

**Integration of commercial and
conservation objectives in Prek Toal, Tonle Sap and
Battambang Fishing lot #2**

**Phase 1: Understanding current management systems
and recommendations for reforms**

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Integration of commercial and conservation objectives in Prek Toal, Tonle Sap and Battambang Fishing lot #2. Phase 1: Understanding current management systems and recommendations for reform

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List of Acronyms

CFi	Community Fisheries
CFiC	Community Fisheries Committee
CFiDO	Community Fisheries Development Office
DoF	Department of Fisheries (now Fisheries Administration)
FAO	Food and Agricultural Organization of the United Nations
FiA	Fisheries Administration (formerly Department of Fisheries)
FL	Fishing Lot
GDANCP	General Department for Administration of Nature Conservation & Protection
GIS	Geographical Information System
GPS	Global Positioning System
HH	Household
IFReDI	Inland Fisheries Research and Development Institute
Lot 2	Battambang Fishing lot #2
MAFF	Ministry of Agriculture, Forestry and Fisheries
MRC	Mekong River Commission
MoE	Ministry of Environment
PA	Public Access Fishing Area
PT	Prek Toal
PTCA	Prek Toal Core Area
R	Riel (Cambodia currency) \$1 = approx 4147 R
TSBR	Tonle Sap Biosphere Reserve
TSCP	Tonle Sap Conservation Project
TSEMP	Tonle Sap Environmental Monitoring Project
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UTM	Universal Transverse Mercator
WCS	Wildlife Conservation Society
WUP-FIN	Water Utilization Program, Finnish Environment Institute Consultancy Consortium

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Village	Commune	Province	Surveys
Prek Toal	Koh Chiveang	Battambang	Chapters 3, 4 & 6
Anglong Taor	Koh Chiveang	Battambang	Chapters 3, 4 & 6
Kampong Prahok	Koh Chiveang	Battambang	Chapters 3, 4 & 6
Thvang	Koh Chiveang	Battambang	Chapters 3, 4 & 6
Prek Kantiel	Koh Chiveang	Battambang	Chapters 3, 4 & 6
Basaet	Tapon	Battambang	Chapter 4
Boeng Tuem	Tapon	Battambang	Chapter 4
Samdach	Tapon	Battambang	Chapter 4
Svay Sa	Tapon	Battambang	Chapter 4
Tapon	Tapon	Battambang	Chapter 4
Ambaeng Thngae	Roka	Battambang	Chapter 4
Chhung Tradak	Roka	Battambang	Chapter 4
Pou Battambang	Roka	Battambang	Chapter 4
Roka	Roka	Battambang	Chapter 4
Ta Haen Muoy	Roka	Battambang	Chapter 4
Ta Haen Pii	Roka	Battambang	Chapter 4
Puk Chhma	Anlong vil	Battambang	Chapter 4
Svay Kang	Anlong vil	Battambang	Chapter 4
Andoung Trach	Kampong Preah	Battambang	Chapter 4
Kampong Preah	Kampong Preah	Battambang	Chapter 4
Kralanh	Kampong Preah	Battambang	Chapter 4
Panhnhha	Kampong Preah	Battambang	Chapter 4

Prey Chaek	Kampong Preah	Battambang	Chapter 4
Srah Kaev	Kampong Preah	Battambang	Chapter 4
Phat Sundai	Phat Sundai	Kampong Thom	Chapter 6
Peam Bang	Peam Bang	Kampong Thom	Chapter 6
Ta Chreaneang	Kampong Kleang	Siem Reap	Chapter 6
Kok Kdol	Kampong Pluk	Siem Reap	Chapter 6
Kampong Luong (3)	Kampong Luong	Pursat	Chapter 6
Kampong Thkoul	Ansa Chambak	Pursat	Chapter 6
Reang Til	Reang Til	Pursat	Chapter 6
Dei Renneath	Mateuk	Pursat	Chapter 6
Kbal Toal	Koh Chiveang	Battambang	Chapter 6

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Soa Orn	Ranger, Prek Toal	Data collector, lot 2
Vath Vuthy	Ranger, Prek Toal	Data collector, lot 2
Ngourn Sareth	Ranger, Prek Toal	Data collector, lot 2
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Chait Sophear		Data collector, Pou Battambang
Sokha Sitha		Data collector, Ambaeng Thngae
Mao Toeun		Data collector, Roka
Leap Sopheak		Data collector, Ta Haen Muoy
Net Ny		Data collector, Ta Haen Pir
Moeun Vannay		Data collector, Svay Kang
Sos Savin		Data collector, Puk Chhma
Cheam Sreynha		Data collector, Prey Chaek
Chann Phalla		Data collector, Kralanh
Net Saret		Data collector, Panhnha
Pov Lab		Data collector, Andoung Trach
Lay Leak		Data collector, Kampong Preah
Manh Muoy		Data collector, Srah Kaev
Set Chanty		Data collector, Prek Toal
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Executive Summary: English

1. Introduction

Background

Considerable debate persists over the various forms of management that are appropriate for areas of the Tonle Sap Great Lake, particularly where fishing lots and conservation areas overlap. This project aimed to review the overlapping Battambang fishing lot 2 and Prek Toal Core Area (PTCA) to better understand the conservation, commercial and socio-economic importance of the current management regimes. We then make the first step in developing recommendations for adaptation.

The Tonle Sap Lake is one of the most productive freshwater ecosystems in the world. It is extremely important for Cambodian people as a source of food and income, and is recognised as of immense biodiversity value. The Tonle Sap Biosphere Reserve is divided into a number of different management zones including three core areas, of which the PTCA is most significant for biodiversity. At the same time, the lake is divided into fishing lots (large commercial concessions controlled by private operators) and community fisheries areas. All three of the core areas overlap with fishing lot boundaries to some extent, but the PTCA is completely contained within fishing lot 2.

The core area of a Biosphere Reserve is defined as an area devoted to the conservation of biological resources and of the ecosystem. However, the Department of Fisheries (DoF, now Fisheries Administration, FiA) had previously held jurisdiction over the area and changing the status of the core area was seen as a severe contravention of their authority. After negotiations between DoF and the Ministry of the Environment (MoE) an agreement was reached including a number of significant compromises, including the continuation of the fishing lot system, even when they overlap with core areas.

In principal both government agencies, the MoE and FiA, have overlapping responsibility for the PTCA. In reality the core area has effectively remained under lot management, with all conservation and tourism activities in the area dependent on authorisation from the lot operator. Whilst this has hindered conservation efforts in some instances, the system has one critical compensatory dimension: comparable areas of freshwater swamp habitat have been persistently and unsustainably exploited throughout the region and PTCA's exemption from this destruction is almost certainly due to the existence of lot 2. The lot operator allocates vast resources to the protection of the lot, effectively limiting habitat loss. The resources available to conservation or government agencies to manage access and use are tiny compared to the finance, manpower, boat and firearm resources of the lot operator.

Although conservation and private enterprise objectives overlap when it comes to habitat protection, they do not completely coincide. In addition, the current management system has few benefit sharing mechanisms with regard to the local communities and demands no accountability on the part of lot operators. As a result of these deficiencies and the perceived dichotomy between the core area functions as sanctioned by Royal Decree/UNESCO and the current commercial fishing lot regime,

the future of the fishing lot is uncertain. An agreement was reached between the Government and the ADB, advocating the abolition of all commercial enterprises within the designated core areas by 2010: *“The removal of fishing lots from the core areas would signify the Government's intention to meet the obligations that are embodied in treaties and conventions, and work toward the goals of the Seville Strategy for Biosphere Reserves, 1995” (Tonle Sap Sustainable Livelihoods, 2 prodoc).*

An alternative view is that if the current management system for lot 2 is revoked, the consequences for the PTCA wildlife and fish would be catastrophic. Without the protection of the lot operator, PTCA would revert to de-facto open access situation and become vulnerable to the same extreme harvesting pressures and habitat degradation seen elsewhere. Under these circumstances, it is predicted that the MoE monitoring team responsible for the success of the current conservation measures would rapidly be overwhelmed by outside pressures and it is unlikely that either Government or conservation agencies would have the capacity to restore their value.

Project objectives and components

This project aims to propose a new model for integration of commercial, community and conservation objectives in fishing lot 2, balancing the needs of a core area for conservation with maximising long-term sustainable commercial management of fishing lot 2 whilst promoting local distribution of benefits in a manner that is as equitable as possible. One potential solution involves the creation of a smaller Prek Toal Conservation Area or Fish Sanctuary (hereafter “Prek Toal Sanctuary”) within the PTCA, in which human activity would be strictly limited to activities sanctioned by Royal Decree (including no commercial fishing). This proposal was examined including identification of the key areas for biodiversity within the PTCA, and the information used to suggest tentative boundaries for a potential Prek Toal Sanctuary. The impacts to commercial and local fishing of this potential Sanctuary were then investigated.

The project was divided into five research components:

- *Assessment of the ecological and conservation value of the PTCA/lot 2 and proposals for the boundary of the new Prek Toal Sanctuary.*
- *Assessment of the value of commercial fisheries within lot 2, and subsequent impact of management changes (including the new PT Sanctuary) on the commercial viability of lot 2.*
- *Assessment of the distribution of socio-economic benefits to local communities and stakeholders under the current system. Results used to examine the potential impacts on local communities of proposed management changes.*
- *Investigation of the impact of upstream development on fishing lot 2 and PTCA.*
- *Comparison between outcomes under the proposed Prek Toal Sanctuary and alternative management regimes.*

2. The ecological and conservation value of the Prek Toal Core Area and Fishing Lot #2

The core areas are considered to represent unique ecosystems marked for long-term protection. The PTCA is recognised as a site of global conservation significance,

primarily due to breeding colonies of some of the world's most threatened waterbird species, as well as being an important area for reptiles (including Siamese crocodiles and water snakes), mammals, fish and other birds.

Many existing data sources on the conservation priorities of the area were analysed to assess the conservation value of the PTCA and to propose boundaries for a new Prek Toal Sanctuary. The boundaries proposed are smaller than the current core area, but encompass the bird colonies, preferred crocodile habitats and some key rivers. We suggest that the area outside the proposed Sanctuary, including the lake shore, remain under lot management, creating a protective but commercial "buffer" zone. Inside the Sanctuary, habitat disturbance and human intrusion would be minimised and so conducive to increasing bird and fish populations throughout the area. The Sanctuary would be a no-use area (except monitored ecotourism), prohibiting commercial fishing and other human uses. It is anticipated that as the Sanctuary would be effective for both fish and wildlife, both the FiA and MoE would provide full support, creating a mutually beneficial solution to a longstanding contentious situation.

3. The value of the commercial fisheries

The relationships between fishing areas, the lot operator, sub-lessees and local fishers were investigated. The economic value of areas in lot 2 inside and outside the Core Area and proposed Prek Toal Sanctuary were assessed to ascertain the economic and commercial impact of any changes to the management regime within the fishing lot.

Lot management and operations calendar

Lot 2 has been classified as a 'research and development' lot since 1996, thus bypassing the normal auction process, with the government selecting the leaseholder(s). These lot operators then fish the area themselves, or sub-lease out sections to other fishers. From 1996 – 2009, lot 2 has had two joint leaseholders holding one lease, which was renewed in 2009 for five more years.

Fishing practices within the lot vary between seasons:

- **Closed season (July – September):** The lot is closed for commercial fishing, but open to fishers using traditional gears. Many fishers do use traditional gears during this time, but an equal or greater number use *bors* or arrow-shaped traps, an illegal medium-scale gear. The closed season officially runs from 1st June – 31st October, but in reality fishers say they have access from 1st July – 30th October.
- **Open season, high water (October – mid-January):** Lot operators allow a number of *bors* to continue for a fee. A fence contained large fish traps is constructed between lot 2 and the adjacent lot. Family fishing gear is no longer allowed, except for some water snake fishers and residents of Prek Kantiel, who pay a fee.
- **Open season, receding water (mid-January – March):** In January, when the water levels are low enough, outer fences (36km x 3m) are placed into the lake ~1km from the shore. As water levels decrease, the fence channels fish migrating out of the flooded forest to the lake into five capture pens, placed along the fence. When the water levels have fallen enough, similar barrages are put across the streams of the lot. In addition, *bors* are set up along the lake shore (inside the fence), with their owners paying for a sub-lease.

- **Open season, low water (April – June):** When water levels are lowest and much of the lot is dry, there are many dry season lakes and pools in the watershed of each of the streams in the lot. These serve as refuges for the non-migratory fish species such as snakeheads, and are usually sub-leased (and sometimes sub-sub-leased). Fish in these areas are caught during ‘dragging’ operations, made more effective by lowering the water levels (usually by pumping). Snakehead fish are able to survive in oxygen-poor water conditions, so after dragging, the remaining water and mud is usually electrocuted to harvest the remaining fish.

Throughout the year, the lot is patrolled by the lot operators’ staff, in conjunction with FiA inspectors, local police and military. During the open season, the lot operator has about 15 armed men with boats patrolling the streams. Each entrance to the lot is guarded and a resident armed soldier protects each outer fence pen. The protection of the upland lakes and pools is the responsibility of the respective sub-sub-leaseholders.

Fish catch

Fish harvests were monitored from July 2008 to July 2009. Data were collected daily from a sample of fishing gears within lot 2 on the weight, species, price sold and destination of fish harvested, fishing gear, village and number of fishers present, and details of fees paid. Data were compared to fish catches recorded at fish landing sites, and estimates of fish catch and value made. Fishing gears were divided into three categories: Mobile gear (traditional gear such as fish nets, hooks and traps); Fixed gear (medium sized gear, such as *bors*); and Pens and Barrages (large scale fishing). For the latter gear type, data collectors recorded all fish catch, not just a sample. The figures show that while almost half the quantity and value of the fish catch is currently caught within the core area, most of that is along the lake shore. The proposed sanctuary does not include the lake shore areas, and would encompass only 6% of the quantity (8% of the value) of the fish catch from the 2008/09 fishing season (Table 1.1 and 1.2).

Table 0.1. Table showing number of tons of fish caught inside and outside the current Core Area and the proposed Prek Toal Sanctuary.

Fishing gear	Core Area		Proposed Sanctuary		Unknown location	Total catch
	Inside	Outside	Inside	Outside		
Pens & Barrages	696	1,618	19	2,294	0	2,313
Fixed Gear	1,382	444	221	1,605	33	1,859
Mobile Gear	64	36	17	81	53	151
Total Catch	2,142	2,097	257	3,980	86	4,323
Percent	49.5%	48.5%	5.9%	92.1%	2.0%	100%

Table 0.2. Table showing value (US\$) of fish caught inside and outside current Core Area and the proposed Prek Toal Sanctuary

Fishing gear	Core Area		Proposed Sanctuary		Unknown location	Total value (\$ million)
	Inside	Outside	Inside	Outside		
Pens & Barrages	428,351	1,260,193	31,605	1,656,939	0	1.69
Fixed Gear	977,868	326,678	192,089	1,112,457	19,457	1.32
Mobile Gear	78,255	43,663	20,451	100,954	69,179	0.19
Total \$	1,484,473	1,630,534	244,145	2,870,350	88,636	3.20
Percent	47.7%	52.3%	7.6%	89.6%	2.8%	100%

Indicators of fishing sustainability

During the course of our investigations, a number of indicators suggested that fishing was unsustainable. These included reports of reduced fish catches by local fishers and sub-lessees, smaller fish sizes, and a widespread scaling-up of fishing gear over the last five years, including the now common usage of destructive techniques such as pumping and electro-fishing. While none of these are conclusive, they do suggest that there is a real need for a functioning fish sanctuary to ensure the long-term sustainability of fish harvests in lot 2 and in surrounding areas. This is particularly true for black fish species which are less resilient to large harvests than white fish species.

4. *Assessment of the distribution of socio-economic benefits*

We assessed the distribution of socio-economic benefits to local communities and stakeholders from lot 2 and the PTCA under the current management system and examined the impacts of proposed management changes. Surveys were conducted in the five floating villages adjacent to lot 2, and in 19 'uplands' villages, from which many seasonal migrant fishers, labourers and sub-lessees in lot 2 originate. Survey methods included monthly questionnaires, focus group discussions, and interviews.

Livelihood activities and incomes

In floating villages, the vast majority of households relied on fishing or related activities. However, for the majority of the year (open season) all but the wealthiest families were excluded from lot 2, and fished in the CFI and PA areas. The exceptions were wealthy fishers who could afford sub-leases, labourers for lot 2, and fishers from Prek Kantiel village (who do not have a CFI area nearby and so are permitted to fish inside the lot for a fee). During the closed season almost all families report some use of lot 2. Small and medium scale fishing were consistently ranked as the most common livelihood activities, with over half of households using the illegal *bor* in some villages.

Approximately 100 people from neighbouring floating villages worked as labourers for lot 2, a tenth of the total estimated 1000 labourers employed. The remainder came from a variety of villages, often far from the lot, as they were supposedly happier to work for low salaries (according to lot operators), or less likely to complain over the use of illegal activities (according to local fishers). Similarly, fish processing provided fewer jobs than expected in local communities, as much of the lot 2 fish was taken directly to large ports for processing. Fish processing work was poorly paid and seasonal, but did play an important role in income provision for the poorest families, particularly because it is one of the few paid jobs available to women.

Conservation activities provided income for approximately 35 households, all from floating villages. Very little of the tourism revenue currently flows to local communities, as most services are provided by Siem Reap based organisations. Encouragingly, the PT Environmental Station has recently implemented plans to distribute part of the Core Area entrance fee (\$20/tourist) to local community development, conservation and station logistics, but this system is still in its infancy.

In uplands communities, livelihoods were dominated by agriculture and livestock, with the vast majority either owning or working in rice fields. A sizable proportion also fished, but the scale of this varied considerably, and was usually seasonal. Over half the families who fished did so only in local rivers or ponds. Of the other half, most went to public access areas near to lot 2, or in the public access area inside lot 2. It was not possible to distinguish between these two categories (PA areas inside and outside of lot 2) as respondents didn't know themselves. A large number fished in lot 2 during the closed season, but very few bought *dongs* for fishing in the open season. Some people from the uplands villages were also employed as labourers in lot 2.

Average incomes from lot 2 activities varied widely, ranking the highest and lowest compared to other village livelihoods. Highest incomes earned were by sub-lessees, followed by fixed gear owners, shop owners and fish traders. Due to the small number of sub-lessees, it was the fixed gear owners who earn the most from lot 2 across all households. The lowest incomes were earned by fishers with traditional gears.

Impacts of management changes

The predicted 6% reduction in fish catch under a PT Sanctuary scenario would involve the cancellation of one or two key sub-leases, which would mean that the lot operator would lose the income from one or two leases, but other sub-leases would remain intact (leaving their income unchanged). During the open season, the main local impacts would be on the 50 households in Prek Kantiel which buy *dongs* to fish in lot 2. An important caveat is made with the recommendations for a Prek Toal Sanctuary, namely that current laws on fisheries are enforced more stringently. This would effectively mean no fixed gear inside lot 2 during the closed season. This would result in a loss of (unofficial) revenue to the MoE, local FiA, local police, and local military, and also a reduction in fish catch by the medium wealth families owning this gear.

5. Investigation in the impact of upstream development

Future development activities, both within the Tonle Sap and upstream in the Mekong catchment areas, are likely to have a major impact on the fish catches and flooded forest around the lake. In particular, current and planned hydropower dams and reservoirs, irrigation schemes and urban development are predicted result in flow alterations in the Mekong, threatening sensitive ecosystems downstream, particularly the Tonle Sap river, lake and floodplain, by changing the flood pulse system of the lake.

One of the most well-known examples concerns predicted changes in the depth of the Lake during the dry season. Relatively small increases in dry season water levels, due to water releases from dams, are expected to cause widespread reduction in the area of flooded forest over the next 10-15 years, as previously seasonally inundated areas of the floodplain become permanently flooded. This is likely to massively decrease the productivity of the ecosystem (including fisheries production), which would have devastating impacts to local livelihoods and food security.

Models from WUP-FIN suggest that up to 40% of the Prek Toal Core Area and one third of lot 2 could be affected, impacting up to 40% of the bird nesting trees, and 25% of crocodile dry season habitats. Consequently, the proposal for the new PT Sanctuary

should be informed by the latest available information from these scenarios, so that the final area chosen has the highest potential for long-term sustainability.

6. Comparison between outcomes under the proposed Prek Toal Sanctuary and alternative management regimes

We compared outcomes under the proposed Prek Toal Sanctuary and alternative management regimes, particularly focusing on the sustainability and maintenance of the flooded forest/scrub habitat, and extent and distribution of benefits to communities. Existing information on the Fishing lots and Community Fisheries was reviewed, and a survey was conducted in villages from four provinces around the Tonle Sap to investigate community perceptions on management systems.

Management systems

Commercial Fishing Lots

Before the year 2000, the system whereby leases to large-scale commercial fishing lots were granted by the government to private operators was believed to served two principle purposes: to generate revenue for the treasury through lease fees and to create a system of incentives for lease holders to manage and protect the fisheries and fisheries environment of the lot in order to ensure their long-term productivity. However, the extent to which these incentives actually work in achieving sustainable use of the fisheries resource is unclear. Where fishing lot operators have confidence of being able to maintain long-term control over a particular lot (either through influencing the auctioning process or through lots being declared for “research” purposes), there is considerable incentive for the lot operator to protect the fisheries resource. On the other hand, where the length of tenure is unclear, fishing lot operators may have a greater incentive to extract as much benefit as they possibly can, and fishing activities may be carried out with little regard to long-term sustainability. In addition, even where there are incentives for the lot operators to protect resources, the same is often not true for sub-lessees and sub-sub-lessees who often have short-term, one-season leases, even where the lot operator is assured of a long-term lease.

Community Fisheries Areas

Under the old fishing lot system, local communities were effectively excluded from access to the area’s most productive fishing grounds. As a consequence the lot system generated growing antagonism towards the lot operators, which led to conflict with violent episodes. The Fisheries Policy Reforms in late 2000 were designed to return control of 50% of the fishing lot areas to the communities, designating these areas as “Community Fisheries”. The DoF was responsible for determining which fishing lots should be abolished, and with supporting the creation of new institutional arrangements for Community Fisheries.

The impact of the deregulation of the fishing lots has been analysed through a series of assessments conducted by the DoF/FiA in conjunction with civil society. The immediate easier access to the rich fisheries resources and consequent short-term increases in reported fish catches within the new CFis were initially greeted with enthusiasm by the local people. Obviously, there was less enthusiasm among lot operators, who lost the

very sizeable profits which the lots generated. Significantly, in many areas there was an impression that DoF staff, particularly at the provincial level, were “de-legitimised” by the policy reforms as they were often perceived as being “allies” of the wealthier lot operators and less concerned or supportive of small-scale operators. However, the combination of a significant increase in fishing effort, lack of controls by local authorities to ensure sustainable fishing practices, and lack of a well-defined institutional and legal framework for the new CFi areas quickly led to a decrease of these immediate benefits, with local fishers soon reporting large decreases in fish catches. Illegal and destructive fishing methods became widespread, and communities which were supposed to have taken control of these new fishing areas often found themselves excluded by powerful elites (including ex-lot operators). Whereas the lot operators are presumed to have significant incentives to protect the fisheries resource and the flooded forest/scrub habitats, these incentives were largely absent in the “open-access” CFi system. Moreover, CFi organisations were generally politically weak and lacked capacity and investment capital to properly engage in protection and management. Consequently, the removal of the fishing lot management structure has led to widespread conversion of many flooded forest/scrub areas inside CFis for rice cultivation. While the reforms were intended to improve access to fisheries resources, they therefore ended up leading to a significant reduction of those resources.

With the finalisation of the Sub-decree governing Community Fisheries and the clarification of the roles and responsibilities surrounding them, efforts to effectively manage these newly released areas are beginning to improve in some areas, although evidence is patchy. Many studies looking at CFi management have indicated that the very agencies that should be responsible for law enforcement are often among the worst violators. Concern is growing that the pressure on key habitats (notably flooded forest), is so intense due to increasing population, demand for land and resources, and rapid economic growth, that the lack of strong incentives for strict management could mean that it is difficult for CFi committees to achieve their long term aims.

Village surveys

A number of focus group discussions and interviews were held in all five study floating villages, and in an additional eleven villages. Questions were asked about perceived management systems in the different fisheries areas near the village (FL, CFi and PA areas), and changes to natural resources and resource use over the last 10 years. A number of recurring issues emerged, reported in all or most villages. These included:

- 1) **Widespread perceived degradation of fish stocks, in CFi & FL.** Including decreased fish catches and sizes, particularly in CFi areas, but also reported in FLs.
- 2) **Widespread perceived lost in forest and scrub area, particularly in CFi.** Due to:
 - a. Clearing/burning for agriculture, particularly by uplands migrants (CFi);
 - b. Clearing for fishing gears and fishing access (FL);
 - c. Burning to drive out and capture wildlife (FL & CFi);
 - d. Accidental fire (all areas, but particularly CFi areas).
- 3) **Lack of knowledge of FL and CFi boundaries.** Sometimes leading to conflicts between local fishers, lot operators and local authorities.
- 4) **Loss of access to Public Access areas due to unofficial changes in lot boundaries and restriction of previous permitted access routes by lot operators.** Previously

accessible fishing areas and routes were reportedly denied to local fishers due to unofficial changes in lot boundaries and regulations in recent years.

- 5) **Lack of knowledge of Law on Fisheries and lot burden books.** Including confusion over fisheries laws, particularly where certain gears are commonplace, but believed to be illegal (and for which unofficial fees are usually extracted).
- 6) **Widespread illegal fishing.** A large scaling-up of fishing gear was reported in all areas, particularly since 2005. This included commonplace use of *bors* and smaller mesh sizes in all areas, and common use of pumping and electro-fishing, particularly in FLs. There were also frequent reports of large trawler boats, spot lights and surrounding nets in PA areas in the lake, including in fish sanctuaries.
- 7) **Large number of unofficial fishing fees** levied by virtually all local authorities, including local fisheries inspectors, police, military and CFi committees.
- 8) **Large variation in CFi management and quality.** Some CFi areas were seemingly managed by committed CFi committees with some control over illegal fishing (but limited by a lack of capacity or resources), while other CFi areas were operated like commercial fishing lots, with dry season ponds leased to the highest bidder.
- 9) **Local communities often excluded from income generating activities in lots.** In particular, many fishing lot labourers were recruited from outside the local area.

In conclusion, the CFi and PA areas have experienced a perceived large degradation of forest and scrub habitats and loss of fish stocks, particularly since 2005, largely due to intensification of fishing gear, lack of capacity and resources of CFi committees, and the lack of law enforcement by local authorities. While FLs have also experienced increases in fishing pressure, there has not been the same scale of habitat loss, and this may be responsible for the slower rate of decreased fish catches observed in FLs.

The proposed Prek Toal Sanctuary would offer increased protection for fish and other wildlife, including the bird colonies, crocodiles and forest and scrub habitat. It is therefore hoped that the area will act as a fish sanctuary, and play an important role in the continuing sustainability of fish harvests in lot 2 and the neighbouring CFi areas. Local fishers would be restricted somewhat in the short term, as they would no longer have access to the sanctuary area in the closed season, but this would hopefully be offset by increases in fish harvests in the long-term. There would be a small reduction in the number of areas available for sub-lease inside the lot, which would affect the lot operator, but given that there is an expected 6% decrease in fish harvest this would not be huge, particularly given the large financial gains made by the lot.

7. Recommendations for future management of Fishing Lot 2 and Prek Toal Core Area

A number of recommendations emerged during this report, presented below. The details would be defined during discussions between ministries and stake-holders.

1) Establishment of a Prek Toal Sanctuary in Lot 2: The evidence shows that a PT sanctuary could encompass key habitats for fish and other wildlife, with only minimal losses to commercial and local fisheries. Indeed, the indicators of unsustainable practices in all fishing areas suggest that a sanctuary is vital to the long-term maintenance of fish harvests in the area. However, it is crucial that the PT Sanctuary is

responsibly managed and that this does not simply result in another authority which demands unofficial fees for illegal fishing in this area. This requires long-term sustainable financing and with a transparent, robust, and monitored system in place that is fully supported by the appropriate ministries and local authorities.

2) Increase local community participation in and benefits from Lot 2: Efforts should be made to increase local community participation in the lot, potentially including:

- Commitment by lot operators to preferentially offer labouring jobs to people from local communities, before offering them to outsiders.
- Increasing benefits from tourism to local communities, by developing local service providers and by the continued and improved development of the recently implemented scheme to distribute the \$20 core area entrance fee transparently and equitably, including to local communities and conservation activities. Money to local communities could be spent by an elected Community Development committee, potentially including funds for education, health, etc.
- Investigating the possibility of improving fish processing in local villages, so that more lot 2 fish is processed locally.

3) Enforce existing Law on Fisheries: Law enforcement, particularly of destructive practices such as pumping and electro-fishing, and enforcing no-fishing zones in existing sanctuaries should be more stringently enforced in FL, CFI and PA areas. This would involve ensuring that law enforcement involves more than just extracting small fees from fishers (seen as an unofficial tax), but larger penalties such as equipment confiscation. A decision should be reached as to the legality of *bors* and small mesh sizes. While *bors* are illegal but owned by the majority of families, it becomes unclear what it is to be illegal. It may be that as with elsewhere law enforcement becomes a pragmatic system whereby authorities choose to enforce particular laws more stringently than others, simply because to enforce all laws at once risks not enforcing the law for the most damaging and destructive behaviours. Care should be taken that if law enforcement activities have excessive impacts on local livelihoods (particularly poorer families) there is interim support for those families.

4) Widespread dissemination of, and education, on fishing and wildlife laws and boundaries, and the impacts of over-fishing: Including making copies of the burden book and Law on Fisheries publicly available in each village, as well as discussing laws with the lot operators, local fisheries staff, local communities, and other stakeholders.

The implementation of these recommendations will involve a number of phases:

- 1) A process of consultation of these proposals by FiA, MoE and local stakeholders. This would allow modifications to be made, taking into consideration the concerns of authorities where they do not conflict with conservation objectives, and to clarify the legal status of the Prek Toal Sanctuary. Authorities would then need to accept the revised recommendations.
- 2) Designing a management plan with FiA and MoE including how to implement laws and regulations, resource use, benefit sharing mechanisms and monitoring, together with designs for fair, transparent and sustainable structures to enforce these rules, which can then be established and monitored.
- 3) The final stage would involve demarcating the new PT Sanctuary and piloting the management plan, including education and dissemination of the rules and regulations inside the new area, and training for the new law enforcement teams.

សេចក្តីសង្ខេប

១ សេចក្តីផ្តើម

ប្រវត្តិរឿង

ការពិភាក្សាដេញដោលដែលគួរពិចារណា មានទម្រង់នៃការគ្រប់គ្រងផ្សេងៗគ្នាជាច្រើន ដែលសមស្របសម្រាប់តំបន់នានានៃបឹងទន្លេសាប (ទន្លេសាប) ជាពិសេសតំបន់ឡឆ្នាំនេសាទ និងតំបន់អភិរក្សដែលត្រួតស៊ីគ្នា។ គម្រោងនេះមានគោលបំណង ដើម្បីពិនិត្យមើលឡើងវិញនូវឡឆ្នាំនេសាទ ដែលត្រួតស៊ីគ្នានៅខេត្តបាត់ដំបង (ឡឆ្នាំ លេខ២) និងតំបន់ស្ទឹងព្រែកទាល់ (Prek Toal) ដើម្បីស្វែងយល់ឱ្យកាន់តែប្រសើរឡើងនូវការអភិរក្សសារសំខាន់ផ្នែកសេដ្ឋកិច្ចសង្គម និងពាណិជ្ជកម្មនៃរបបគ្រប់គ្រង បច្ចុប្បន្នសម្រាប់តំបន់ទាំងពីរនេះ បន្ទាប់មកយើងបង្កើតជំហានដំបូងក្នុងការរៀបចំអនុសាសន៍សម្រាប់ការអនុវត្ត។

បឹងទន្លេសាប ក៏ជាប្រព័ន្ធអេកូសាស្ត្រមួយក្នុងចំណោមប្រព័ន្ធអេកូសាស្ត្រទឹកសាប ដែលផ្តល់ផលយ៉ាងច្រើនបំផុតក្នុងពិភពលោក ហើយមានសារសំខាន់បំផុតសម្រាប់ប្រជាពលរដ្ឋខ្មែរ ដែលជាប្រភពអាហារ និងចំណូល។ បឹងនេះក៏ត្រូវបានទទួលស្គាល់ផងដែរថា ជាគុណតម្លៃនៃជីវិតផ្សេងៗគ្នាយ៉ាងធំសំបើម។ អាងជីវ៌ដៃនៃបឹងទន្លេសាប (គ្របដណ្តប់បឹងទន្លេសាប) ត្រូវបានបែងចែកជាតំបន់គ្រប់គ្រងខុសៗគ្នាមួយចំនួនរួមមាន តំបន់ស្ទឹងចំនួនបីដែលតំបន់ស្ទឹងព្រែកទាល់មានសារសំខាន់បំផុតសម្រាប់ជីវចម្រុះ ក្នុងពេលជាមួយគ្នានេះបឹងទន្លេសាបត្រូវបានបែងចែកឡឆ្នាំនេសាទមួយចំនួនដូចជា សម្បទានពាណិជ្ជកម្មទ្រង់ទ្រាយធំ ដែលគ្រប់គ្រងដោយក្រុមហ៊ុនប្រតិបត្តិការឯកជន និងតំបន់ជលផលសហគមន៍ តំបន់ស្ទឹងអាងជីវ៌ដៃនៃបឹងទន្លេសាបទាំងបីនេះត្រួតស៊ីគ្នាជាមួយព្រំដែន ឡឆ្នាំនេសាទចំពោះវិសាលភាពមួយចំនួន ប៉ុន្តែតំបន់ស្ទឹងព្រែកទាល់ស្ថិតនៅទាំងស្រុងក្នុងឡឆ្នាំនេសាទលេខពីរ។

តំបន់ស្ទឹងនៃអាងជីវ៌ដៃនៃ ត្រូវបានកំណត់ថាជាតំបន់មួយ ដែលទុកសម្រាប់ការអភិរក្សធនធានជីវសាស្ត្រ ទេសភាព និងប្រព័ន្ធអេកូសាស្ត្រ។ ទោះបីយ៉ាងណាក៏ដោយ នាយកដ្ឋានជលផល (DoF) ឥឡូវនេះហៅថា រដ្ឋបាលជលផល (FIA) ពីមុនមកធ្លាប់មានយុត្តាធិការលើតំបន់នេះទាំងមូល ហើយការផ្លាស់ប្តូរលក្ខណៈនៃតំបន់ស្ទឹងនេះត្រូវបានគេមើលឃើញថា ជាបទល្មើសធ្ងន់ធ្ងររបស់អាជ្ញាធរនៃតំបន់ទាំងនេះ។ បន្ទាប់ពីមានការចរចារយៈពេលបួនឆ្នាំរវាងនាយកដ្ឋានជលផល និងក្រសួងបរិស្ថាន កិច្ចព្រមព្រៀងមួយត្រូវបានបង្កើតឡើងដោយរួមមានការសម្រុះសម្រួលគ្នាយ៉ាងសំខាន់ជាច្រើន និងការបន្តប្រព័ន្ធឡឆ្នាំនេសាទ ទោះបីជានៅពេលដែល

តំបន់ទាំងនេះ ត្រូវបានស្ថិតនៅជាមួយតំបន់ស្នូលនានាក្តី ក៏ដូចជាការអនុវត្តតាមឱ្យមានសកម្មភាព “ទេសចរណ៍អេកូ-សាស្ត្រ” នៅក្នុងតំបន់ស្នូលនានាទាំងនោះផងដែរ ។

ជាគោលការណ៍ ទាំងភ្នាក់ងាររដ្ឋាភិបាល ក្រសួងបរិស្ថាន និងរដ្ឋបាលជលផលមានការទទួលខុសត្រូវជាន់គ្នាលើតំបន់ស្នូលព្រែកទាល់ ។ ទោះជាយ៉ាងនេះក្តី ជាក់ស្តែងតំបន់ស្នូលនេះនៅតែស្ថិតក្រោមការគ្រប់គ្រងផ្នែកឡឆ្នាំនេសាទយ៉ាងមានប្រសិទ្ធភាពជាមួយនឹងការអភិរក្ស និងសកម្មភាពទេសចរណ៍ក្នុងតំបន់នេះទាំងអស់ ដោយពឹងផ្អែកលើការធានាសន្តិសុខថាទៅកែឡឆ្នាំនេសាទ ។ ខណៈពេលដែលមានការរារាំងកិច្ចខិតខំប្រឹងប្រែងអភិរក្សក្នុងជំហានសកម្មភាពមួយចំនួន ប្រព័ន្ធគ្រប់គ្រងបច្ចុប្បន្នមានទំហំនៃការសងជម្ងឺចិត្ត ដែលប្រកបដោយគ្រោះថ្នាក់ ។ ដែនជម្រកវាលល្បាប់ទឹកសាបដែលស្រដៀងគ្នា ត្រូវបានកេងយកទូទាំងតំបន់នេះយ៉ាងមាន៖ និងដោយគ្មានការអនុញ្ញាត ហើយការកំណត់តំបន់ស្នូលព្រែកទាល់ពីការបំផ្លាញនេះស្ទើរតែលាតសន្ធឹងទូទាំងឡឆ្នាំនេសាទលេខ ២ ។ ថៅកែឡឆ្នាំនេសាទ ចំណាយធនធានយ៉ាងច្រើនចំពោះការការពារឡឆ្នាំនេសាទ ដោយការកំណត់យ៉ាងមានប្រសិទ្ធភាពពីការបាត់បង់ទីជម្រក ។ ធនធានដែលអាចនាំឱ្យមានការអភិរក្ស ឬឱ្យភ្នាក់ងាររដ្ឋាភិបាលធ្វើការគ្រប់គ្រងលើការចូលទៅកាន់កាប់ និងការប្រើប្រាស់តំបន់នេះ ដូចគ្នាបន្តិចបន្តួចទៅនឹងធនធានរបស់ថៅកែឡឆ្នាំនេសាទ ដោយរួមមាន ការផ្តល់ហិរញ្ញវត្ថុ ហត្ថពលិក ទូក និងក្រុមប្រដាប់អាវុធ ។

ទោះបីជាគោលបំណងឧស្សាហកម្មឯកជន និងការអភិរក្សត្រូវបានគ្នាក្តីនៅពេលឈានដល់ការការពារដែនជម្រកក្តី ក៏គោលបំណងទាំងនោះមិនកើតឡើងក្នុងពេលដំណាលគ្នាទាំងស្រុងនោះដែរ ។ បន្ថែមពីលើនេះទៀត ប្រព័ន្ធគ្រប់គ្រងបច្ចុប្បន្ន មានយន្តការបែងចែកផលប្រយោជន៍ជាមួយសហគមន៍មូលដ្ឋាន និងមិនទាមទារការទទួលខុសត្រូវលើចំណែករបស់ថៅកែឡឆ្នាំនេសាទឡើយ ។ ជាលទ្ធផលពីប្រសិទ្ធភាពទាំងនេះ និងការបំបែកចេញដែលអាចស្ថានដឹងរវាងតួនាទីតំបន់ស្នូល ដែលត្រូវបានអនុម័តដោយអនុក្រឹត្យរបស់រដ្ឋាភិបាល/អង្គការយូនីស្កូព្រមទាំងរបបឡឆ្នាំនេសាទផ្នែកពាណិជ្ជកម្មបច្ចុប្បន្នផង ឡឆ្នាំនេសាទពេលអនាគតនឹងមិនជាក់លាក់នោះទេ ។ កិច្ចព្រមព្រៀងមួយត្រូវបានចុះហត្ថលេខារវាងរាជរដ្ឋាភិបាល និងធនាគារអភិវឌ្ឍន៍អាស៊ី ដោយការទាមទារឱ្យលប់ចោលនូវសហគ្រាសពាណិជ្ជកម្មទាំងអស់នៅក្នុងតំបន់ស្នូល ដែលត្រូវបានរៀបចំឡើងត្រឹមឆ្នាំ ២០១០ ៖ “ការលុបចោលឡឆ្នាំនេសាទពីតំបន់ស្នូលទាំងនេះ គួរប្រកាសអំពីឆន្ទៈរបស់រាជរដ្ឋាភិបាល ដើម្បីឱ្យឆ្លើយតបនឹងកាតព្វកិច្ចដែលត្រូវបានធ្វើជាតំណាងក្នុងសន្ធិសញ្ញា និងអនុសញ្ញា ហើយធ្វើការឆ្ពោះទៅរកគោលដៅនៃយុទ្ធសាស្ត្រស៊ីវិលស្តីពីការដែនជីវបម្រុងទុក ឆ្នាំ ១៩៩៥” (ការចិញ្ចឹមជីវិតប្រកបដោយនិរន្តរភាពនៃបឹងទន្លេសាប) ។

ទស្សនៈដែលជាជម្រើសមួយគឺថា ប្រសិនបើប្រព័ន្ធគ្រប់គ្រងបច្ចុប្បន្នសម្រាប់ឡឥន្សាទលេខ២ ត្រូវបានគេដកហូតវិញនោះ ផលវិភាគសម្រាប់ជីវិតសត្វព្រៃ និងមច្ឆាក្នុងតំបន់ស្នូលព្រៃក្រោយនឹងជួបប្រទះភាពអន្តរាយ។ ដោយគ្មានការការពារពីថៅកែឡឥន្សាទ តំបន់ស្នូលព្រៃក្រោយនឹងត្រឡប់ទៅរកស្ថានភាពចូលកាន់កាប់ដោយបើកចំហយ៉ាងពិតប្រាកដ ហើយក្លាយទៅជាអន្តរាយដោយសារសម្ពាធ នៃការប្រមូលផលហួសប្រមាណដូចគ្នានេះ ហើយការខូចខាតដែនជម្រកនឹងកើតឡើងនៅកន្លែងផ្សេងៗទៀត។ ស្ថិតក្រោមការលះលើនេះគេព្យាករណ៍ថា ឥឡូវនេះក្រុមត្រួតពិនិត្យរបស់ក្រសួងបរិស្ថាន ដែលទទួលខុសត្រូវចំពោះជោគជ័យ នៃរបបគ្រប់គ្រង ការអភិរក្សនាពេលបច្ចុប្បន្ននឹងរកឃើញ ដោយខ្លួនឯងយ៉ាងលឿនដែលត្រូវបានធ្វើឱ្យរន្ធត់ដោយសម្ពាធពីខាងក្រៅ ហើយវាទំនងថា ទាំងភ្នាក់ងារអភិរក្ស និងរដ្ឋាភិបាលនឹងមានសមត្ថភាពស្តារឡើងវិញនូវតុល្យភាពនៃរបស់ពួកគេ។

គោលបំណង និងសមាសធាតុនៃគម្រោង

គោលបំណងសំខាន់នៃគម្រោងនេះ គឺដើម្បីស្នើសុំនូវកិច្ចសម្រាប់ការបញ្ចូលគោលបំណងពាណិជ្ជកម្ម សហគមន៍ និងអភិរក្សក្នុងឡឥន្សាទលេខ២ ដែលមានតុល្យភាពនឹងតម្រូវការនៃតំបន់ស្នូលសម្រាប់ការអភិរក្សជាអតិបរមានូវការគ្រប់គ្រងពាណិជ្ជកម្ម ដែលប្រកបដោយនិរន្តរភាពរយៈពេលវែងនៃឡឥន្សាទលេខ២ ខណៈដែលការលើកកម្ពស់ការបែងចែកផលប្រយោជន៍នៅមូលដ្ឋានក្នុងលក្ខណៈ ដែលប្រកបដោយសមធម៌តាមដែលអាចធ្វើទៅបាន។ ដំណោះស្រាយដែលប្រកបដោយសក្តានុពលមួយ អាចពាក់ព័ន្ធនឹងការបង្កើតឡើងនូវតំបន់អភិរក្សព្រៃក្រោយ ឬតំបន់ការពារមច្ឆា (ពីពេលនេះទៅហៅថា "តំបន់ការពារព្រៃក្រោយ") ក្នុងតំបន់ស្នូលព្រៃក្រោយដែលនឹងត្រូវកំណត់យ៉ាងតឹងរ៉ឹងនូវសកម្មភាពរបស់មនុស្ស ចំពោះសកម្មភាពទាំងឡាយណាដែលត្រូវបានកំណត់ដោយព្រះរាជក្រឹត្យ (ដោយមិនរាប់បញ្ចូលនូវការនេសាទលក្ខណៈពាណិជ្ជកម្មទេ)។ ជាផ្នែកមួយនៃគម្រោងនេះយើងបានកំណត់សំណើសុំនេះ រួមបញ្ចូលជាមួយការកំណត់តំបន់សំខាន់ៗ សម្រាប់ជីវចម្រុះក្នុងតំបន់ស្នូលព្រៃក្រោយដោយការប្រើប្រាស់ព័ត៌មាននេះ ដើម្បីលើកជាយោបល់អំពីការកំណត់ព្រំដែនសាកល្បងសម្រាប់តំបន់ការពារព្រៃក្រោយដែលប្រកបដោយសក្តានុពលមួយ និងដោយការស៊ើបអង្កេតផលប៉ះពាល់ចំពោះការនេសាទជាលក្ខណៈគ្រួសារ និងជាលក្ខណៈពាណិជ្ជកម្មតំបន់ការពារនេះគួរតែត្រូវបានបង្កើតឡើង។

គម្រោងនេះត្រូវបានចែកជាសមាសធាតុស្រាវជ្រាវចំនួន ៥:

- ការប៉ាន់ប្រមាណតុល្យភាពនៃការអភិរក្ស និងបរិស្ថានវិទ្យាក្នុងតំបន់ស្នូលព្រៃក្រោយ/ឡឥន្សាទលេខ ២ ព្រមទាំងសំណើសុំកំណត់ព្រំដែនតំបន់ការពារព្រៃក្រោយថ្មីនេះ។

- ការប៉ាន់ប្រមាណគុណតម្លៃនៃការនេសាទលក្ខណៈពាណិជ្ជកម្មក្នុងឡឆ្នាំនេសាទលេខ ២ និងគំរូបន្តបន្ទាប់នៃផលប៉ះពាល់ដែលបានគ្រោងទុកដោយសារការផ្លាស់ប្តូរការគ្រប់គ្រង (រួមមានតំបន់ការពារព្រែកទាល់ថ្មី) លើលទ្ធភាពធ្វើពាណិជ្ជកម្មឡឆ្នាំនេសាទលេខ ២ ។
- ការប៉ាន់ប្រមាណអំពីការបែងចែកផលប្រយោជន៍សេដ្ឋកិច្ចសង្គមចំពោះសហគមន៍មូលដ្ឋាន និងអ្នកពាក់ព័ន្ធនានាដែលស្ថិតក្រោមប្រព័ន្ធបច្ចុប្បន្ននេះ ។ លទ្ធផលត្រូវបានប្រើដើម្បីកំណត់ផលប៉ះពាល់ដែលមានសក្តានុពលលើសហគមន៍មូលដ្ឋានពីការផ្លាស់ប្តូរការគ្រប់គ្រងដែលត្រូវបានស្នើឡើង ។
- ការស៊ើបអង្កេតផលប៉ះពាល់នៃការអភិវឌ្ឍន៍ផ្នែកខាងលើនៅឡឆ្នាំនេសាទលេខ ២ និងតំបន់ស្នូលព្រែកទាល់ ។
- ការប្រៀបធៀបរវាងលទ្ធផលស្ថិតក្រោមតំបន់ការពារព្រែកទាល់ដែលបានស្នើឡើង និងរបបគ្រប់គ្រងដែលជាជម្រើស ។

