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An Integrated Assessment for Preliminary Zoning of Peam Krasop Wildlife Sanctuary, Southwestern Cambodia

An Dara, Kong Kimsreng, Hout Piseth, and Robert Mather

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IUCN Cambodia Liaison Office
#19, Street 312, Sangkat Tonle Basac, Khan Chamkar Mon
P.O.Box: 1504
Tel: +855 23 222 311
Fax: +855 23 222 312
E-mail: info.cambodia@iucn.org

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List of abbreviations

ADB	Asian Development Bank
AFN	Asia Forest Network
BPAMP	Biodiversity Protected Areas Management Plan
CPAD	Cambodia Protected Areas Development
GDANCP	General Department of Administration for Nature Conservation and Protection
GIS	Geographic Information System
GPS	Global Positioning System
ICEM	International Center for Environmental Management
IUCN	International Union for Conservation of Nature
PKWS	Peam Krasop Wildlife Sanctuary
MoE	Ministry of Environment
NTFPs	Non-Timber Forest Products
PAs	Protected Areas
SCW	Save Cambodia's Wildlife
sp.	Species
UTM	Universal Transverse Mercator
WCS	Wildlife Conservation Society
PMMR	Participatory Mangrove Management Research

About this Publication

This publication is part of a series of publications developed by the Livelihoods and Landscapes Strategy funded by the Government of the Netherlands, and implemented by IUCN and partners.

About the Livelihoods and Landscapes Strategy

The Livelihoods and Landscapes Strategy (LLS) is a global IUCN project working in 23 countries and funded by the Directorate General for International Cooperation (DGIS) of the Netherlands Ministry of Foreign Affairs. In Asia, LLS works with a wide range of partners from local communities, non-government organizations, university and research institutions, local, regional and national governments and the private sector.

A Livelihoods and Landscape Strategy (LLS) addresses human and environmental needs simultaneously in large areas of land. Each strategy is different, but they all aim to deliver environmentally friendly, financially sustainable and socially equitable outcomes. In achieving multiple aims, planning decisions of different uses in different parts of a landscape often result in trade-offs that are negotiated between various groups that have interests in the landscape.

The LLS initiative represents a new way of thinking – from focussing on threats, to promoting negotiated plans for productive landscapes. To achieve this, LLS goes beyond forest management and links positively with other sectors such as agriculture, water, energy, health and the private sector. LLS provides for immediate needs while supporting long term change to improve human wellbeing and resilience.

In Asia, the LLS initiative works in nine landscapes in seven countries. There is great diversity in the landscapes and each strategy is unique.

In Cambodia LLS is working in Peam Krasop Wildlife Sanctuary in Koh Kong Province in a varied landscape with evergreen forests, mangroves, rivers, wetlands, coastal areas, coral reefs and islands. It provides rich biodiversity which many local people depend on for their livelihoods. While the Sanctuary has been established, its boundaries are not well recognized and the area's rich resource base is threatened by overuse. To address this, the LLS initiative is working with new protected area zoning laws to identify core, conservation, sustainable use and community zones in the sanctuary. The intention is for communities to use the community and sustainable use zones and help monitor the core and conservation zones. This will help ensure sustainable use of the natural resources in the sanctuary by all stakeholders, especially local communities.

About IUCN

IUCN, International Union for Conservation of Nature and Natural Resources brings together States, government agencies, and a diverse range of non-governmental organizations in a unique partnership. As a Union of members, IUCN seeks to influence, encourage and assist societies around the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. www.iucn.org and www.iucn.org/asia

About the Authors

An Dara
Dara had worked as the Wildlife Monitoring Coordinator with WCS as part of Protected Areas work under the MoE, Cambodia from 2000-05. From 2006-08 he was awarded a Japanese Grant Aid for Human Resource Development Scholarship to earn his master degree at Tokyo University of Agriculture and Technology and conducted his research fieldwork on 'Agricultural Expansion and its Effects on Breeding Habitat of Giant Ibis in Kulen Promtep Wildlife Sanctuary, Northern Cambodia'. After his graduation, Dara returned to work with GDANCP of MoE in cooperation with WCS. He has been responsible for community development research and management of the Northern Plains, Cambodia.

Hout Piseth
Piseth holds a bachelor degree of management from the National University of Management and a Diploma of Forestry from the School of Preak Leap Agriculture. In 1999 he conducted a field survey on the relation of the community with wildlife hunting and trade, Ratanakiri province (Cambodia). From 2000 to 2008 he was the project officer and senior project officer with theWildlife Conservation Society in charge of community conservation, development and zoning. In late 2008 and early 2009 he was the free-lance consultant for IUCN. At present he is working for the WWF Cambodia program.

Kong Kimsreng
Kimsreng holds a master degree on natural resources management from the Royal University of Agriculture, graduated in January 2008. He has been working almost ten years (1999- 2009) in both natural resource management and research as the National Wetland Ecology Advisor, in Cambodia with the Ministry of Environment (MoE), the Wildlife Conservation Society (WCS), and the Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP). With MWBP he has coordinated an integrated assessment of the biodiversity, livelihood and economic implications of the proposed special management zones in the Stung Treng Ramsar Site, Cambodia that was supported by the Darwin Initiative. He currently holds the position of senior program officer for IUCN Cambodia.

Robert Mather
From 1988-90 Robert conducted fieldwork on gibbons in Central Kalimantan (Indonesian Borneo) for his Ph.D. awarded by Cambridge University in 1992. Since 1993 he has lived mostly in Thailand and Laos working on many aspects of conservation with both local and international organisations. After 15 years with WWF, Robert joined IUCN in 2008, and is now responsible for IUCN's work in Cambodia, Laos and Vietnam.

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ABSRACT

Peam Krasop Wildlife Sanctuary (PKWS) is one of the most significant coastal wildlife sanctuaries in Cambodia because it maintains a sizeable area of both mangrove forest and evergreen forest, as well as a number of globally threatened species. However, both unique habitat and critically endangered species in the sanctuary have been declining at an alarming rate (especially from the mid 1980s to the late 1990s) due to human activities such as charcoal production, over fishing, overexploitation of wildlife and NTFPs, land clearance for agriculture, and illegal hunting which have also grown along with immigration into the sanctuary and urbanization of the surrounding area. The purpose of this assessment was to (i) generate information that can be used to identify preliminary management zones in PKWS based on the assessment of biodiversity, livelihoods, and socio-economics, (ii) understand the perception and perspectives of local people on PKWS management and the proposed zoning system, (iii) develop preliminary recommendations for a partial zoning scheme for PKWS supported by high quality maps, and (iv) build capacity of staff of the Ministry of Environment to develop approaches for zoning of protected areas under the PA Law 2008. Consultations with local authorities, and group discussions, participatory mapping, seasonal calendar exercises, and consultation workshops with local communities as well as interviews with households and with key informants were all used as methods to achieve the integrated assessment for identification and feasibility of preliminary zoning in PKWS. Four management zones were tentatively characterized in PKWS based on the actual or presumed existence of globally endangered species, key habitats, and local consensus - namely the core zone, conservation zone, sustainable use zone, and community zone. Recommendations for further interventions are provided.

សេចក្តីសង្ខេប

ដែនជំរកសត្វព្រៃពាមក្រសោប គឺជាដែនជំរកមួយក្នុងចំណោមដែនជំរកសត្វព្រៃសមុទ្រដែលមានសារសំខាន់បំផុតនៅប្រទេសកម្ពុជាដោយសារវារក្សាបាននូវតំបន់ដ៏ធំធេងមួយពោរពេញទៅដោយព្រៃកោងកាងព្រៃស្រោង និងប្រភេទសត្វព្រៃកំពុងទទួលរងនូវការគំរាមកំហែងនៅលើពិភពលោក។ តែទោះជាយ៉ាងនេះក្តីប្រភេទទីជំរកដែលមានតែមួយគត់ និងប្រភេទសត្វព្រៃជិតផុតពូជបំផុតទាំងនេះបាននឹងកំពុងថយចុះក្នុងអត្រាមួយគួរអោយព្រួយបារម្ភនៅក្នុងដែនជំរកសត្វព្រៃនេះ (ជាពិសេសចាប់ពីពាក់កណ្តាលទសវត្សឆ្នាំ ១៩៨0 ទៅដល់ចុង ឆ្នាំ១៩៩0) ដោយសារតែមានសកម្មភាពមនុស្សជាច្រើនដូចជាការកាប់ព្រៃផលិតធ្យូង ការនេសាទលើសកំណត់ ការធ្វើអាជីវកម្មសត្វព្រៃ និងអនុផលព្រៃឈើលើសពីតំរូវការ ការកាប់ទន្ទ្រានដីព្រៃសំរាប់ធ្វើកសិកម្ម ការបរបាញ់ខុសច្បាប់ ដែលបាននឹងកំពុងកើតមានឡើងរួមជាមួយនឹងជនចំណាកស្រុកនៅក្នុងដែនជំរកសត្វព្រៃព្រមទាំងការអភិវឌ្ឍន៍នគរូបនីយកម្មនៅជុំវិញដែនជំរកសត្វព្រៃពាមក្រសោបនេះ។

គោលបំណងរបស់ការសិក្សានៃការវាយតំលៃនេះគឺដើម្បី (១) បង្កើតនូវព័ត៌មានដែលអាចយកទៅប្រើប្រាស់បានក្នុងការកំណត់តំបន់គ្រប់គ្រងបឋមនៅក្នុងដែនជំរកសត្វព្រៃពាមក្រសោបដោយផ្អែកតាមការវាយតំលៃទៅលើជីវៈចំរុះជីវភាពរស់នៅរបស់ប្រជាជន និងសេដ្ឋកិច្ចសង្គម (២) យល់ដឹងពីសញ្ញាណ និងទស្សនវិស័យរបស់ប្រជាជននៅតាមមូលដ្ឋានស្តីពីការគ្រប់គ្រងដែនជំរកសត្វព្រៃពាមក្រសោប និងប្រព័ន្ធកំណត់តំបន់ដែលបានស្នើសុំ (៣) អភិវឌ្ឍន៍អនុសាសន៍បឋមនៃផែនការណ៍កំណត់តំបន់មួយសំរាប់ដែនជំរកសត្វព្រៃពាមក្រសោបដែលបង្ហាញដោយផែនទីដែលមានគុណភាពខ្ពស់ (៤) កសាងសមត្ថភាពដល់មន្ត្រីរាជការក្រសួងបរិស្ថានដើម្បីអភិវឌ្ឍន៍វិធីសាស្ត្រក្នុងការកំណត់តំបន់គ្រប់គ្រងសំរាប់តំបន់ការពារធម្មជាតិដទៃទៀត ដែលស្ថិតនៅក្នុងក្របខ័ណ្ឌច្បាប់តំបន់ការពារធម្មជាតិឆ្នាំ២00៨។

ការពិគ្រោះយោបល់គ្នាជាមួយអជ្ញាធរមូលដ្ឋាន ការពិភាក្សាជាក្រុម ការធ្វើផែនទីដោយមានការចូលរួម ការធ្វើប្រតិទិនតាមរដូវកាល សិក្ខាសាលាពិគ្រោះយោបល់ជាមួយប្រជាសហគមន៍ និងអាជ្ញាធរមូលដ្ឋានព្រមទាំងការសំភាសន៍ដាច់ដោយឡែកតាមលំនៅដ្ឋានជាមួយនឹងអ្នកផ្តល់ព័ត៌មានសំខាន់ៗ ដែលទាំងអស់នេះត្រូវបានប្រើប្រាស់ជាវិធីសាស្ត្រដើម្បីសំរេចអោយបាននូវការវាយតំលៃជារួមសំរាប់ការធ្វើអត្តសញ្ញាណកម្ម និងភាពដែលអាចអនុវត្តទៅបាននៃការកំណត់តំបន់គ្រប់គ្រងជាបឋមសំរាប់ដែនជំរកសត្វព្រៃពាមក្រសោប។

តំបន់គ្រប់គ្រងចំនួន ៤ ត្រូវបានកំណត់ឡើងជាបណ្តោះអាសន្ននៅក្នុងដែនជំរកសត្វព្រៃពាមក្រសោបដោយផ្អែកទៅលើវត្តមានពិតប្រាកដនៃប្រភេទសត្វព្រៃដែលជិតផុតពូជបំផុតនៅលើពិភពលោក ប្រភេទទីជំរកសំខាន់ៗ និងការព្រមព្រៀងពីសហគមន៍មូលដ្ឋាន។ តំបន់ទាំង ៤ នេះរួមមាន **តំបន់ស្នូល តំបន់អភិរក្ស តំបន់ប្រើប្រាស់ដោយចេរភាព** និង **តំបន់សហគមន៍**។ ការវាយតំលៃនេះក៏បានផ្តល់ផងដែរនូវអនុសាសន៍មួយចំនួនសំរាប់អន្តរាគមន៍បន្ថែមក្នុងការកំណត់តំបន់គ្រប់គ្រងដើម្បីឈានទៅរកការគ្រប់គ្រងតំបន់ការពារធម្មជាតិប្រកបដោយប្រសិទ្ធិភាព។

Eurasian Curlew *(Numenius arquata*) and Far Eastern Curlew (*Numenius madagacariensis*) in the proposed core zone of PKWS © IUCN Cambodia/ Sun Kong

White-bellied Sea-eagle *(Halianeetus leucgaster*)
© Margaret Ingles, Bang kok

Irrawaddy Dolphin (*Orcaella brevirostris*) found in PKWS © IUCN Cambodia/ Sun Kong

Koh Sralao's people processing King Crab meat © IUCN Cambodia/ K. Kimsreng

A woman from Phoum Boun *(village 4)*
collecting Oysters in mangrove roots
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IUCN's Mud Crab Census site in PKWS
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1. Introduction

1.1. Background

The Kingdom of Cambodia is known worldwide for its rich biodiversity. Historically, the country has paid considerable attention to the protection and conservation of biodiversity in particular of forests and wildlife. In 1925 the Kingdom of Cambodia became the first country to create protected areas in Southeast Asia (Smith, 2001; ADB, 2004; BPAMP, 2006). The Angkor Temple complex and its surrounding area became natural protected zones during that particular era. In total six national parks and wildlife sanctuaries were declared that covered about 12% of Cambodia's total land area (181,035km². Unfortunately, the country suffered from civil war for more than two decades from 1970 to 1992. This dark period led biodiversity and natural resources to decline at a frightening rate (Global Witness, 2007).

In 1993 Cambodia achieved full peace after the signing of the Peace Accords in Paris. In the meantime, MoE in cooperation with several NGOs played a very significant role in re-establishing 23 PAs throughout the country based on biological and scientific field surveys. Those parks were approved by His Majesty King Norodom Sihanouk in a Royal Decree or "Kret" (ICEM, 2003). Protected areas of Cambodia were classified into four categories - National Park, Wildlife Sanctuary, Protected Landscape, and Multiple Use Area (Table 1) based on the IUCN Protected Areas categories in 1993 (Smith, 2001; CPAD, 2004; BPAMP, 2006).

Table 1 – The four classifications of protected areas in Cambodia based on IUCN Protected Areas Categories in 1993

Protected Areas	IUCN Categories
National Park	(IUCN category II) – Natural and scenic area of significance for their scientific, educational and recreational values
Wildlife Sanctuary	(IUCN category IV) – Natural area where nationally significant species of flora or fauna, natural communities, or physical features require specific intervention for their perpetuation.
Protected Landscape	(IUCN category V) – Nationally significant natural and seminatural landscapes that must be maintained to provide opportunities for recration
Multiple-Use Area	(IUCN category VIII) – Areas that provide for the sustainable use of water resources, timber, wildlife, fish, pasture, and recreation with the conservation of nature primarily oriented to support these economic activities.

Source: CPAD, 2004

Peam Krasop Wildlife Sanctuary (PKWS) is one of the most significant sanctuaries in Cambodia because it maintains a sizeable area of both mangrove forest as well as evergreen forest, the important landscape level feature of connectivity between these two major forest types, and a number of globally threatened species. The sanctuary is also important for migratory birds (PMMR, 2000). Beside the forest habitat there are many waterways in this sanctuary (PMMR, 2000) that support important aquatic resources and endangered species including dolphins and otters. However, both unique habitat and critically endangered species in the sanctuary have been declining at an alarming rate due to cutting of forest for charcoal production, shrimp farming, firewood collection, over fishing for trade, land reclamation for agriculture and residential land, and land speculation. According to the World Bank (2003) large-scale conversion for agriculture, urbanization, industrial purposes, illegal logging, illegal hunting, illegal wildlife trade, forest fires, and poor forest management planning are all significant issues.

In order to effectively manage protected areas in a sustainable way article 11 of the Protected Areas Law (2008) states that "*each protected area shall be divided into four (4) management zones. The fourth zone is the community zone (Table 2) which includes management area(s) for socio-economic development of the local communities and indigenous ethnic minorities and may contain existing residential lands, paddy fields and field gardens or swidden agriculture (Chamkar)*" (MoE, 2008).

Table 2 - Summary of the four management zones of protected areas based on the Protected Areas Law, MoE in 2008

Types of zone	Descriptions
1. *Core zone*	Management area*(s)* of high conservation values containing threatened and critically endangeredspecies, and fragile ecosystems.
2. *Conservation zone*	Management area*(s)* of high conservation values containing natural resources, ecosystems, watershed areas, and natural landscape located adjacent to the core zone.
3. *Sustainable use zone*	Management area*(s)* of high economic values for national economic development and management, and conservation of the protected area(*s*) itself thus contributing to the local community, and indigenous ethnic minorities' livelihood improvement.
4. *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 garden or swidden agriculture (*Chamkar*).

Source: Cambodia National Report Protected Areas Law, MoE 2008

However, this zoning system has not been fully implemented throughout Cambodia's protected areas yet and not in PKWS. Zoning is a crucial step in management of the sanctuary that will benefit all relevant stakeholders; particularly all users would find it useful for the future management of the resources in the sanctuary. Ultimately, it should help ensure their livelihoods, food security, and poverty reduction. The specific objectives of this research assessment were developed with this in mind.

