as fish, wildlife and aquatic animals.

Deep pools are recognised as important conservation areas, but are traditional fishing grounds for Veun Sean villagers. In the Stung Treng Ramsar Site, strategies to conserve and protect the fisheries resource must consider the biological importance of the habitats in the region as spawning and dry season refuges. However, it is critical that this information be considered in light of local-level dependencies on and access to the resources. In this context, participatory research methods for economic assessment should be a key tool used in the planning process – to gain an understanding in the importance of wetlands resource to local communities.

PART III: INTEGRATED ASSESSMENT OF ZONING PROPOSALS

This section presents integrated analysis of the four zoning proposals.

7 Proposed Upper Island Conservation Zone

7.1 Background and introduction

The proposed Upper Island Conservation Zone (see Map 3) includes the two proposed Core Zones discussed below, the proposed Koh Khon Kham gallery forest restoration zone, O'Talas, various important deep pools and a complex mosaic of habitats. The Ramsar Site currently falls short of the Lao border and does not encompass the Anlong Chheuteal Dolphin Protection Zone.

The purpose of this assessment was to better understand resource use dynamics within the area and to review implications of designating the entire Upper Island area as a Conservation Zone. Both primary and secondary data were used for the analysis and discussion. The findings presented below provide a summary overview of the biological importance of the proposed Upper Island Conservation Zone, the nature and extent of resource use and a range of other economic issues that influence livelihood strategies, poverty and biodiversity, such as markets.

7.2 Key habitat features

The following descriptions of the key habitat features of the proposed Upper Island Conservation Zone are primarily taken from Timmins (2006). Specific reference is made to areas of ecological importance. Timmins reported that one of the most spectacular of the channel habitats is the channel woodlands, dominated by the tree *Anogeissus rivularis*. The branches and trunks of the trees are swept horizontally in the direction of wet season water flow and the crowns of the trees, which are somewhat lower than the maximum flood level become totally submerged. In other places *Anogeissus* trees take on a different form with taller trees reaching 25 m or more in some places. In this case the upper branches remain above the maximum flood levels and the *Anogeissus* trees are commonly mixed with other species including *Barringtonia*, *Eugenia* and *Ficus*. A further channel woodland formation is characterised by tall (15-25 m) spreading *Acacia* cf. *A. harmandiana*. This appears to predominate in areas with more prolonged dry season exposure and an abundance of sand. Such formations are often relatively open and have many shrubs and smaller trees including *Crateva* and *Barringtonia*, while *Anogeissus* is often relatively scarce in such formations. Overall, channel woodlands appear to be still in excellent condition with minimal signs of disturbance (Timmins 2006).

Extensive areas of the channel are dominated by shrubs. These bushlands are totally submerged during the high flow season. Bushlands take on a number of forms characterised by a variety of shrub species, substrates and hydrological conditions. Some of the most striking bushlands are dominated by *Phyllanthus* cf. *P. jullienii*, mainly occurring in channel areas that are exposed for only short periods, such as in Preah Sakhon, where the

Plate 6: Channel woodland typical of the Stung Treng Ramsar Site.

current is doubtless swift when inundated, and the substrate is mainly rock. Another type of bushland is dominated by *Telectadium* cf. *T. edule* which occurs in rocky channel areas. Other areas of bushland are more mixed and in these *Homonoia* cf. *H. riparia* is often very obvious and common, along with both *Telectadium* and *Phyllanthus*. Another common component in such bushlands is *Crateva* spp.

Sand features are widespread within the channel and take a number of forms. Most sandbanks remain bare of vegetation. On some large, higher sandbanks there is abundant grass growth, especially tall cane grasses. Channel mosaic areas contain a mix of the above habitat types. They have heterogeneous substrates with varying heights above the dry season minimum water level.

Riverbanks differ somewhat from the previous habitats both in their physical characteristics and their vegetation formations. Timmins (2006) found it hard to characterise the natural bankside vegetation because no stretches of intact natural bank vegetation were observed. However, the original state was presumably characterised by a combination of dense shrub and small tree growth with many vines and lianas in situations where light penetration was good, and heavily shaded banks with soils consolidated by dense root growth from tall and overhanging gallery forest trees.

Riparian habitats include gallery forests and tall floodplain grasslands. As with riverbank vegetation, riparian 'gallery' forests have been heavily modified and cleared. Most riparian areas are now a mix of agriculture (of various ages) and relatively short, dense secondary vegetation.

Three types of forest occur in 'terrestrial' areas not directly influenced by the Mekong's hydrology, including much of the area of the islands. Of these, Mixed Deciduous and Deciduous Dipterocarp Forest predominates. Another forest type, Semi-evergreen Forest, is also present, but is more localised.

Agriculture and secondary formations are widespread and often dominant in areas of human settlements within the proposed Upper Island Conservation Zone. Most agriculture is either in the form of established wet season paddy rice, or swidden cultivation of generally recently cleared forest land. All is generally low intensity wet season agriculture, although much of the swidden may be driven by local and regional demand for cash crops.

The proposed Upper Island Conservation Zone contains a number deep pools along the mainstream Mekong that provide sanctuary for a range of fish species – primarily as dry season refuge.

7.3 Biodiversity features and key species accounts

This section provides an overview of some of the species of conservation significance recorded in the Upper Island Conservation Zone. Where possible, species links to subsistence and trade are also discussed. Bird observations throughout the area were largely opportunistic, with the exception of one systematic transect conducted. All bird records are reported in Annex 2. Locations are provided for some significant sightings but this does not necessarily reflect distribution.

7.3.1 Birds

Green Peafowl *Pavo muticus*
Khmer: Kngoak baytong
Conservation Status: Global: Vulnerable; Endangered in Thailand, At Risk in Laos.
Locations recorded: Koh Konkeo, Koh Rusei & Anlong Reusei habitat complex
The Koh Khon Keo, Koh Rusei and Anlong Rusei habitat complexes are undoubtedly an area of critical conservation significance for the Green Peafowl. Fresh tracks (possibly a few hours old) were found on a sand bar adjacent to Anlong Rusei in an area of riverine shrub and small patches of the semi-evergreen forest in the Koh Khon Keo and bamboo forest areas of Koh Rusei. The tracks probably belonged to 3 individuals. Individuals were heard calling, about 200 m southeast of UTM 1523717, 0603463. It was not possible to estimate the size of the remaining local population of this globally threatened species. However, reliable local information[7] confirmed a breeding population of at least 10 individuals within this habitat complex. Independent discussions with a fisher[8] who frequents this area revealed that he had spotted 8 individuals on the riverbanks and sand bars of Koh Khon Keo. Hunting

[7] Based on information from Mr. Keo Choam, a Ramsar Ranger and the only individual living permanently on Koh Khon Keo.
[8] Mr. Ny Vy from Koh Cheuteal Touch

continues to be a key threat to this species. A pair of Green peafowl chicks were collected from Koh Khon Keo in 2006 by buffalo owners from Krala Peas[9]. The chicks were later sold at the Cambodia-Laos border and reported to fetch a price of 60,000 *Riel* (USD15). Boonratana *et al*. (2005) however reports tail feathers alone being sold at 30,000 *Riel* per feather. The sale price of chicks will need further verification. Trade in this species and species products is clearly a threat and efforts are needed to enforce controls, in particular at markets. Public awareness needs to be raised so that people know the species is threatened and should not be traded – many are probably unaware of this situation.

White-Shouldered Ibis *Pseudibis davisoni*
Khmer: Tror Yorng Chamkomkorsor
Conservation Status: Global: Critically Endangered
Locations recorded: Koh Khon Keo*,* Koh Rusei & Anlong Rusei
Local reports[10] indicate that this species prefers to perch on the high branches of dead trees generally in open canopy forested areas adjacent to small water bodies amongst the channel bushlands. Five individuals were observed feeding in shallow seasonal ponds amongst the channel bushlands (UTM: 1525159, 0603852). The birds were flushed and took flight upon noticing the survey team. Local reports[11] indicate that this species usually nests between February and April. In the dry season the species has been reported to use the areas of Koh Khon Keo, Koh Khon Kham, Koh Kanthao, and Koh Kaki for nesting and feeding, and also to use Preah Sakhon for feeding during the dry season but not for nesting.

Sreng *et al.* (2006) observed this species regularly, in groups and as individuals, in the proposed Upper Island Conservation Zone. Birds were also reported in the wetlands and grassland *veals* to the west of the Mekong mainstream in the north. Both these habitats have declined in extent and quality with the loss of wild ungulates. However, the grazing of domestic buffalo in these areas is potentially beneficial in maintaining suitable habitat. The whole Stung Treng Ramsar Site is thought likely supports a minimum of 20-30 birds given the dispersion and regularity of survey records. Three reported nests were found in March 2006. Two of these were found in the channel woodland north and south of Koh Khon Thao, and the third unconfirmed nest was reported on Koh Kaki. Based on direct observation and interviews with local people, Koh Khon Keo, Anlong Rusei, Koh Kham and Koh Khon Thao, provide suitable and important nesting habitat for the White-shouldered ibis.

Both this survey and Timmins (2006) reported the capture of chicks and adults. Timmins reported the attempted purchase of an adult bird by wildlife traders from Thailand, and found chicks in fishing camps within the Upper Island Conservation Zone. Trade in this species and species products is clearly a threat and efforts are needed to enforce controls, in particular at markets.

Lesser Adjutant *Leptoptilos javanicus*
Global status: Vulnerable
Two Lesser Adjutants were observed flying past Koh Khon Keo and Koh Khon Kham. Local people reported that they occasionally see this species flying and feeding near the water bodies of Koh Khon Keo, Koh Khon Kham and Preah Sakhon. Sous Chanphal reported seeing the species near his rice fields by the deciduous dipterocarp forest of Phoum Krom village. No information was obtained on the breeding status of the species within the Ramsar Site.

Oriental Darter *Anhinga melanogaster*
Great Cormorant *Phalacrocorax carbo*
Indian Cormorant *Phalacrocorax fuscicollis*
Little Cormorant *Phalacrocorax niger*
These four species are treated together as they are often found in mixed groups. Small groups of 3-5 individuals were observed in the inundated river woodlands in the main Mekong River. They were also observed in large mixed groups of more than 30 individuals. Sous Chanphal and Keo Choam suggested the species is migratory and that they move back to the Stung Treng area around the time of the survey in January/February. It is rare to see these species nesting, but roost trees were commonly observed along the main stream, particularly at the northern part of the Site. Mr. Ny Vy (from Koh Chheuteal Touch) reported these species roosting in mixed groups and nesting in Preah Sakhon. He

[9] Based on interview with Mr. Choum Nhib, deputy chief of Community Fisheries of Krala Peas.
[10] Reported by Keo Chorm, Ramsar ranger.
[11] Keo Choam, Ramsar Ranger and Sous Chanphal, boat driver

indicated that in Preah Sakhon the eggs were not collected by local people because the nests were too high and difficult to access. Adult birds are not popular for consumption as the meat often smells bad.

Main threats are disturbance of roosting and nesting sites but chick and egg collection is not considered a major problem as it is with other species such as the Hill Myna and Parakeets.

Woolly-necked Stork *Ciconia episcopus*
Conservation Status: Regionally Threatened
Although only two individuals of this species were recorded during this survey they are reported as being common within the upper island area. One individual was observed on the ground near Koh Khon Keo and Koh Khon Kham and the other one was seen in flight near Koh Khon Thao. Local people report that this species is using similar habitats as the Lesser Adjutant. No information was obtained to confirm if the species breeds within the Stung Treng Ramsar Site.

Great Thick-nee *Esacus recurvirostris*
Conservation status: Least Concern
Local reports[12] indicate that this species nests on the ground (on sand bars) between February and March with clutches of about 4 eggs. Eggs are easily destroyed by dogs or people trampling on their nests. The birds and their eggs are collected for consumption but not for sale. One individual was observed on a sand bar, east of Koh Chheuteal Touch.

The key threat to the species is likely to be the collection of eggs, chicks and adults. Trapping is reportedly relatively easy, as the bird can be caught by placing snares near nests. Timmins (2006) indicates that the species has declined in many areas where there is intensive human use, and is at moderate risk mainly from nest disturbance and predation by domestic dogs and people, perhaps exacerbated by clearance of woody channel vegetation.

River Tern *Sterna aurantia*
Conservation status: Least Concern
River Tern were frequently observed in the proposed Preah Sakhon Core Zone and on sandbars close to Koh Chheuteal Touch, generally in groups of 4-6 individuals. Birds in breeding conditions were agitated by the presence of the survey team, possibly indicating the presence of nests nearby. Individuals were also observed digging small holes on the sandbars (presumably attempting to nest) on Preah Sakhon and Koh Chheuteal Touch. Local people reported that the species nests in the area between February and April. Timmins (2006) confirms this, reporting that birds had finished breeding and were moving around the Ramsar Site itinerantly towards the end of his March-April survey. Nesting requirements for this species are similar to the Great Thick-knee.

The species has undergone a major decline in Southeast Asia, once being common on many of the large rivers of Indochina. The Ramsar Site population is certainly the only significant population of the species within a conservation area in the combined areas of Indochina and Thailand (Timmins 2006).

Eggs are collected for local consumption but the main threat is thought to be from disturbance from human and dogs, and from trampling of nests. Reduction in the available sand areas for nesting due to smothering by the green algae may present an additional threat.

River Lapwing *Vanellus duvaucelii*
Conservation status: Least Concern
The River Lapwing was commonly observed in pairs feeding on the sand bars near water. Local people reported that it nests on the ground, in particular on sandbars where there is limited human activity. The nesting season is January to April.

Spot-billed Duck *Anas poecilorhyncha*
Conservation status: Least Concern
This species was commonly observed in the proposed Upper Island Conservation Zone, within the areas of Preah Sakhon, Koh Khon Keo and Koh Khon Kham. Timmins (2006) reported that it is resident and breeds within the Ramsar Site. Additional information on nesting behaviour was reported by Mr. Ny Vy who also collects the eggs for subsistence. In 2006 he collected 7 eggs from a hole in a tree in

[12] Mr. Ny Vy, key informant from Koh Cheuteal Touch

Preah Sakhon. He reported that the nests were usually made in dead trees about 1 m above the ground. He confirmed that within the proposed Upper Island Conservation Zone, Preah Sakhon is an important habitat for this species. The main threat is from the collection of eggs and disturbance of nesting sites.

7.3.2 Mammals

Smooth-coated Otter *Lutrogale perspicillata*
Conservation status: Vulnerable
In an earlier survey (Bambaradeniya *et al*. 2006) observed an otter (most likely Smooth-coated otter *L. perspicillata*) in the northern part of the Ramsar Site. Timmins (2006) commented that otters are already locally extinct and that the sighting was probably of an itinerant animal moving through the area. However, further reports during the current survey confirmed the likelihood that the record of Bambaradeniya *et al*. is of a resident animal. For example, fishers from the Preah Sakhon area, and the Ramsar ranger (who resides on Koh Khon Keo) independently reported sightings of 2 individuals during March 2006 swimming across the river at Kbal O'Talev about 300 m from southern boundary of the proposed Preah Sakhon Core Zone. These sightings suggest that there are no more than 2-3 individuals present as compared to earlier reports in the 1980s when animals were observed in groups of 8-12 individuals. Areas where this species occurred in the past include O'Talas, Koh Khon Keo and Preah Sakhon. It is thought unlikely that the current population is viable, or that it could recover at all without well-regulated anti-poaching measures.

Otters have suffered heavily in Cambodia, and throughout the wider region, from a lucrative trade in whole animals and in their body parts. They are used in traditional medicine within Cambodia (Poole 2003). Prices of more than USD100 per animal have been reported (Timmins 2006).

7.3.3 Reptiles

Siamese Crocodile *Crocodylus siamensis*
Conservation status: Critically Endangered
There were no direct sightings of crocodiles during the survey, though the survey team observed crocodile tracks on the west bank of Anlong Rusei amongst dense *Phragmites sp*p. A resident on Koh Rusei, Mr. Seng Heng, and the Ramsar ranger who is familiar with the area confirmed that the tracks belonged to the Siamese crocodile. The survey team also recorded reports from local people of crocodile sightings on the east bank of Anlong Rusei (2 adults, November 2006), west bank of Anlong Rusei (November 2006) and crocodile tracks on the southwest bank of Anlong Rusei (December 2006). Local fishers reported that they no longer use fish nets in Anlong Rusei due to their destruction by crocodiles.

Conservation threats: Prior to 1987, crocodiles were reportedly common in Veun Sean, Koh Chheuteal Touch, Krala Peas and Phoum Krom, and were still common in O'Talas and Anlong Rusei up until 1998. Crocodiles have decreased rapidly due primarily to the high market demand for crocodile skin and body parts both within the country and for export.

Management recommendations: It is uncertain whether a viable population of Siamese crocodiles remains within the Stung Treng Ramsar Site, and those that are present are probably limited to the proposed Anlong Rusei Conservation Zone. Strict monitoring and enforcement of anti-poaching measures is required, and it is unlikely that the population will survive within the Ramsar Site without active conservation intervention.

Turtles
Although Timmins (2006) reported a scarcity of both hard and soft-shelled turtles within the Ramsar Site (captive specimens were observed within O'Talas). This survey confirmed that the sandy banks on the eastern side of Koh Khon Kham provide an important nesting area for a large softshell turtle (possibly *Amyda cartilagenea;* Global status: VU). An empty nest was encountered during the survey and the team suspects that the eggs were taken recently.

