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## MONITORING OF LARGE WATERBIRDS AT PREK TOAL, TONLE SAP GREAT LAKE 2011



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## 1. Summary

Prek Toal is the most ecologically important of the three core areas of the Tonle Sap Biosphere Reserve. It is the only remaining breeding site in mainland South-east Asia for two Globally Threatened species, Spot-billed Pelican *Pelecanus philippensis* and Milky Stork *Mycteria cinerea* and the largest colony in the region 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*.

In 2001 WCS initiated platform based counts of key species to monitor the effectiveness of conservation interventions aimed at protecting waterbird colonies. Platform based monitoring methodologies were modified in 2003 and data collected from 2004 onwards has used this revised methodology. Waterbird nest trees are located by boat in the wet season, prior to the beginning of the breeding season for all key species except Oriental Darter and marked with numbered tags. Throughout the breeding season the number of visible nests, adults and chicks of each key species are counted from observation platforms. Data are collated and checked to avoid double counting of marked trees. Overflights of the colony, last conducted in 2007, indicate that only half of the Asian Openbill *Anastomus oscitans*, Painted Stork and Spot-billed Pelican nests are counted each year from platforms. Ranger patrols, advocacy and platform based monitoring has proved an effective deterrent to egg collectors, formerly the greatest threat to the waterbird colonies of Prek Toal.

Since monitoring began there has been a significant increase in the number of waterbirds breeding at Prek Toal. Oriental Darter has shown the greatest increase and in 2011 there were 6,751 nests compared with 241 nests in 2002. Numbers of Asian Openbill nests have also increased rapidly since monitoring began: in 2011 13,042 nests were counted from monitoring platforms, up from 688 in 2004. The number of Painted Stork nests has increased from 1,089 to 2,345 over the same time period. The number of Milky Stork nests recorded, which are typically located in amongst the Painted Stork colonies, increased from 2 to 16. Overflights of the colony in 2007 indicate that only 50% of Asian Openbill and Painted Stork nests can be seen from the monitoring platforms, and therefore the total number of nests of these species maybe double that counted from the platforms. Greater and Lesser Adjutant populations are increasing at a slower rate: the number of Greater Adjutant nests counted from monitoring platforms has increased from 56 in 2004 to 146 in 2011 and the number of Lesser Adjutant nests from 158 to 363 over the same time period. The number of Spot-billed Pelican nests counted from monitoring platforms has fluctuated and now numbers 1,574. The mean peak nesting date of large waterbirds in Prek Toal is nearly two months earlier than when records began. For the first time, in 2011, data were collected on the occurrence of otters *Lutra* spp. and Long-tailed Macaque *Macaca fascicularis*.

Data on population trends in large waterbirds in Prek Toal Core Area represent one of the most complete datasets on trends in the populations of any species, or group

of species, at any site in tropical Asia. They provide an objectively verifiable measure of the success of the simple, relatively low cost conservation measures implemented by General Department of Administration for Nature Conservation and Protection (GDANCP) in partnership with WCS. These data provide a baseline against which trends in waterbird populations can be monitored following management changes such as the cancellation of the fishing lots in August 2011.



**Photograph 1. Spot-billed Pelican, by Eleanor Briggs**



**ខ្លឹមសារសង្ខេប**

ព្រែកទាល់ជាតំបន់ស្នូលសំខាន់ជាងគេបំផុត ក្នុងចំណោមតំបន់ស្នូលទាំងបី នៃតំបន់បំប៉នវិស័យជីវមណ្ឌលបឹងទន្លេសាប ។ វាជាតំបន់ពងកូនសំខាន់បំផុតតែមួយគត់ នៅតំបន់អាស៊ីអាគ្នេយ៍សំរាប់ប្រភេទសត្វស្លាបទឹក ដែលទទួលបានការគាំទ្រកំហែងលើពិភពលោកពីប្រភេទ គឺទ្វីបប្រទេស *Pelecanus philippensis* និងរនាស *Mycteria cinerea* និង ជាបន្ទាយពងកូនធំជាងគេបំផុតនៅក្នុងតំបន់ សំរាប់ប្រភេទទទួលបានការគាំទ្រកំហែង និងជិតទទួលបានការគាំទ្រកំហែងលើពិភពលោកចំនួន ៦ប្រភេទ ដូចជា ស្មៅព្យ *Anhinga melanogaster* ត្រងក់តូច *Leptoptilus javanicus* ត្រងក់ធំ *Leptoptilus dubius* ក្អួនស *Threskiornis melanocephalus* រនាសពណ៌ *Mycteria leucocephala* អកត្រីក្បាលប្រទេស *Ichthyophaga ichthyaetus* ។

នៅឆ្នាំ ២០០១ អង្គការសមាគមអភិរក្សសត្វព្រៃបានចាប់ផ្តើមការប្រមូលទិន្នន័យប្រភេទសត្វស្លាបសំខាន់ៗតាមរយៈការរាប់សត្វពីលើរាន ដើម្បីធ្វើការអង្កេតតាមដានចំនួនសត្វស្លាបប្រកបដោយប្រសិទ្ធិភាព និងការពារបន្ទាយពងកូនសត្វស្លាបទាំងនោះ ។ វិធីសាស្ត្រអង្កេតតាមដានសត្វស្លាបពីលើរាន បានធ្វើការកែសម្រួលនៅឆ្នាំ ២០០៣ ហើយទិន្នន័យត្រូវបានប្រមូល ដោយផ្អែកតាមវិធីសាស្ត្រនេះចាប់តាំងពីឆ្នាំ ២០០៤មក ។ ដើមឈើដែលសត្វប្រើប្រាស់ដើម្បីធ្វើការពងកូន ត្រូវបានកំណត់ទីតាំងដោយទូកនៅរដូវវស្សា ដែលធ្វើឡើងមុនការចាប់ផ្តើមរដូវបន្តពូជរបស់សត្វស្លាបទឹកសំខាន់ៗទាំងនោះ លើកលែងតែប្រភេទស្មៅព្យ និងធ្វើការដាក់ស្លាកលេខនៅលើដើមឈើទាំងនោះផងដែរ ។ ពេញមួយរដូវបន្តពូជ ចំនួនសំបុក សត្វមេ សត្វកូន របស់ប្រភេទនីមួយៗ ត្រូវបានរាប់ពីរានអង្កេតតាមដានសត្វ ។ ទិន្នន័យត្រូវបានរៀបចំទៅតាមលំដាប់ និងពិនិត្យឡើងវិញ ដើម្បីជៀសវាងការរាប់ជាងគ្នានូវដើមឈើដែលមានស្លាកលេខ ។ ការរាប់ដោយការហោះហើរពីលើបន្ទាយសត្វស្លាប ដែលបានអនុវត្តនៅឆ្នាំ ២០០៧ បានបង្ហាញអោយឃើញថា សំបុកប្រភេទសត្វក្រៀលខ្យង *Anastomus oscitans* រនាសពណ៌ទង្កៀបប្រទេស ដែលបានធ្វើការរាប់ពីលើរានជាអារាមរាល់ឆ្នាំ គឺឃើញចំនួនតែពាក់កណ្តាលនៃចំនួនសរុបប៉ុណ្ណោះ ។ ការយាមល្បាតដោយក្រុមឧទ្យានុរក្ស ការអង្កេតតាមដាននៅតាមរានធ្វើអោយជនល្មើសប្រមូលពង កូនសត្វស្លាបមានការខ្លាចរអា ដែលការប្រមូលពងកូននេះ គឺជាការគាំទ្រកំហែងដ៏ធ្ងន់ធ្ងរបំផុត ចំពោះបន្ទាយពងកូនសត្វស្លាបនៅតំបន់ព្រែកទាល់ ។