1.2. Objectives

- To conduct an integrated assessment (biodiversity, livelihoods, socio-economics, economic valuation) in five pilot villages to generate information that can be used to identify a preliminary zonation scheme for part or all of the sanctuary
- To understand the perceptions and perspective of local people on their relationship with PKWS management authorities, and their thoughts about the zoning system, including the appropriate location of different zones and how they should be managed
- To develop preliminary recommendations for a partial zoning scheme for PKWS supported by high quality maps
- To build capacity of MoE staff to develop approaches for zoning of protected areas under the PA Law of 2008

1.3. Zoning in Protected Areas

A establishment of management zones in protected areas is believed to be an effective mechanism to help improve the conservation of biodiversity in the sustainable way worldwide (ICEM, 2003). Many developed and developing countries have applied zoning systems in order to define specific areas for species protection and management (Sabatinia, et al., 2006) and sustainable use by local communities because protected areas normally coincided with established communities. However, the management zones used differ among countries depending on the specific situation of each country as can be seen in the following examples.

In Asinara Inland National Marine Reserve of Italy four preliminary zones namely 'no entry no-take zone', 'different entry no-take zone', 'general-reserved zone', and 'partial-reserve zone' were developed based

mainly on the use of spatial multiple-criteria analysis to investigate dissimilar uses and levels of protection, geographic information system (GIS) to define the key area from different perspectives of all stakeholders, and a planning process for conservation and feasibility with consensus from different interest groups to minimize and control the conflicts and tensions in the marine protected area The *no entry, no-take zone* was mainly defined based on existence of key biological species and relative isolation. The *different entry, no-take zone* gave priority to biological diversity values and easy access for effective administration of invasion and ecotourism. The *general-reserved zone* was for the conservation of sensitive coastal benthic assemblages such as seagrass meadows threatened by allowed human activities in this area. *The partial-reserve zone* is regarded as a buffer zone to permit traditional activities (Villa, et al., 2002).

Three conservation zones: 'strict protected zone, buffer zone, and multiple-use zone' have been defined in Tambopata National Reserve and Bahuaja Sonene National Park of Peru based on the Protected Areas Law of Peru enacted in 2001. The Local Planning Committee formed of representatives of agriculturalist and indigenous federations played an important role in the consultation meeting to discuss and define zoning with other stakeholders such as mining cooperatives, conservation NGOs, tourism companies and staff from the National Council for the Environment and Natural Resource Institute in Peru (Naughton, 2007). The strict protected zone is the highest category of protection; the buffer area falls into a category that allows for limited use of natural resources, and some areas remaining as private landholdings are permitted in the multiple-use areas.

In the Philippines, the Mountain Pulag National Park was also divided into different management zones based on the methods of community consultations and biodiversity survey. The country has legally recognized the rights of indigenous people to live and use the natural resources in the protected area. Several problems occurred since management of the park has been changed to be under the authority of municipal governments. Therefore, two management zones namely '*strict protection zone and multiple-use zone'* were established in this park to sustain biological conservation and improve livelihoods of local communities within the park (Naughton, 2007).

According to Ruchi Badola (1998) '*most PAs in India have a core zone with national park status and a peripheral buffer zone, which can be either a wildlife sanctuary or a reserve forest. Resource use has been restricted to the buffer zones, where it has been regulated, while core areas are completely closed. A 1991 amendment to the Wildlife Protection Act specifies that, in wildlife sanctuaries, the chief wildlife warden must certify that any manipulation does not harm wildlife, and that the manipulation be approved by the state government'*. In addition India's protected areas have agreed to the principle of zonation for different patterns of resource use and protection. The core and buffer zones practically follow the Man and Biosphere approch of UNESCO. The sustainable uses of natural resources: grazing, timber and other biomass exploitation, including 'minor' forest produce, are largely permitted in most buffer zones, whilst the core zone is strictly protected (Rodgers, 2003).

While the specifics of zoning differ from country to country the conservation objectives of zoning are broadly similar.

2. Study area

2.1. Peam Krasop Wildlife Sanctuary and its significance

Peam Krasop Wildlife Sanctuary is one of Cambodia's protected areas established by the Royal Decree in 1993. It covers an area of 23,750 hectares situated in the southwestern coastal strip of Koh Kong Province with coordinates of 11°50'75"N/103°06'77"E (Fig. 1) (Environmental status Report, 2004) however, based on the PKWS map which was developed in 2003 and approved by the ministry of environment, ministry of land management, urban planning and contruction, and Koh Kong provincial authority, PKWS has covered an area of 25,897 hectares (Ministry of Environment, 2003).

For the integrated assessment for identification of a preliminary zoning scheme for Peam Krasop Wildlife Sanctuary in southwest Cambodia we are using the map of Peam Krasop Wildlife Sanctuary which covers 25,897 hectares.

The sanctuary is primarily covered by mangrove forest at the western part and evergreen forest to the east. Significantly, it is crossed by many channels and creeks which play a very important role not only to maintain the key aquatic species but also to facilitate local community travel for both fishing and market activities. PKWS contains thirteen human settlements, from parts of six communes in three districts (Peam Krasop, Bak Khlong and Toul Kaki communes in Mondul Siema, Koh Kapik and Tatai communes in Koh Kong district and Sangkat Stung Veng of Krong Khemarak Phommin (Table 4). Notably, while the administrative boundaries between provinces, districts and communes are well recognised, detailed surveys of the peripheral boundaries of individual villages have often not been made.

The area contains a variety of natural features including mountainous areas with evergreen forest, streams, rivers and waterfalls, coastal beach areas, swamps, islands and coral reefs. At least 64 species of mangroves in which *Rhizophora mucronata* and other *Rhizophora* species are the most dominant, cover the largest part of the sanctuary (PMMR, 2000). Human settlements include residential areas, rice paddies, cultivated and fallow fields, and aquaculture ponds.

The sanctuary provides many subsistence and livelihood services for local people who live in and around the areas (Nong, et al., 1998). These include providing direct food sources such as fish, crab, shrimp, squid, and mollusk and non food products such as firewood, construction materials and traditional medicine for treatments of diarrhea, pain-killing and others. Unfortunately, during the late 1980's the mangrove forests were cut for charcoal production, firewood collection for trade, shrimp farming, conversion to settlement and farming (PMMR, 2000; PRA Team, 2003). This combined with Illegal logging, overexploitation, hunting, fishing, and land grabbing have been the main causes of past biodiversity decline in the sanctuary.

The richness of natural resources of PKWS has had a magnet effect, attracting many people from different provinces to immigrate to the sanctuary for economic purposes. This is putting more pressure on natural resources in PKWS due to increased market demand locally and internationally for the resources of the sanctuary. Recent migrants from other provinces and illegal poachers from neighbouring countries add to the pressures of unsustainable uses of the resource base. Push netting, trawling, dynamite fishing, and coastal back net (locally known as Phong Phang) fishing have all been practiced within the sanctuary, and all are highly destructive to habitats and fish stocks. Push netting and trawling destroy marine habitats, while Phong Pang reduces fish stocks, in particular fingerlings. Although dynamite fishing does no longer happen so much, push nets, trawlers and Phong Pang are still common today. Notably, the price of land has been increasing dramatically in recent years, which is causing more encroachment into the sanctuary.

Overall it can be said that effective management has still not been established for PKWS in the 16 years since it was declared and established as a wildlife sanctuary in 1993. A coastal management plan encompassing the sanctuary was created by a Coastal Zone Management Project funded by Danida, which has already been phased out. The plan has never been implemented because there was little awareness of the plan by stakeholders, particularly the local communities, other resources users and even the provincial

authorities. The plan itself was very broad and suitable for the sanctuary authority to implement. However, the capacity of the authority is limited and they were unable to break the plan down into more simple and practical implementation measures. The UNEP South China Seas programme has also apparently developed a management plan for PKWS. However it appears that the superindent of the sanctuary and the rangers have no knowledge of this plan.

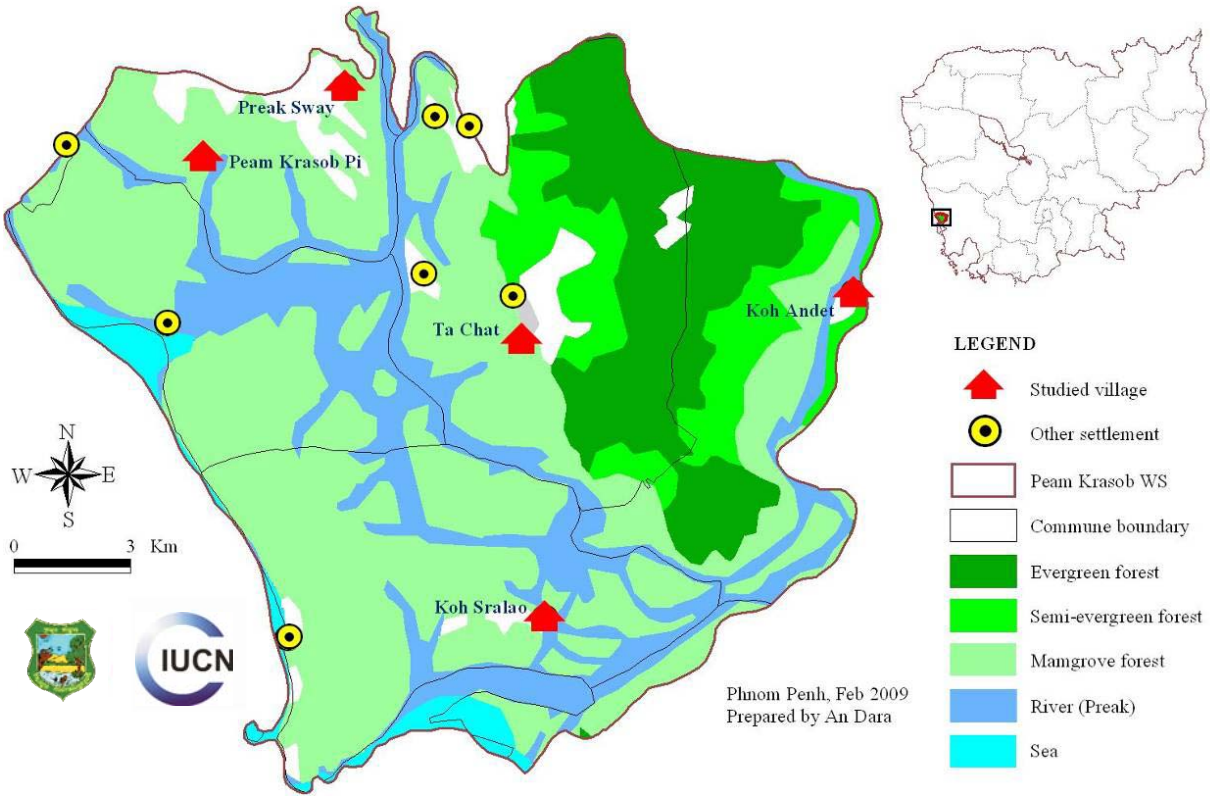
Currently, the sanctuary falls under the responsibility of the General Department of Administration for Nature Conservation and Protection, (formerly called the Department of Nature Conservation and Protection), of the Ministry of Environment. PKWS employs 21 local rangers who are paid approximately $20/month to protect and manage the sanctuary.

Given current unsustainable uses of the resources and the impracticality of implementing complex management plans at the local level, it is essential that simple, easy, but sufficient workable plans be developed so that the sustainable use of the natural resources in the sanctuary is ensured and participated in by all stakeholders, especially the local communities, and relevant authorities including the sanctuary authority, the local authority, the necessary provincial authorities and the national authority. In this context identifying specific management zones in the sanctuary, and then developing simple priority actions specific to each zone is one starting point.

2.2. Target villages

Five of the total of 13 villages in PKWS were studied – namely Peam Krasop Pi, Koh Sralao, Ta Chat, Preak Svay, and Koh Andet (Fig. 1). The location of these five human settlements are widely scattered throughout PKWS and represent all of the six communes covered by the sanctuary. Habitat stratification was also considered in selecting these five villages. The studied villages are located in six different communes in three districts of Koh Kong province and they also have different livelihoods, population sizes, and establishment history (Table 4).

Fig. 1 - The five villages studied in Peam Krasop Wildlife Sanctuary



3. Methods

The need for the assessment and the scope of work were first identified by two of the authors - Kong Kim Sreng and Robert Mather. The same two authors then developed the broad approach and methodologies to be used, and the timeframe for the assessment. After these invitations were requested from consultants to help conduct the assessment, a lead consultant was selected and detailed planning discussions followed.

A field survey was conducted for five weeks from 6 December 2008 to 9 January 2009 in the five targeted villages of PKWS in Koh Kong province, southwestern Cambodia by the lead author An Dara and Hout Piseth. This was intended as a preliminary zoning assessment based mainly on the actual activities of local residents and their knowledge on key species diversity.

Four main methods were used, derived from field techniques of Participatory Rural Appraisal (PRA) (Chambers, 1994; AFN, 2002) and Rapid Rural Appraisal (RRA): (i) group discussions (ii) semi-structured interviews (iii) seasonal calendar, and (iv) participatory mapping and zoning were conducted to assess the basic identification and feasibility of the first round of zoning for sustainable conservation and management of natural resources in the sanctuary. In addition to the above participatory methods, consultations with all levels of authority, as well as direct observation in the villages and field were also implemented. The important sites of globally critically endangered species were also visited for ground-truthing to identify and draw these key sites on the map. The details of these four methods, village observation and field visits are described below:

3.1. Consultations with local authorities

After receiving technical support from GDANCP of MoE and financial support from IUCN on developing management zones in PKWS, several meetings and discussions were held with experts and all levels of local authorities such as the provincial governor, director of the Provincial Department of Environment, district governor, commune leader, village chief, rangers and director of PKWS, and Peam Krasop ecotourism committee in order to provide them with the concept and goal of participatory zoning in the sanctuary. The survey teams explained to local authorities about the existence of 23 PAs managed by MoE, which were established by King Norodom Shihanuk's Royal Decree or "Preah Reach Kret". In order to manage these PAs in the sustainable way, every PA will be divided in four zones according to the new Protected Areas Law. Until now several PAs have not yet been subject to a process of defining the management zones. Peam Krasop Wildlife Sanctuary is one of them, and should be considered as a priority due to the existence of its unique habitat including large blocks of mangrove forest and globally threatened species of wildlife such as dolphins, fishing cat, otters, pelican, adjutants, storks etc. Significantly, the team convinced authorities about the key important goals for zoning: to improve biodiversity conservation and management in a sustainable way; to minimize the conflicts between the PA authorities and local communities; and to help improve local livelihoods in the sanctuary.

3.2. Group discussions

a. *Local villagers:* Group discussions were conducted in each target village. These discussions principally focused on key informants: village chiefs, village team leaders (known locally as Krom), ecotourism committees, teachers, elder villagers, active fishermen and farmers, and other stakeholders. This focus group was believed to be more aware of the village situation than others. The topic of the discussion aimed at recording existence of key wildlife species and forest/habitat types known by participants and identifying significant areas for globally endangered species of wild animals and different habitat types within the sanctuary. Initially, survey teams explained to participants about participatory zoning in PAs and how it is critically important for sustainable conservation of biodiversity such as protecting key wildlife species and habitats, minimizing conflict between PA authorities and local communities, and improving local livelihoods. The four following sections were considered in the group discussion:

• *Free listing of wildlife species and historical trends*: All participants were asked to provide the names of any wildlife species that they know exist in the sanctuary. Every species was written down on flip chart paper (App. A). The teams did not classically divide species into mammals, birds, amphibians and reptiles during the dialogue. In doing so, it seemed to allow audiences to come up with other species more promptly. A guide to the mammals of Cambodia, A field guide to the birds of Thailand and South-East Asia, The photographic guide to the turtles of Thailand, Lao, Vietnam and Cambodia, the field guide for crocodile research and monitoring were used to confirm the biodiversity species that were identified by the local people. A 1:50 000 scale topographic map was used to allow participants and other stakeholders to point out the specific location of all the species they listed, and principally the globally endangered species. One member of the survey team marked areas on the map known by local residents as the key zones for wildlife.

Historical trends, local status of each species, and reasons for changes were also discussed by all attendants of the group discussion. The survey teams also identified timelines including particular periods of memorable change of wildlife habitats through discussion with all participants. Participants were also asked to rank the relative abundance of each species on a scale from 5 to 1 (very abundant, abundant, common, rare, and very rare). The reasons of population decline of each species were also written down in detail on the flip charts.

• *Free listing of forest habitat and historical trends*: This activity was conducted in the same was as for wildlife species and trends, i.e. the team allowed participants to list all existing habitat types of the sanctuary (see above). The periods of historical change of habitat were identified from the knowledge of all participants. However, these particular periods were always alike between species and habitat in each studied village. The causes of habitat change over decades were further discussed to clarify from participants' experience in PKWS. A member of the survey team always recorded all of the reasons for each habitat trend provided by villagers in the group discussion.

• *Identifying zones*: The topographic maps with the areas of existence of globally endangered species and key habitats identified by communities marked on the maps, were presented back to all participants and other stakeholders. The survey team asked them to give comments on classifying which areas should be kept for conservation zones, which areas should be reserved for sustainable use, and which areas should constitute the community zone. The discussion also focused on overlapping areas in order to find the consensus to divide the area into both biological conservation zone and sustainable use zone for the local communities in PKWS.