Conservation threats: Nest poaching and over-exploitation of live animals are probably the key factors contributing to the rapid decline in turtles within the Ramsar Site. During their assessment on trade in wildlife resources, focussing on 4 Ramsar Site villages (three located within the proposed Upper Island Conservation Zone), Boonratana *et al*. (2005) documented several species of turtle that were subject to

trade. These included the Elongated Tortoise *Indotestudo elongata* (EN), Asian Box Turtle *Cuora amboinensis* (VU), Giant Asian Pond Turtle *Heosemys grandis* (VU), Malayan Snail-eating Turtle *(Malayemys subtrijuga* (VU), Yellow-headed Temple Turtle *Hieremys annandalii* (EN), Asian Leaf Turtle *Cyclemys dentata complex* (NE), Black Marsh Turtle *Siebenrockiella crassicollis* (VU), Asian Giant Softshell Turtle *Pelochelys cantorii* (EN) and the Asian Softshell Turtle *Amyda cartilaginea* (VU). It is likely that all species present are traded or locally consumed.

Conservation measures: Regulations or local agreements should be implemented to prohibit people from bringing dogs into the forest, especially fishermen who visit the islands and remoter beaches where turtles nest. Awareness should be raised as to the importance of these species given their globally threatened status – most members of the local communities will have no idea that these species have declined so dramatically over their entire ranges. Awareness-raising could be piloted at a few small sites initially, such as at O'Svay or Veun Sean villages. A nest protection scheme could also be initiated through the Ramsar Site rangers where local people are rewarded (conservation payment). Finally, trade in turtles in local markets should be monitored closely and people trading in threatened species should be informed that this is prohibited. It would be useful if identification sheets could be produced so that local people can identify the species of most concern so that they might be encouraged to no longer take these species.

7.3.4 Amphibians

During the survey, no consistent effort was made to document amphibians. However, Bambaradeniya *et al*. (2006) and Kong Kim Sreng (2006) have separately conducted brief amphibian surveys in the Stung Treng Ramsar Site. Only one species was reported as traded (*H. rugulosa*; Bezuijen *et al.* 2005b), but it is likely that many other species are present within the Ramsar wetlands, and that most are utilised on an opportunistic basis by households.

Table 28: Amphibians recorded in the Stung Treng Ramsar Site.

Species	Family	Local name	Locations	Red List status
Polypedates leucomystax	Rhacophoridae	Kanh Chanh Chek Thomada	Trapaeng Ytha Trapaeng Chouk	**LC**
Rana macrodactyla	Ranidae	Kang Keb Srov Kang Keb Sre Kang Keb Ach Ko	Trapaeng Ytha Trapaeng Chouk	**LC**
Limnonectes kuhlii	Ranidae	Kang Keb Toch Chhnot Khnorng	Trapaeng Ytha Trapaeng Damrei Ngeab Trapaeng Chouk	**LC**
Occidozyga lima	Ranidae	Tror Lorn, Torn Lima	Trapaeng Ytha Trapaeng Damrei Ngeab Trapaeng Chouk	**LC**
Rana erythraea	Ranidae	-	Banks/edge of islands with seasonally inundated forest	**LC**
Hoplobatrachus rugulosus	Ranidae	Kang Keb Kob	Trapaeng Ytha Trapaeng Damrei Ngeab Trapaeng Chouk	**LC**
Microhyla pulchra	Microhylidae	Kang Keb Krob Khlok	Trapaeng Ytha	**LC**

Note: Amphibiaweb (http://amphibiaweb.org/) records 44 species for Cambodia.

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Plate 7: Boys hunting frogs.

Plate 8: Frog harvest.

7.3.5 Fish

Information on fish utilisation was collected through a combination of interviews and additional information obtained from the Sala Phoum community research project (see Annex 3) which identified 130 fish species (97 of which have so far been identified to species level). Given the importance of the freshwater fishery to both the livelihoods of communities within the Ramsar Site and to the national economy and food security, it is vital that the resource is better managed and that more information is collected on the distribution and conservation status of species.

As well as over-exploitation, a current major threat to fish and the associated fisheries is the alteration of river flows and migration routes (many of these species are migratory) through planned hydroelectric dam schemes both above and below the Site.

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Plate 9: Catfish.

7.3.6 Molluscs

Although a comprehensive survey was not conducted, 19 mollusc species were sampled during the survey, although only 13 have been identified to date (see Table 29, below). The collection of molluscs (gastropods and bivalves) is an important subsistence activity for both household consumption and local trade (four unidentified species were observed in the TRAFFIC trade report (Bezuijen *et al.* 2005)). Annex 6 provides a full list of species of molluscs documented during this survey. Molluscs' total contribution to livelihoods within the proposed Upper Island Conservation zone was, however, not assessed. Although none of the species identified have yet had their conservation status assessed it is thought unlikely that the present scale of collection represents a conservation risk.

In summary, it is highly likely that this survey of the mollusc fauna of Stung Treng greatly under-represents the true species diversity of the area. A wider variety of habitats should be searched across the whole wetland Site. The survey did not sample freshwater shrimps, and a number of these appear in the Stung Treng market; *Macrobrachium rosenburgi, Macrobrachium hirsutimanus, Macrobrachium niphani, Macrobrachium sp.* (Chavalit, pers. com). In addition to a number of other shrimp species, it is likely that a range of crabs are present within the Site, and further survey work is required.

Table 29: Identified molluscs collected during the survey work in Stung Treng Ramsar Site

Scientific name	English name	Local name	Use
Filopaludina martensi	Pond Snail	Kchao Thmor	Common. Household consumption. If excess, sold for 1 milk can = 300 *Riel*.
Filopaludina martensi cambodjensis	Pond Snail	Khao romors	Occasional household use
Brotia costula	Thairid snail	Kchao Oklanglang	Household consumption only. Favoured species
Hemiplecta distincta	Land snail	Khyorng Sork	Not consumed
Pilsbrychoncha exilis	Freshwater mussel	Krum	Household consumption only.
Mekongia swainsoni flavida	River Snail	Kchao Ksach	Common. Household consumption and sale (1 milk can = 300 *Riel*)
Corbicula spp.	Sand clam	Leas	Common. Household consumption and sale (1 milk can = 300 *Riel*, or dried for 500 *Riel*)
Hyriopsis (Limnoscapha) bialatus	Wing Mussel	Krum Srouch	Household consumption
Limnoperna sp.	Freshwater mytilid	Kchao Torng	Household consumption
Pseudodon vondembuschianus	Freshwater mussel	Krum O	Household consumption
Pomacea canaliculata	Golden apple snail	Khyorng Krahorm	Common throughout Ramsar Site. Household consumption
Hyriopsis (Limnoscapha) bialatus	Wing Mussel	Krum Srouch	Household consumption only
Pila ampullacea		Khyong Moit Thom	Household consumption only

A total of 19 species were sampled, though 6 of these could not be identified. Almost all molluscs within the Site are consumed, either within the household or at the local scale.

7.3.7 Odonata

Odonata were sampled on an occasional basis during several of the project fieldtrips within the Ramsar Site, and a preliminary checklist of Odonata was compiled by Kong Kim Sreng (2006). Although no comprehensive survey was conducted a total of 17 species of Odonata were identified during the fieldwork, with a small number of unidentified individuals observed but not identified due to the lack of clarity of the photographs. Although limited in extent, this is the first ever compilation of baseline information on Odonata within the Ramsar Site. Besides contributing to the complex food web of the wetland ecosystem, there is little or no evidence to directly link Odonata to subsistence for rural livelihoods, although in some parts of Asia income is generated through the capture and sale of specimens to collectors. As with other taxa, this collection can lead to localised extinctions of high value or charismatic species. Odonata were included in the survey due to the relative ease with which they can be surveyed and, because of their vulnerability to habitat degradation and loss, they are often used as bioindicators for the health of wetland ecosystems. Local people do not distinguish between species but refer to the various species of Odonata generically as *Ketom Roy*.

Plate 10: *Euphaea masoni*

Plate 11: *Trithemis aurora*

Plate 12: *Camacinia gigantea*

Of the 17 odonata identified to species level, only one *(Pantala flavescens*, LC*)* had been assessed at the global level (IUCN Red List). Odonata are generally understudied, and the majority of species have not yet had their conservation status assessed.

Table 30: Odonata species observed within the Stung Treng Ramsar Site.

Species	Family	Red List Status
Vestalis gracilis	Calopterygidae	**NE**
Aristocypha fenestrella	Chlorocyphidae	**NE**
Agriocnemis nana	Coenagrionidae	**NE**
Euphaea masoni	Euphaeidae	**NE**
Brachythemis contaminata	Libellulidae	**NE**
Camacinia gigantea	Libellulidae	**NE**
Crocothemis servillia	Libellulidae	**NE**
Diplacodes trivialis	Libellulidae	**NE**
Macrodiplax cora	Libellulidae	**NE**
Neurothemis fulvia	Libellulidae	**NE**
Orthetrum sabina	Libellulidae	**NE**
Palpopleura sexmaculata	Libellulidae	**NE**
Pantala flavescens	Libellulidae	**LC**
Potamarcha congener	Libellulidae	**NE**
Rhodothemis rufa	Libellulidae	**NE**
Trithemis aurora	Libellulidae	**NE**
Trithemis festiva	Libellulidae	**NE**

Almost all species recorded occur in open standing water habitats, with the exception of *Euphaea masoni* which is a stream species, although most will also be found near flowing water. With 4 exceptions, they are all members of the family Libellulidae. This reflects the nature of the sampling effort which was opportunistic alongside other survey activities, and primarily focused on the main water channel and associated habitats. A much greater diversity of Odonata species would be expected within other wetland habitats such as forest and woodland (many tropical species occur within forest habitats at low densities), smaller streams, and seasonal pools away from the main channel. In Indochina, even on streams in open agricultural land, with few trees or large shrubs along the water course, it would be normal to find quite a large number of species from a number of families that are not represented in the above species list e.g. Calopterygidae, Chlorocyphidae, Protoneuridae, and Gomphidae. Seasonality of sampling effort would also be significant; a larger number of species would be expected in the main channel during the dry season when more potential habitats are exposed and water flows are slower.

In summary, it is highly likely that this survey of the odonate fauna of Stung Treng greatly under-represents the true species diversity of the area. A wider variety of habitats should be searched across the whole wetland Site.

7.3.8 Aquatic vegetation

Aquatic vegetation in the Upper Island Core Zone has been described in brief in the section discussing the main habitat features at the beginning of this chapter. To date, no detailed systematic vegetation survey has been conducted in the Stung Treng Ramsar Site. A great many species of aquatic plants are harvested for local use. Time constraints have unfortunately prevented any attempt to quantify the contribution of these plant species to livelihoods.

The table below (from Bezuijen *et al.* 2005) summarises plant or plant-based products observed for sale within the markets at Stung Treng and Veun Kham (at the Laos border). Not all are strictly aquatic in habitat requirements, but most are likely to have been soured from the Wetlands within the Stung Treng Ramsar Site. Unfortunately, none are presently identified to species level.

Table 31: Plant and plant-based products observed for sale at the Stung Treng and Veun Kham markets (both close to the Stung Treng Ramsar Site, Cambodia).

Lao Name	Khmer Name	Use	Unit	Veun Kham USD/Unit	Stung Treng USD/Unit
Dok Kae	Anh-kia-dae	Food	Fresh flowers (c.10)	0.05	
Mak ka-tin	Ka tom-tet	Food	Seeds (c.12)	0.05	
Mak Bok		Food	Fresh bunch, seeds	0.05	
Mak Mua		Food	Fresh seed pod (2)		0.10
Mak Jong		Food	Seed per kg	3.00	
Buak Xin Cam		Medicine	Fresh strips of red tree bark (6-7)		0.05
Xi Xiet		Medicinal	Fresh strips of grey tree bark (2)	0.05	
Pua Ham Au		Medicinal	Rolled tree bark strips, fresh, packet (c.14)	0.05	
	Kham Khon Chai	Medicinal	Chipped tree bark, packet	0.30	0.38
Mua		Medicinal	Tree bark, fresh strips (c.2)	0.05	
	Chun Lok/Priel	Lighting	Dipterocarp resin sticks, leaf rolls (7-8)	0.20	0.15
		Food	Root of ginger, fresh, one piece	0.10	
Mak Mat		Food	Root, fresh, five pieces	0.30	
Ha Een Lon		Medicinal	Root, fresh, c.15 pieces	0.30	
	Nam Chum	Medicinal	Rhizome, per kg		1.25
	Bong Khi	Medicinal	Dried root, two pieces		0.13
	Se Chkay Sraeng	Medicinal	Dried root, three pieces		0.13
Pak Kin-nya	Truei Song Khoui	Food	Fresh leaves, 15 stems		
Nyort Mak Uut	Truei Con Dot	Food	Fresh leaves, c.10	0.05	
	Tra Dot	Food	Fresh leaves, 6-7 stems		0.13
Ka-Done	Riaeng	Food	Fresh leaves		
Pak Hut	Lak Cho Plu	Food	Fresh leaves		
	Swai	Food	Mushroom, fresh, c. 200g		0.25
	Sut Prik	Food	Mushroom, fresh, c. 100		0.08
	Run Sai	Food	Mushroom, fresh, c.10		0.08
	Thum Phaeng	Food	Bamboo, fresh stems, per kg	0.05	0.38
		Food	Bamboo, fresh sections		
	Tro Kune	Food	Water plant, fresh		
	Pro Lut	Food	Water lily, fresh stems, c.6-7		0.25
	Wam Bando	Food	Vine, fresh stems, 9-10		0.25
	Tich	Food	Vine, fresh bunch		0.13

Source: from Bezuijen *et al.* 2005

Sampling for aquatic vegetation in this survey was conducted primarily to contribute to the baseline information for Stung Treng. During this assessment, sampling was conducted in Koh Khan Kheo, Koh Khan Kham and Preah Sakhon. While some specimens have been identified, others are pending.

7.3.9 Significant non-fish species present

A large number of regionally or globally threatened species have been found or are assumed to be present within the Upper Island Conservation Zone of the Stung Treng Ramsar Site. All the species shown in Table 32 below, are either listed under CITES (Annex I or II), or have been assessed as threatened according to the IUCN Red List. These include the globally threatened White-shouldered Ibis *Pseudibis davisoni* (CR), Spot-billed Pelican *Pelecanus philippensis* (VU), Lesser Adjutant *Leptoptilos javanicus* (VU); Eld's Deer *Cervus eldii (*VU*),* Siamese Crocodile *Crocodylus siamensis* (CR), and a number of threatened turtles and tortoise.

Table 32: Significant non-fish species recorded in the Ramsar Site (as recorded by Timmins (2006) supplemented by information Bambaradeniya *et al.* (2006) and Singh (2007))

English Name	Scientific Name	Darwin survey	Conservation Status	Ramsar Site status
Green Peafowl	*Pavo muticus*	T	VU	Present
Spot-billed Duck	*Anas poecilorhyncha*	S	Regionally threatened	Common
White-bellied Woodpecker	*Droops javensis*	S	Regionally threatened	Frequent
Oriental Pied Hornbill	*Anthracoceros albirostris*	S	Regionally threatened	Common
Pied Kingfisher	*Ceryle rudis*	S	Regionally threatened	Local
Blue-tailed Bee-eater	*Merops philippinus*	S	Regionally threatened	Common
Alexandrine Parakeet	*Psittacula eupatria*	S	Regionally threatened	Present
Blossom-headed Parakeet	*Psittacula roseata*	S	Regionally threatened	Common
Barn Owl	*Tyto alba*		Regionally threatened	Present
Brown Fish Owl	*Ketupa zeylonensis*		Regionally threatened	Common
Spotted Wood Owl	*Strix seloputo*		Regionally threatened	Common
Orange-breasted Green Pigeon	*Treron bicincta*	S	Regionally threatened	Present
Yellow-footed Green Pigeon	*Treron phoenicoptera*		Regionally threatened	Common
Green Imperial Pigeon	*Ducula aenea*		Regionally threatened	Common
Eurasian Thick-knee	*Burhinus oedicnemus*		Regionally threatened	Present
Great Thick-knee	*Esacus recurvirostris*	S	Regionally threatened	Common
River Lapwing	*Vanellus duvaucelii*	S	Regionally threatened	Common
Small Pratincole	*Glareola lacteal*	S	Regionally threatened	Local
River Tern	*Sterna aurantia*	S	Regionally threatened	Common
Brahminy Kite	*Haliastur indus*	S	Regionally threatened	Common
Grey-headed Fish Eagle	*Ichthyophaga ichthyaetus*	S	NT	Common
Darter	*Anhinga melanogaster*	S	NT	Common
Little Cormorant	*Phalacrocorax niger*	S	Regionally threatened	Common
Indian Cormorant	*Phalacrocorax fuscicollis*		Regionally threatened	Common
Great Cormorant	*Phalacrocorax carbo*		Regionally threatened	Common
Grey Heron	*Ardea cinerea*	S	Regionally threatened	Common
Black-crowned Night Heron	*Nycticorax nycticorax*		Regionally threatened	Common
White-shouldered Ibis	*Pseudibis davisoni*	S	CR	Frequent
Spot-billed Pelican	*Pelecanus philippensis*		VU	Present
Woolly-necked Stork	*Ciconia episcopus*	S	Regionally threatened	Frequent
Lesser Adjutant	*Leptoptilos javanicus*	S	VU	Occasional
Swinhoe's Minivet	*Pericrocotus cantonensis*		Regionally threatened	Present
Hill Myna	*Gracula religiosa*	S	Regionally threatened	Common
Mekong Wagtail	*Motacilla samveasnae*	S	NT	Common
Baya Weaver	*Ploceus philippinus*		Regionally threatened	Local
Long-tailed Macaque	*Macaca fascicularis*		NT; CITES II	Occasional
Eld's Deer	*Cervus eldii*		VU; CITES I	Present
[Sambar]	*C. unicolor*		Regionally threatened	Local
Smooth otter	*Lutrogale perspicillata*		LR; CITES II	
[Siamese Crocodile]	*Crocodylus siamensis*	T	CR; CITES I	Present
[Asiatic Rock Python*]	*Python molurus*		II	Present
[Reticulated Python*]	*Python reticulatus*		II	Present
[King Cobra*]	*Ophiophagus hannah*		II	Present
[Monocellate Cobra*]	*Naja kaouthia*		II	Present
[Water Monitor*]	*Varanus salvator*		II	Common
[Bengal Monitor*]	*Varanus bengalensis*		I	Common
[Yellow-headed Temple Turtle*]	*Hieremys annandalii*		EN; CITES II	Rare
[Elongated Tortoise*]	*Indotestudo elongata*		EN; CITES II	Rare
[Asian Box Turtle*]	*Cuora amboinensis*		VU; CITES II	Rare
[Giant Asian Pond Turtle*]	*Heosemys grandis*		VU; CITES II	Rare
[Malayan Snail-eating Turtle*]	*Malayemys subtrijuga*		VU; CITES II	Rare
[Asian Giant Softshell Turtle*]	*Pelochelys cantorii*		EN; CITES II	Rare
[Asiatic Softshell Turtle*]	*Amyda cartilaginea*		VU; CITES II	Rare

Notes:
T-Tracks; S- Sightings; V – Vocalisation; LR – Local reports. […] species expected present but not observed
Survey information supplemented by Timmins 2006, Bambaradeniya *et al.* 2006
*Reptile data from Singh (2007).