ចាប់តាំងពីការចាប់ផ្តើមអនុវត្តកម្មវិធីអង្កេតតាមដាននេះមក ចំនួនសត្វស្លាបនៅតំបន់ព្រែកទាល់មានការកើនឡើងគួរអោយកត់សំគាល់ ។ ស្មៅព្យមានការកើនខ្លាំងនៅឆ្នាំ ២០១១ មានចំនួន ៦៧៥១សំបុក បើប្រៀបធៀបនឹងឆ្នាំ ២០០២ មានតែ ២៤១សំបុកប៉ុណ្ណោះ ។ ចំនួនសំបុកក្រៀលខ្យង មានការកើនឡើងយ៉ាងលឿនចាប់តាំងពីកម្មវិធីអង្កេតតាមដានបានចាប់ផ្តើម ដែលនៅឆ្នាំ ២០១១ នេះមានចំនួន ១៣០៤២សំបុក ដែលកើនពីចំនួន ៦៨៨សំបុក នៅឆ្នាំ ២០០៤ ។ ចំនួនសំបុករនាសពណ៌ មានការកើនឡើងពី ១០៨៥សំបុក រហូតដល់ ២៣៤៥សំបុក ចំនួនសំបុករនាស ដែលពងកូនលាយឡំគ្នានៅក្នុងបន្ទាយពងកូនសត្វរនាសពណ៌ ដែលកើនឡើងពីចំនួន ២សំបុក

រហូតដល់ ១៦សំបុក។ ការរាប់ដោយការហោះ ហើរពីលើបន្ទាយសត្វនៅ ឆ្នាំ ២០០៧ បានបង្ហាញថា ប្រភេទ ក្រៀលខ្យង រនាសពណ៌ រនាសសរ រាប់ពីលើរានឃើញតែ ៥០ភាគរយ នៃចំនួនសរុប ដូច្នេះចំនួនសំបុកសរុបរបស់ ប្រភេទទាំងនេះ អាចមានចំនួនទ្វេដងនៃចំនួនរាប់ពីលើរាន។ ចំនួនប្រភេទត្រដក់ធំ និងត្រដក់តូច មានការ កើនឡើងក្នុងកំរិតយឺត ដូចជាចំនួនសំបុកត្រដក់ធំដែលរាប់ពីលើរានបានកើនពី ៥៦សំបុក នៅឆ្នាំ ២០០៤ ដល់ ១៤៦សំបុក នៅឆ្នាំ ២០១១ ហើយចំនួនសំបុករបស់ត្រដក់តូចមានការកើនឡើងពី ១៥៨សំបុក ទៅ ៣៦៣សំបុក នៅក្នុងកំឡុងពេលដូចគ្នា។ ចំនួនសំបុកប្រភេទទ្វេប្រផេះ ដែលរាប់ពីលើរានមានការឡើងចុះ ហើយរហូតមក ដល់សព្វថ្ងៃនេះមានចំនួន ១៥៧៤សំបុក។ កាលបរិច្ឆេទជាមធ្យមនៃការធ្វើសំបុកពងកូនច្រើនបំផុតរបស់សត្វស្លាប ទឹកនៅព្រែកទាល់ដើមរដូវបន្តពូជជាងរដូវបន្តពូជកន្លងមក ជិតពីរខែបើប្រៀបធៀបនឹងពេលចាប់ផ្តើមប្រមូល ទិន្នន័យ។ នៅឆ្នាំ ២០១១ ជាឆ្នាំដំបូងនៃការប្រមូលទិន្នន័យ ពពួកភេ *Lutra spp* និងប្រភេទស្វាត្តាម *Macaca fascicularis* ។

ទិន្នន័យពីបំបែបបំប្លែងចំនួនប្រភេទសត្វស្លាបទឹកធំ នៅតំបន់ស្នូលព្រែកទាល់ ជាតំណាងទិន្នន័យមួយក្នុង ចំណោមទិន្នន័យទាំងអស់ ស្តីពីបំបែបបំប្លែងប្រភេទ វិក្រុមនៃប្រភេទនៅតំបន់ណាមួយនៅអាស៊ី។ ទិន្នន័យទាំងអស់ នោះផ្តល់នូវការគណនា មួយដែលអាចពិនិត្យដឹងនូវខុសត្រូវបាន ដែលមានលក្ខណៈសាមញ្ញ និងប្រើប្រាស់វិធីការតិច ដែលអនុវត្តដោយអគ្គនាយកដ្ឋានការពារ និងអភិរក្សធម្មជាតិ ដោយសហការជាមួយអង្គការសមាគមអភិរក្ស សត្វព្រៃ WCS ។ ទិន្នន័យទាំងនេះផងដែរ ជាមូលដ្ឋាន ទិន្នន័យដើម្បីដឹងពីបំបែបបំប្លែងចំនួនសត្វស្លាបទឹក ដែលអាច ធ្វើការអង្កេតតាមដាននូវការផ្លាស់ប្តូរការគ្រប់គ្រង ផ្សេងៗ ដូចជាការលប់ឡូត៍នេសាទកាលពីខែសីហា ឆ្នាំ ២០១១ កន្លងទៅនេះ ។



## 2. Introduction

The Tonle Sap Great Lake in central Cambodia is the largest freshwater lake in South-east Asia. It is one of the most productive freshwater ecosystems in the world and is extremely important for Cambodian people as a source of food and income. Its unique cultural, social and environmental values were recognized by its designation as a Biosphere Reserve by UNESCO in 1997. Prek Toal, the most important of three core areas, is the last significant breeding stronghold in mainland South-east Asia for many globally threatened and near-threatened large waterbird species. The Prek Toal bird colonies are the only remaining breeding sites in mainland South-east Asia for two Globally Threatened species, Spot-billed Pelican *Pelecanus philippensis* and Milky Stork *Mycteria cinerea*. They are also the largest remaining breeding site in the region 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 significance of these colonies led the Prek Toal Core Area to be selected for the creation of a comprehensive monitoring and protection program. The project was started in 2001 by the Wildlife Conservation Society (WCS) in collaboration with the General Department Administration of Nature Conservation and Protection (GDANCP), within the Ministry of Environment (MoE) of the Royal Government of Cambodia.

The conservation project at the Prek Toal Core Area aims to consolidate management activities and to monitor the success of ongoing conservation and protection strategies. Obtaining accurate population estimates allowing the detection of population increases or decreases for species of conservation concern is critical to evaluate the success of management interventions. Consequently, population counts of the large breeding colonies of waterbirds began in 2001. Initial counts between 2001 and 2003 were incomplete, so 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 from the 2003/4, 2004/5, 2005/6, 2006/7, 2007/8, 2008/9 and 2009/10 breeding seasons, as previously reported (Goes 2005; Clements et al. 2007; Sun Visal and Clements 2008, Sun Visal & Allebone-Webb, S. 2009 and Sun Visal et al. 2010). This report will provide the results of the 2010/11 breeding season for the large waterbird colonies at the Prek Toal Core Area.

### **3. Methods**

The methods described below are the protocols that have been used since 2003.

#### **3.1. Platform Counts**

##### **3.1.1. Origins of bird counts**

Between 2001 and 2003, initial conservation activities consisted of forest patrols by up to 25 rangers, depending on the season. The rangers used a network of semi-permanent vantage platforms (*'rien'*) located at the top of trees for surveillance activities and also to count nesting birds. Although this method allowed for the partial monitoring of the colony area, there was no measure of the percentage of the colony that could be seen from the platforms, or of parts of the colonies that were inadvertently counted more than once. The ranger platform-based counts did, however, prove to be an extremely efficient protective mechanism and resulted in an almost complete cessation of egg and chick collection incidences. The colony protection facilitated by these counts, from both poaching and disturbance, has remained an essential consideration in the development of the monitoring programme. As the programme evolved the platform counts continued to form the basis of the monitoring regime but since 2003 these counts have been supplemented by other methods.