• *Local knowledge on conservation of PKWS*: The survey teams furthermore questioned all participants and other stakeholders about their knowledge/perception on existing management of PKWS and their conceptualization of management zonation in PKWS. Several questions were asked: (i) have you ever heard about PKWS? (ii) do you know who manages this sanctuary? (iii) do you clearly know the boundaries of the sanctuary? (iv) Do you think making management zones in the sanctuary such as biodiversity conservation zone, sustainable use zone, and community zones is a good idea? In addition the same questions were asked of individual informants in semi-structured interviews in order to make sure their answers were not affected from someone else in the group discussion.

b. *Park rangers*: Two main ranger stations in PKWS were visited (Table 3). Those two stations were established based on the areas believed to maintain globally threatened species, key forest habitat, and the key access points of illegal logging and hunting. These locations are suitable for park rangers to do biological research and patrol effectively in the Sanctuary. Apart from these two stations, other rangers are mostly based in their village to monitor and work in their village area. They usually report to the central station when they come across any serious issues that could not be solved at the local level. All rangers at each station actively participated in the discussion with our expert team on their perception of local communities and on zoning in PKWS and the Protected Areas Law. The relationship between PKWS authority and local residents, local knowledge on Protected Areas Law and specific zones, and their ideas on how these zones could be improved were furthermore discussed.

Table 3 - The two main ranger stations located in PKWS

Station name	Location (UTM)	Number of ranger	Year of establishment
Bung Kayak	11° 56'83''N/102° 97'23"E	10	2002
Bung Kachhang	11° 56'80"N/102° 97'07"E	12	2006

3.3. Semi-structured interviews

a. *Sample size and selection*: In the five studied villages, 100 respondents were selected by focusing on household leaders. This sampling method is essential to gain statistically representative information of the whole research site (Freese, 1967; Evans et al., 2003). The selected informants seemed to know more than other members in their household in terms of existing biodiversity and other internal and external activities related to villagers' livelihoods according the preliminary finding from the meetings with all levels of local authority. This sample size is statistically believed to represent information of the entire research site because it was equivalent to about 13 % of the total number of households in the sanctuary.

b. *Questionnaire interview*: The activity was mainly conducted at each household of selected informants. The village chiefs and active fishermen and farmers who have known the village situation and are friendly with local residents played a very important role to facilitate the interview process in the villages (Dara, 2008). In the field, the selected respondents were not always present during the period of our interview survey. In this case other villagers of the target group were substituted accordingly (Kimsan, 2005). The questions were mainly asked to household leaders who were very active in farming, fishing, and collecting NTFPs. Opportunely, both husband and wife mostly appeared during the interview. The questionnaires of this research aimed to identify the main local livelihoods, areas used for fishing and farming, rice and fishing products, major sources of income and relevant activities inside the sanctuary (App. C).

3.4. Participatory mapping

We selected outstanding local residents from the group discussion part, in particular the experienced individuals who have a good knowledge of the villages, daily activities, and the areas throughout the sanctuary. The teams allowed them to draw the village map, the areas where local people go for fishing, farming, and NTFP collection. Their access routes to travel in the sanctuary and additionally the forest around their village area were also put in to the map.

3.5. Seasonal calendar

This mainly focused on the activities of the local community: fishing, farming, NTFP collection, and others. The team wrote down all the local activities pointed out by participants and listed all calendar months from January to December on flip charts. Then the teams started asking them when did each activity start and finish? And where did they usually visit each different place for these activities? Regular activity was presented by dark grey color and activity that only happened occasionally was shown by the pale grey shade (App. D).

3.6. Consultation workshop

This additional seminar was conducted on 5th February 2009 in Koh Kong provincial town attended by all relevant national, provincial, local authorities, the media and the representatives of relevant NGOs. The seminar was chair by the director general of GDANCP, Koh Kong deputy provincial governor and the representative of IUCN Cambodia.

The main purposes of this seminar were to solicit strong support from local authorities on zoning in KPWS, to educate all participants about the significance of the zoning process for effective conservation and management of the rich biodiversity in PKWS, and to discuss with all levels of local authorities (mainly with village and commune chiefs from every village in PKWS) to finalize the preliminary results on zoning achieved during the five weeks field survey. Participants were divided into three groups based on geographic location of their home village. In doing so, this allowed participants from specific landscapes to provide comments and recommendations on the preliminary assessment output. Topographic maps of A0 size with demarcated boundaries of each proposed zone were provided to each group. The groups were asked six questions: (i) do you agree with the defined zones in the map? (ii) are there any important areas you think should be considered as different management zones from what has been identified? (iii) are there any gaps related to the zoning in the particular map? (iv) what do think about zoning for management in PKWS? (v) have there been any problematic points between the local community and sanctuary authorities, and how could this be improved? (vi) are there any other comments or recommendations? After intensive discussion in the group, one representative of each team presented their results to all participants in a plenary session. The findings of each team were actively discussed and recommendations made to finalize the proposed management zones of PKWS.

4. Results

4.1. Consultations about zoning

Consultations with relevant authorities on management zones in PKWS showed that the provincial governor, director of Provincial Department of Environment, district governor, commune leader, village chief, and Peam Krasop ecotourism committees seemed to strongly support the zoning process in this sanctuary proposed by MoE in cooperation with IUCN. They anticipated that this preliminary participatory zoning will assist in protecting important biodiversity, minimising the conflicts between park authority and local villagers, and improving local livelihoods in a sustainable manner.

The Director of PKWS and rangers were also consulted concerning zonation of the sanctuary. They all strongly supported this work as they are facing several illegal activities such as land encroachment, trapping for wildlife, and illegal fishing. Management of these activities might be exacerbated by unclear zoning, so designating clear zones may be very helpful to reduce the conflicts and can provide an opportunity for improved communication between local communities and park authorities.

The discussion was also held concerning communication between rangers and local villagers. The result illustrated that the communication with local communities was often based on the provision of regular information concerning illegal activities provided by the local community. However, not surprisingly the rangers reported that some people who committed illegal activities were obviously not happy with the rangers in particular whenever they were fined and/or had illegal products confiscated from them by law enforcement teams.

A similar consultation was also conducted with the five target villages whilst having the group discussion or individual interviews. Four of the five studied villages seemed to strongly support the zoning of Peam Krasop Wildlife Sanctuary with participation of the local community and the PA authority. They stated that zoning can show them clearly about where the land for local community use is, and where the land for conservation is. In doing so, it can reduce the conflict between the park authority and local community and also help to minimize the risk of outsiders claiming forestland. One village was seemingly not clear about their support for a zoning system because they felt concerned that whilst implementing zoning the authority will stop them from freely fishing in all areas. Most of them complained about the decline of aquatic resources because of the lack of a clear management plan in the park.

4.2. Basic information of the studied villages

a. *Peam Krasop Pi*: The village chief and some elder residents described that Peam Krasop was established a long time ago, probably before World War II. The settlement was started with the people from outside such as Chinese and residents from Dorngtong village, Mondul Seima district of Koh Kong province. They came to this region to collect shrimp and other marine species and began to settle small cottages for their residential village by using sacks (known locally as Baov) to cover their cottages. Then most people referred to the area as Bang Baov, (covered by sacks) but later on local villagers changed this name to Peam Krasop, and it has been used and recognized officially by the national authority until now. Most villagers are engaged in a variety of fishing activities, while some families are engaged in small businesses and agriculture.

b. *Koh Sralao*: Older people in the village explained that Koh Srolao was established during World War II (Table 4) because local residents noted the Japanese airplanes flying overhead. Historically, this island was the place that was able to provide fresh water to other people in other islands as well. At that specific time it maintained many wildlife species: tiger, elephant, rhinos etc. The people nearby always came to collect the fresh water in this island. Due to the existence of many wildlife species, local residents seemed to be scared of nocturnal wild animal species, thus they always brought spears to protect themselves. Thai people called these spears *Chaola*o and from that particular time villagers started calling this *Chaolao* Island. Over time pronunciation changed until it became Koh Sralao. Fishing is the main livelihood of the people in Koh Sralao community because they are able to sell their fishing products for income to the Koh Kong province conveniently.

c. *Ta Chat*: The establishment period of this human settlement was similar to Koh Sralao village. People initially called this village Ta Kat meaning the place with white sand. Later on, the name changed to Ta Chat. Notably, the geographical situation of this village is favorable for local residents to develop diversified livelihoods because it consists of not only suitable mainland area for agriculture but also many existing channels and streams for fishing (Table 4 & Fig 1). Fishing was recognised as the key income source of most villagers because they mainly fished for trade to the urban area.

d. *Koh Andet*: This is also a long established village. The elder villagers indicated that the channel known locally as "Preak" receives water from the sea. This influence causes the Preak water to go up and down frequently. During the rainy season fresh water replaces salt water. One day villagers saw a floating mat with small plants. Residents suspected that there was probably a creature under the floating material moving around. It did not go further away from this particular area. After a long period of time the size of this floating mat steadily increased and did not move anymore. Therefore, after people settled their village they decided to use this floating mat as the name of the village (Koh Andet). Population size of the village was roughly similar to the Ta Chat village (Table 4).

e. *Preak Svay*: This village is located on the mainland of the eastern part of the sanctuary and was established a long time ago perhaps during World War II. There were many mangoes growing in this area, but there was only one tree bigger than the others and this tree grew next to "Preak". Thus, people named this area Preak Svay (Svay locally means mango) and they took the name of this Preak Svay for their village as well. The majority of village dwellers have been engaging in agriculture for subsistence and fishing activity for additional household income.

According to the recent GIS database from the Wildlife Conservation Society (2008), there are thirteen villages in PKWS. The majority of village families depend greatly on fishing, opening forest area for agriculture and collecting forest products such as NTFPs.

Table 4 - The five target study villages selected in PKWS

Village	Commune/ district	Lat/Long	Year of establishment	Total population
Peam Krasop Pi	Peam Krasop / Mondul Seima	11° 52'41"N/ 102° 99'03"E	World War II	768
Koh Sralao	Koh Kapik / Koh Kong	11° 45'80"N/ 103° 07"68"E	World War II	1309
Ta Chat	Tuol Kaki / Mondul Seima	11° 57'80"N/ 103° 03'04"E	World War II	325
Preak Svay	Sangkat Stung Veng / Krong Khemarak Phommin	11° 57'80"N/ 103° 03'04"E	World War II	672
Koh Andet	Tatai Kraom / Khoh Kong	11° 53'22"N/ 103° 14'70"E	World War II	219

4.3. The presence and absence of wildlife species in PKWS

Sixty three species of wildlife were listed during group discussions consisting of 24 mammals, 28 birds, and 11 reptiles (App. A). However, there are probably more important species existing in this sanctuary, which were missed and not pointed out by local villagers. More importantly, the sanctuary still maintains many globally threatened species known by local villagers: Dolphins, Fishing Cat, Otters, Bears, Pelican, Adjutants, Storks, Hornbills, Eagles, etc. (Table 5). No attempt was made to list important fish and amphibians, as the knowledge of the assessors on these groups was considered too limited.

Table 5 - Globally threatened species known or considered likely to still exist in PKWS, southwestern Cambodia

No	English name	Scientific name	IUCN Status	Confirmed by the studied villages
Mammals				
1	Fishing Cat	*Pronailurus viverrinus*	VU	PK,TC, KA, KS
2	Otter sp.*	*Lutra sp.**	DD	PK, PS, TC, KA, KS
3	Dolphin sp.*		DD/LC	PK, PS, KS
4	Tiger	*Panthera tigris*	EN	PK
5	Hog Badger	*Arctinyx collaris*	LC	PK, TC
6	Gibbon sp.*	*Hylobates sp.**	VU	PK, TC, KA
7	Northern Pig-tailed Macaque	*Macaca leonine*	VU	KA
8	Dhole	*Cuon alpinus*	EN	KP, TC, KA
9	Loris sp.*	*Nycticebus sp.**	VU/DD	KP, TC
10	Sunda Pangolin	*Manis javanica*	NT	KP, TC, KA
11	Bear sp.*	*Ursus sp.**	VU	PK, PS, TC, KA
12	Clouded Leopard	*Neofelis nebulosa*	VU	PS
13	Jungle Cat	*Felis chaus*	LC	PS, TC
14	East Asia Porcupine	*Hystrix brachyuran*	VU	TC, KA
15	Silvered langur	*Trachypithecus germaini*	LR/NT	KA
Birds				
16	Adjutant sp.*	*Leptoptilos sp.**	EN/VU	PK
17	Giant Ibis?	*Pseudibis gigantean*	CR?	PK
18	White-bellied Sea Eagle	*Haliaeetus leucogaster*	NT	PK
19	Imperial Eagle	*Aquila heliaca*	VU	PK
20	Sarus Crane	*Grus antigone*	VU	PK
21	Spot-billed Pelican	*Pelecanus philippensis*	VU	PK
22	Stork sp.*	*Mycteria sp.**	VU/NT	PK
23	Hornbill sp.*		NT/LC	PS, TC, KA
24	Wreathed Hornbill	*Aceros undulates*	LC	TC, KA
25	Green Peafowl	*Pavo muticus*	VU	KA

(*) *more than one species but unclear identification*

Village: *PK = Peam Krasop Pi, TC = Ta Chat, KS = Koh Sralao, PS = Preak Svay, and KA = Koh Andet*

4.4. Historical trend of existing species reported by key village informants

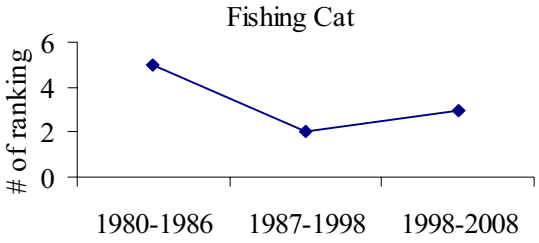
Three significant periods were clearly identified from the five villages in group discussions on the historical change of all wild animal species and their habitat use. These particular stages differed from one village to another depending on the specific situations that they experienced over particular decades, but the events shared broad similarities among these five human settlements (Table 6).

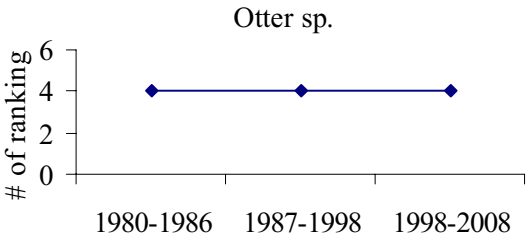
Table 6 - The three significant periods for wildlife and habitat trends of each studied village
See Table 5 for the village abbreviation

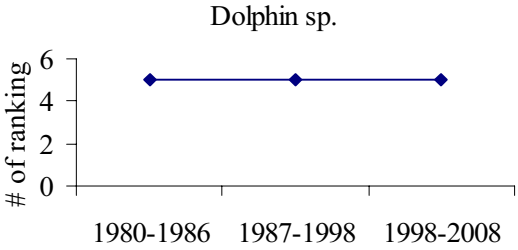
Period/Village	Described by villagers
1st period PK: 1980-86, KS: 1981-86, TC: 1979-90, PS: 1979-89, KA:1979-89	This was the time when many villagers started to settle inside KPWS, during that era wildlife and fishery resources were abundant and fishing for both subsistence and trade was retively easy.
2nd period PK: 1987-98, KS: 1987-93, TC: 1991-96, PS: 1990-97, KA:1990-98	This was an anarchic period with many illegal activities: illegal hunting, logging, and fishing, land grabbing, cutting down the mangrove for charcoal to export abroad etc. During that time, Cambodia was plagued by chronic war and unrest and there was little control over biodiversity.
3rd period PK: 1999-08, KS: 1994-08, TC: 1997-08, PS: 1998-08, KA:1998-05	In his period relevant governmental authorities and other national and international NGOs have paid increasing attetion to reduce the loss of biodiversity by using scientific research to define the important areas for key species; law enforcment to stop illegal logging, hunting, and fishing; local participation in conservation, ecotourism etc.

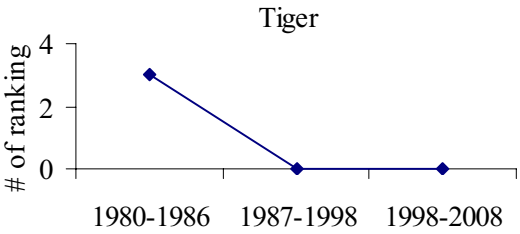
Abundance of all species of wildlife reported was ranked by village respondents. Ranking of each species status was divided into 5 categories: 5 = very abundant, 4 = abundant, 3 = common, 2 = rare, 1 = extremely rare. In the results highlighted in this report, only the information for globally endangered species of mammals and birds is presented. The common species in each village were not included in the graphs and the chart of reptiles was also not shown in the findings because several key species of reptile particularly turtles and soft-shelled turtle were unclearly identified by local community respondents during the field discussion. However, the general trend of those species seemed to decrease over the three identified periods.

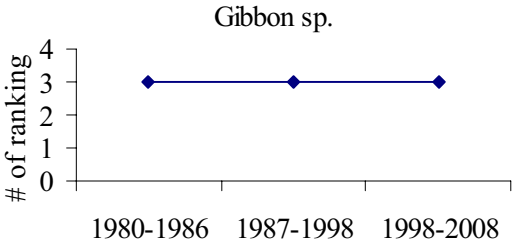
Using the above ranking categories, the charts below show the historical trend of key species of mammals and birds from 1980 to 2008 as reported by local people in Peam Krasop Pi village. The population of fisting cat, loris sp., and spot-billed pelican seemed to be more abundant during the first period whilst they declined sharply during 1987-98, but then their number slightly increased from 1998 to 2008. Notably, the number of otter sp., dolphin sp., gibbon sp., and hog badger remained unchanged from 1980 to 2008. Tiger, stork sp., adjutant sp., giant ibis, sarus crane, and imperial eagle were more abundant from 1980 to 1986 whilst they dramatically decreased in 1987-98 and continued to stay the same within 1998-2008. The number of bear sp. in Pream Krasob Pi steadily decreased from 1980 to 2008. In general, the number of key species in Pream Krasob Pi has declined from 1980 to the present (Fig. 2).