២.គុណតម្លៃនៃបរិស្ថានវិទ្យា និងការអភិរក្សនៅតំបន់ស្នូលព្រែកទាល់និងឡឆ្នាំនេសាទលេខ២

តំបន់ស្នូលទាំងនេះ ត្រូវបានចាត់ទុកថាជាតំណាងប្រព័ន្ធអេកូស្តេម ដែលត្រូវបានកំណត់សម្រាប់ការការពាររយៈពេលវែង ។ តំបន់ស្នូលព្រែកទាល់ ត្រូវបានទទួលស្គាល់ថាជាទីតាំងសំខាន់សម្រាប់ការអភិរក្សទូទាំងពិភពលោក ដោយសារតែការបន្តមានវត្តមាននៃការបង្កាត់ពូជក្រុមប្រភេទបក្សីទឹកមួយចំនួន ដែលបានទទួលការគាំទ្រកំហែងយ៉ាងខ្លាំងនៅលើពិភពលោក ។ បន្ថែមពីនេះទៀត វាត្រូវបានគេទទួលស្គាល់ថា ជាតំបន់ដែលសំខាន់មួយសម្រាប់ពពួកសត្វល្អន (រួមមានក្រពើ-ត្រី និងពស់ដែលរស់ក្នុងទឹក) ថនិកសត្វ មច្ឆា និងបក្សីដទៃទៀតជាច្រើន ។ ប្រភពទិន្នន័យដែលមានស្រាប់ជាច្រើនស្តីពីអាទិភាពនៃការអភិរក្សតំបន់នេះត្រូវបានវិភាគ ដើម្បីប៉ាន់ប្រមាណគុណតម្លៃនៃការអភិរក្សតំបន់ស្នូលព្រែកទាល់ និងដើម្បីស្នើសុំឱ្យមានការកំណត់ព្រំដែនសម្រាប់តំបន់ការពារព្រែកទាល់ថ្មីមួយ ។ ការកំណត់ព្រំដែនដែលមានសក្តានុពលចំនួនពីរដែលបានស្នើឡើងនោះ មានទំហំតូចជាងតំបន់ស្នូលបច្ចុប្បន្ន ហើយតំបន់ទាំងពីរនេះព័ទ្ធជុំវិញតំបន់បច្ចុប្បន្នដែលសម្បូរបក្សី និងដែនជម្រកសត្វក្រពើគេចូលចិត្តតាមដាន (ជាពិសេសគឺដែនជម្រករដូវប្រាំង) ព្រមទាំងទន្លេសំខាន់ៗមួយចំនួនទៀត ។ យើងលើកយោបល់ថា តំបន់នៅខាងក្រៅតំបន់ការពារដែលបានស្នើឡើង ដោយរួមមានច្រាំងបឹងទាំងមូល នៅតែស្ថិតក្រោមការគ្រប់គ្រងឡឆ្នាំនេសាទ ថ្វីបើមានការបង្កើតតំបន់ការពារក៏ដោយ ប៉ុន្តែជាតំបន់ "ទ្រនាប់" ផ្នែកពាណិជ្ជកម្មតែប៉ុណ្ណោះ ។ ការរំខានដែនជម្រក និងការឈ្លានពានពីមនុស្សនៅខាងក្នុងតំបន់ការពារ នឹងត្រូវបានកាត់បន្ថយឱ្យនៅត្រឹមកម្រិតអប្បបរមា ហើយលទ្ធផលដូច្នេះ នឹងបង្កើនទាំងអត្រាកំណើនបក្សី និងមច្ឆាទូទាំងតំបន់នេះ ។ តំបន់ការពារនេះ គួរតែជាកន្លែងគ្មានការប្រើប្រាស់មួយ (លើកលែងតែវិស័យទេសចរណ៍ដែលមានការត្រួតពិនិត្យ) គួរតែហាមឃាត់ការនេសាទផ្នែកពាណិជ្ជកម្ម និងការនេសាទរបស់មនុស្សផ្សេងៗទៀត ។ ក្នុងនាមជាតំបន់ការពារដែលទើបបានបង្កើតឡើងថ្មីៗ យើងអាចស្មានដឹងជាមុនថា គួរតែធ្វើឱ្យមានប្រសិទ្ធភាពសម្រាប់ទាំងមច្ឆា ក៏ដូចជាទាំង

ជីវិតសព្វព្រៃ ទាំងរដ្ឋបាលជលផល និងទាំងក្រសួងបរិស្ថាន នឹងផ្តល់ឱ្យនូវការគាំទ្រពេញទំហឹង ដោយមានការបង្កើតដំណោះស្រាយឈ្នះ-ឈ្នះដែលមានផលប្រយោជន៍ទៅវិញទៅមក ចំពោះស្ថានភាពវិវាទមួយដែលមានរយៈពេលយូរ ។

៣. គុណតម្លៃនៃការនេសាទផ្នែកពាណិជ្ជកម្ម

ទំនាក់ទំនងរវាងតំបន់នេសាទផ្សេងៗគ្នា ថៅកែឡូត៍នេសាទ អ្នកជួលបន្តខុសៗគ្នា និងអ្នកនេសាទក្នុងមូលដ្ឋានត្រូវបានស៊ើបអង្កេត ។ គុណតម្លៃផ្នែកសេដ្ឋកិច្ចនៃតំបន់នានាក្នុងឡូត៍នេសាទលេខ ២ ខាងក្នុង និងខាងក្រៅតំបន់ស្ទួល ព្រមទាំងតំបន់ការពារព្រែកទោល ត្រូវបានប៉ាន់ប្រមាណចំពោះផលប៉ះពាល់ផ្នែកសេដ្ឋកិច្ច និងពាណិជ្ជកម្មពីការផ្លាស់ប្តូររបបគ្រប់គ្រងនៅក្នុងតំបន់ឡូត៍នេសាទនេះ ។

ការប្រកបរបរឡូត៍នេសាទ និងប្រក្រតីវិធីនៃការប្រកបរបរ

ឡូត៍នេសាទលេខ ២ ត្រូវបានចាត់ថ្នាក់ថាជាឡូត៍ "ស្រាវជ្រាវ និងអភិវឌ្ឍន៍" មួយ ចាប់តាំងពីឆ្នាំ ១៩៩៦មក ដោយរដ្ឋាភិបាលជ្រើសរើសអ្នកដែលខ្លួនចង់ឱ្យជួលឡូត៍នេសាទនេះ ទោះបីជាមានការបង្វាងដំណើរការដេញថ្លៃធម្មតាក៏ដោយ ។ ក្រោយមកថៅកែឡូត៍នេសាទទាំងនេះ នេសាទនៅតំបន់នោះដោយខ្លួនឯង ឬជួលបន្តផ្នែកនានាទៅអ្នកនេសាទដទៃទៀត ។ ចាប់តាំងពីឆ្នាំ ១៩៩៦ ដល់ ២០០៩ ឡូត៍លេខ ២ មានអ្នកជួលរួមគ្នាចំនួនពីរនាក់ដែលមានកិច្ចសន្យាមួយរយៈពេលវែង កិច្ចសន្យាជួលនេះត្រូវបានធ្វើឡើងវិញជាថ្មីក្នុងខែមិថុនា ឆ្នាំ ២០០៩ សម្រាប់រយៈពេលប្រាំឆ្នាំបន្ថែមទៀត ។

ការនេសាទដែលធ្វើឡើងនៅក្នុងឡូត៍នេសាទនេះប្រែប្រួលទៅតាមរដូវកាល ៖

- **រដូវបិទការនេសាទ (កក្កដា-កញ្ញា) :** ឡូត៍នេះត្រូវបានបិទមិនឱ្យមានការនេសាទធ្វើអាជីវកម្ម ប៉ុន្តែបើកចំហចំពោះអ្នកនេសាទដែលប្រើឧបករណ៍នេសាទបែបប្រពៃណី ។ ដូច្នេះអ្នកនេសាទជាច្រើនពិតជាប្រើប្រាស់ឧបករណ៍បែបប្រពៃណីក្នុងកំឡុងពេលនេះមែន ប៉ុន្តែអ្នកនេសាទចំនួនស្មើគ្នា ឬច្រើនជាងក៏ប្រើប្រាស់ប្តូរ ឬឧបករណ៍ដែលមានមាត់តូចចង្អៀតផងដែរ ដែលជាឧបករណ៍ខុសច្បាប់មានទំហំមធ្យម ។ រដូវបិទការនេសាទជាផ្លូវការរាប់ចាប់ពីថ្ងៃទី ១ ខែមិថុនា ដល់ថ្ងៃទី ៣១ ខែតុលា ប៉ុន្តែជាក់ស្តែងអ្នកនេសាទ និយាយថាពួកគេចាប់អនុវត្តពីថ្ងៃទី ១ ខែកក្កដា ដល់ថ្ងៃទី ៣០ ខែតុលា ។

- **រដូវបើកការនេសាទ ដែលទឹកនៅមានកម្រិតខ្ពស់ (ខែតុលា-ពាក់កណ្តាលខែមករា) :** ថៅកែឡូត៍នេសាទអនុញ្ញាតឱ្យមានប្តូរមួយចំនួនបន្តការនេសាទដោយមានការបង់ថ្លៃ ។ រំពង់មួយត្រូវបានកសាងឡើងរវាងឡូត៍នេសាទលេខ ២ និងឡូត៍នេសាទជិតគ្នានេះ ដោយមានឧបករណ៍ដាក់ចាប់ត្រីធំៗដាក់នៅលើរំពង់ នេះ ។

ឧបករណ៍នេសាទលក្ខណៈគ្រួសារមិនត្រូវបានអនុញ្ញាតឡើយ លើកលែងតែអ្នកនេសាទសត្វពស់ទឹក មួយចំនួន និងប្រជាពលរដ្ឋព្រែកពាក់កន្ទាល់ប៉ុណ្ណោះដែលអាចនេសាទដោយមានការបង់ថ្លៃ ។

• **រដូវបើកការនេសាទ ដែលកំពស់ទឹកកំពុងស្រកចុះ (ពាក់កណ្តាលខែមករា-ខែមីនា) :** ក្នុងខែមករា នៅពេលដែលកម្រិតទឹកស្រកទាបល្មមហើយ រហ័ងខាងក្រៅ (៣៦គ.ម x ៣ម) ត្រូវបានដាក់នៅក្នុងបឹងនេះ ប្រហែល ១គ.មពីច្រាំង។ ប្រសិនបើកម្រិតទឹកថយចុះ បង្គោលនេះប្រមូលត្រីដែលចេញពីព្រៃលិចទឹកឆ្ពោះទៅ រកបឹងឱ្យចូលទៅក្នុងទ្រុងសម្រាប់ចាប់ត្រីចំនួនប្រាំ ដែលត្រូវបានដាក់នៅចន្លោះរហ័ង។ នៅក្នុងខែកុម្ភៈនៅ ពេលកម្រិតទឹកបានធ្លាក់ចុះគ្រប់គ្រាន់រហូតដល់មើលឃើញច្រាំងទន្លេដែលខ្ពស់ជាង គេហើយរហ័ងប្រហាក់ ប្រហែលគ្នាជាធម្មតា ត្រូវបានដាក់នៅពាសពេញឡូត៍នេសាទ។ បន្ថែមពីនេះទៀត ប្តូរត្រូវបានរៀបចំឡើង តាមបណ្តោយទន្លេ (នៅខាងក្នុងរហ័ង) ដោយមានម្ចាស់ប្តូរចំណាយលុយជួលបន្ត និង/ឬស្ថិតក្រោមការត្រួតពិនិត្យ ដើម្បីផ្តល់ត្រីសត្វច្រូង (ត្រីចង្វា) ចំនួន ៦០% និងត្រីមានតម្លៃទាំងអស់ដែល ចាប់បានទៅឱ្យអ្នកជួលឡូត៍ នេសាទ ។

• **រដូវបើកការនេសាទ ដែលទឹកស្រកនៅទាប (មេសា-មិថុនា) :** នៅពេលកម្រិតទឹកទាបជាងមុន ហើយ ផ្ទៃភាគច្រើននៃឡូត៍នេសាទបានរីងអស់ទៅបង្កើតបានជាបឹង និងត្រពាំងរដូវប្រាំងមួយចំនួនក្នុងទីជម្រាលនៃ ខ្សែទឹកក្នុងឡូត៍នេសាទនេះ។ ពីង និងត្រពាំងទាំងនេះផ្តល់ជាទីជម្រកសម្រាប់ពពួកត្រី ដែលមិនធ្វើបម្លាស់ទី ដូចជា ត្រីរស់ជាដើម ហើយជាធម្មតាត្រូវបានជួលបន្ត (និងជួនកាលត្រូវបានគេជួលបន្តពីរដង) ត្រីនៅក្នុង តំបន់ទាំងនេះត្រូវបានគេចាប់តាមរយៈ "ការកៀរ" ដែលត្រូវបានធ្វើឡើងកាន់តែមាន ប្រសិទ្ធភាពដោយការ ធ្វើឱ្យកម្រិតទឹកកាន់តែរាក់ (ជាធម្មតាដោយការបូមទឹកចេញ)។ ជាញឹកញាប់ត្រីរស់អាចរស់រាននៅក្នុងទឹកដែល មិនសូវមានអុកស៊ីសែន បន្ទាប់ពីការកៀររួចមក ហើយជាធម្មតាត្រីដែលនៅសល់ក្នុងទឹក និងភក់ត្រូវបាន សម្លាប់ និងប្រមូលយកតាមរយៈការប្រើឧបករណ៍រកដោយចរន្តអគ្គិសនី។

ពេញមួយឆ្នាំ ឡូត៍នេសាទត្រូវបានល្បាតដោយបុគ្គលិករបស់ថៅកែឡូត៍នេសាទ ដោយមានការ សហការជាមួយអធិការរដ្ឋបាលជលផល នគរបាលមូលដ្ឋាន និងទាហាន។ កំឡុងរដូវបើកការនេសាទ ថៅកែឡូត៍ នេសាទមានជនប្រដាប់អាវុធប្រមាណ ១៥នាក់ ជាមួយនឹងទូកបានជិះល្បាតលើខ្សែទឹកនានា។ ច្រកចូលនីមួយៗ ទៅកាន់ឡូត៍នេសាទត្រូវបានការពារ ហើយទាហានដែលមានអាវុធនៅលើផ្ទះមួយ ជាអ្នកការពារច្រករាំងខាង ក្រៅ។ ការការពារបឹង និងត្រពាំងដែលនៅផ្នែកខាងលើ គឺជាការទទួលខុសត្រូវរបស់អ្នកជួលបន្តបន្ទាប់រៀងៗខ្លួន។

ការចាប់ត្រី

ការប្រមូលផលត្រីតាមរយៈវិធីសាស្ត្របែបប្រពៃណី និងបែបពាណិជ្ជកម្ម ត្រូវបានត្រួតពិនិត្យពីខែ

កក្កដា ឆ្នាំ ២០០៨ ដល់ខែកក្កដា ឆ្នាំ ២០០៩។ ទិន្នន័យត្រូវបានប្រមូលជាច្រើនរាល់ថ្ងៃពីឧបករណ៍នេសាទគំរូ មួយនៅក្នុងឡូត៍នេសាទលេខ ២ បែងចែកតាមទម្ងន់ ប្រភេទ តម្លៃលក់ចេញ និងទីកន្លែងប្រមូលផលត្រី ក៏ដូចជា ឧបករណ៍នេសាទផងដែរ ភូមិនិងចំនួនអ្នកនេសាទ ព្រមទាំងតម្លៃលម្អិតនានាដែលបានចំណាយ។ ទិន្នន័យត្រូវបាន ប្រៀបធៀបទៅនឹងទិន្នន័យដែលបានប្រមូលនៅតំបន់ចុងឃ្លាស និងទីតាំងទទួលទិញត្រីក្នុងខេត្តបាត់ដំបងក្នុងរយៈ ពេលដូចគ្នា ហើយធ្វើការប៉ាន់ប្រមាណនូវបរិមាណត្រីដែលបានចាប់ និងតម្លៃដែលទទួលបាន។ ប្រភេទឧបករណ៍ នេសាទ ត្រូវបានបែងចែកជាបីប្រភេទ គឺឧបករណ៍នេសាទចល័ត (ឧបករណ៍នេសាទបែបប្រពៃណី ដូចជាមង/អូន សន្ទូច និងទ្រូ/សែ) ។ ឧបករណ៍នេសាទអចល័ត (ឧបករណ៍នេសាទដែលមានទំហំមធ្យម ដូចជា ប្តូរជាដើម) ទ្រុង និងរំបាំង (ការនេសាទទ្រុងទ្រាយធំ) ។ សម្រាប់ប្រភេទឧបករណ៍នេសាទចុងក្រោយ អ្នកប្រមូលទិន្នន័យបានកត់ ត្រាអំពីការចាប់ត្រីទាំងអស់ មិនមែនគ្រាន់តែត្រីមធ្យមគំរូប៉ុណ្ណោះទេ។ តួរលេខបង្ហាញថា ខណៈពេលដែលបរិមាណ និងតម្លៃផលត្រីស្ទើរតែពាក់កណ្តាល ត្រូវបាននេសាទក្នុងតំបន់ស្នួលនេះ នោះភាគច្រើននៃបរិមាណត្រីគឺនៅតាម បណ្តោយច្រាំងនៃបឹង។ ផ្ទុយទៅវិញ តំបន់ការពារដែលបានស្នើឡើង មិនរួមបញ្ចូលតំបន់ច្រាំងនៃបឹងទេ ហើយតួរ តែមានបរិមាណត្រីប្រហែលត្រឹមតែ ៦% (៨%នៃតម្លៃ) នៃផលត្រីពីរដូវនេសាទឆ្នាំ ២០០៨/០៩ ប៉ុណ្ណោះ។ (តារាង ១.១ និង ១.២) ។

តារាង ១.១. តារាងបង្ហាញចំនួនតោននៃផលត្រីនៅតំបន់ស្នួលផ្នែកខាងក្នុង និងខាងក្រៅ និងតំបន់ការពារ ព្រែកទាល់ដែលបានស្នើឡើង។

ឧបករណ៍នេសាទត្រី	តំបន់ស្នួល		តំបន់ការពារដែលបានស្នើឡើង		ទីតាំងដែល មិនស្គាល់	ផលសរុប
	ខាងក្នុង	ខាងក្រៅ	ខាងក្នុង	ខាងក្រៅ		
ទ្រុង និងរំបាំង	៦៩៦	១១៦១៨	១៩	២២៩៤	០	២៣១៣
ឧបករណ៍នេសាទអចល័ត	១៣៨២	៤៤៤	២២១	១១៦០៥	៣៣	១៣៨៩៩
ឧបករណ៍នេសាទចល័ត	៦៤	៣៦	១៧	៨១	៥៣	១៥១
ផលសរុប	២១៤២	២១០៩៧	២៥៧	៣៤៥៨០	៨៦	៤៣២៣
ភាគរយ	៤៩ ។ ៥៥	៤៨ ។ ៥៥	៥ ។ ៥៥	៩២ ។ ១៥	២ ។ ០៥	១០០៥

តារាង ១.២. តារាងបង្ហាញតម្លៃ^{១៤} នៃផលត្រីនៅតំបន់ស្នូលបច្ចុប្បន្នផ្នែកខាងក្នុង និងខាងក្រៅ និងតំបន់ការពារព្រែកទាល់ដែលបានស្នើឡើង ។

ឧបករណ៍នេសាទត្រី	តំបន់ស្នូល		តំបន់ការពារដែលបានស្នើឡើង		ទីតាំងដែលមិនស្គាល់	តម្លៃសរុប (លានដុល្លារ)
	ខាងក្នុង	ខាងក្រៅ	ខាងក្នុង	ខាងក្រៅ		
ទ្រូង និងរំបាំង	៤២៨៣៥១	១១២៦០១៩៣	៣១១៦០៥	១១៦៥៦៩៣៩	០	១ ១៦៩
ឧបករណ៍នេសាទអចល័ត	៩៧៧៨៦៨	៣២៦១៦៧៨	១៩២១០៨៩	១១១១២៧៤៥៧	១៩៧៤៥៧	១ ៣២
ឧបករណ៍នេសាទចល័ត	៧៨៧២៥៥	៤៣១៦៦៣	២០៧៤៥១	១០០៧៩៥៤	៦៩១១៧៩	០ ១១៩
សរុប (៤)	១១៨៤៣៤៧៣	១១៦៣០១៣៤	២៤៤៧១៤៥	២២៨៧០៣៥០	៨៨៧៦៣៦	៣ ២០
ភាគរយ	៤៧ ។ ៧៥	៥២ ។ ៣៥	៧ ។ ៦៥	៨៩ ។ ៦៥	២ ។ ៨៥	១០០៥

សន្និសីទនៃនិរន្តរភាពផ្នែកនេសាទ

ក្នុងកំឡុងពេលស៊ើបអង្កេតរបស់យើង សន្និសីទមួយចំនួនបង្ហាញថា ការនេសាទមិនមាននិរន្តរភាពនោះទេ។ ការស៊ើបអង្កេតទាំងនេះរួមមាន របាយការណ៍នានាស្តីពីការនេសាទត្រីដែលបានថយចុះ ដោយសារអ្នកនេសាទនៅមូលដ្ឋាន និងការជួលបន្តការនេសាទត្រីកាន់តែតូចទៅៗ និងការបង្កើនចំនួនឧបករណ៍នេសាទកាន់តែច្រើនឡើងក្នុងរយៈពេលជាងប្រាំឆ្នាំចុងក្រោយនេះ ដោយរួមបញ្ចូលនូវការប្រើប្រាស់បច្ចេកទេស ដែលនាំឱ្យអន្តរាយជាទូទៅនាពេលបច្ចុប្បន្ន ដូចជាការប្តូរទីកន្លែង និងការប្រើឧបករណ៍ឆក់ត្រីជាដើម។ នៅពេលដែលគ្មានរបាយការណ៍ណាមួយក្នុងចំណោមរបាយការណ៍ទាំងនេះ ត្រូវបានធ្វើការសន្និដ្ឋានដោយគ្មានការសិក្សាបន្ថែមទៀតនោះទេ។ គេស្នើជាយោបល់ថា ពិតជាមានតម្រូវការជាក់ស្តែងមួយសម្រាប់តំបន់ការពារត្រី ដែលកំពុងតែដំណើរការដើម្បីធានានូវនិរន្តរភាពរយៈពេលវែងនៃការប្រមូលផលត្រីក្នុងឡឆ្នាំនេសាទលេខ ២ និងតំបន់ជុំវិញទាំងឡាយ។ ជាពិសេស នេះគឺជាការពិតសម្រាប់ប្រភេទត្រីពណ៌ខ្មៅ ដែលទទួលបានខ្លាំងជាងប្រភេទត្រីពណ៌សចំពោះការនេសាទទ្រង់ទ្រាយធំ។

៤. ការប៉ាន់ប្រមាណអំពីការបែងចែកផលប្រយោជន៍ផ្នែកសេដ្ឋកិច្ចសង្គម

យើងបានប៉ាន់ប្រមាណអំពីការបែងចែកផលប្រយោជន៍ផ្នែកសេដ្ឋកិច្ចសង្គមចំពោះសហគមន៍មូលដ្ឋាន និងអ្នកពាក់ព័ន្ធពីតំបន់ឡឆ្នាំនេសាទលេខ ២ និងតំបន់ស្នូលព្រែកទាល់ ក្រោមប្រព័ន្ធគ្រប់គ្រងបច្ចុប្បន្ន ហើយបានកំណត់ផលប៉ះពាល់នានាពីការផ្លាស់ប្តូរការគ្រប់គ្រងដែលបានស្នើឡើង។ ការស្ទង់មតិនានាត្រូវបានធ្វើឡើងក្នុងភូមិបណ្តែតទឹកចំនួនប្រាំ ដែលនៅជិតឡឆ្នាំនេសាទលេខ ២ និងនៅក្នុងភូមិ“ដីផ្នែកខាងលើ” ចំនួន ១៩ ដែលភាគច្រើនជា

អ្នកនេសាទចំណាកស្រុកតាមរដូវកាល ពលករ និងអ្នកជួលបន្តនៅក្នុងឡឆ្នាំនេសាទលេខ ២ ពីដើមមក ។ វិធីសាស្ត្រស្តង់ដារតាម រួមមាន ទម្រង់សំណួរប្រចាំខែ ការពិភាក្សាតាមក្រុមគោលដៅ និងការធ្វើសម្ភាសន៍ ។

សកម្មភាពចិញ្ចឹមជីវិត និងប្រាក់ចំណូល

នៅក្នុងភូមិបំណែតទឹក គ្រួសារភាគច្រើនបំផុតបានពឹងផ្អែកលើការនេសាទ ឬសកម្មភាពដែលទាក់ទងនឹងការនេសាទ ។ ទោះបីជាយ៉ាងណាក៏ដោយ (រដូវបើកការនេសាទ) ភាគច្រើនគ្រួសារទាំងអស់ លើកលែងតែគ្រួសារដែលមានទ្រព្យសម្បត្តិបំផុត មិនត្រូវបានបណ្តេញចេញពីឡឆ្នាំនេសាទលេខ ២ ទេ ហើយបាននេសាទនៅក្នុងតំបន់ CF និងតំបន់ PA ។ ការលើកលែងនេះ គឺសម្រាប់អ្នកនេសាទដែលមានទ្រព្យសម្បត្តិដែលអាចមានលទ្ធភាពជួលបន្តក្នុងឡឆ្នាំនេសាទលេខ ២ សម្រាប់ពលករក្រីក្រដែលធ្វើការនៅឡឆ្នាំនេសាទទី ២ និងសម្រាប់អ្នកនេសាទពិភូមិព្រែកកន្ទាល (ដែលមិនមានតំបន់ CF នៅក្បែរ ហើយដូច្នេះត្រូវបានអនុញ្ញាតឱ្យនេសាទនៅខាងក្នុងឡឆ្នាំនេសាទនេះដោយមានការបង់ថ្លៃ ។ កំឡុងរដូវបិទការនេសាទ គ្រួសារស្ទើរតែទាំងអស់រាយការណ៍អំពីការនេសាទមួយចំនួននៅក្នុងឡឆ្នាំនេសាទលេខ ២ ។ ដោយប្រាកដទៅការនេសាទកម្រិតតូច និងមធ្យម ត្រូវបានចាត់ថ្នាក់ថាជាសកម្មភាពចិញ្ចឹមជីវិតជាទូទៅបំផុត ដោយគ្រួសារជាងពាក់កណ្តាលកំពុងប្រើប្រាស់ឧបករណ៍ខុសច្បាប់ក្នុងភូមិមួយចំនួន ។

ប្រជាពលរដ្ឋប្រហែល ១០០នាក់ មកពីភូមិបំណែតទឹកដែលនៅជិតខាង បានធ្វើការជាពលករនៅឡឆ្នាំនេសាទលេខ ២ គឺមួយភាគដប់នៃពលករសរុបប្រមាណ ១០០០ នាក់ បានបម្រើការងារ ។ អ្នកដែលនៅសល់បានមកពីភូមិផ្សេងៗគ្នាជាច្រើន ជាញឹកញាប់នៅឆ្ងាយពីឡឆ្នាំនេសាទនេះ ប៉ុន្តែពួកគេប្រហែលជាសប្បាយចិត្តនឹងធ្វើការដែលមានប្រាក់ខែទាប (រាយការណ៍ដោយថៅកែឡឆ្នាំនេសាទ) ឬទំនងជាតូចតាមតួលើការប្រព្រឹត្តសកម្មភាពខុសច្បាប់ (រាយការណ៍ដោយអ្នកនេសាទក្នុងមូលដ្ឋាន) ។ ស្រដៀងគ្នានេះដែរ ការងារនេសាទបានផ្តល់នូវការងារតិចតួចជាងការរំពឹងទុកក្នុងសហគមន៍មូលដ្ឋាន ផ្ទុយទៅវិញត្រឹមយ៉ាងច្រើននៅឡឆ្នាំនេសាទលេខ ២ ត្រូវបាននាំចេញផ្ទាល់ទៅផែនការសម្រាប់ការដឹកទៅលក់បន្តទៀត ។ ការងារនេសាទត្រី បានទទួលប្រាក់ខែយ៉ាងតិចតួច ហើយមានតាមរដូវកាលតែប៉ុណ្ណោះ ប៉ុន្តែបានដើរតួនាទីយ៉ាងសំខាន់មួយក្នុងការផ្តល់ឱ្យនូវប្រាក់ចំណូលសម្រាប់គ្រួសារដែលមានជីវភាពក្រីក្របំផុត ជាពិសេសដោយសារតែវាជាការងារមួយក្នុងចំណោម ការងារមានប្រាក់កម្រៃពីរបីដែលអាចរកបានសម្រាប់ស្ត្រីភេទ ។ ទោះបីជាគ្រួសារដែលក្រីក្របំផុតបានលក់ NTFPs ក៏ដោយក៏គ្រួសារមួយចំនួនធំបានប្រមូលផលិតផលទាំងនេះផងដែរ ដោយការប្រមូលភាគច្រើនសម្រាប់ការប្រើប្រាស់ក្នុងគ្រួសារតែប៉ុណ្ណោះ ។

សកម្មភាពអភិរក្ស បានផ្តល់ប្រាក់ចំណូលឱ្យប្រជាពលរដ្ឋប្រមាណ ៣៥គ្រួសារ ដែលពួកគេទាំងអស់មកពីភូមិបំណែតទឹកនានា ។ បច្ចុប្បន្ននេះ ប្រាក់ចំណូលពីរិស័យទេសចរណ៍តិចតួចបំផុតបានហូរចូលមកក្នុង

សហគមន៍មូលដ្ឋាននេះ ក្នុងពេលដែលអង្គការនានាដែលមានមូលដ្ឋាននៅខេត្តសៀមរាប បានបង្កើតសេវាកម្មជាច្រើន (ដូចជា អាហារ និងការដឹកជញ្ជូនជាដើម) ។ ដោយមានការជំរុញទឹកចិត្តថ្មីៗនេះ ស្ថានីយ៍បរិស្ថានបានអនុវត្តផែនការ ដើម្បីបែងចែកប្រាក់ចំណូលខ្លះពីការចូលទស្សនាតំបន់ស្នួល (\$២០/អ្នកទេសចរណ៍ម្នាក់) ទៅឱ្យផ្នែកអភិវឌ្ឍសហគមន៍ មូលដ្ឋាន ការអភិរក្ស និងសម្ភារសម្រាប់ស្ថានីយ៍ ប៉ុន្តែប្រព័ន្ធនេះនៅមានលក្ខណៈក្មេងខ្ចីនៅឡើយ ។

ការប្រកបរបរចិញ្ចឹមជីវិត និងសហគមន៍ផ្នែកខាងលើ ត្រូវបានគ្រប់គ្រងដោយផ្នែកកសិកម្ម និងបសុសត្វ ដោយភាគច្រើនបំផុតកំពុងតែកាន់កាប់ ឬធ្វើការងារជាពលករក្នុងការដាំដុះស្រូវ ។ ចំនួនដ៏ច្រើនមួយក៏បានធ្វើការនេសាទផងដែរ ប៉ុន្តែកម្រិតនេះបានប្រែប្រួលយ៉ាងច្រើន ហើយជាធម្មតាមានតាមរដូវកាលតែប៉ុណ្ណោះ ។ គ្រួសារជាងពាក់កណ្តាលដែលបាននេសាទត្រឹមតែក្នុងទន្លេ ឬត្រពាំងនៅតាមមូលដ្ឋានតែប៉ុណ្ណោះ ។ ឯអ្នកដទៃទៀតប្រមាណពាក់កណ្តាលបានធ្វើដំណើរទៅកាន់តែឆ្ងាយ ភាគច្រើនបំផុតបានទៅកាន់តំបន់នេសាទសាធារណៈដែលនៅក្បែរឡូត៍នេសាទលេខ ២ ឬនៅតំបន់នេសាទសាធារណៈក្នុងតំបន់ឡូត៍នេសាទលេខ ២នេះ ។ វាមិនអាចទៅរួចនោះទេ ដើម្បីស្គាល់ឱ្យបានច្បាស់រវាងផ្នែកទាំងពីរនេះ (តំបន់ PA ដែលនៅខាងក្នុង និងខាងក្រៅឡូត៍នេសាទលេខ ២) ប្រសិនបើអ្នកឆ្លើយតបមិនបានស្គាល់ខ្លួនឯង ។ មនុស្សមួយចំនួនធំបាននេសាទក្នុងឡូត៍នេសាទលេខ ២ ក្នុងរដូវបិទការនេសាទ ប៉ុន្តែមនុស្សតិចតួចបានទិញដី ដើម្បីនេសាទក្នុងរដូវបើកការនេសាទ ។ មនុស្សខ្លះដែលមកពីភូមិផ្នែកខាងលើក៏បានទទួលការងារជាពលករក្នុងឡូត៍នេសាទលេខ ២ផងដែរ ។

ប្រាក់ចំណូលជាមធ្យមដែលបានមកពីសកម្មភាពឡូត៍នេសាទលេខ ២ បានប្រែប្រួលយ៉ាងធំធេង ដោយការរៀបចំតាមជួរខ្ពស់បំផុត និងទាបបំផុត ដែលបានធ្វើការប្រៀបធៀបទៅនឹងការចិញ្ចឹមជីវិតរបស់អ្នកភូមិផ្សេងទៀត ។ អ្នកដែលរកប្រាក់ចំណូលបានខ្ពស់ជាងគេបំផុតសម្រាប់គ្រួសារមួយ គឺអ្នកជួលបន្តដែលត្រូវបាននាំពីក្រោយដោយម្ចាស់ឧបករណ៍នេសាទអចល័ត ម្ចាស់ហាង និងអ្នកជួញដូរត្រី ។ ទោះបីជាយ៉ាងណាក្តី ដោយសារតែអ្នកជួលបន្តមានចំនួនតិច អញ្ចឹងគឺម្ចាស់ឧបករណ៍នេសាទអចល័ត ដែលរកប្រាក់ចំណូលបានច្រើនបំផុតពីឡូត៍នេសាទលេខ ២ ក្នុងចំណោមគ្រួសារទាំងអស់ ។ អ្នកដែលរកប្រាក់ចំណូលបានតិចជាងគេបំផុត គឺអ្នកនេសាទដែលប្រើឧបករណ៍នេសាទបែបប្រពៃណី ។

ផលប៉ះពាល់នៃការផ្លាស់ប្តូរការគ្រប់គ្រង

ការធ្លាក់ចុះ ៦% ដែលត្រូវបានព្យាករណ៍ទុកសម្រាប់ការនេសាទត្រី ដែលស្ថិតនៅក្រោមការរៀបចំតំបន់ការពារព្រែកទោល នឹងពាក់ព័ន្ធនឹងការលុបចោលកិច្ចសន្យាជួលបន្តសំខាន់ៗចំនួនមួយឬពីរ ដែលអាចមានន័យថា ថៅកែឡូត៍នេសាទនឹងបាត់បង់ប្រាក់ចំណូលពីការជួលមួយឬពីរកន្លែង ប៉ុន្តែការជួលបន្តផ្សេងៗទៀតគួរតែ

ស្ថិតនៅដដែល ។ ហេតុដូច្នេះហើយ ប្រាក់ចំណូលចំពោះអ្នកជួលបន្តទាំងនោះដែលកំពុងអនុវត្តកិច្ចសន្យានៅឡើយ នឹងនៅតែអាចមានការផ្លាស់ប្តូរ ។ កំឡុងរដូវបើកការនេសាទ ផលប៉ះពាល់ក្នុងមូលដ្ឋានដែលចំបង គួរតែចំណី គ្រួសារចំនួន ៥០ ក្នុងតំបន់ព្រែកកន្ទាល់ដែលទិញដង ដើម្បីធ្វើការនេសាទក្នុងឡឆ្នាំនេសាទលេខ ២ ។ ការព្រមាន សំខាន់មួយ ត្រូវបានធ្វើឡើងជាមួយនឹងអនុសាសន៍សម្រាប់តំបន់ការពារព្រែកកន្ទាល់ គឺថាច្បាប់បច្ចុប្បន្នស្តីពីផលជល ត្រូវបានពង្រឹងយ៉ាងតឹងរ៉ឹងបន្ថែមទៀត ។ នេះនឹងមានន័យយ៉ាងច្បាស់ថា គ្មានឧបករណ៍នេសាទអចល័តនៅខាងក្នុង តំបន់ឡឆ្នាំនេសាទលេខ ២ ទៀតទេ នាកំឡុងរដូវបើកការនេសាទ ។ នេះនឹងធ្វើឱ្យបាត់បង់ប្រាក់ចំណូល (មិនផ្លូវការ) ចំពោះក្រសួងបរិស្ថាន រដ្ឋបាលជលផលមូលដ្ឋាន នគរបាលមូលដ្ឋាន និងទាហានមូលដ្ឋាន ហើយក៏ជាការកាត់បន្ថយ ការនេសាទដោយគ្រួសារដែលមានទ្រព្យសម្បត្តិមធ្យមដែលកំពុងគ្រប់គ្រងឧបករណ៍នេសាទនេះផងដែរ ។

៥. ការស៊ើបអង្កេតផលប៉ះពាល់នៃការអភិវឌ្ឍន៍ខ្សែទឹកខាងលើ

សកម្មភាពអភិវឌ្ឍន៍ពេលអនាគត ទាំងក្នុងបឹងទន្លេសាប និងទាំងខ្សែទឹកខាងលើក្នុងតំបន់តាមដង ទន្លេមេគង្គទំនងជានឹងមានផលប៉ះពាល់យ៉ាងសំខាន់លើការនេសាទ និងព្រៃលិចទឹកជុំវិញបឹងទន្លេសាប ។ ជាពិសេស ទំនប់វារីអគ្គិសនីបច្ចុប្បន្ន និងទំនប់វារីអគ្គិសនីដែលស្ថិតក្នុងគម្រោង ព្រមទាំងអាងស្តុកទឹក គម្រោងស្រោចស្រប់ និងការអភិវឌ្ឍជនបទ ត្រូវបានព្យាករណ៍ថានឹងនាំទៅរកការប្រែប្រួលលំហូរទឹកក្នុងទន្លេមេគង្គ ដែលនឹងគំរាម កំហែងដល់ប្រព័ន្ធអេកូស្ត្រូខ្សែទឹកខាងក្រោមដែលងាយរងផលប៉ះពាល់ ជាពិសេសគឺទន្លេសាប បឹងទន្លេសាប និងតំបន់វាលលិចទឹក ដោយសារការផ្លាស់ប្តូរប្រព័ន្ធរចនាសម្ព័ន្ធទឹកជំនន់ក្នុងបឹងទន្លេសាប ។

ក្តីបារម្ភមួយក្នុងចំណោមក្តីបារម្ភនានាដែលគេដឹងច្បាស់បំផុតនោះ គឺបានព្យាករណ៍អំពីការផ្លាស់ប្តូរ ជម្រៅបឹងទន្លេសាបកំឡុងរដូវប្រាំង ។ ការកើនឡើងតិចតួចដោយមិនប្រាកដនូវកម្រិតទឹកនារដូវប្រាំង ដោយសារ តែ ទឹក ដែលបញ្ចេញពីទំនប់វារីអគ្គិសនី ត្រូវបានរំពឹងថានឹងបណ្តាលឱ្យមានការថយចុះយ៉ាងធំធេងនូវតំបន់ព្រៃលិច ទឹករយៈពេលពី ១០ ទៅ ១៥ឆ្នាំ ខាងមុខ ពីព្រោះតំបន់វាលលិចទឹកតាមរដូវកាលពីមុនក្លាយជាតំបន់លិចទឹកជា អចិន្ត្រៃយ៍ ។ នេះទំនងជានឹងបន្ថយយ៉ាងធំធេងនូវសកម្មភាពផលិតប្រព័ន្ធអេកូស្ត្រូ (រួមមានផលិតកម្មផ្នែក នេសាទជាដើម) ដែលនឹងមានផលប៉ះពាល់ធ្ងន់ធ្ងរចំពោះជីវភាពរស់នៅតាមមូលដ្ឋាន និងសន្តិសុខស្បៀង ។

គំរូនានាពីអង្គការ WUP-FIN បង្ហាញថាតំបន់ស្នូលព្រែកកន្ទាល់រហូតដល់ ៤០% និងឡឆ្នាំនេសាទលេខ ២ រហូតដល់មួយភាគបី អាចត្រូវទទួលរងផលប៉ះពាល់ ។ នេះអាចប៉ះពាល់ដល់ដើមឈើដែលជាសំបុកបក្សីរហូត ៤០% និងទីជម្រករដូវប្រាំងរបស់សត្វក្រពើរហូតដល់ ២៥% ។ ហេតុដូច្នេះហើយ គម្រោងសំណើសម្រាប់តំបន់ស្នូល ព្រែកកន្ទាល់ថ្មី គួរត្រូវបានផ្សព្វផ្សាយដោយព័ត៌មានដែលអាចរកបានចុងក្រោយបំផុតពីការរៀបចំទាំងនេះ ដូច្នេះ តំបន់ចុងក្រោយដែលបានជ្រើសរើស នឹងមានសក្តានុពលខ្ពស់បំផុតសម្រាប់និរន្តរភាពរយៈពេលវែង ។

៦. ការប្រៀបធៀបរវាងផលសម្រេចបាន ស្ថិតក្រោមតំបន់ការពារព្រៃកន្លែងដែលបានស្នើឡើង និងរបបគ្រប់គ្រងដែលជាជម្រើស

យើងបានធ្វើការប្រៀបធៀបផលសម្រេចបានពីតំបន់ការពារព្រៃកន្លែងដែលបានស្នើឡើង និងពីរបបគ្រប់គ្រងដែលជាជម្រើស ជាពិសេសការផ្តោតការយកចិត្តទុកដាក់លើនិរន្តរភាព និងការថែរក្សាទីជម្រកព្រៃលិចទឹក ព្រមទាំងការពង្រីក និងបែងចែកផលប្រយោជន៍ដល់សហគមន៍នានា។ ព័ត៌មានដែលកំពុងមានស្រាប់ស្តីពីឡូត៍នេសាទ និងផលផលសហគមន៍ត្រូវបានពិនិត្យមើលឡើងវិញ ហើយការស្ទាបស្ទង់មតិមួយត្រូវបានរៀបចំឡើងក្នុងភូមិនានាពីបណ្តាខេត្តចំនួនបួនជុំវិញបឹងទន្លេសាប ដើម្បីធ្វើការស៊ើបអង្កេតការយល់ដឹងរបស់សហគមន៍លើប្រព័ន្ធគ្រប់គ្រង។

ប្រព័ន្ធគ្រប់គ្រង

ឡូត៍នេសាទបែបពាណិជ្ជកម្ម

មុនឆ្នាំ ២០០០ ប្រព័ន្ធគ្រប់គ្រងការជួលឡូត៍នេសាទបែបពាណិជ្ជកម្មទ្រង់ទ្រាយធំ ត្រូវបានផ្តល់ឱ្យដោយរដ្ឋាភិបាលចំពោះក្រុមហ៊ុនឯជន ដោយគេមានជំនឿថានឹងបម្រើគោលបំណងពីរយ៉ាង គឺដើម្បីបែងចែកប្រាក់ចំណូលសម្រាប់រតនាគារ តាមរយៈតម្លៃពីការជួល និងដើម្បីបង្កើតប្រព័ន្ធលើកទឹកចិត្តមួយសម្រាប់អ្នកកាន់អាជ្ញាប័ណ្ណក្នុងការគ្រប់គ្រង និងការពារជលផល និងបរិស្ថានជលផលនៃឡូត៍នេសាទ សម្រាប់ការធានានូវការប្រមូលផលរយៈពេលយូររបស់ពួកគេ។ ទោះជាយ៉ាងណាក៏ដោយ ក៏ការបន្តនូវការលើកទឹកចិត្តទាំងនេះដើម្បីសម្រេចបាននូវការប្រើប្រាស់ធនធានជលផលដែលមាននិរន្តរភាពនោះនៅតែមិនមានលក្ខណៈច្បាស់លាស់។ កន្លែងដែលថៅកែឡូត៍នេសាទមានការជឿជាក់ថា អាចថែរក្សាការគ្រប់គ្រងរយៈពេលវែងលើឡូត៍ជាក់លាក់ណាមួយ (ទោះជាតាមរយៈការដាក់ឥទ្ធិពលលើដំណើរការដេញថ្លៃ ឬតាមរយៈការប្រកាសគោលបំណង “ស្រាវជ្រាវ” លើឡូត៍នេសាទក៏ដោយ) ក៏មានការលើកទឹកចិត្តដែលអាចពិចារណាសម្រាប់ថៅកែឡូត៍នេសាទនោះ ដើម្បីការពារធនធានជលផល។ ម្យ៉ាងវិញទៀត រយៈពេលនៃការគ្រប់គ្រងមិនច្បាស់លាស់ ថៅកែឡូត៍នេសាទអាចមានការលើកទឹកចិត្តកាន់តែច្រើនឡើង ដើម្បីទាញយកផលប្រយោជន៍ឱ្យបានច្រើនតាមដែលគេអាចធ្វើបាន ហើយសកម្មភាពនេសាទអាចធ្វើឡើងដោយគោរពយ៉ាងតិចតួចចំពោះនិរន្តរភាពរយៈពេលវែង។ បន្ថែមពីនេះទៀត ទោះបីជានៅកន្លែងណាដែលមានការលើកទឹកចិត្តសម្រាប់ថៅកែឡូត៍នេសាទ ដើម្បីការពារធនធានក៏ដោយ ក៏ជាញឹកញាប់មិនអាចធ្វើទៅរួចសម្រាប់អ្នកជួលបន្ត និងអ្នកជួលបន្តមួយជាន់ទៀត ដែលជាញឹកញាប់មានកិច្ចសន្យារយៈពេលខ្លី ឬកិច្ចសន្យារយៈពេលមួយរដូវ ទោះបីជាថៅកែឡូត៍នេសាទនោះត្រូវបានធានាពីការជួលរយៈពេលវែងមួយក៏ដោយ។

តំបន់ជលផលសហគមន៍

ក្រោមប្រព័ន្ធឡូត៍នេសាទចាស់ សហគមន៍មូលដ្ឋានត្រូវបានហាមឃាត់មិនឱ្យចូលទៅតំបន់នេសាទ

ដែលសម្បូរត្រីបំផុតឡើយ ។ ថៅកែឡូត៍នេសាទក៏នឹងមានបំណងផងដែរ ក្នុងការគ្រប់គ្រងតំបន់នេសាទដែលផុតពីសិទ្ធិដែលចែងដោយកិច្ចសន្យាពួកគេ ខណៈដែលអ្នកនេសាទមូលដ្ឋាន ជាញឹកញយរំលោភចូលទៅក្នុងតំបន់ឡូត៍នេសាទ ។ ជាផលវិបាក ប្រព័ន្ធឡូត៍នេសាទបានធ្វើឱ្យមានបក្សពួកនិយម ដែលកំពុងតែកើនឡើងចំពោះថៅកែឡូត៍នេសាទ ដែលបាននាំទៅរកជម្លោះហិង្សាជាបន្តបន្ទាប់ ។ កំណែទម្រង់គោលនយោបាយជលផលបានអនុវត្តនាចុងឆ្នាំ ២០០០ ត្រូវបានរៀបចំឡើងដើម្បីប្រគល់ការគ្រប់គ្រងតំបន់នេសាទ ៥០% ទៅឱ្យសហគមន៍ ដោយការរៀបចំតំបន់ទាំងនេះថាជា “ជលផលសហគមន៍” ដើម្បីឱ្យមានការគ្រប់គ្រងសម្រាប់ជាផលប្រយោជន៍របស់សហគមន៍មូលដ្ឋាន ។ រដ្ឋបាលជលផលដែលមានភារកិច្ចទទួលខុសត្រូវ សម្រាប់ការកំណត់ឡូត៍នេសាទត្រូវបានលុបចោល ហើយគាំទ្រឱ្យមានការរៀបចំបង្កើតស្ថាប័នថ្មីមួយសម្រាប់ជលផលសហគមន៍ ។

ផលប៉ះពាល់ពីការឈប់គ្រប់គ្រងឡូត៍នេសាទនេះ ត្រូវបានធ្វើការវិភាគតាមរយៈការប៉ាន់ប្រមាណជាស៊េរី ដែលបានរៀបចំឡើងដោយនាយកដ្ឋានជលផល/រដ្ឋបាលជលផល ដោយមានការជួបប្រជុំគ្នាជាមួយផ្នែកសង្គមស៊ីវិល ។ ការទទួលបានធនធានជលផលដែលសម្បូរបែបកាន់តែងាយស្រួលក្លាមៗ និងការកើនឡើងនូវលទ្ធផលរយៈពេលខ្លីក្នុងការនេសាទ ដែលបានរាយការណ៍នៅឡូត៍នេសាទដែលគេបានលុបកិច្ចសន្យាចោលត្រូវបានស្វាគមន៍ជាទូទៅជាមួយនឹងការរំភើបរីករាយដោយប្រជាពលរដ្ឋក្នុងមូលដ្ឋាន ។ ជាជាក់ស្តែងមានការរីករាយតិចតួចក្នុងចំណោមថៅកែឡូត៍នេសាទ ដែលបានបាត់បង់ផលប្រយោជន៍យ៉ាងធំ ដោយសារឡូត៍នេសាទត្រូវបានបែងចែក ហើយជួនកាលរួមទាំងអ្នកជួលបន្តក្នុងចំនួនដ៏ច្រើន ព្រមទាំងកម្មកររបស់ពួកគេផងដែរ ។ ជាសំខាន់បំផុតក្នុងតំបន់ជាច្រើន មានការអាក់អន់ចិត្តដែលបុគ្គលិកនាយកដ្ឋានជលផល ជាពិសេសនៅកម្រិតខេត្ត “មិនត្រូវបានទទួលស្គាល់” ដោយកំណែទម្រង់គោលនយោបាយ ពិព្រោះជាញឹកញយគេមើលឃើញថាពួកគេជា “សម្ព័ន្ធមិត្ត” របស់ថៅកែឡូត៍នេសាទដែលមានទ្រព្យសម្បត្តិ ហើយដែលបាត់បង់តួច ឬដែលគាំទ្រថៅកែឡូត៍នេសាទតូចតាច ។