##### **3.1.2. Observation platforms**

The waterbird colonies are located by boat at the end of the wet season, from August to January. The rangers use their knowledge of the area and the previous year's records to identify the colony sites, including any new satellite colonies which have been established. The platforms are built in tall trees which allow a good view of the colonies and are situated close enough to permanent streams to facilitate access in the dry season. The trees are selected as close to the colony as possible without causing disturbance. The fact that the birds actually began nesting on one of the platforms in 2005 (Platform three, Spot-billed Pelican and Greater Adjutant colony) indicates that the presence of the rangers causes minimal disturbance to the birds. During the wet season, boats can access the core area, and are therefore a potential source of (often unintentional) disturbance to the colonies. To avoid this, colony boundaries are demarcated using brightly coloured string and warning signs. These signs are also helpful when counting the birds, as they can help to identify the colony boundaries and distinguish groups of trees that should be counted from different platforms.

##### **3.1.3. Data collection**

Bird counts at the colonies are conducted by the ranger teams two to three times weekly. Pre-formatted data sheets are used when conducting a count, ensuring that data collection and quality is standardised. These counts yield three types of output:

- a. Daily colony count datasheet
- b. Weekly summary datasheet and

#### c. Tree datasheets.

The daily count datasheet gives detailed information on the colony population and its evolution during the breeding season. This provides the basic raw monitoring data. The datasheets are returned to the Prek Toal Core Area Management Centre when the ranger teams rotate. This ensures that counts by different teams are independent – i.e. the newly arriving team does not know how many birds the previous team counted on each tree. The tree datasheet follows exactly the same format as the daily count datasheet, but serves a different purpose. It maintains a running log of the occupied trees in the colony (but not the number of birds), to help the new team in locating occupied trees and identifying the occupying bird species. The weekly summary datasheet simply extracts the daily counts on a weekly basis for each colony. These datasheets are also returned to the management centre when the teams rotate.

#### **3.1.4. Counting procedure**

Boat-based counts are used during high water level in the wet season, when the Oriental Darters are breeding. They provide accurate data in a short period of time from all nesting trees and do not require the use of platforms. However, for all other species the breeding period falls during the low water levels, rendering the colonies inaccessible. During this period counts are conducted from the observation platform using telescopes.

Rangers receive ongoing training to ensure that standardised counting protocols are followed. This allows the collection of scientifically rigorous data which can be combined and compared over different years. Ranger teams count the trees in order from the platform, tree by tree. Counts always start at the same tree and proceed in the same direction from each platform. Rangers measure the direction of each tree, estimate the distance to the tree from the platform, identify the tree species, give the tree a number and estimate the percentage of the tree that can be seen from the platform. A ranger team comprises two people, one as the observer and the other as the recorder. The recorder is responsible for completing the datasheet whilst the observer uses the telescope to count the number of birds on each tree. Counts are conducted only when visibility is high and the weather is favourable

For each tree, one species is counted at a time, beginning with the adult birds, then the chicks, the nests with chicks and finally the nests without chicks (parents incubating eggs). Only visible bird species are counted, focusing on the key species: Oriental Darter, Greater Adjutant, Lesser Adjutant, Painted Stork, Milky Stork and Asian Openbill, but including other species where present. The Black-headed Ibis is only visible when the species breed on the top of the trees, but most individuals nest in the scrub, so these data are incomplete and not included.

#### **3.1.5. Timing of counts**

Counts at the colonies are taken throughout the breeding season for each species. However, only data collected during the 6 week period when species' colonies are at

maximum size are used for population estimation and monitoring. During this period the rangers must pay extra attention to collect data accurately as the volume of records will increase significantly.

**Table 1. Peak nesting period for key species at Prek Toal**

Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Oriental Darter												
Spot-billed Pelican												
Greater Adjutant												
Lesser Adjutant												
Painted Stork												
Milky Stork												
Asian Openbill												
Grey-headed Fish Eagle												



**Photograph 2. Tree top platform for counting birds at the colonies, by Sun Visal**

### 3.2. Marking of Nesting Trees

#### 3.2.1. Visible Trees

Trees are marked in order to calculate the total number of occupied trees seen from platforms, and to resolve the problem of multiple counting of the same tree. Trees are uniquely identified by a zinc plate with a large, visible number, thus assisting rangers to improve the quality of the platform-based count. Tree mapping and marking is conducted by boat after the breeding season, during the wet season, between August and October when the area is accessible by boat, and before the

Pelicans arrive in November. At this time of year the bird colonies are effectively unoccupied.

The tree mapping and marking is conducted by at least two ranger teams. One or more teams use boats to find and attach the zinc numbers to the trees, directed by another team on the platform with a telescope and compass. Boat team(s) records the tree number, species, GPS waypoint number and the UTM easting and northing of every tree that is mapped. If possible, a large zinc number plate is attached to the tree facing the platform; otherwise a small lead number plate is attached. It is not possible to attach numbers to some trees and so, although they are *mapped*, these trees are not *marked*.

Sometimes rangers arrive at a tree that already has a zinc plate or lead plaque belonging to another platform. In this case they attach a second zinc plate facing the second platform from which it was counted. They also record on the tree mapping datasheet the other numbers present on the tree, and the platforms these numbers are associated with. These trees are therefore counted from more than one platform. In 2004/5, 2005/6, 2006/7, 2007/8, 2008/9, 2009/10 and 2010/2011 the rangers also checked all trees previously marked with a zinc plates in order to replace lost or damaged marks. Previously mapped trees can easily be located using the GPS coordinates obtained during the previous season.

### **3.2.2. Darter Colonies**

It is impossible to mark the trees of the Oriental Darter colonies because this species arrives very early in the season (August), when the water levels are still too low to allow boat access. For these colonies the rangers use a 1000-metre rangefinder to measure the distance and a compass to measure the bearing from the platform to the trees when the birds are counted. This allows the nesting trees to be accurately mapped. Sometimes nesting trees are located beyond the 1000 metre capacity of the rangefinder, in which case the trees are recorded as being >1000m distant.