7.4 Biodiversity resource use patterns and issues

Fishing is the main extractive activity within the Upper Island conservation area. Surveys by Sala Phoum (in preparation) revealed that people from 3 villages (Koh Sneng, Koh Langor, and Veun Sean) generally fish all year round within the proposed Upper Island conservation area. Information collected

by village researchers indicates that the village fishing grounds are distributed throughout the Ramsar Site (see Map 7). Collection of other non-fish wetland products is both intentional and opportunistic. Boonratana *et al*. (2005) provided information on trade in both aquatic and non-aquatic wildlife and plant products based on 4 villages in the proposed Upper Island Conservation Zone.

7.5 Issues and concerns

Major concerns for people in the upper island proposed conservation zone include:

- the degradation of key fishery resources, such as the deep pools of the Mekong,
- loss of access to forest resources as a result of commercial land and forestry concessions,
- the impacts of environmental change as a result of upstream water resource development.

Additionally, people in the proposed conservation zone face many other impacts of poverty: poor health and lack of access to basic health care services, lack of access to safe drinking water, low agricultural productivity and lack of access to state extension services, weak links to markets, poor communications and low income generating opportunities. One study on consumption poverty states that, if defined as:

> *Having insufficient cash income (or its equivalent in kind) to meet basic livelihood needs, 47% of households [in Stung Treng] are below the consumption poverty line. These households will struggle to have enough cash available to buy food needs on the market and to meet other expenditure needs such as health services.* (UNDP 2004).

Whilst on one hand contributing to local livelihoods, unsustainable harvesting of a range of species (primarily fauna) has taken some close to extinction. The demands of local and regional markets, lack of regulatory mechanisms, and the general situation of the 'tragedy of open access commons' has been the main causes for these species declines.

Almost all species have some direct economic importance and Sarinda (2006) notes that demands for different species have played and significant role in pushing them close to local extinction, citing the case of the Long-tailed Macaque as an example. The key aquatic species that appeared to have faced the same fate include the Siamese crocodile*,* otters and turtles[13].

7.5.1 Land issues

Settlers have traditionally moved into fertile agricultural lands, rich forests and areas with productive fisheries. Rivers have long been used as transport routes for trade and exchange. These early settlers would have been highly mobile exploiting a range of wild food sources from a variety of habitats at different times of the year. Existing communities living in the Upper Island Conservation Zone continue to be highly migratory for both off farm and on farm activities[14]. With an increasing population density and declining resource base, migration is constrained by resource and land availability.

Availability of paddy land is a serious limiting factor in many of the villages of the Upper Island Conservation Zone and throughout the entire Ramsar Site, and is a major cause of vulnerability. The pioneering of new lands is a cause of habitat degradation. It is not uncommon for more than 50% of households in a village to be without paddy land and to have limited access to agricultural land for crop production in general. Villagers from Koh Chheuteal Touch farm a total of eight nearby islands[15] (see Table 33) on both a seasonal and permanent basis.

Although the gallery forests along Koh Khon Kham are still in relatively good condition there were signs of forest clearance for settlement and agriculture. Koh Khon Kham in particular has attracted new settlers.

Migrants who choose to settle permanently are often particularly vulnerable without land or sufficient household assets to sustain their livelihoods. Furthermore, there are large inequities in the quantity and quality of agricultural land available to individual households. Both the extent and fertility of agricultural land limit crop productivity and thus food availability for many rural households.

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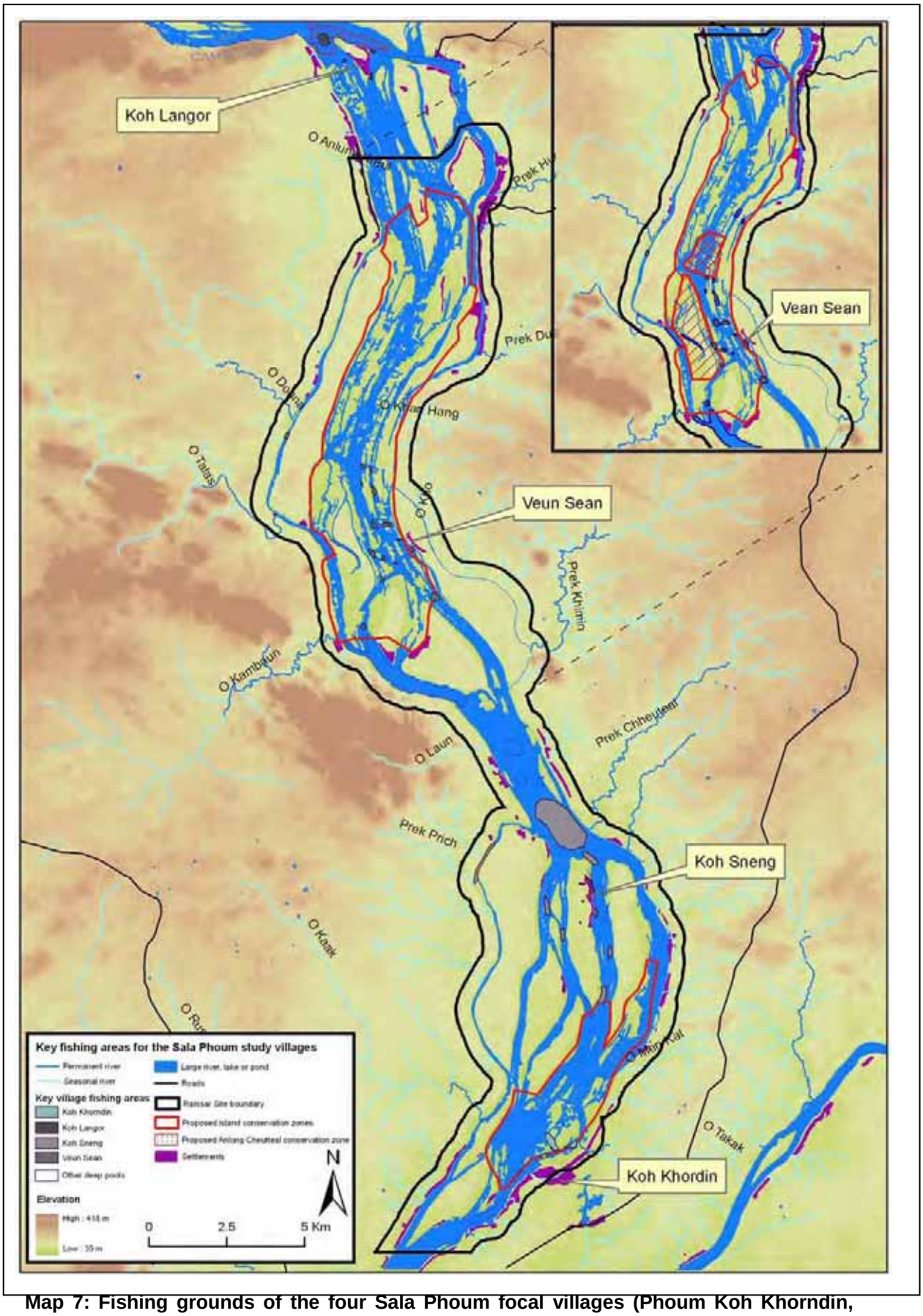
[13] Based on discussions with local villagers in Koh Kankeo and Veun Sean

[14] In one village, Koh Chateal Touch, 56 of a total 86 households engage in permanent or seasonal agriculture on one or more of eight river channel islands.

[15] Veun Soht, Koh Ka kii, Koh Vaeng (long island) , Koh Tonsay (rabbit island) , Koh Ko Tao, Koh Khorn Kam or Boung Kvek, Koh Ko & Kok Russei.



Map 7: Fishing grounds of the four Sala Phoum focal villages (Phoum Koh Khorndin, Phoum Koh Sneng, Phoum Veun Sean and Phoum Koh Langor) within the Stung Treng Ramsar Site. The inset map shows the proposed Upper Island Conservation Zone.

Table 33: Channel islands used for farming by villagers of Koh Chheuteal Touch.

Channel Island	Households	When	Crop
Veun Soht	21-25	Dec-Apr	Tobacco, Chilli, Eggplant, Spring onion, Sugar cane
Koh Vaeng	4-5	Oct-Apr	Tobacco, Chilli, Eggplant, Spring onion, Sugar cane
Koh Kaki	2-3	Oct-Apr	Tobacco
Koh Tao	3-4 (poor)	Dec-Apr	Tobacco
Koh Ko	2	All year	Rice, Tobacco, Chilli, Eggplant, Spring onion, Sugar cane
Koh Com / Koh Tonsay	2	Jun-Oct Dec-Apr	Rice Tobacco
Koh Rusei (nr KTT)	?	Dec-Apr May-Oct	Tobacco, Chilli, Eggplant, Spring onion, Sugar cane, Rice
Koh Khon Kham (Boung Kvek)	4	All year	Rice, Chilli, Eggplant, Spring onion, Sugar cane
Koh Khon Kham and Other locations	6	All year Dec-Jan Jul-Sept	Roof grass, Mushroom, and Bamboo shoots

A common “safety net” employed by households with insufficient farmland or rice is to rely on increased fishing effort when other resources are scarce. In the event of a decline in fish productivity or access restrictions to the fishery there are few, if any, alternatives. Families may be unable to meet their basic needs in the village and be driven to pioneer new lands elsewhere. These pioneers often have no legal rights, land tenure or access to basic services. Many households have been forced through lack of land to pioneer new channel islands, clearing forest and forming new settlements with resulting impacts on habitat integrity.

7.5.2 Fishery issues

As discussed above, aquatic products such as fish form a vital component of people’s livelihoods providing an important source of nutrition (forming the largest source of animal protein in peoples diets) and income, a critical safety net in times of food insecurity, especially poorer groups. In addition, improved fisheries management has great potential through sustainable and equitable production to contribute to poverty reduction throughout the Site (Dubois 2005).

Reliable information on the status of fishery stocks is not available but the general consensus is that fish catches are declining over time. Given that the total fish catch in Stung Treng has been over time, it may be that the average catch per fisher has declined as more people are now fishing and fishing for trade as well as subsistence (MRC 2003)[16]. It is also likely that improvements to fishing gears are at least in part also responsible for the rise in fish catches.

A widely held belief amongst fishers is that many species of fish are now considered to be in decline. The Sala Phoum data to date records 130 fish species[17]. Five of these are classed as being abundant, 80 as medium, and 32 as rare. From a temporal perspective even over the last year, Sala Phoum researchers have found that just two species are recorded as having increased in number, 28 have remained the same, whereas 89 are believed to have decreased.

Reasons cited for this decline vary, the most common of which are; increased fishing pressure, use of illegal fishing gears and inappropriate concessionary rights. We discuss these in turn using examples from the proposed Upper Island Conservation Zone and adjacent areas.

[16] The concern would then be whether total catches have exceeded maximum sustainable yields (see Baran 2005).
[17] See Annex 6.

Box 9: **What are the drivers of settlement?**

A common response from pioneers when asked about their livelihood status before and after permanently settling new lands is that things are improving now! Families will not normally leave the village institution. The cultural, economic and social fabric of life is a network of relational threads, interwoven and consolidated through worship, work, festivals and other affirming interactions. To give this up and move away from family and friends and the security of an institutional structure that assists with providing services such as marketing, health and education is often a last resort--desperate actions cede desperate measures. However, the positive change in livelihood status people mention is, their ability to engage in farming and related activities such as livestock raising, as a compliment to their diverse portfolio of existing livelihood strategies. Food security is commonly enhanced (which seems to be on the surface at least the most critical indicator), despite long periods of insecurity still being widespread, but on balance for now at least; these new permanent residents are on the up! The question is, given the status and trends in resource decline, and the lack of supporting services and infrastructure, for how long?

7.5.3 Increased fishing pressure

MRC (2006) highlights the changing patterns of aquatic resource use being driven by infrastructure, improved fish storage, better transport facilities, and more effective gear. They quote one fisherman from Koh Khong as saying;

> *Fishing pressure has increased - not necessarily because there are more fishermen but because fishermen use more and better fishing gear.*

Vannara (2003) discusses the issue of illegal fishing as follows:

> *Fishing exploitation by using illegal tools not only destroys fish resources but it also creates a bias towards violent conflicts between rural communities and violators.*

and;

> *Illegal fishing has been widespread in Stung Treng, and this has affected the fisheries and local people's livelihoods... But what is most surprising is that the provincial authority has sold off streams to private companies. The companies have denied the local people access to these streams for fishing and subsistence living.*

7.5.4 Inappropriate and illegal concessions: the case of O'Talas in the Upper Island Conservation Zone

Mr. Kham Van, a fisher in Phoum Leu village, Stung Treng province, described the concession as being responsible for wiping out the fish stocks and threatening the fishery and forest–based livelihoods of thousands of village people. Although we were unable to directly confirm if this concession is still operating, an interview with one household in O'Talas suggested that it is still in force and continues to have a significant impact on the fishery and local people's livelihoods. Local communities from 8 communes in Stung Treng rely on O'Talas for fishing for their living.

Facing the problems discussed above and other issues, it seems clear that any decline in the fishery (in addition to increasing inequity of access to the resource) will be borne most heavily by those most reliant on the resource, whom are often the poorest in communities.

Management Recommendation

It is recommended that local communities and the State should engage in co-management of the fishery through community fisheries organisations, perhaps with the support of participative research (e.g. Sala Phoum) as a strategy for reducing livelihood vulnerability, and degradation of the resource base. Despite efforts by the Cambodian government, current community fisheries practices and structures continue to face a range of challenges, including the lack of supporting legislation and financial support for implementation.

Box 10: The impact of the O'Talas fisheries concession

The 40 km O'Talas stream is the largest tributary of the Mekong River between the provincial capital of Stung Treng and the Mekong's entrance into Northeast Cambodia. The O'Talas stream has long been recognised as an important area for aquatic and forest resources in the Ramsar Site (Try & Chambers 2006; Baird 1994). The stream is an important spawning ground for fish and an important fishing ground for local communities. In 1998, an influential businessman paid high-level provincial officials to approve a fishing concession that blocks the stream at its confluence with the Mekong – the blockage violates a Prime Ministerial resolution banning fishing concessions along this stretch of the Mekong and its tributaries".

The village people oppose the blockage of their fishing grounds. The O'Talas stream is one of the tributaries of the Mekong River located upstream of Stung Treng provincial town. It is an important feeding and spawning habitat for fish. The fish enter the stream from the Mekong for feeding and spawning. After the rainy season, the fish return to the Mekong. So this stream can provide a lot of fish for village people during the fishing season every year. The stream is very long so people rotate their fishing areas in the stream to catch different kinds of fish. We would normally spend a few hours to catch fish then go back to work in the rice fields. Some families rely mainly on the fish which they also sell for cash. Some fish are sold in Laos. Previously, we never sold the fish we caught but shared it within our community with other people who did not have fish to eat. Last year, the Governor of Stung Treng province sold the stream to a fishing concessionaire and since then local fishers have not been able to enter the O'Talas stream. This year, the stream continues to be blocked by the fishing companies. They use a manh, a large net across the mouth of the stream that catches even the very small fish.

Since last year, several villages located along the Mekong River are affected, as they cannot access the fishing in the O'Talas stream. All of these villages always caught fish in O'Talas but now they do not have enough fish to eat. Now, we must try to catch fish in other areas away from O'Talas.

Source: 'Watershed' periodical 2007

7.6 Fish trade and market dynamics

The major market outlets for fish caught in the proposed Upper Island Conservation Zone are:

- Veun Kham and Veun Khao Markets (Cambodia-Lao border market)
- Stung Treng town market

It is estimated that 3-4 tonnes of the fresh fish are traded daily at the Veun Kham market. Most of this is caught within the proposed Upper Island Conservation Zone area, largely by small-scale fishers. During the *trey riel* fishing season processed fish are taken to the Veun Kham market. Most fisher households are engaged in preparation of p*ra hok* which fetches a market price of about USD10 per jar (25 kg). The fish catch across the Upper Island Conservation Zone varies according to season, gear type and fishing site.

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Plate 13: Selling the catch at Stung Treng market..

Fish brought at the Lao-Cambodia boarder markets are ultimately transported towards larger markets in Thailand via the Pakxe-Ubon Rajathani market. Despite the large scale of fish (and other wetland products) caught and traded in the area, fish trade at the Cambodia-Laos market is officially illegal, but practice is a completely different issue.