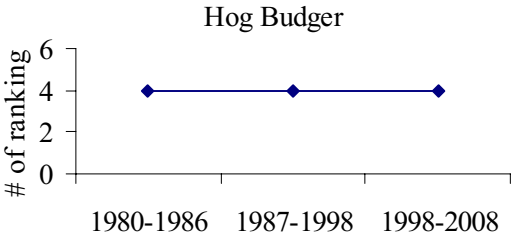

Fishing Cat
# of ranking
6
4
2
0
1980-1986
1987-1998
1998-2008

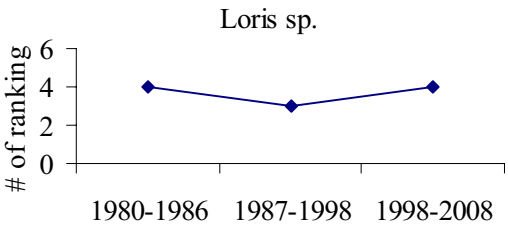

Otter sp.
# of ranking
6
4
2
0
1980-1986
1987-1998
1998-2008

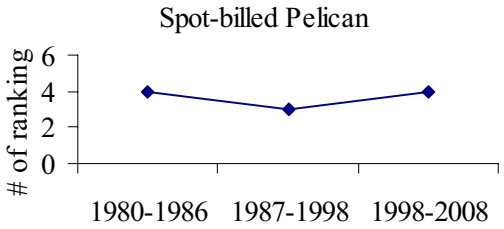

Dolphin sp.
# of ranking
6
4
2
0
1980-1986
1987-1998
1998-2008

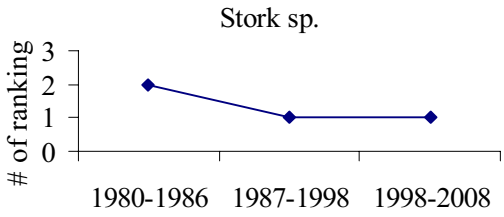

Tiger
# of ranking
4
2
0
1980-1986
1987-1998
1998-2008

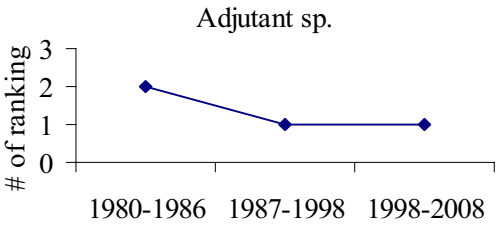

Gibbon sp.
# of ranking
4
3
2
1
0
1980-1986
1987-1998
1998-2008

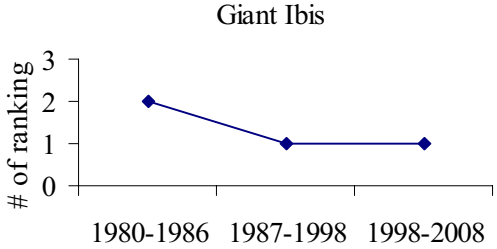

Hog Budger
# of ranking
6
4
2
0
1980-1986
1987-1998
1998-2008

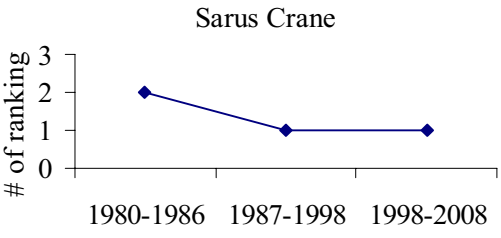

Loris sp.
# of ranking
6
4
2
0
1980-1986
1987-1998
1998-2008


Spot-billed Pelican
# of ranking
6
4
2
0
1980-1986
1987-1998
1998-2008


Stork sp.
# of ranking
3
2
1
0
1980-1986
1987-1998
1998-2008


Adjutant sp.
# of ranking
3
2
1
0
1980-1986
1987-1998
1998-2008


Giant Ibis
# of ranking
3
2
1
0
1980-1986
1987-1998
1998-2008


Sarus Crane
# of ranking
3
2
1
0
1980-1986
1987-1998
1998-2008

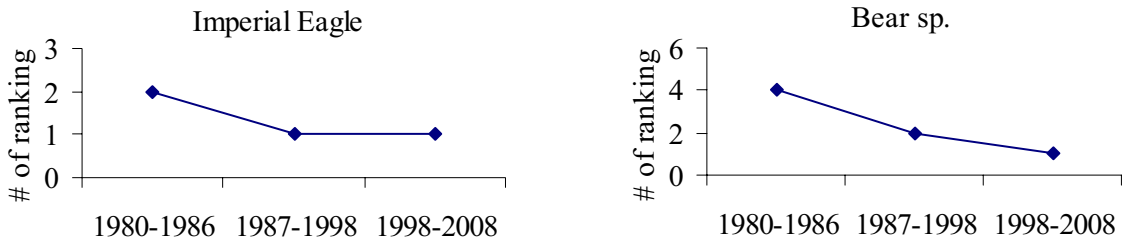


Fig. 2 - Historical change of reported population abundance of globally threatened species from 1980 to 2008 in Peam Krasop Pi village

Only three globally threatened species were reported by local villagers in Koh Sralao. The graphs below illustrate the historical change of key species from 1981 to 2008. The number of otter sp. and dolphin sp. stayed the same from 1981-93 whilst these two species sharply declined from 1994 to 2008. The fishing cat was more abundant in the first period, but its population dropped from 1987-93 and continued to remain unchanged until 2008 (Fig. 3).

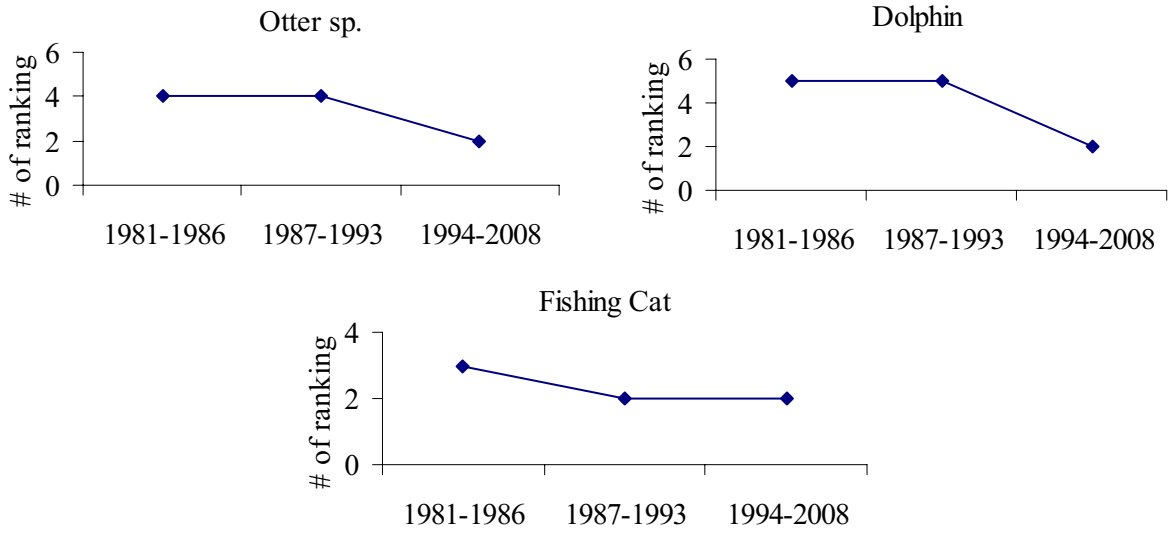


Fig. 3 - Historical change of reported population abundance of globally threatened species from 1981 to 2008 in Koh Sralao village

In Ta Chat village the population of bear sp. steadily declined from 1991 to 2008 whilst otter sp. abundance stayed the same from 1979-96 and started increasing slightly from 1997-2008. Fishing cat abundance stayed at 4 in 1979-90 whilst it was slightly less abundant during 1991-96 and then increased again. Notably, the reported abundance of populations of sunda pangolin and loris sp. remained unchanged from 1979 to 2008 in this village area. Hog badger, jungle cat, dhole, and wreathed hornbill were more abundant in the first period whilst their number went down in 1991-96, and then stayed the same until 2008. However, other hornbill sp. remained unchanged from the first to the second period, then started to decline from 1997 to 2008 (Fig.4).

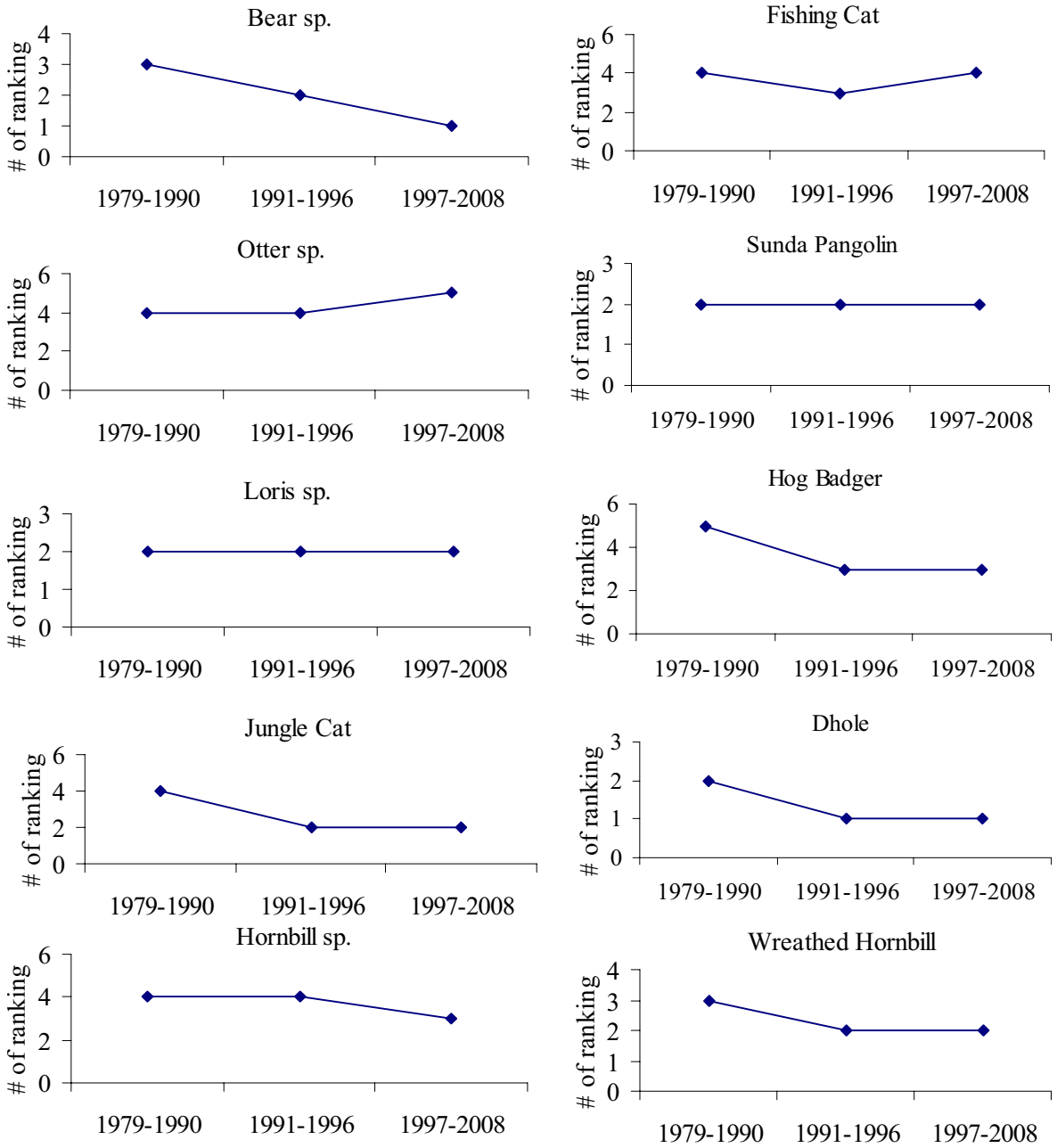


Fig. 4 - Historical change of reported population abundance of globally threatened species from 1979 to 2008 in Ta Chat village

The charts below indicate the historical trend of abundance of key species reported by local villagers in Preak Svay village from 1979 to 2008. The abundance of otter sp., fishing cat, and jungle cat dramatically declined between 1990 and 1997, whilst slightly increased from 1998 to 2008. The clouded leopard, bear sp., and dolphin sp. were reported as more abundant in the first period whilst their population declined from 1990-97 and then continued to remain unchanged until the 2008. Only hornbill sp. population abundance stayed the same from 1979 to 1997, and began to increase slightly from 1998 to 2008 (Fig.5).

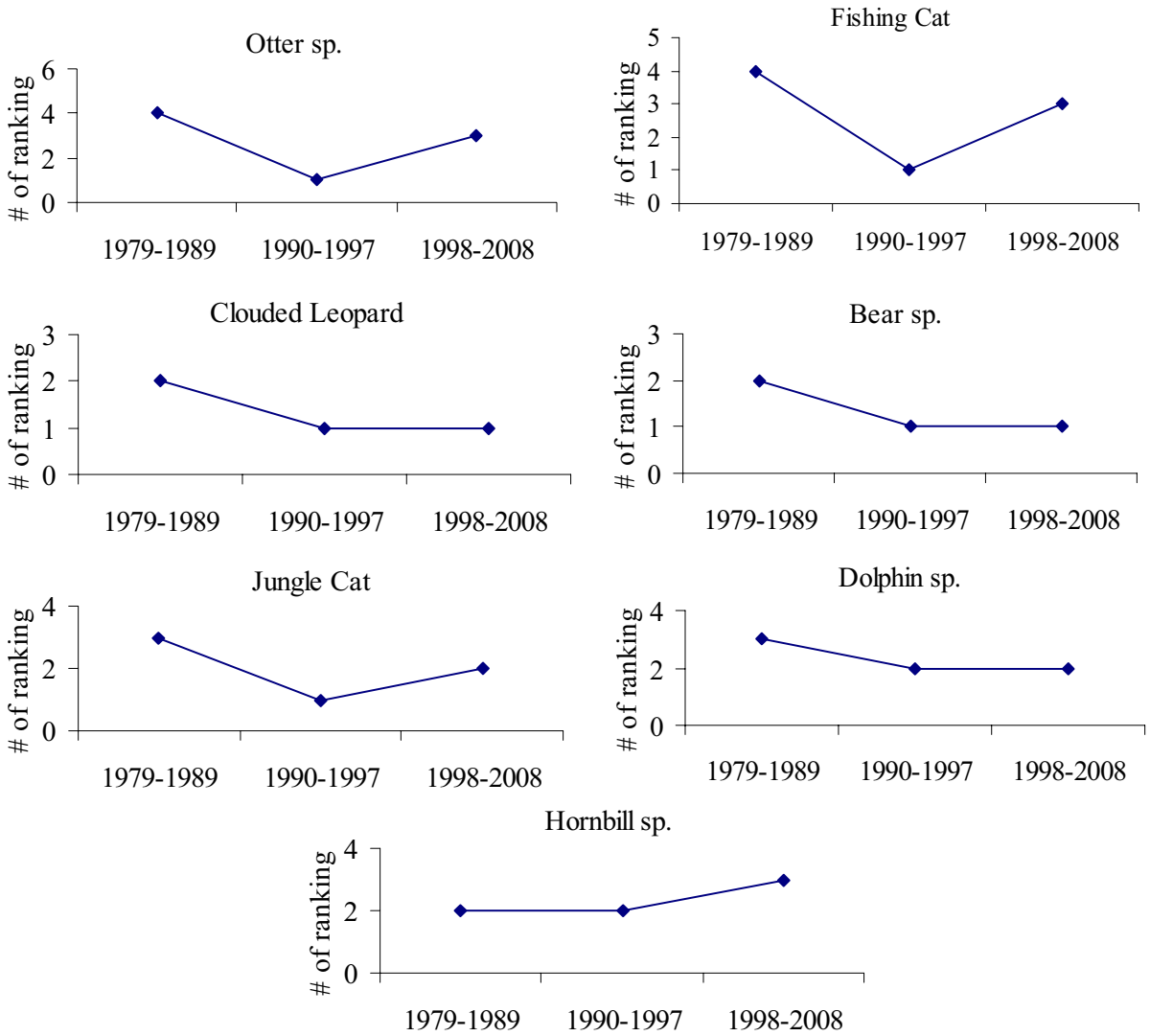
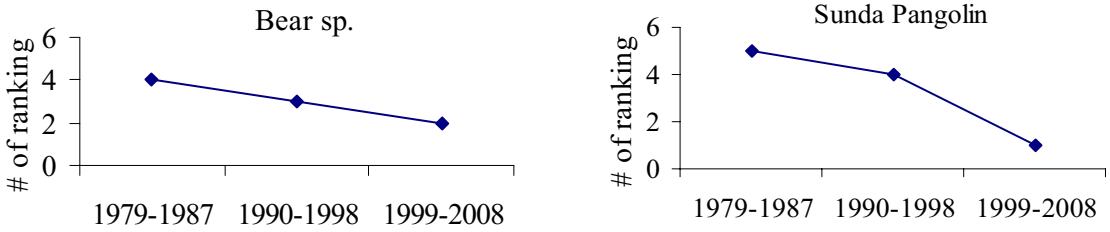


Fig. 5 - Historical change of reported population abundance of globally threatened species from 1979 to 2008 in Preak Svay village

Koh Andet village was recognized as the second most important village after Peam Krasop Pi in terms of the existence and abundance of key species of wildlife. There were 11 globally threatened species of mammals and birds reported by local villagers namely bear sp., sunda pangolin, otter sp., fishing cat, dhole, gibbon sp., pig-tailed macaque, silvered langur, green peafowl, hornbill sp., and adjutant sp. The charts below indicate the reported historical trend of each species from 1979 to 2008. All key species of mammals and birds steadily declined in abundance from 1979 to 2008 in Koh Andet village of PKWS (Fig.6).