យ៉ាងណាក៏ដោយ កត្តារួមផ្សំនៃការកើនឡើងយ៉ាងសំបើមនូវការនេសាទ កង្វះការគ្រប់គ្រងដោយមន្ត្រីជលផលមូលដ្ឋាន និងភ្នាក់ងារអនុវត្តន៍ច្បាប់ ដើម្បីធានាថាការនេសាទត្រូវបានអនុវត្តតាមវិធីសាស្ត្រ ដែលមានការទទួលខុសត្រូវ និងដែលមាននិរន្តរភាព និងកង្វះក្របខ័ណ្ឌផ្លូវច្បាប់និងស្ថាប័នដែលត្រូវបានកំណត់ត្រឹមត្រូវសម្រាប់តំបន់ CFI ថ្មីនេះ បាននាំទៅរកការថយចុះយ៉ាងលឿននូវផលនេសាទដែលរកបានក្លាមៗទាំងនេះ ដោយអ្នកនេសាទ នៅមូលដ្ឋានកំពុងរាយការណ៍ពីការថយចុះយ៉ាងសំបើម នៅក្នុងការនេសាទបន្ទាប់ពីរយៈពេលត្រឹមតែពី ៣ ទៅ ៦ ឆ្នាំមកនេះ ។ វិធីសាស្ត្រនេសាទដែលមានលក្ខណៈបំផ្លាញ និងខុសច្បាប់ បានរាលដាលពាសពេញ ហើយសហគមន៍ នានាដែលត្រូវបានគេស្មានថានឹងបានគ្រប់គ្រងតំបន់នេសាទ ដែលបានបើកកាលពីពេលថ្មីៗទាំងនេះជាញឹកញយ បានជួបប្រទះនូវការបដិសេធមិនឱ្យធ្វើការនេសាទ ដោយឥស្សរជនមានអំណាច (ដោយរួមទាំង

អតីតថៅកែឡូត៍នេសាទផង) ។ ដោយហេតុតែស្ថិតនៅក្រោមប្រព័ន្ធគ្រប់គ្រងឡូត៍នេសាទ ថៅកែឡូត៍នេសាទត្រូវបានសន្មតថានឹងមានការលើកទឹកចិត្តដែលសំខាន់ ដើម្បីការពារធនធានជលផល និងដែនជម្រកព្រៃលិចទឹក ហើយការលើកទឹកចិត្តទាំងនេះភាគច្រើនមិនមានទេក្នុងប្រព័ន្ធ CFI “បើកចំហ” ។ បន្ថែមពីនេះទៀត អង្គការ CFI ជាទូទៅមិនរឹងមាំខាងផ្នែកនយោបាយ ហើយខ្វះសមត្ថភាព និងធនធានវិនិយោគ ដើម្បីផ្សារភ្ជាប់ដោយត្រឹមត្រូវក្នុងសកម្មភាព ការពារ និងគ្រប់គ្រង។ ដោយហេតុដូច្នេះហើយ ការលុបចោលរចនាសម្ព័ន្ធគ្រប់គ្រងឡូត៍នេសាទ បាននាំទៅរកការផ្លាស់ប្តូរយ៉ាងធំនូវតំបន់ព្រៃលិចទឹក និងតំបន់ដីទំនាបដែលនៅសល់ជាច្រើនក្នុងតំបន់ឡូត៍នេសាទទាំងនេះឱ្យទៅជាការធ្វើស្រែចំការវិញកំឡុងរដូវប្រាំង។ ក្នុងខណៈដែលកំណែទម្រង់នេះត្រូវបានពន្យារពេល ដើម្បីធ្វើឱ្យប្រសើរឡើងនូវការទទួលបានធនធានជលផល ដូច្នេះពួកគេបានបញ្ចប់ការឈានទៅរកការកាត់បន្ថយធនធានដែលសំខាន់ទាំងនោះ ។

ដោយមានការធ្វើបញ្ចប់នូវអនុក្រឹត្យស្តីពីការគ្រប់គ្រងជលផលសហគមន៍ និងការប្រកាសពិភ័យនាទី និងការទទួលខុសត្រូវជុំវិញបញ្ហាជលផល និងកិច្ចខិតខំប្រឹងប្រែងដើម្បីគ្រប់គ្រងឱ្យមានប្រសិទ្ធភាព តំបន់ដែលទើបបង្កើតថ្មីៗទាំងនេះកំពុងចាប់ផ្តើមធ្វើឱ្យប្រសើរឡើងក្នុងតំបន់មួយចំនួន ទោះបីជាភស្តុតាងមិនទាន់ជាទីពេញចិត្តក៏ដោយ។ ការសិក្សាជាច្រើនកំពុងសំឡឹងមើលទៅរកការគ្រប់គ្រងជលផលសហគមន៍ក្នុងប្រទេសនេះ បានបង្ហាញថា ភ្នាក់ងារជាច្រើនដែលជាអ្នកទទួលខុសត្រូវអនុវត្តន៍ច្បាប់ ជាញឹកញាប់គឺជាអ្នកស្ថិតក្នុងចំណោមអ្នកប្រព្រឹត្តល្មើសនឹងច្បាប់យ៉ាងធ្ងន់ធ្ងរបំផុត។ ក្តីបារម្ភកំពុងតែរីកធំឡើងថាសម្ពាធលើដែនជម្រកសំខាន់ៗ (ដូចជាព្រៃលិចទឹកជាដើម) កំពុងទទួលរងការគំរាមកំហែងយ៉ាងខ្លាំង ដោយសារតែកត្តាអត្រាប្រជាពលរដ្ឋដែលកំពុងតែកើនឡើងតម្រូវការដីធ្លី និងធនធានកំពុងតែកើនឡើងកំណើនសេដ្ឋកិច្ច ដែលល្បឿនរហ័សកង្វះការលើកទឹកចិត្តខ្លាំងក្លាសម្រាប់ការគ្រប់គ្រងរឹងមាំអាចមានន័យថា ការគ្រប់គ្រងធនធានសហគមន៍ អាចមានផលវិបាកក្នុងការធ្វើឱ្យសម្រេចគោលបំណងគ្រប់គ្រងរយៈពេលវែងរបស់ខ្លួន។

ការស្ទង់មតិតាមភូមិ

ការពិភាក្សាតាមក្រុមគោលដៅមួយចំនួន និងការធ្វើសម្ភាសន៍អ្នកផ្តល់ព័ត៌មានសំខាន់ៗ ត្រូវបានធ្វើឡើងក្នុងភូមិបណ្តែតទឹកដែលធ្វើការសិក្សាទាំងអស់ចំនួនប្រាំ និងភូមិចំនួនដប់មួយបន្ថែមទៀត។ សំណួរត្រូវបានសួរអំពីប្រព័ន្ធគ្រប់គ្រងដែលបានដឹងក្នុងតំបន់ជលផលខុសៗគ្នានៅក្បែរភូមិនេះ (តំបន់ FL, CF និង PA) និងប្តូរទៅរកធនធានធម្មជាតិ និងការប្រើប្រាស់ធនធានរយៈពេលជាង ១០ ឆ្នាំចុងក្រោយនេះ បញ្ហាដែលកំពុងកើតឡើងមួយចំនួនបានលេចឡើង ដែលត្រូវបានរាយការណ៍ក្នុងបណ្តាភូមិទាំងអស់ ឬភូមិភាគច្រើនបំផុតបញ្ហាទាំងនេះរួមមាន :

- ១- ការខូចខាតឃ្លាំងស្តុកត្រីដែលបានដឹងជាទូទៅ ក្នុងតំបន់ CFI និង FL ។ រួមមានការប្រមូលផលត្រី និង ទំហំត្រីដែលបានថយចុះ ជាពិសេសក្នុងតំបន់ CFI ប៉ុន្តែក៏ដោយសារតែអ្នកជួលបន្តនៅក្នុងតំបន់ FLs ផងដែរ ។
- ២- ការបាត់បង់ដែលបានដឹងជាទូទៅក្នុងតំបន់ព្រៃ និងព្រៃរេច ជាពិសេសក្នុងតំបន់ CF ។ ដោយសារតែ :
 - ការកាប់ឆ្កា និងដុត ដើម្បីធ្វើកសិកម្ម ជាពិសេសដោយអ្នកធ្វើចំណាកស្រុកមកពីផ្នែកខាងលើ (CFI)
 - ការកាប់ឆ្កាដើម្បីធ្វើឧបករណ៍នេសាទ និងចូលទៅនេសាទ (FL)
 - ការដុតដើម្បីបំផ្លាញ និងចាប់សត្វព្រៃ (FL & CFI)
 - ភ្លើងឆេះព្រៃដោយចៃដន្យ (តំបន់ទាំងអស់ ប៉ុន្តែជាពិសេសនៅតំបន់ CF) ។
- ៣- កង្វះចំណេះដឹងអំពីព្រំដែនតំបន់ FL និង CFI ។ ជយនកាលនឹងនាំទៅរកជម្លោះរវាងអ្នកនេសាទមូលដ្ឋានថៅកែ ឡូត៍នេសាទ និងអាជ្ញាធរមូលដ្ឋាន ។
- ៤- បាត់បង់ការនេសាទនៅតំបន់នេសាទសាធារណៈ ដោយសារការផ្លាស់ប្តូរមិនផ្លូវការនូវព្រំដែនឡូត៍នេសាទ និងការរឹតបន្តឹងផ្លូវនេសាទដែលបានអនុញ្ញាតពីមុន ដោយថៅកែឡូត៍នេសាទ ។ តាមសេចក្តីវាយការណ៍ថា តំបន់ និងផ្លូវនេសាទដែលអាចចេញចូលបានកាលពីមុន ត្រូវបានហាមឃាត់ចំពោះអ្នកនេសាទមូលដ្ឋាន ដោយ សារតែការផ្លាស់ប្តូរមិនផ្លូវការនូវព្រំដែនឡូត៍នេសាទ និងបទបញ្ជាកាលពីប្រាំឆ្នាំមុន ។
- ៥- កង្វះចំណេះដឹងច្បាប់ស្តីពីជលផល និងសៀវភៅបន្តកឡូត៍នេសាទ ។ រួមមានការភ័ន្តច្រឡំលើច្បាប់ជលផល ជាពិសេសនៅកន្លែងដែលឧបករណ៍នេសាទជាក់លាក់ត្រូវបានរកឃើញញឹកញាប់ ប៉ុន្តែដែលគេជឿជាក់ថា ជា ឧបករណ៍នេសាទខុសច្បាប់ ជាញឹកញយអាជ្ញាធរមូលដ្ឋានបានយកតម្លៃមិនផ្លូវការចំពោះ ឧបករណ៍នេសាទដែល គេជឿជាក់ថាជាឧបករណ៍ខុសច្បាប់ ប៉ុន្តែជានិច្ចកាលនេះមិនបានស្របនឹងច្បាប់ជាក់ស្តែងទេ ។
- ៦- ការនេសាទខុសច្បាប់ជាទូទៅ ។ ការកើនឡើងនូវឧបករណ៍នេសាទក្នុងចំនួនដ៏ច្រើន ត្រូវបានរាយការណ៍នៅ តាមតំបន់ទាំងអស់ ជាពិសេសចាប់តាំងពីឆ្នាំ ២០០៥មក ។ នេះបានរួមបញ្ចូលនូវការប្រើប្រាស់ឧបករណ៍ និង មុង/អូនតូចតាចនៅគ្រប់តំបន់ទាំងអស់ និងការប្រើប្រាស់ជាទូទៅនូវឧបករណ៍ឆក់ត្រី និងការបូមទឹកចេញ ជាពិសេសក្នុងតំបន់ FLs ។ ក៏មានរបាយការណ៍ញឹកញាប់ផងដែរអំពីទូកនេសាទខ្នាតធំ ដោយមានភ្លើងបញ្ចាំង និងមុង/អូនព័ទ្ធជុំវិញក្នុងតំបន់ PA ក្នុងផ្ទៃបឹងដោយរួមទាំងតំបន់ការពារត្រីផងដែរ ។
- ៧- តម្លៃនេសាទមិនផ្លូវការក្នុងចំនួនដ៏ធំ បានហូតយកពន្ធដោយអាជ្ញាធរមូលដ្ឋានទាំងអស់យ៉ាងជាក់ស្តែង ដោយ រួមមានអធិការជលផលមូលដ្ឋាន នគរបាល ទាហាន និងគណៈកម្មាធិការតំបន់ CFI ។
- ៨- ការប្រែប្រួលដ៏ធំក្នុងការគ្រប់គ្រងតំបន់ CFI និងគុណភាព ប្រាកដណាស់ថា តំបន់ CFI មួយចំនួនត្រូវ បានគ្រប់គ្រងដោយគណៈកម្មាធិការ CFI ជាមួយនឹងការគ្រប់គ្រងមួយចំនួនលើការនេសាទខុសច្បាប់ (ប៉ុន្តែនៅ

មានកម្រិត ដោយសារតែកង្វះសមត្ថភាព ឬធនធាន) ខណៈដែលតំបន់ CFI ដទៃទៀតត្រូវបាននេសាទ ដូចជា ឡឺត្រីនេសាទបែបពាណិជ្ជកម្ម ដោយត្រពាំងរដូវប្រាំងបានជួលទៅឱ្យអ្នកដេញថ្លៃខ្ពស់ជាងគេ ។

៩- ជារឿយៗសហគមន៍មូលដ្ឋានមិនត្រូវបានគេរាប់បញ្ចូល ក្នុងសកម្មភាពបែងចែកប្រាក់ចំណូលក្នុងឡឺត្រីនេសាទនានាទេ ជាពិសេសពលករឡឺត្រីនេសាទជាច្រើនត្រូវបានជ្រើសរើសពីតំបន់មូលដ្ឋាន និងតំបន់ខាងក្រៅ ។

ក្នុងការសន្និដ្ឋានតំបន់ CFI និង PA បានជួបប្រទះនូវការខូចខាតដែនជម្រកព្រៃរោះ និងព្រៃក្រាស់ យ៉ាងធំតាមដែលបានដឹង ព្រមទាំងបាត់បង់ផលស្តុកត្រី ជាពិសេសចាប់តាំងពីឆ្នាំ ២០០៥មក ដែលភាគច្រើន ដោយសារកង្វះសមត្ថភាពរបស់គណៈកម្មាធិការ CFI ឧបករណ៍នេសាទដែលទំនើបជាងមុន និងកង្វះការអនុវត្ត ច្បាប់ដោយអាជ្ញាធរមូលដ្ឋាន ។ ខណៈដែលតំបន់ FLs ក៏បានជួបប្រទះនូវការកើនឡើងប្រហាក់ប្រហែលគ្នាពីសម្ពាធនៃនេសាទផងដែរ មិនមែនជាកម្រិតដូចគ្នានៃការបាត់បង់ដែនជម្រកនោះទេ ហើយបញ្ហានេះយ៉ាងហោចណាស់ក៏ អាចទទួលខុសត្រូវមួយផ្នែកដែរ សម្រាប់អត្រានៃការនេសាទត្រីដែលបានថយចុះយឺតជាងមុនតាមដែលបានអង្កេត នៅក្នុងតំបន់ FLs ។

តំបន់ការពារព្រៃក្រាស់ដែលបានស្នើឡើង នឹងផ្តល់នូវការការពារដែលបានកើនឡើងសម្រាប់ត្រី និង សត្វព្រៃផ្សេងៗទៀត រួមមានហ្លួងបក្សី ក្រពើ និងដែនជម្រកព្រៃរោះ និងព្រៃក្រាស់ ។ ដូច្នេះគេសង្ឃឹមថា តំបន់ នេះនឹងដើរតួជាតំបន់ការពារត្រី ហើយដើរតួនាទីសំខាន់មួយក្នុងការបន្តនិរន្តរភាព នៃការប្រមូលផលត្រីក្នុងឡឺត្រី នេសាទលេខ ២ ព្រមទាំងតំបន់ CFI ដែលនៅជិតខាង ។ អ្នកនេសាទមូលដ្ឋាន គួរត្រូវបានរឹតបន្តឹងបន្តិចបន្តួច ក្នុងរយៈពេលខ្លី ពីព្រោះពួកគេនឹងមិនអាចចូលទៅកាន់តំបន់ការពារបានទៀតទេក្នុងរដូវបិទការនេសាទ ប៉ុន្តែនេះ នឹងទូទាត់ដោយមានសង្ឃឹមតាមរយៈការកើនឡើងនូវផលត្រីក្នុងរយៈពេលវែង ។ គួរតែមានការបញ្ចុះតម្លៃតិចតួច ក្នុងតំបន់មួយចំនួន ដែលអាចមានការជួលបន្តឡឺត្រីនេសាទ ដែលនឹងប៉ះពាល់ដល់ថ្លៃកែឡឺត្រីនេសាទ ប៉ុន្តែគេ និយាយថា មានការថយចុះ ៦% ដែលបានគិតទុកនៅក្នុងការប្រមូលផលត្រី នេះនឹងមិនជាចំនួនធំដុំទេ ជា ពិសេសគេបានផ្តល់ឱ្យនូវកំណើនហិរញ្ញវត្ថុធំធេងដែលបានបង្កើតឡើងដោយឡឺត្រីនេសាទ ។

៧. អនុសាសន៍សម្រាប់ការគ្រប់គ្រងឡឺត្រីនេសាទលេខ ២ និងតំបន់ស្នូលព្រៃក្រាស់នៅពេល អនាគត

អនុសាសន៍សំខាន់ៗមួយចំនួនបានលេចឡើងពេញរបាយការណ៍នេះ ។ ផ្ទុយទៅវិញរបាយការណ៍លម្អិត នឹងជាបញ្ហានៃការពិភាក្សាមួយរវាងក្រសួងពាក់ព័ន្ធ និងអ្នកពាក់ព័ន្ធនានា ហើយគោលគំនិតត្រូវបានបង្ហាញនៅ ខាងក្រោម ។

១- ការបង្កើតតំបន់ការពារព្រែកទាល់មួយក្នុងឡឆ្នាំនេសាទលេខ ២ : ភស្តុតាងបង្ហាញថា តំបន់ការពារព្រែកទាល់មួយអាចរួមបញ្ចូលនូវដែនជម្រកត្រី និងសត្វព្រៃសំខាន់ៗផ្សេងៗទៀត ជាមួយនឹងការបាត់បង់ត្រីមតិបន្តិចបន្តួចប៉ុណ្ណោះចំពោះការនេសាទក្នុងស្រុក និងនេសាទបែបពាណិជ្ជកម្ម។ តាមពិតសន្ទស្សន៍នៃការអនុវត្ត ដែលមិនមាននិរន្តរភាពក្នុងតំបន់នេសាទទាំងអស់បង្ហាញថា តំបន់ការពារមួយ គឺជាជីវិតចំពោះការរក្សាផលត្រីរយៈពេលវែងក្នុងតំបន់នោះ។ ទោះបីយ៉ាងណាក៏ដោយក៏វា ចាំបាច់ដែលតំបន់ការពារព្រែកទាល់ត្រូវបានគ្រប់គ្រងប្រកបដោយការទទួលខុសត្រូវ ហើយថានេះមិនងាយស្រួលសម្រាប់អាជ្ញាធរដទៃទៀត ដែលទាមទារតម្លៃមិនផ្លូវការសម្រាប់ការនេសាទខុសច្បាប់ក្នុងតំបន់នេះទៀតឡើយ។ រឿងនេះត្រូវការការផ្តល់ហិរញ្ញវត្ថុ ដែលមាននិរន្តរភាពរយៈពេលវែង ហើយដោយមានតម្លាភាពភាពរឹងមាំ និងប្រព័ន្ធគ្រប់គ្រងនៅនឹងកន្លែង ដែលត្រូវបានគាំទ្រយ៉ាងពេញទំហឹងដោយក្រសួង និងអាជ្ញាធរដែនដីសមស្រប។

២- បង្កើនការចូលរួមរបស់សហគមន៍មូលដ្ឋាន និងទាញផលប្រយោជន៍ពីឡឆ្នាំនេសាទលេខ ២ : កិច្ចខិតខំប្រឹងប្រែង គួរត្រូវបានធ្វើឡើងដើម្បីបង្កើនការចូលរួមរបស់សហគមន៍មូលដ្ឋាន នៅក្នុងឡឆ្នាំនេសាទនេះដោយសក្តានុពលរួមមាន :

- ការប្តេជ្ញាចិត្តដោយថៅកែឡឆ្នាំនេសាទ ដើម្បីផ្តល់នូវការងារពលកម្ម ដោយសេចក្តីចូលចិត្តចំពោះប្រជាពលរដ្ឋពីសហគមន៍មូលដ្ឋាន មុនពេលផ្តល់ការងារនេះទៅឱ្យអ្នកពីខាងក្រៅ។
- ការបង្កើនផលប្រយោជន៍ពីវិស័យទេសចរណ៍សម្រាប់សហគមន៍មូលដ្ឋាន ដោយការបង្កើតឱ្យមានអ្នកផ្តល់សេវាកម្មមូលដ្ឋាន និងដោយការអភិវឌ្ឍន៍បន្តពីមុនមកនូវគម្រោង ដែលបានអនុវត្តកាលពីពេលថ្មីៗនេះឱ្យកាន់តែប្រសើរឡើង ដើម្បីបែងចែកតម្លៃ ២០ដុល្លារ សម្រាប់ការចូលទស្សនាតំបន់ស្នួល ប្រកបដោយតម្លាភាពនិងសមភាព ដោយរួមបញ្ចូលសហគមន៍មូលដ្ឋាន និងសកម្មភាពអភិរក្ស ផងដែរ។ ថវិកាសម្រាប់សហគមន៍មូលដ្ឋានអាចត្រូវបានចំណាយយ៉ាងមានសិក្តានុភាព ដោយគណៈកម្មាធិការអភិវឌ្ឍន៍សហគមន៍ ដែលត្រូវបានបោះឆ្នោតជ្រើសរើសឡើង រួមមានថវិកាសម្រាប់ផ្នែកអប់រំផ្នែកសុខភាព។ល។
- ការស៊ើបអង្កេតលទ្ធភាពនៃដំណើរការនេសាទ ដែលកាន់តែប្រសើរឡើងក្នុងភូមិមូលដ្ឋាន ដូច្នេះត្រីនៅក្នុងឡឆ្នាំនេសាទលេខ ២ ត្រូវបានប្រើប្រាស់នៅមូលដ្ឋាន។

៣- ពង្រឹងច្បាប់ស្តីពីផលផលដែលកំពុងមានស្រាប់ : ការពង្រឹងច្បាប់ ជាពិសេសការនេសាទដែលមានលក្ខណៈបំផ្លិចបំផ្លាញ ដូចជាការប្តូរទឹកចេញ និងការប្រើឧបករណ៍ឆក់ត្រី ព្រមទាំងតំបន់គ្មានការនេសាទ គួរត្រូវបានពង្រឹងយ៉ាងតឹងរ៉ឹងក្នុងតំបន់ FLs, CFI និង PA។ ការពង្រឹងគួរចាប់ផ្តើមជាមួយ ថៅកែឡឆ្នាំនេសាទ និងអ្នកនេសាទទ្រង់ទ្រាយធំ ដែលជាការនេសាទមានលក្ខណៈបំផ្លិចបំផ្លាញ ហើយធានាថាតំបន់ការពារត្រីមិនមានការនេសាទ

ឡើយ ។ នេះនឹងធានាថា ការពង្រឹងច្បាប់ពាក់ព័ន្ធ ច្រើនជាងការគ្រាន់តែយកតម្លៃបន្តិចបន្តួចពីការនេសាទ (ដែលត្រូវបានមើលឃើញថា ជាពន្ធមិនផ្លូវការ) ប៉ុន្តែពាក់ព័ន្ធនឹងទណ្ឌកម្មធ្ងន់ធ្ងរ ដូចជាការរឹបអូសយកឧបករណ៍នេសាទជាដើម ។ ការសម្រេចចិត្តមួយគួរត្រូវបានធ្វើឡើង ដូចជាចំពោះភាពស្របច្បាប់នៃ *ប្លូ* និងមង/អូនតូចតាច ។ ផ្ទុយទៅវិញ *ប្លូ* ជាឧបករណ៍នេសាទខុសច្បាប់ ប៉ុន្តែប្រជាពលរដ្ឋភាគច្រើននៅក្នុងភូមិបណ្តែតទឹកប្រើប្រាស់វា ហើយវាក្លាយទៅជាមិនច្បាស់ថាអ្វីមួយជាឧបករណ៍ខុសច្បាប់ ។ វាអាចថា ប្រសិនបើការពង្រឹងច្បាប់នៅកន្លែងដទៃក្លាយជាប្រព័ន្ធអនុវត្តន៍មួយ ហេតុដូច្នេះអាជ្ញាធរអាចជ្រើសរើសការពង្រឹងច្បាប់ជាក់លាក់តឹងរឹងជាងកន្លែងដទៃយ៉ាងងាយ ពីព្រោះការពង្រឹងច្បាប់ទាំងអស់ ដោយប្រឈមនឹងភាពប្រថុយប្រថានតែម្តង មិនមែនជាការពង្រឹងច្បាប់ឱ្យកាន់តែវិសាល និងមានលក្ខណៈបំផ្លិចបំផ្លាញថែមទៀតនោះទេ ។ ការយកចិត្តទុកដាក់គួរត្រូវបានអនុវត្តថា ប្រសិនបើសកម្មភាពពង្រឹងច្បាប់មាន ផលប៉ះពាល់ហួសហេតុពេកលើជីវភាពប្រជាពលរដ្ឋមូលដ្ឋាន (ជាពិសេសគ្រួសារក្រីក្រ ហើយជា ពិសេសទៀតសម្រាប់សកម្មភាពដែលស្របច្បាប់ពិតប្រាកដរយៈពេលប្រាំឆ្នាំកន្លងមក) ដូច្នេះគួរតែមានការគាំទ្រជាបណ្តោះអាសន្នសម្រាប់គ្រួសារទាំងនោះ ។

៤- ការផ្សព្វផ្សាយ និងការអប់រំយ៉ាងទូលំទូលាយអំពីការនេសាទ ច្បាប់និងព្រំដែនសព្វព្រៃ ព្រមទាំង

ផលប៉ះពាល់នៃការនេសាទលើសង្គម : នេះរួមមាន ការថតចម្លងសៀវភៅបន្ទុក និងច្បាប់ស្តីពី ផលផលដែលអាចរកបានជាសាធារណៈនៅតាមភូមិនីមួយៗ ក៏ដូចជាការពិភាក្សាច្បាប់ជាមួយ ថៅកែឡឺត៍នេសាទបុគ្គលិកផលផល មូលដ្ឋាន សហគមន៍មូលដ្ឋាន និងអ្នកពាក់ព័ន្ធផ្សេងៗទៀត ។

ការអនុវត្តរាល់អនុសាសន៍ទាំងនេះនឹងពាក់ព័ន្ធជាមួយដំណាក់កាលច្បាស់លាស់មួយចំនួនដូចជា:

- ១- ដំណើរការនៃការពិគ្រោះយោបល់ និងការពិចារណាអំពីសំណើទាំងនេះដឹកនាំ ដោយរដ្ឋបាលផលផល និងសហការក្រសួងបរិស្ថាន និងអ្នកពាក់ព័ន្ធនានាតាមមូលដ្ឋាន ។ បញ្ហានេះនឹងអនុញ្ញាតឱ្យមានការកែប្រែ ដើម្បីឈានដល់ការពិចារណាអំពីកិច្ចប្រមូលរបស់អាជ្ញាធរ ដែលពួកគេមិនប្រឆាំងជាមួយគោលបំណងអភិរក្សត្រី និងសព្វព្រៃនោះទេ និងដើម្បីបញ្ជាក់អំពីលក្ខណៈស្របច្បាប់នៃតំបន់ការពារព្រៃកំណត់ ។ បន្ទាប់មកអាជ្ញាធរនឹងត្រូវបានធ្វើការស្នើសុំឱ្យទទួលយកអនុសាសន៍ទាំងនេះ ក្នុងទម្រង់ ដែលបានកែប្រែឡើងវិញរបស់ពួកគេ ។
- ២- បន្ទាប់មកទៀត ការអនុវត្តសំណើនេះ នឹងពាក់ព័ន្ធនឹងការរៀបចំគម្រោងគ្រប់គ្រងជាមួយរដ្ឋបាលផលផល និងក្រសួងបរិស្ថាន ដោយរួមបញ្ចូលនូវរបៀបអនុវត្តច្បាប់ និងបទបញ្ជា ការប្រើប្រាស់ ធនធាន យន្តការ និងការត្រួតពិនិត្យអំពីការបែងចែកផលប្រយោជន៍ ដោយមានការរៀបចំត្រឹមត្រូវ មានតម្លាភាព និងមានរចនាសម្ព័ន្ធដែលមាននិរន្តរភាព ដើម្បីពង្រឹងវិធានទាំងនេះ ដែលពេលនោះ អាចត្រូវបានបង្កើតឡើង និងត្រួតពិនិត្យ ។

៣- ជំហានចុងក្រោយ នឹងពាក់ព័ន្ធការកំណត់តំបន់ការពារព្រៃកម្រិតខ្ពស់ និងការអនុវត្តផែនការគ្រប់គ្រង ដោយរួមមានសមាសធាតុចម្បងស្តីពីការអប់រំ និងផ្សព្វផ្សាយវិធាន ក៏ដូចជាបទបញ្ជានៅខាងក្នុងតំបន់នេះ និងការបណ្តុះបណ្តាលសម្រាប់ក្រុមពង្រឹងច្បាប់ថ្មី ។

1. Introduction

By Tom CLEMENTS¹ and Sophie ALLEBONE-WEBB¹

¹ Wildlife Conservation Society



Photograph 1.1. Prek Toal village.
By Sophie Allebone-Webb

1.1 Summary

Considerable debate persists over the various forms of management that are appropriate for areas of the Tonle Sap Great Lake (hereafter “Tonle Sap”), not least where fishing lots and conservation areas overlap. This project aimed to review the overlapping Battambang fishing lot #2 (hereafter “lot 2”) and Prek Toal Core Area (PTCA) using social, environmental, economic and spatial analytical techniques to better understand the conservation, commercial and socio-economic importance of the current management regimes. In light of this improved understanding of the advantages and disadvantages of the respective management systems, we then make the first step in developing recommendations for adaptation where appropriate.

1.2 Tonle Sap Biosphere Reserve and Prek Toal Core Area

The Tonle Sap Lake was designated as a Biosphere Reserve by the Royal Government of Cambodia in April (2001) and by UNESCO in October 1997. The inclusion of the Tonle Sap within the global network of Biosphere Reserves is a testament to the site’s immense ecological, economic and socio-cultural importance. The Tonle Sap Biosphere Reserve (TSBR) is divided into a number of different management zones including a buffer zone, a transition zone and three core areas, of which Prek Toal is one (Figure 1.1). The Prek Toal core area has been recognised as site of global conservation significance, primarily due to the continued presence of breeding colonies of some of the world’s most threatened waterbird species.

1.3 Tonle Sap and the Fishing Lots

The Tonle Sap Lake and its associated floodplain represent the largest permanent body of fresh water in South-east Asia and is the most extensive area of wetland habitat in the Mekong system. The lake is one of the most productive freshwater ecosystems in the world, yielding up to 300,000 tons of fish annually (Bonheur 2001; Van Zalinge *et al.* 2003), and is extremely important for the Cambodian people as a source of food and income. For the purposes of fisheries management the Tonle Sap is divided into a number of Fishing lots – large-scale commercial concessions which are granted by the Government to private operators. Until the year 2000, approximately 80% of the floodplains surrounding the lake were incorporated into this fishing lot system. This situation effectively precluded access of local communities to the area’s most productive fishing grounds and generated growing antagonism towards the lot operators. Consequently, it was decided in late 2000 to return control of 50% of the fishing lot areas to the communities and to re-designate these areas community fishing grounds (Figure 1.2).

1.4 Battambang Fishing Lot No. 2 and the Core Areas

All three of the TSBR core areas overlap with fishing lot boundaries to some extent (Figure 1.1). The Prek Toal Core Area, however, is completely contained within fishing lot 2, occupying an area of 213 km² within the 501 km² of lot 2 (Figure 1.3).

The Core Area of a Biosphere Reserve is defined as an area devoted to the conservation of biological resources, of landscapes and of the ecosystem. The Royal

Decree by which the TSBR was declared concurs with this characterization and cites biodiversity conservation, monitoring and research as the primary objectives of the core area. However, the DoF/FiA had previously held jurisdiction over the entire area and the changing status of the core area was perceived as a severe contravention of their authority. They were particularly concerned about the inherent restrictions of this new designation on the revenue generating capacity of the area. After four years of negotiations between DoF and the Ministry of the Environment (MoE) an agreement was reached which entailed a number of significant compromises, including the continuation of the fishing lot system, even where overlap with core areas occurs, and also the authorisation of “ecotourism” activities within the core areas. Fishing lot 2 is currently a “research lot”, a decision born of political expedience.

1.5 Current context

In principal both government agencies, the MoE and the FiA have overlapping responsibility for the Prek Toal Core Area. However, in reality the dynamics of economic and political power have ensured that the core area remains under fishing lot management. This effectively means that all conservation (and tourism) activities in the area have been dependent on securing authorisation from the lot operator. Whilst this has hindered conservation efforts in some instances (particularly the capacity of local rangers to patrol for illegal fishing) the current management system has one critical compensatory dimension. Comparable areas of freshwater swamp habitat have been relentlessly exploited and ultimately decimated throughout the region and it would not be an overstatement to assert that PTCA’s exemption from this cycle of destruction is due almost entirely to the existence of fishing lot 2. The lot operator allocates vast resources to the protection of his investment in the area and recognises the necessity of maintaining areas of intact habitat to function as breeding and nursery sites for the fish stock, effectively limiting habitat loss. The resources available to conservation or government agencies in their efforts to manage access and use of the area simply pale into insignificance when compared to those at the disposal of the lot operator, including financing, manpower, boats and firearms.

Although conservation and private enterprise objectives overlap when it comes to habitat protection they do not completely coincide. The commercial fishing sector focuses on short-term protection and the subsequent maximisation of yields, whereas conservation initiatives endorse the concepts of long-term sustainability and stability. Furthermore, the current management system has few benefit sharing mechanisms with regard to the local communities and demands no accountability on the part of lot operators or leaseholders. As a result of these deficiencies and the perceived dichotomy between the core area functions as sanctioned by Royal Decree/UNESCO and the current commercial fishing lot management regime, the future of the fishing lot is uncertain. An agreement has been reached between the Government and the Asia Development Bank (ADB), which advocates the abolition of all commercial enterprises within the designated core areas by 2010: *“The removal of fishing lots from the core areas would signify the Government's intention to meet the obligations that*

are embodied in treaties and conventions¹ and work toward the goals of the Seville Strategy for Biosphere Reserves, 1995.² (Tonle Sap Sustainable Livelihoods, TSSL, 2 prodoc).

An alternative view is that if the current management system for fishing lot 2 is revoked, the consequences for Prek Toal and the bird colonies would be catastrophic. Without the protection afforded by the lot operator, Prek Toal would revert to de-facto open access situation and become vulnerable to the same extreme harvesting pressures and habitat degradation which is manifest in analogous contexts throughout the country. Under these circumstances, it is predicted that the MoE monitoring team now responsible for the success of the current conservation management regime would rapidly find themselves overwhelmed by outside pressures and it is unlikely that either the relevant Government or conservation agencies would have the capacity to restore their efficacy.

¹ Cambodia's obligations vis-à-vis the Tonle Sap are embodied in more than 10 treaties and conventions. These include the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention), 1971; the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1979; and the Convention on Biological Diversity, 1992. One of the core areas of the TSBR, Boeng Tonle Chhmar, was designated as one of the country's three Ramsar sites in 1999.

² The goals of the Seville Strategy for Biosphere Reserves are to (i) use biosphere reserves to conserve natural and cultural diversity; (ii) use biosphere reserves as models of land management and of approaches to sustainable development; (iii) use biosphere reserves for research, monitoring, education, and training; and (iv) implement the biosphere reserve concept.

Figure 1.1. Map of Tonle Sap Biosphere Reserve, Core Areas, and Commercial Fishing Lots

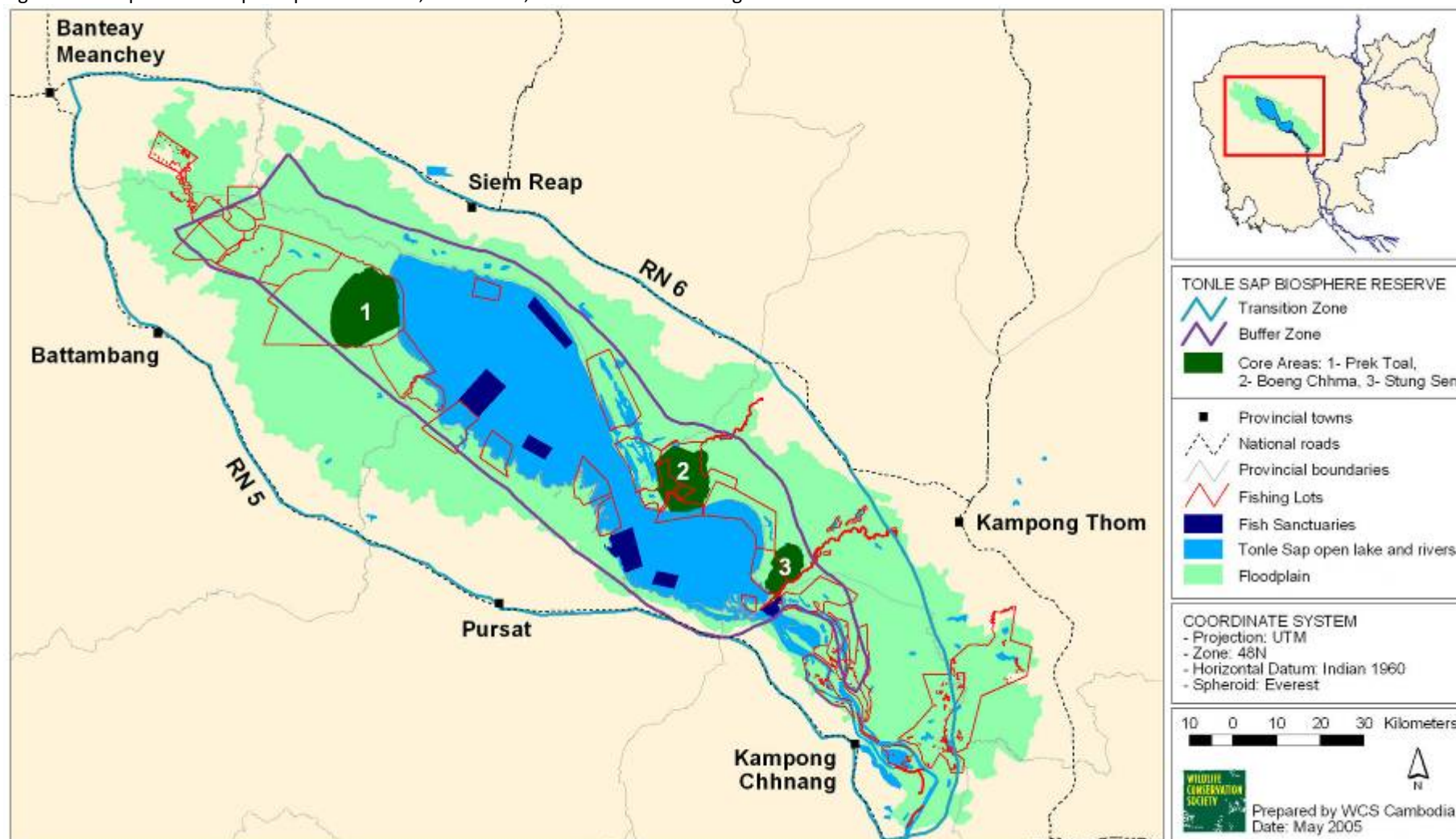


Figure 1.2. Map of Tonle Sap Commercial and Community Fishing Lots.
 Reproduced with permission from the Department of Fisheries (now FiA)

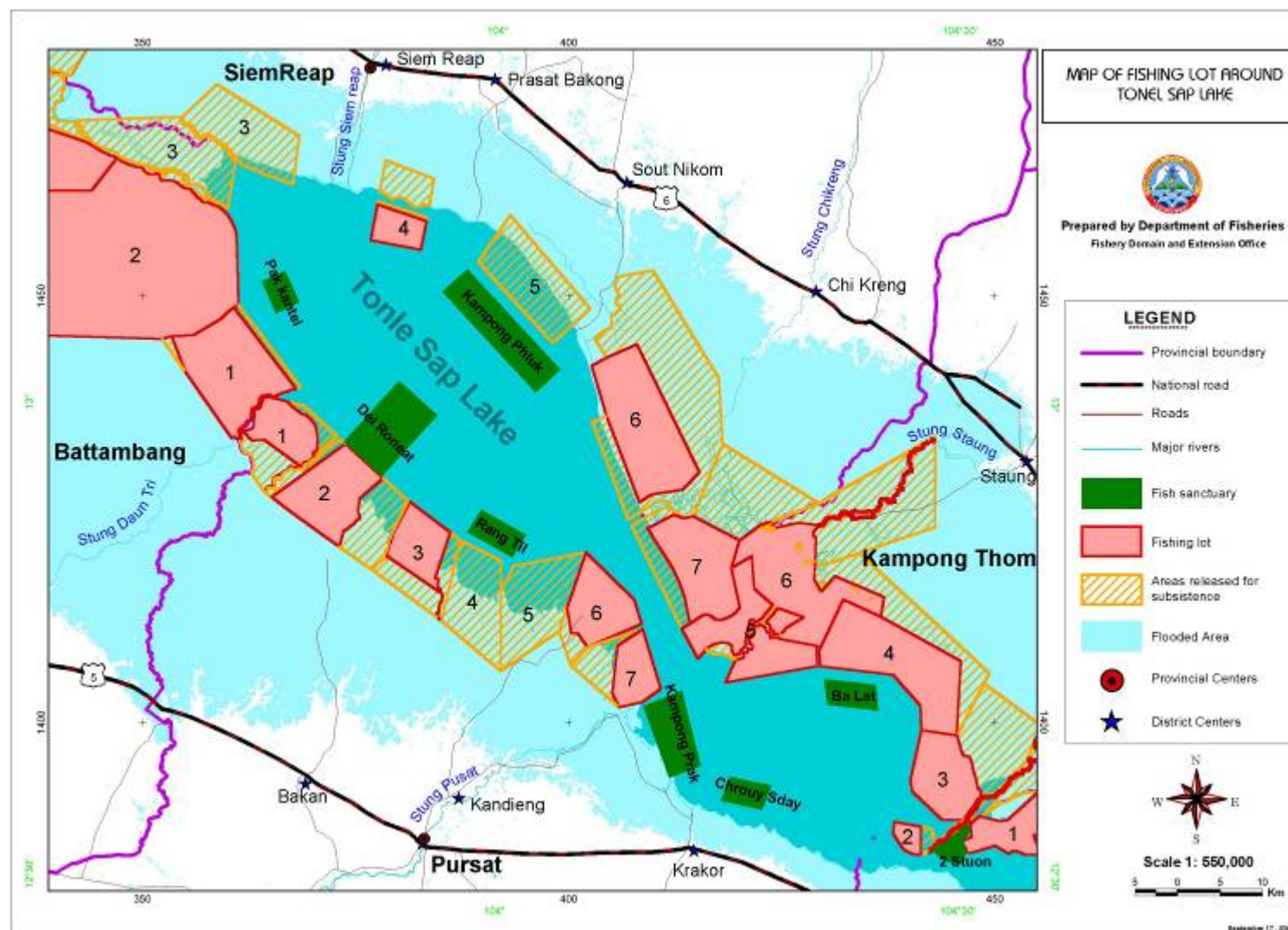
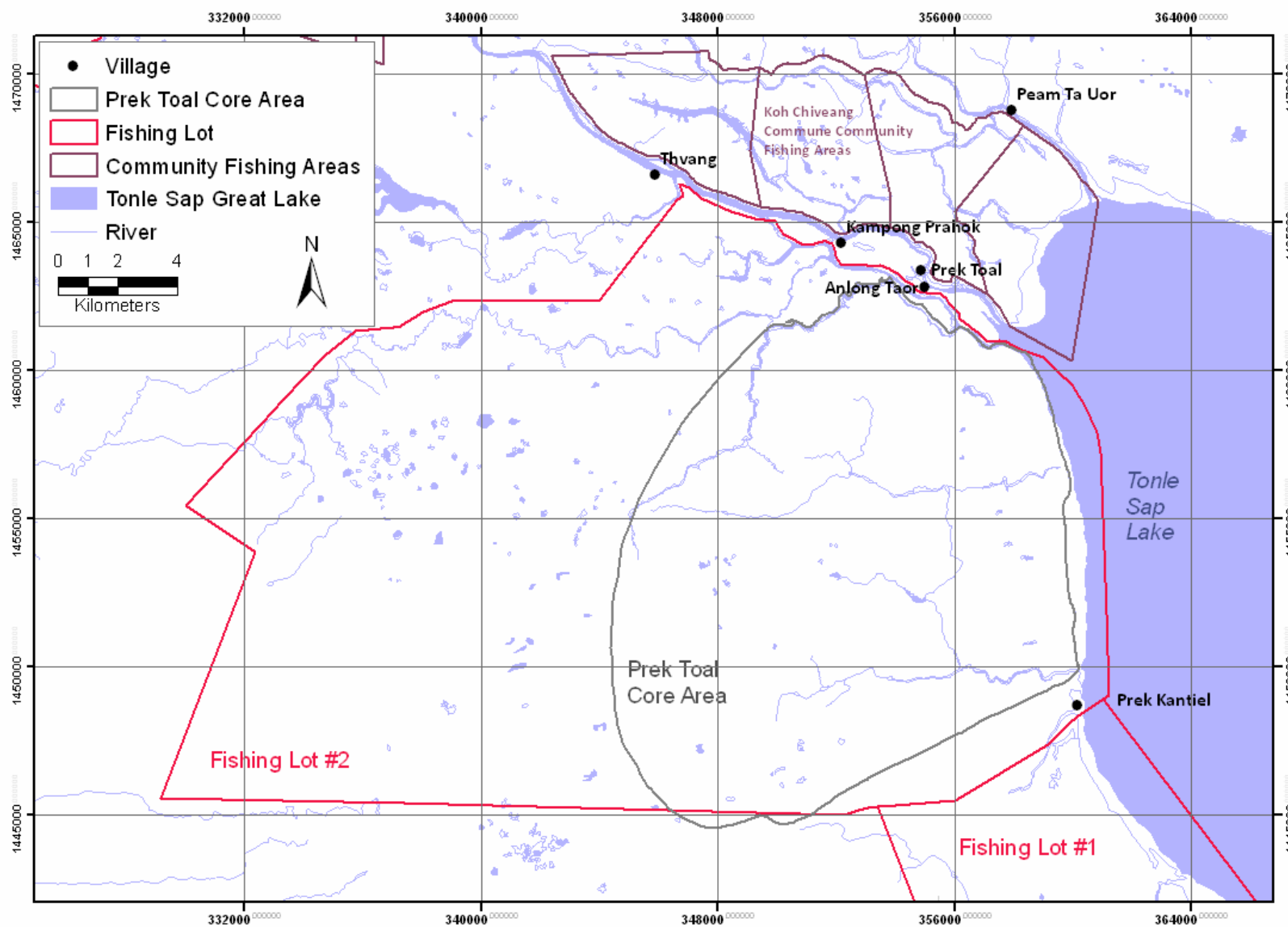


Figure 1.3. Map of Prek Toal and Fishing lot #2



1.6 Project objectives and components

The key objective of this project is: *to propose a new model for integration of commercial, community and conservation objectives in fishing lot 2, which balances the needs of a core area for conservation with maximising long-term sustainable commercial management of fishing lot 2 whilst promoting local distribution of benefits in a manner that is as equitable as possible.*

A series of data were compiled and analysed to ascertain the ecological, commercial and socio-economic values of fishing lot 2 and the Core Area, and this information was then used to develop a proposal for a new management regime (including boundaries, conservation status and fishing techniques) for the area.

One potential solution could involve the creation of a smaller Prek Toal Conservation Area or Fish Sanctuary (hereafter called “Prek Toal Sanctuary”) within the Prek Toal Core Area, within which human activity would be strictly limited to activities sanctioned by Royal Decree (including no commercial fishing). As part of this project we examined this proposal, including identifying the key areas for biodiversity within the PTCA, using this information to suggest tentative boundaries for a potential Prek Toal Sanctuary, and investigating the impacts to commercial and local fishing should this Sanctuary be created.