Fish prices are ultimately guided by trading activities at these two wholesale fish markets located outside the Ramsar Site. An understanding of these cross-border fish trading issues (international trade) will be essential to any long term management of wetland resources.

7.6.1 Market structure and channels

Most of the fish caught (over 90% during the main fishing season) in the proposed Upper Island Conservation Zone is transported to the Veun Kham market, and ultimately to the wholesale markets in Thailand or Viet Nam. Therefore, activities at the regional and international fish markets influence the fish prices in the Upper Island Conservation Zone and ultimately affect cash income and the livelihoods of many fishers in the Ramsar Site.

An estimated 6-7 large-scale fish traders operate in and around the lower part of the Upper Island Conservation Zone. The scale of operation of these fish traders varies, with some supplying 100 kg of fish to the border market on alternate days, whilst others supply over 200 kg every day. Fish prices are summarised in Table 34.

In nearby Preah Sakhon, 4 to 5 large-scale fish traders collect fish from their network of village traders who they provide with the necessary storage facilities, such as ice boxes.

Traders who have direct access to the Veun Kham boarder market pay fishers a higher price, c.1000 *Riel* per kg more than those traders who only have access to the Veun Khao market in Cambodia. This reduces the competitiveness of the small-scale traders who cannot access the Lao market. In addition, gasoline costs have increased sharply over the years, and this has greatly affected the dynamics of market structures and market channels of fish trading business in the Ramsar area.

Some major issues and concerns on fish trading in the Upper Island Conservation Zone are summarized below.

- A recent increase in algae in the area is thought responsible for reduced catches and is a concern.
- Increased numbers of fishers in the area with resultant increased fishing pressure.
- Policy failure and inefficient government regulations
  - The price of fish declined in the wet season of 2006 due to a ban on fish trade in the area
  - Police at the Veun Khao checkpoint arrest and fine local fish traders who directly sell to the Lao market. All fish must be sold to a newly established Cambodian wholesaler (ex-security personnel) who then sell it on to Lao PDR.

The increased regulation and restriction on the fish trade on the Cambodian side at the border market has led to a rapid change in the structure of the fish trade. Fish trading is becoming more and more concentrated in terms of scale of operation.

Table 34: Fish prices in Preah Sakhon (29 January 2007), as given by the trader operating at the fishing campsite south of Preah Sakhon.

Fish Grade	Fish Price	Major Species	Remarks
Grade 1	14,000 *Riel* (Buying) 15,000 *Riel* (Selling)	Trey Kya (up to 3kg), Trey Kess	Fish of large-size (>3 kg) are in high demand at Veun Kham market.
Grade 2	7,000 *Riel* (Buying) 8,000 *Riel* (Selling)	Trey kya, Trey kess, Trey ke	
Grade 3	4,500 *Riel* (Buying) 5,500 *Riel* (Selling)	Trey Chhang, Trey Po, Trey Pava, Trey Ka ek, Trey Chpeun, Trey Chkok, Trey Glass carp	

Note: Buying price is at the campsite, and selling prices are at the Cambodian boarder market (Veun Khao).

A significant price difference between the Stung Treng Market and Veun Kham market (was recorded, as high as 3,000 to 4,000 *Riel*/kg for Grade 1 category fish. Prices vary on a daily basis depending on the availability and demand for fish.

Possible reasons for difference in fish prices between Stung Treng market and Veun Kham market are;

- High demand from Thailand. Higher demand at the tertiary market ultimately leads to an increased price at the local markets, such as at Veun Kham.
- Fish prices in the Stung Treng town market are largely determined by local demand and the prevailing fish price in the Phnom Penh market.
- Fish prices at the landing market in Stung Treng are usually 30-40% lower than those at the nearby town wholesale market. This possibly indicates inefficiency in fish marketing channels and existence of some structural problems (infrastructural constraints, and information asymmetry) in fish marketing system in Stung Treng town market.

7.7 General conclusion and recommendations regarding zoning

The proposed Upper Island Conservation Zone is clearly an area of significance from a biodiversity perspective. The diversity of habitat complexes within the area provides a range of ecosystem services and hosts a wide variety of threatened species. Fishing is generally the main livelihood activity (particularly of the poor) but collection of other wildlife and plant products is also important for both subsistence and trade. Landlessness and poverty are the key drivers of migration and the pioneering new lands. Large inequities prevail with regard to quantity and quality of agricultural land available to households in the vicinity of their villages.

Although previous studies have indicated no major decline in fish catches, people living in this area suggest otherwise. Factors contributing to the reported declines in fish catch include increasing number of fishers, illegal fishing activities, inappropriate allocation of concessionary rights and recent major changes in river ecosystem conditions. Ecosystem changes are more apparent during the dry season when the proliferation of filamentous green algae has increased significantly over the past four years.

Trading in fish has always been an important activity for villagers in the upper island areas but numerous perverse policies operate that enable richer and more powerful individuals to reap the benefits of fisheries resources at the expense of the poor and marginalised.

Designating the Upper Island area as a Conservation Zone can be viewed as having both advantages and disadvantages. It would raise its profile and potentially result in better management of the ecosystem and better governance. Well-resources patrolling and enforcement would reduce the incidence of illegal activities, such as blast fishing and electro-fishing. However, some immediate concerns with existing Conservation Zone regulations include the associated restriction in trade of natural resources. It will be very difficult to restrict trade levels without negatively impacting rural livelihoods within the area.

Located in the mainstream Mekong, this zone is also an important transport route (especially for traffic between Stung Treng and the Lao border). Transport through the zone will therefore need to be permitted (with regulation on the speed of boats), although it is currently disallowed in the MoE ‘Conservation zone’ regulations.

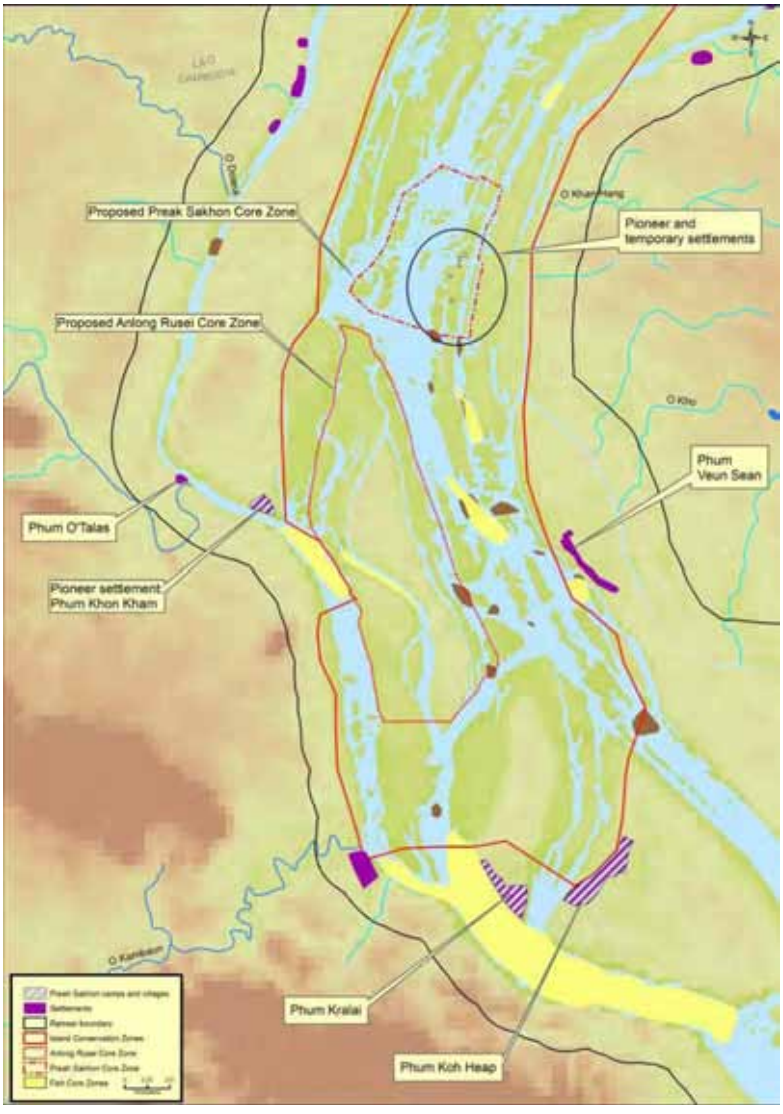
As in Preah Sakhon, the high incidence of poverty, especially in fishing households, coupled with a lack of viable alternatives, make it of utmost importance to link conservation with income generating activities, awareness raising and alternative livelihood options. This is particularly the case with regard to pioneering households.

Finally, local people must be included in the planning, management and monitoring of conservation initiatives and those conservation initiatives should generate livelihood benefits for surrounding communities.

8 Proposed Preah Sakhon Core Zone

8.1 Overview

The key objective of the assessment was to determine the implications of designating Preah Sakhon as a Core Zone (an effective exclusion zone), from a biodiversity, economics and livelihood perspective. The Preah Sakhon Core Zone is part of the proposed Upper Island Conservation Zone and has been highlighted as an area of ecological significance due to its habitat value and the species present there. One of the key features of the Site, as described by Timmins (2006), it is important as a nesting area for regionally or globally significant bird species such as the Great Thick Knee, Oriental Darter and River Tern. Notably, the Preah Sakhon area was also described as being subject to 'minimal human use'.



Map 8: Location of the proposed Anlong Rusei and Preah Sakhon Core Zones within the Stung Treng Ramsar Site. Village settlements, fishing camps and fish core zones are shown.

The integrated assessment was conducted between 28 January and 5 February, preceded by a separate team composed of Kong Kim Sreng (IUCN Cambodia) and researchers from CEPA who georeferenced the proposed SMZs and undertook the initial biodiversity, livelihoods and economic survey work in the study area.

The assessment found that, contrary to previous findings, there are a number of different groups using resources within the Preah Sakhon site. These resource users are highly migratory and scattered throughout the proposed Upper Island Conservation Zone and beyond. For example, it was found that fishers from Koh Langor village on the northern boundary of the Ramsar Site utilise Preah Sakhon. Resource users' migrations take a number of forms, from the seasonal *trey riel* fishery, in which both individual fishers and entire households may participate, to the pioneering activities adopted by many of the poorest in communities such as those settling the channel islands of Koh Khon Kham (adjacent to the east of Preah Sakhon; see Map 8) for farming and fishing. The migrant communities are at particular risk as they have no legal rights, land tenure, or access to services such as clean water, health care or education. There is also considerable livelihood and economic value attached to the human use of biodiversity, such as the fishery, in and around Preah Sakhon.

Nutritionally, fish constitutes the main source of animal protein for most communities within the wetland. Economically, and as a critical safety net during periods of rice deficit, fishing plays a key role in food security, income generation and exchange, especially for the poorest groups.

© IUCN / Kong Kim Sreng

Plate 14: Wetland products, such as these reeds, are vital to the livelihoods of the communities within the Stung Treng Ramsar Site.

Other than fishing, livelihood activities on Preah Sakhon are largely opportunistic and carried out as a subsidiary to the exploitation of the fishery. These uses include collection of gastropods, wild vegetables, bird chicks and eggs. In comparison to the various other activities these are of limited economic or livelihood importance. These activities are conducted primarily as subsistence while camping on the island during fishing activities in adjacent areas.

Preah Sakhon has a sacred stone revered by many in the area. Offerings are placed at the foot of the stone and believers say that in the vicinity of the stone the Buddhist principles of 'right speech and action' must be observed lest misfortune occur to the perpetrator. Those wishing to access the island for spiritual purposes have historically done so freely. Access to the stone is by boat from the western shore.

8.2 Biodiversity significance and issues affecting it

This survey further confirmed the biodiversity significance of Preah Sakhon. Direct observations confirmed the presence of threatened species, such as River Terns observed in breeding plumage and attempting to nest on the island. Bird nesting was also reported by locals, who opportunistically harvest both eggs and chicks. The survey supported the findings of Timmins (2006), who reported the presence of large Cormorant and Darter breeding colonies during July-August. A wide range of fish species were confirmed to be present, and fishing appears to be the main livelihood activity in the vicinity. Key species of fish reported by the user groups as being regularly caught in Preah Sakhon are briefly discussed below.

8.2.1 Notable Species

Birds

The following bird species of conservation concern at global or regional scales were recorded (Table 35).

River Tern *Sterna aurantia*

Timmins (2006) reported that Preah Sakhon was the only area within the Ramsar Site where successfully fledged juvenile birds were observed. The species has undergone a rapid and severe decline in most of Southeast Asia and the Stung Treng Ramsar Site is one of its few remaining strongholds, and probably represents the largest breeding colony within a protected area in Southeast Asia (Timmins 2006).

The species decline is likely to be due to nest disturbance and predation by domestic dogs, which often accompany fishers to temporary camps, and the collection of eggs, chicks and adult birds by people. The harvesting of other wildlife is mainly an opportunistic activity that accompanies fishing.

Great Thick-knee *Esacus recurvirostris*

The local population is likely to be large, probably a few hundred birds (Timmins 2006). The species is shy and highly susceptible to disturbance through the presence of humans.

Spot-billed Duck *Anas poecilorhyncha*

A local fisherman in Preah Sakhon reported this species as nesting in the area. In most cases he found birds nesting in holes in trees during the dry season. The species is present throughout the channel areas, especially in the channel bushlands when exposed, and in the riparian woodlands when submerged. The local population is likely to represent a significant proportion of the regional breeding population with several hundred birds likely to be present (Timmins 2006).

Table 35: Notable bird species observed within the Preah Sakhon Core Zone with their regional and global conservation status (IUCN Red List Categories).

Common Name	Latin Name	Regional Status	Global Status
Great Cormorant	*Phalacrocorax carbo*	**Vulnerable**	**LC**
Little Cormorant	*Phalacrocorax niger*	**Vulnerable**	**LC**
River Tern	*Sterna aurantia*	**Vulnerable**	**LC**
White-shouldered Ibis	*Pseudibis davisoni*	**Vulnerable**	**CR**
Lesser Adjutant	*Leptoptilos javanicus*	**Vulnerable**	**VU**
Spot-billed Duck	*Anas poecilorhyncha*	**-**	**LC**
Great Thick-knee	*Esacus recurvirostris*	**Vulnerable**	**LC**
Oriental Darter	*Anhinga melanogaster*	**Vulnerable**	**NT**

Note: Regional status based on conservation status assessments in Laos and Thailand.

Gastropods

The Mekong is a recognised hotpot for its high diversity of gastropod snails. A limited and far from comprehensive collection of species during this field survey identified the following species as being present: *Krum Srouch (Hyriopsis (Limnoscapha bialatus*), Kchorng Krahorm (*Pomacea canaliculata*), Kchorng Moit Thom (*Pila ampulacea*), Kchao Ksach (*Mekongia swainsoni flavida*), and Kchau romois (*Filopaludina martensi cambodjensis*). A more comprehensive and systematic survey is required to assess the full diversity of species present.

Plate 15: Snail harvesting

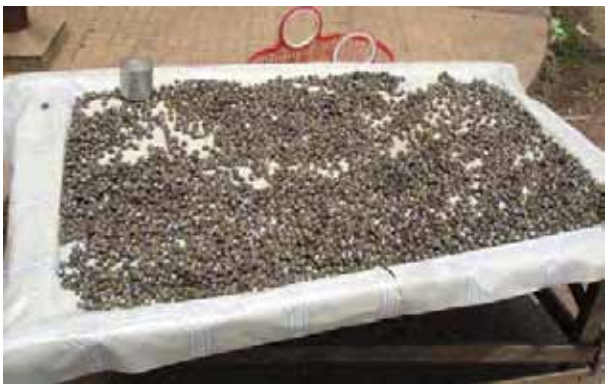


Plate 16: Molluscs for sale

Vegetation

The primary vegetation on the island is *Homonoia riparia*. These are rheophytes from the family Euphorbiaceae, usually found at riverbanks. Apparently this plant has a number of medicinal properties including treatment for various venereal diseases.

8.2.2 Main biodiversity management issues

The main management issues surrounding the conservation of biodiversity in Preah Sakhon are:-

1. The regular occurrence of **explosive fishing** (and possibly the use of **poisons**).

2. **Incidental collection of wildlife** by fishers.

3. The reported **increase in the unidentified filamentous green algae** (possibly *Hydrodictyon* sp.). The extensive algal mats cause problems through the fouling of fishing gear and potentially impedes boat transport. They may also have localised negative impacts on the biota. For example, macrophyte beds that become smothered are prone to collapse and subsequently decay. Dense accumulations of these algae in seasonal ponds can cause localized anoxic conditions while decaying in the shallow water. This could potentially affect benthic species that serve as food sources for other critical species in Preah Sakhon. Another possibility is the inhibition of phytoplankton productivity due to reduced light penetration. Many migratory fish feed on a dry season abundance of phytoplankton prior to their annual migrations; if this food source were to be reduced it may have a serious impact on certain fisheries.

4. **Nest predation**: River Terns, which are sandbar nesting birds, were observed attempting to nest on small patches of exposed sand on Preah Sakhon. Timmins (2006) noted that reproductive success of River Terns appeared to be very low. The presence of extensive algal mats covering exposed sand features (*see* Plate 18) might possibly be one of the factors contributing to this. However, the main reason for the steep decline in the species is likely to be due to nest predation by domestic dogs and people. Timmins reported sightings of dogs or their signs in all areas with suspected breeding pairs of the River Tern, including the Preah Sakhon area.

Plate 17: Aquatic shrub (*Phyllantus* sp.) smothered with algae.

5. **Invasive species. In addition to the algal mats discussed above, o**ccasional stands of *Mimosa pigra* were observed in Preah Sakhon but are probably not thought to be of major concern as the annual hydrological cycle seems to result in a partial dieback and curtail their spread. Local people have also reported collection of Golden Apple Snail (*Pomacea sp*.) on Preah Sakhon.