**Photograph 3. Tree marking in Prek Toal, by Sun Visal**

## 4. Results

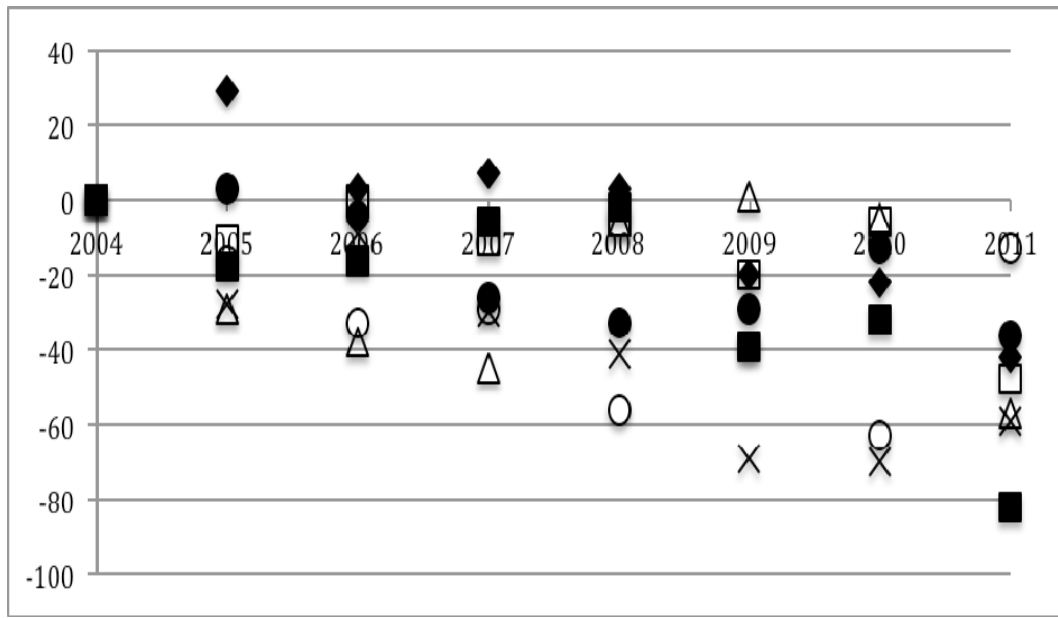
The Colony Monitoring Program started in Prek Toal Core Area in 2003 and continues to follow the population trends of breeding large waterbirds and the evolution of bird colonies in the area to evaluate the effectiveness of the conservation program. The breeding season in 2010/11 has shown a continuation of the success of this program.

### 4.1. Timing of Peak Counts

The timing of peak counts of the key species varies between species and years (Table 2 and Figure 1) although the overall trend is towards earlier peak counts. The two adjutant species have shown the most marked trends towards earlier nesting dates and peak counts for these species are now over two months earlier than in 2004 (Figures 3 and 4). In contrast Asian Openbill, Painted Stork and Milky Stork have shown less severe change in peak nesting date, although these species nested particularly early in 2011 (Figures 2, 5 and 6). Trends in peak nesting date for Spot-billed Pelican are unclear, whilst Oriental Darter displayed a clear trend towards earlier nesting dates until 2011, when the peak nesting date was later than in recent years (Figures 7 and 8).

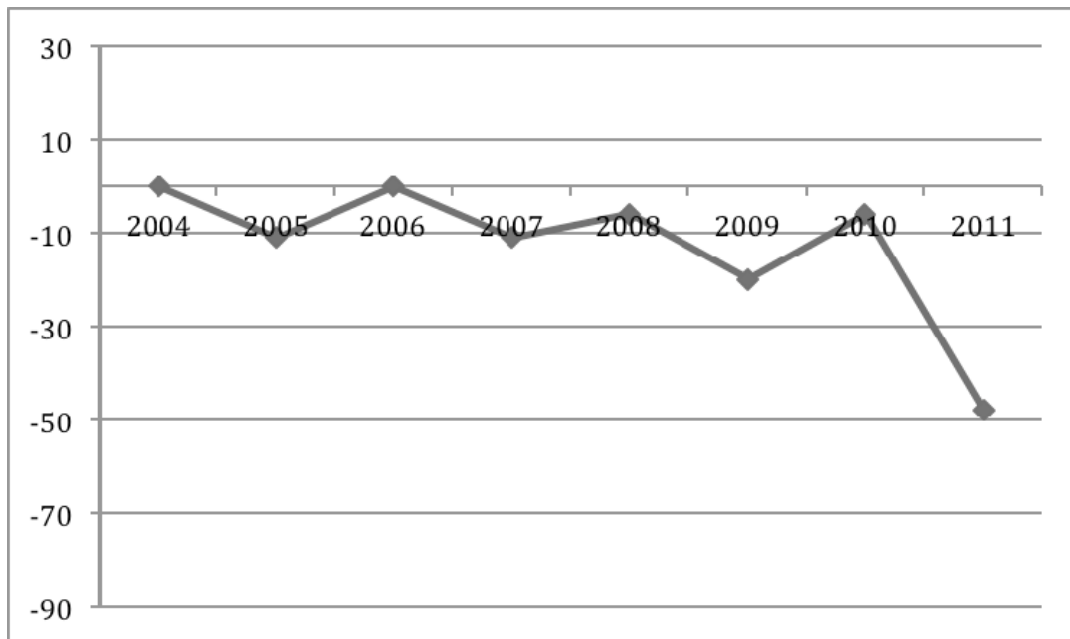
**Table 2. Peak nesting dates of key species**

Species	2004	2005	2006	2007	2008	2009	2010	2011
Asian Openbill	15-Mar	04-Mar	15-Mar	4-Mar	9-Mar	24-Feb	09-Mar	27-Jan
Greater Adjutant	24-Apr	6-Apr	8-Apr	18-Apr	22-Apr	16-Mar	23-Mar	2-Feb
Lesser Adjutant	21-Apr	24-Mar	12-Apr	22-Mar	11-Mar	12-Feb	11-Feb	22-Feb
Milky Stork	25-Mar	23-Apr	28-Mar	1-Apr	28-Mar	05-Mar	03-Mar	12-Feb
Painted Stork	10-Apr	13-Apr	6-Apr	15-Mar	08-Mar	12-Mar	28-Mar	5-Mar
Spot-billed Pelican	16-Mar	16-Feb	7-Feb	31-Jan	10-Mar	17-Mar	11-Mar	19-Jan
Oriental Darter	07-Dec	21-Nov	04-Nov	08-Nov	12-Oct	29-Oct	05-Oct	24-Nov



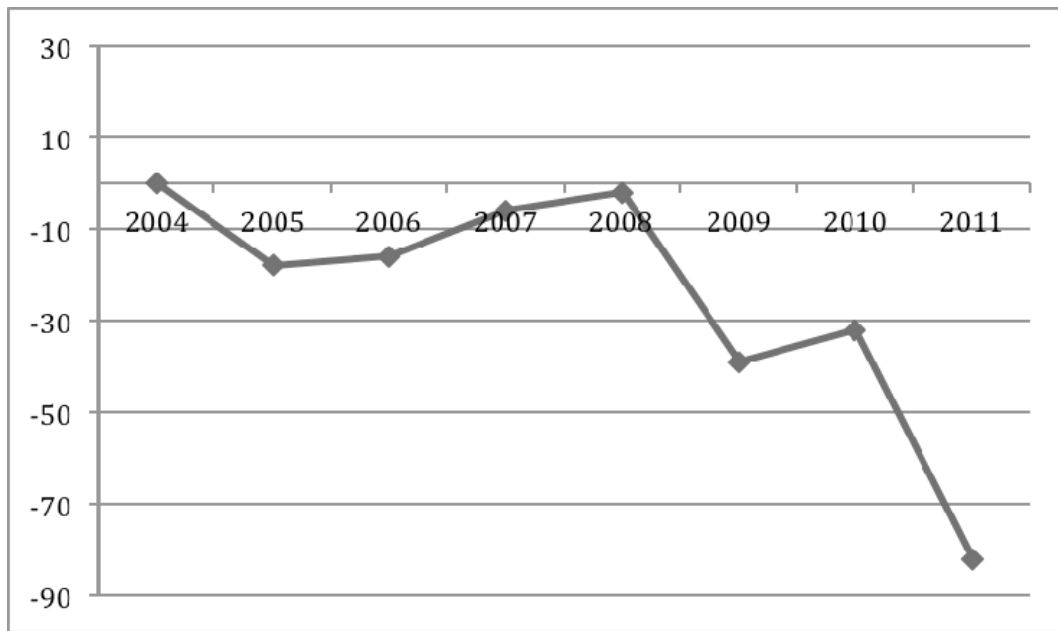
**Figure 1. Trends in date of peak nesting count for key species in Prek Toal. Data are displayed as number of days deviation from 2004 peak nesting date.**

Note: □ = Asian Openbill, ■ = Greater Adjutant, X = Lesser Adjutant, ◆ = Milky Stork, ● = Painted Stork, Δ = Spot-billed Pelican, O = Oriental Darter.