The project was divided into five research components:

1. Assessment of the ecological and conservation value of the Prek Toal Core Area/fishing lot 2 and proposals for the boundary of the new Prek Toal Sanctuary.

There are a large number of existing data sources on the conservation priorities of the Prek Toal Core Area, including the water bird colonies, water bird feeding areas, and large ponds and lakes used by wild Siamese Crocodiles. These data sources were reviewed and spatial data assessed to improve our understanding of the importance of areas with PTCA for biodiversity conservation, allowing us to propose the boundaries of a potential Prek Toal Sanctuary.

2. Assessment of the value of commercial fisheries within fishing lot 2, and subsequent model of the projected impact of management changes (including the new Prek Toal Sanctuary) on the commercial viability of the fishing lot 2

Gaining an in-depth understanding of the existing fishing lot management structure is essential to develop a realistic proposal for the future management of commercial fisheries, as well as the potential modification in the boundaries of fishing lot 2. At present, the rights to exploit the commercial fisheries within the fishing lots around the Tonle Sap are no longer auctioned, and their status is that of a ‘research’ fishing lot. Fishing lot 2 has been leased by the Government to two lot operators, who then either exploit the lot themselves or lease the rights to all or part of the lot to a third party. The economic value of areas within fishing lot 2, including those areas within the proposed Prek Toal Sanctuary, were assessed in order to ascertain the economic and commercial impact of any changes to the management regime within fishing lot 2.

3. Assessment of the distribution of socio-economic benefits derived from the current management system to local communities and stakeholders. Results used to examine the potential impacts on local communities of proposed management changes.

The extent to which local communities rely on the Prek Toal Core Area within fishing lot 2 is unclear. Communities have access to PTCA during the closed fishing season for traditional fishing but are mostly excluded from the lot when it is in operation. However, some local families do certainly benefit as sub-lessees, lot workers, and from fishing in upland areas (with or without the consent of the lot operator). The lot may have other benefits, such as employment in fish trading and processing services which support the existing system, food security and possible knock-on effects of these on other spheres of livelihood activity. Wider benefits are provided by the environmental and ecological services which the current system supports, such as wood supply, maintenance of water access, support to tourism, etc. These benefits were described and quantified, specifically focusing on local communities and upland villages. The potential changes in these benefits under different management regimes, was then examined, to analyse the expected impact of the proposed management changes on local communities.

4. Investigation of the impact of upstream development on fishing lot 2 and the Prek Toal Core Area.

Future development activities, both within the Tonle Sap and upstream in the Mekong catchment areas, are likely to have a major impact on the fish catches and flooded forest around the lake. One of the most well-known and potentially highly damaging examples concerns predicted changes in the depth of the lake during the dry season. Rising dry season water levels, due to water releases from dams, is expected to cause widespread reduction in the area of flooded forest over the next 10-20 years (as the dams are completed). Here, models from WUP-FIN are updated and scaled to the Prek Toal Core Area and fishing lot 2, in order to assess the long-term sustainability of existing and proposed areas, using the latest available information from these scenarios.

5. Comparison between outcomes under the proposed Prek Toal Sanctuary and alternative management regimes.

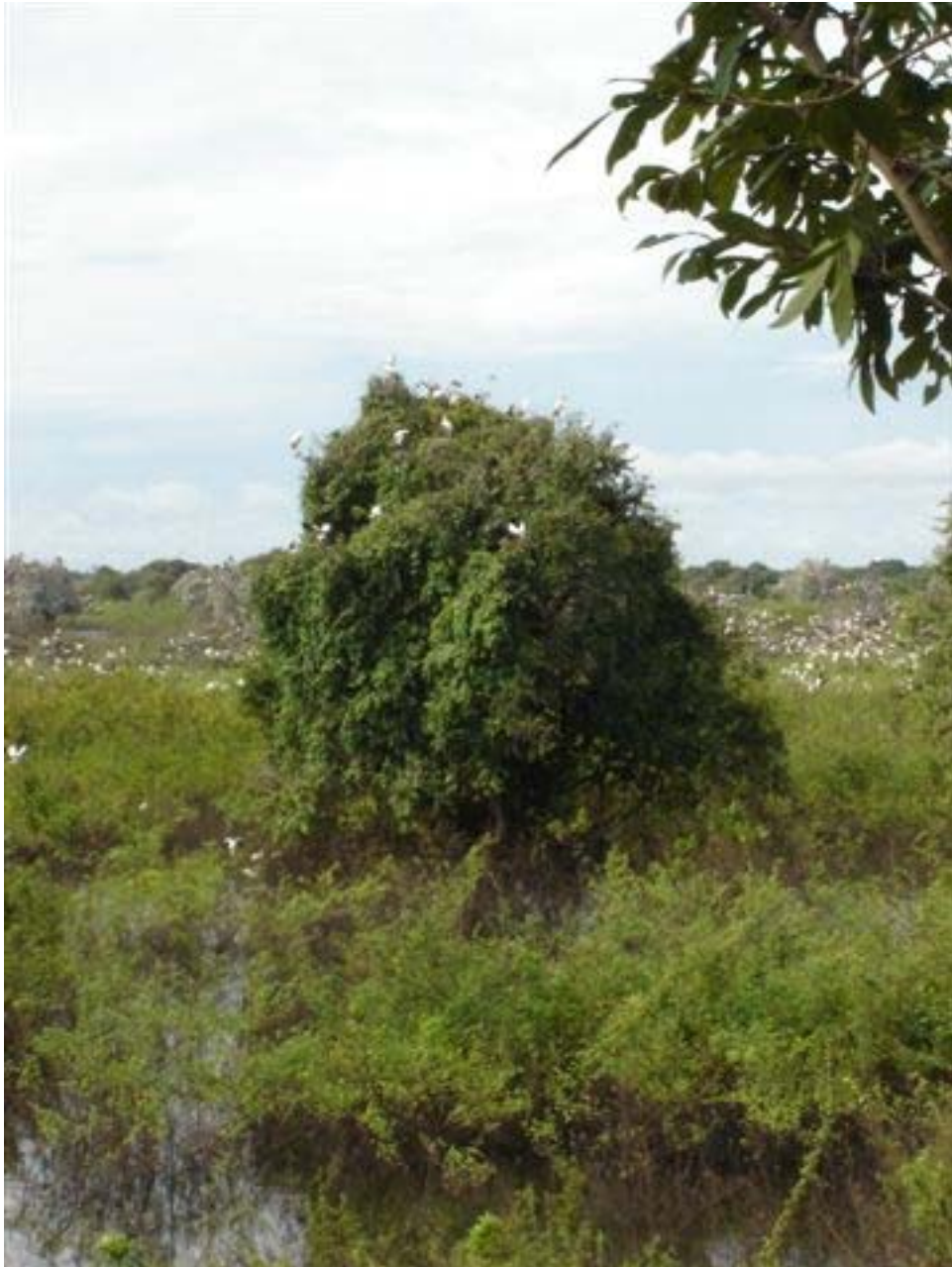
One of the key arguments in favour of the proposed Prek Toal Sanctuary is that it represents an efficient and effective management system, in comparison with the current alternatives – privately run fishing lots and Community Fisheries areas. Under this research component, a comparison of the existing management system to alternative systems, especially Community Fisheries areas, particularly focusing on (1) sustainability and maintenance of the flooded forest/scrub habitat; and (2) extent and distribution of benefits to community members.

2. The ecological and conservation value of the Prek Toal Core Area and Battambang Fishing Lot 2

By Sophie Allebone-Webb¹, Tom Clements¹ & Sun Visal^{1, 2}

¹ Wildlife Conservation Society

² Ministry of Environment



Photograph 2.1. Bird colonies in Prek Toal Core Area
By Sophie Allebone-Webb

2.1 Objectives

Assess the ecological and conservation value of the Prek Toal Core Area/fishing lot 2 and propose boundaries for a new Prek Toal Sanctuary.

There are a large number of existing data sources on the conservation priorities of the Prek Toal Core Area, including the water bird colonies, water bird feeding areas, and large ponds and lakes used by wild Siamese Crocodiles. These data sources were reviewed and updated to improve our understanding of the importance the area for biodiversity conservation. Spatial data were assessed to ascertain the priorities for biodiversity within PTCA and this information was then used to develop a proposal for new boundaries for a Prek Toal Sanctuary that encompasses the spatial requirements of biodiversity, and could be removed from fishing lot 2.

2.2 Introduction

The Tonle Sap Great Lake in central Cambodia is the largest freshwater lake in south-east Asia. In recognition of its outstanding ecological, economic and social value, it was designated a Biosphere Reserve by UNESCO in 2007 and by a Royal Decree of the Cambodian Government in 2001. The Tonle Sap Biosphere Reserve (TSBR) is divided into three management zones; a transition zone, which serves as an area for sustainable agricultural development (899,652 ha), a buffer zone, designated as for sustainable fisheries management (510,768 ha); and three core areas, reserved for biodiversity conservation (70,837 ha in total) - Prek Toal, in Battambang province, and Boeung Chhma and Stung Sen both in Kampong Thom province. The Core Areas are considered to represent unique ecosystems demarcated for long-term protection and conservation (Neou 2001). The Prek Toal Core Area has since been recognised as site of global conservation significance, primarily due to the continued presence of breeding colonies of some of the world's most threatened water bird species. In addition, it is recognised as being an important area for reptiles (including the Siamese crocodile and water snakes), mammals, fish and other birds.

Below we present a review of the biodiversity of the Prek Toal Core Area, based on the available literature and on the results of biodiversity monitoring done by WCS over the last eight years. See Davidson (2006) for a full review.

2.3 Birds

The Prek Toal Core Area is the most important site for biodiversity conservation on the Lake due to the presence of breeding colonies of some of the world's most threatened waterbird species. The Prek Toal bird colonies represent the only remaining breeding site in South-east Asia for two Globally Threatened or Near Threatened species, Spot-billed Pelican *Pelecanus philippensis* and Milky Stork *Mycteria cinerea*. They are also the largest remaining site for six more Globally Threatened or Near-threatened species, namely the Oriental Darter *Anhinga melanogaster*, Lesser Adjutant *Leptoptilus javanicus*, Greater Adjutant *Leptoptilus dubius*, Black-headed Ibis *Threskiornis melanocephalus*, Painted Stork *Mycteria leucocephala* and Grey-headed Fish Eagle *Ichthyophaga ichthyaetus*.

The conservation of the Prek Toal waterbird colonies has been actively managed by the General Department for Administration of Nature Conservation and Protection (GDANCP), within the Ministry of Environment (MoE) of the Royal Government of Cambodia in collaboration with the WCS since 2001. Comprehensive monitoring and protection strategies have been employed to eliminate the previously severe pressure on colonies resulting from egg and chick collection. On-going monitoring activities also allow population estimates to be calculated for each the species of conservation concern and for annual population trends to be detected. Obtaining accurate population estimates allows ongoing evaluation of the success of the protection and management strategies implemented in PTCA and throughout the birds' range.

The water bird colonies and nesting trees are mapped out each breeding season, and birds show a high level of fidelity, returning to areas in the centre of the Prek Toal Core Area each year (Figure 2.4). Population counts of the breeding colonies began in 2001, but initial counts were incomplete. Consequently, in 2003 a comprehensive monitoring program was put in place, aiming to monitor the population size and detect the annual population trends of globally key species. The program has generated large, reliable data sets showing ranger counts of nests from the 2003/4, 2004/5, 2005/6, 2006/7, 2007/8 and 2008/9 breeding seasons, as previously reported (Goes 2005; Clements *et al.* 2007; Sun and Clements 2008; Sun and Allebone-Webb 2009), showing significant increases for four species and stable populations for three species (Figure 2.1, Figure 2.2). See WCS (2007) for details of methods.



Photograph 2.2. Feeding bird aggregations inside PTCA.

By Mr. Rorng.

Figure 2.1. Nest counts for three water bird species, 2004-2009.
Error bars show 95% confidence intervals.

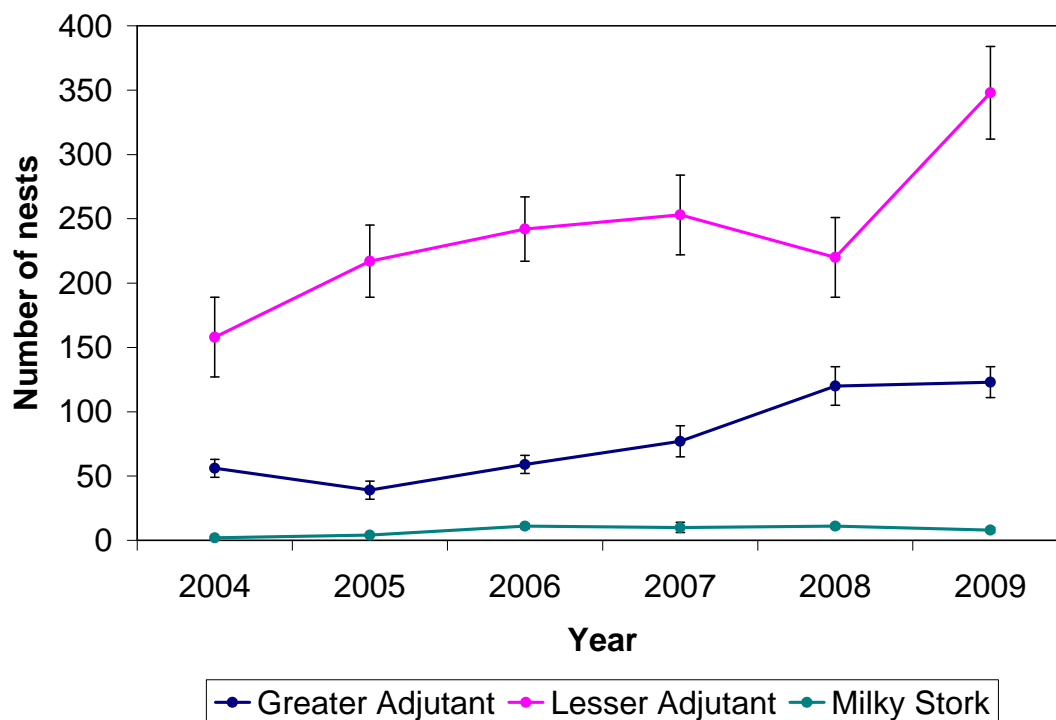
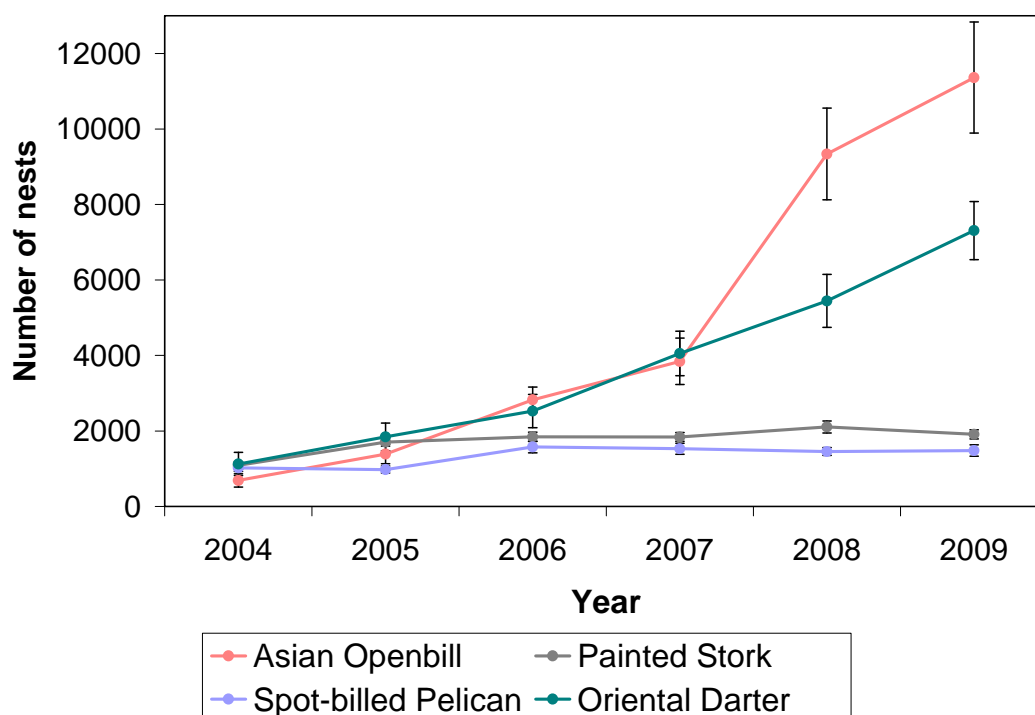


Figure 2.2. Nest counts for four water bird species, 2004-2009.
Error bars show 95% confidence interval.



Prek Toal is an important site for many other globally threatened bird species. It is the only site in South-east Asia where there are confirmed breeding records for the Black-

necked Stork *Ephippiorynchus asiaticus*. In addition, in 2009 there were approximately 58 breeding pairs of Grey-headed Fish Eagle recorded in PTCA, one of the highest known densities for this species, and at least 43 breeding pairs of Black-headed Ibis *Threskiornis melanocephalus* (Sun and Allebone-Webb 2009). In addition, there are confirmed records of the Masked Finfoot *Heliopais personata*, Woolly-necked Stork *Ciconia epicopus*, Black-necked Stork *Ephippiorhynchus asiaticus* and substantial populations of Little Cormorant *Phalacrocorax niger*, Indian Cormorant *P. fuscicollis*, Great Egret *Casmerodius albus* and Asian Openbill *Anastomus oscitans* (Seng *et al.* 2003).



Photograph 2.3. Bird colonies in Prek Toal Core Area.
By Mr. Rorng.

2.4 Reptiles

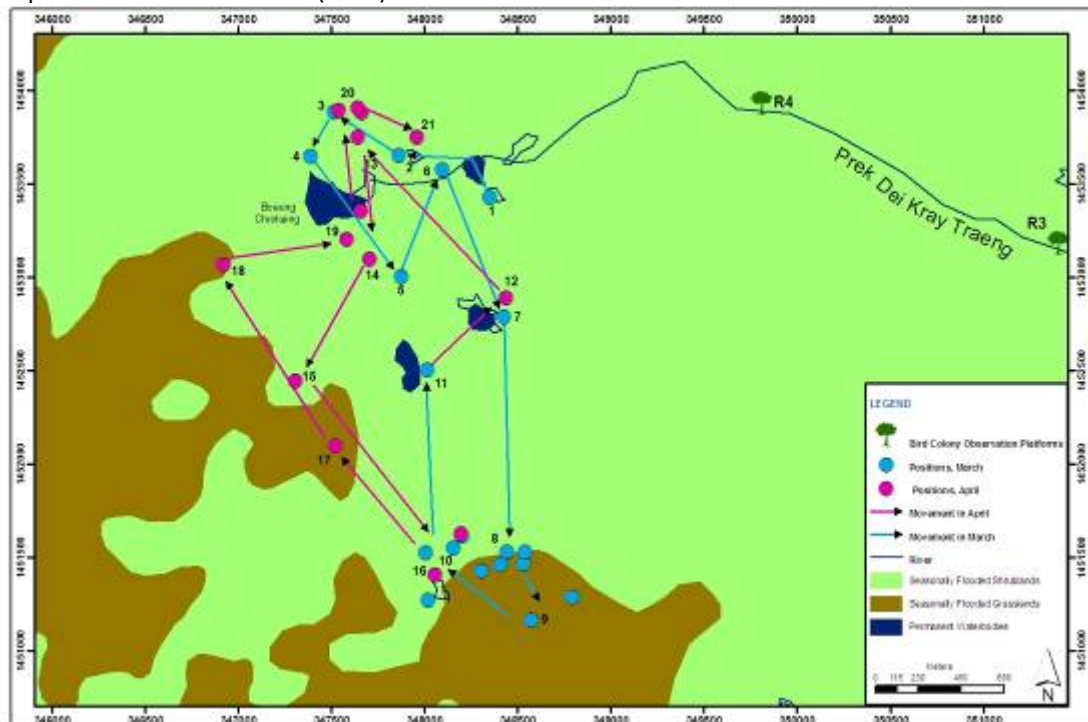
The extensive wetland habitats of the Tonle Sap are believed to support internationally significant populations of at least eight globally threatened reptile species, leading some to consider this area as perhaps the most important wetland area for reptile conservation in South-east Asia (Goes 2005).

The Critically Endangered Siamese Crocodile *Crocodylus siamensis* is thought to persist in the TSBR, including at Prek Toal (Long 2002; Platt *et al.* 2004; Campbell *et al.* 2006b), making this a significant site for the conservation of this species. In 2006, two wild-caught Siamese Crocodiles were released back into the wild in Prek Toal, and tracked to establish habitat preferences throughout the year (Sovannara 2008). Although the signal from one crocodile was lost fairly quickly, the second was tracked for a total of

nine months. It was apparent that the critical factor for crocodile conservation was the availability of suitable dry season habitats. During the dry season, crocodiles are confined to a few forest lakes or rivers containing deep water and fish. Females will often breed near these sites, but it is at these sites where crocodiles are probably most vulnerable to deliberate or incidental capture, making these sites a priority for conservation. The monitored crocodile spent virtually all its time within the Prek Toal Core Area, and the Boeng Chokraing water body was identified as potentially suitable for Siamese Crocodiles, as it attracted one of the released crocodiles for an extended period, and there are reports of wild crocodiles breeding there (Figure 2.3, Figure 2.4).

Figure 2.3 Map of dry season movements of released Siamese crocodile during the dry season (March – April, 2007).

Reproduced from Sovannara (2008).



In addition to the Siamese crocodiles, there are at least six species of freshwater turtle in the Tonle Sap, including the Endangered Yellow-headed Temple Turtle *Hieremys annandalii*. There are also a large number of water snakes, including the Near Threatened Burmese Python *Python molurus* and some of the cobras (*Naja spp.*), although numbers of these are believed to be declining substantially, mainly due to the annual harvest of 6.9 million snakes from the lake (Brooks *et al.* 2007).

2.5 Mammals

There have been no extensive mammal surveys done in Prek Toal, but several globally threatened species are regularly sighted, and are thought to exist in the Tonle Sap in internationally significant numbers. These include Loris species *Nycticebus bengalensis* and *Nycticebus pygmaeus*, Long-tailed macaque *Macaca fascicularis* (fairly common in Prek Toal), Germain's Silver Leaf Monkey *Trachypithecus villosus germaini*, Hairy-nosed Otter *Lutra sumatrana*, Smooth Otter *Lutrogale perspicillata*, Fishing Cat *Prionailurus viverrinus* (Davidson 2006).

2.6 Vegetation

Two main vegetation types have been identified in the Prek Toal flood plain, the swamp or gallery forest, and the short-tree shrub lands. The forest occurs mainly around the dry season lake shore and river banks, and is flooded by 4-6m (up to 8m) water for around 8 months of the year (McDonald *et al.* 1997; Rundel 2000). The short-tree shrub lands are dense, fairly homogenous groups of 2-4m tall trees and scrub, and make up about 80% of the floodplain. A total of 206 species have been identified by the four main studies of the Tonle Sap flora completed to date (Rollet 1972; McDonald *et al.* 1997; Lamberts 2001; Davidson 2004), with an additional 19 unidentified species. This includes a relatively large proportion of which are endemic to the Indochinese region and some of which are unique to the Tonle Sap floodplain.

2.7 The proposed Prek Toal Sanctuary

Both the water bird colonies and the observed crocodile habitats are concentrated in the centre and west of the Prek Toal Core Area, with the birds depending heavily on the five streams leading from the main lake into the flooded forest areas where the colonies are situated, and the crocodiles on a number of dry season ponds (Figure 2.4).

Two potential boundaries for a new Prek Toal Sanctuary have been proposed (Figure 2.5). Both encompass the current extent of the colonies, the observed preferred crocodile habitats and also a number of the key rivers within the core area (Figure 2.5), and are smaller than the current Core Area. The larger of the two proposed Sanctuary boundaries (Proposed Conservation Area 1 on the map) also encompasses some satellite bird colonies. We propose that the area outside the proposed Sanctuary, including the entire lake shore, remain under fishing lot management, thus creating a protective but commercial “buffer” zone around the water bird colonies. Inside the Sanctuary habitat disturbance and human intrusion would be minimised, which will be conducive to increasing both bird and fish populations throughout the Tonle Sap area. The Sanctuary would be a no-use area (except monitored ecotourism), which would preclude commercial fishing and other human activities. Details of the management regime would need to be clarified in conjunction with local stakeholders in order to ensure a robust, fair and sustainable system.

The reduction in the size of the no-use area from the existing Core Area (officially, if not actually, a no-use area), to the proposed Prek Toal Sanctuary should mitigate against any perceived loss of control over fishing grounds from the perspective of the Fisheries Administration. It is also anticipated that as the newly created sanctuary would be effective for both fish as well as wildlife, both the FiA and MoE will provide full support. If consensus can be reached between these two Government agencies this proposed change could constitute a mutually beneficial win-win solution to a longstanding contentious situation.

It is important to note that because of the extreme environmental changes in the lake due to the annual flooding, many species use Prek Toal and the Tonle Sap on a seasonal basis only, both for breeding (e.g. the water bird colonies) or non-breeding feeding aggregations. Consequently, their conservation depends on both the

management of the TSB, and on measures taken in other parts of their annual range. This also means that at any one time, changes occurring in the Tonle Sap may affect species that are not there at that season, but to whom the Tonle Sap represents a critical habitat for some stage of their life cycle. Currently, little is known about the range and migration patterns of some of the most vulnerable species in the TSB.

Figure 2.4. Map showing distribution of bird colonies and crocodile movements
 “BirdTrees” are nesting trees for large water birds

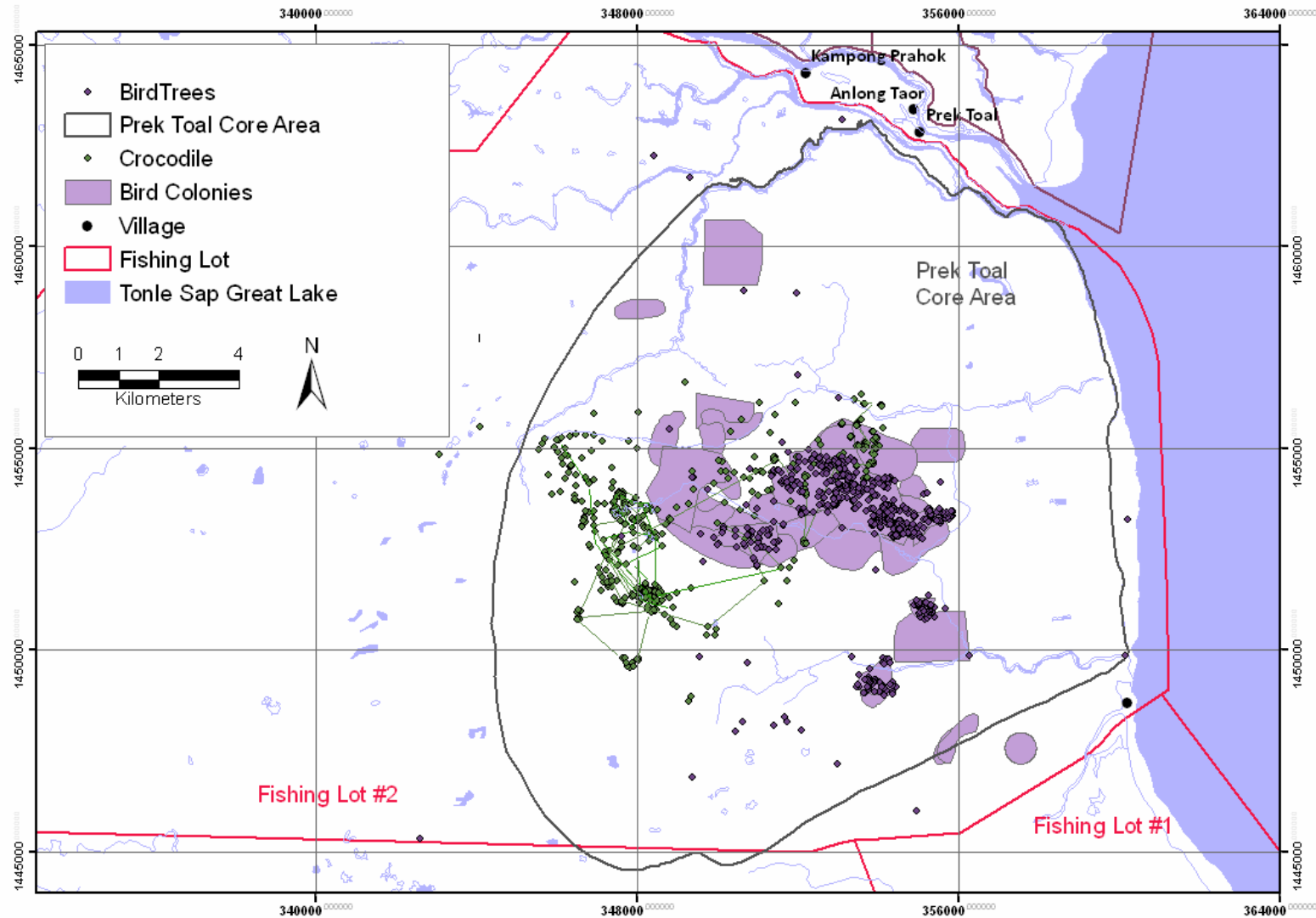
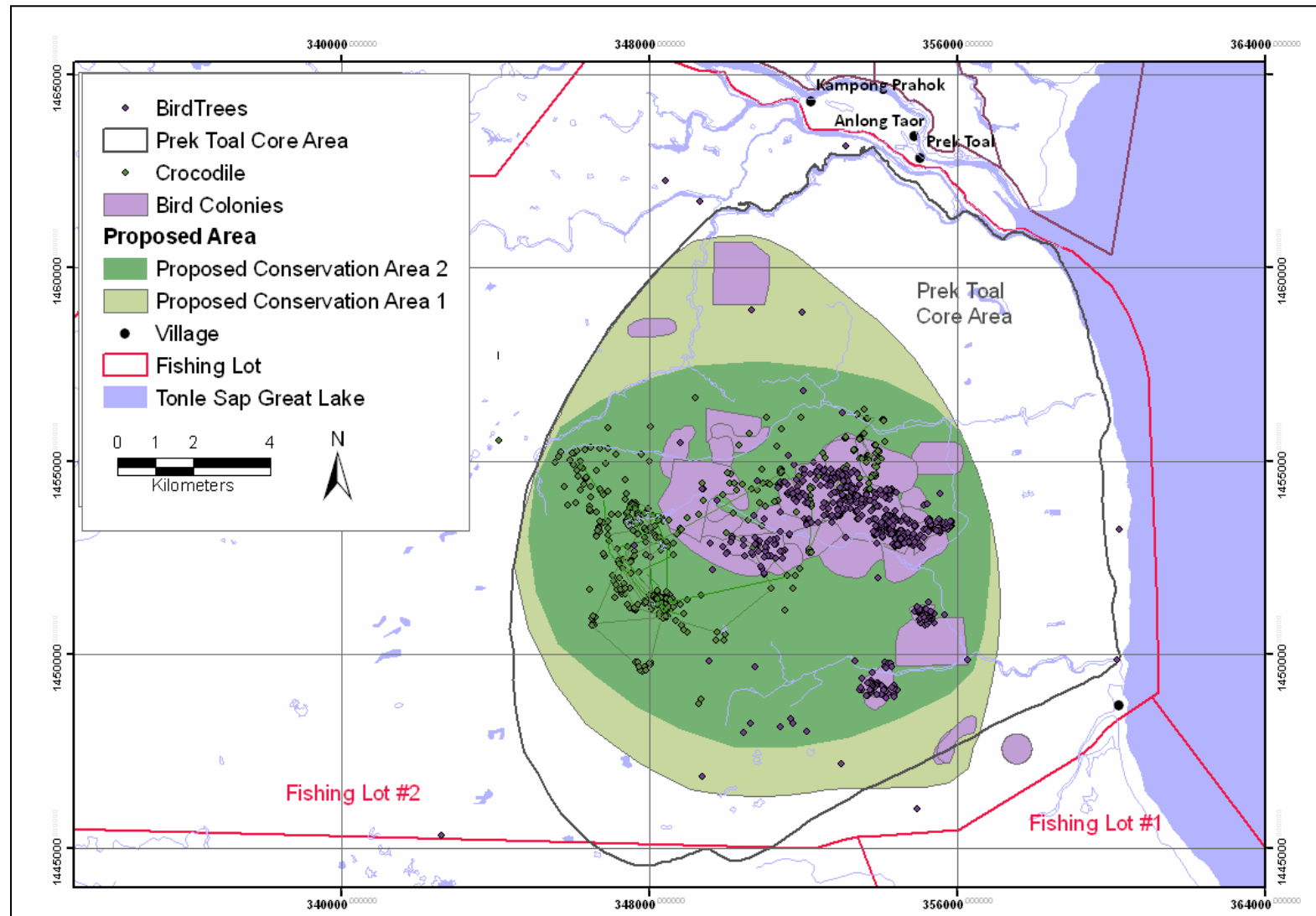


Figure 2.5. Map showing recommended Prek Toal Sanctuary (Proposed Conservation Area 1) in Prek Toal, and a smaller possible Sanctuary boundary (Proposed Conservation Area 2)

"BirdTrees" are nesting trees for large water birds



3. The value of the commercial fisheries

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Photograph 3.1. Part of Lot 2 fence and fence pen.
By Sophie Allebone-Webb

3.1 Objectives

Assess the value of commercial fisheries within Battambang fishing lot No.2, and use this to model the projected impact of management changes (including the new Prek Toal Sanctuary) on the commercial viability of the lot.

Gaining an in-depth understanding of the existing fishing lot management structure is essential to develop a realistic proposal for the future management of commercial fisheries, as well as the potential modification in the boundaries of fishing lot 2. In particular, lot 2 is known to include areas such as rivers and ponds which fall within the proposed new Prek Toal Sanctuary and which have been subleased to others. The economic value of these areas was assessed in order to ascertain the economic and commercial impact of any changes to the management regime within the fishing lot.

3.2 Introduction

3.2.1 Fish productivity and Tonle Sap

The Tonle Sap Lake is believed to be one of the most productive systems in the world (e.g. Lamberts 2001; Lieng and Van Zalinge 2001; Baran 2005), with an estimated annual harvest of 300,000 tons of fish (Bonheur 2001; Van Zalinge *et al.* 2003), and nearly 7 million water snakes (Brooks *et al.* 2007), making it extremely important as a source of food and income. This high productivity is believed to be due to a number of factors, including the annual inundation cycle with its extensive and long-lasting flooding, the floodplain vegetation, including the flooded forests and flooded scrub, and the high rates of nutrient cycling (Lamberts 2001). During the flood, water levels can rise from less than 1m to 6-9.5m, depending on the strength of the monsoon, expanding the area of the lake from 2,500 km² to 12-15,000 km² (Kummu *et al.* 2006), submerging the adjacent riparian forest and scrublands thereby creating ideal conditions to many Mekong fish species for feeding, breeding and rearing their young (Poulsen *et al.* 2002).

On-going research based on *dai* fishery landings has shown that there is high annual variation in fish harvest, which is largely related to flooding levels (Halls *et al.* 2008). However, recently concerns have been raised that since the release of many of the fishing lots to Community Fisheries in 2000, fish catches first increased and are now decreasing, possibly due (in part) to changes in fisheries management (DoF 2006). However, it is difficult to disentangle individual reports of reductions in fish catch with increased numbers of fishers and changes in fishing gear.

Battambang fishing lot 2 is thought to be one of the most productive lots in the Tonle Sap, but accurately assessing the total value of fish catch is difficult. A previous study of fish catch in 1995-2000 relied on data provided to the FiA by the lot operators, and estimated an average annual harvest of 1,700 tons of black fish in fishing lot 2, peaking at nearly 2,200 tons in 1998/99 (Table 3.1).

Table 3.1. Black fish catch and its value in lot #2 (doesn't include white fish species).
Reproduced with permission from (Troeung 2001)

Season	Forest coverage (ha)		Total ha	Total fish catch (Kg)	Total value (1000 riel)	Catch/ha (kg)	Value/ha (1000 riel)
	Old forest	Young forest					
1994–1995	36,212	10,670	46,882	1,181,643	1,091,622	25.2	23.28
1995–1996	36,212	10,670	46,882	1,241,881	1,500,692	26.49	32.01
1996–1997	36,212	10,670	46,882	2,095,860	2,107,612	44.71	44.96
1997–1998	36,142	10,670	46,812	1,738,510	2,319,400	37.14	49.55
1998–1999	36,142	10,670	46,812	2,190,827	3,318,720	46.8	70.89
1999–2000	36,142	10,670	46,812	1,879,000	1,927,810	40.14	41.18
Average catch and value per year per hectare				1,721,287	2,044,309 (\$524,182)	36.75	43.65 (\$11)

3.3 Methods

3.3.1 Describing the Fishing Operation in Lot 2

An initial assessment of the fishing lot 2 commercial fishing operation was completed in June 2008 by Nicolaas Van Zalinge through interviews with key stakeholders, including Mr. Chea Phal (the current lot operator), his family members, the sub-leaseholders and other personnel working at lot 2. In addition, a number of key documents provided useful overviews of the fishing practices or fishing gears in the Tonle Sap, namely: Goes (2005), Deap (2003), Poole (2005). Other relevant information concerning lot management is found in the Law on Fisheries (2006) and the “Burden Book 2007-08” specific to fishing lot 2, which is updated every other year. For a full version of the preliminary report (Troeung and van Zalinge 2008), and the Law on Fisheries (2006), see accompanying documents.

In addition to the key informant interviews described above, group discussions were held in each of the five floating villages adjacent to fishing lot 2, namely Prek Toal, Anglong Taor, Kampong Prahok, Thvang, and Prek Kantiel. Group exercises were held to complete seasonal calendars, natural resource use maps, and discussions about the lot management. See Chapters 4 and 6 for more details.

3.3.2 Measuring Fish Catch

Based on the details of the lot operation provided by the initial exercises, the following commercial fisheries activities were sampled in lot 2:

- Fixed gear: *bors* and arrow-shaped fence traps inside the lot: July - January.
- Traditional mobile fishing gear used during closed season by local people: June - September.
- Fishing lot fence wall locks: October – January.
- Pens in the Fishing lot fence wall and Bors along the lakeshore: January - May.
- Barrages across the streams. January - May. Fish from Lake Boeng Norea, Prek Spot and Prek Damcheu are kept in pens and transported out in August as water levels rise.
- Upland Lakes: March - May.

Sampling was conducted in the 2008-09 season in both the open and closed seasons. The **open season** is from October to June, when the lot is open to commercial fishing (and therefore effectively closed to traditional fishing). The **closed season** is when the lot is closed to commercial fishing, but traditional fishing gears are allowed (effectively open to local fishers). The new cycle of fishing activities starts during the closed season, when the water rises again in June. The sampling program started in July 2008 and was continued until the end of July 2009. Timelines for sampling the different fishing gears in lot 2 are given in Table 3.2.

Table 3.2. Timeline for sampling fish catch from different fishing gears

Gear type	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Season	Closed season			Open season									
Bors & arrow-s.													
Mobile gears													
Locks at fence													
Pens & Bors													
Barrages													
Upland lakes													
Fish landings in Siem Reap													
Fish landings in Battambang													

3.3.2.1 Closed season (July – September)

During the closed fishing season, fixed gears such as arrow-shaped traps and *bors* were counted and fish catch recorded from a random sample chosen each week. For mobile gears, a count was made once a week, and the fish catch from a sample (roughly 10%) of that gear was recorded. For each fish catch, the weight of the fish was recorded, as well as fish species or species group, from which part of the lot the captured fish originated, what fishing gear was used, what price it was sold for, who it was sold to, and the GPS position of the fishing gear. Although the catch was usually sorted into species groups, where possible a more detailed species composition was taken. Data were collected by a team of 6-8 trained data collectors from Prek Toal, overseen by a team leader. Total fish catch was estimated by calculating the average catch per gear type, and multiplying by the gear count for that week.

3.3.2.2 Open season (October – June)

Between October and January, fish catch from fixed gear operating inside the lot before the outer fence pen was erected were sampled as for the closed season. The total number of fixed gear were counted, and fish catch measured for approximately 10% of gear each week.

From January to June, the barrages and fence pens were operational and producing fish in large quantities. Consequently, the complete fish catch from these gears was recorded (rather than a sample) as far as possible. Five teams of two data collectors

were stationed around fishing lot 2, each team covering a maximum of three pens or barrages.

Data collectors remained at the fishing gear, and whenever fish was harvested (visible from afar by the arrival of a fish trader's boat), data collectors would observe the harvest, and record the amount, species, price and destination of the fish catch. Where fish was weighed by the fish trader for sale, data collectors directly observed the scales, and recorded the weight accordingly. Where fish was taken to the port directly by the lease-holder (and so not weighed on the boat), the catch weight was estimated by weighing one scoop of fish, and then counting the subsequent number of scoops of fish. This was then checked against the records of fish weights at the fish landing sites at the ports. Under these circumstances, fish was usually divided by type (or similar prices) but not necessarily by species, as fishers would separate out the more valuable fish. In addition, data collectors counted the number of fixed gear along the lake shore (inside the lot fence), and recorded fish catches from a 10% sample. Each data collector team had one boat, so could travel between pens, and usually slept on the fishers platforms, in order to record fish catch sold to traders during the night.

3.3.2.3 Upland fishing

Fish catch from the watershed lakes from Prek Stung Chas, Prek Da, Prek Angkrong, Prek Spot, and Prek Damcheu were recorded where possible by data collectors working at the barrages of the rivers (e.g. when fish was transported up the river, passed the barrage), and data collected at Battambang and Chong Kneas ports used to verify any missed fish catch. In addition, two surveys of 7-10 days were completed between March – May 2009 to record data on the uplands ponds (both commercial, and public access ponds). Two experienced data collectors travelled on foot, motorbike and/or boat between different ponds in the uplands areas collecting data on the name, size, fishing activity and human presence of each pond, access routes, and the size of settlements, origin of people, price of fishing leases, and quantities of fish at all ponds come across.

3.3.2.4 Socio-economic information

Additional information was also collected from fishers for all fish catch, including the number of people working on the gear, what village they came from, what wage they were paid (if labourers) and what price they paid for their licence (if any).

3.3.2.5 Data collection at fish landing sites, Chong Kneas and Battambang

One FiA staff member from the Siem Reap office recorded all fish catch arriving at the Chong Kneas port from fishing lot 2 between August 2008 – June 2009. The data collector observed the weighing of the fish catches, and recorded the quantities, origin, price and destination of all fish coming from fishing lot 2. These data were then checked against the data collected inside the lot to check for discrepancies.

Similarly, a second FiA staff member collected the same data on fish arriving from lot 2 at the Battambang fish landing site between February – June 2009. As in Chong Kneas, the weight, species, origin, price and destination was recorded and checked against

the fishing lot 2 records. This also allowed data to be collected from the upland areas that may otherwise have been missed.

Total fish catches were estimated by adding all fish catch recorded from all open season fishing gear. Any discrepancies between data collected in fishing lot 2, and that recorded in Chong Kneas and Battambang ports was investigated and the most accurate figure taken. All data entry and manipulation was done in MS Access and MS Excel.

To assess the extent of fish catch and value falling within the current Prek Toal Core Area, and the proposed Prek Toal Sanctuary, the locations of all fishing gear were imported into ArcGIS, where location data were available. For each gear item, it was recorded whether they overlapped with the current Core Area and proposed Sanctuary. The catch and value of gear within and outside of each area was then calculated to give the proportions expected from each.

3.4 Results

3.4.1 The Lot Operators/Leaseholders

Since 1996 fishing lot 2 in Battambang has been classified as a 'research and development' lot. This means that the normal auction process is by-passed and the government selects the person(s) to whom it wants to lease the lot for a nominal tax of about US\$147,818 (R613 million), according to the Burden Book. This is paid in instalments over 2 years, with the final price depending on the precise type and duration of fish exploitation (see Burden Book for Stream/Lake Fishing Lot #2, auctions for exploitation years 2007-2008 and 2008-2009 (FiA 2008)). These leaseholders (called 'lot operators' throughout this document, but often called 'lot owners' elsewhere) can then fish the area themselves, or sub-lease out smaller sections to other fishers. From 1996 to the 2008/09 season, the lot has had two leaseholders: Mr. Chea Phal (72 years of age, lives in Siem Reap) and Mr. Nai Kimson (56, lives in Battambang and runs the Golden Fish processing and export company). Their leases ended in June 2009, after which it will be renewed for 5 years to Mr. Nai Kimson.

The two leaseholders divide the lot into 12 subleases – 7 streams and 5 pens. Nai Kimson leases the seven streams of the lot, but does not involve himself with the management of the lot. Chea Phal, who is a master fisherman who has fished his whole life, leases the lakeside of the lot with the outer fence and its five pens, which he operates himself, as well as three streams (Prek Da, Prek Damcheu and Boeng Norea) which he sub-leases from Nai Kimson. The relatives of Phal Chea manage most of his subleased assets. Each of the stream subleases has upland areas that are sub-sub-leased to yet other persons, who may again sub-sub-lease parts.

The main sub-leaseholders market quality fish, such as snakeheads (Trey Roh & Diep, see Appendix 1 for fish species) through the business of Chea Phal's daughter Mrs. Chea Pouv and her adopted mother Mrs. Mao Vun in Siem Reap. Trey Kampleanh (Gourami) and most Cyprinids are sold for Prahoc-making directly to buyers mostly

from Prek Toal, but sometimes even as far away as from Vietnam. Sub-sub-leaseholders of the 'upland' areas bring out their fish catch mostly through a track leading through Tapon commune and onward to Battambang.

A radiotelephone system is operated to communicate and keep Chea Phal and others informed of catch size, sales, etc. Chea Phal has about 15 armed men with boats patrolling the streams. Each entrance to the lot is guarded and a resident armed soldier protects each outer fence pen. The protection of these upland lakes and pools is the responsibility of the respective sub-sub-leaseholders.

In addition to the sub-leased assets, fishing lot 2 is used for medium and small-scale fishing by local communities during the closed season (July-September), and part of the upland area is used as an informal community fishery area during the open season. Arrow-shaped bamboo fence traps (*lo-op nor raev*) and *bors* are also operated within the lot both during the closed and open seasons.

Table 3.3. Fishing gear in Lot 2.
See Deap et al (2003) for further descriptions.

Gear type	Khmer name	English description
Fixed gear	<i>Bors</i>	Enclosure net with lead fence
	<i>Noral</i>	Enclosure net with lead fence (larger than bor)
	<i>Lo-op nor raev</i>	Arrow-shaped trap
	<i>Chhnouk</i>	Giant lift net or crane net
Mobile gears	<i>Chuch</i>	Tubular trap (Sock trap)
	<i>Duos Antung</i>	Encircling net for eel
	<i>Lo-op Preang</i>	Horizontal cylinder trap for snakehead with small bamboo fence
	<i>Lo-op Loung</i>	Horizontal cylinder trap for snakehead without bamboo fence
	<i>Lowan</i>	Bamboo tube trap for eel
	<i>Keo Chhlos</i>	Spears with illuminating lamp
	<i>Morng</i>	Gillnet
	<i>Morng Proyung</i>	Sense net (40m to 70m)
	<i>Santoi Reay</i>	Hook long line
	<i>Tom</i>	Eel trap
Fences, Pens, Barrages & lakes	<i>Soung</i>	Fence pen
		Barrage or bamboo fence
	<i>Morng Oh</i>	Drag net
	<i>Buom teuk</i>	Pumping
	<i>Chock trey</i>	Electro-fishing
Other resource collection	<i>Chap Andeuk</i>	Catch turtle by hand
	<i>Kap Oh</i>	Cut firewood

3.4.2 Law enforcement in Fishing Lot 2 and Community Fisheries

During the open season, law enforcement in fishing lot 2 is predominantly done by the lot operator's staff, many of whom are police or military officials employed by the lot. In addition, MoE rangers patrol the Prek Toal Core Area, and enforce no-hunting laws,

as well as reducing disturbance to nesting bird colonies. However, MoE rangers have little power to control for illegal fishing activities. During the closed season, fishing lot 2 is patrolled by the lot operators' staff in conjunction with the FiA inspectors and local police and military.