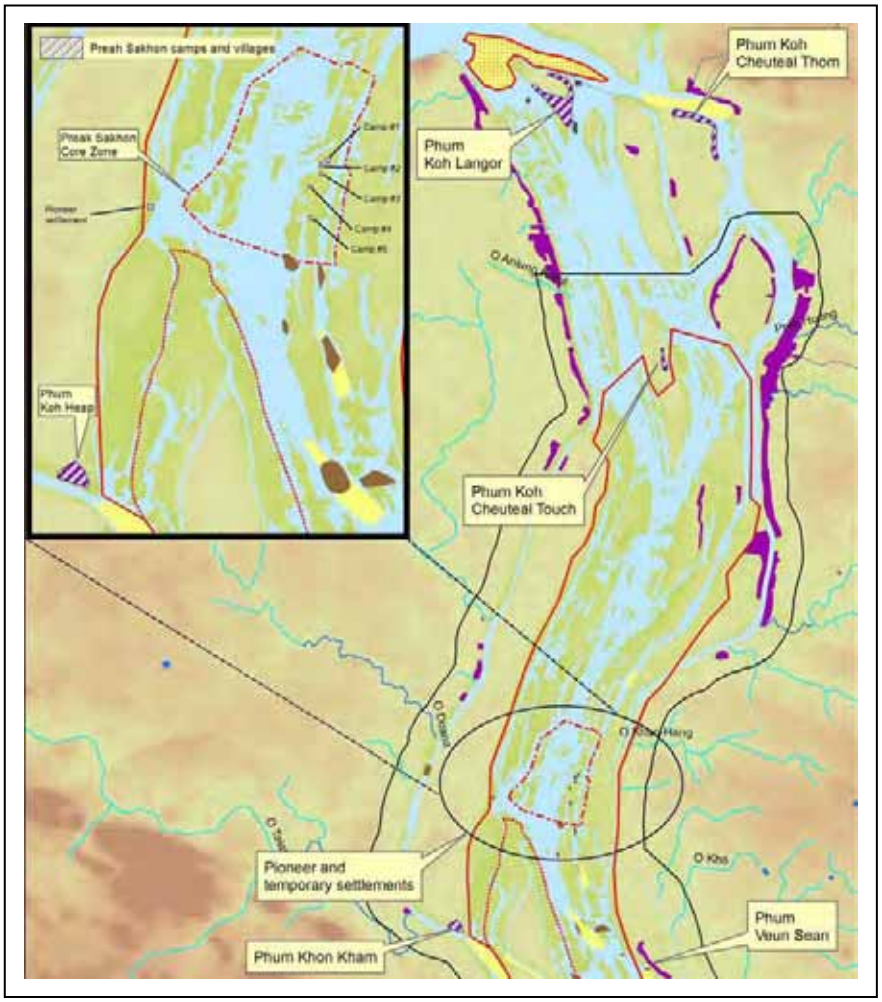
8.3 Local Resource Users

8.3.1 Settlement details

There are six villages, one pioneer settlement, and five longer term seasonal trading and fishing camps in and around Preah Sakhon (*see* Table 36 and Map 9).

Table 36: Settlements in and around the proposed Preah Sakhon Core Zone.

Settlement	Name
Six Villages	Koh Chheuteal Touch Koh Heap Koh Chheuteal Tom Koh Kralai Koh Langor Koh Khon Kham
One pioneer settlement	-
Five longer term seasonal trading and fishing camps	Camp #1 Camp # 2 Camp # 3 Camp #4 Camp #5



Map 9: The northern area of the Stung Treng Ramsar Site showing the location of all village settlements and a number of the temporary settlements and fishing camps.

8.3.2 Wealth status

Wealth ranking was conducted in two sites; the unofficial pioneer settlement (near Koh Khon Kham) and the village of Koh Chheuteal Touch. In both sites, the poor group clearly outweighed the other wealth groups. In the pioneer settlement however, the difference between groups was much narrower and the wealth pyramid was significantly larger at its base. This is unsurprising given that pioneering new settlements is often a last resort for poor households.

The wealth ranking shows that more than half (approximately 56%) of the families in Koh Chheuteal Touch are landless and without large livestock. This group tends to have a very high reliance upon wetland resources, and can be considered to be most vulnerable to shocks such as ill health or restrictions on fishing or trade. All those using Preah Sakhon (outside of the *trey riel* season), fall into the poorest group. This is unusually homogenous, doubtless reflecting the high incidence of landlessness[18].

Table 37: Wealth Ranking in Koh Chheuteal Touch village.

	Village criteria				
Wealth Class	**Land and food sufficiency**	**Cattle and boat**	**Children at school?**	**Other assets**	**No. of families**
Enough	>1ha permanent rice field Annual surplus in rice	6 or more Buffaloes 8 cc boat engine	Allow children go to school	Rice milling machine Generator Satellite dish	**9**
Medium	Rice field > 0.7ha Occasionally lack food	3-4 Buffalos 5 cc boat engine	Children can go to school	-	**30**
Poor	No paddy rice Live from hand to mouth often without enough food to eat	No buffalo Row boat, no engine Travel to fishing areas far from village	-	-	**51**

[18] In Koh Chheuteal Touch, approximately 50% of all households have no paddy land, a common criteria for poverty.

8.3.3 Assets and entitlements

Settlers must obtain a letter of approval from the Ministry of Interior to become a legal village. Before 2003 there were about 3 households in this area; since then the number of households has increased to the current 10-15 households (of which 5-7 are permanent and the others are temporary).

8.3.4 Livelihood activities

The vast majority of resource users are artisanal fishers with a high dependence on common property wetland resources. Seasonal exploitation of the *trey riel* fishery for p*ra hok* is conducted by a great many households. Many households interviewed use the waters around Preah Sakhon for the *trey riel* fishery, usually travelling in boats with family and friends. It is a festive occasion. All wealth classes are engaged in this annual fish migration. Outside the t*rey riel* season[19], more than 25% of households[20] use the area for fishing and other livelihood activities.

> *I am camping here because of restrictions on fishing due to dolphin conservation regulations around Anlong Cheuteal and village fishing grounds. I have to travel a long way to fish here and it is too expensive unless I camp long*

Seasonal cultivation of nearby islands is commonplace, but permanent settlement is also undertaken (often as a last resort) by landless families; permanent settlers tend to be from poorer groups. Fishers use Preah Sakhon for different fisheries at different times of the year, some of which camp on the island for several months at a time.

Women are involved in all aspects of fish capture, processing, trading and marketing. Female-headed households also use Preah Sakhon to meet basic household income and nutritional needs.

Some users travel considerable distances, sometimes rowing their boats by hand to fish around Preah Sakhon, camping for considerable periods at a time.

Most common reason cited for <u>not</u> using Preah Sakhon

1. Fast flowing water
2. They do not have power boat
3. Too distant
4. Local fishing grounds are sufficient

8.3.5 When do resource users use Preah Sakhon?

The majority of resource users use the area around Preah Sakhon for the *trey riel* fishery from May to July. Other users fish and occasionally hunt birds year-round. The seasonal calendar shows that molluscs are collected throughout the dry season, with a peak in abundance in May. Nesting birds are resident throughout the dry season and are recorded through interview as having been collected in March. Nests of the Oriental Darter have been observed in September, though the respondent cited Buddhist teachings as a reason for not hunting this species. Oriental Darters and Cormorants nest between July and September on Preah Sakhon. This verifies the report of Timmins (2006). The Black Drongo is common in the Ramsar Site; it is not specifically targeted, but occasionally caught by net trap placed by hunters to catch Green Pigeon or Spotted Doves.

8.3.6 Direct economic benefits from fish

Indications of economic importance of wetland resources were obtained through a focus group of 7 key informants and triangulated from other group meetings. The daily catch in kilos per household is converted to a cash value in *Riel* by multiplying quantity by average price for the specific grade of fish. Outside of the *trey riel* season, November, December and April are the most economically profitable months. *Trey riel* is of low value; however, it is caught in large quantities during its migration run. One group suggested the proportion sold to eaten is 30:70. Higher value species are more commonly caught in the rainy season.

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[19] Southward migration between May-July. One estimate from a men's focus group in Koh Chheuteal Touch, suggested as many as 80-90% of all households fish for *trey riel* during this time, the majority of whom see Preah Sakhon as an important fishing ground for this purpose.

[20] Data averaged from two villages and one settlement visited during the assessment.

8.3.7 Relative livelihood importance of Preah Sakhon

Due to the diverse livelihood strategies and wealth status of households within the communities that utilise Preah Sakhon, it is difficult to assess the relative importance of the area. In addition, some households are highly migratory due to the nature of the fisheries and the limited availability of arable land. In short, different habitats are important at different times and for different households.

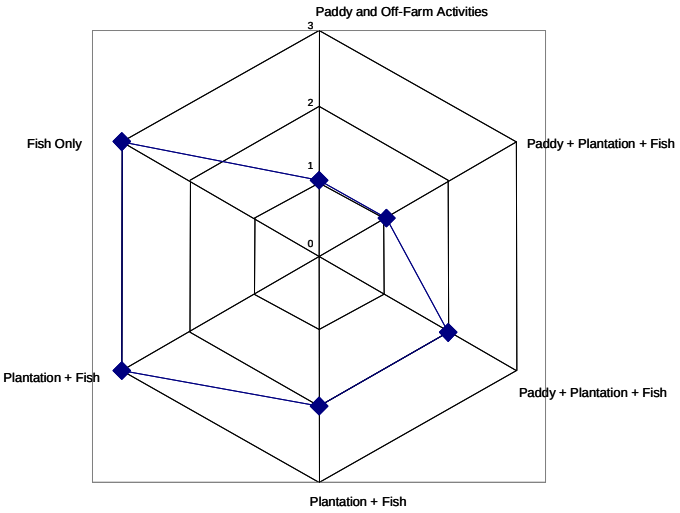


Figure 7: Radar plot showing the relative importance of Preah Sakhon to households by income source.

That said, efforts were made to discuss the relative importance of Preah Sakhon as a habitat to a variety of users, across wealth and gender groups. The radar graph, based on data the settlements of Koh Khon Khan, a pioneer settlement to the west of Preah Sakhon, and Koh Chheuteal Touch, an official village, (see Fig. 8) indicates the most common outcomes of people interviewed. There appeared to be no significant difference between the responses of men and women. Preak Sakhon was of most importance to those households who rely on fishing only, or fishing activities and plantation cultivation. These households tend to be the poorest within the Ramsar Site, with little or no land tenure, and cultivation occurring on the bank of the main channel of the Mekong.

8.3.8 In summary

- Preah Sakhon is one of a range of habitats used by fishers;
- Outside the *trey riel* season it is mostly the poor who fish around Preah Sakhon;
- Landlessness, access to land and water resources, lack of alternative livelihood options and policies are all key factors in determining use of Preah Sakhon;
- Fisheries are dynamic and though certain fishing grounds are favoured, people tend to fish where catch per unit effort is most favourable;
- Women play a key role in both fishing and processing fish;
- Preah Sakhon is important to some for spiritual purposes.

8.4 Implications of protection of Preah Sakhon to livelihoods

When discussing the implications of designating Preah Sakhon as a core zone the main considerations are; implications to who or what, when and why and how much? Some might argue there is an inevitable trade-off. The purpose of this section is to further highlight the implications of designation of Preah Sakhon as a core zone, and if some kind of trade-off is deemed appropriate, propose management recommendations towards addressing this scenario.

A number of different conservation options and impacts on livelihoods and biodiversity were assessed. It is obvious that in theory total protection i.e. no access will have the most positive impact on biodiversity. However, as has been seen globally, conservation that ignores peoples' needs and excludes peoples' participation in both the planning and management, especially in areas of medium to high human use, are not always effective. With the exclusion of communities most reliant on the resources being conserved, there can also be much higher incidences of 'illegal' encroachment and poaching and thus conflict between the local communities and the park authorities.

Table 38: Livelihood impacts from a range of potential conservation interventions within the proposed Preah Sakhon Core Zone.

Options **Wealth class**	Option 1 **Total protection - no access**	Option 2 **Limited protection - restricted access**	Option 3 **No protection - open access**
Enough	LOW	LOW	LOW
Medium	LOW - MEDIUM	LOW	LOW Initially to potentially MEDIUM
Poor	MEDIUM - **HIGH**	LOW	LOW Initially to potentially **HIGH**

Wealth classes are according to the main household occupation: Enough - Paddy and off-farm activities; Medium - Paddy and plantation and fishing; Poor - Fishing only

Table 39: Potential impacts of conservation interventions on both biodiversity and the livelihoods of the poorest.

Options **Importance**	Option 1 **Total protection - 'no access'***	Option 2 **Limited protection - restricted access**	Option 3 **No protection - open access**
Biodiversity	☺ ☺ ☺ Subject to illegal activities	☺ ☺	
Livelihood impact on fishing (poorest)		☺ ☺	☺ ☺ ☺ In the short term

*'No access' as defined by Timmins (2006).

In the opposite scenario, a system of open access may initially be favourable to communities, especially those not local to the area however this too becomes a management issue and source of potential conflict between 'local and outside' resource users. Issues of sustainability and long-term availability abound also especially in view of community perception of resource *viz* fish decline across the Ramsar Site. When considering the impact within groups employing different livelihood strategies and from differing wealth classes (table 39), it can be seen that it is the poorest that will be affected most by exclusion measures and potentially by a decline in resources as a result of a 'riparian tragedy' unfolding.

Both tables point to a system that is neither exclusion nor open access, rather some form of restricted access, is deemed to be more appropriate. When discussing the options with communities and during the preliminary findings the following management recommendations were suggested.

8.5 General recommendations

Peoples' participation in conservation initiatives is highly desirable especially given the high incidence of poverty, relatively high resource exploitation and proximity of local communities. Efforts to implement initiatives without local participation in assessment, planning, management, monitoring and enforcement are likely to fail.

To this end the Ramsar implementing body needs to be directed and informed by community fisheries organizations where they exist and include representation of surrounding communities including those outside of the authorities' jurisdiction such as Koh Khon Kham, in the planning and management of Preah Sakhon. It is also very important to engage local government in order that they may endorse and support local management regimes, i.e. some form of co-management.

In addition, the high incidence of poverty especially in solely fishing households, coupled with a lack of viable alternatives, make it of utmost importance to link conservation with income generating activities, awareness raising and alternative livelihood options.

Box 11: Local people's management recommendations for the Preah Sakhon Core Zone

Fishing ***Allowed*** ***All year***
Fishing around the perimeter of PS is not seen as a significant threat to biodiversity on PS. It is also important for livelihoods and a significant contribution to household income, especially for the poor. Efforts to ensure sustainability should be initiated, such as restrictions on fishing gear. In the peak wet season the island is under 10 m of water with just the canopy of the tallest trees above water. The island becomes part of the river channel and fishers expect to continue to be allowed to fish there. However in the dry season, fishing on the island itself is not allowed.

Camping ***Not Allowed*** ***All year***
All camping is to be prohibited. Camping on Preah Sakhon especially during *trey riel* season is widespread owing to the easy mooring and camping, and availability of raw materials for processing. Certain families have been camping in the same place on Preah Sakhon for more than a generation. However, as the majority of the damage to the nesting sites and bird and egg collection occur as a consequence of people (and their dogs) being allowed to camp on the island, it is suggested that, given that there are a number of suitable nearby locations, camping on Preah Sakhon be prohibited.

Bird/egg collection ***Not Allowed*** ***All year***
The main reason for designating the area a special management zone is its importance for nesting birds. Thus, owing to the minimal contribution to household income and livelihoods that are derived from bird and egg collection on Preah Sakhon it is suggested that this activity be prohibited.

Gastropod collection ***Not Allowed*** ***All year***
Only one family is recorded as occasionally collecting gastropods on Preah Sakhon and only as a consequence of camping on the island. Gastropods such as the mud creeper are widely distributed and abundant elsewhere. Impact will be negligible to the household.

Other mollusc collection ***Not Allowed*** ***All year***
Molluscs are collected around the perimeter of Preah Sakhon in the dry season. Peak harvesting occurs in May, just before the start of the *trey riel* season. Some collection possibly occurs before that. Similar impacts to biodiversity as above and prohibition is deemed necessary.

Spiritual access ***Allowed*** ***All year***
A sacred stone is located approximately 50m from the west bank of Preah Sakhon. This has traditionally been a site of respect and worship. Access is to be granted for spiritual purposes but not beyond the site of the stone.

Mooring boats ***Not Allowed**** ***All year***
Not allowed at any time except for access to the sacred stone.

Transportation ***Allowed*** ***All year***
Boat transportation along both West and East channels is acceptable provided no stopping at Preah Sakhon.

8.6 Conclusions

- Preah Sakhon is one of the few remaining important sites for biodiversity within the Ramsar Site that has not been degraded through anthropogenic activities.
- A range of bird species of conservation significance are confirmed to be nesting in Preah Sakhon.
- An invasive green filamentous algae threatens the ecology and natural processes in Preah Sakhon especially in the dry season.
- Main uses of Preah Sakhon are for fishing, especially *trey riel* during their downstream spawning migration.
- Poorer people are most dependent on the Common Property Resources available at Preak Sakhon.
- The main negative biodiversity impacts from human use are from associated activities that go with fishing. During the *trey riel* period, fishers camp on Preah Sakhon. Domestic dogs disturb nesting birds, especially River Tern and Great Thick-knee, and fishers collect the eggs, chicks and adults of any species found for consumption (and sometimes trade).
- Designating Preah Sakhon and its perimeter as a no-go area (core zone) is questionable from an economic, social, cultural and biodiversity perspective.
- Banning fishing could have serious impacts on livelihoods, especially for the poorest.
- Limiting/banning access for non fish purposes will have minimal impact on livelihoods.
- Landlessness is a key driver of off-farm and pioneering activities in the core zone and Preah Sakhon.
- A restricted access zone is deemed the most appropriate management option for Preah Sakhon.
- People should be included in the planning, management and monitoring of conservation initiatives.
- Conservation initiatives should generate livelihood benefits for surrounding communities.
- Alternative livelihood options should be identified and encouraged.