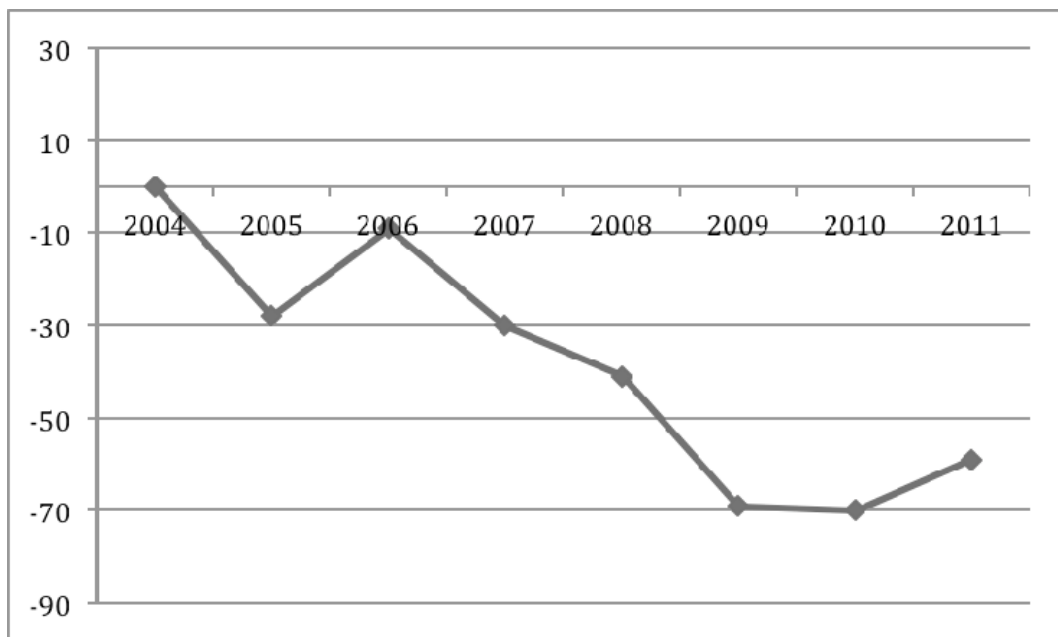


**Figure 2. Trends in date of peak nesting count for Asian Openbill in Prek Toal. Data are displayed as number of days deviation from 2004 peak nesting date.**

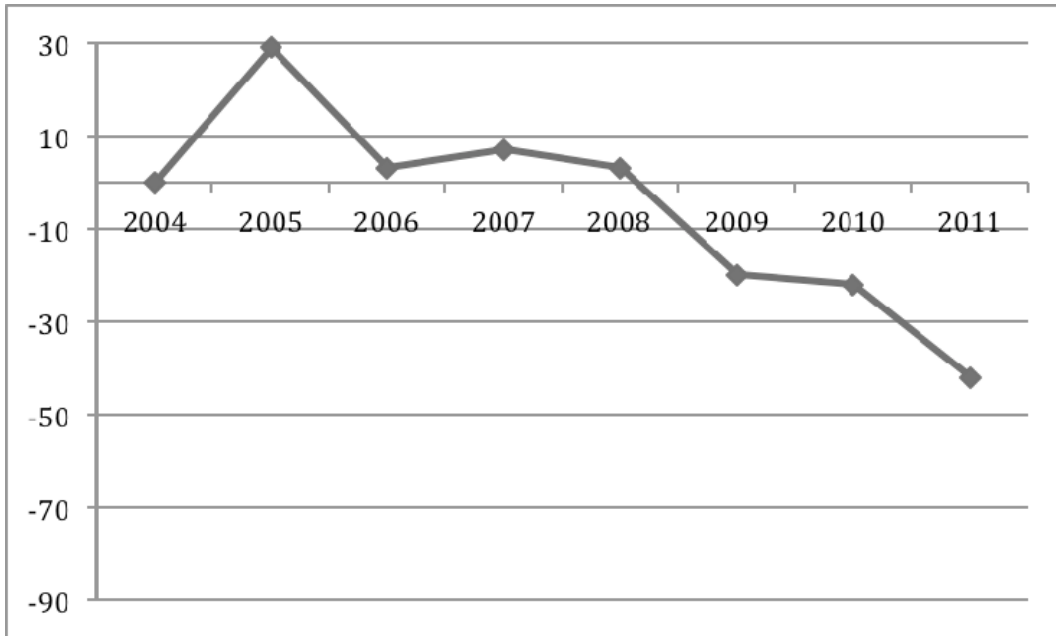




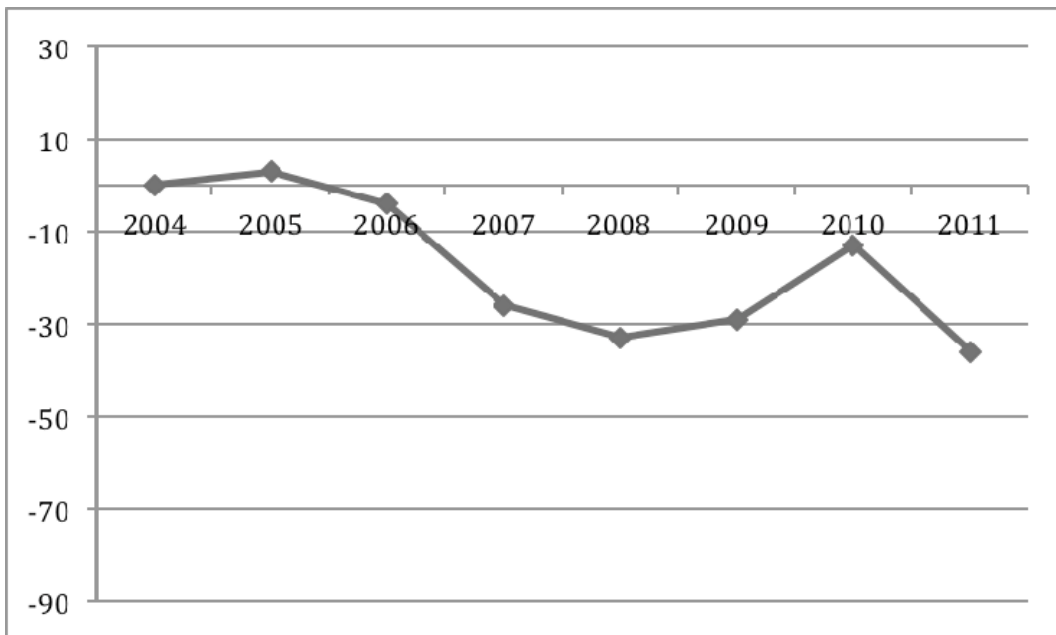
**Figure 3. Trends in date of peak nesting count for Greater Adjutant in Prek Toal.**  
Data are displayed as number of days deviation from 2004 peak nesting date.