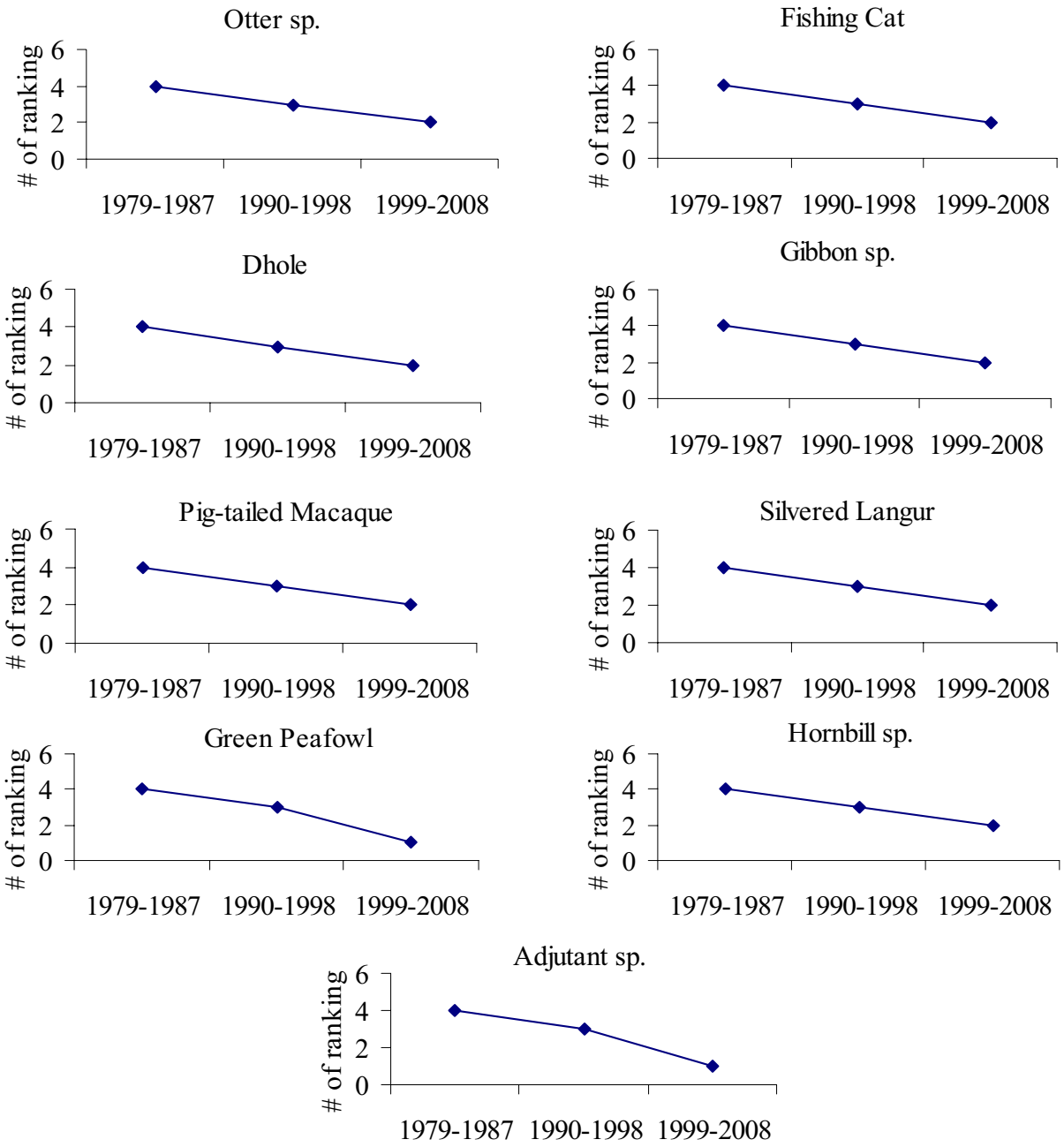


Fig. 6 - Historical change of reported population abundance of globally threatened species from 1979 to 2008 in Koh Andet village

4.5. Habitat and their historical trends in PKPWS

Ten types of habitat namely evergreen forest, mangrove forest, bamboo forest, Khbanh or Krovanh forest, and the other forests known locally in Khmer as Smach (*Melaleuca leucadandraon*), Sme (*Aegialites rotundefolia*), Brong (*Acrostichum aureum*), Kranhep (*Combretaceae*), Brasac (*Rhizophoraceae*), and Sngaw (*a type of pine tree*) have been identified by participants of each studied village (App. B). These vegetation habitats were seemingly easy for participants to classify and to demonstrate the historical change over the years.

In Peam Krasop Pi village eight types of forest were reported by local people during the group discussion survey. Mangrove, Sme, and Brorng seemed to be more abundant in the first period whilst they were

dramatically reduced between 1987-98 and they began to recover slightly from 1998 to 2008. Kbanh forest (cardamom) stayed the same from 1987 to 2008 whilst Smach remained unchanged from first and the second period and then it began to drop down slightly from 1998 to 2008. Brasac and Sngaw forest were more abundant in the first period whilst they went down sharply within 1987-98 and these two types of forest continued to remain unchanged until 2008. Notably, only Kranheb steadily decreased from 1987 to 2008 in Peam Krasop Pi village (Fig.7).

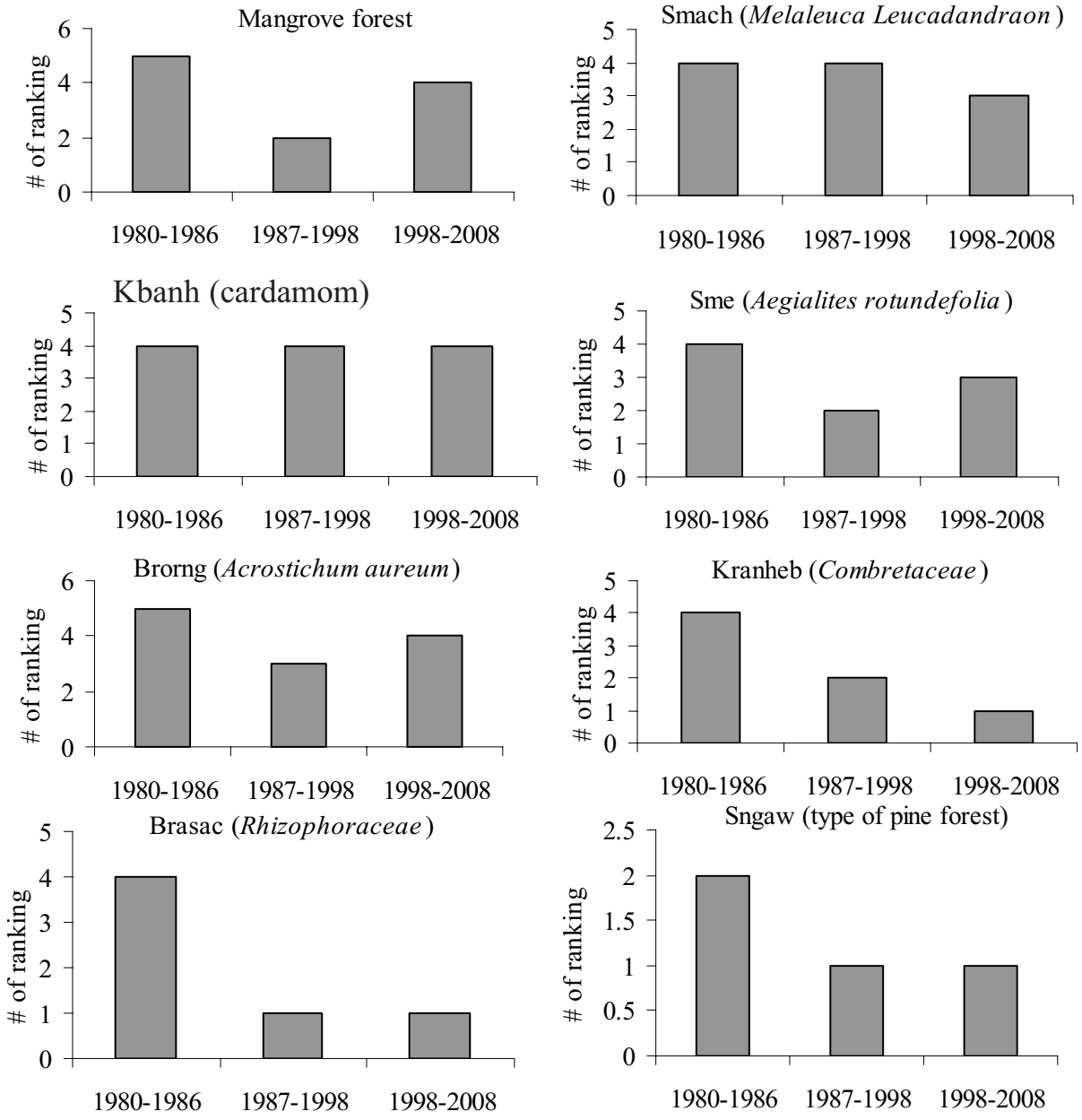


Fig. 7 - Historical change of habitat types known by Peam Krasop Pi villagers from 1980 to 2008

The bar graphs below demonstrate the habitat change over the three particular identified periods in Koh Sralao village. Sme, Kranheb, and Brorng seemed to stay the same whilst Smach forest steadily decreased from 1981 to 2008. The mangrove forest was more in the first period whilst it declined dramatically in 1987-93 and then from 1994 to 2008 this forest increased to the same amount as the first period. Remarkably, the evergreen forest seemed to stay the same from the first to the second period, but it declined dramatically from 1994 to 2008.

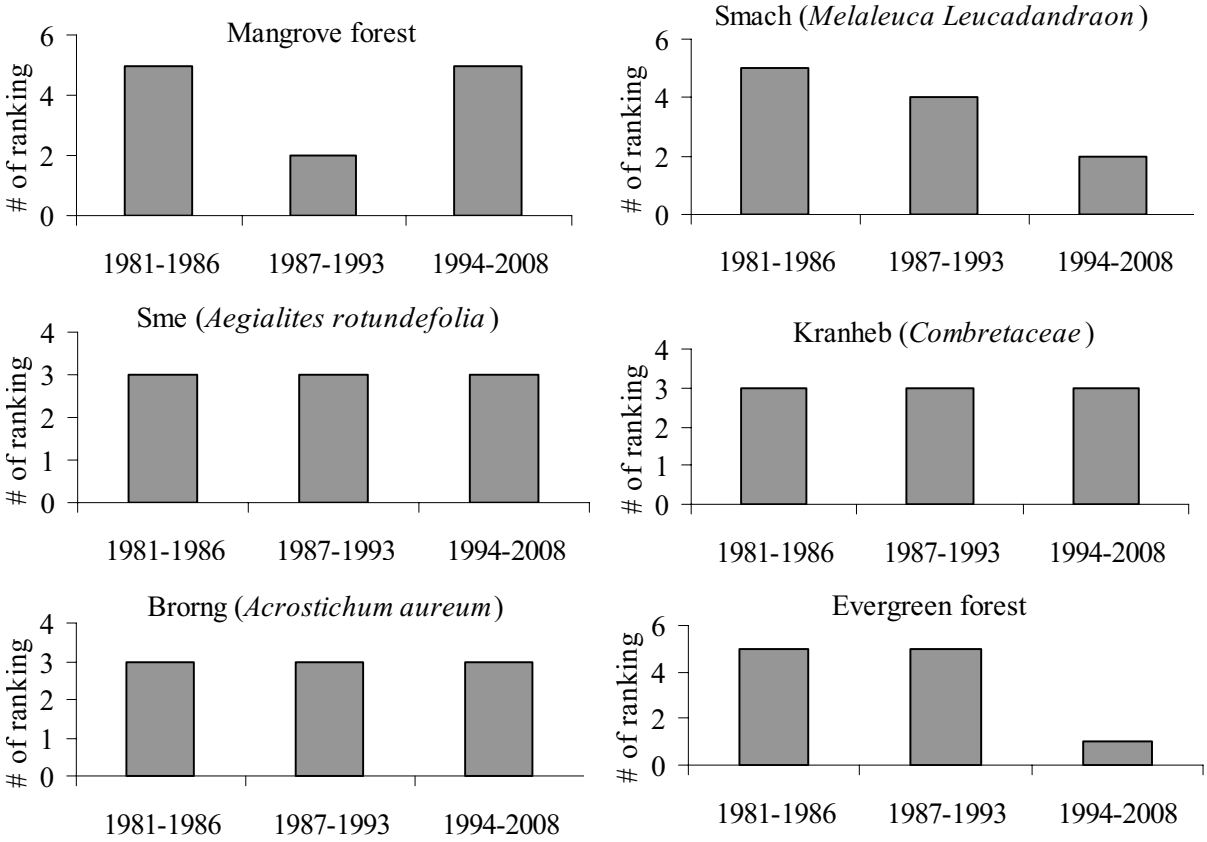
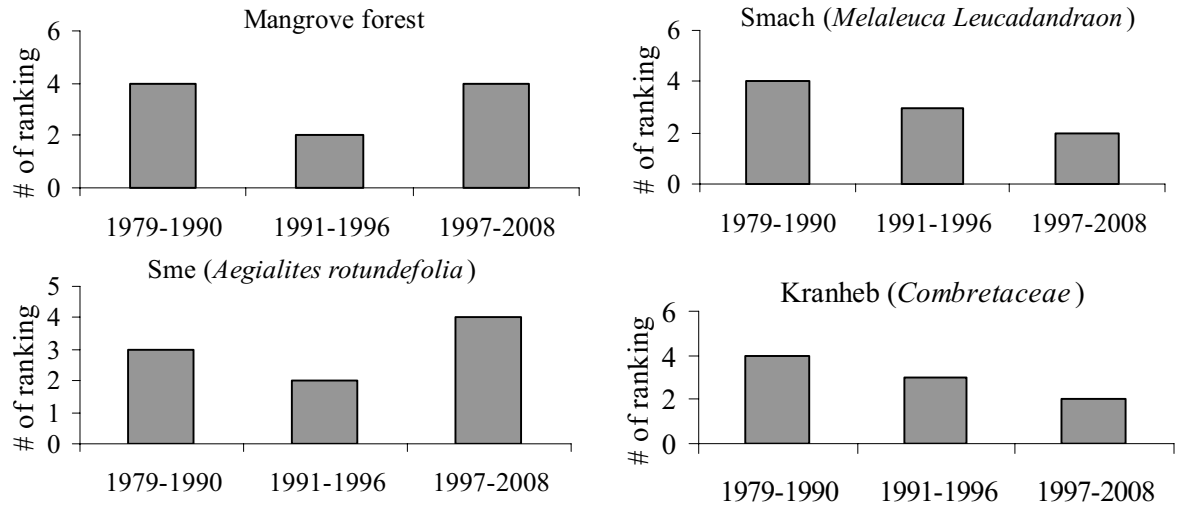


Fig. 8 - Historical change of abundance of habitat types reported by Koh Sralao villagers from 1981 to 2008

In Ta Chat village evergreen forest, Smach, Kranheb, Brorng, and bamboo gradually decreased from 1979 to 2008. The Sme forest was slightly reduced in abundance in 1991-96 and then this forest type began to increase sharply from 1997 to 2008. The mangrove forest was more abundant in the first period whilst it declined dramatically in 1991-96 and then from 1997 to 2008 returned to the same abundance as the first period.



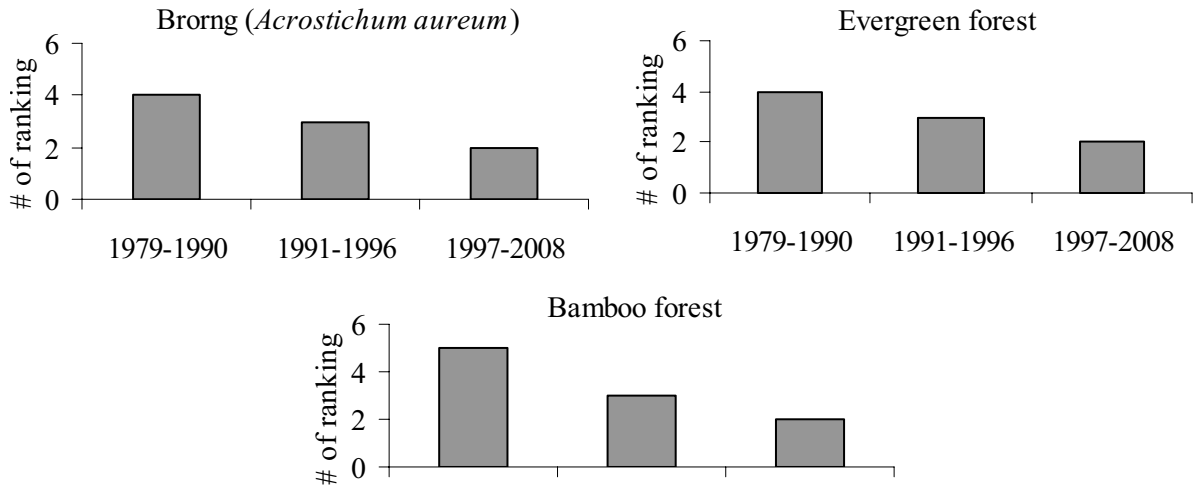


Fig. 9 - Historical change of abundance of habitat types reported by Ta Chat villagers from 1979 to 2008

The charts below show the historical trend of five identified forest types (mangrove, Smach, Sme, Kranheb, and Brorng) in Preak Svay village from 1979 to 2008. The Sme forest remained unchanged whilst Smach, Kranheb, and Brorng gradually reduced from 1979 to 2008. The mangrove forest of Preak Svay village was more in the first period whilst it declined sharply during 1990-97, and then it started to increase somewhat from 1998 to 2008.