9 Proposed Anlong Rusei Core Zone

9.1 Background and introduction

The key objective of this assessment was to determine the implications of designating Anlong Rusei as a core zone (i.e. exclusion zone) from a biodiversity, economics and livelihood perspective.

The proposed Core Zone of Anlong Rusei is part of the proposed Upper Island Conservation Zone and has been highlighted as an area of ecological significance particularly for the Siamese crocodile *Crocodylus siamensis*. Timmins (2006) indicated that this is probably one of the last remaining areas for Siamese crocodiles within the Ramsar Site. He also proposed that community-based crocodile conservation efforts be explored with the families living in the area.

Geographically, Anlong Rusei is a deep pool isolated from the mainstream in the dry season and sandwiched between Koh Kankeo to the east and Koh Rusei to the west. The southern section of Koh Rusei is locally referred to as Koh Chheuteal (*see* Map 4).

Information was gathered to understand the dynamics of resource use in Anlong Rusei and its vicinity (i.e. Koh Khon Kheo, Koh Rusei and Koh Chheuteal) and the potential implications of designating the area as core zone where access is forbidden. Further information was gathered to better understand the current status of the crocodiles in the area and to evaluate the importance of the area for other biodiversity.

9.2 Findings

The resource users of Anlong Rusei include those permanently settled in the area, with some travelling distances of up to 12 km from their villages, and seasonal visitors. Resource users are from a number of different wealth classes. For the non-residents, the main purpose for coming to Anlong Rusei and adjacent islands was for fishing and tending buffaloes.

9.2.1 Biodiversity significance of Anlong Rusei and issues affecting it

Anlong Rusei (c.46 ha) was proposed as a core zone primarily because of the presence of the Critically Endangered Siamese crocodile. The crocodile population here has faced the same fate as other populations throughout Cambodia and the Mekong region, where they have been hunted to dangerously low levels.

Cambodia remains the global stronghold for wild Siamese crocodile populations, though recent surveys estimate only a few hundred individuals remaining in the wild (J. Daltry, pers. comm.). Interviews with key informants indicated that the crocodile population in the Anlong Rusei to O'Talas section of the river drastically declined in the early 1980s due to hunting for the local market and for export to Viet Nam. Independent interviews with villagers[21] living in the vicinity of Anlong Rusei estimate the total remaining population has been reduced to 2-4 individuals.

The unique habitat mosaic surrounding Anlong Rusei provides sanctuary to a range of wildlife and bird species. Koh Khon Kheo, the island to the east of Anlong Rusei, in particular has minimal anthropogenic influence (there is only one person farming on the island). A wide range of habitat types are represented including channel woodlands, channel bushlands, tall grasslands, semi-evergreen forests, seasonal pools and sand features. The Green Peafowl *Pavo muticus* was noted to be present in significant numbers and to breed on the island. On several occasions during this survey, fresh tracks were spotted, with a maximum of three individuals in a group. Other notable species reported in the vicinity of Koh Khon Kheo are the Critically Endangered White-shouldered Ibis *Pseudibis davisoni* and the Smooth Otter *Lutrogale perspicillata* (VU). The otter was also reported to be breeding near the eastern shores of Koh Kankeo, south of the Ramsar Ranger's station, and a key informant confirmed

[21] Based on interview with households on Koh Rusei and also information from villagers in Veun Sean.

the sighting of three pups three years previously. Individual species accounts are discussed separately in the following chapter on the proposed Upper Island Conservation area.

Occasional perennial stands of *Mimosa pigra* were also observed in Anlong Rusei but, as for Preah Sakhon, are probably not a major concern as the annual hydrological cycles seems to result in a partial dieback and to curtail their spread. The accumulation of clumps of decomposing green filamentous alga in seasonal pools could potentially affect the productivity in these sub-ecosystems.

Occasional electro-fishing activities are also reported within Anlong Rusei itself but apparently these activities are quite rare and not seen as a major problem.

9.3 Who uses Anlong Rusei and where are they from?

9.3.1 Settlements on Koh Rusei, Koh Chheuteal and Koh Khon Kheo

No detailed wealth ranking exercise was conducted in Anlong Rusei. Of the four households living on Koh Rusei only 2 were interviewed and one indicated that they reside there for 8 months in a year while the other was permanently settled. Both the households interviewed indicated that they very rarely use Anlong Rusei for fishing or any other purpose. They indicated that their preference for fishing is normally Anlong Angor (a much larger deep pool on the west bank of Koh Rusei). One respondent[22] indicated that he does not fish in Anlong Rusei any more because the crocodiles have been destroying his nets over the past year. Both the respondents were originally from Phoum Kraom. Their main activities are illustrated in Table 40. The other key resource user in the area, the Ramsar ranger, is the only resident of Koh Kankeo.

9.3.2 Buffalo owners from Krala Peas

For generations (reportedly over 75 years), buffaloes from Krala Peas (a village approximately 12 km north of Anlong Rusei) have been brought to the vicinity of Anlong Rusei to graze on the tall grasses (believed to be *Phragmites spp)*. A respondent from Krala Peas indicated that he owned 9 buffaloes, while another indicated that she had 14 buffaloes. Although no detailed participatory wealth ranking was possible in the time available, owning one or more buffalo would likely justify ranking the owner in either the medium or wealthy category. Therefore, these reasonably wealthy buffalo owners have established some sort of traditional user rights to the area. Whilst the buffaloes are left to graze on Koh Khon Kheo and Koh Rusei for up to five months, the owners themselves only occasionally (three times a month) visit the area in groups of about three to check on their buffaloes. Whilst they are there, they often camp and harvest wildlife for consumption. Species reported to be regularly collected opportunistically include muntjac, wild pig, and turtles.

9.3.3 Other resources users

Other resource users are reported to use Anlong Rusei at different times of the year both for fishing and harvest of other aquatic and forest products, although to a lesser degree. These include the villages below[23]:

- Veun Sean.
- O'Talas (occasional; main areas of use are Anlong Angor and O'Talas itself).
- Koh Khorndin and Ketui Koh[24].

Most common reason cited for <u>not</u> using Anlong Rusei

1. Fish from Anlong Rusei smell bad.
2. Crocodiles destroy nets.
3. Fishing is normally more productive in Anlong Angor, the larger deep pool adjacent to Koh Rusei.

[22] Residence of Mr. Khuon Phon in the southern section of Anlong Rusei
[23] Information obtained from group discussion of economics team in Veun Sean
[24] Reported to be electro fishing occasionally in Anlong Rusei in the dry season (Information source: Ramsar Ranger)

9.4 Why and when do resource users use Anlong Rusei?

Table 40 below presents a seasonal calendar based on information compiled from various key informants and focus group discussions[25]. The main activity of the households interviewed (n=3) residing in Koh Rusei and Koh Kankeo is farming (i.e. growing rice and other crops) with about a hectare or less of cultivated rice per household. Landlessness has driven them from their original villages. Wildlife trapping (especially of birds) is undertaken to supplement livelihoods. Fishing activities are conducted regularly but rarely in Anlong Rusei. A species frequently observed trapped in rope snares placed on trees is the Orange-breasted Green Pigeon *Treron bicincta* (LC). One individual of a Lineated Barbet *Megalaima lineate* (LC) was also observed entangled in a snare on a fruit tree on Koh Rusei.

Although fishing is mainly in Anlong Angor it has also been reported as an important activity (particularly in the wet season) in Anlong Rusei. Accessibility by boat to Anlong Rusei is a key issue as it becomes completely isolated from the main channel in the dry season. We were not able to determine the total number of fishers/ boats normally fishing (especially for *trey riel*) in Anlong Rusei and within the flooded forests of Koh Kankeo.

Buffaloes (an estimated 50 to 60 animals) from Krala Peas normally make their way to Koh Kankeo and Koh Rusei and remain there between December and May. Towards the end of May, the buffalo owners take their animals back to work on the rice fields. This traditional practise has in the recent times created conflict between the settlers of Koh Rusei. Apparently, in the recent years several buffaloes have died after being trapped in the snares set by the people living on Koh Rusei. At this stage no workable solutions have been negotiated.

Table 40: Seasonal Calendar for Resource Use at Anlong Rusei and surrounding islands (Koh Kankeo, Koh Rusei and Koh Chheuteal).[26]

Activity	Villages using the resources	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1. Paddy rice	Koh Khon Keo (1 HH) Koh Rusei (2 HH) Koh Chheuteal (2HH)												
2. Buffalo grazing at the surrounding areas	Krala Peas (50-60 buffaloes), Phoum Kraom, Phoum Lergh												
3. *Trey Riel* Fishing	N.D.												
4. Other crops – Banana, sugar cane, papaya, corn, vegetables, watermelon	Koh Khon Keo (1 HH) Koh Rusei (2HH) Koh Chheuteal (2HH)												
5. Raising livestock – pigs and chicken	Koh Khon Keo (1 HH) Koh Rusei (2 HH) Koh Chheuteal (2HH)												
6.Hunting for wildlife, birds and their eggs/nests (using snares/bamboo traps)	Koh Khon Keo, Koh Rusei; Veun Sean, and opportunistic hunting by buffalo owners from Krala Peas												

[25] Primarily from Koh Rusei, Koh Khon Keo and Krala Peas.
[26] Information in table based on responses from key informants at Anlong Rusei and Krala Peas.

9.5 Wealth status of main resource users in Koh Khon Kheo, Koh Rusei and Koh Chheuteal

Without a detailed wealth ranking exercise, it is difficult to draw a conclusion on the wealth status of the different groups of key resource users of Anlong Rusei. An intelligent guess would indicate that the buffalo owners from Krala Peas who claim traditional rights to the area are probably the most well off[27]. The households currently settled on Koh Rusei and Koh Khon Kheo have been there for less than 5 years. Anlong Rusei and Koh Kankeo are still considered open access areas with no institutional set-up in place. Information during the interviews indicated that additional people are also planning to migrate to Koh Rusei to pioneer new land.

9.6 Conclusion and zoning recommendations

Given the uncertain viability of the remaining population of Siamese crocodiles in Anlong Rusei, the proposal for designating Anlong Rusei as a Core Zone to mainly serve as a crocodile sanctuary is questionable. Locals estimate that there are no more than 2-4 individuals left. The second issue is the ongoing use of the area by local villagers, in particular people from Krala Peas village, as a grazing area for livestock. If the area is designated as a core zone it will mean people can no longer access the area as a traditional area for grazing. Alternative options for designating the area as a conservation zone have been discussed with DNCP and the Ramsar Site Director. This option could still provide people with grazing rights while limiting other activities thought likely to harm the crocodiles. However, given that there is minimal use of resources in Anlong Rusei, it might still be one of the best sites for designation as a Core Zone. Such a designation might curtail the reported illegal activities such as electro-fishing and blast fishing – at least in the dry season, given proper enforcement.

The suggested extension of the Core Zone to include Koh Kankeo and Koh Rusei raises more issues. Current farming activities, although small scale, and the grazing of domestic buffaloes are clearly incompatible with the regulations associated with a Core Zone. It would therefore be more appropriate to designate this area as part of the Upper Island Conservation Zone on account of its biodiversity significance. Effort should certainly be made to regulate or prohibit activities that are currently causing conflicts such as the setting of snares on the ground. This will not only avoid conflict with the owners of the buffaloes from Krala Peas, but will also prevent further decline in several species of conservation concern, such as Green Peafowl and the White-shouldered Ibis. At this stage, it is not possible to determine if the presence of buffaloes are having any significant impact on the overall ecology of the area. We expect that this is highly unlikely given the fact that domestic buffaloes have been part of this Koh Khon Kheo and Koh Rusei system for several generations now. A dedicated study would be required to answer this.

Finally, for any conservation option to be successful, the local users will need to be involved in the development of management objectives, and the subsequent management of those areas. Further dialogue and awareness-raising with the community are critical to ensure success in maintaining both the biodiversity values and in the identification of appropriate alternative livelihood options.

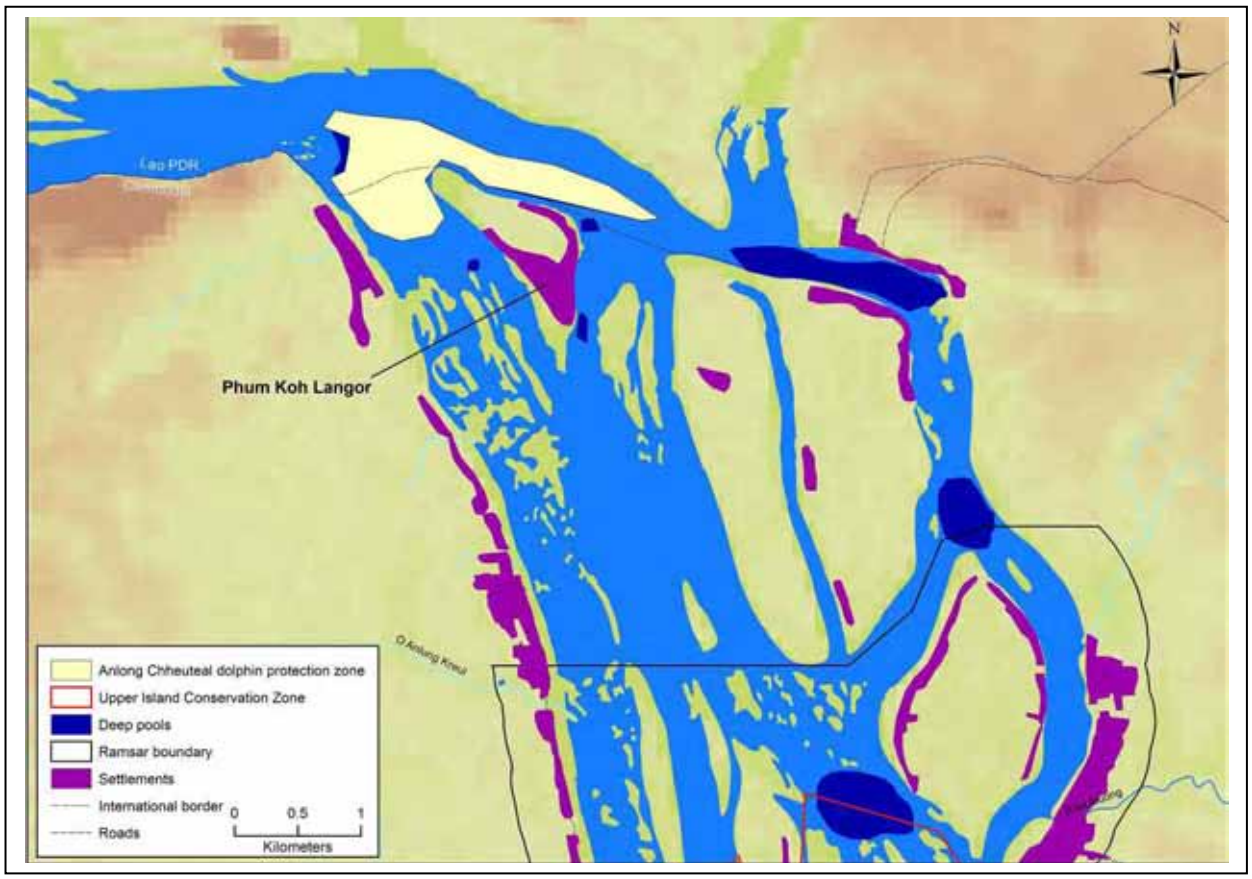
[27] Considering the fact that buffaloes are often used as wealth criteria.

10 Anlong Chheuteal Dolphin Protection Zone

This section provides information from a rapid assessment of biodiversity and livelihoods impacts of the strict protection at the Anlong Chheuteal Dolphin Protection Zone.

10.1 Background and Introduction

Anlong Chheuteal (called *Veun Nyang* in Laos) is a small (c.2 km^2) transboundary deep pool that straddles the Cambodia–Lao PDR international border (*see* Map 10) in the mainstream Mekong channel. It is inhabited by the Mekong River Irrawaddy Dolphin (Mekong subpopulation; CR), the only significant location of the species north of Kratie, especially in the dry season.



Map 10: Anlong Chheuteal deep pool, showing the location of international boundary and nearby settlements.

The effective range of the Irrawaddy Dolphin in the Mekong is a 190 km segment located between Kratie, Cambodia (about 500 km upstream of the river estuary in Viet Nam) and Khone Falls, which physically obstructs further upstream movement, located slightly upstream of the Lao PDR-Cambodia border (Beasley *et al.* 2003; WCS 2007). Dolphins previously inhabited Tonle Sap (Lloze 1973) but have been extirpated from there (Beasley *et al.* 2003). The remaining population of the Mekong River Irrawaddy Dolphin is very small (approximately 100-140 individuals; Beasley 2006); of this population, the sub-population in Anlong Chheuteal only numbers around 10 individuals.

Anlong Chheuteal is a key fishing location for fishers from Phoum Koh Langor and other villages on both the Cambodian and Lao sides of the border. At present, the most northerly point of the Stung Treng Ramsar Site lies approximately 3.5 km to the south of Anlong Chheuteal (though there is uncertainty over the legal site boundary).