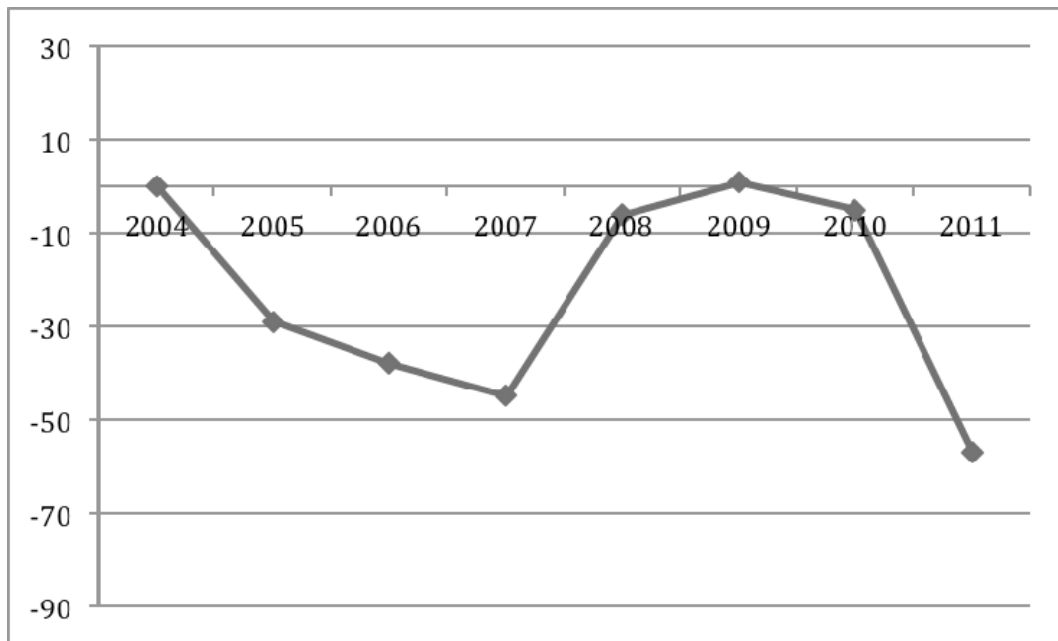
**Figure 4. Trend in dates of peak nesting count for Lesser Adjutant in Prek Toal.**  
Data are displayed as number of days deviation from 2004 peak nesting date.



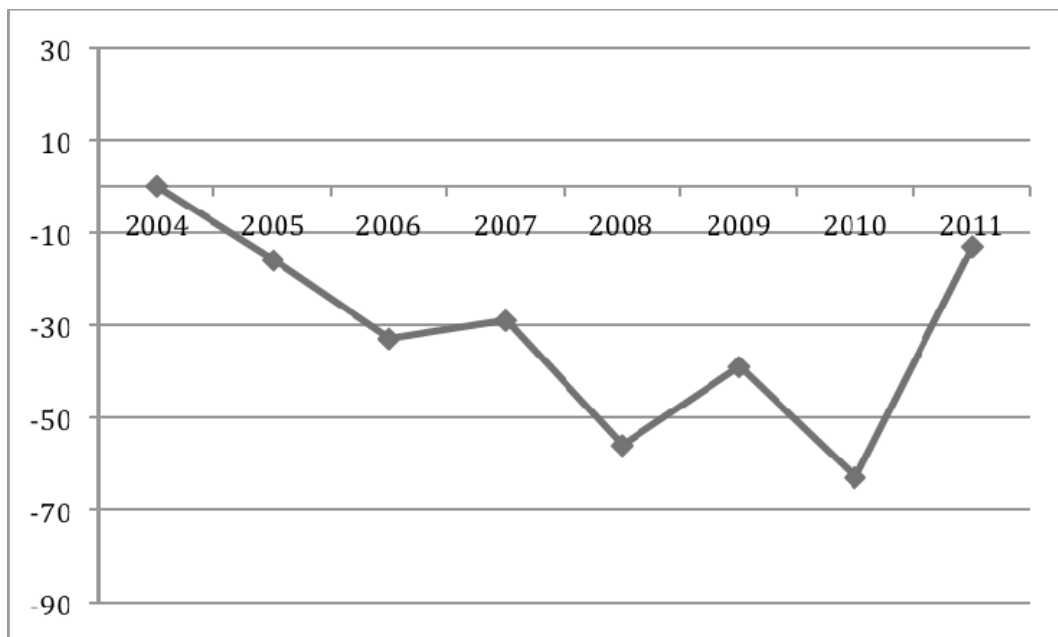
**Figure 5. Trend in dates of peak nesting count for Milky Stork in Prek Toal. Data are displayed as number of days deviation from 2004 peak nesting date.**



**Figure 6. Trend in dates of peak nesting count for Painted Stork in Prek Toal. Data are displayed as number of days deviation from 2004 peak nesting date.**



**Figure 7. Trend in dates of peak nesting count for Spot-billed Pelican in Prek Toal. Data are displayed as number of days deviation from 2004 peak nesting date.**

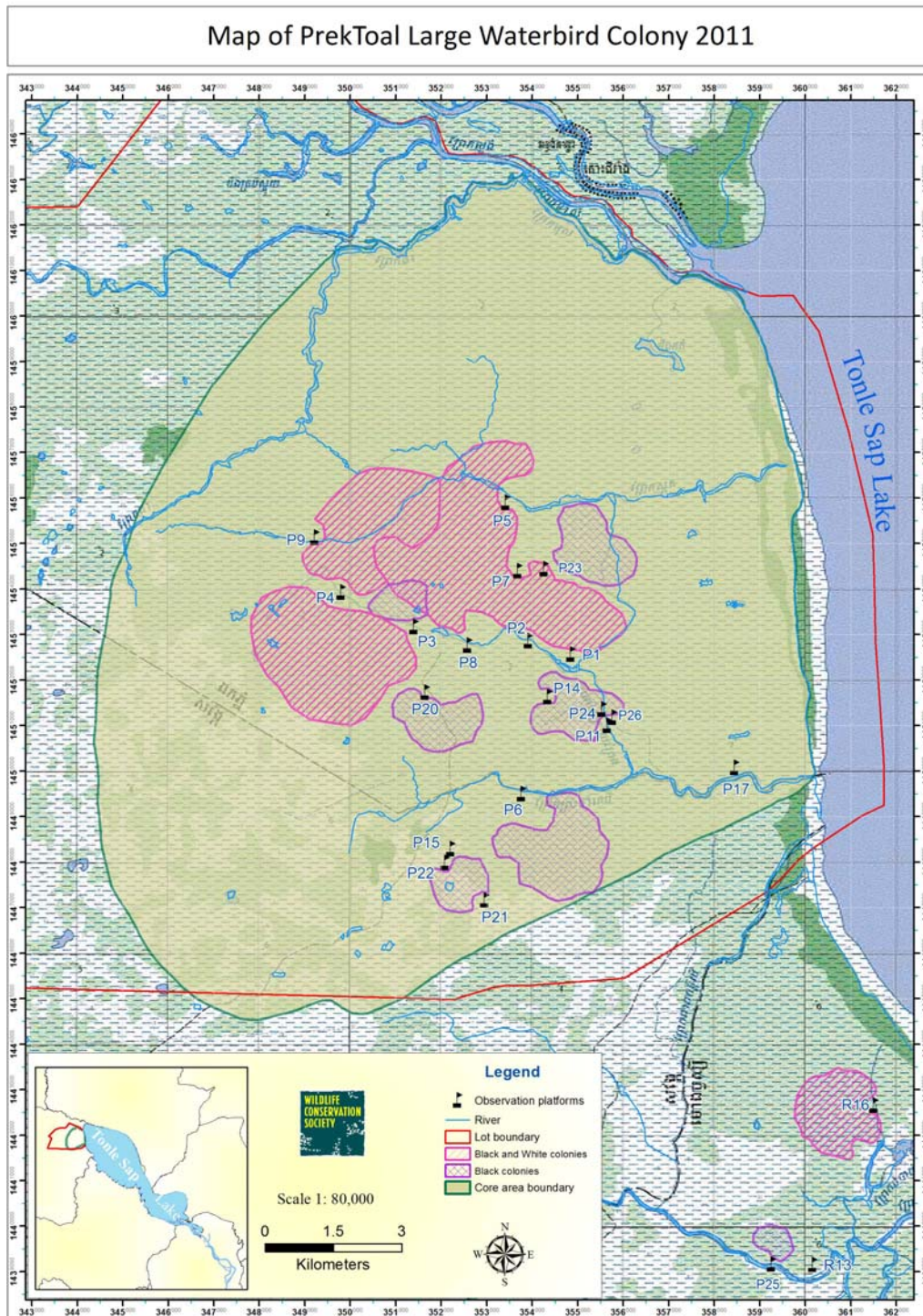


**Figure 8. Trend in dates of peak nesting count for Oriental Darter in Prek Toal. Data are displayed as number of days deviation from 2004 peak nesting date.**