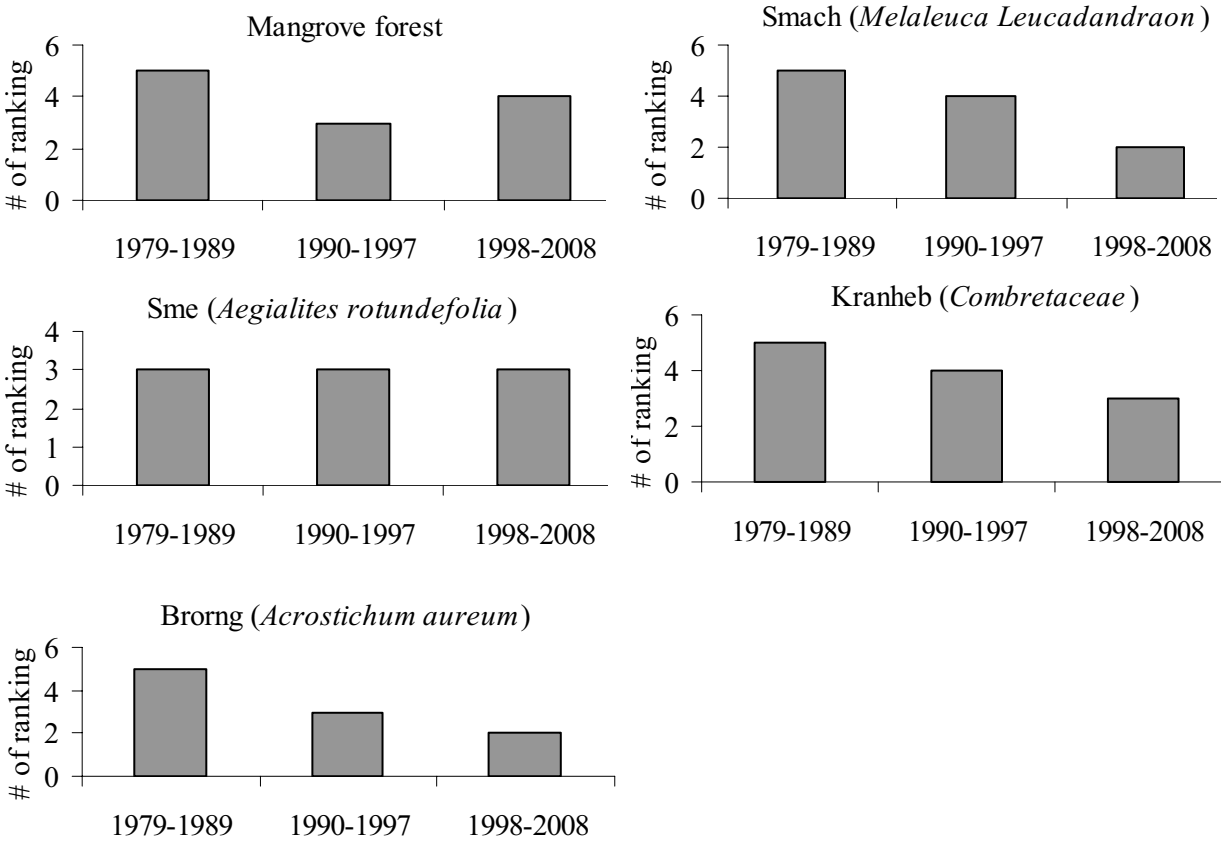


Fig. 10 - Historical change of abundance of habitat types reported by Preak Svay villagers from 1979 to 2008

Six clear habitat types of forest were identified by local villagers of Koh Andet village during the group discussion survey. The bar graphs below illustrate the historical trend of these particular habitats over 29 years from 1979 to 2008 in Koh Andet village. The mangrove, Smach, and Brorng forest steadily decreased, whilst Kranheb remained unchanged from 1979 to 2008. The evergreen forest seemed to be more abundant in the first period whilst it declined dramatically during 1990-98 and it continued to stay the same in 1999 to 2008. The Sme forest declined sharply within 1990 -98, but it began to increase slightly again from 1999 to 2008.

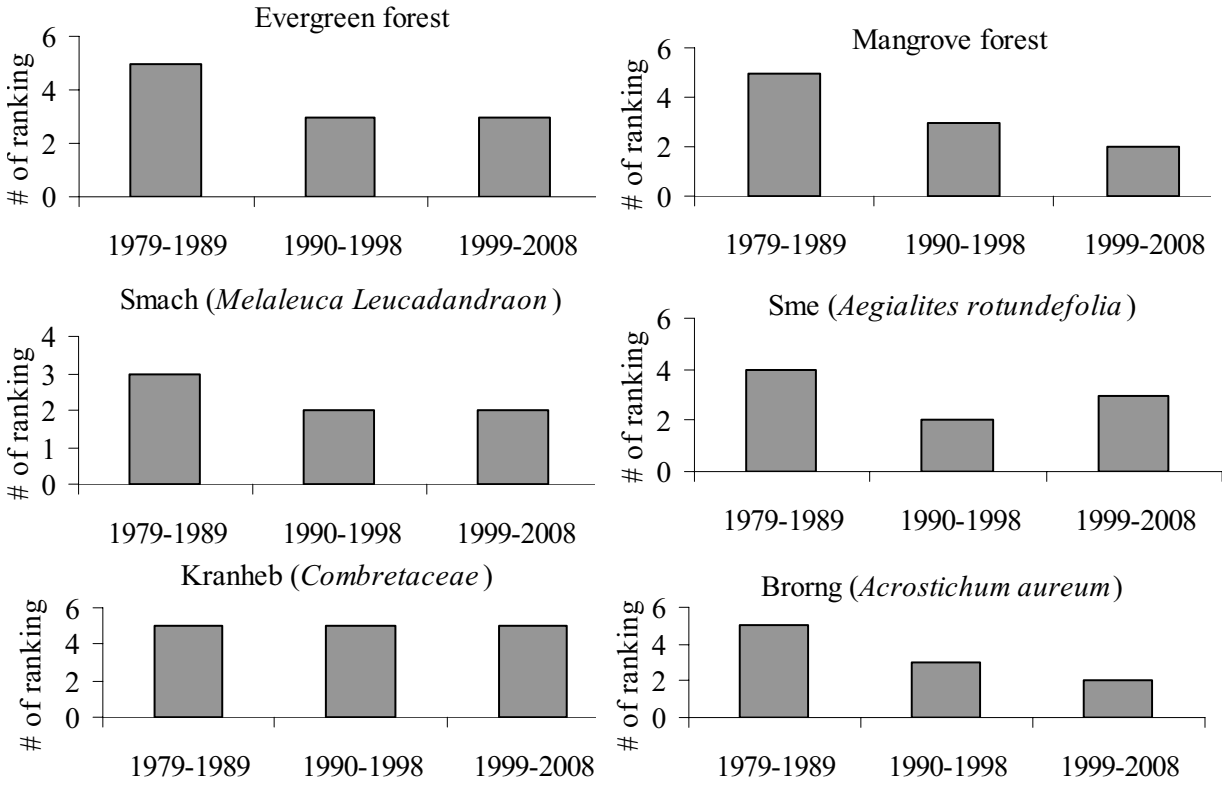


Fig. 11 - Historical change of abundance of habitat types reported by Koh Andet villagers from 1979 to 2008

4.6. The proposed areas for management zones in PKWS

As mentioned above, there are four management zones: core zone, conservation zone, sustainable use zone, and community zone (Table 2) according to the Protected Areas Law (MoE, 2008). However, these zones must be defined on the ground and in practice zoning systems will differ from one protected area to another depending on their geographical, biological, social, and political characteristics. Based on group discussion data from the five studied village of PKWS and the recommendations and results from the consultation workshop, four management zones were identified by survey teams in cooperation with local villagers - the core zone, conservation zone, sustainable use zone, and community zone (Fig. 12). One core zone with 1,270 ha, two conservation zones covering 6,168 ha, eight community zones of 4,221 ha, and 14,238 ha of the sustainable use zone were completely defined during the field survey, local community discussions, and consultation meeting with relevant authorities and experts. A core zone was practically defined during the consultation meeting because the participants seemed to obviously demarcate the central area between Peam Krasop Pi and Koh Sralao village. This particular zone was believed to maintain the high conservation values containing threatened and critically endangered species and fragile ecosystems. However the real value of this site remains to be confirmed on the ground scientifically. The presence of globally endangered species such as dhole fishing cat, otters, pangolin, dolphins, adjutants, crane, hornbills, green peafowl etc. are however believed to exist in this sanctuary based on local villagers' reports. Additional consultation was conducted with participants including commune chief, village chief, eco-tourism committee, and park rangers on specific locations of those key species in PKWS. They seemed

to accept the four zones that the team drew up and proposed during the field discussion and consultation. Apart from the output of this assessment, one ecotourism site covering 5,466 hectares was already mapped (Schipani, 2008) and approved by MoE. However, these proposed management zones were only tentatively agreed by local communities and other stakeholders. Further ground-truthing survey and discussion sharing with villagers and other stakeholders using a clear topographic map of the four proposed management zones (Fig. 12) will be very important to finalize the management zones for PKWS.

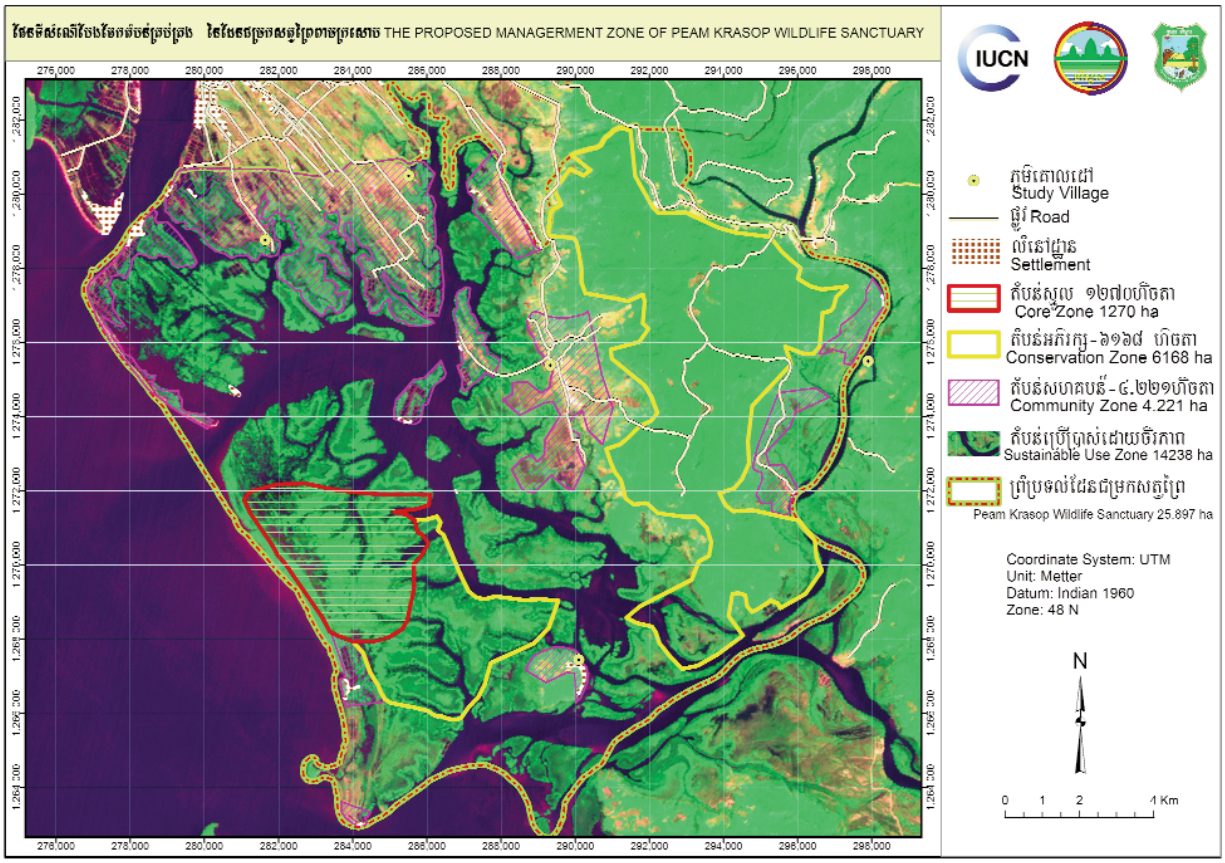


Fig. 12 – The proposed areas for initial management zones tentatively agreed by participants in PKWS (See also attach figure 18: Latest PKWS zoning map through various consultation at page 44)

4.7. Local livelihoods and livelihoods activities in PKWS

4.7.1. Seasonal calendar of people in PKWS

People conduct a variety of livelihood activities including fishing, paddy, Chamkar, small trade, and wage labor. Based on the seasonal calendar worked out with the local communities, the findings indicated that they have different types of work throughout the year (App. D). The villagers implemented fishing activities all year round, but they focused on different species at different times of year - mainly different types of crabs, fishes, shrimps, squid, and horse crab were caught from October or November to April or May (depending upon the rainfall). From May to October, people could not fish for the swing crab in the estuary because this specific area was heavily influenced by fresh water. At this time villagers were able to fish for this crab in the open sea but this entailed more risks. For mud crabs, fishermen were able to fish throughout the year. However, other activities such as other types of fishing, ecotourism services, moto-taxi, and house construction were also implemented commonly. In PKWS many traditional festivals are held in common with Cambodian people across the country. However, the fishermen of the studied villages have additional festivals due to their need to pray for their fishing boats in order to bring good luck and safety at sea and to be able to collect a better harvest. This activity was usually celebrated between late January and early February.

4.7.2 Local livelihoods in PKWS

Of the five studied villages, two are located deep inside the sanctuary and the other three villages are inside the sanctuary as well, but nearer to the boundary of PKWS. The table below indicates the percentage of the main occupation in each studied village. The information in table 8 indicates that there are two main occupations for the local communities, fishing and farming (paddy and Chamkar). However, other alternative works also occurred in each village including small scale business, teacher, wage labourer etc.

Table 7 - The main occupation of local communities in PKWS

Name of village	% fisherman	% fisherman and Chamkar &/or paddy%	% Chamkar &/or paddy	Other
Peam Krasop Pi	100	x	x	x
Preak Svay	60	20	20	x
Ta Chat	x	50	50	x
Koh Sraloa	50	50	x	x
Koh Andet	x	75	20	5

X = none

People generally go to fish in the open sea and/or in the estuary as much as they can. Normally, the fishermen fish in the open sea if they have a big boat and good equipment. These fishermen seemed richer than their neighbors who only fished in and around the estuary. These richer fishermen sometimes go to fish extremely far from their village and stay in the open sea for up to half a month. Some residents reported that they went to fish at Koh Sdach, Kompong Som etc. and sometimes they fished in the estuary too. Local fishermen without a big boat and good engine and enough experience usually fish about 5 to 7 Km from the estuary of PKWS or offshore. During fishing some people return back home daily and some decide to stay one to two nights in the fishing area.

According to the interview data, the fishing areas of fishermen were different from one family to another depending on their skill, domestic resources, and other facilities. In PKWS the villagers traveled from one and up to around twenty kilometers from their residential land in order to fish. They normally leave their village during the afternoon and begin to lay fishing gears in their target area. Then, they may decide to come back home early the next morning to bring their catch to sell to the middlemen in their village. The fishermen who use spears and Kantrong (a kind of small fishing net with a long wooden handle) leave the village at the same time, and spend the whole night spotlighting to find mud crab, shrimp, and fish whilst other fishermen have time to relax after laying their gear. This kind of fishing is not done far from the village and is mainly done in the mangrove forest during low tide.

Fishing areas of different fishermen from the target villages seemed to overlap each other in all the open water areas and in the mangrove forest inside the sanctuary. In addition other fishermen from other non-surveyed villages and from outside PKWS also used these areas for fishing. Apart from fishing activity some people in the four villages have been doing farming because they have their own rice paddy

and Chamkar for additional livelihoods. Paddy fields are normally near to the village. The Chamkar seemed to be further away from the village, especially in Koh Srolao village as it was a small and isolated island of about 6 km^2. Only a small number of Koh Sralao villagers practiced Chamkar on this island, and many families decided to go to the mainland or the evergreen forest for their Chamkar cultivation.

4.8. Local perception and knowledge on conservation of PKWS

The survey teams interviewed 100 villagers of the five selected villages about their knowledge and perception on the conservation of PKWS. The results (displayed in bar charts) illustrate the local knowledge on the existing sanctuary, PKWS boundary, and PAs Law in each studied village.

In Peam Krasop Pi village 28% of respondents realized the existence of PKWS whilst 72% did not know about PKWS. The knowledge of Peam Krasop Pi villagers on the PKWS boundary was limited to only 8% whilst 92% of them did not recognize the boundary of PKWS. Importantly, none of the informants were aware of the protected areas law of the Ministry of Environment. In general most Peam Krasop Pi villagers seemed not to realize the existence of PKWS, the location of the boundary of PKWS, and the protected areas law which are managed by GDANCP of MoE (Fig. 13).

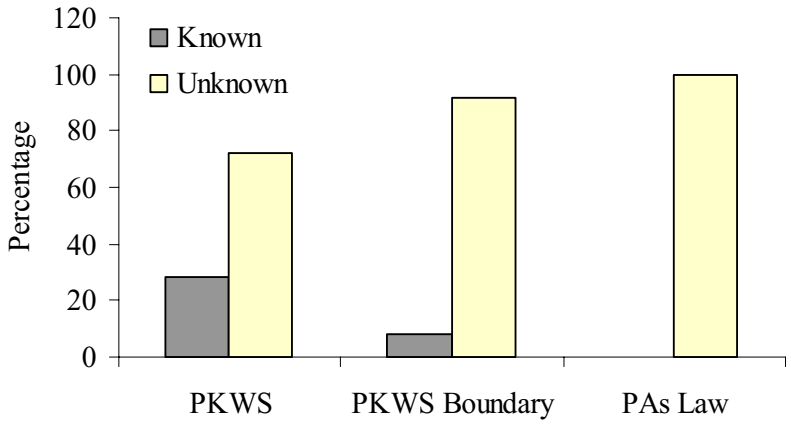


Fig. 13 - Local perception and knowledge on conservation of PKWS in Peam Krasop Pi village

The bar chart below illustrates the knowledge of Koh Sralao villagers on the PKWS, its boundary, and the protected areas law. Eighty percent of respondents knew of the existence of PKWS whilst only 20% of them did not know about the sanctuary. Only 10% of villagers were able to identify the PKWS boundary whilst 90% of them did not know the location of the boundary of this sanctuary at all. Similar to the Peam Krasop Pi villagers, no villagers were aware of the protected areas law. Therefore, the Koh Sralao villagers seemed to know the existence of PKWS, but they did recognise and understand the boundary of PKWS and the protected areas law of MoE (Fig. 14).