While the Irrawaddy Dolphin sub-population at the transboundary pool presents a promising eco-tourism potential, existing numbers are probably too low to withstand even minimal pressure. Several efforts in the past have attempted to address the conservation issues affecting the dolphins. Lao PDR has attempted to address these issues through community fisheries and dolphin projects, but activities came to a halt as soon as projects ended (Lopez 2005). Overwhelming evidence indicates that gill net entanglement (especially the use of large-meshed gill nets) is the main cause of dolphin mortality in the Mekong River (Baird *et al.* 1994; Baird and Mounsouphom 1994, 1997; Beasley, pers. com.). In 2005, Cambodia stepped up measures to restrict gill nets in Cambodian waters. This was primarily done through occasional monitoring by staff from the Department of Fisheries.

Plate 18 Dolphin tourism at Anlong Chheuteal

In 2006, responding to increasing concern over the status of the dolphin, the Cambodian government formed the Cambodian Dolphin Commission. This commission has since set up additional measures to address dolphin conservation issues throughout the Mekong, including at the transboundary pool.

There have been several other efforts to address the transboundary wetland management issues at various scales. The Mekong River Commission facilitated the signing of a transboundary wetland management agreement in 2006. Lao PDR has proposed Siphandone (the wetland complex along the mainstream of the Mekong north of Anlong Chheuteal) as a candidate Ramsar Site and is working towards its designation; however, Laos has not as yet ratified the Ramsar Convention. Although this pool lies outside the Ramsar Site, we have included it in the scope of our assessment due to the transboundary nature of the pool and its relevance in assessing the impacts of total gill net restriction on livelihoods and also biodiversity.

10.2 Approach and scope

The purpose of considering Anlong Chheuteal in this integrated assessment was to perform a rapid review of the effectiveness of the enforcement in place for dolphin conservation and to gain an understanding the impacts conservation measures on the local economy and livelihoods (especially the poor). Information was gathered through one focus group discussion and 6 key informant interviews.

Although gill net restrictions effect more than the one village in the vicinity of the dolphin pool, the assessment was confined to Koh Langor. The economics and livelihoods team only visited this village. The biodiversity team was already familiar with the relevant dolphin issues affecting Anlong Chheuteal and chose to spend the time filling other gaps in the assessment. Only half a day in total was spent in Anlong Chheuteal therefore the discussion in this chapter will not be at a similar depth as the other chapters.

10.3 Findings

The assessment found that a total of three villages were impacted by the recent strict protection and total ban of gill nets for the purpose of dolphin conservation. Of those affected households most reliant on fishing for their livelihoods (often the poorest) have been hit the hardest. The findings revealed that

there continue to be conflicts between enforcement authorities (the river guards and police) and the villagers.

All villagers who fish (about 90% of households) have been affected by the ban on the use of gill nets in Anlong Chheuteal. At best, the ban means that fishers travel further to satisfy basic food needs, spending more time and/or fuel for similar benefits. At worst, the fragile livelihoods of the poorest groups are pushed towards resorting to exploring other livelihood strategies, such as pioneering new land, and fishing in other important biodiversity areas such as Preah Sakhon.

10.3.1 Conflict between river guards and communities

Since 2002 there have been regulations in place relating to fishing activities and dolphin protection (see Table 41) in Anlong Chheuteal. However, these are restricted to the Cambodian side. The recent enforcement of stricter regulations and a total ban of gill nets have resulted in a conflict situation between villagers and authorities. In order to facilitate enforcement of the new regulations, community fisheries groups are being asked to assist implement the new rules and regulations and are quite reluctant to do so.

Plate 19: The Irrawaddy Dolphin *Orcaella brevirostris* **at Anlong Chheuteal**

Table 41: Overview of the regulations imposed in relation to Dolphin protection.

Period	Regulations imposed
2000-2005	No gill net use permitted in Anlong Chheuteal, but permitted around the periphery.
2005-2006	No fishing using gill nets more than 50 m from the village
2007	Mekong Dolphin Commission issues a total ban on use of gill nets within the Anlong Chheuteal deep pool. Armed river guards are appointed for enforcement

Source: key informant interviews, Koh Langor

10.3.2 Dolphin watching 'eco-tourism – inequitable benefits distribution

Dolphin-watching tourism began in the area approximately eight years ago, initiated by Lao villagers. However, a Lao eco-tourism company currently monopolizes the dolphin eco-tourism. No benefits go to the villages adjacent to Anlong Chheuteal. From the Cambodian perspective, they do not benefit from eco-tourism revenue apart from what is collected by the river guards from each of the boats that access the dolphin pool.

10.3.3 Alternative livelihood strategies diversify as a result of the ban on gill nets

The wider implications of the gill net ban in Anlong Chheuteal were also apparent from this rapid assessment. One of the interesting biodiversity implications of failing to look at the wider perspective is that fishers may now be forced to find other means to support their livelihoods. These activities include clearing forested land in an attempt to initiate agricultural activities. A key concern is that this restriction has resulted in fishers being forced to travel to other places (including the proposed Preah Sakhon Core Zone) to conduct fishing activities. Information from Koh Langor revealed that families go to Preah Sakhon and surrounding areas by motorboat or canoe. If they travel either way they will spend several

days or weeks at a time, as they will return only when they have enough to cover the cost of the fuel and some for profit.

10.3.4 On-the-ground implementation of regional facilitated inter-provincial agreements unclear

As mentioned above, there is currently an agreement on transboundary wetland management between Lao PDR and Cambodia at the provincial level (i.e. Champasack and Stung Treng). This agreement was facilitated by the Mekong River Commission in 2006 and includes dolphin conservation and management. However, implementation of on-the-ground activities under this agreement and mechanisms for actual cooperation with Lao fishers unclear. Cambodian river guards only have authority to undertake enforcement on the Cambodian waters. Lao fishers can set their nets in the transboundary pool without intervention from the Khmer river guards.

10.4 General conclusion, lessons learnt and recommendations

The government of Cambodia designated the dolphin protection zone with good intentions and the ban on gill nets on the Cambodian side of the border resulted from a drastic decline in the dolphin population. The decline in dolphin populations throughout the Mekong is clearly the result of anthropogenic influence (for example, see Lopez 2004). However, have the resulting management actions (i.e. the ban on gill net fishing gears that are critical to livelihoods in the area) resulted in positive outcomes for the dolphin or biodiversity in general? This question still remains to be answered.

Would the management solutions be more acceptable if a livelihoods impact assessment was conducted in order to determine the impacts of the ban in gill nets on the livelihoods of the fishing communities prior to issuing the ban? Perhaps restriction on type of gill net and mesh size might be an option, but decisions need to be informed by the information on the effectiveness the intervention in preventing dolphin mortality resulting from fishing activities. Local knowledge on dolphin movements should be applied to develop more workable solutions.

It is clear that a biodiversity management solution has impacted the livelihoods of the actual custodians of the dolphins. A lack of livelihood options may result in people continuing to place gill nets in Anlong Chheuteal, and continued conflicts between enforcement authorities and local people.

The implications of this situation are directly relevant to the proposed zoning recommendations within the Ramsar Site. However, in the case of this proposed zoning the preceding chapters have demonstrated the relationships and the complex dynamics between biodiversity and the livelihood strategies of the communities, especially the poorest households. This in itself is an invaluable first step in developing appropriate management guidelines for the zones.

For the Anlong Chheuteal transboundary pool, several immediate recommendations may be considered:

1. Use local knowledge on dolphin seasonal movements and distributions to identify workable solutions regarding zonation and to inform on the placing of gill nets for fishing.
2. Explore alternative livelihood options for affected communities, especially the poorest whose livelihoods depend solely on fishing.
3. Develop a joint programme between Cambodia and Lao PDR in order to agree on the equitable distribution eco-tourism benefits to local communities.

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Annexes

Annex 1: Survey itinerary

Date	Biodiversity team	Livelihoods team	Economics team
26 Jan 2007	Internal planning meetings in Stung Treng town and preparation of final field plan	Internal planning meetings in Stung Treng town and preparation of final field plan	Internal planning meetings in Stung Treng town and preparation of final field plan
27 Jan 2007	Internal planning meetings in Stung Treng town and preparation of final field plan	Internal planning meetings in Stung Treng town and preparation of final field plan	Internal planning meetings in Stung Treng town and preparation of final field plan
28 Jan 2007	Left for Koh Kankeo (adjacent to Anlong Rusei at 1000hrs) - Polygons for Anlong Rusei/Koh Kankeo/ Koh Rusei on foot – Interviews with key informants on status of biodiversity. - Opportunistic biodiversity observations and sampling	Visited Koh Khan Kham to meet with pioneering elder and other island settlers. - Transect walk - ad hoc house hold interviews - small women's group interview	Veun Sean – group discussions
29 Jan 2007	- Continue foot-survey in vicinity of Anlong Rusei. - Habitat and biodiversity observations - Interview with households adjacent to Anlong Rusei	- Return visit to KKK to conduct men and women focus group interview. Key informant interview. - Travelling by boat to directly observe and interview resource users.	Visited Fish Camp adjacent Preah Sakhon (WP20) – whole day (Interview with Fishers and traders)
30 Jan 2007	- Completed polygon for Anlong Rusei/Koh Kankeo. - Vegetation transect on Koh Kankeo. Prepared herbarium specimens - Mapped eastern boundary of Preah Sakhon and brief interview at fishing camp	- Boat-to-boat interviews - Fishing camp interviews - Transect walk with Key informant.	Visited same fish camp and interviewed fish traders Visited Preah Sakhon and interviewed 2 additional fish camp Veun Sean household surveys – to understand resource use
31 Jan 2007	Boat trip to Phoum Kraom - Conducted a 1km interval transect on observations on birds spp, habitat features, and fishing activities for the whole 12km stretch of the upper island proposed conservation zone - Met with village headman and informal chat with villagers at Koh Chheuteal Touch	Boat trip to Phoum Kraom. Conducted a 11km interval transect on observations on birds spp, habitat features, and fishing activities for the 12km stretch of the upper island proposed conservation zone -Met with village headman and informal chat with villagers at Koh Chheuteal Touch. -Wealth ranking with key informants. -Social/relationship building	Boat trip to Phoum Kraom (Conducted 1 km transect) Went to Koh Chheuteal Touch.
1 Feb 2007	Interview with Head of Community fisheries in Krala Peas on issues related to resource use in Anlong Rusei Afternoon: focus group discussion on Anlong Rusei Issues	Village-based survey in Koh Chheuteal Touch. Village meeting with 54 people. Activities inc.: village narrative; social & resource mapping, matrix ranking.	Interview with Head of Community fisheries in Krala Peas on issues related to resource use in Anlong Rusei Afternoon: focus group discussion on Anlong Rusei Issues
2 Feb 2007	- Interview with Preah Sakhon resource users at Koh Chheuteal Touch - Interview with one key information at Koh Chheuteal Touch related to spp and resource use at Preah Sakhon	Power analysis. Joint working with villagers Small unstructured/semi structured focus groups session on markets and trade Ad hoc discussions.	Visited Koh Chheuteal Touch – Interview with 7-8 resources re information related to trade and economics related to Preah Sakhon
3 Feb 2007	Trip to O'Talas to gather preliminary understanding of resource use and significance of fisheries	am: 5 HH livelihood survey forms & social mapping with key informant. GPS waypoints of village features. pm travel to Koh Langor and dinner with key resource users	Follow up with Krala Peas on key resource users of Anlong Rusei Visit to Koh Langor to assess implications of buffaloes grazing in Anlong Rusei
4 Feb 2007	Trip to O'Talas; Opportunistic bird observations; Interview with resource user in O'Talas on spp harvested; Vegetation transects in Koh Khon Kham and Preah Sakhon - Night at Veun Sean – discussion about bird collection in the vicinity of Preah Sakhon	Ad hoc interviews and village based walks around Koh Langor. Met & interviewed previous district governor, Community fisheries staff and men and women fishers to discuss impacts of strict conservation measures on Koh Langor. Travel to Veun Sean and conduct male hunter/bird collector focus group interview.	Additional meetings at Koh Langor on impact of gill net bans in Dolphin Conservation Zone Fish trade discussion at border. - Return to Stung Treng town.
5 Feb 2007	-Trip to Koh Khon Kham to investigate temporary settlement that are reported to be resource users of Preah Sakhon - Return to Stung Treng	With Biodiversity team	

Annex 2: Opportunistic bird observations made by the Darwin project team during field assessment (17 Jan – 5 Feb. 2007)

Note: No effort is made to provide indication of relative abundance of species, as the effort was not consistent. As indicated above observations were only opportunistic as it was not the main purpose of this assessment. Some information on key species accounts (along with georeferences) are provided in the main text

English Name	Scientific Name	Provisional protected status in Cambodia	IUCN Red List status
Green Peafowl	*Pavo muticus*	x	**VU**
Chinese Francolin	*Francolinus pintadeanus*		**LC**
Red Junglefowl	*Gallus gallus*		**LC**
Lesser Whistling-duck	*Dendrocygna javanica*		**LC**
Spot-billed Duck	*Anas poecilorhyncha*	x	**LC**
Common Flameback	*Dinopium javanense*		**LC**
Lineated Barbet	*Megalaima lineata*		**LC**
Oriental Pied Hornbill	*Anthracoceros albirostris*	x	**LC**
Common Hoopoe	*Upupa epops*		**LC**
Indian Roller	*Coracias benghalensis*		**LC**
Dollarbird	*Eurystomus orientalis*		**LC**
Common Kingfisher	*Alcedo atthis*		**LC**
Stork-billed Kingfisher	*Halcyon capensis*		**LC**
White-throated Kingfisher	*Halcyon smyrnensis*		**LC**
Black-capped Kingfisher	*Halcyon pileata*		**LC**
Pied Kingfisher	*Ceryle rudis*		**LC**
Blue-tailed Bee-eater	*Merops philippinus*		**LC**
Chestnut-headed Bee-eater	*Merops leschenaulti*		**LC**
Asian Koel	*Eudynamys scolopacea*		**LC**
Greater Coucal	*Centropus sinensis*		**LC**
Lesser Coucal	*Centropus bengalensis*		**LC**
Vernal Hanging Parrot	*Loriculus vernalis*		**LC**
Alexandrine Parakeet	*Psittacula eupatria*	x	**LC**
Grey-headed Parakeet	*Psittacula finschii*	x	**LC**
Blossom-headed Parakeet	*Psittacula roseata*	x	**LC**
Red-breasted Parakeet	*Psittacula alexandri*		**LC**
Asian Palm Swift	*Cypsiurus balasiensis*		**LC**
Fork-tailed Swift?	*Apus pacificus*		**LC**
Brown Fish Owl	*Ketupa zeylonensis*	x	**LC**
Indian Nightjar?	*Caprimulgus asiaticus*		LC
Large-tailed Nightjar?	*Caprimulgus macrurus?*		LC
Spotted Dove	*Streptopelia chinensis*		**LC**
Red Collared Dove	*Streptopelia tranquebarica*		**LC**
Pink-necked Green Pigeon	*Treron vernans*		**LC**
Orange-breasted Green	*Treron bicincta*		**LC**
Thick-billed Green Pigeon	*Treron curvirostra*		**LC**
Yellow-footed Green Pigeon	*Treron phoenicoptera*	x	**LC**
Green Imperial Pigeon	*Ducula aenea*		**LC**
White-breasted Waterhen	*Amaurornis phoenicurus*		**LC**
Common Greenshank	*Tringa nebularia*		**LC**
Common Redshank	*Tringa totanus*		**LC**
Great Thick-knee	*Esacus recurvirostris*	x	**LC**
Little Ringed Plover	*Charadrius dubius*		**LC**
River Lapwing	*Vanellus duvaucelii*	x	**LC**
Red-wattled Lapwing	*Vanellus indicus*		**LC**
Small Pratincole	*Glareola lactea*		**LC**
Brown-headed Gull	*Larus brunnicephalus*		**LC**
River Tern	*Sterna aurantia*	x	**LC**
Osprey	*Pandion haliaetus*		**LC**
Black Baza	*Aviceda leuphotes*		**LC**
Brahminy Kite	*Haliastur indus*		**LC**
Grey-headed Fish Eagle	*Ichthyophaga ichthyaetus*	x	**NT**
White-rumped Vulture	*Gyps bengalensis*	x	**NT**
Red-headed Vulture	*Sarcogyps calvus*	x	**NT**

Crested Serpent Eagle	*Spilornis cheela*		**LC**
Eastern Marsh Harrier	*Circus spilonotus*		**LC**
Green Imperial Pigeon	*Ducula aenea*		**LC**
Darter	*Anhinga melanogaster*	x	**NT**
Little Cormorant	*Phalacrocorax niger*		**LC**
Indian Cormorant	*Phalacrocorax fuscicollis*		**LC**
Great Cormorant	*Phalacrocorax carbo*		**LC**
Grey Heron	*Ardea cinerea*		**LC**
Little Egret	*Egretta garzetta*		**LC**
Great Egret	*Casmerodius albus*		**LC**
Intermediate Egret	*Mesophoyx intermedia*		**LC**
Cattle Egret	*Bubulcus ibis*		**LC**
Chinese Pond Heron	*Ardeola bacchus*		**LC**
Javan Pond Heron	*Ardeola speciosa*		**LC**
Yellow Bittern	*Ixobrychus sinensis*		**LC**
White-shouldered Ibis	*Pseudibis davisoni*	x	**EN**
Asian Openbill	*Anastomus oscitans*	x	**NT**
Woolly-necked Stork	*Ciconia episcopus*	x	**LC**
Lesser Adjutant	*Leptoptilos javanicus*	x	**VU**
Rufous Treepie	*Dendrocitta vagabunda*		**LC**
Black-hooded Oriole	*Oriolus xanthornus*		**LC**
Large Cuckooshrike	*Coracina macei*		**LC**
Small Minivet	*Pericrocotus cinnamomeus*		**LC**
Scarlet Minivet	*Pericrocotus flammeus*		**LC**
Black Drongo	*Dicrurus macrocercus*		**LC**
Bronzed Drongo	*Dicrurus aeneus*		**LC**
Spangled Drongo	*Dicrurus hottentottus*		**LC**
Greater Racket-tailed Drongo	*Dicrurus paradiseus*		**LC**
Chestnut-tailed Starling	*Sturnus malabaricus*		**LC**
Black-collared Starling	*Sturnus nigricollis*		**LC**
Vinous-breasted Starling	*Sturnus burmannicus*		**LC**
Common Myna	*Acridotheres tristis*		**LC**
White-vented Myna	*Acridotheres cinereus*		**LC**
Hill Myna	*Gracula religiosa*	x	**LC**
Black-crested Bulbul	*Pycnonotus melanicterus*		**LC**
Stripe-throated Bulbul	*Pycnonotus finlaysoni*		**LC**
Lesser Necklaced	*Garrulax monileger*		**LC**
White Wagtail	*Motacilla alba*		**LC**
Yellow Wagtail	*Motacilla flava*		**LC**
Mekong Wagtail	*Motacila samveasna*		**NT**

Annex 3: Fish species in the Stung Treng Ramsar Site identified through the Sala Phoum fisheries research in collaboration with the Darwin Project, with their use and trade values.