#### **4.2. Bird Colonies**

There were 16 main waterbird colonies in the 2010/11 breeding season. Of these there were nine main large waterbird colonies (black and white colonies) located at platforms 1, 2, 3, 4, 5, 7, 8, 9 and 20 (Figure 9). These colonies supported breeding

Spot-billed Pelican, Painted Stork, Asian Openbill, Greater Adjutant, Lesser Adjutant, Milky Stork and Black-headed Ibis. For these species the breeding season started in mid November 2010, and the birds left the colonies in mid June 2011. There were eleven black colonies (Darter and cormorants) located at platforms 3, 5, 14, 16, 20, 21, 22, 23, 24, 26 and 27. These birds started to arrive in late July with the peak breeding period in late November 2010, and had left by late February 2011.



**Figure 9. Map of Prek Toal bird colonies, 2011.**

This year there were three satellite colonies consisting of Lesser Adjutant and Asian Openbill which were located at platforms 6, 16 and 25. The birds started to arrive at the colonies for breeding in late November 2010, with the peak nesting period in February and March; they left in June 2011.

#### **4.3. Key Species**

Table 3 and Figures 10, 11 and 12 show the number of visible (counted) trees, the number of nests and the average nests per tree respectively recorded during peak platform counts, for all seven key species.

Between 2004 and 2011, the mean number of Asian Openbill and Oriental Darter nests per tree has increased dramatically (from 13.49 to 44.75 and from 22.06 to 38.06 respectively). The number of Painted Stork and Greater Adjutant nests per tree have shown gradual increases during the same time period (from 3.59 to 5.29 and from 1.33 to 1.90 respectively). In contrast, the number of Lesser Adjutant nests per tree has remained stable at a little less than three. Numbers of Milky Stork and Spot-billed Pelican nests per tree has fluctuated during the same time period, with no clear trends.



**Photograph 4. Painted Stork colony in Prek Toal Core Area, by Sun Visal**

2011 was a good year for large waterbirds in Prek Toal, with more nests counted for most species than in 2010. The total number of Oriental Darter nests counted in the peak surveys in 2011 was 6,751 nests (95% CI: 5,959-7,543), higher than the 5,437 nests (95% CI: 4,822-6,052) in 2010. However, since 2008 the population has been fairly stable, with annual some annual fluctuation in numbers. The number of Spot-billed Pelican nests counted increased from 1,475 (95% CI: 1,347-1,603) in 2010 to 1,574 nests (95% CI: 1,412-1,736) in 2011, making 2011 the best year yet for the species. The number of Lesser Adjutant nests also increased in 2011, to 363 nests



(95% CI: 321-405) up from 312 nests in 2010 (95% CI: 276-348). This maintains the gradual increase in the number of nests of this species since monitoring began. The number of Greater Adjutant nests counted in 2011 was 146 (95% CI: 127-165), a small increase on 2010 when there were 126 nests (95% CI: 107-145). This maintains the gradual increase in number of counted nests for this species. The number of Milky Stork and Painted Stork nests counted in 2011 was little different to 2010. There was a slight decrease in the number of Asian Openbill nests counted in 2011, the first year that the population has not increased, although the change is not statistically significant. The number of nests counted in 2011 was 13,042 (CI: 11,833-14,251, down from 13,845 nests (CI: 12,418-15,272) in 2010.

**Table 3. Colony size estimates based on the visible trees recorded from the platforms**

Species	Year	Average Nests / Tree	Visible Trees	Total Nests	Confidence Interval
Greater Adjutant	2004	1.33	42	56	(49-63)
	2005	1.39	28	39	(32-46)
	2006	1.34	44	59	(52-66)
	2007	1.83	42	77	(65-89)
	2008	1.85	65	120	(105-135)
	2009	1.66	74	123	(111-135)
	2010	1.85	61	126	(107-145)
	2011	1.90	77	146	(127-165)
Lesser Adjutant	2004	2.82	56	158	(127-189)
	2005	2.61	83	217	(189-245)
	2006	2.52	96	242	(217-267)
	2007	2.94	86	253	(222-284)
	2008	2.82	78	220	(189-251)
	2009	2.95	118	348	(312-384)
	2010	2.81	102	312	(276-348)
	2011	2.77	131	363	(321-405)
Milky Stork	2004	1.00	2	2	
	2005	1.00	4	4	
	2006	1.10	10	11	(9-13)
	2007	1.43	7	10	(6-14)
	2008	1.10	10	11	(9-13)
	2009	1.14	7	8	(6-10)
	2010	1.21	14	17	(14-20)
	2011	1.23	13	16	(12-20)
Asian Openbill	2004	13.49	51	688	(514-862)
	2005	15.93	87	1386	(1132-1640)
	2006	18.71	151	2825	(2485-3165)
	2007	22.88	168	3844	(3229-4459)
	2008	29.84	313	9340	(8124-10556)
	2009	34.23	332	11364	(9892-12836)
	2010	41.21	307	13845	(12418-15272)
	2011	44.75	292	13042	(11833-14251)
Painted Stork	2004	3.59	303	1089	(991-1187)
	2005	4.25	402	1707	(1596-1818)
	2006	4.79	385	1846	(1723-1969)
	2007	4.57	403	1841	(1724-1958)

	2008	4.98	423	2106	(1946-2266)
	2009	4.20	455	1910	(1789-2031)
	2010	5.28	435	2419	(2275-2563)
	2011	5.29	443	2345	(2207-2483)
<b>Spot-billed Pelican</b>	2004	5.95	172	1024	(932-1116)
	2005	5.09	192	978	(883-1073)
	2006	8.25	191	1575	(1419-1731)
	2007	8.84	173	1529	(1381-1677)
	2008	7.32	199	1456	(1349-1563)
	2009	5.54	267	1480	(1328-1632)
	2010	6.02	229	1475	(1347-1603)
	2011	7.64	206	1574	(1412-1736)
<b>Oriental Darter</b>	2002		4	241	(118-364)
	2003	17.97	29	521	(367-675)
	2004	22.06	51	1125	(819-1431)
	2005	24.25	76	1843	(1475-2211)
	2006	31.99	79	2527	(2087-2967)
	2007	27.20	149	4053	(3463-4643)
	2008	30.60	178	5447	(4745-6149)
	2009	38.06	192	7308	(6537-8079)
	2010	30.37	179	5437	(4822-6052)
	2011	37.72	177	6751	(5959-7543)