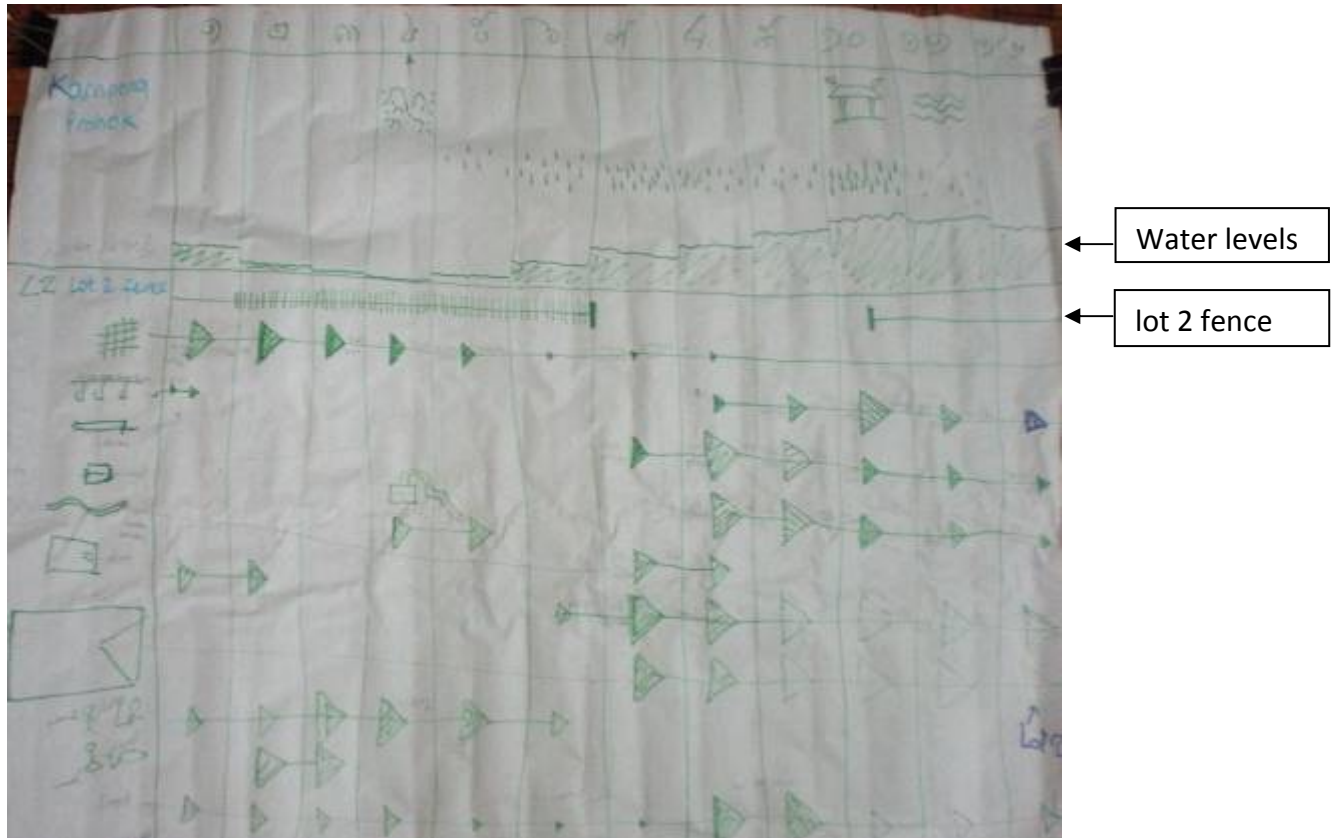
Law enforcement in the Community Fisheries areas for the Prek Toal, Anglong Taor, Kampong Prahok and Thvang villages is conducted by the Community Fisheries Committee, in conjunction with FiA inspectors and local police and military officials.

3.4.3 The Calendar of Lot Operations

3.4.3.1 July – September (closed season)

The closed season for fishing by the lot operators runs from 1st June to 31st October according to the Burden Book law (except for *Dai* lot fishing), although Chea Phal is allowed to guard the lot as of 1st October. The Burden book contradicts the Law on Fisheries, which states that the closed season is from 1st June – 1st October. During the rest of the year the lot operators are free to operate fishing gears in the lot, under conditions stipulated in the Law on Fisheries and Burden Book. However, in the closed season the lot area is open to exploitation by family fishers from Prek Toal and other villages. In practice, villagers reported that they had little or no access to the lot from mid October to the end of June (e.g. seasonal calendar from Kampong Prahok, Photograph 3.2).

Water levels start rising slowly in June. The MoE rangers' report for August 2007 mentions that 12 arrow-shaped bamboo fence traps (*lo-op nor raev*) and 148 *bors* were operating in the Core Area of the lot, with one *lo-op nor raev* found to be seven kilometers long. In addition, mobile gears, such as gillnets, castnets, hooked lines, spotlight and spear and other gears are used in the lot (see Table 3.3 for list of fishing gear). At this time, fish catch caught in Lake Boeng Norea in the previous season (April-May) can be transported to market taken out by Chea Phal's men, as water levels are again sufficiently high to allow boat access. The same happens in Prek Spot and Prek Damcheu.



Photograph 3.2. Seasonal calendar from Kampong Prahok.

Note lot 2 fence drawn, showing access to lot 2 during the closed season from the beginning of July to mid-October.

3.4.3.2 October – January (open season, high water)

In October water levels usually reach their peak, and in the following months the water starts to recede slowly. By January, water levels are sufficiently low to erect the long outer fence and the barrages. Hence these months are used to assemble the materials. Chea Phal still uses a lot of bamboo, but this is becoming scarce and prices are going up. Where possible it is replaced by nylon netting, e.g. in the construction of *bors*. Netting has the advantage of lasting up to five years, whereas bamboo is usable only for two seasons and is very time-consuming to construct. For these preparations between 100-150 people are employed, some from the nearby villages, others from upland villages.

Chea Phal allows a number of the arrow-shaped traps and *bors* that were operating in the previous months (closed season), to continue, usually for a fee. In addition, he erects a fence between lot 1 and lot 2 and places a number of locks (large fish traps) in this fence. Family fishing gear is no longer allowed for a fee (*dong*) - the '*dong*' system stopped three years ago, continuing only for harvesting snakes and for residents of Prek Kantiel (who have no Community Fisheries area).

3.4.3.3 January – March (Open season, receding water)

On an auspicious day, usually after mid-January and determined by the water level and the weather, the outer fences (36 km long x 3 m tall) are placed around 1 km away from the shore, into the lake. The fence stretches from Koh Chinuk (10 km long) along

the edge of the Great Lake (20 km long) and up Prek Kantiel (6 km long), taking around 10 days to complete. As water levels decrease, the fence channels fish migrating out of the flooded forest to the deeper waters of the lake into five capture pens, which are placed at regular intervals along the lake shore fence. In around February, when the water levels have fallen enough to uncover the top of the riverbank, barrages are usually put in place across the streams (*preks*) of the lot (Table 3.6). These structures are dismantled at the end of June at the end of the fishing season. Snakehead species are the most important component of the catch. Chea Phal and his family operate three of the pens, and sub-lease the other two (Table 3.4). The catch from all five pens is marketed by Chea Phal's daughter in Siem Reap.

A section of the lakeshore belongs to each pen, in which a 51 *bors* were set up perpendicular to the lake shore in 2008, in between the lake shore and the fence (Table 3.5, Figure 3.8). *Bors* operate from mid January till April, when water levels have become too low to reach them, and are usually sub-leased to family members, or to local villagers under the condition that 60% of the *Kamplanh* (small white fish) catch value goes to the pen leaseholder and 40% to the sub-sub-leaseholder. In addition, the pen leaseholder gets the accidental catch of snakehead and other valuable species. There are also at least 40 *bor* traps attached to the outer fence at the side that is open to the lake. Although the operators of these *bors* pay a connecting fee, they catch fish from the lake and not from the lot. Hence they are not considered part of this study.

In the watershed of each of the streams in the lot there are a number of lakes and pools that become apparent in the dry season. They serve as refuges for the non-migratory fish species such as snakeheads. The practice of subleasing these lakes and pools is usually well-established, with the sub-leaseholder of a stream having the right to sell them off. Only in the case of the Stung Chas lakes does the principal leaseholder (Nai Kimson) sell the total package of upland fishing rights for one year directly to someone from a neighboring village, who in turn sells each lake separately to people from neighboring villages or farther upland, who will actually fish them out.

In addition, in the southwest of the lot there are areas with small lakes outside the watersheds of these streams that are free for upland people to fish provided they use family fishing gear. If they use a *bor*, they have to pay a fee to Chea Phal. Guards of Chea Phal keep an eye on this area.

3.4.3.4 April – June (Open season, low water)

In April water levels are lowest and much of the lot is dry. In order to capture the fish (mostly snakeheads) remaining in the streams and the upland lakes and ponds, operations called 'dragging' are carried out. This happens mostly just before and around Khmer New Year (mid April), as demand for fish is high. To make the dragging more effective, the water level in some of the streams is lowered by letting water out (usually by pumping), aiming to lower the water level until a depth of about 1 m. Snakehead fish are able to survive in oxygen-poor water conditions, so consequently, after dragging, the remaining water and mud is usually electrocuted to harvest any surviving snakehead.



Photograph 3.3. Pumping in Lot 2, pond.



Photograph 3.4. Pumping in Lot 2, river

Table 3.4. Outer fence pens, 2008

Map Station Number	Name	Type	UTM Position	Habitat	Leaseholder
022	Damcheu	Pen on outer fence	0361728 1450226	Open lake	Chea Phal
023	Koh Krong	Pen on outer fence	0361550 1452804	Open lake	Chea Phal family
024	Koptcheh	Pen on outer fence	0361483 1455205	Open lake	Commune chief of Prek Toal
025	Spot	Pen on outer fence	0360958 1457440	Open lake	Son of Chea Phal
026	Saray	Pen on outer fence	0360300 1459659	Open lake	Community fisheries PT

Table 3.5. Lakeside bors in Lot 2, 2008

See Figure 3.8 for map.

Map Station number	Type & number	UTM Position	Habitat	Associated Pen
Sangke river mouth				
009	Bor 1	0358553 1460453	Lakeside with reeds	Sayray
	Bor 2 - 7		"	Sayray
010	Bor 8	0359240 1458891	"	
	Bor 9		"	
011	Bor 10	0359445 1458466	"	
	Bor 11 - 12		"	
012	Bor 13	0359633 1457898	"	
	Bor 14 - 15		"	
014	Bor 16	0360001 1456823	"	
Entrance to Prek Spot				
	Bor 17 - 19		"	
015	Bor 20	0360202 1455260	"	
	Bor 21 - 29		"	
016	Bor 30	0360474 1452067	"	
	Bor 31 - 32		"	
017	Bor 33	0360480 1451226	"	Damcheu
	Bor 34 - 38		"	Damcheu
018	Bor 39	0360292 1450004	"	Damcheu
Entrance to Prek Damcheu				
020	Bor 40	0360297 1449836	"	Damcheu
	Bor 41 - 47		"	Damcheu
021	Bor 48	0360357 1448885	"	Damcheu
	Bor 49 - 51		"	Damcheu
Village of Prek Kanteel				

Table 3.6. Lot 2 barrages, 2008

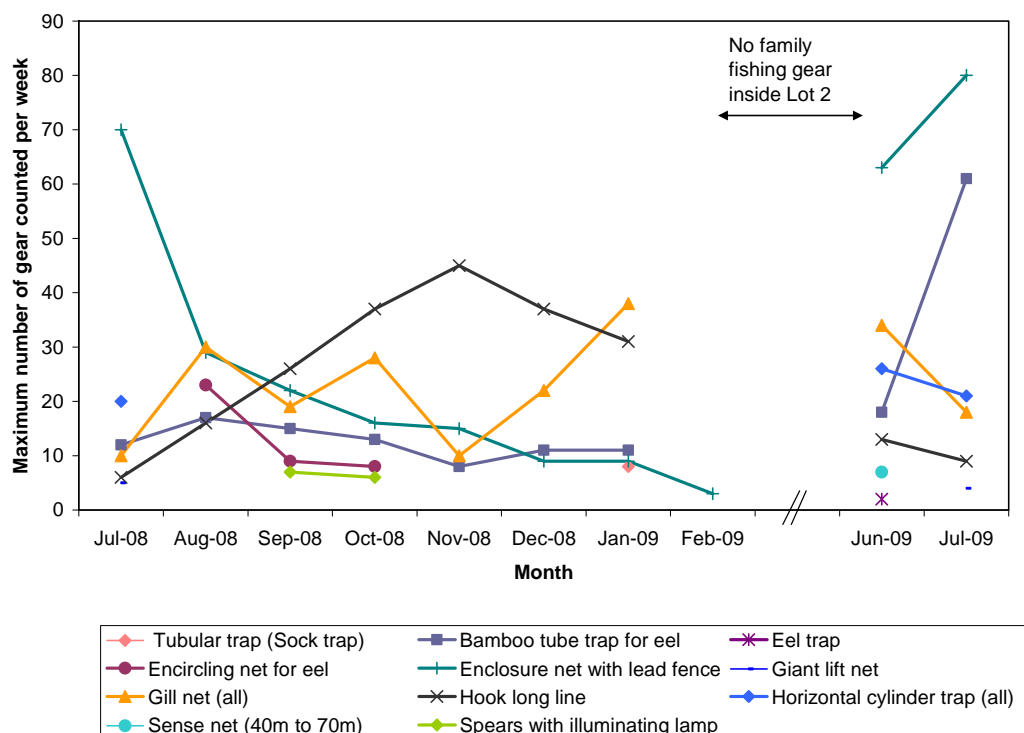
See figure 3.8 for map.

Map Station No.	Stream Name	Type	UTM Position	Sub-leaseholder	Operating period
002	Prek Da	Barrage with pen	0355132 1463778	Chea Phal	Mid Jan – end April
027 & 028	Prek Krolokda	2 Barrages	0354878 1462432 0353967 1463077	Chea Phal	April
003	Stung Chas	Barrage with pen	0351876 1463733	Sub-leaseholder	Mid Jan – end April
004	Prek Angkrong	Barrage with pen	0350696 1464193	Sub-leaseholder	Mid Jan – end April
005 & 008	Prek Long Ong 1 & 2	2 Barrages with pen	0349909 1464932 0358564 1460506	Sub-leaseholder	Mid Jan – end April
006 & 029	Prek Mus	1Barrage with pen & 1 without	0356110 1461381 0353871 1462891	Sub-leaseholder	Mid Feb – end April
007	Boeng Norea lake	Barrage no pen	0357151 1460742	Chea Phal	Operational in April
013	Prek Spot	Barrage with pen	0358492 1456473	Sub-leaseholder	Mid Jan – end April
019	Prek Damcheu	Barrage with pen	0358984 1449804	Chea Phal	Mid Feb – end April

3.4.4 Fishing effort, 2008/09

As in 2008, five pens and seven barrages were in operation for the 2009 open season fishing. In addition, between June and January (when there is no lot fence), large numbers of mobile and fixed gear were counted weekly, with particularly high levels counted in June and July of both 2008 and 2009 (Figure 3.1).

Figure 3.1. Monthly fishing effort for family and medium mobile and fixed gear inside lot 2. Chart shows maximum weekly counts for that month. See Figure A 2.1 for weekly totals.



3.4.5 Fish catch, 2008/09

3.4.5.1 Fixed gear

Fixed gear in lot 2 were predominantly *bors*, but also included catch from around five crane nets in July 2008 and 2009. A total of 2166 *bors* and 22 crane nets (*chhnouk*) were counted, with a maximum of 160 *bors* counted in any one week. Of these, fish catch from 680 *bors* and 9 crane nets was recorded, giving a total of 272.5 tons measured. This gave an estimated annual catch of 1715.8 tons caught between August 2008 and July 2009, with a value of US\$1,159,198 for the same period (or an estimated 1858 tons at a value of \$1,164,800 for the full study period, July 2008 – July 2009). See Figure 3.2, below, for details.

Fixed gear was mainly located along the lake shore and river edge, with some *bors* also recorded inside lot 2 during the high water levels (mainly August – December), see Figure 3.3, below, for details.

Figure 3.2. Monthly fish catch and value from fixed gear in lot 2.

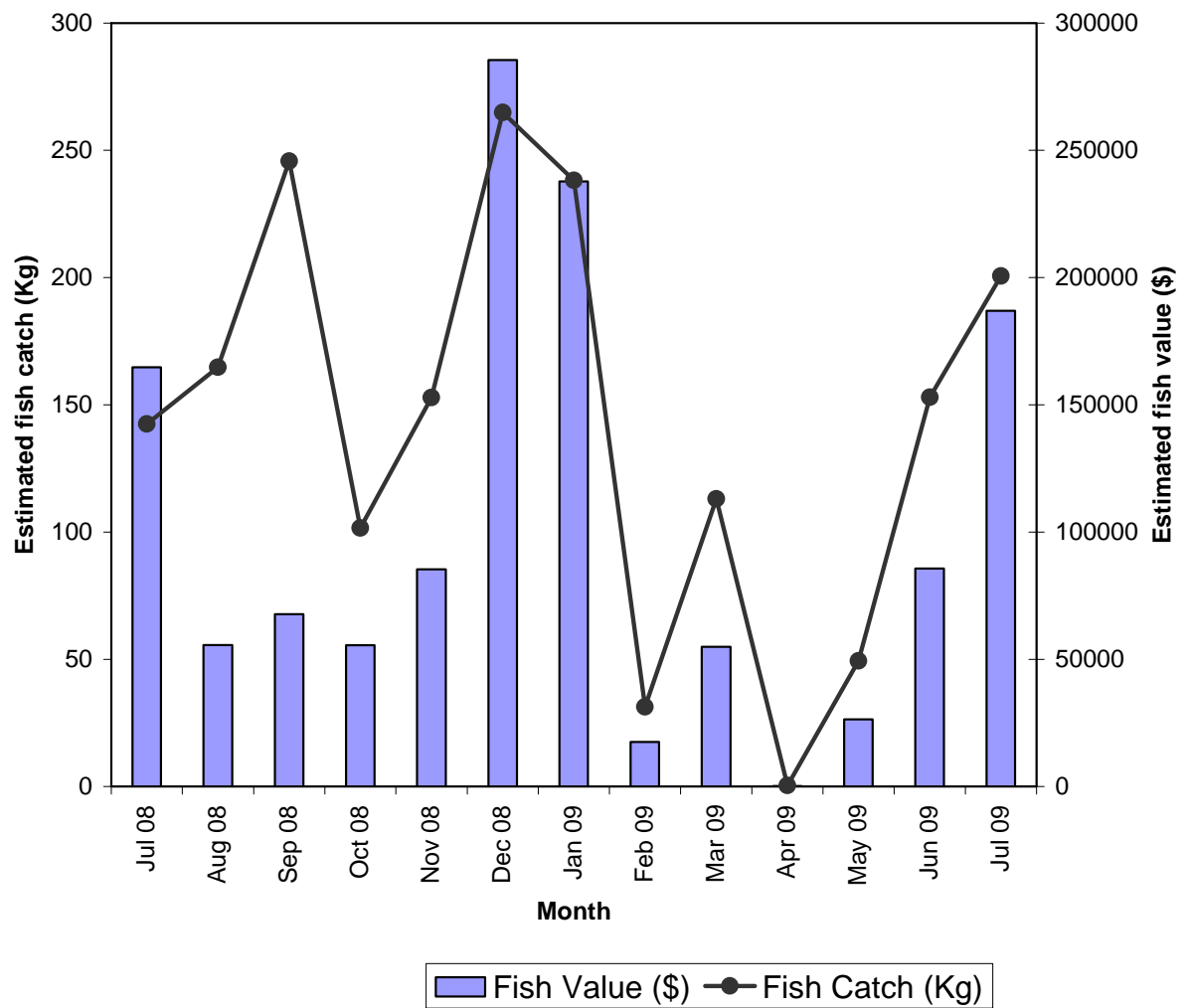
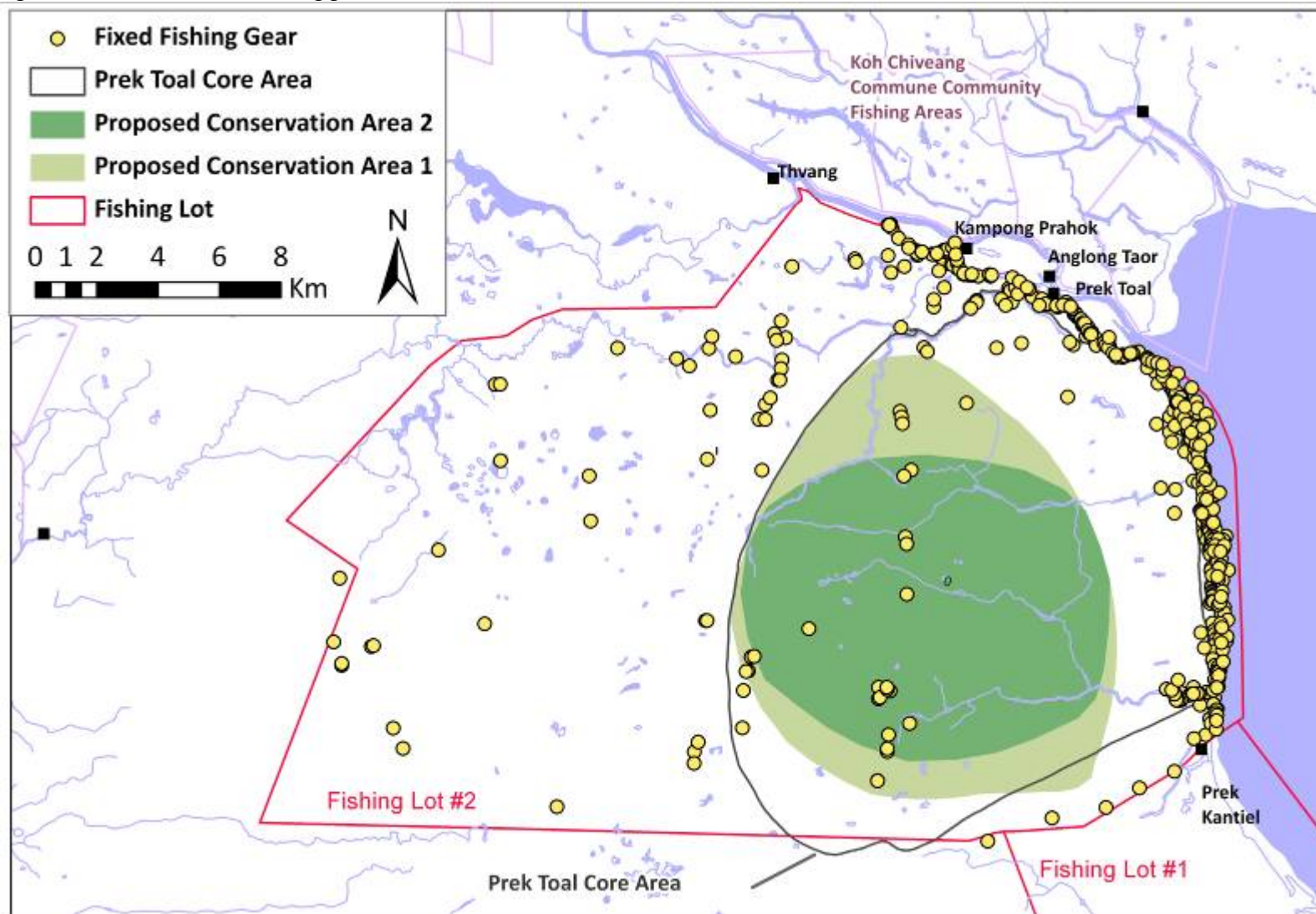


Figure 3.3. Locations of fixed fishing gear



3.4.5.2 Mobile fishing gear

A total of more than 3000 mobile fishing gears were counted, of which the most common mobile gear were gillnets, long line fish hooks, and fish traps (particularly “Lo-op”). Fish catch from more than 1000 fishing events was recorded, making a total 35.9 tons fish measured. This gave an estimated annual fish catch of 148.7 tons (August 2008 – July 2009), with an estimated value of US\$186,422 for the same period, peaking in May (Figure 3.4). Mobile fishing gear was recorded throughout lot 2, particularly during the closed season (Figure 3.5)

Figure 3.4. Mobile fishing gear fish catch quantity and value.

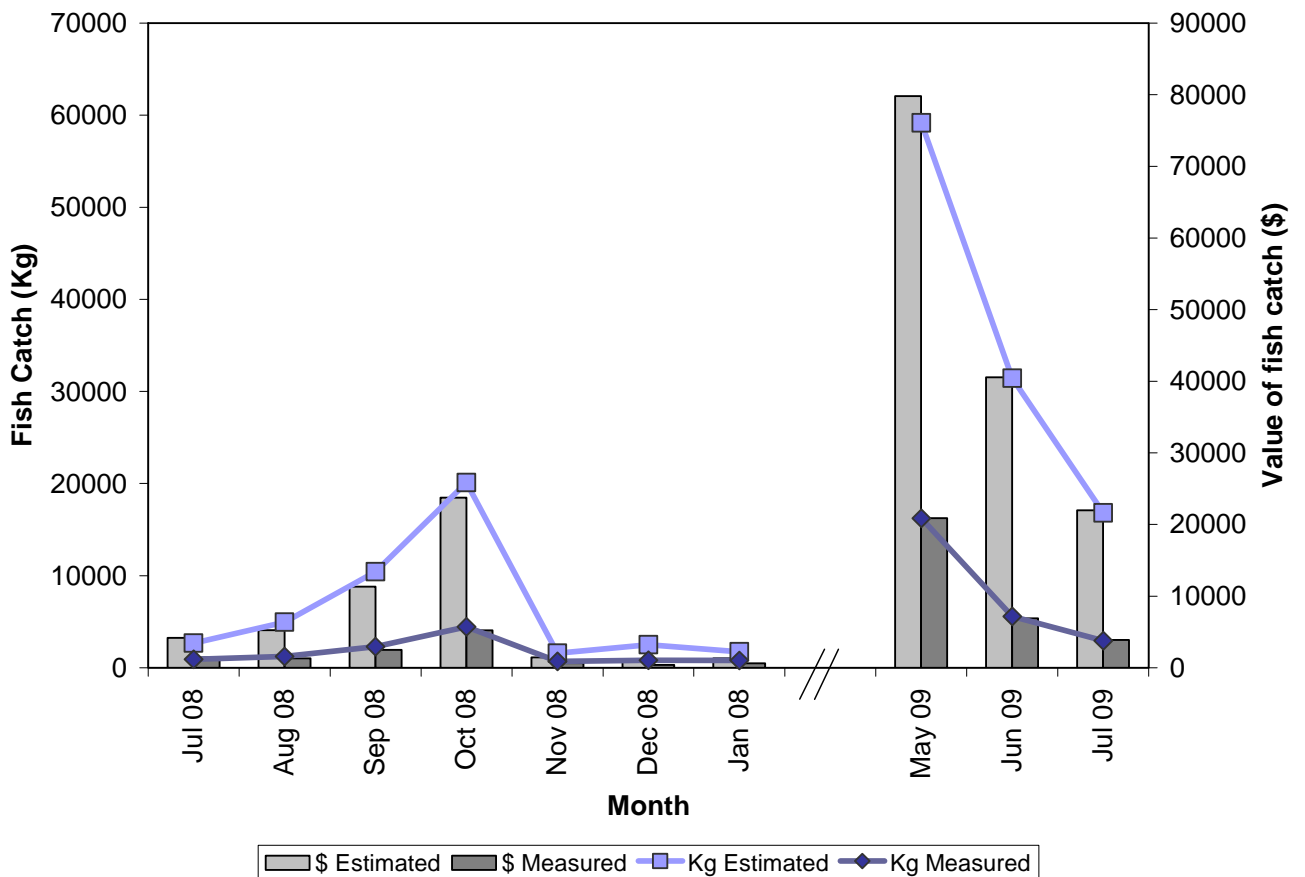
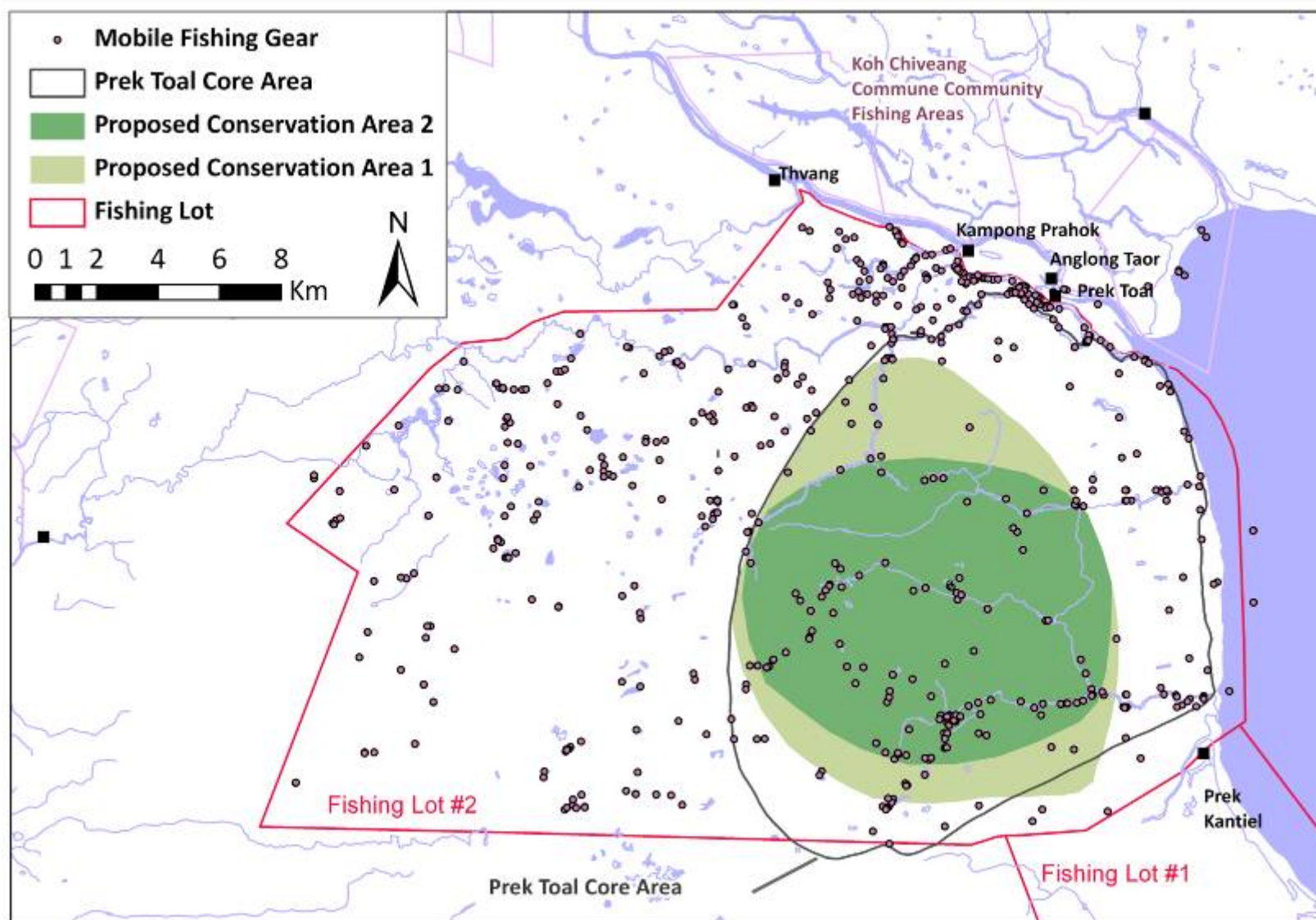


Figure 3.5. Locations of mobile fishing gear



3.4.5.3 Pens and Barrages

A total of 2313 tons of fish was recorded at the pens and barrages between February – June 2009 (Figure 3.6), with a total value of US\$1,688,543 (Figure 3.7), see Figure 3.8 for map.

Figure 3.6. Fish catch at Pens and Barrages

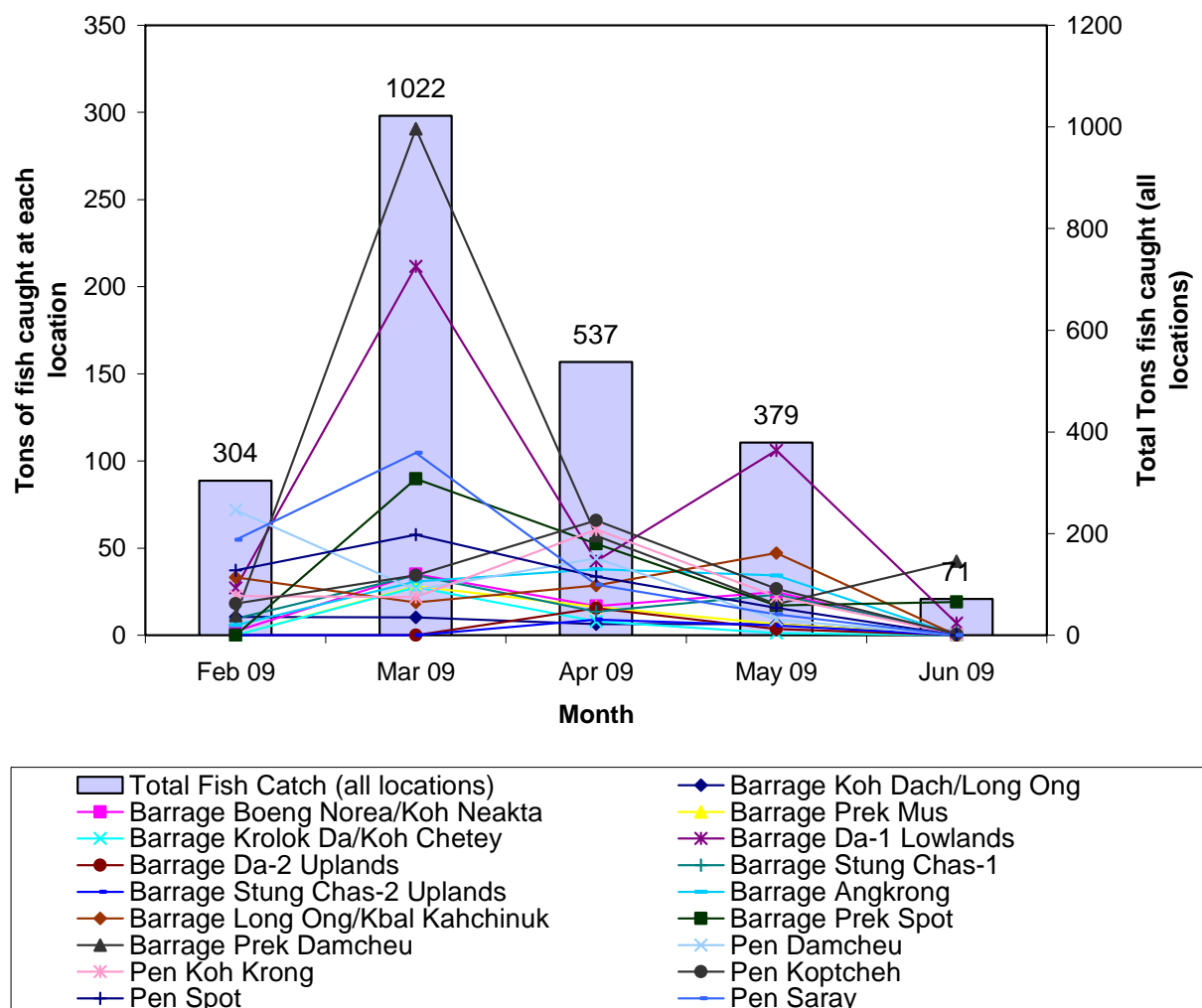
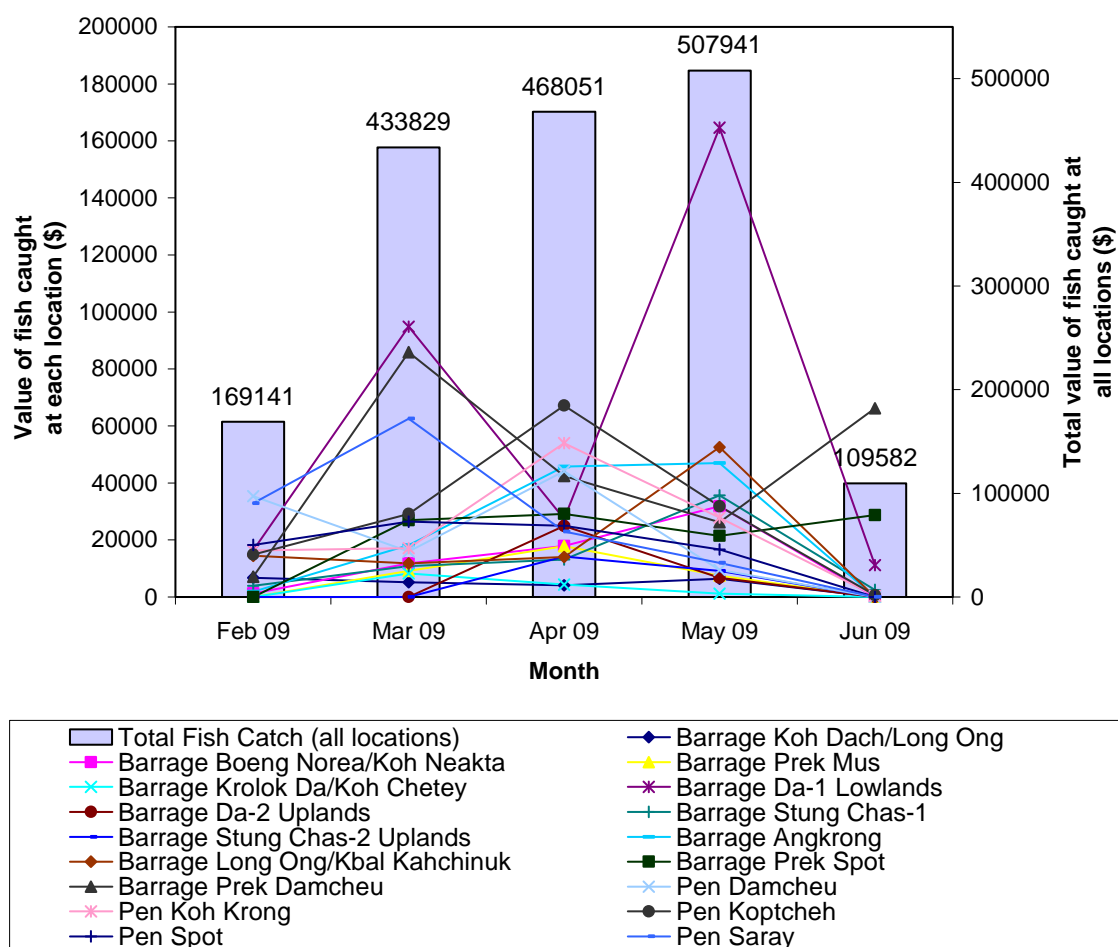


Figure 3.7. Value of fish caught at pens and barrages



3.4.5.4 Total Fish Catch

An estimated 4,178 tons of fish was captured in fishing lot 2 between August 2008 – July 2009 (4,323 tons, July 2008 – July 2009), with an estimated value of US\$3,034,164. The majority of this was caught by large scale commercial fishing gear at pens and barrages between February and June, but a significant proportion was caught by *bors* throughout the rest of the year (Figure 3.9 and Figure 3.10). Only a small proportion of fish was caught by traditional gear.

The discrepancy between fish catch recorded at Prek Toal and that recorded at the Chong Kneas fish landing site was insignificant, and was not consistently highly or lower. The exception was for very small fish (mixed species), which were occasionally sold at Prek Toal village for crocodile feed before the trader's boat transported the fish to the port.

Figure 3.8. Map of Fishing Lot 2 pens and barrages.

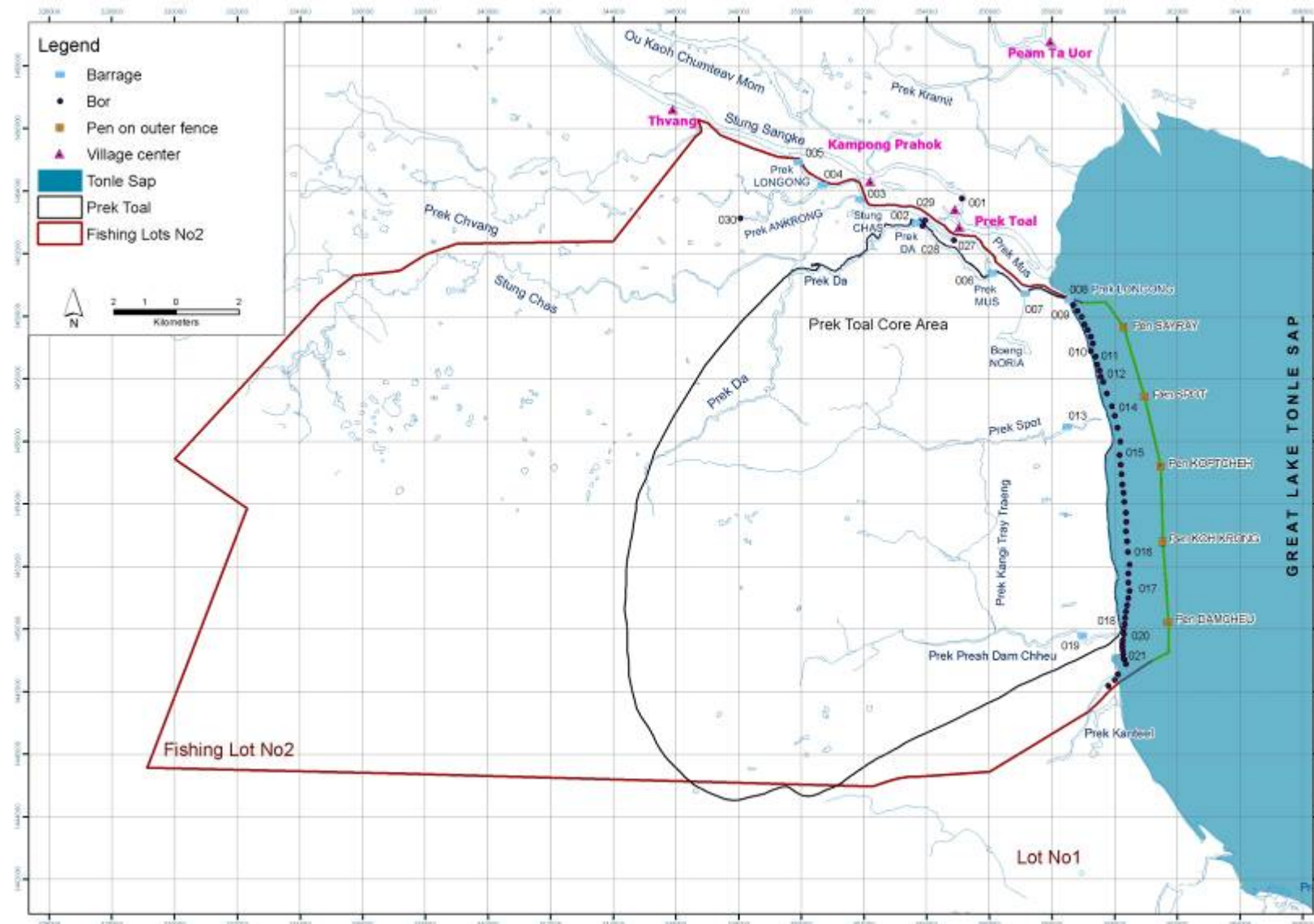


Figure 3.9. Fish catch (Kg) from all fishing gear, by month

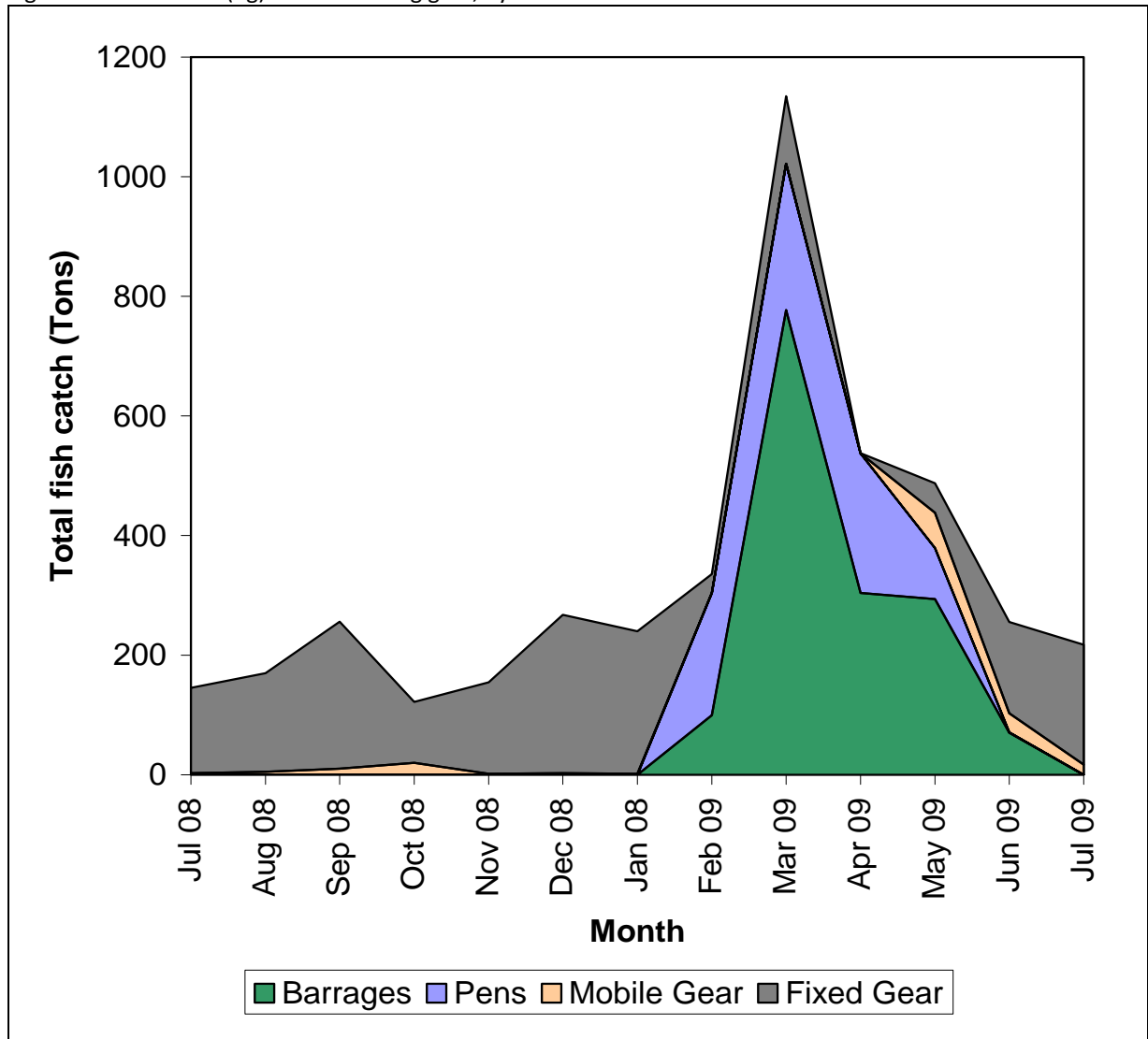


Figure 3.10. Value of fish catch (\$) from all fishing gear, by month

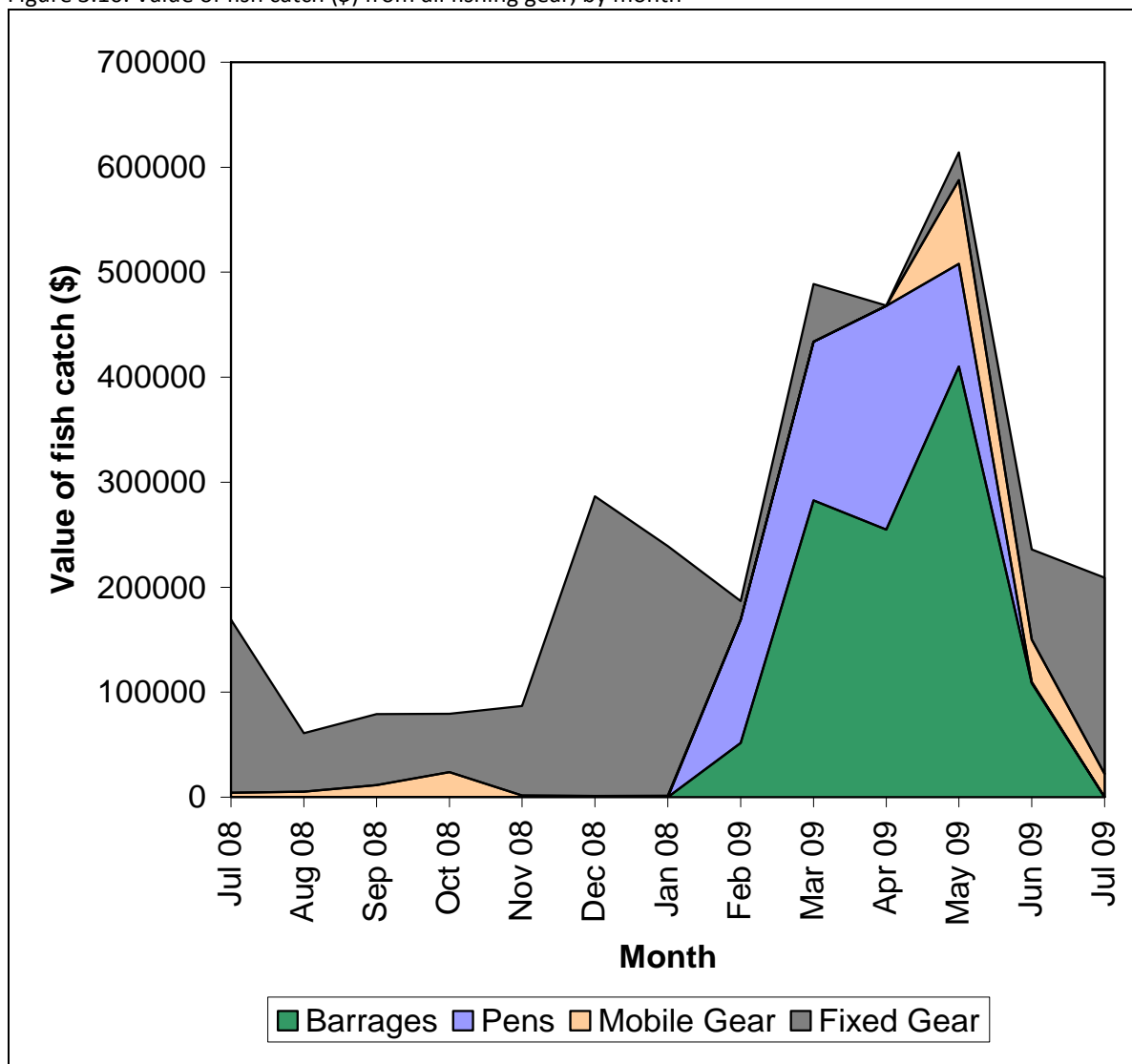


Table 3.7. Table showing number of tons of fish caught inside and outside the current Core Area and the proposed Prek Toal Sanctuary.