Of the 130 species identified, only 97 have been identified to species level, and only 6 of these have had their global conservation status (IUCN Red List) assessed.

	Scientific Name	Local Name	Fresh fish price Riel/kg	Red List
1	*Acantopsis spp.1*	Trei Reus chek 1	Not traded - seldom caught	-
2	*Acantopsis spp.2*	Trei Reus chek 2	Not traded - seldom caught	-
3	*Achiroides melanorhynchus*	Trei Andat Chhker	Not traded	NE
4	*Amblyrhynchichthys truncatus*	Trei Kambot chromos	No value	NE
5	*Anabas testudineus*	Trei Kranh	Not traded	NE
6	*Arius maculatus*	Trei Ka O'ck	-	NE
7	*Bagarius yarrelli*	Trei Krapeu 1	3000 - 6000	NE
8	*Bagrichthys macracanthus*	Trei Chektum 2	4000 - 7000	NE
9	*Bagrichthys macropterus*	Trei Chektum 1	4000 - 7000	NE
10	*Barbodes gonionotus*	Trei Chhpen Tpoil Khmao	1200 - 1500	NE
11	*Barbonymus schwanenfeldii*	Trei Kraher	-	NE
12	*Belodontichthys dinema*	Trei Klanghay	5000 - 8000	NE
13	*Boesemania microlepis*	Trei Prormar	5000 - 7000	NE
14	*Botia helodes*	Trei Kanchrouk Bangkang	-	NE
15	*Botia lecontei*	Trei Kanchrouk Kantuy khmao	-	NE
16	*Botia modesta*	Trei Kanchrouk Thmor	-	NE
17	*Botia spp.*	Trei Kanchrouk Khla	-	-
18	*Channa micropeltes*	Trei Chhdor	3000	NE
19	*Channa orientalis*	Trei Ksan	Not traded	NE
20	*Channa striata*	Trei Roh	2000 - 3000	NE
21	*Chitala blanci*	Trei Kray	4000 - 5000	NT
22	*Chitala ornata*	Trei Ka ei / Trei Kray Sac	4000 - 5000	NE
23	*Cirrhinus microlepis*	Trei Proul	2000 - 4000	NE
24	*Clarias batrachus*	Trei Andeng Reung	Sell in the village, 1 bundle = 500 - 1000	NE
25	*Clarias macrocephalus*	Trei Andeng Tunn	Sell in the village, 1 bundle = 500 - 1000	NE
26	*Cyclocheilichthys apogon*	Trei Sraka Kdarm	Not sold	NE
27	*Cyclocheilichthys armatus*	Trei Phkakor	1000 - 2000	NE
28	*Cyclocheilichthys enoplus*	Trei Chhkoak Mole	4000 - 5000	NE
29	*Cyclocheilichthys furcatus*	Trei Chhkoak Kdar	>3kg = 5000	NE
30	*Datnioides microlepis*	Trei Khla 2	7000 - 8000	NE
31	*Datnioides polota*	Trei Khla1	7000 - 8000	NE
32	*Glyptothorax lampris*	Trei Krapeu 2	3000 - 6000	NE
33	*Hampala dispar*	Trei Khman	4000 - 5000	NE
34	*Helicophagus waandersii*	Trei Pra Kandol	4000 - 6000	NE
35	*Hemibagrus filamentus*	Trei Tanel Thmor	5000 - 6000	NE
36	*Hemibagrus wyckioides*	Trei Clang	3000 - 4000	NE
37	*Henicorhynchus cryptopogon*	Trei Real Thmor	1 bundle = 500 - 1000	NE
38	*Henicorhynchus siamensis*	Trei Real Tob	1000 - 1500	NE
39	*Himantura chaophraya*	Trei Borbele	3000	VU
40	*Hypsibarbus lagleri*	Trei Papean	1000 - 2000	NE
41	*Hypsibarbus malcolmi*	Trei Chhpin Mole	2000 - 3000	NE
42	*Hypsibarbus spp.CF. vernayi*	Trei Chhpin Meas	2000 - 3000	-
43	*Kryptopterus schilbeides*	Trei Kampleav	1000 - 2000	NE
44	*Krytopterus moorei*	Trei Slabmoin 1	1000 - 1500	NE
45	*Krytopterus schilbeides*	Trei Slabmoin 2	1000 - 1500	NE
46	*Labeo chrysophekadion*	Trei Ka Ek Khmao	1500 - 3000	NE
47	*Labeo erythropterus*	Trei Pava Mok Moy	2000 - 3000	NE
48	*Labiobarbus siamensis*	Trei Achkok	2000 - 3000	NE
49	*Leiocassis siamensis*	Trei Kanchoss para	1 bundle = 5 to10 fishes = 500 - 1000	NE
50	*Lobocheilos rhabdoura*	Trei Real 2	1000 - 2000	NE
51	*Luciosoma setigerum*	Trei Changva Nornorng	1 bundle = 1000 - 1500	NE
52	*Macrognathus siamensis*	Trei Chhlonh Nhy	2000 - 3000	NE
53	*Mastacembelus favus*	Trei Khcheung	3000 - 6000	NE

54	*Mekongina erythrospila*	Trei Pase ii	15000 - 30000	**NE**
55	*Micronema bleekeri*	Trei Kes Chumrao	12000	**NE**
56	*Micronema micronema*	Trei Kes Meas	10000 - 12000	**NE**
57	*Monopterus albus*	Trei Antung	6000 - 7000	**NE**
58	*Mystus bocourti*	Trei Kanchoss kdoang	5000	**NE**
59	*Mystus multiradiatus*	Trei Kanchoss Chnote	2500 - 3000	**NE**
60	*Mystus sp.cf.wolffi*	Trei Kanchoss pruy 1	No value	**-**
61	*Mystus wolffii*	Trei Kanchoss pruy 2	1000 - 2000	**NE**
62	*Hemibagrus wyckioides*	Trei Khya	8000 - 13000	**NE**
63	*Notopterus notopterus*	Trei Slart	1bandle~0.2kg = 1000 - 1500	**NE**
64	*Ompok bimaculatus*	Trei Ta Own or Trei Kromorm	2000 - 3000	**NE**
65	*Opsarius koratensis*	Trei Changva bangkang	No	**NE**
66	*Osphronemus exodon*	Trei Romeas	1500 - 3000	**NE**
67	*Osteochilus hasselti*	Trei Kross 1	Not traded	**NE**
68	*Osteochilus melanopleurus*	Trei Krum	Not traded	**NE**
69	*Osteochilus microcephalus*	Trei Kross Chhnote 2	1 bundle = 500 - 1000	**NE**
70	*Osteochilus waandersil*	Trei Kross Chhnote 1	1 bundle = 1000 -15000	**NE**
71	*Oxyeleotris marmorata*	Trei Damrei	Not traded	**NE**
72	*Pangasius conchophilus*	Trei Ker	3000 - 4000	**NE**
73	*Pangasius djambal*	Trei Pra	4000 - 5000	**NE**
74	*Pangasius larnaudii*	Trei Ker Paphork	4000 - 5000	**NE**
75	*Pangasius macronema*	Trei Chhveat Dong	3000 - 5000	**NE**
76	*Pangasius sanitwongsei*	Trei Pour Pruy	4000 - 5000	**DD**
77	*Paralaubuca barroni*	Trei Sleuk Reusey	2000 - 3000	**NE**
78	*Parambassis wolffii*	Trei Kantrong Preng	-	**NE**
79	*Polynemus dubius*	Trei Pream	-	**NE**
80	*Poropuntius deauratus*	Trei Kross 2	Not traded - consumed within village	**NE**
81	*Poropuntius deauratus*	Trei Lolok Sar	1500 - 3000	**NE**
82	*Poropuntius malcolmi*	Trei Chhpen Mole	1500 - 3000	**NE**
83	*Pristolepis fasciata*	Trei Kantrob	Not sold	**NE**
84	*Probarbus labeaminor*	Trei Trorsorck	3000 - 8000	**DD**
85	*Puntioplites falcifer*	Trei Chrorkeng 1	1500 - 2000	**NE**
86	*Puntioplites proctozysron*	Trei Chorkeng 2	1500 - 2000	**NE**
87	*Puntius orphoides*	Trei Phka Char/ Trei Ampil Tum	-	**NE**
88	*Rasbora aurotaenia*	Trei Changva Mole	-	**NE**
89	*Setipinna melanochir*	Trei Chhmar	Not traded	**NE**
90	*Tenualosa thibaudeaui*	Trei Kbork	No value	**EN**
91	*Tetraodon nigroviridis*	Trei Kamport	No value	**NE**
92	*Thynnichthys thynnoides*	Trei Linh	Not traded - small size	**NE**
93	*Trichogaster pectoralis*	Trei Kanthor	Not traded	**NE**
94	*Trichogaster trichopterus*	Trei Kampheanh	Not valuable	**NE**
95	*Wallago attu*	Trei Sanday	5000 - 6000	**NE**
96	*Wallago leerii*	Trei Stouk	3000 - 4000	**NE**
97	*Xenentodon canciloides*	Trei Phtoang	-	**NE**
98	*Trei Pakeng*		No data	-
99	*Trei Pava Mokbac*		4000 - 5000	-
100	*Trei Pava Phka Andeng*		5000 - 6000	-
101	*Trei Chveat Kantuy reach*		2500 - 4000	-
102	*Trei Chhveat Chnot*		4000 - 5000	-
103	*Trei Pakok*		2000	-
104	*Trei Thmor*		2000 - 3000	-
105	*Trei Chhpin Koang*		1500 - 3000	-
106	*Trei Chhpin Kda*		2000 - 3000	-
107	*Trei Real 1*		2000 - 3000	-
108	*Trei Pour Khmao Trocheak*		3000 - 4000	-
109	*Trei Ker Mort Loeung*		4000 - 5000	-
110	*Trei Pra sahat*		6000 - 7000	-
111	*Trei Kropoit*		5000 - 6000	-
112	*Trei Ambong*		2000 - 3000	-
113	*Trei Lhou*		6000 - 8000	-
114	*Trei Chhnok Dorb*		Not value	-
115	*Trei Dorng Khteng*		No data	-

116 *Trei Kampul bay*		1000 - 2000		-
117 *Trei Tanel*		5000 - 7000		-
118 *Trei Ka Ek*		3000 - 4000		-
119 *Trei Chlonh Chhmole*		2000 - 3000		-
120 *Trei Chanva Kantuy Krorhorm*		Not traded - small size		-
121 *Trei Kross 3*		1000 - 2000		-
122 *Trei Kross Khyall*		1 bundle = 500 - 1000		-
123 *Trei Kross Kantuy Krorhorm*		1000 - 2000		-
124 *Trei Pakeng Pruy Leung*		Not value		-
125 *Trei Chamnang Kaky*		Not sold		-
126 *Trei Parpok*		Not traded		-
127 *Trei Nornoung Lving*		No data		-
128 *Trei Trasorck Ka Ek*		Not sold		-
129 *Trei Panai*	New species for the Ramsar Site	2000 - 3000		-
130 *Trei Phlere Sdao*	New species for the Ramsar Site	1000 - 3000		-

Notes
33 species were recorded with Khmer names through the survey but were not identified to species level i.e. a total of 130 species. The IUCN conservation status of these species could not be ascertained.
Local name may be Khmer or Laotian-based
Red List status (according to the IUCN Red List Categories and Criteria). DD: Data Deficient; NT: Neat Threatened; VU: Vulnerable; EN: Endangered; CR: Critically endangered; NE: the species has not been assessed (at a global level); - Scientific name of the species not known/unclear.
USD 1 = 4000 Riel
Species 129 and 130 are new records for the Stung Treng Ramsar Site.

Annex 4: Species observed in trade at markets and restaurants in Stung Treng, and at Vean Kham border market in October 2005.

A number of plant non-timber forest products, including aquatic plants, were also observed, but not identified to species level (extracted from Bezuijen *et.al*. 2005).

Scientific name	Common name (English)	IUCN status	CITES App.	Use	Unit
MAMMALS					
Nycticebus pygmaeus	Pygmy Slow-Loris		**II**	Medicinal	Skin
Macaca	Long-tailed/Rhesus	**NT**	**II**	Ornamental	Live individual
Petaurista elegans	Lesser Giant Flying			Food	Skin
Hystrix brachyura	East Asian Porcupine	**VU**		Ornamental	Quill
Ursus	Bear sp.	**VU**	**I**	Ornamental	Claw
Canis sp.?	Canine sp.			Ornamental	Tooth
Panthera tigris	Tiger	**EN**	**I**	Ornamental	Claw
Panthera tigris	Tiger	**EN**	**I**	Ornamental	Tooth
Elephas maximas	Asian Elephant	**EN**	**I**	Ornamental	Single hair
Elephas maximas	Asian Elephant	**EN**	**I**	Ornamental	Bone fragment
Panthera tigris	Tiger	**EN**	**I**	Ornamental	Claw
Sus scrofa	Eurasian Wild Pig			Food	Smoked (strips)
Sus scrofa	Eurasian Wild Pig			Ornamental	Tusk
Tragulus javanicus	Lesser Oriental			Food	Dead individual
Muntiacus muntjac	Red Muntjac			Ornamental	Antlers (pair)
Cervus porcinus	Hog Deer			Ornamental	Antlers (pair)
Cervus unicolor	Sambar			Ornamental	Antlers (pair)
Cervus eldii	Eld's Deer	**VU**	**I**	Ornamental	Antlers (pair)
	Deer sp.			Ornamental	Antlers (fragments)
Bos javanicus	Banteng	**EN**		Ornamental	Horns (pair)
Bos gaurus	Gaur	**VU**	**I**	Ornamental	Horns (pair)
BIRDS					
Pavo muticus	Green Peafowl	**VU**	**II**	Ornamental	Feathers
Psittacula alexandri	Red-breasted Parakeet		**II**	Ornamental	Live individual
Gallinula chloropus	Common Moorhen			Food	Dead individual
Sturnus nigricollis	Black-collared Starling			Ornamental	Live individual
FISH					
Chitala blanci		**NT**		Food	Live/dead individual
Chitala ornata				Food	Live/dead individual

Chitala lopis				Food	Live/dead individual
Probarbus jullieni	Jullien's Golden Carp	**EN**	**I**	Food	Live/dead individual
Puntioplites falcifer				Food	Live/dead individual
Puntioplites/Hypsibarbus				Food	Live/dead individual
Hypsibarbus malcomi				Food	Live/dead individual
Hampala dispar				Food	Live/dead individual
Labeo sp.				Food	Live/dead individual
Morulius barbatula				Food	Per kg
Osteochilus lini (?)				Food	Live/dead individual
Botia beauforti				Food	Live/dead individual
Botia modesta				Food	Live/dead individual
Mystus sp.				Food	Live/dead individual
Mystus filamentus				Food	Per kg
Mystus wyckioides				Food	Per kg
Belodontichthys dinema				Food	Live/dead individual
Micronema sp.				Food	Live/dead individual
Ompok sp.				Food	Live/dead individual
Wallago attu				Food	Live/dead individual
Wallago leeri				Food	Live/dead individual
Pangasius larnaudiei			**I**	Food	Per kg
Pangasius siamensis			**I**	Food	Live/dead individual
Bagarius yarrelli				Food	Per kg
Clarias batrachus				Food	Per kg
Xenentodon cancila				Food	Per kg
Monopterus albus				Food	Per kg
Macrognathus siamensis				Food	Per kg
Mastacembelus favus				Food	Per kg
Coius undecimradiatus				Food	Per kg
Pristolepis fasciata				Food	Per kg
Oxyeleotris marmorata				Food	?
Osphronemus gouramy				Food	Live/dead individual
Osphronemus exodon				Food	?
Channa micropeltes				Food	Per kg
Channa striata				Food	Per kg
Channa sp.				Food	Per kg
Brachirus harmandi				Food	Live/dead individual
REPTILES					
Physignathus cocincinus	Indo-chinese Water			Food	Live individual
Varanus bengalensis	Bengal Monitor		**I**	Food	Live individual
Varanus salvator	Water Monitor lizard		**II**	Food	Live/dead individual
AMPHIBIANS					
frog sp. (skinned)				Food	Dead individual
CRUSTACEANS					
?	Crab			Food	Per bag (30-50)
Macrobrachium	Giant river prawn			Food	Per 100 g
?	Watersnail-Type 2			Food	Per cup
?	Watersnail-Type 3			Food	Per kg
?	Freshwater mussel			Food	Live individual
TIMBER PRODUCTS					
Dalbergia oliveri	Rosewood	**EN**		Ornamental	Carving
D. bariensis	Burmese Rosewood	**EN**		Ornamental	
Afzelia xylocarpa	Afzelia	**EN**		Ornamental	

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