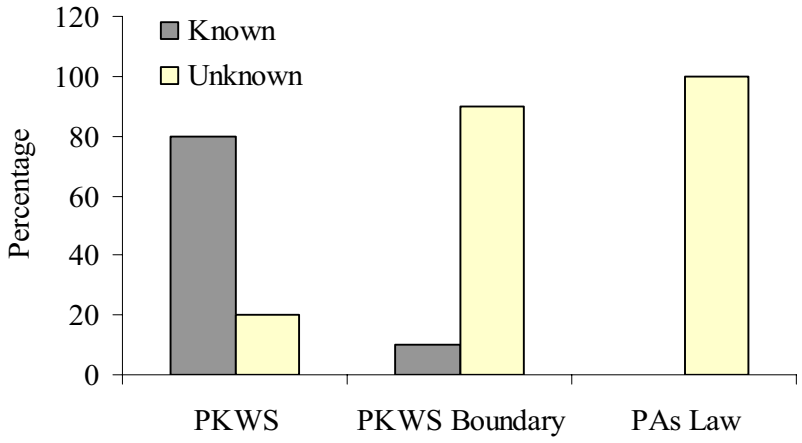


Fig. 14 - Local perception and knowledge on conservation of PKWS in Koh Sralao village

The bar chart below demonstrates that 70% of Ta Chat villagers were aware of the existence of PKWS whilst 30% did not know about this sanctuary. On the other hand while, 30% of informants in Ta Chat village know about the PKWS boundary, 70% of them were not aware of it at all. Again, no local villagers of Ta Chat village were aware of the protected areas law. Thus, most local community seemed to know about PKWS, but not the PKWS boundary and protected areas law (Fig. 15).

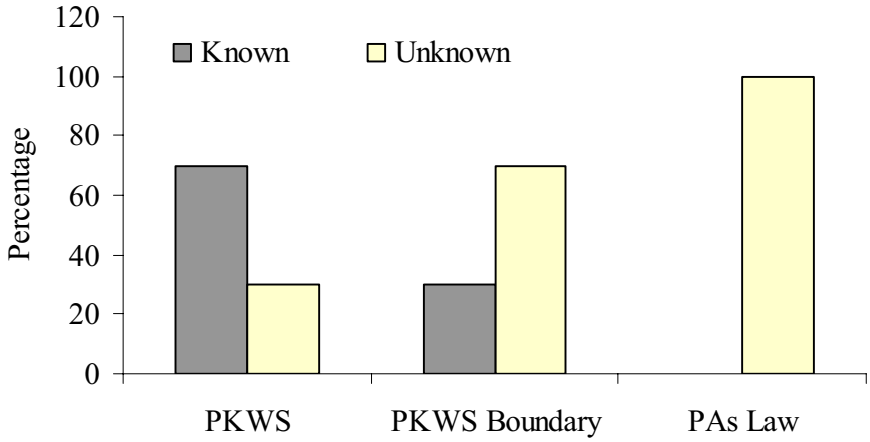


Fig. 15 - Local perception and knowledge on conservation of PKWS in Ta Chat village

In Preak Svay village 72% of interviewees were aware of the existence of PKWS whilst 28% of them did not know about it. On the contrary, 28% knew the sanctuary boundary whilst 72% were not able to identify the boundary. Notably, there were 17% of respondents understanding the protected areas law whilst 83% did not understand the law. Hence, most of the local community in Prey Svay village seemed to know about PKWS, but not the PKWS boundary and protected areas law (Fig. 16).

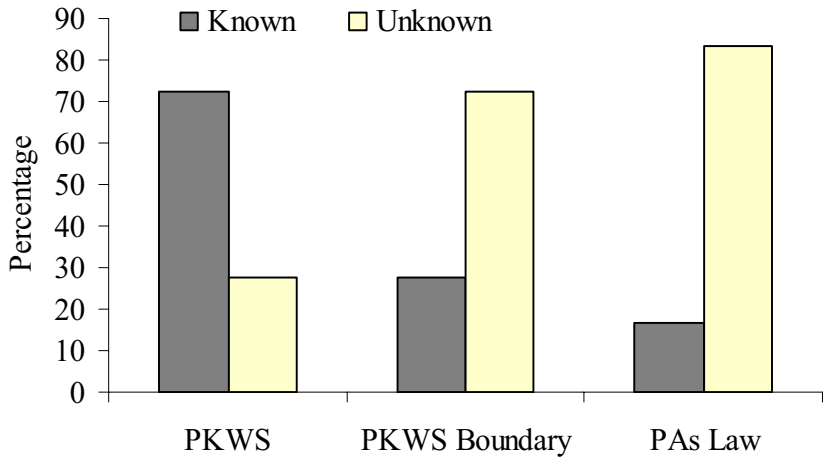


Fig. 16 - Local perception and knowledge on conservation of PKWS in Preak Svay village

The bar graph below similarly indicates the knowledge and perception of Koh Andet villagers on PKWS, its boundary, and protected area law. Forty percent of informants knew about PKWS whilst 60% of them were not aware of it. Only 5% could identify the boundary of PKWS whilst 95% could not. Likewise, only 10% of Koh Andet respondents understood the protected areas law whilst 90% were not aware of this law at all. Therefore, most local villagers seemed not to know the PKWS, PKWS boundary, and protected areas law in Koh Andet village (Fig. 17).

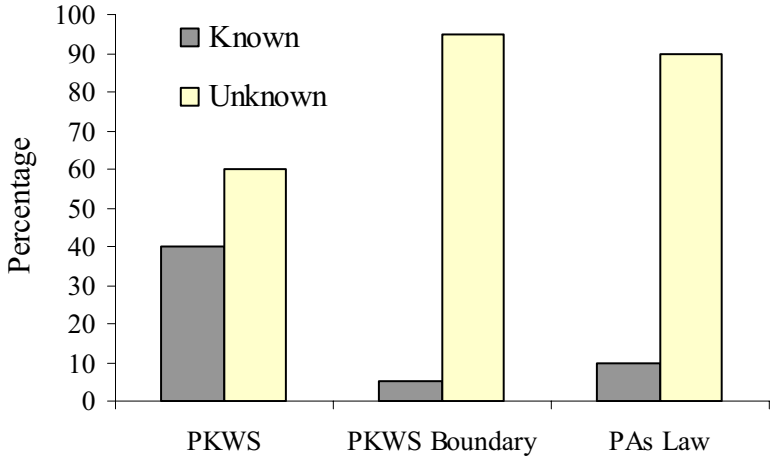


Fig. 17 - Local perception and knowledge on conservation of PKWS in Koh Andet village

Taking the five villages together, overall more than 60% of respondents know of the existence of PKWS as one of the protected areas under the authority of MoE whilst only 40% did not know about the existence of PKWS. About 80% of villagers were not aware of the boundary of PKWS, whilst only 20% understood the boundary of the sanctuary. Ninety one percent did not realize there is a Protected Areas Law, whilst only 9% of local people knew of this particular law (Fig.5). It appears that the knowledge of the local community on the sanctuary has remained very limited in PKWS.

5. Discussion

5.1. The presence of wildlife species and historical trends in PKWS

Peam Krasop Wildlife Sanctuary still maintains many species of wild animals, with twenty five globally threatened species identified by local villagers of the sanctuary (Table 5). Species including dolphins, fishing cats, otters, bears, dhole, pangolin, adjutants, storks, eagles, and hornbills were promptly identified by most local residents in the group discussion. These species currently seem to be present throughout the sanctuary due to its favorable geographic location and habitat types. There might be many species living in the sanctuary that did not appear in the group discussion because of the limitation of time and the number of participants. Therefore, in order to confirm the presence and absence of wildlife species in PKWS, a substantial ground-truthing survey should be conducted using appropriate survey methodologies. This further research will be very useful not only to understand the existence of key species, but also to assist in improving the management zones for sustainable biodiversity conservation.

Although the sanctuary houses numerous globally endangered species identified by local communities, the species have steadily been declining in abundance from the mid-1980s to the present. Before 1986, the population of all species seemed to be abundant as human settlement inside the sanctuary was relatively low during this period. During that particular era they identified that almost no illegal activity had yet threatened the wildlife and forest. The fisheries were also plentiful and it was easy for people to do fishing. However, the population of key species started to decline dramatically until about 1998. This stage was an anarchic period due to occurrence of many illegal activities such as illegal hunting, logging, fishing, land grabbing, cutting down the mangrove forest for charcoal to export abroad (Thailand and probably Singapore). The rapid population growth was considered another serious threat to wildlife especially globally endangered species and locally economically important species. From 1999 to the present the wild animal population has reportedly remained unchanged due to interventions from relevant governmental departments and conservation NGOs. These institutions are now playing a significant role to set up effective mechanisms and conservation strategies such as law enforcement, community based ecotourism, community development, and education awareness (Walston et al., 2001; Dara, 2003).

5.2. Key existing habitats and trends in PKWS

There were ten specific habitat types identified by local people namely evergreen forest, mangrove forest, bamboo forest, cardamom forest, and the other forests known locally as in Khmer as Smach (*Melaleuca Leucadandron*), Sme (*Aegialites rotundefolia*), Brong (*Acrostichum aureum*), Kranhep (*Combretaceae*), Brasac (*Rhizophoraceae*), and Sngav (Pine tree). The evergreen forest and mangrove forest cover the majority of the sanctuary because of its geographical location connecting from the sea up to a high mountain range. Adjacent to the sea and tributaries there was about 60% of mangrove forest covering the sanctuary with some patches of other habitat types (Fig.12). This pattern of habitat is now playing a very significant role to minimize the impact of strong and high waves. More importantly, the mangrove forest is evidently believed to be the key habitat not only for inland wild animals but also for a lot of species of marine animals. Another favorable habitat for other important species of mammals and birds was the presence of evergreen forest covering about 30% of the total area of the park. Furthermore there remains a direct connection from the mangrove forest to the evergreen forest, including several channels and streams, and this connectivity (from reef to ridge-top) is considered an important feature enhancing the significance of the area in terms of its ability to support a diversity of wildlife. Follow-up biodiversity field surveys should be conducted in PKWS to investigate this aspect in more detail.

Even though the sanctuary maintains important habitats, the areas of each key habitat started to steadily decline from the mid-1980s onwards (for the same reasons explained above). From 1999 up to now the forest habitat has remained relatively unchanged due to concerted efforts of relevant governmental departments and conservation NGOs already described above.

5.3. The proposed areas for management zones in PKWS

Using the results from individual semi-structured interviews, consultation in group discussion, and the consultation meeting the teams finally drafted out the map of four management zones namely the core zone, conservation zone, sustainable use zone, and community zone (Fig. 1 & 12). However, more field work is necessary in order to define those specific areas in the future. The four management zones of PKWS were discussed in this preliminary research as follows:

The core zone was enthusiastically discussed and specifically demarcated during the consultation meeting based on the geographic markers such as Preak (channels). In particular the participants mainly from Peam Krasop Pi and Koh Sralao seemingly were more knowledgeable about the presence or absence of globally endangered species and human activities in their territory. The area they defined as the core zone not only consists of globally threatened species and key habitat but also is considered as a breeding area for marine species. Therefore, participants wanted to protect this particular area for sustainable production of natural resources in PKWS. On the contrary, the participants from other villages were unclear about drawing up the area for the core zone. They suggested survey teams in cooperation with specific local community members conduct more fieldwork to unmistakably identify the key sites for core zones in other parts of PKWS (Fig. 12).

The proposed conservation zone was defined based on areas that potentially maintain many globally endangered species: dhole, fishing cat, otters, pangolin, dolphins, adjutants, crane, hornbills, green peafowl, storks etc. pointed out by the local community. In addition to the existence of key species the sanctuary also contains an important landscape level habitat feature – that is the contiguity and connectivity of mangrove forest and evergreen forest. Additionally, the local villagers seemed to support the survey teams to put these important habitat areas in the conservation zone (Fig. 12). However in order to finalize this particular zone another critical discussion should be implemented among local community, relevant authorities, and social and biological experts.

The tentative sustainable use zone focused on the area which supports fewer key wildlife species, but includes more common species of wildlife and forest habitats. Those areas are mainly fishing channels, streams, and some patches of mangrove forest areas used for NTFP collection along the waterways. These areas potentially support major livelihoods of local communities, especially the income benefit from marine fishing activity. Regarding this particular zone, the teams drafted out the area based on the daily and monthly use areas of local residents in each studied village. Additionally, the results from interviews indicated that village people have been utilizing all water bodies in the sanctuary including mangrove forest for their monthly fishing activity. The proposed sustainable use zone of PKWS seemed to slightly overlap with some parts of the conservation zone because the area was drawn based on the topographic map in the villages, not yet implemented in the actual field. Further consultation with the local communities, relevant authorities, key decision makers, and boundary checking using GPS should be conducted in order to move towards consensus on this matter.

Finally, the community zone was also mapped out based on the discussion between the expert teams and key villagers who know the village clearly. The area of each village and its agricultural land (paddy field and Chamkar) were considered as the community zone in the sanctuary (Fig.12). This zone clearly corresponds to the community use zone as described in the Protected Areas Law of 2008 because it serves for socio-economic development of the local communities and indigenous ethnic minorities and contains existing residential lands, paddy field, Chamkar, home gardens, and shifting cultivations. However, the ground-truthing survey with local participation from each land owner family and additional consultation with all levels of relevant authorities are going to play a significant role in finalizing this particular zone properly and effectively.

5.4. Local perception on conservation of PKWS

Peam Krasop wildlife Sanctuary was established in 1993, but figure 5 (above) illustrates that only 60% of local residents are aware of the existence PKWS. In addition, 79% of villagers were not aware of the sanctuary's boundary and only 9% of the local community had some knowledge of environmental laws gained mostly through the provincial radio (probably only regarding earlier laws of MoE but not for the current PA Law because it was only approved on 15 February 2008). Three of the five villages studied had established community protected areas. While knowledge of local communities on PKWS and the Protected Areas Law are limited the villagers tend to find their own ways to manage use of natural resources, and this leads to increasing tension between the local community and the ranger teams who implement patrolling activities in the sanctuary for whom many of the villagers activities are illegal.

5.5. Immigration pattern in PKWS

The survey teams discussed this issue with the older villagers or other residents who have been living in the village since before the war. They informed the teams that during 1975 most of the people in the village evacuated to stay in Thailand and some of them were evacuated to other villages. After 1979 some people decided to come back to their place of birth and later on the immigration population to these villages started to increase.

According to individual interviews and group discussion, most people in the studied villages immigrated from other provinces such as Kampong Som, Takeo, Kampot, Kandal, Phnom Penh, Kampong Cham etc. These provinces have high population density and the available land for agriculture was very limited. Also other opportunities for work and for subsistence were subject to high levels of competition in those urbanized provinces. Hence, they started to leave their villages to find better alternative livelihoods in PKWS because this area has low population density and rich natural resources. There were new comers flowing into PKWS and they also brought new ideas and new fishing techniques and fishing gears that were more efficient in catching marine fish in large quantities. Besides the fishing gears, the number of charcoal kilns dramatically increased in late 1980's as the market opened in Thailand (PMMR, 2000) in the mean time many villagers owned charcoal kilns. Therefore, rapid human population growth, more efficient fishing gear, and other activities such as clearing the forest for paddy and Chamkar became the main challenges to managing the natural resources in this sanctuary.

6. Conclusions and recommendations

6.1. Conclusions

The findings of this preliminary research assessment indicated that PKWS still maintains many globally threatened species of wildlife both in the mountainous forest habitat and the coastal and marine environment. The combination of evergreen forest, mangrove forest, and various types of canal "Preak" or stream and the connectivity between them is considered as a relatively unique habitat feature in the sanctuary which plays a critical role not only for supporting globally endangered species but also other species important to local livelihoods. However, both the unique habitat and the globally endangered species in the sanctuary have been declining at an alarming rate from the mid 1980s to the late 1990s due increased growth of communities in the sanctuary, and increased immigration as well as urbanization. These social pressures have been causing numerous issues such as widespread fishing activity, large-scale conversion for agriculture, industrial purposes, illegal logging, hunting, illegal wildlife trade, and poor forest management in this sanctuary. In order to minimize the major threats to PKWS's biodiversity species, management zoning is one of the key starting-point mechanisms. In this research four management zones were tentatively characterized in the PKWS based on the existence of globally endangered species, key habitats, and local consensus - namely the core zone, conservation zone, sustainable use zone, and community zone.

6.2. Recommendations

The recommendations of this preliminary assessment can be more completely developed as long as relevant governmental departments, biodiversity conservation NGOs, taxa specialist and other interested parties are willing to contribute long-term support and cooperation. Several recommendations for biological conservation and management should be immediately considered to address immediate gaps:

- To produce the final participatory zoning of PKWS, more time is needed to allow for wildlife and community experts to work in each village and throughout the sanctuary to more clearly define core, conservation, sustainable development, and community areas appropriately. Additionally, updated satellite images and aerial photos are critically important especially for designating the community zone.
  - Additional ground-truthing survey is going to play an important role in clearly defining community zones in each village especially villages where were not included in this assessment.
  - The ground-truthing surveys of mammals, birds, and reptiles should be conducted by species experts together with local villagers in order to more clearly understand the presence and the absence of globally endangered species. In doing so, this will allow field researchers and local community members to define the specific areas for management and conservation zones more clearly, especially the core zone.
  - More time is also needed to define the sustainable use zone to ask for more information on the areas where local communities usually go for their daily activities such as fishing, collection of aquatic products or NTFPs by taking UTM coordinate by using GPS.
  - There are a lot of aquatic species in PKWS, but those species are not well known or clearly confirmed yet. Therefore, an aquatic resources study should be undertaken to identify the key marine species for sustainable development.