Fishing gear type	Core Area		Proposed Sanctuary		Unknown location	Total catch
	Inside	Outside	Inside	Outside		
Pens & Barrages	696	1618	19	2294	0	2313
Fixed Gear	1382	444	221	1605	33	1859
Mobile Gear	64	36	17	81	53	151
Total Tons	2142	2097	257	3980	86	4323
Percent	49.5%	48.5%	5.9%	92.1%	2.0%	100%

Table 3.8. Table showing value (US\$) of fish caught inside and outside current Core Area and the proposed Prek Toal Sanctuary

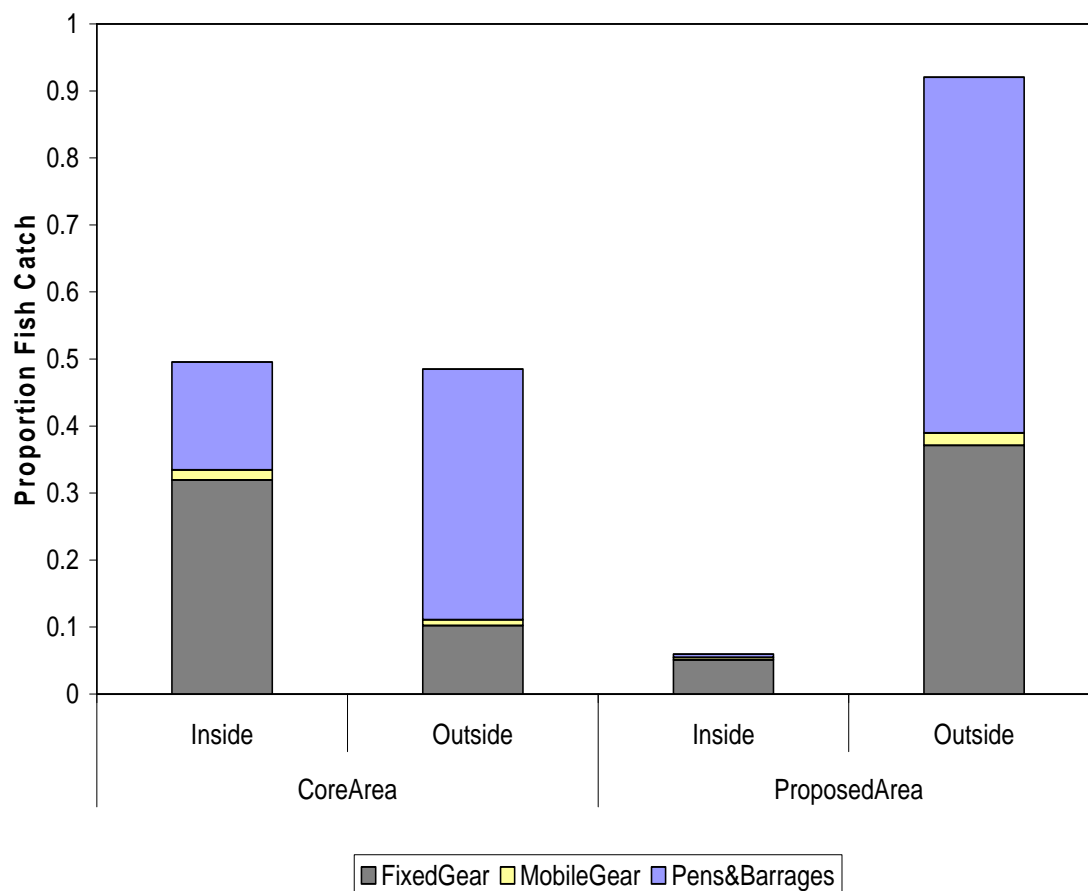
Fishing gear type	Core Area		Proposed Sanctuary		Unknown location	Total value (\$ million)
	Inside	Outside	Inside	Outside		
Pens & Barrages	428351	1260193	31605	1656939	0	1.69
Fixed Gear	977868	326678	192089	1112457	19457	1.32
Mobile Gear	78255	43663	20451	100954	69179	0.19
Total \$	1484473	1630534	244145	2870350	88636	3.20
Percent	47.7%	52.3%	7.6%	89.6%	2.8%	100%

3.4.6 Impact of no fishing in proposed Prek Toal Sanctuary on fish catches

Using the locations recorded of fixed and mobile fishing gears, and pens and barrages, the proportion of fish catch and value for the 2008/09 fishing season that fell within the current Prek Toal Core Area was calculated, and that proportion that would have been within the larger new Prek Toal Sanctuary (proposed Conservation Area 1) outlined in Chapter Two. The locations of all pens and barrages were known, but only roughly 60% of fixed gear and 40% of mobile gear were known.

Of the 12 barrages on the seven streams, four are outside of the Core Area and the proposed Sanctuary (Stung Chas – Riverside, Stung Chas – uplands, Prek Angkrong, and Prek Longong/Kbal Kohchanik), so their status is unaffected. However, four barrages are on the border of the Prek Toal Core Area (Prek Mus, Prek Longong/Koh Dach, Prek Da – Riverside and Prek Krolok Da) while an additional four are within the Core Area (Prek Spot, Prek Damcheu, Boeng Noria, Prek Da – Uplands), meaning that any attempt to remove commercial fishing from Core Areas would affect these eight barrages. In contrast, the proposed Sanctuary does not include areas near to the lake shore or river shore, and would overlap with only part of one barrage – the upstream proportion of Prek Da, which has one of the lowest fish catches of all the barrages. Similarly, while much of the fixed fishing gear is within the Core Area, it is not within the proposed Sanctuary (Figure 3.3). In total, for the 2008/09 fishing season, 49.5% of the total fish catch was captured inside the Core Area, but only 6% of this was within the proposed Sanctuary (Figure 3.11).

Figure 3.11. Fish catch 2008/09 within the current Core Area, and the proposed Prek Toal Sanctuary ("Proposed Area").



3.4.7 Indicators of sustainability

During the study, there were a number of (albeit inconclusive) indicators suggesting that fishing practices are unsustainable. While the large natural annual variation in fish catch and the resilience of white fish species to large harvests makes it difficult to make firm conclusions about sustainability, these indications are of concern nonetheless.

During interviews, a large number of fishers and other key informants raised the following points:

- **Reduced fish catches by traditional fishers:** This is fairly inconclusive as it is difficult to differentiate between the impacts of increased numbers of fishers and individual reductions in fish catches
- **Reduced fish catches by sub-leaseholders:** This is more suggestive of a decline, particularly where sub-leaseholders have held the same lease for 10 years or more (the case with one interviewee)
- **Smaller fish sizes:** Fishers and sub-leaseholders reported that fish caught were on average smaller, and that smaller fish that had previously been thrown back were now sold to market (mainly for prahok and for crocodile feed)

- **Scaled-up fishing gear:** All fishers reported more intensive fishing gears over the last 10 years. This included a general decrease in mesh sizes, the introduction of *bors* about five years ago, and the now widespread use of electro-fishing and pumping techniques that had been scarce or non-existent before five years ago.

These concerns are particularly relevant to black fish species (including some of the more valuable snakehead species such as *Trey roh*). Black fish species are less resilient to over-fishing, and rely on recession ponds to withstand the dry season. Local reports that water is pumped out of absolutely all dry season ponds and that they are then electro-fished to harvest the black fish remaining in the mud are worrying to say the least. A fish sanctuary preventing fishing in some dry season ponds could ensure that black fish populations are not as negatively affected by these practices.

3.5 Discussion

The fish catch of fishing lot 2 is large in both quantity and value, especially when considering that the figures here are conservative, with some fish catch undoubtedly unrecorded, particularly from the uplands areas outside of the Core Area. However, the most productive fisheries areas are along the lake and river shores, and thus do not coincide with areas of high conservation priority. Consequently, a strict no fishing regulation inside the proposed Prek Toal Sanctuary would be of low cost to commercial fisheries. An exception to the no fishing rule could perhaps be made for mobile fishing gear, particularly in the closed season. These gears are confined to traditional fishing gears, which catch both a small amount of fish and are operated by the poorest members of the community. The same exception should not be made for fixed gear, which while widespread in both the open and closed season, is both illegal and large, with *bors* of up to 5 km reported, the vast majority of which have small mesh sizes.

The difficulties in ascertaining exactly where each fish catch originated mean that there may be some fish catch coming from within the proposed Prek Toal Sanctuary that has not been recorded here. This is particularly true of the ponds and lakes near to the bird colonies, from which fishermen were very reluctant to report fish catch, mainly because they are aware of fishing restrictions in those lakes, and because of the illegal nature of the fishing activities conducted (namely pumping and electro-fishing), so that some of this fish catch may have been reported as originating from the barrages. Difficulties in measuring this offtake were further exacerbated by strong restrictions on entry to parts of the lot by the lot operators, particularly during the driest months.

The very large number of *bors* counted reflects a change in local fishing gear. Whereas previously, the majority of people in the floating villages had only traditional fishing gears such as hand held nets, fishing hooks and bamboo traps, the widespread availability of cheap nylon netting, the reported low catches using traditional gears and the now formalised payment system to use this illegal fishing gear has made this one of the most popular fishing gears in the floating villages, particularly among the

medium-wealth families. Enforcing existing laws banning this fishing gear would therefore be very difficult, and would have large negative impacts on local livelihoods for almost half the households in some villages.

The destructive nature of some fishing practices, combined with reports of reduced fish sizes and fish catches give cause for concern over the long-term sustainability of these recently introduced fishing methods. While the biology of white fish species may make them fairly resilient to high levels of harvest, care should be taken that populations of black fish species (which include many of the more valuable species, such as snakeheads) are not severely affected. In particular, the pumping and electrocution of virtually all recession ponds during the dry season could have large negative impacts on black fish populations, as these are often used as dry season refuges for many of these species. The proposed Prek Toal Sanctuary includes some of these recession ponds, and although it is from these ponds that the enforcement of no-fishing would have the greatest commercial impact, it is also the preservation of these recession ponds that will act as an important fish sanctuary, hopefully having positively impacts on future fish populations.

4. Assessment of the distribution of socio-economic benefits

By Sophie ALLEBONE-WEBB¹, YIM Sambo¹, LIENG Saroeun², SENG Leang², Phil TOWNSLEY³, Mark Aeron-Thomas³ & Tom CLEMENTS¹

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Photograph 4.1. Local fishers in public access area.

By Mr. Rorng.

4.1 Introduction

This component aims to assess the distribution of socio-economic benefits derived from the current management system to local communities and stakeholders, and then use those results used to examine the potential impacts on local communities of proposed management changes.

In addition to their value for commercial fisheries and conservation, fishing lot 2 and the Prek Toal Core Area are also of value to local communities, and are thought to contribute significantly to local livelihoods. Livelihood activities supported by the lot area vary from almost year-round intensive use of lot fishing resources, to occasional or seasonal use of the lot for NTFP collection and small scale fishing during the closed season (when the lot is open to villagers for traditional uses). In addition, lot labourers, seasonal migrants and village-based livelihoods involving fishing gear maintenance, fish trading and fish processing are all thought to be somewhat dependent on the lot.

However, to date little has been done to quantify the extent to which the lot supports local communities and in what contexts. Understanding the extent to which livelihoods and incomes are derived from the lot under the current management system, including both the value of natural resources harvested, and the monetary income from those resources is an important step in determining the costs to local communities of any potential management changes.

This component aims to assess the value of fishing lot 2 to local communities, looking at both the value of community fishing activities undertaken during the closed fishing season (July - September) and the economic rewards available through employment by the fishing lot operator during the open fishing season. Furthermore, the additional values of the Prek Toal Core Area were assessed, including employment by the conservation project and revenue generated through ecotourism. These benefits, and their long-term sustainability, are then compared to the likely outcome under alternative management regimes, including the impacts of a proposed Prek Toal Sanctuary on local communities.

4.2 Study area and villages

This study focused on the five floating villages located on the fishing lot 2 border: Prek Toal, Anglong Taor, Kampong Prahok and Prek Kantiel, all in Koh Chiveang commune, Ek Phnom District, Battambang province. Of these, Prek Toal and Anglong Taor are adjacent and are the largest villages, effectively forming one large community, albeit with separate village authorities. Additional surveys were done in 19 “uplands” agricultural villages from Tapon, Roka, Anglong Vil and Kampong Preah communes, Sankaj district, Battambang province. These villages were selected as being on the roads closest to lot 2 on the Western side (moving away from the lake), and the communes are known as being the source of often seasonal migrant fishers, labourers and sub-leaseholders in lot 2. See Table 4.1 for details.

Table 4.1. List of study Villages

Village	Commune	District	Surveys
<i>Floating villages</i>			
Prek Toal	Koh Chiveang	Battambang	Chapters 3, 4, & 6
Anglong Taor	Koh Chiveang	Battambang	Chapters 3, 4, & 6
Kampong Prahok	Koh Chiveang	Battambang	Chapters 3, 4, & 6
Thvang	Koh Chiveang	Battambang	Chapters 3, 4, & 6
Prek Kantiel	Koh Chiveang	Battambang	Chapters 3, 4, & 6
<i>Uplands villages</i>			
Basaet	Tapon	Battambang	Chapter 4
Boeng Tuem	Tapon	Battambang	Chapter 4
Samdach	Tapon	Battambang	Chapter 4
Svay Sa	Tapon	Battambang	Chapter 4
Tapon	Tapon	Battambang	Chapter 4
Ambaeng Thngae	Roka	Battambang	Chapter 4
Chhung Tradak	Roka	Battambang	Chapter 4
Pou Battambang	Roka	Battambang	Chapter 4
Roka	Roka	Battambang	Chapter 4
Ta Haen Muoy	Roka	Battambang	Chapter 4
Ta Haen Pii	Roka	Battambang	Chapter 4
Puk Chhma	Anlong vil	Battambang	Chapter 4
Svay Kang	Anlong vil	Battambang	Chapter 4
Andoung Trach	Kampong Preah	Battambang	Chapter 4
Kampong Preah	Kampong Preah	Battambang	Chapter 4
Kralanh	Kampong Preah	Battambang	Chapter 4
Panhnhha	Kampong Preah	Battambang	Chapter 4
Prey Chaek	Kampong Preah	Battambang	Chapter 4
Srah Kaev	Kampong Preah	Battambang	Chapter 4

4.3 Methods

A variety of methods were employed to study the socio-economic benefits of fishing lot 2 and Prek Toal Core Area to local communities.

4.3.1 Focus group discussions

A number of group discussions were held in floating and uplands villages, which served a variety of purposes, including to introduce the project, to collect basic information on villages and stakeholder groups, and to collect more detailed information on local livelihoods, fisheries management and views on fishing lot 2 management. Many of the group discussions focussed on a specific group exercise, which provided information of itself, but which also served as a tool around which wider information could be discussed in an informal setting. Efforts were made at each group discussion to invite a cross section of the community, to assure people of anonymity (no names were ever written down), and to give people a chance to ask questions and discuss general subjects relating to fishing. Indeed, we gained more useful information from the group discussions around the group exercises, than possibly we did during the actual exercises.

At the beginning of the project, four group exercises were completed in each of the floating villages, namely the natural resource use map, a list and rank of livelihood activities, a village map, and an assessment of the characteristics of wealth groups. The former two of these (natural resource use map and livelihoods list) were also repeated in each of the uplands villages. Towards the end of the study, an additional two group discussions were conducted in each floating village (and a number of other floating villages – see chapter 6), to investigate more sensitive issues now that the project had been accepted by villagers, and to fill in any gaps in information. These included discussions on the seasonality of livelihood activities, and a timeline detailing changes in the last 10 years, focussing on changes in management, law enforcement and natural resource use. The final two group exercises are discussed in Chapter 6. Group discussions were conducted by trained facilitators acting in pair, one of whom oversaw the discussion, and the second who took notes.

4.3.1.1 *Natural resource use map*

Respondents drew a map of all areas used by villagers. This included information on: names of access routes (rivers, streams, pathways, roads, etc.), land areas and what people use them for (flooded forest, ponds/lakes, agricultural land, aquaculture, fishing lot zones), boundaries and other zones, landmarks (bird platforms, streams owned/leased by particular people, big trees), and land use/livelihood activities done in each zone. The map had to be agreed on by the majority of people and was later used to identify resource use zones.

4.3.1.2 *Livelihood activities list and rank*

Respondents were asked about all livelihood activities done by people from that village, in both the flood and dry seasons. Respondents then draw a picture on pieces of paper to represent each activity, and as a group arranged those activities in order of the number of people that participated in those activities. This was repeated for both seasons, and once the order agreed on, respondents asked to estimate the number of families or individuals involved in that activity.

4.3.1.3 *Wealth characteristics*

Groups were asked to describe the characteristics of rich, medium and poor family in the village. On a large sheet of paper, respondents then drew these differences for poor, medium and rich families under different categories, including:

- Property - size of house, materials used in the house, location in village;
- Livelihood assets – type and number of boats, fishing equipment, other livelihood assets such as crocodile farms/aquaculture, and access to natural resources, including permits and sub-leases, domestic animals, land owned;
- Members and characteristics of the family, including no. of children, education, remittances;
- Food and food security, including differences in everyday diet, what families could do in case of emergencies (health and food);
- Non-livelihood assets.

This was aimed help as general information and to inform the questionnaire design. Participants were assured that “rich” was a relative term, and meant here at the level of the village: it did not mean that rich families in the village were wealthy at the scale of the country. Efforts were made not to impose the facilitators’ views of wealth on the participants.

4.3.1.4 Village map

Respondents were asked to draw a map of the village, including all major landmarks and groups of houses. This included: local names and official names for community buildings (school, hospital, commune leader building, community building, temple, etc.); access routes in and out of village (pathways, rivers, streams, etc.); and groups of houses, including the approximate number of households in each group, and any distinguishing characteristics (e.g. ethnicity). This was done in part to identify groups of households within a village, potentially as a way to identify families of similar livelihoods and/or wealth, and also as a way to stratify villages for later sampling.

4.3.2 Village surveys

A village survey was conducted monthly with 700 households - 50 families in each floating village, and 25 families in each upland village, from February 2009 to August 2009. This included questions on all livelihood activities conducted by the members of the household over the past month, including details of resources harvested, goods sold and any other income or resources entering the home. Careful sampling procedures were conducted in order to get a random sample of households, stratified by livelihood activity, selecting 5 families from each livelihood activity. These varied for the floating and uplands villages, and are detailed below. A local data collector from each village was trained for three days before conducting the survey after which they were visited monthly by a supervisor who checked all completed data sheets, and accompanied the data collector for one day of data collection. In addition, any families who had questions were be visited by the supervisor, and questions answered.

4.3.2.1 Sampling strategy: Floating villages

A census style questionnaire was conducted with half of the households for each of the floating villages, with every other house being visited by the data collector. Data were collected on the demographics of the household, and on the livelihood activities conducted by all household members in the past year. From these census questionnaires, the following livelihood activities were identified and five households randomly selected for each group:

- Leaseholders, sub-leaseholders, and people who buy permits or *dongs*³ in lot 2
- Small of medium scale fishers who use lot 2 (without a permit)
- Labourer for lot 2
- Wildlife collection from lot 2 (e.g. firewood, frogs, crabs, snails, etc.)

³ A dong is a permit paid to the lot Leaseholder, allowing a fisher to fish in a particular area (e.g. dry season pond) or using a particular fishing gear (e.g. water snake fishing or bors in lot 2 during the flooded open season)

- MoE or conservation workers (e.g. MoE rangers, MoE boat drivers, Environmental station employees, etc.)
- Tourism operators and workers
- Fish traders
- Labourer for fish processing
- Dry season vegetable growing
- General service providers (e.g. shop owners, small businesses, traders)

For groups where less than five households were been identified during the census questionnaire, the village chief or other key informant was asked to name all the families in the village doing that activity. These names were then put into a hat, and a random five households selected, in front of the village chief and other witnesses. Each household was then visited, the project explained, the data collector introduced, and asked if they would participate in the study.

4.3.2.2 Sampling: Uplands villages

Due to a fewer number of households fishing or using lot 2, the sampling strategy varied slightly for the uplands villages. No census style questionnaire was conducted, and instead village chiefs or key informants were asked to name all families in the villages belonging to one of the five activity groups identified, and five households randomly selected. Where there were too many households to name in each group, researchers walked through the village interviewing every 20th household to ask what livelihood activities were done by the household. Five households from each group were therefore identified. Again, each household was then visited, the project explained, the data collector introduced, and asked if they would participate in the study. The five livelihood activities identified were:

- Leaseholders, sub-leaseholders, and people who buy permits or dongs in lot 2
- Small of medium scale fishers who use lot 2 (without a permit)
- Labourer for lot 2
- Fish traders
- Wildlife collection from lot 2 (e.g. firewood, frogs, crabs, snails, etc.)

4.3.2.3 Migrants surveys

In addition to the selected households, the same questionnaire was done for any season migrants arriving in the village. Each month, the data collector and supervisor spent one day identifying seasonal migrants and asking these same questions for as many months as the migrants were there. In practice there were only migrants for the floating villages.

4.3.3 Interviews

Interviews were conducted with fishers and forest product collectors encountered by data sampling teams under Chapter 3, during their activities in the area. These included questions on village of origin, income or salary (for labourers) and duration of work. This allowed us to cross-check data gathered from village interviews.

In addition, in-depth interviews were conducted with key informants from different stakeholder groups. These were often informal, and were designed to understand

more fully some of the issues that had been identified during surveys or group discussions.

4.3.4 Uplands surveys

Two surveys of 7-10 days were conducted in March and May 2009, using methods developed in WCS Upland surveys conducted in 2004 and 2006. A team of 2-3 data collectors travelled along different routes through the uplands portion of lot 2, collecting data on the location, size and names of uplands ponds; the size, location and village of origin of human settlements; and the type of fishing, name of sub-leaser, price of sub-lease, and approximate fish catch of any fishers encountered.

4.4 Results

A wide range of seasonally adapted livelihood activities were identified in the villages. The results presented here focus on the number of families gaining some income from fishing lot 2 activities (for at least some part of the year) compared to other activities and then the average income earned from fishing lot 2 livelihood activities. The final results section discusses the impact of a future Prek Toal Sanctuary, compared to other management scenarios. We also include general comments repeated by more than one respondent or group, about local livelihoods.

4.4.1 Number of households involved in different livelihood activities

4.4.1.1 Floating communities

Unsurprisingly, whilst a wide variety of livelihood activities was reported in the floating villages, the majority of these depended in some way on fishing in the floating communities (Table 4.2, Table 4.3). In floating villages, the vast majority of households either used traditional fishing gear (mobile gear such as fish hooks, smaller fish traps, gill nets, eel traps, etc) or medium fishing gear (fixed gear such as *bors* – arrow or box-shaped netted enclosure with a long net leading to the enclosure).

During the closed season (July – September), virtually all families with traditional and medium fishing gear reported going to fishing lot 2 at some point, although most report also going to the Community Fisheries (CFi) and Public Access (PA) fishing areas. Respondents claimed that although this is the least productive season for fish catches (because there is so much water, extracting fish is more difficult), many claimed that they still catch more fish in these months, because it is when they are allowed to go to fishing lot 2 (where fish are more plentiful) as opposed to the CFi areas, where fish stocks are reportedly severely reduced.

During the open season (October – June), all families with traditional gear and most families with medium gear went only to the CFi and PA areas (Table 4.4). Only in Prek Kantiel (a village surrounded by two fishing lots, and without a CFi area) were *dongs* common, whereby virtually all families with fixed fishing gear (*bors*) bought a permit to fish inside the lot during the open season, when the water is still high (October – January). Of these, half (50) were *dongs* for fishing lot 2, and half for the neighbouring fishing lot 1. A fewer families in all floating villages had larger fishing gear such as

“*norals*” (a large *bor*), which again were mainly used in the CFI areas and the PA areas (including in the middle of the Tonle Sap), but which often employed labourers.

During the dry season (February – June), a very limited number (~5) of wealthy families bought sub-leases for the large-scale fishing gear at the pens and barrages. With the exception of Prek Kantiel, no families reported buying leases for dry season ponds, presumably because these ponds are a long way from the village. The dry season is also the peak period for labourer work in lot 2 (and in public access areas). However, contrary to expectations, a fairly limited number of families from the floating communities were employed in the lot (~100 compared to the estimated 1000 people working in the lot during this season), and the majority of these were from Prek Toal and Anglong Taor villages. Villagers claim that only people who know one of the sub-leaseholders can get this work, and that it is badly paid, so is mainly for the poorer families.

The fish traders in the floating villages play a key role in providing small loans (often at very high interest rates) and buying and selling fish from small and medium scale fishers. These traders also provide work in the dry season to a large number of women who are employed as labourers for fish processing. This work is paid roughly half of that of the lot 2 labouring work (reportedly because it is “women’s work”). However, very little of the fish bought by these village based traders comes from fishing lot 2. During the open season, most large-scale fishers (i.e. fishers in lot 2) sell to large traders who come from the Chong Kneas port, or take the fish to the port directly. Only in the closed season do local traders buy fish originated in fishing lot 2.

There were a large number of families who collected other natural resources, including aquatic plants, firewood, crabs, snails, crickets and grasshoppers. However, far fewer actually sold these products, and these families were generally reported as being the poorest of the village.

The conservation activities in the Prek Toal Core Area do provide employment for around 35 households, which is a small fraction of the total number of households, although there are no employees from outside of the floating villages. However, efforts had been made to employ rangers who were often among the poorer households in the village, and including former egg and chick collectors where possible.

Despite an estimated 700 - 1,300 tourists per year, very little of the tourist money currently flows to local communities. Local livelihoods benefiting from tourism were confined to a small number of people working as boat drivers for tour groups on a rotational basis, the two households who provide a restaurant service to a limited number of tourists, and a number of poorer households who make handicrafts goods out of water hyacinth under an Osmose (local NGO) programme⁴. In addition, a number of service providers (e.g. shop owners) presumably benefit from increased sales in boat fuel. A few households also host “homestays” in Prek Toal and Prek

⁴ Although the majority of these goods are transported to Siem Reap and elsewhere for sales.

Kantiel, although the number of tourists wishing to sleep at the floating villages is currently very limited. Kampong Prahok and Thvang villages receive no income from tourism. However, the system is such that most of the services (i.e. food and transport) are provided by Siem Reap-based organisations. A notable two NGOs do give a portion of their tourist revenue to conservation activities in Prek Toal (Sam Veasna Centre) or to community development projects (Osmose), but others give nothing but the Core Area admission fee. This system is currently under review by the MoE and encouragingly, plans to divide the Core Area entrance fee (\$20/tourist) into funds for conservation activities, local community development, environmental education and logistics costs of running the station have recently been put in place. However, this system is has only been implemented since November 2009, and will require a strong, transparent and accountable system to be in place for it to be sustainable.



Photograph 4.2. Fishing camp near pond in uplands public access area.

Table 4.2. Number of families participating in different livelihoods, floating villages.
Numbers stand for number of families, unless followed by a “p”, in which case show number of people.
CFi = Community Fisheries areas; PA = Public Access fishing areas

		Koh Chiveang commune				
		Prek Toal	Anglong Taor	Kampong Prahok	Thvang	Prek Kantiel
Total No. HHs		500	550	350	250	100
No. HHs fishing in lot 2	Traditional gear: Closed season (fish hooks, gill nets, laals)	150		250	230	90
	Traditional gear: Open season (lot 2)	0 ⁵		0	0	0
	Water snake fishing	20		0	0	0
	Medium gear: Closed season (bor)	250		100	50	
	Medium gear: Open season	255 total (mainly in CFi and PA)		150 (mainly in CFi and PA)	0	50 (buy <i>dong</i>)
	Large gear/sub-lease holders: Open season	2		0	3 (buy <i>dong</i> for ponds)	0
Traditional gear: Open season NOT lot 2		150		50	160	70
Bor/noral owner, all areas		255		150	50	100
Fishing in neighbouring fishing lots		0		0	4 buy <i>dong</i> in lot 4. 40 <i>bor</i> & 10 <i>noral</i> (PA & CFi only)	50 buy <i>dong</i> in lot 1
Other lot 2 activities	Labourer lot 2	70 p		10	3	0
	MoE ranger	20-30 p		20	0	0
	Tourist boat driver	20 p		0	0	7
	Fish trader	20		4	4	15
Lot 2 services	Restaurant for tourists	2		0	0	2
	Shops	20		10	5	15
Other work	Fish Processing Labourer*	300		150	0	30
	Fish rearing	20		50	30	25
	Labourer – norals in lake & CFi areas	50 (closed) 80 (open)		30	30	
	CFi ranger				25	0
	Osmose staff					3
	Other trader (e.g. cake or vegetable seller)	10		17	8	15
	Teacher	8		1	1	0 ⁶
	Sell NTFP plants	10		0	0	40
	Crocodile rearing	80		10	25	7
	Firewood selling	4		0	50	0
	Dry season vegetables	0		50	4	0
	Poultry rearing	0		200	110	0

⁵ Families with traditional gear cannot use lot 2 during the open season, except for a few snake fishers who buy a *dong*. Everyone else with traditional gear fishes in the Community Fisheries areas, or the public access areas.

⁶ The government teacher left, and no new one has been assigned. The Osmose employees or elder villagers occasionally give lessons at the school. Indeed, there was great protest when authorities tried to remove their school.

Table 4.3. Rank of number of families involved in each livelihood activity

1 = most families involved. Where ranks were different between seasons, the highest (i.e. most families) was taken. Blue = fish based activities, Yellow = agriculture based activities, Green = other natural resource harvesting

Village:	Prek Toal	Anglong Taor	Kampong Prahok	Thvang	Prek Kantiel
Fishing, small-scale gear (net and hook)	2	3	1	1	1
Fishing, medium-scale gear (bor)	1	1	2	5	2
Fishing, large-scale gear	12	7	X	12	3
Fishing, dong ponds					
Fishing, labourer	4.5	4	7	5	X
Fish processing	1	2	1	X	3
Fish trader	9	11	10	13	6
Water snake fishing	5	4	X	15	X
Shop owner	7	9	6	11	6
Trader (non-fish products)	8	7	7	14	5
Fish Rearing	6	7	4	8	4
Teacher	13	12	11	15	X
MoE Ranger	11	9	7	X	X
Boat Driver for tourists	12	12	X	X	7
Sell aquatic plants	10	12	X	X	3
Crocodile farming	4	6	7	9	7
Sell firewood	14	12	X	6	X
Chicken/duck rearing			2	3	X
Dry season vegetables			4	11	X
Community Fisheries Ranger				9	X
Osmose staff					9

4.4.1.2 Uplands communities

In the uplands communities, livelihoods were dominated by agriculture and livestock, as expected (Table 4.4). The vast majority either owned rice fields, or worked as a labourer in a rice field for at least some part of the year. In addition, a sizable proportion did some fishing, but the scale of this fishing varied considerably. Over half of the families who fished did so only in local rivers or ponds. Of the other half who travelled further away, most went to public access areas near to lot 2, or in the public access area of lot 2. It was not possible to distinguish between these two categories (public access areas inside and outside of lot 2) as respondents didn't know themselves: there were no markers to show the lot 2 border (only the border between the public access and non-public access areas). A large number fished in lot 2 during the closed season, but very few bought *dongs* for fishing in the open season (Table 4.4).

Some people from the uplands villages were employed as labourers in lot 2. Again, respondents reported that this work was only available to those who knew one of the sub-leaseholders. Indeed, of the labourers interviewed at the fishing gear, more than 50% Reported coming from villages far from lot 2.

Table 4.4. The number of families working in lot 2, all villages

Blank cells indicate that figures aren't available/are unknown

	Village	Total No. HHs	July - Sep	Oct – Jan		Feb – Jun		All year			
			Fishing L2, closed season	Fishing, L2, wet open season, dong/ sublease	Fish L2, wet open, PA	Fishing, L2, dry season (PA)	Fishing in lot 2, dry season, dong	lot 2 labourers	Boat drivers	Tourism	MoE rangers
Floating villages	Prek Toal	522	400	~4	0	0	0	70	20	3	25
	Anglong Taor	373	300	~2	0	0	0	~25		3	5
	Kampong Prahok	209	350	0	0	0	0	3	0	0	0
	Thvang	250	<210 (~100) ⁷	0	0	0	3 ⁸	3	0	0	0
	Prek Kantiel	100	~100	50	0	0	50	0	10	2	0
Land villages	Puk Chhma	392		0	0	8	3	0	0	0	0
	Svay Kong	423		0	0		3	0	0	0	0
	Ambaeng Thnagae	186									
	Chhung Tradak	301		0	6	5	0	2 (PA)	0	0	0
	Pou Battambang	214		0	0		15	0	0	0	0
	Roka	469			10	65	15	50	0	0	0
	Ta Hein Moy	300		0	0		1	10	0	0	0
	Ta Hein Pii	187		8	0		20	40	0	0	0
	Basaet	631		0	0		0	0	0	0	0
	Boeung Tuem	545		0	0	50	8	8	0	0	0
	Sambdach	614	<100	0	100	50	2	25	0	0	0
	Svay Sor	542	<160	0	0	0	0 ⁹	0	0	0	0
	Tapon	422	<45		50	10					
	Andoung Trach	201	<120		5	5	0 ¹⁰				

⁷ Many fishermen with traditional gear and medium gear go to neighbouring lot 4 during the closed season, as well as lot 2.

⁸ Families with *Norals* don't buy *dongs* – they fish in the CFI area in the open season. People from Thvang do buy *dongs* for ponds in lot 2 and 4.

⁹ Nine families buy *dongs* in lots 4 and 6,

¹⁰ But 2 families buy a *dong* in lot 1

4.4.2 Income gained from lot 2

Average incomes from lot 2 based livelihood activities again varied widely, from the large sums earned by sub-leaseholders to the small amounts earned by those with traditional fishing gear during the closed season. Indeed, incomes from Fishing lot 2 were ranked both the highest and the lowest compared to other village livelihoods (Table 4.5).

The total highest incomes earned per household were buy sub-leaseholders, followed by fixed gear owners, shop owners and fish traders. However, due to the small number of sub-leaseholders, it was the fixed gear owners who earn the most from lot 2 across all households (Table 4.6).

Table 4.5 Rank of income, floating villages

1 = highest income per household over the whole year. Activities which earned high incomes for just a short period of time were ranked lower than their month income suggested, to take into account the lack of earnings for the rest of the year.

Livelihood Activities	High water	Low water
Large fishing gear: <i>noral</i> owner	1	1
Medium fishing gear: <i>bor</i> owner	2	2
Shop owner	=3	3
Fish trader (village based traders buy only from small fishers, not from lease-holders)	=3	4
Traditional fishing gear: Gillnets " <i>mornng</i> "	=4	5
Traditional fishing gear: Fish hook " <i>san toi</i> "	5	NA
Fish rearing	=4	6
Other trader (e.g. cake or vegetable seller)	6	7
Teacher	7	9
Crocodile rearing	NA	8
Water snake fishing	=9	NA
Firewood selling	=9	NA
Labourer lot 2	=8	=10
MoE ranger	=8	=10
Labourer – <i>norals</i> in middle of lake	=8	=10
Tourist boat driver	10	NA
Fish Processing Labourer*	NA	11
Sell NTFP plants	11	NA
Traditional fishing gear: Fish trap " <i>laal</i> "	NA	12

Table 4.6. Average and total incomes for Fishing lot 2 livelihood activities

Livelihood activity	Average income	Average duration/frequency of work	Average annual salary/family or person	Estimated no. of people/ families			Average annual value TOTAL
				Floating villages	Uplands villages	Elsewhere	
Labourer, lot 2	50,000 – 200,000R/month	2 – 3 months	\$125	101p	30p	~80p ¹¹	\$26,375
Boat driver for	\$5/day	1/2 months (PT)	\$30	20p	0	0	\$700

¹¹ This is probably an underestimate, as is based on those labourers interviewed during Component 2

tourists		1/6 months (PK)	\$10	10p			
MoE Rangers	\$5.4/day	14 days/month, 6 months/year	\$453.6	30p	0	0	\$13,608
Other Environmental station staff	\$80/month*	All year	\$960	4	0	0	\$3,840
Osmose staff	\$80/month*	All year	\$960	6p	0	0	\$5,760
Tourism: restaurant	\$2/meal (price = \$3)	10 meals/month, 4 months/year	\$80	2f	0	0	\$160
Tourism: guest houses	10,000R/ night/ tourist	1 night, less than 1/6 months	\$20	5f	0	0	\$20
Fishing, traditional gear, closed season		* days/month, July - September					
Fishing, fixed gear, closed season		* days/month, July – September					
Fishing, – Public Access Area ponds		February – June					
Fishing, dong – lot 2 ponds		February – June					
Fishing, dong – lot 2 fixed gear		October - January		50f (PK only)	0	0	
Fishing, sublease – lot 2 pens & barrages		February – June		12p (~half of which are Chea Phal's family)	0	0	

4.5 Discussion

4.5.1 Potential impacts of management changes on local communities

Under management changes involving the creation of a Prek Toal Sanctuary (see Chapter 2) only 7.6% reduction in fish catch is predicted during the open season (see Chapter 3). This would involve the cancellation of one or two key sub-leases, (rather than a 10% decrease from all sub-leased areas), which would mean that the lot operator would forego the income from one or two leases, but other leases would remain intact. Consequently, the income to those sub-leaseholders still holding a lease would remain changed. However, a 10% in fish catch could also lead to a decrease in labourers needed. However, as less than half of all labourers currently employed are from local communities, it is recommended that these reductions are absorbed by communities far from lot 2, which may have more opportunities for alternative livelihoods. Consequently, during the open season, the main local impacts would be on the 50 households in Prek Kantiel which buy *dongs* to fish in fishing lot 2.

An important caveat is made with the recommendations for a Prek Toal Sanctuary, namely that current laws on fisheries are enforced more stringently. This would

effectively mean no fixed gear inside lot 2 during the closed season. This would result in a loss of (unofficial) revenue to the MoE, local FiA, local police, and local military, and also a reduction in fish catch by the medium wealth families owning this gear.



Photograph 4.3. Fish in floating village.

5. Investigation into the impact of upstream development

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Photograph 5.1. Flooded forest.

5.1 Summary

This component aimed to investigate the impact of upstream development on fishing lot 2 and the Prek Toal Core Area.

Future development activities, both within the Tonle Sap and upstream in the Mekong catchment areas, are likely to have a major impact on the fish catches and flooded forest around the lake. One of the most well-known examples concerns predicted changes in the depth of the Lake during the dry season. Rising dry season water levels, due to water releases from dams, is expected to cause widespread reduction in the area of flooded forest over the next 10-15 years (as the under construction and planned dams are completed). Models (from WUP-FIN) suggest that up to 40% of the Prek Toal Core Area could be affected. The proposal for the new Prek Toal Core Area should be informed by the latest available information from these scenarios, so that the final area chosen has the highest potential for long-term sustainability.

5.2 Introduction

Rapid development in the upper reaches of the Mekong River, in the form of construction of large hydropower dams and reservoirs, large irrigation schemes and rapid urban development, is putting water resources under stress. Recent studies have concluded that these developments will lead to flow alterations in the Mekong (ADB 2004; World Bank 2004; Webby *et al.* 2007). These flow alterations would threaten the sensitive ecosystems downstream, particularly Tonle Sap River, Lake and floodplain, and its gallery forest and protected areas, by changing the flood pulse system of the lake.

The other predicted impact on the lake hydrology is climate change. It has not been included in the analysis but is considered to have an important impact on the Mekong and Tonle Sap hydrology, especially during the latter part of the century (Penny 2008; TKK and SEA START RC 2009). Indeed, in an assessment of 132 countries, Cambodia was ranked in the top 30 countries whose fisheries are most exposed to the impacts of climate change and whose economies are most vulnerable those changes (Allison *et al.* 2009).

Relatively small rises in the dry season lake water level would permanently inundate disproportionately large areas of floodplain, rendering it inaccessible to floodplain vegetation and eroding the productivity basis of the ecosystem (Kummu and Sarkkula 2008). Therefore, it would be highly important to maintain the natural hydrological pattern of the Mekong, particularly the dry season water levels, to preserve the lake's ecosystem productivity.

This study is based on three Cumulative Impact Assessment reports (ADB 2004; World Bank 2004; Webby *et al.* 2007) that are made for the Mekong Basin, mainly analysing the future development impacts on the basin hydrology and further on the Tonle Sap Lake's water levels. They conclude that dry season water levels would rise and wet

season water levels would be lower than at present. The flow alterations would be more significant close to the dam sites and gradually decrease, with distance, in the lower Mekong Basin. The flow alterations in the Mekong mainstream would directly impact on the flood pulse of the Tonle Sap Lake. This is because around 60% of the Tonle Sap flood water originates from the Mekong and the water level in the lake is controlled by the water level in the Mekong mainstream (Kummu and Sarkkula 2008).

This study aims to assess the impacts of the flow alteration, and particularly the increased dry season water levels, on the fishing lot 2 and Prek Toal Core area. Specific tasks are as follows

- Analysis of the impact of upstream developments on Prek Toal Core Area and Battambang fishing lot 2. This should include analysis of changes in water levels and impacts on flooded gallery forest, bird communities, trees with observed birds and observed crocodiles.
- Comment on the results of this analysis pertaining to the new suggested conservation area (within lot 2)
- Discussion on the longer term prospects for the Prek Toal Core Area and fishing lot (e.g. due to climate change)

5.3 Study area

Tonle Sap Lake (Figure 5.1) is an integral part of the Mekong River, being the largest freshwater lake in Southeast Asia. The Mekong is among the largest rivers in the world and is ranked as the 10th largest by volume with an annual discharge of 475 km³ (Mekong River Commission 2005). The importance of the lake is unquestioned for Cambodia and the lower Mekong Basin (e.g. Bonheur 2001; Sverdrup-Jensen 2002; Campbell *et al.* 2006a; Keskinen 2006; Kummu *et al.* 2006). Over one million people are depending on the natural resources of the lake. The value of Tonle Sap Lake has also been recognized internationally and the lake has three Biosphere Reserve core areas under the UNESCO *Programme on Man and the Biosphere* (UNESCO 2006) and one Ramsar site under the Ramsar Convention (Ramsar Convention on Wetlands 2007).

The fishing lot 2 and Prek Toal core area are located in the Northwest part of the lake as illustrated in Figure 5.2.

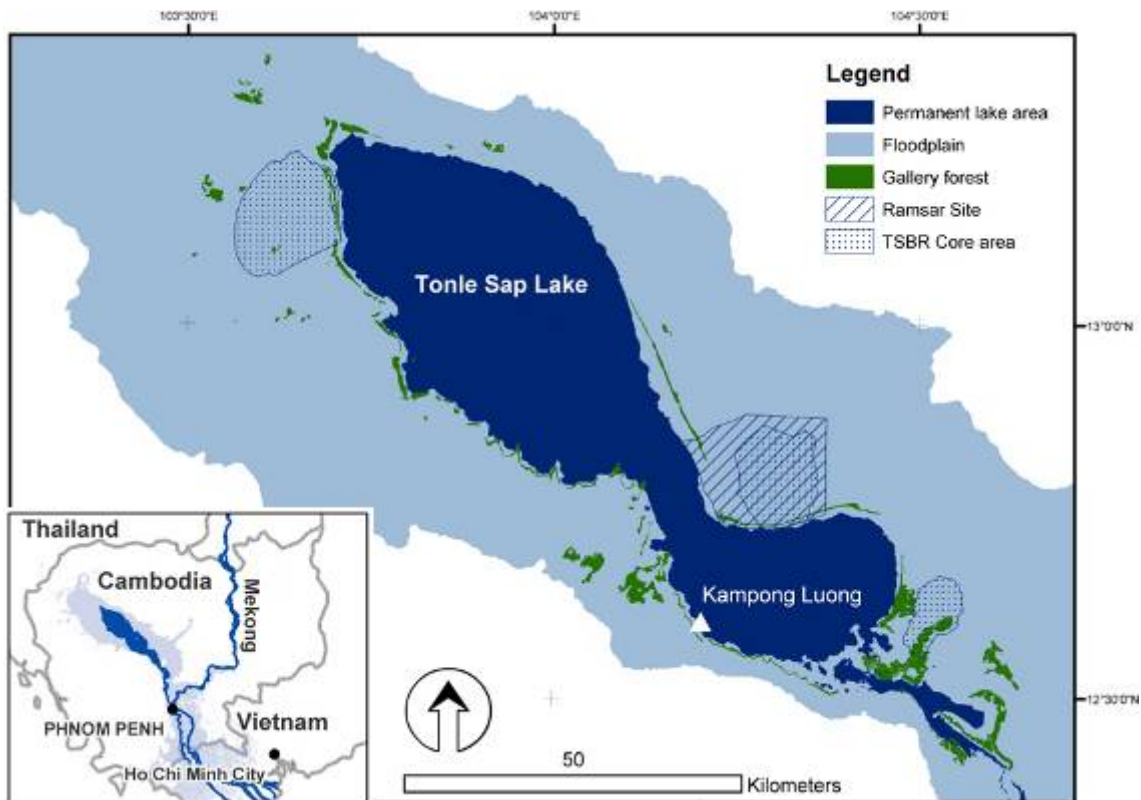


Figure 5.1. Map of Tonle Sap Lake and its location including the distribution of gallery forest and the protected areas.

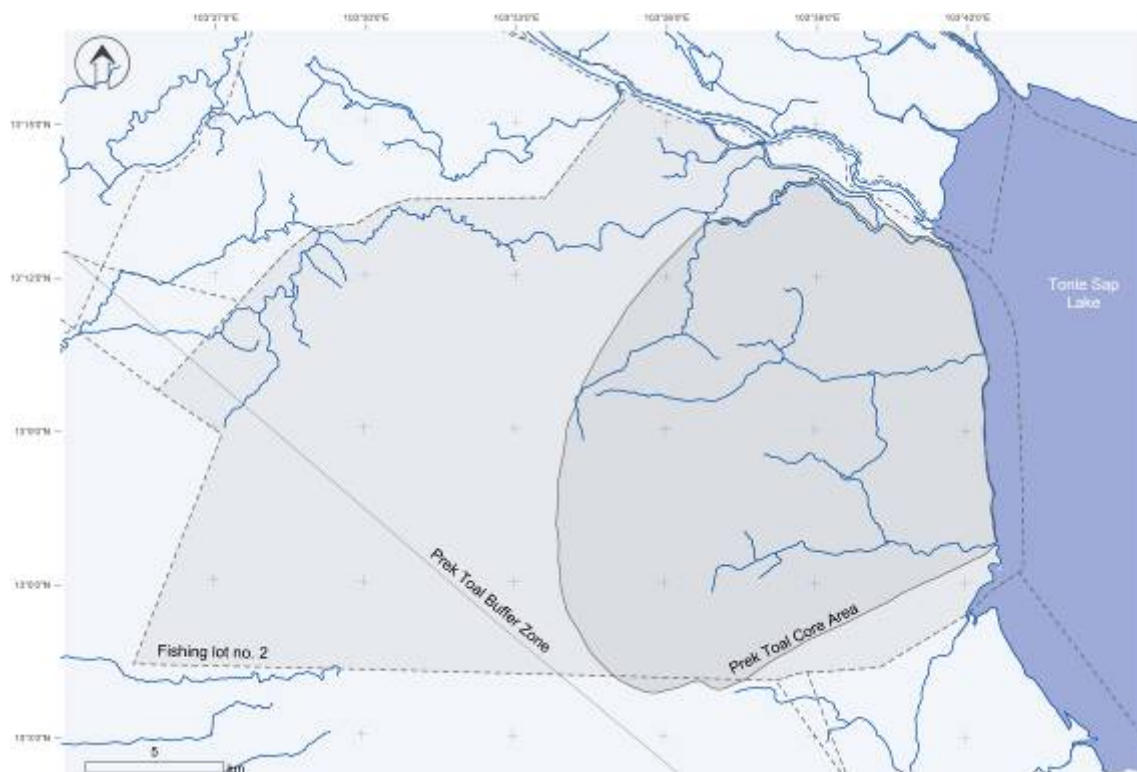


Figure 5.2. Map of the Fishing Lot 2 and Prek Toal Core Area.

5.3.1 Water balance of the lake

Water balance calculations for Tonle Sap Lake have shown that most of the inflow into the lake (57%) originates from the Mekong main stream, either by discharge through the Tonle Sap River (52%) or by overland flooding (5%) (Kummu and Sarkkula 2008). Tributaries to Tonle Sap Lake contribute about 30% and precipitation directly into the lake some 13% of inflow. The average annual inflow is 79.0 km^3 , ranging between 44.1 km^3 in 1998 and 106.5 km^3 in 2000. Around 88% of the receding lake water returns to the Mekong through the Tonle Sap River (87%) and overland flooding (1%), while 12% evaporates from the lake. The average annual outflow is 78.6 km^3 , ranging from 43.5 km^3 in 1998 to 104.8 km^3 in 2000.

The flow in the Mekong River is, therefore, the principal factor determining the flood pulse of the Tonle Sap Lake. Moreover, the water level in the Mekong mainstream controls the water level in the lake and thus, should the dry season water level be higher in the Mekong due to e.g. hydropower operation rules it would have direct impact on the Tonle Sap's water level.

5.3.2 Floodplain gallery forest surrounding the permanent lake

The floodplain vegetation is one of the most important elements of the Tonle Sap ecosystem (Kummu *et al.* 2006; Lamberts 2006). Among it, the tall gallery forest stripe in the immediate vicinity of the permanent lake shore (illustrated in Figure 5.1) covers only a small part of the floodplain but it constitutes an important physical barrier between the open lake and the floodplain, creating favourable conditions for effective sedimentation within the forested zone (Kummu *et al.* 2008). In addition to the permanent lake edge and the river banks, isolated stands of trees are scattered throughout the floodplain. The bird colonies nest in these stand of trees. The total area of the gallery forest of the Tonle Sap Lake's floodplain is around 198 km^2 calculated from the landuse map created by JICA (1999). McDonald *et al.* (1997) provide more information on the gallery forest and other floodplain vegetation.

5.4 Data and Methods

The analysis here is based on the Kummu & Sarkkula study (2008). Their work has been updated and scaled down to the study area.

5.4.1 Cumulative impact assessment studies

Due to the considerable variety and ambiguity of different development plans, the prediction of cumulative impacts of on-going and planned development is extremely challenging. For example, existing cumulative impacts assessment (CIA) studies focusing on flow changes have applied different approaches, and used different values, and therefore provide different estimates of the potential changes in flow. Three different CIA studies have been used in the analyses:

- CIA 1: The Mekong River Commission (MRC) has compiled a basin wide CIA under the Integrated Basin Flow Management (IBFM) project by using Decision Support Framework (DSF) modelling tools (World Bank 2004)
- CIA 2: The Asian Development Bank (ADB) conducted a basin wide CIA within the Nam Thuon 2 environmental impact assessment study (ADB 2004)

- CIA 3: Adamson (2007) compiled analyses of the downstream hydrological impact of the Chinese cascade of dams

The results of the above mentioned CIAs are used to analyze the flow alteration due to upstream development and its impacts on the Tonle Sap flood pulse. The summary of the CIA studies is presented in Table 5.1 and each CIA and its background has been briefly summarized below.

Table 5.1. Summary of the flow alteration according to the CIA studies.

	CIA 1	CIA 2	CIA 3
Basic assumptions and methods			
Increased storage in the Mekong Basin	49.5 km ³	54.9 km ³	22.7 km ³ *
Increased irrigation	+ 53%	–	–
Other development activities taken into account	Increased domestic and industrial use of water, and basin diversions	Increased domestic and industrial use of water	–
Method used to estimate the development impact on flow alterations	Hydrological and hydrodynamic model	Water balance and hydrodynamic model	Statistical analysis
Flow alteration impacts on Tonle Sap water levels			
Wet season water level	- 0.36 m	- 0.54 m	N/A
Dry season water level	+ 0.15 m	+0.60 m	+ 0.30 m

* Only reservoirs planned to be constructed in China are considered

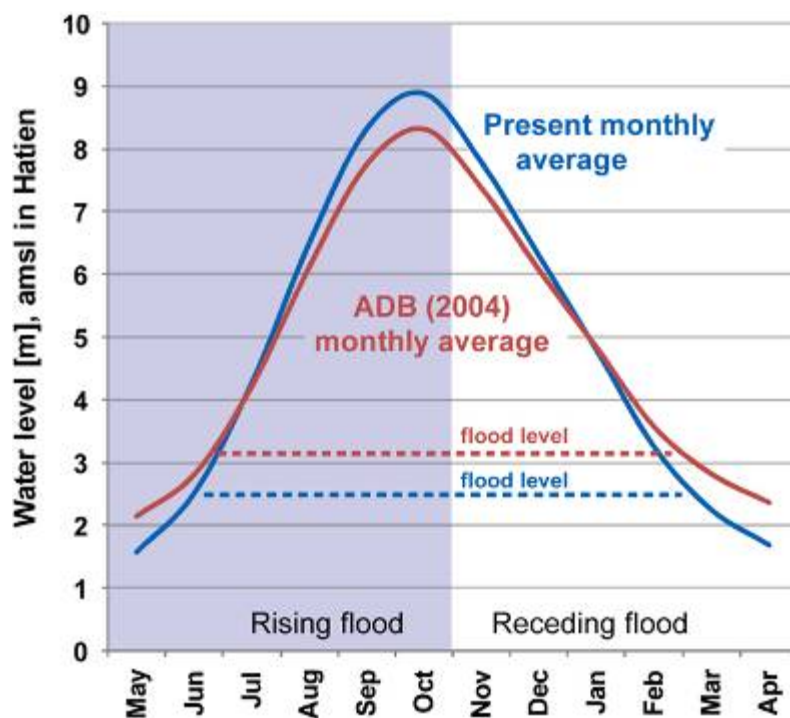


Figure 5.3. Change in yearly hydrograph due to the upstream development, based on ADB (ADB 2004) results.

5.4.2 Updated development plans

The existing CIAs are based on the old development plans, particularly the outcomes of the hydropower development plans. The used increased in the storage capacity in the CIAs is 22.7 – 54.9 km² while based on the updated plans the increased storage capacity could be more than 75 km³. The recent plans are illustrated in the figures below (Figure 5.4 and Figure 5.5). Therefore, the dry season water level rise of 0.9 m is used as one of the estimated water levels to correspond the increased development activities.

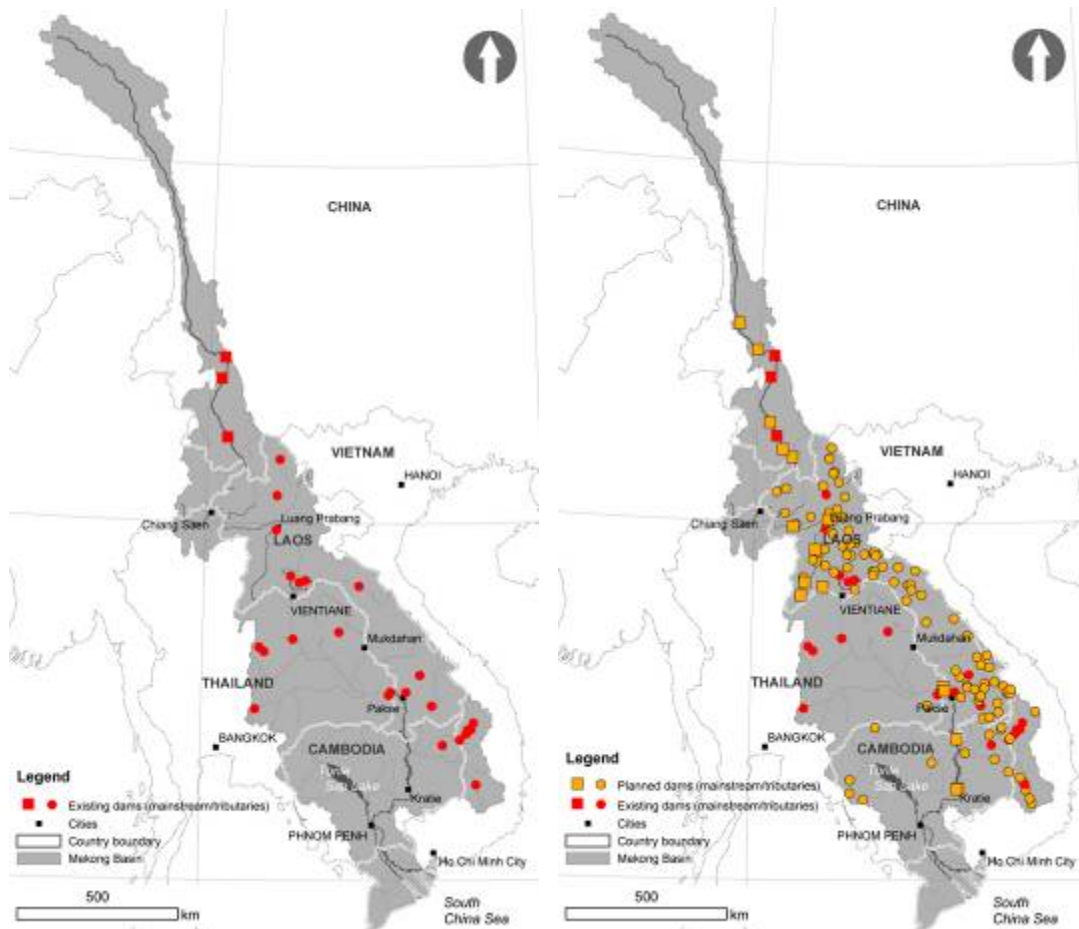


Figure 5.4. Existing dams (left) and planned dams (right) in the Mekong Basin.

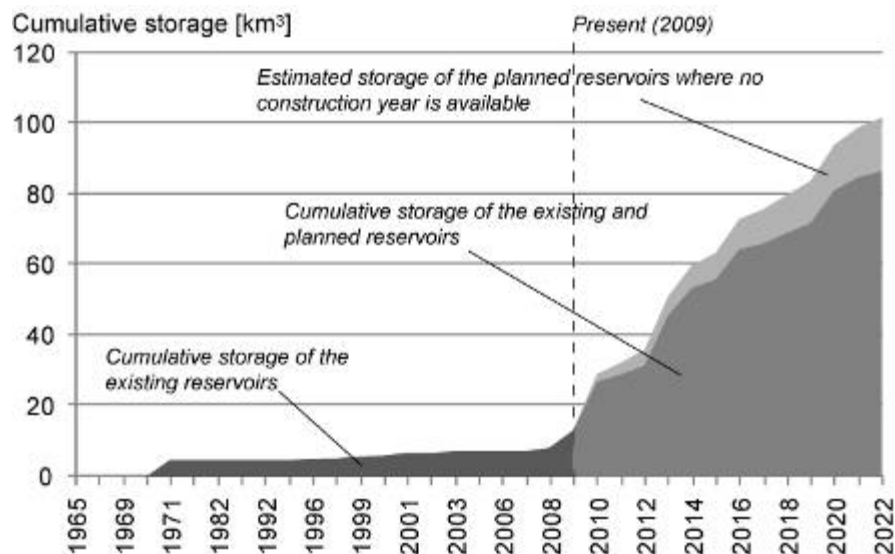


Figure 5.5. Estimated cumulative storage of the existing and planned reservoirs.

5.4.3 Spatial data

The available land use, bathymetric and elevation data, as well as other related spatial datasets are used for GIS analysis to assess the impacts of flow alteration on the flooded area, including gallery forest, and protected areas in the floodplain.

The following GIS data have been used for the spatial analysis:

- The digital bathymetry model (DBM) for Tonle Sap Lake, Tonle Sap River and their floodplains is based on the combined datasets of the Certeza survey (Certeza Surveying 1964) of the Tonle Sap floodplain, and the Mekong River Commission Hydrographic Atlas for the lake proper and Tonle Sap River (Mekong River Commission 1999)
- Land use data around the Tonle Sap, from which here only the gallery forest layer is used, were compiled by JICA (JICA 1999)
- Protected areas; the location of Tonle Sap Biosphere Reserve is based on the data provided by WCS.
- Fishing lot boundaries data was provided by WCS
- The data for bird trees, bird colonies and crocodiles was provided by WCS

5.4.4 Methods used for assessment of the flow alteration changes on flooded area, gallery forest and protective areas

With the GIS data listed above, by using ESRI's ArcGIS 9.2 software and its extensions, the assessment of impacts caused by flow alteration on the flooded area - gallery forest and protected areas - was achieved. The inundated areas were first analyzed for each estimated future water level by using the DBM constructed for the Tonle Sap Lake and its floodplain (see Figure 5.6). This resulted in polygons of inundated areas. The inundated areas were then mapped and their extent was calculated by using the polygons. Thereafter the areas of gallery forest, bird colonies, bird trees, and crocodile locations inundated due to the increased dry season water level were mapped. The same was done with the location of the Prek Toal core area itself and fishing lot 2.

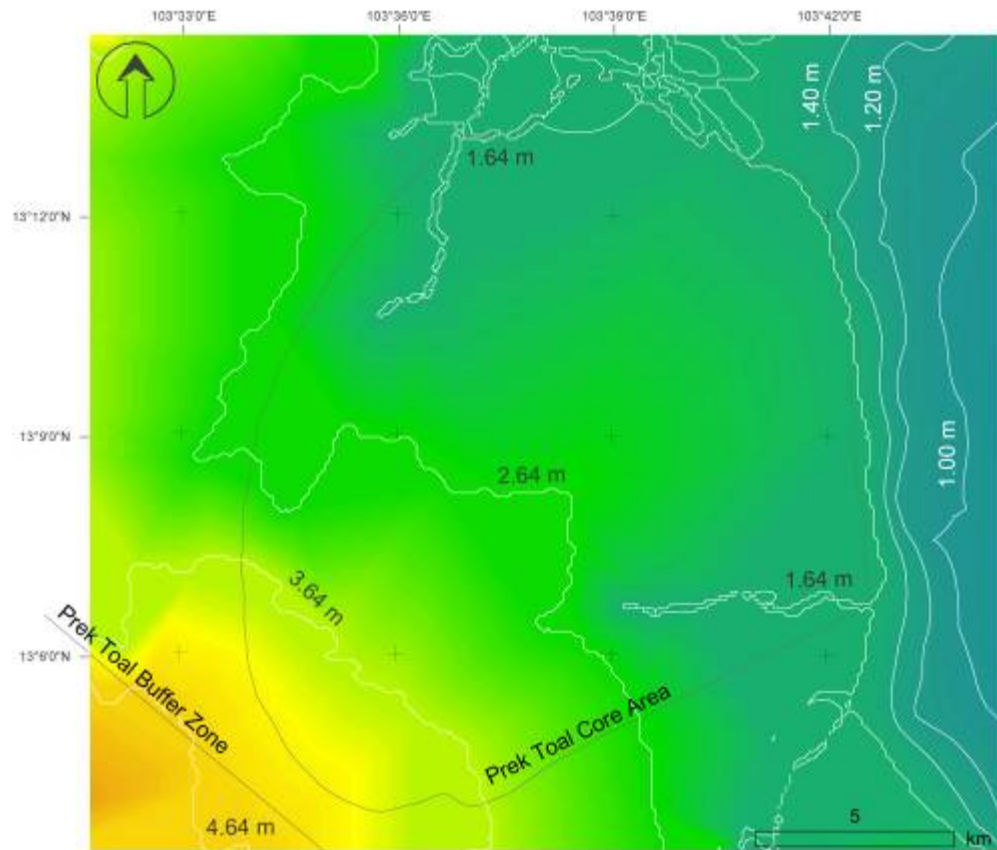


Figure 5.6. Digital bathymetry map for the study area.

5.5 Results

The results of the spatial analysis are presented for each analysed parameter.

5.5.1 Flow alteration impacts on flooded area

The results of the spatial analysis illustrate how the increased dry season WL would impact the permanently inundated area (Figure 5.7 and Figure 5.8). The average 30-day minimum water level during the analysis period of 1997-2006 was 1.44 m AMSL and has been used as a reference level for the dry season water level.

The lake area corresponding to the water level of 1.44 m AMSL is approximately 2,300 km². Rises of 0.15 m, 0.3 m, 0.6 m and 0.9 m, representing each estimated future dry season water level, would result a permanent lake area of 2,560 km², 3,107 km², 3,345 km², and 3,504 km² respectively. Thus, the permanent lake area would increase between 260 and 1,204 km² (11%-52%).

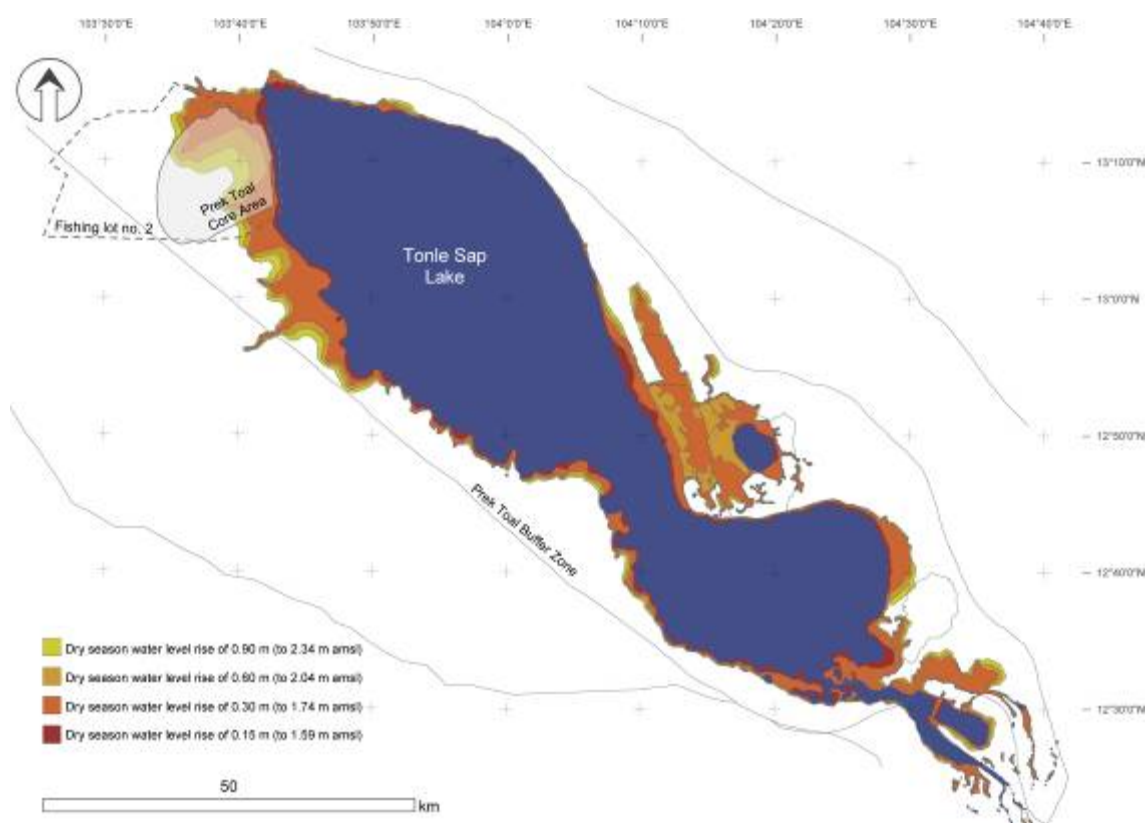


Figure 5.7. Inundated areas due to increased dry season water level illustrated with the study area.

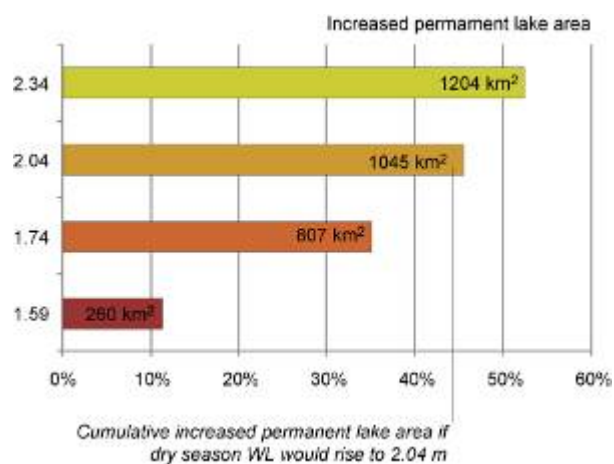


Figure 5.8. Cumulative increased permanent lake area under each analysed dry season water level rise.

5.5.2 Flow alteration impacts on gallery forest

The predicted dry season water level rise of 0.15-0.90 m would mean permanent inundation of large areas of gallery forest stripes located in the vicinity of the lake shore (illustrated in Figure 5.9). This significant reduction, and with the 0.60 m dry season water level rise close to total extinction of the gallery forest stripes along the lake proper could have a significant impact on the entire Tonle Sap ecosystem. Around Prek Toal the water level rise of 0.30 cm would submerge already major part of the forest stripe (Figure 5.9). The statistics for the submerged flooded gallery forest are presented in Figure 5.10. The total area of the gallery forest is 197 km² JICA (1999).

However, around half of the forest is located upper in the floodplain as can be seen in Figure 5.9.

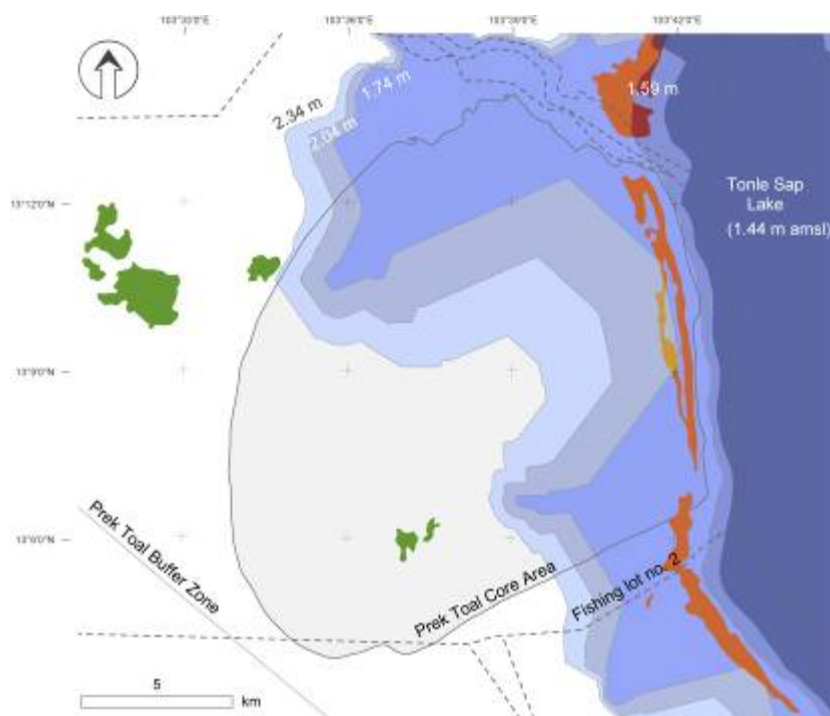


Figure 5.9. Impacted gallery forest areas under each analysed dry season water level rise. The colours of the gallery forest represent forested areas that would be permanently submerged given different water level increases, correlating to Figure 5.10.

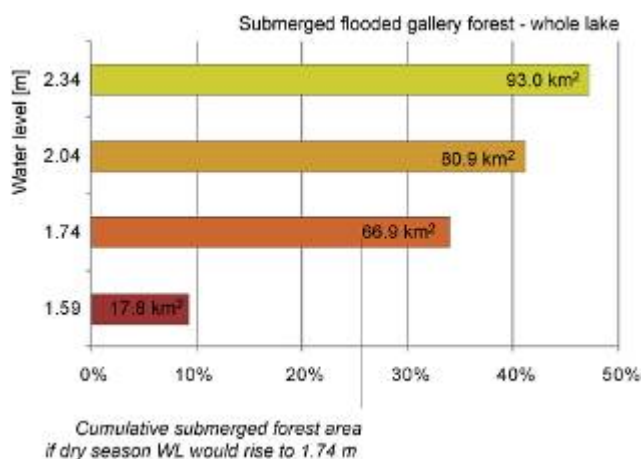


Figure 5.10. Cumulative impacted gallery forest areas around the Tonle Sap Lake under each analysed dry season water level rise.

5.5.3 Flow alteration impacts on Fishing Lot 2 and Prek Toal Core Area

The increased dry season water level impacts on the fishing lot 2 are presented below (Figure 5.11 and Figure 5.12). The total area of the fishing lot is 501.3 km². The increased dry season water level impacts on the Prek Toal Core area are presented below (Figure 5.11 and Figure 5.13). The total area of the core area is 213.4 km².

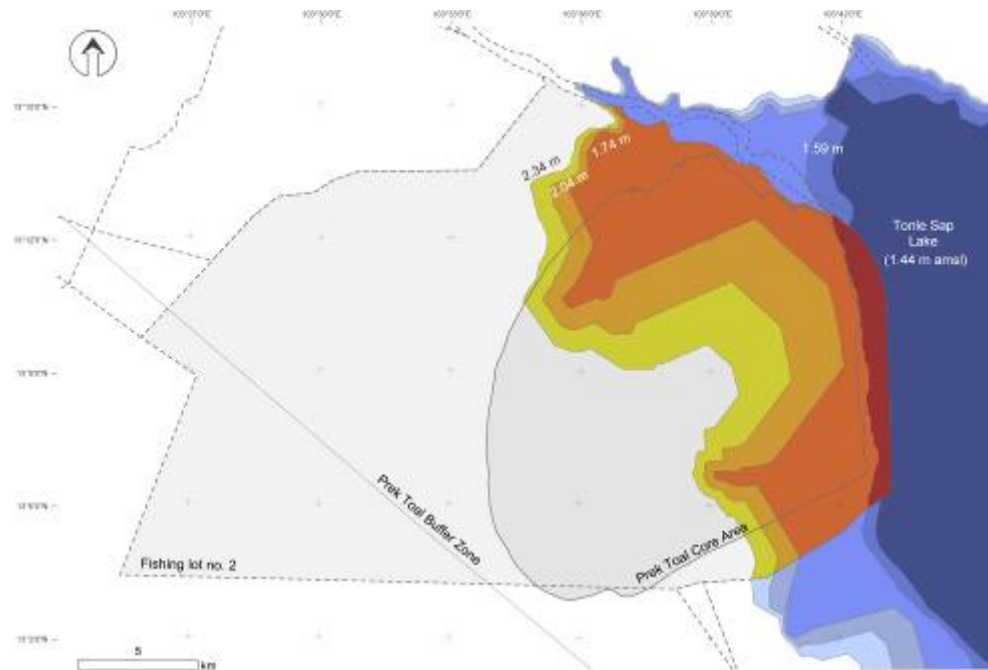


Figure 5.11. Impacted Fishing Lot.2 areas due to the analysed increased dry season water levels.

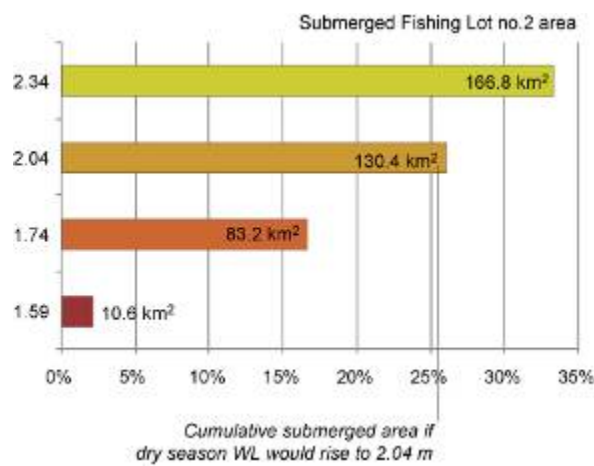


Figure 5.12. Cumulative impacted areas of Fishing Lot 2 due to the analysed increased dry season water levels.

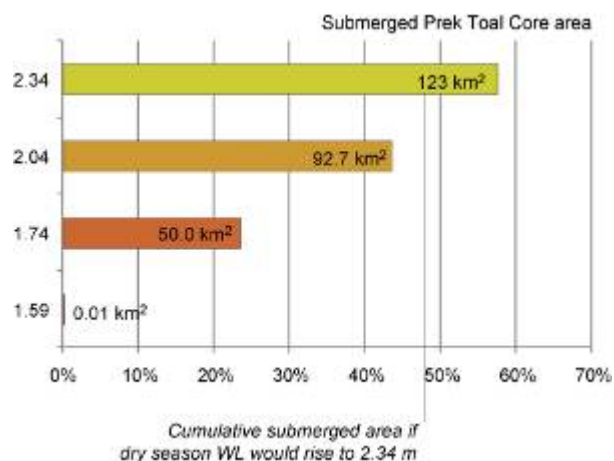


Figure 5.13. Cumulative impacted areas of the Prek Toal Core area due to the analysed increased dry season water levels.

5.5.4 Flow alteration impacts bird colonies

The increased dry season water level impacts on the bird colonies in the Prek Toal Core area are presented below (Figure 5.14 and Figure 5.15). The total dissolved area of the bird colonies is 29.8 km². The impact of dry season water level rise would have significant impact on the bird colonies on levels 2.04 m and 2.34 m amsl.

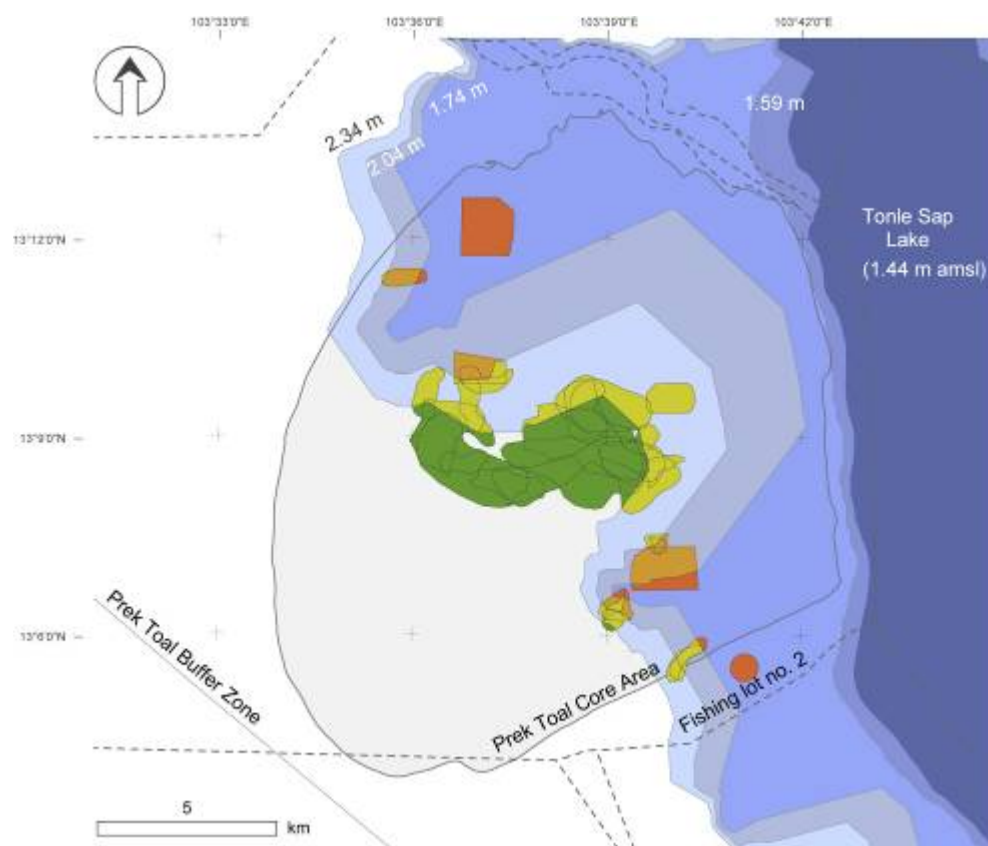


Figure 5.14. Impacted parts of the bird colonies in the Prek Toal Core area due to the analysed increased dry season water levels.

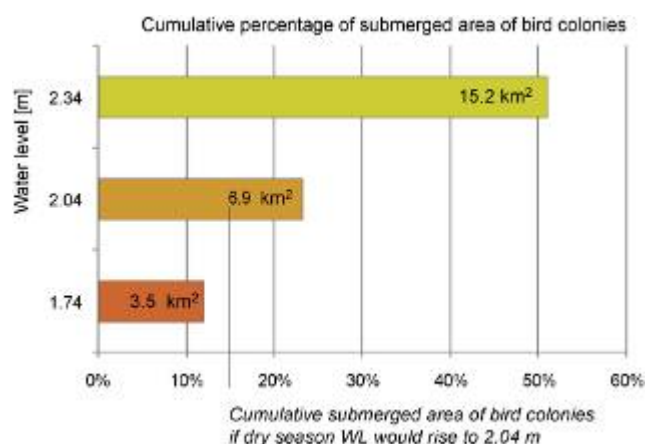


Figure 5.15. Cumulative impacted areas of the bird colonies in the Prek Toal Core area due to the analysed increased dry season water levels.

5.5.5 Flow alteration impacts on occupied bird trees

The increased dry season water level impacts on the occupied bird trees (trees where birds have nested in at least one year 2004-2008) in the Prek Toal Core area are presented below (Figure 5.16). The total number of trees was 2088. In the second part the datasets were handled separately for each individual bird species. Dry season water level rise to level of 2.34 m amsl would have very significant impact on the trees (over 40% submerged) while with lower water levels the impact is much smaller.

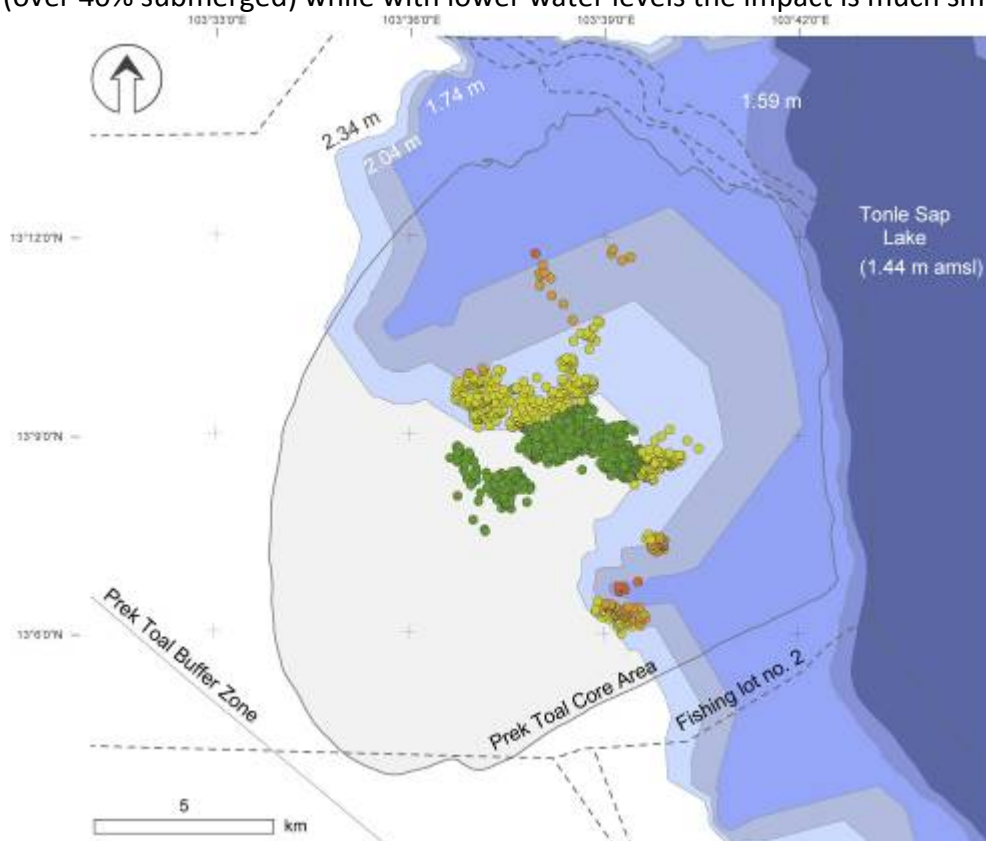


Figure 5.16. Impacted parts of the bird colonies in the Prek Toal Core area due to the analysed increased dry season water levels.

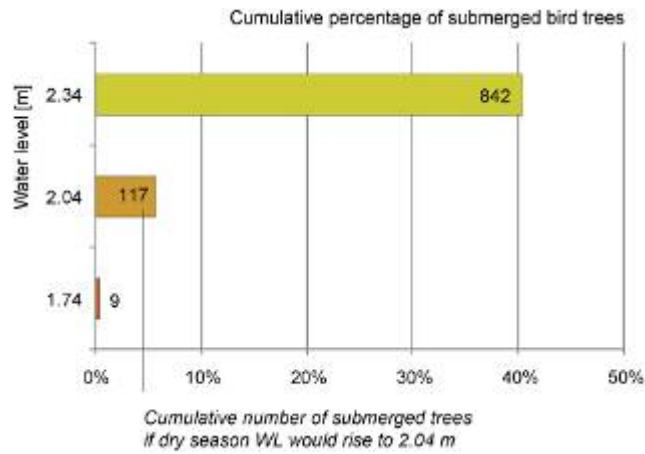


Figure 5.17. Cumulative impacted areas of the bird colonies in the Prek Toal Core area due to the analysed increased dry season water levels.

The increased dry season water level impacts on the individual bird species in the Prek Toal Core area are presented below (Figure 5.18). For most of the species only an increase of 0.9 m (to level of 2.34 m amsl) would mean significant impact. Only Lesser Adjutants would be significantly impacted if the water level would increase to level of 2.04 m amsl.

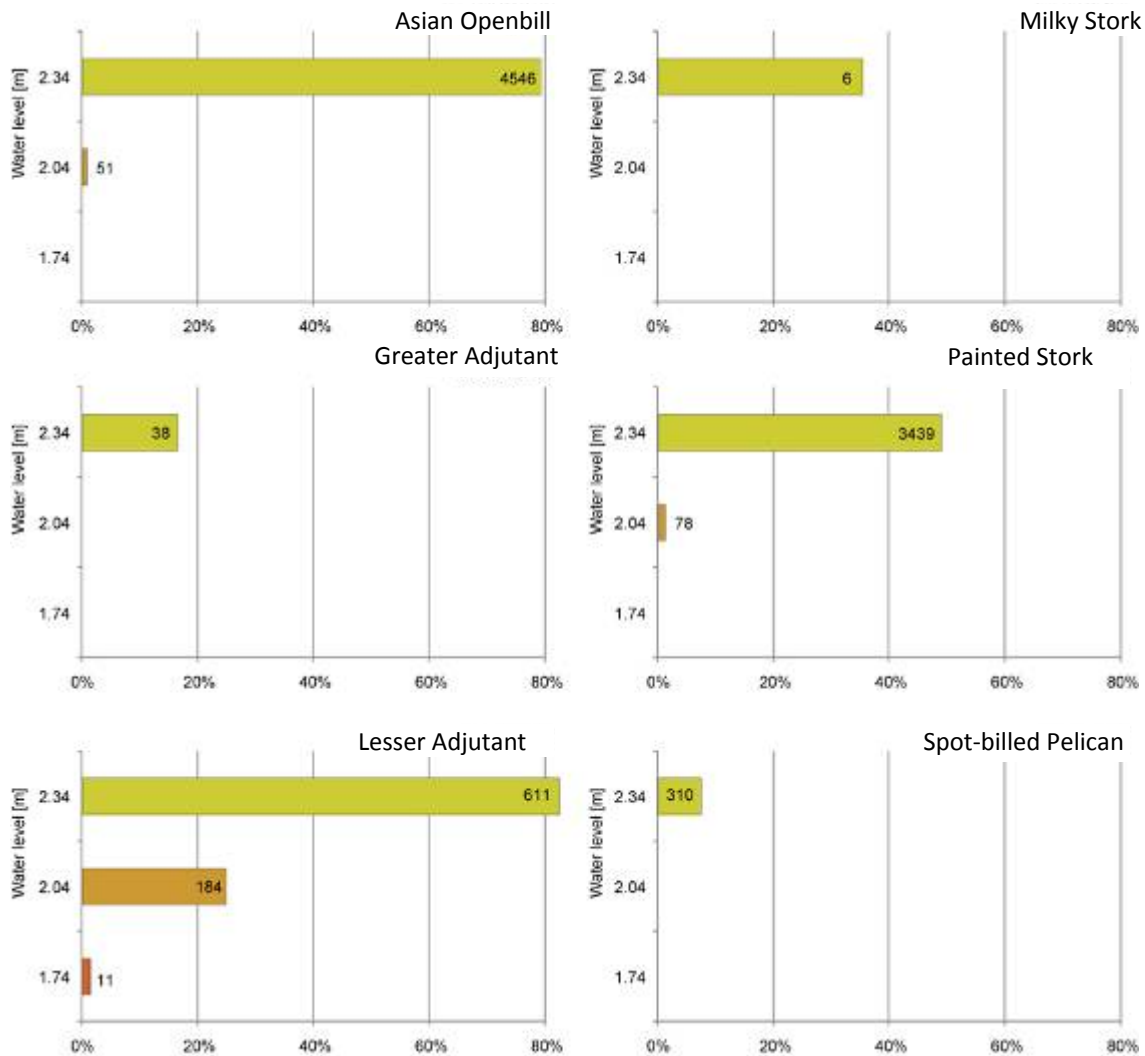


Figure 5.18. Cumulative percentage of impacted individual bird species in the Prek Toal Core area due to the analysed increased dry season water levels.

5.5.6 Flow alteration impacts on crocodiles

The increased dry season water level impacts on the observed crocodiles in the Prek Toal Core area are presented below (Figure 5.19 and Figure 5.20). The total number of observed crocodile locations was 186. It should be noted, that crocodiles spent a lot of time in deeper ponds in the dry vegetation areas.

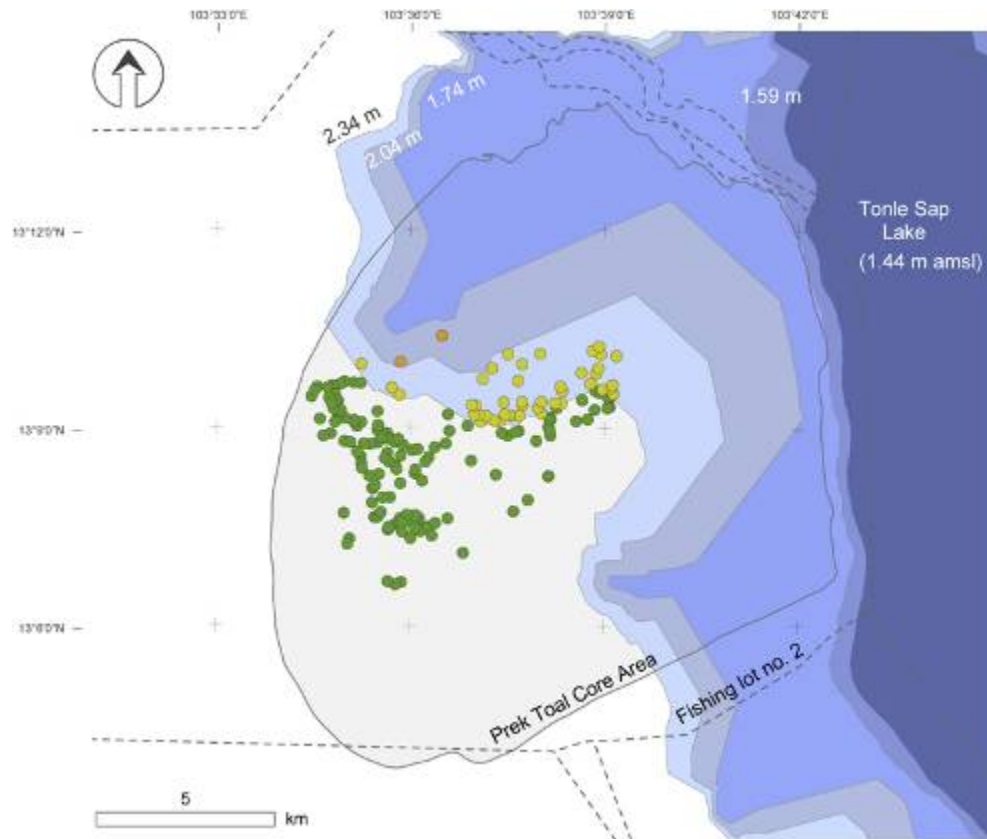


Figure 5.19. Impacted observed crocodiles in the Prek Toal Core area due to the analysed increased dry season water levels.

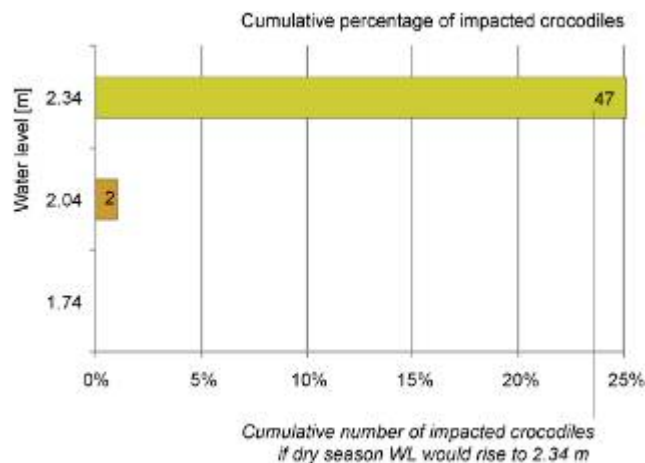


Figure 5.20. Cumulative percentage of impacted crocodiles in the Prek Toal Core area due to the analysed increased dry season water levels.

5.6 Discussion

Here the data and assumptions in it are discussed. Further, the possible role of climate change in Tonle Sap future water levels is briefly discussed highlighting the importance of looking at all the change factors (climate change, upstream development and local development) together in a cumulative impact assessment. Finally, the results of this study are reflected to the proposed conservations.

5.6.1 Data

The present water level analysis is based on observed data from the Tonle Sap Lake. The quality of these data has been checked but still there is the possibility of some inaccuracy as only one measurement site has been used in a large lake. During periods of with strong winds the water level might differ significantly from one end of the lake to the other. However, this does not seem to be a major source of error since the wind velocities are normally relatively low and strong wind events last only a few hours (MRCS/WUP-FIN 2003).

The flooded area analysis is based on the bathymetry data collected on 1960's by Certeza survey company (Certeza Surveying 1964). Even though the data used are rather old, their accuracy has been tested and reaffirmed during the MRC/WUP-FIN project (MRCS/WUP-FIN 2003) and it is generally agreed that it is the best data-set available. The Prek Toal area is, however, extremely flat and therefore the results are subject to the errors due to the local variations in the elevation. For more reliable results, a detail bathymetry survey should be done in the Prek Toal Core area.

The flow alterations predicted by the CIAs have similar trends in each of the studies, but the magnitude of the predicted changes in the Tonle Sap hydrograph differs considerably between the scenarios. This is due to the different methods and assumptions used in each CIA. There are also many uncertainties in the CIAs, e.g. in the scenario definition, and assumptions involved in the modelling and analysis. Due to the different scenarios used in each CIA, the results cannot be directly compared with each other. Thus, since part of the analysis presented in this paper is based on the CIA studies, the results are subject to the possible inaccuracies in the source data.