- There has been recent pressure to approve community zones quickly in the sanctuary, separating the approval of these zones from the approval of the whole zoning system (the Minister of Environment has authority to approve community zones, but other zones have to be approved by the Cabinet). While this priority is based on an understandable desire to regularize residential and agricultural use and tenure, there are very good reasons to proceed with zoning as a package. These include:
  - Recognition of the community zone separately removes much of the potential for negotiation between uses of the various zones.
  - Separating zoning of community zones from the overall process does not address conservation or livelihood issues. Management of resource use and access to sensitive biodiversity areas will not be addressed and the threats to both biodiversity and sustainable livelihoods will not be addressed until exclusive rights are addressed.
  - Deferring full zoning leaves open the probability that more land will be converted to farms or other land uses outside the community zone.

- Reduction of conflict between the PKWS authority and local people requires a clear understanding on both sides of the agreed boundaries between parts of the sanctuary available for one use or another. Zoning only the community zone will not reduce conflict in the other three zones.
- An objective of the use of PKWS as a pilot site for zoning was to demonstrate the application of international best practice for zoning. Dealing with one zone separately runs against international best practice. In addition, the value of the PKWS zoning experience as a learning exercise for other PAs in Cambodia will be significantly weakened.

- Any large scale development schemes in PKWS should be banned in particular the activities which destroy the habitat of key wildlife species and local fishing species such as crabs, shrimps, squids, fishes etc.

- Education and awareness raising amongst local communities about the existence of PKWS, management zones of PAs, the Protected Area law and how their livelihood activities could be implemented in more sustainable ways is a clear necessity.

- Government budgets and support for PKWS management activities need to be increased – particularly the facilities, equipment and patrolling budget for the rangers.

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Appendices

App. A. Wildlife species known or considered likely to still exist in PKWS, southwestern Cambodia

No	Common name	Scientific name	Local name	IUCN Status	Confirmed by studied villages
Mammals					
1	Long-tailed Macaque	*Macaca fascicularis*	ស្វាក្តាម		PK, PS, TC, KA
2	Fishing Cat	*Pronailurus viverrinus*	ខ្លាត្រី	VU	PK, PS, TC, KA
3	Civet sp.*		សំពោច		PK, TC, KA
4	Otter sp.*	*Lutra sp.**	ភេ	VU	PK, PS, TC, KA
5	Dolphin sp.*		ផ្សោត	DD/LC?	PK, PS
6	Flying Fox sp.*		ជ្រើង		PK, PS
7	Wild Pig	*Sus scrofa*	ជ្រូកព្រៃ		PS, TC, KA
8	Tiger	*Penthera tigris*	ខ្លាធំ	EN	PK
9	Hog Badger	*Arctinyx collaris*	ជ្រូកពោន	EN	PK, TC
10	Gibbon sp.*	*Hylobates sp.**	ទោច	LC	PK, TC, KA
11	Mouse Deer sp*		ក្តាន់ព្ងែង	VU	PK
12	Dhole	*Cuon alpinus*	ឆ្កែព្រៃ	EN	PK, TC, KA
13	Red Muntjac	*Muntiacus muntja*	ឈ្លូស		PK, TC, KA
14	Sambar	*Cervus unicolor*	ប្រើស		PK, TC, KA
15	Loris sp.*	*Nycticebus sp.**	រញ្ជើ	VU/DD	PK, TC
16	Sunda Pangolin	*Manis javanica*	ពង្រួល	NT	PK, TC, KA
17	Bear sp.*	*Ursus sp.**	ខ្លាឃ្មុំ	VU	PK, PS, TC, KA
18	Hare sp.*		ទន្សាយ		PK
19	Squirrel sp.*		កំប្រុក		PK, KA
20	Clouded Leopard	*Neofelis nebulosa*	ខ្លាពពក	VU	PS
21	Jungle Cat	*Felis chaus*	ឆ្មាព្រៃ	LC	PS, TC
22	East Asian Porcupine	*Hystrix brachyuran*	ប្រម៉ា	VU	TC, KA
23	Pig-tailed Macaque	*Trachypithecus germaini*	ស្វាត្រោស	VU	KA
24	Silvered Langur	*Trachypithecus germaini*	ស្វាព្រាម	LR/NT	KA

Birds					
25	Egret sp.*		កុក		PK
26	White-breasted Water hen	*Amaurormis phoenicurus*	មាន់ទឹក		PS, KA
27	Common Kingfisher	*Alcedo atthis*	ចចោតក្រឹម		PK
28	Spot-billed Pelican	*Pelecanus philippensis*	ទុងប្រផេះ	VU	PK
29	Crow sp.*		ក្អែក		PK, PS
30	Owl sp.*		ទីទុយ		PK
31	Tern sp.*		រំពេរ		PK
32	Water cock	*Gallicrex cinerea*	ក្តំ		PK, PS, KA
33	Stork sp.*	*Mycteria sp.**	រនាល	VU/NT	PK
34	Adjutant sp.*	*Leptoptilos sp.**	ត្រដក់	EN	PK, KA
35	Giant Ibis?		ត្រយ៉ងយក្ស	CR	PK
36	Buttonquail sp.*		ក្ងួច		PK
37	Garganey	*Anas querquedula*	ទាព្រៃ		PK
38	Pigeon		ពពូល		PK, KA
39	Parrot sp.*		សេក		PK
40	Dove sp.*		លលក		PK
41	Myna sp.*		សារិការកែវ		PK
42	White-bellied Sea-eagle	*Halianeetus leucgaster*	អកសមុទ្រ		PK
43	Eagle sp.*		ឥន្ទ្រី		PK
44	Red Jungle fowl	*Gallus gallus*	មាន់ព្រៃ		PK, KA
45	Sarus Crane	*Grus antigone*	ក្រៀល	VU	PK
46	Barn Owl	*Tyto alba*	ខ្លែងស្រោក		PS
47	Brahminy Kite	*Haliastur indus*	ខ្លែងឆាប លឿងក្រម៉ៅ		PK
48	Hornbill sp.*		កេងកង	NT/LC	PS, TC, TC
49	Wreathed Hornbill	*Aceros undulates*	ញ្ជាំង	LC	TC, KA
50	Lesser Whistling Duck		ប្រវឹក		TC, KA
51	Green Peafowl	*Pavo muticus*	ក្ងោក	VU	KA
52	Hornbill sp.*		កេងកង	NT/LC	KA

Reptiles					
53	Python sp.*		ពស់ថ្លាន់		PK, PS, KA
54	Cobra sp.*		ពស់វែក		PK
55	Turtle sp.*		អណ្តើក		PK
56	Water Monitor	*Varanu salvator*	អន្សង		PK, PS, KA
57	Bangal Monitor	*Varanu bangalensis*	ត្រកួត		PK, KA
58	Soft-shelled Turtle sp*		កន្ធាយ		PK, KA
59	Black-masked Turtle		អណ្តើកភ្នែក		TC, KA
60	Yellow-headed Temple		អណ្តើកសកល		TC
61	Asian Leaf Turtle		អណ្តើកទឹក		KA
62	Yellow-headed Temple		អណ្តើកសកល		KA
63	Malayan Snail eating Turtle		អណ្តើកស្រែ		KA

(*) *more than one species but unclear identification*

Village: *PK = Peam Krasop Pi, TC = Ta Chat, KS = Koh Sralao, PS = Preak Svay, and KA = Koh Andet*

App. B. Habitat types known or considered likely to still exist in PKWS, southwestern Cambodia

No	Name of habitat	Local name	Confirmed by the studied villages
1	Mangrove forest	ព្រៃកោងកាង	PK, KS, TC, PS, DA
2	Evergreen forest	ព្រៃស្រោង	KS, TC, DA
3	Smach forest (*Melaleuca Leuca dandraon*)	ព្រៃស្មាច់	PK, KS, TC, PS, DA
4	Sme forest (*Aegialites rotundefolia*)	ព្រៃស្មែរ	PK, KS, TC, PS, DA
5	Brasac forest (*Rhizophoraceae*)	ព្រៃប្រសាក់	PK, KS, TC, PS, DA
6	Sngaw forest (*type of pine forest*)	ព្រៃស្នោរ	PK
7	Kranheb forest (*Combretaceae*)	ព្រៃក្រញឹប	PK
8	Kranheb forest (*Combretaceae*)	ព្រៃក្រញឹប	PK, KS, TC, PS, DA
9	Bamboo forest	ព្រៃឫស្សី	TC
10	Khbanh forest (*some villagers called Krovanh*)	ព្រៃក្បាញ	PK

Village: *PK = Peam Krasop Pi, TC = Ta Chat, KS = Koh Sralao, PS = Preak Svay, and KA = Koh Andet*

App. C. Research questionnaire

Name of interviewer……Day……....Month…….....Year 2008
Name of family leader…….Sex…….age…….....
Number in the family……....., which year did you come to stay in this village? ……..……..

1. Where was your home province? .....……..…..…..……
2. How much rice does your family use to cook a day? No. of Kampong……No. of Kilogram ……., How much do you usually spend for food?.....
3. What is your main occupation? Paddy ; Chamkar ; Fishing ; Other….....
   * If engaging paddy, how far from the village?....., which direction? .....
   size……., product in Kg……..….....
   * If engaging Chamkar, how far from the village?....., which direction?.....
   size……., rice product in Kg…….....
4. What kinds of plants has your family grown?.....
5. What is your supplementary job? Wildlife hunting ; NTFP collection ;Other....….....

* If hunting, how far from the village?....., which direction?.....
....., No. of hunters…...……....., name of hunting areas….....
……., How often?....., hunting species…...…….....,
what will you use the hunting products for?.....
How do you normally go to hunt? Machine boat ; Raw boat ; Ox-cart ;
motorcycle ; Walk ; Other…….....……...….....
.....
* If NTFP collection, how far from the village?....., which direction?.....,
No. of people…...……., name of NTFP collection areas…...…….....
How often?....., collecting species…… … ...……...…….....
what will you use the products for?....., How do you normally go to collect NTFPs? Machine boat ; Raw boat ; Ox-cart; Motorcycle ; Walk ;
Othe…….....…….....

6. Fishing

Name of fishing areas					
Times spent to the fishing areas					
Distance to the fishing areas					
Fishing month					
No of days stayed in the fishing areas					
How many times per week spent in the fishing areas					
Amount of fishing products[3] 1……... 2……... 3……... Other……...					

7. Did you sell the fishing products? Yes ; No ;
8. Are there any villagers from other villages to fishing in your fishing areas Yes ;No
   * If Yes, what are the names of those villages…….....
   Type of fishing boat…… Power of machine… …….....
   Type of fishing materials…….....
9. Have the fishing products increased or decreased compared to the last 5 years?
   Increased ; Decrease ;
   * If Decreased, why?…….……..…….....,
   If increased, why?.....
10. Price of fishing products
    Stone crap 1 kg: Dry season……., Rainy season…….....
    Horse crap 1 kg: Dry season……., Rainy season……...….....
    Shrimp 1 kg: Dry season……., Rainy season……...…….....
    Squid 1 kg: Dry season……., Rainy season……...….....

Others:...….....…….....

App. D. Seasonal calendar

D. 1. Peam Krasob Pi village

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fishing Horse crab	■	■	■	■	■				■	■	■	■
Fishing flying crab						■	■	■				
Fish	■	■	■	■	■			■	■	■	■	■
Fishing shrimp	■	■	■	■	■							■
Fishing squid	■	■	■	■	■							■
Eco-tourism service	▒	▒	▒	▒	▒						▒	▒
Moto taxi	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
House construction	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
Khmer New year				▒								
Pchum Ben									▒			
Water festival											▒	
Pray for fishing boat	▒	▒										

■ indicates activity conducted for whole month

▒ indicates activity conducted for a few days of month

D. 2. Koh Sralao village

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fishing - Mud crab, fish, flying crab - Collect mud shell and Chak chreng	■	■	■	■	■	No fishing, the salt water was filled by fresh water					■	■
Cultivating Chamkar						■	■	■	■	■		
Khmer New year				▒								
Pchum Ben									▒			
Water Festival											▒	

See the meaning of color in D. 1

D. 3. Ta Chat village

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cultivating Chamkar												
Fishing												
Cultivating paddy rice												
Khmer New year												
Pchum Ben												
Water Festival												
Planting water-melon												

See the meaning of color in D. 1

D. 4. Preak Svay village

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fishing												
Cultivating paddy rice												
Growing vegetable												
Growing corn												
Growing sweet potato												
Growing green nut												
Khmer New year												
Pchum Ben												
Water Festival												
Growing wate-melon												
Growing cucumber												
Growing pumpkin												

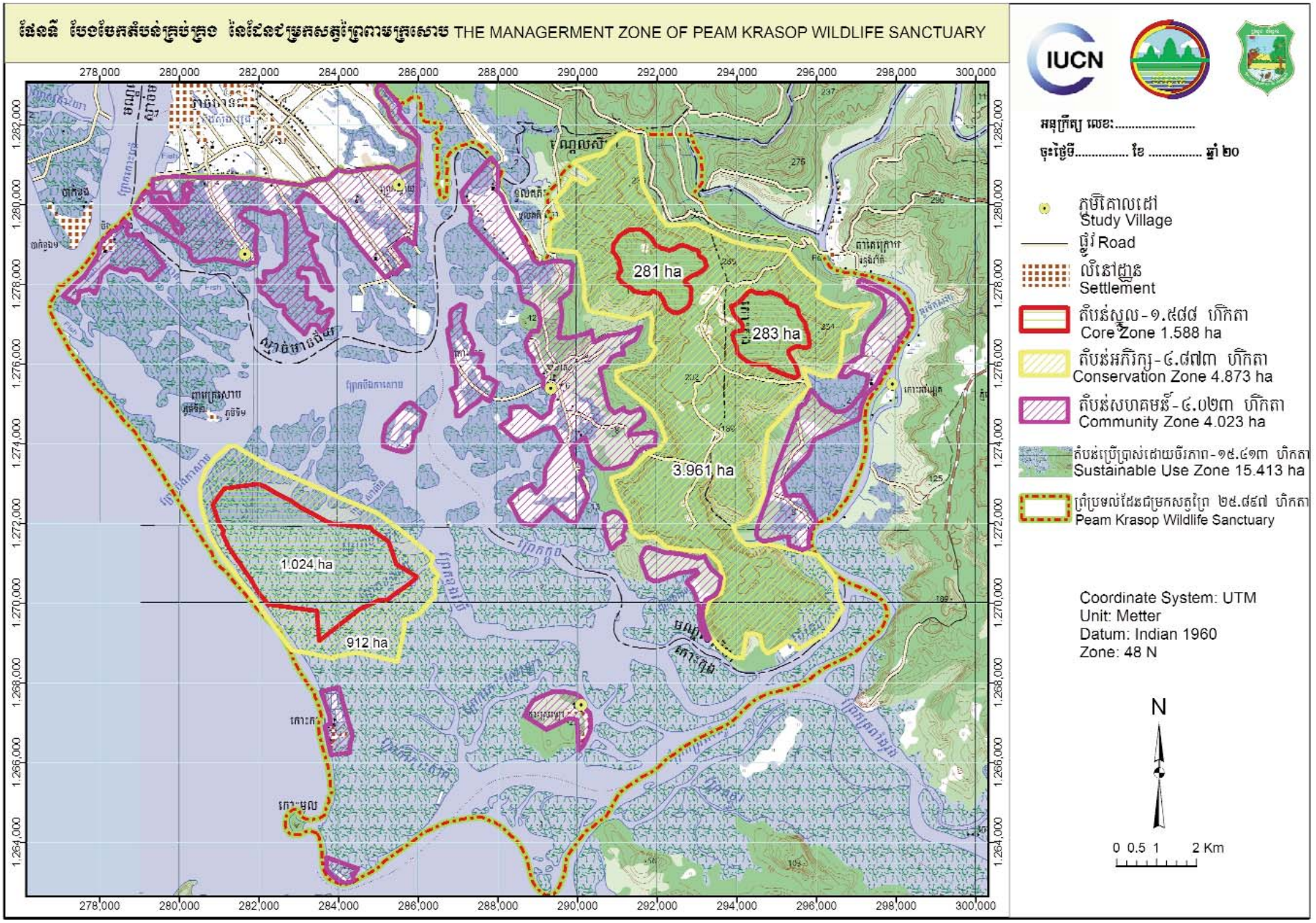
See the meaning of color in D. 1

D. 5. Koh Andet village

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cultivating paddy rice												
Planting cucumber												
Gourd												
Planting cassava												
Planting banana												
Planting cashew												
Planting jackfruit												
Planting mango												
Fishing												
Khmer New year												
Pchum Ben												
Water Festival												

See the meaning of color in D. 1

Figure 18. Latest PKWS zoning map through various consultation



About IUCN

IUCN, International Union for Conservation of Nature, brings together States, government agencies, and a diverse range of non-governmental organizations in a unique partnership. As a Union of members, IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.
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About the Livelihoods and Landscapes Strategy

The Livelihoods and Landscapes Strategy (LLS) is an approach to achieving poverty reduction, biodiversity conservation and ecosystem management goals through landscape level planning and action. Such planning and action includes those that enable the rural poor to expand their economic opportunities while restoring the productive and other values of forests across the landscape. By working with all stakeholder representatives in a landscape, a shared vision of the role of forests in supporting local livelihoods and providing watershed and other ecosystems services can be negotiated and implemented. Ultimately, such experience at landscape levels can be used to influence policies and programmes nationally. LLS is a global initiative with project sites in South America, Central America, Africa and Asia. In Asia, LLS is working in Cambodia, China, India, Indonesia, Lao PDR, Vietnam and Thailand.

In Cambodia, LLS is working with the poorest groups in target communities within Peam Krasop Wildlife Sanctuary (PKWS) in Koh Kong Province. The work is focusing on sustainable fisheries, ecotourism, mangrove restoration and securing use rights for local communities.

IUCN Cambodia Liaison Office
#19, Street 312, Sangkat Tonle Basac,
Khan Chamkar Mon
P.O.Box: 1504
Tel: +855 23 222 311
Fax: +855 23 222 312
E-mail: info.camdodia@iucn.org

International Union for Conservation of Nature