5.6.2 Climate change and cumulative impact assessment

Various studies highlight the importance of the future climate change impacts on the precipitation by intensifying the monsoon rains and thus, leading to increased flooding in Southeast Asia (e.g. Bhaskaran and Mitchell 1998; Degen *et al.* 2000), especially after 2030 (Degen *et al.* 2000), and particularly in the Mekong (Falloon and Betts 2006; Penny 2008). The most recent study by TTK and SEA (2009) concluded that Tonle Sap dry season water level would increase due to the simulated climate change scenarios.

Therefore, the cumulative impact assessment would be required, where direct human development impact (reservoirs, irrigation, etc) is modelled together with the predicted climate change impacts on precipitation and temperature. This work is undergoing but no results yet are available.

One should also remember that time spans of the events are different: the time span in climate change studies is normally several decades while in the foreseen direct basin development it is only 10-20 years (TTK and SEA START RC 2009). That should be taken into account when comparing, or combining, the different impacts. A global analysis of the potential effect of climate change on river basins indicates that rivers impacted by dams or extensive development will require more management interventions to protect ecosystems and people than basins with free flowing rivers (Palmer *et al.* 2007).

5.6.3 Proposed Prek Toal Sanctuary

There are two options presented for the Prek Toal Sanctuary (proposed conservation areas 1 and 2, Figure 5.21). The option 1 is almost entirely outside the possibly impacted area of the simulated inundated areas and only increased dry season level 0.9 m would have significant impact on the area. The option contains larger area and thus, would be heavier impacted due to the possible changes in the inundation areas.

The option A includes all the locations where crocodiles have been observed and excludes only around 10 occupied bird trees out of over 2000 (Figure 5.21). The option 2 would include most of these trees but still would exclude few occupied trees.

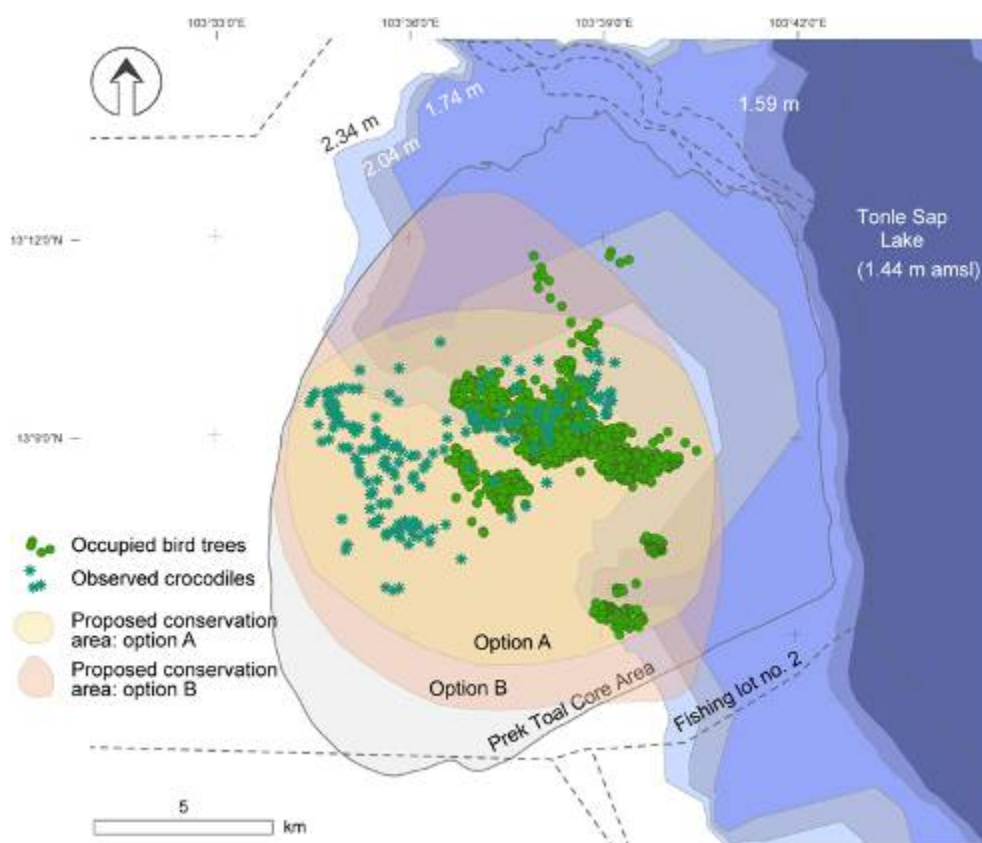


Figure 5.21. Proposed conservations areas plotted together with simulated inundated areas due to increased dry season water level due to development plans.

The observed crocodiles and occupied bird trees are also presented.

5.7 Conclusions

The recent cumulative impact assessment studies of the Mekong Basin are consistent in saying that increased development activities, especially construction of hydropower dams and reservoirs, large irrigation schemes and rapid urban development, will result in higher dry season water levels and lower flood peaks. This study aimed to assess the impacts of these predicted flow alterations, and particularly the increased dry season water level, on the fishing lot 2 and Prek Toal Core Areas.

The flow alterations in the Mekong, due to development activities in the upstream countries, would increase the dry season water level significantly. Four estimated dry

season water levels were analysed here: 0.15 m, 0.3 m, 0.6 m and 0.9 m increase on the current average dry season water level.

Relatively small rises in the dry season lake water level would permanently inundate disproportionately large areas of floodplain, particularly in the Prek Toal area. Therefore, large parts of internationally protected areas under Ramsar Convention and the Tonle Sap Biosphere Reserve Programme (under UNESCO) would also be heavily impacted due to the submersion in the lake.

The lake extension would cause permanent submersion, in essence destruction, of considerable areas of gallery forest stripe surrounding the lake in the floodplain. Thus, the trees on the shore of the present dry season lake would die if the area is flooded. This would mean loss of livelihood sources for a significant number of people, due to both loss of gallery forests per se and consequent negative effects on aquatic productivity, i.e. reduced fish catches (Keskinen *et al.* 2007). Further, large number of bird colonies and trees occupied by the birds in the Prek Toal Core area would be impacted particularly if the dry season water level would increase 0.6 m – 0.9m.

In the event of many of the bird nesting trees dying, the ability of the birds to move to new nesting sites will depend on their adaptability and the availability of those large trees further upland. Any new Sanctuary or conservation area should take into account the potential for possible future adaptability.

The regulation of the upstream hydropower dams will be probably the main cause of the flow alterations in the near foreseen future, within 10-15 years or so. Other important actors are the land cover changes and irrigation schemes. Climate change may play an equally important role from the 2040-2050 on according to the latest climate models and basin wide simulations. Integrated, cross-boundary planning, involving both downstream and upstream countries and cumulative impact assessment, is urgently required to minimize the impacts of the flow alteration on the nature and consequently on the people.

6. Comparison between outcomes under the proposed Prek Toal Sanctuary and alternative management regimes

By Wildlife Conservation Society & Fisheries Administration



Photograph 6.1. Patrol staff at Lot 2/PTCA.

6.1 Introduction

This component aimed to compare outcomes under the proposed Prek Toal Sanctuary and alternative management regimes.

One of the key arguments in favour of the proposed Prek Toal Sanctuary is that it represents an efficient and effective management system, in comparison with the current alternatives – privately run fishing lots and community fisheries area. These benefits need to be properly understood in comparison with the alternatives. Under this research component comparison will be made with alternatives, especially Community Fisheries areas, focusing on (1) sustainability and maintenance of the flooded forest/scrub habitat; and (2) extent and distribution of benefits to community members.

Understanding the current limitations of different management systems for fisheries areas in the Tonle Sap is crucial to developing a pragmatic and effective management system for the short and long term conservation of wildlife and fish stocks in fishing lot 2 and Prek Toal. In order to do this, we first reviewed existing information on the fishing lots and the Community Fisheries, drawing particularly from key studies such as the Policy Reform Impact Assessment Cambodia (PRIAC) studies (DoF 2004; DoF 2006), which assessed the impacts of lot conversion to Community Fisheries in 2000. Secondly, a survey was conducted in villages from five provinces around Tonle Sap, to investigate community perceptions and reports of management systems.

6.1.1 History of the Fishing Lot system

Prior to the year 2000, approximately 80% of the floodplains surrounding the Tonle Sap were divided into a number of fishing lots – large-scale commercial concessions which were granted by the Government to private operators. This system served two principle purposes: to generate revenue for the treasury through lease fees received from the regular auctions of fishing rights; and to create a system of incentives for lease holders to manage and protect the fisheries and fisheries environment of the lot in order to ensure their long-term productivity. The incentives were generated through the very considerable financial gains which accrued to lot operators as a result of their control over these fishing lots and their production. While the lease fees paid would often be considerable, the financial benefits accruing to lease holders, even after the sometimes significant investments which they would make in protection of the lots (in the infrastructure necessary for their exploitation and, in some cases, in improvement of their productivity), were generally far greater (Degen and Nao 1998).

The extent to which these incentives actually work in achieving sustainable use of the fisheries resource is unclear. Where fishing lot operators are confident in being able to maintain long-term control over a particular lot, either through influencing the auctioning process to achieve consecutive lease periods or through lots being declared for “research” purposes (where regular auctions are not necessary), there is considerable incentive for the lot operator to protect the fisheries resource. On the other hand, where the length of tenure is unclear, fishing lot operators may have a greater incentive to extract as much benefit as they possibly can, and fishing activities

may be carried out with little regard to long-term sustainability. Given a political environment where there is considerable pressure for the abolition of all fishing lots, the incentive for lot operators to deplete the fisheries resource, while they still have control over it, is growing. In addition, even where there are incentives for the lot operators to protect resources, the same is often not true for sub-leaseholders who often have short-term, one-season leases, even where the lot operator is assured of a long-term lease. The lack of incentives may be further exaggerated for sub-sub-leaseholders, particularly those who are seasonal migrants and therefore live far away from the fishing grounds and consequently have little or no long-term interest in the long-term sustainability of the area.

Local communities on and around the Tonle Sap are heavily dependent on fish from the lake, both for their subsistence needs and for their livelihoods. In the past, the fishing lots have effectively precluded local communities from access to the area's most productive fishing grounds. Lot operators would also attempt to exert control over areas, at certain times of the year, above and beyond their contractual rights, while local fishers often intruded into fishing lot areas in an attempt to get access to some of the considerable benefits which they offer (Swift 1997). As a consequence the lot system generated growing antagonism towards the lot operators, which led to conflict with episodes of violence (Degen *et al.* 2000). Therefore, the Fisheries Policy Reforms carried out by the Royal Government of Cambodia in the late 2000 were designed to return control of 50% of the fishing lot areas to the communities and to re-designate these areas as "Community Fisheries" (community-based fisheries management organisations) to be managed for the wider benefit of local communities. The Department of Fisheries (DoF, now Fisheries Administration, FiA) of the Royal Government of Cambodia was tasked with determining which fishing lots should be abolished, and with supporting the creation of new institutional arrangements for Community Fisheries. This included the necessary changes to the legislative framework within which Community Fisheries would operate.

6.1.2 Community Fisheries Areas

The impact of the deregulation of the fishing lots has been analysed through a series of assessments (DoF 2004; DoF 2006) conducted by the DoF/FiA in conjunction with civil society¹². The immediate easier access to the rich fisheries resources within the abolished fishing lots was generally greeted with considerable enthusiasm by the local people who were most easily able to take advantage. Obviously, there was less enthusiasm among lot operators, who lost the very sizeable profits which the lots generated, and the sometimes very sizeable numbers of sub-lessees, their employees and the service providers that worked with them, who lost out on a relatively secure source of employment and income. Very significantly, in many areas, there was an impression that the staff of the DoF, at the Provincial level in particular, were "de-legitimised" by the policy reforms as they were often perceived as being "allies" of the wealthier lot operators and less concerned or supportive of small-scale operators.

¹² During the 2° round of the PRIAC assessments, CFiDO worked together with Oxfam GB in conducting the assessments in the field.

However, the combination of a significant increase in fishing effort, lack of controls by Fisheries Officers and law enforcement agencies to ensure that fishing was carried out in a responsible and sustainable way, and lack of a well-defined institutional and legal framework for the new Community Fisheries areas quickly led to a dissipation of these immediate benefits. Illegal and destructive fishing methods became widespread and communities which were supposed to have taken control of these newly opened fishing areas often found themselves continuing to be excluded by powerful elites and vested interests (including ex-lot operators). Whereas under the lot management system the fishing lot operator was presumed to have significant incentives to protect the fisheries resource (although see (Troeung 2001) for study showing 30% forest cover lost in Battambang fishing lots, 1965 – 1992), and the flooded forest and scrub habitats the fish are dependent on, these incentives were largely absent in the “open-access” community fisheries system that replaced the lots. Moreover, community fisheries organisations were generally politically weak and lacked capacity and investment capital to properly engage in protection and management activities. Consequently, the removal of the fishing lot management structure has led to widespread conversion of many of the remaining lowland and flooded forest/scrub areas inside these lots for rice cultivation during the dry season (DoF 2004). While the reforms were intended to improve access to fisheries resources, they therefore ended up leading to a significant reduction of those resources and an increase instead to land resources.

With the finalisation of the Sub-decree governing Community Fisheries (2005) and the clarification of the roles and responsibilities surrounding them, efforts to effectively manage these newly released areas are beginning to improve, in some areas, although evidence is patchy. Some features of the legislative framework governing Community Fisheries remain to be perfected and effective implementation of the law is a great challenge. Many studies looking at community fisheries management in the country have indicated that the very agencies that should be responsible for enforcement of the law are often among the worst violators. There is considerable work still to be done in order to enable local communities to sustainably manage their fisheries resources. Concern is growing that the pressure on key habitats, notably the flooded forest, in Cambodia is so intense, with rising population, increasing demand for land and resources, and rapid economic growth, that the lack of strong incentives for strict management may well mean that community resource management may have difficulty in achieving its long term management aims.

6.2 Methods

In order to evaluate differences in management systems of both commercial fishing lots and Community Fisheries around the Tonle Sap Lake (as well as in the immediate study area), a survey was conducted in 16 villages from the provinces of Battambang, Siem Reap, Kampong Thom, Kampong Chhnang and Pursat, focusing on villages near Community Fisheries (CFi) areas converted in 2000 and/or near existing commercial fishing lots. This included the five floating study villages and an additional 11 villages. In each village, group discussions were conducted to ask questions on: 1) Sustainability and maintenance of the flooded forest/scrub habitat; and 2) Extent and distribution of benefits to community members. In addition, efforts were made to understand why

differences in these factors occurred under different management regimes. This information was used to infer likely impacts of changes to Prek Toal and lot 2 management. In each village, three group discussions were held (detailed below), to discuss different aspects of management, and then details were followed up with key informant interviews.

6.2.1.1 Seasonality

In order to understand how livelihoods, management and law enforcement change during the year, a focus group was conducted examining changes in resource use, law enforcement and resource access during the year. A chart was drawn on a large piece of paper, with a column for each month. Group participants were then asked to describe, and then draw, how the situation changed from month to month under various categories, including: access to fishing lots; law enforcement in fishing lots, CFI areas and Public Access (PA) areas, (including which authorities conducted law enforcement activities, how often, and details of any fines); fishing gear used and the approximate income earned per gear; general food security (i.e. when is food/income most plentiful, and when in short supply).

6.2.1.2 Timeline

A chart was drawn on a large piece of paper, with headings for different years (1999 – 2009). Participants were asked to describe, and then quantitatively draw (with circles of different sizes), changes in local resource use and management. This was done under the following categories: local and migrant human populations; amount and type of each fishing gear; fish catch per person or family; law enforcement for different areas and fishing gear; the authorities conducting that law enforcement; changes in forest area or degradation; other changes in wildlife; changes in general well-being (including the ability of the poor to feed their families). For each category, questions were asked on why those changes had occurred, and how it had affected the villagers. Any issues that arose were followed up with individual interviews.

6.2.1.3 Natural resource use map

Villagers were asked to draw a resource use map showing current forested areas, agricultural areas, access routes, settlements, fishing lots, community fishing areas, and other areas. Discussions were then held about each area, to ascertain who uses each area and why (each season); who manages each area (each season); what fishing gear is used there (each season); any changes in forested/agricultural land areas over the last 10 years, and why did those changes occurred; and any changes to the fishing areas.

In addition to these group discussions, a number of interviews were conducted in each village with members of the Community Fisheries Committee, fishers, lot leaseholders/sub-leaseholders and/or lot workers.

6.3 Results

Throughout the discussions and interviews respondents were asked about differences in management of different fishing zones, namely Fishing Lots (FL), Community

Fisheries (CFi) areas, and Public Access (PA) areas. During these exercises, a number of recurring issues emerged. These are listed here, and then discussed in detail below.

- 1) Widespread perceived degradation of fish stocks in CFi & FL
- 2) Widespread perceived lost in forest area, particularly in CFi, due to:
 - a. Clearing or burning for agriculture (CFi), particularly by uplands migrants;
 - b. Clearing for fishing gears and fishing access (FL);
 - c. Burning to drive out and capture wildlife (FL & CFi)
 - d. Accidental fire (all areas, but particularly CFi areas)
- 3) Lack of knowledge of FL and CFi boundaries
- 4) Loss of access to Public Access areas due to changes in lot boundaries and regulation of access routes by lot operators
- 5) Lack of knowledge of Law on Fisheries and lot burden books
- 6) Widespread illegal fishing
- 7) Large number of unofficial fishing fees
- 8) Large variation in CFi management and quality
- 9) Local communities often excluded from lots

6.3.1 Widespread perceived degradation of natural resources

All villages reported reductions in fish catches in all fishing zones over the last ten years, although all villagers said that there was more fish in the fishing lots than in Community Fisheries areas. In addition, fishers reported smaller fish sizes, and an absence of larger species that were previously present. Two sub-lessees also reported that they were now harvesting and selling small fish that they would previously have discarded.

All villages reported reductions in forested area, and/or degradation of forest in fishing lots and Community Fisheries areas, although loss was perceived as greatest in CFi areas. Reasons for reduction in forest area included:

- Clearing or burning for agriculture, particularly by uplands migrants (CFi);
- Clearing during dry season for fishing gears such as *bors* and *norals* in wet season (FL, including lot 2);
- Clearing for fishing access (FL, including lot 2);
- Burning to drive out and capture wildlife such as crocodiles or turtles (FL, including lot 2)
- Accidental fire (all areas, but particularly CFi areas)

6.3.2 Decreasing fisheries access and the need for increased community knowledge of fisheries rights and capacity to manage fisheries areas

Many participants reported unofficial expansion of FL boundaries into public access areas over the last 10 years, including expansion of the lakeside Battambang lot 1 and expansion of the Battambang lot 2 uplands boundary so that some ponds that were previous public ponds were now privately leased. In addition, access routes that had previously been allowed were no longer open. This included access routes specified in

the burden book for lot 2 from Prek Kantiel and Thvang villages to public access ponds in the uplands areas: these routes had been accessible over 10 years ago, but local villagers were no longer allowed, greatly adding to transport costs.

Villagers were often very unsure of their legal rights over access to fisheries and the legality of different fishing gears. In particular, many villagers and even some CFI committees were unsure of exactly where CFI and FL boundaries were, often lacking maps detailing fishing areas. This was reported to have contributed to disputes between villagers, lot operators and staff, and local authorities over fisheries access. In addition, there was often some confusion over the official dates of the open and closed seasons – dates were currently set by the lot operators but varied between lots and between years. On further examination, it is not particularly, and different lots often detail different dates in the Burden book laws.

No villages had copies of the burden books and Law on Fisheries, and so were unsure of both the fishing area boundaries and dates (see above) but also other access and gear information, such as what fishing gear was officially legal.

6.3.3 Widespread illegal activity

Illegal fishing was reported in all FL, CFI and PA areas, particularly increasing since 2005. All fishing lots were reported as having *bors*, pumping and electro-fishing. All CFI areas were reported as having *bors*, and most as having electro-fishing and pumping. All PA areas, particularly the open lake, were reported as having large-scale illegal fishing, including large surrounding nets pulled by boats, spot lights, *chhnouks*, *bors*, etc. All mesh sizes observed and reported were illegally small (often less than 1cm). Illegal fishing was often reportedly done in collaboration, or directly by, local authorities, including local fisheries inspectors for PA and FL (in closed season), CFI committees and local fisheries inspectors for CFI areas, and lot operators in FL (in open season). Some fishing in Public Access fish sanctuaries by large-scale fishers in collaboration with local fisheries inspectors was also reported. The scaling up of fishing gear was reported as being particularly acute since 2005. In addition, illegal fishing in some CFI fish sanctuaries was reported, including rumours that it was done by local authorities and/or CFI committees.

6.3.4 Law Enforcement in fishing lots and Community Fisheries

The widespread illegal fishing in FL and CFI areas, whereby virtually all fishing is illegal except for the traditional gears done by the poorest families, meant that fishing was accompanied by regular and often standard “fines” levied by local authorities. Sometimes these fines were demanded in collaboration with each other, and sometimes by each authority separately. In CFI areas, money was demanded by local fisheries inspectors, military, police, CFI committees, and MoE (where overlapping with Core Areas). In FL areas during the open season, fishing was closely controlled by the lot operator, with all fees going through the operator. In FL areas during the closed season, fees were demanded by local fisheries inspectors, military, police, and MoE (where overlapping with Core Areas, including in Prek Toal), although the lot operator also kept some law enforcement activities, preventing any large-scale habitat clearance. In PA areas, fees were demanded by the local fisheries inspectors, military

and police. In addition, fees were also asked from FiA research teams operating in some “research” commercial lots.

In some cases local authorities were acting without the knowledge of regional authorities, with local fisheries inspectors leaking news of large-scale patrols whenever district authorities were visiting the village, thus allowing local fishers to lower fishing nets below the surface of the water so as to make them invisible to patrol boats.

Respondents explained in numerous villages that any new local authority in a village usually meant that an additional authority which could demand a fine. The problem was explained as being due to the fact that most local authorities (e.g. local fisheries inspectors) have to pay for the privilege of gaining their position and were not given a salary or operational costs. Consequently, they had to find their salary and costs of fuel, etc. through fishing fees. However, there was a large difference in the extent to which this was taken by local authorities, with some local fisheries inspectors seeming to work fairly well in collaboration with other local authorities (e.g. CFI committees) to fine medium gear such as *bors*, but to control more vigorously the large-scale destructive gears such as surrounding nets dragged by boats, etc. Unfortunately this was not true of authorities in all areas.

An additional comment made by many respondents was that all scaling up of fishing gear began in the fishing lots, and was then copied in Community Fisheries areas. Indeed, copying as far as possible the lot operators increased intensity of fishing gears was seen as the only way for local fishers to gain any reasonable livelihood in the face of such intense commercial fishing methods. This has led to widespread resentment against local authority law enforcement controlling medium fishing gears while large-scale destructive fishing practices continued unchecked in fishing lots.

6.3.5 Large variation in Community Fisheries management and quality

As with FiA inspectors, there was a large difference in the extent to which illegal gear was permitted in CFI areas, with some committees seeming to allow only medium-size gear (such as *bors*) but effectively preventing large-scale destructive gears such as electro-fishing and pumping. This was in contrast to other CFI committees who were actually reported to be the people doing the electro-fishing or pumping in the area (while still stopping other people from doing it). In one extreme case, one CFI area was effectively run like a commercial fishing lot by the CFI committee, local FiA staff and commune authorities, with fishing rights to all ponds sold off to private, wealthy fishers, who then prevented access by anyone else to those fishing areas, with the CFI, fisheries staff and commune leaders pocketing the money.

In addition to the large differences in CFI area management, there were also differences in the size and quality of the CFI areas, with some large villages having little or no CFI area, despite having applied for it at the relevant time. Villages such as Kbal Toal attributed the fact that they are not in control of the CFI area 5 km away from the village (but which is controlled by an uplands village 30 km away from the CFI area who demand a *dong* from Kbal Toal villagers) to local corruption.

6.3.6 Exclusion from income generating activities in fishing lots

While some fishing lots did provide paid labouring work or allow local fishing for a small fee (*dong*), in other lots, most local fishers were effectively excluded, with labourers employed from villages far away, reportedly to avoid local villagers complaining about illegal fishing gears and to act as more efficient guards. In addition, little or no processing of the fish caught inside lots was done in local villages, with most large-scale fishers taking their fish directly to large ports for sale and processing there.

6.4 Comparison of impacts under different management regimes

The widespread reported degradation of flooded forest and scrublands area and wildlife is of great concern, both to wildlife conservation and because of the negative impacts to fish production from the loss of flooded forest ecosystems. Although reductions in forest areas are reported for both commercial fishing areas and community fisheries, the most devastating losses were all reported in community fisheries, particularly by small-scale migrant farmers and large-scale commercial farmers. This reflects the lack of capacity for CFI committees to effectively manage these areas, even when forest destruction is not being perpetrated by local people. This loss of flooded forest habitats is particularly concerning due to the likely harmful impacts to fish stocks and productivity in community fisheries, which would have disturbing impacts to local community livelihoods, particularly given the very large dependence on fisheries in these villages. Consequently, conservation of flooded forest and scrubland habitat is crucial to the long-term fish production and livelihoods of local people on the Tonle Sap.

Alternative management strategies previously proposed include converting fishing lot 2 to a community fisheries zone. While this would undoubtedly lead to higher fish catches for most villages in the short term, it would also lead to a loss of labouring work, and more importantly a likely widespread decline in forested area (due to conversion to agriculture) and potentially a large decrease in fish stocks and an eventual exclusion from these areas as well, as has been reported for other CFI areas, having disastrous consequences for local biodiversity and long-term livelihoods. A Prek Toal Sanctuary, surrounded by the existing fishing lot would aim to provide protection for key fish and wildlife habitats, while the lot management would continue to protect the flooded forest around this area, thus hopefully creating a buffer around the sanctuary (see Table 6.1).

Table 6.1. Summary of impacts of proposed management changes (namely creation of PT sanctuary)

Category	Impact	Positive/negative
<i>Biodiversity</i>		
Bird colonies	Increased protection for breeding colonies as nearby ponds are protected from destructive fishing	Positive
Crocodiles	Increased protection from dry season habitats (including suspected breeding sites) as people are excluded from these areas	Positive
Forest and scrub	Increased protection inside the PT sanctuary (as no habitat destruction for fisheries access routes and gear)	Positive

6. Comparison between outcomes under PT Sanctuary and alternative management regimes

	and retained level of protection for the rest of Lot 2 (i.e. more protection than proffered by CFI areas).	
Fish	Increased protection of important nursery grounds and dry season habitats (recession ponds) within the sanctuary could act as a source to maintain high fish harvests outside of the sanctuary, potentially both in Lot 2 and in neighbouring CFI areas.	Positive
<i>Local Livelihoods</i>		
Small-scale fishers (poorest families)	Open season: no change (they are already excluded from lot 2)	Neutral
	Closed season: potentially decreased access to proposed sanctuary, at a time when they have most access to other areas. Hopefully offset by larger fish harvests due to increased fish stocks due to fish sanctuary	Neutral Short-term: Negative Long-term: Positive
Medium-scale fishers (medium wealth families)	Open season: most families are unaffected as already excluded from lot 2. The wealthier families who can afford to buy a lease in October – December would suffer potentially decreased access to proposed sanctuary. NB this is an illegal activity.	Short-term: Neutral for most HHs. Negative (small no. families only). Long-term: positive
	Closed season: potentially decreased access to proposed sanctuary, at a time when they have most access to other areas. Hopefully offset by larger fish harvests due to increased fish stocks due to fish sanctuary. NB this is an illegal activity.	Neutral/ Negative
Sub-lessees	Most sub-lessees would be unaffected. Two or three sub-leases would be unavailable for sale.	Neutral (but less leases for sale)
Lot operator	Would have less sub-leases to sell. An 8% reduction in overall fish catch.	Negative
Benefits from tourism	If accompanying proposals to encourage the distribution of funds from the CA entrance fee continue, local communities will have increased benefits from the CA. In addition, the continued increase in wildlife is likely to attract more tourists.	Positive
Benefits from conservation activities	The number of employees for the conservation project is likely to remain stable.	Neutral
Local authorities	Decreased revenue from unofficial fees levied on illegal fishing inside the proposed sanctuary.	Negative for individual local authority members. Positive for law enforcement and local management structures.
Fish processing	No likely change to fish processing in local villages, as reductions to lot 2 fish catch will impact Chong Kneas and Battambang processing.	Neutral
Fish labourers	Potential 6-8% decrease in number of labouring jobs available (if commensurate with decreases in fish harvests). Offset by encouraging lot operators to use local labour where possible.	Neutral
NTPF collection	Decreased access to PT sanctuary in closed season, (but at a time when they have access to large areas of the lot and CFI areas.	Neutral/negative
Fish traders	Local fish traders mainly trade in fish caught in CFI and PA areas, so would not be impacted by lot 2 changes.	Neutral
<i>Commercial fish catch</i>		

6. Comparison between outcomes under PT Sanctuary and alternative management regimes

Total quantity of fish harvest	Decrease of 6% expected. Future offsets by increase in harvests due to fish sanctuary.	Short-term: Negative Long-term: Positive
Total value of fish harvest	Decrease of 8% expected. Future offsets by increase in harvests due to fish sanctuary.	Short-term: Negative Long-term: Positive

7. Recommendations for the future management of Battambang Fishing Lot 2 and Prek Toal Core Area

By Wildlife Conservation Society & Fisheries Administration



Photograph 7.1. Birds on Lot 2 fence.

A number of key recommendations have emerged throughout this report, and are presented below.

7.1 Establishment of a Prek Toal Sanctuary in Lot 2

The new model is based on the observations that the areas of global conservation priority (the water bird colonies and Siamese crocodile habitats) are concentrated in the centre of the Prek Toal Core Area and the birds depend heavily upon the five streams leading from the main lake into the flooded forest areas where the colonies are situated. In addition, initial indicators of unsustainable fish harvests and practices within lot 2 are very concerning, and should be addressed to prevent negative impacts on local livelihoods and commercial fishing. Consequently, it is possible therefore possible to create a Sanctuary within the Core Area which encompasses the current extent of the bird colonies, a number of the key rivers and important fish nursery areas. This Sanctuary would possibly be smaller than the current Core Area but would comprise all of the key habitat requirements for bird colonies, crocodile dry season habitats and fish. Inside the Sanctuary habitat disturbance and human intrusion would be minimised, which will be conducive to increasing both bird and fish populations throughout the Tonle Sap area, which would benefit both biodiversity and local livelihoods. This area would be removed from the fishing lot and therefore would not be controlled by the lot operator.

The area outside the proposed sanctuary, including the entire lake shore, is the most valuable area commercially and would remain under fishing lot management, thus creating a protective but commercial “buffer” zone around the water bird colonies. The revenue from the commercial fishery will provide sufficient economic incentive for the lot operator to maintain protective management systems in place. It would be crucial that the lot continue to protect the flooded forest habitats in lot 2, to ensure its capacity to support the current fish stocks. This includes resisting any land use changes, particularly deforestation or scrub destruction for both agriculture and access routes.

It is anticipated that both the FiA and MoE will provide full support for the newly created sanctuary, as it would be effective as a nursery ground for fish as well wildlife. If consensus can be reached between these two Government agencies this proposed change could constitute a mutually beneficial win-win solution to a longstanding contentious situation.

It is crucial that the Prek Toal Sanctuary is responsibly managed and that this does not simply result in another authority which demands unofficial fees for illegal fishing in this area. This requires long-term sustainable financing and careful monitoring. For these reasons, the details of how this area would be managed have not been expanded here, as whether controlled by FiA, MoE or a combination of the two, there would need to be a transparent, robust, financed and monitored system in place that is fully supported by the appropriate ministry. Certainly, the MoE rangers who are currently patrol the Core Area would continue in their positions, possibly in an expanded role.

7.2 Increase local community participation in and benefits from lot 2

Efforts should be made to increase local community participation in the lot management and benefits from the lot. Specific schemes should be discussed with communities, but could include:

- A commitment by lot operators to ensure that labouring jobs with fair salaries are available to those that want them from local communities before giving them to people from other villages.
- Increasing the benefits from tourism to Prek Toal to local communities, by developing local restaurants, local guides, and other tourist services. In addition, it is critical that the \$20/tourist Core Area entrance fee is distributed between conservation, community and logistics costs in a transparent and equitable way, as per recent plans laid out by the PT environmental station management team. The funds given to local communities could be managed by an elected Community Development Committee for schemes benefiting the whole community. Decisions on how this money is spent would be taken by the communities themselves, but could include:
 - Education (e.g. top-ups for teachers salaries so that local families don't have to pay/so that villages can attract and keep teachers; money for community boats to transport children to school; scholarship schemes for bright pupils to attend secondary school and/or college)
 - Health (e.g. free health clinics, free reproductive health services, money for emergencies for the neediest families; community latrines)
- Investigating the possibility of fish processing to occur in villages, instead of all fish from the fishing lots being taken directly to Chong Kneas/Siem Reap. This would have a particularly big impact on the potential of women to earn money.
- Investigating the possibility of PT Sanctuary patrol teams supporting the Community Fisheries Committees in their patrols and protection of the Community Fisheries Fish Sanctuaries.

7.3 Enforce existing Law on Fisheries

The widespread and recent increases in large-scale illegal fishing reported throughout Tonle Sap are of great concern due to their potentially long-term impacts on fish stocks, particularly in light of concurrent wide-spread reported decreases in fish catches and fish sizes. In addition, some decision should be reached as to the legality of *bors*. While they are illegal but owned by the majority of families in many floating villages, it becomes unclear what it is to be illegal. If laws are to be properly enforced, enforcement should begin with the lot operators, as the most common statement by local fishers is that if lot operators are using illegal gear (e.g. small mesh sizes, etc) then they have no choice but to follow in both FL and CFi areas, otherwise it is impossible to catch enough fish. Any enforcement activities that begin with gears and fishing practices commonly used by poorer members of the community will rightly be widely criticised by local communities as unfair, losing support for any management changes. Indeed, it may be that as with elsewhere (both in Cambodia and internationally) law enforcement becomes a pragmatic system whereby authorities choose to enforce particular laws more stringently than others, simply because to

enforce all laws at once risks not enforcing the law for the most damaging and destructive behaviours.

Any enforcement of laws should be accompanied by increased education on Law on Fisheries and the impacts of over fishing, and possibly by some interim support for local communities. This includes stopping destructive practices such as pumping and electro-fishing and enforcing sensible mesh size limits.

7.4 Widespread dissemination and education of fishing laws and boundaries

This includes making the burden book and Law on Fisheries available to all communities, including copies publicly available in each village, via village chiefs and/or Community fisheries committees. In addition, discussing the laws with the lot operators and local FiA staff would be crucial in order to reach an accepted and legal agreement. Information on other relevant laws should also be made available, including the laws on protected areas, endangered species, and Community Fisheries.

7.5 Implementing the recommendations: the next steps

The implementation of these recommendations will involve a number of distinct phases:

- 1) The first step will be a process of careful consultation and consideration of these proposals by FiA, MoE and local stakeholders, with modifications made to take into consideration the concerns of these authorities where they do not conflict with wildlife and fish conservation objectives. Discussions should be held with the lot operators and the FiA regarding activities on the main streams, which are detrimental to the birds and also in a more general ecological sense. These include the pumping of rivers and the construction of leader fences in too close a proximity to the trees where birds are nesting. The legal status of the proposed PT Sanctuary would need to be clarified, and a perhaps modified version of the recommendations would then need to be accepted by all authorities.
- 2) Implementation of this proposal will then involve designing a management plan with FiA, MoE and TSA including how to implement laws and regulations, resource use, benefit-sharing mechanisms and monitoring, and involving designs for fair, transparent and sustainable structures to enforce these rules, which can then be established and monitored.
- 3) The final stage would involve demarcating the new PT Sanctuary, and piloting the management plan, including a large component on education and dissemination of the rules and regulations inside the new area, and training for the new law enforcement teams.

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Appendix 1: Species Lists

Table A 1.1. Fish species

Khmer name	English name	Scientific name
Roh / Phtouk	Snakehead	<i>Channa striata</i>
Diep / Chhdor	Snakehead	<i>Channa micropeltes</i>
Kampleanh	Gourami	<i>Trichogaster microlepis</i>
Kanthor	Gourami	<i>Trichogaster pectoralis</i>
Chhkook		<i>Cyclocheilichthys enoplos</i>
Andaign	Walking Catfish & others	<i>Clarias batrachus & others</i>
Kranh	Climbing Perch	<i>Anabas testudineus</i>
Khman		<i>Hampala dispar</i>
Pra	Catfish	<i>Helicophagus waandersi</i>
Kanchos		<i>Mystus multiradiatus</i>
Slat	Featherback	<i>Notopterus notopterus</i>
Chhpin		<i>Puntius gonionotus</i>
Kan Trorb		<i>Pristolepis fasciata</i>
Krai	Featherback	<i>Chitala ornata</i>

Table A 1.2. Tree species

Khmer name	Scientific name
Phnom Phneng	<i>Hymenocardia wallichii</i>
Tauor	<i>Terminalia cambodiana</i>
Rieng	<i>Barringtonia acutangula</i>
Phtol	<i>Diospyros cambodiana</i>
Chrakeng	<i>Coccocera anisopodum</i>

Appendix 2: Additional material, Chapter 3

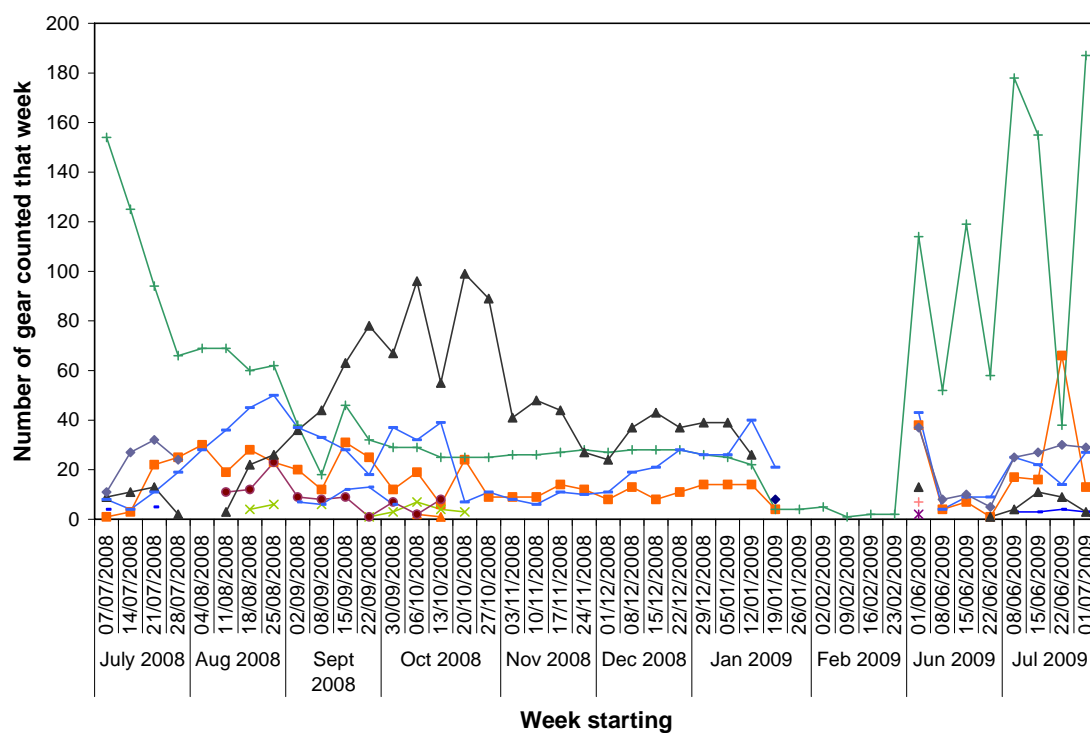


Figure A 2.1. Mobile Gear counts by week.



Figure A 2.2. Fish catch from fixed gear in lot 2, by location and month.

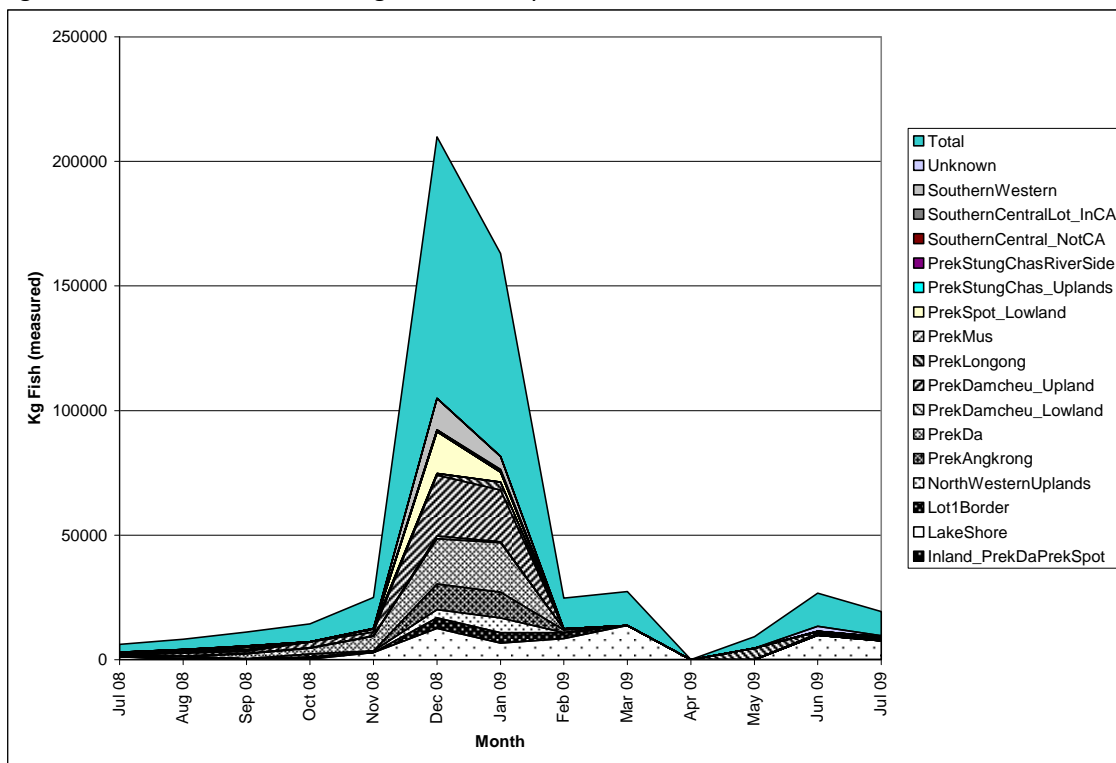
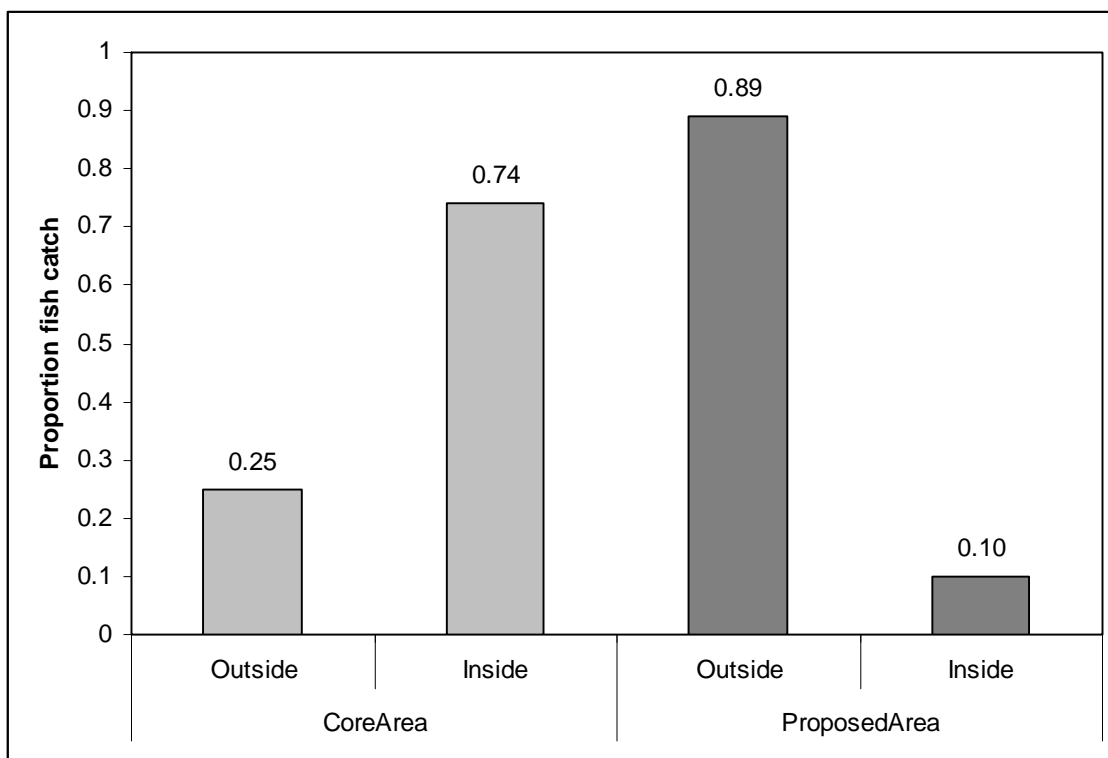


Figure A 2.3. Fixed Gear: Proportion of fish catch recorded inside and outside Core Area (light grey), and estimated proportion of fish catch inside and outside the proposed Sanctuary (called . No fishing in proposed new area would mean a 10% reduction in fish catch



Appendix 3: Public access lakes, lot 2

Public access areas

No.	Name of lake	No.	Name of lake
1	Boeung Phtol	27	Boeung Pal Hal
2	Boeung Krom Chhoeun	28	Boeung Kampream Toch
3	Boeung Damrey Chhlong	29	Boeung Kampream Thom
4	Boeung Sambok Ok	30	Boeung Prang
5	Boeung Chundeu Kach	31	Boeung Tra Keat
6	Boeung Or Eik	32	Boeung Chha-eng Chamny Krobey
7	Boeung Chhuk	33	Boeung Ok
8	Boeung Phluos	34	Boeung Tom Nob
9	Boeung Sdey	35	Boeung Rik
10	Boeung Kanthey Tamrot	36	Boeung Oun
11	Boeung Changvalot Thom	37	Boeung Peas Chol Mong
12	Boeung Changvatot Toch	38	Boeung Cho
13	Boeung Spean	39	Boeung Our
14	Boeung Chork Toch	40	Boeung Chok
15	Boeung Chork Thom	41	Boeung Mel
16	Boeung Kravak	42	Boeung Kon Phe
17	Boeung Rung Anluk	43	Boeung Sbeuv Kanndab
18	Boeung Anluk Phka Troas	44	Boeung Veng (south-east)
19	Boeung Ta Ok	45	Boeung Soung
20	Boeung Pous	46	Boeung Phtol (west of Or Os Tuk)
21	Boeung Peak Chruk	47	Boeung Kampream
22	Boeung Peak Lang	48	Boeung Braveng Khnong
23	Boeung Trey Mouy Poan	49	Boeung Leak Andat
24	Boeung Toteung Thngay (West of Vealveng)	50	Boeung Orm
25	Boeung Chhes Dob/Selpak	51	Boeung Et
26	Boeung A Teang		

Appendix 4: Fish catch in 2007/08

Table A 4.1. Fish catch (tons) by barrage for 2007/08 season.

Figures provided by sub-leaseholders. * Fish Prices: Roh = R 5000/kg; Kampleanh = R 1200/kg (1\$ = R 4000).

Barrage	Trey Roh*	Kampleanh*	Kanthor/Kranj	Other
Prek Da	100	200	14	1.5 (Diep, Slat)
Boeng Norea	15		5	
Prek Mus	12	15 (?)		
Stung Chas	40	40		

Prek Spot				
Prek Damcheu	50	50	15	55 (Andaing)

Table A 4.2. Fish catch from uplands lakes, 2007/08 season.

Stream name	Reported number of lakes by sublessee	FiA count of lakes	FiA reported av. catch (kg) per lake	Sub-sublessee
Prek Da	>20 in core area	45	946	Mr. Kung (Tapon)
Prek Stung Chas	>100	72	960	Mrs. Chinnarom (Kampong Prahoc)
Prek Angkrong	10	10	570	1 sublessee
Prek Mus	7	6	375	No
Prek Spot	8-10	10	880	
Prek Damcheu	< 100 (PC) about 30 (KK)	13	1073	Mr. Sat (Norea commune)
Prek Long Ong	No lakes			
Boeng Noria	?	6	1180	
Chhuong	?	25	862	(areas close to lakeshore)
Total	<>180	187	913	