**Photograph 5. Greater Adjutants on the nest, by Eleanor Briggs**



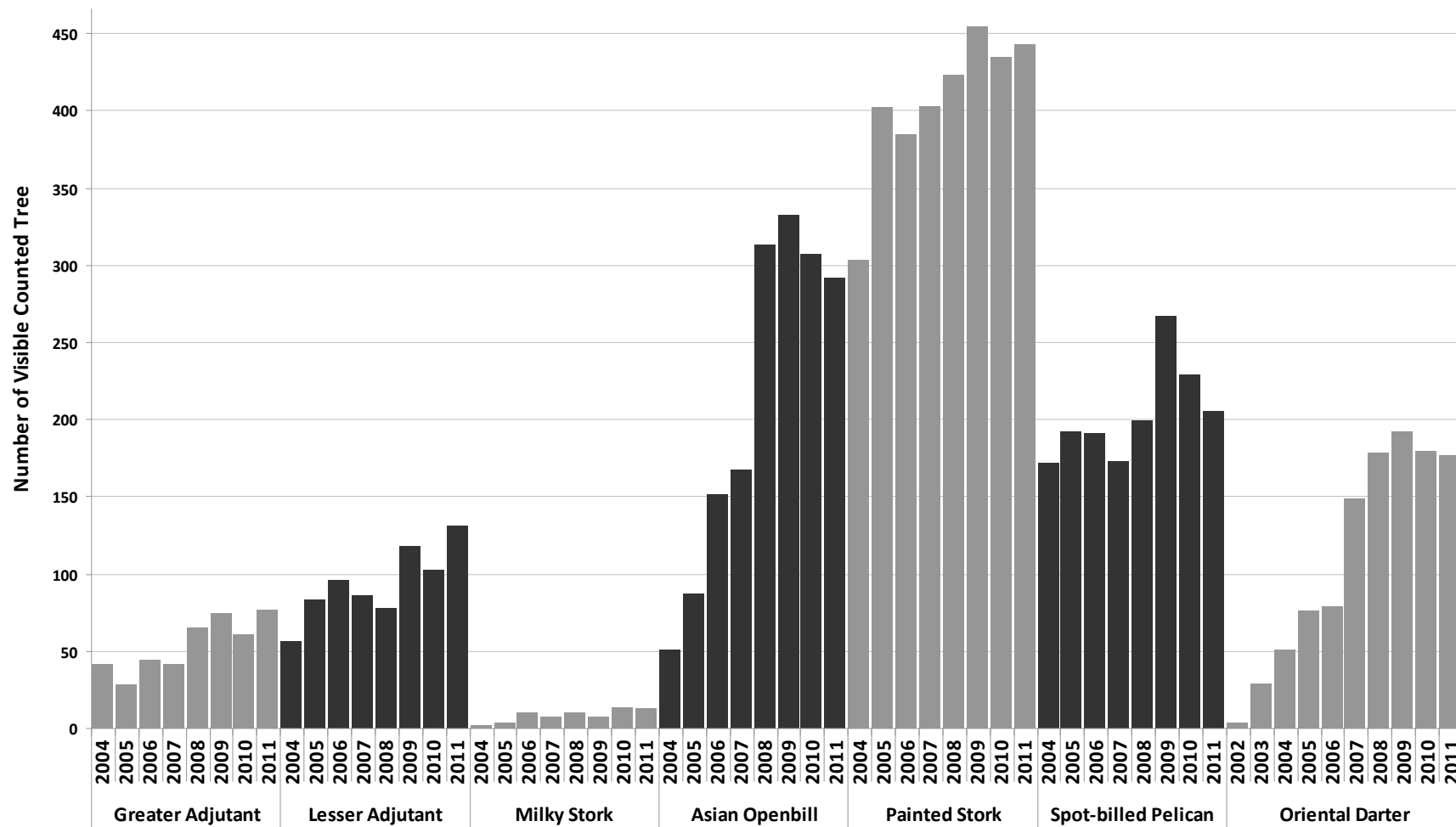


Figure 10. Graph showing number of visible trees

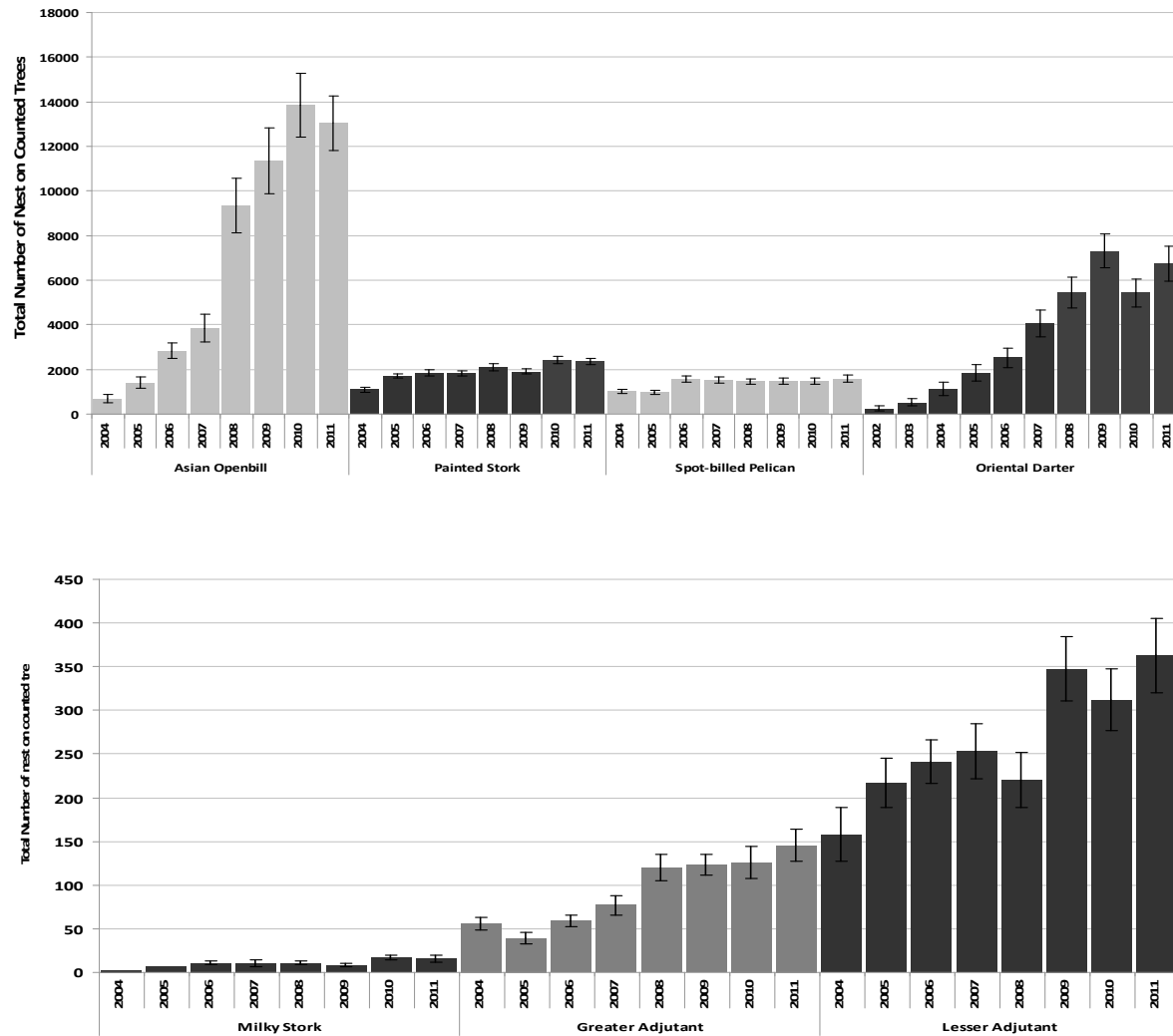


Figure 11. Graph showing number of nests recorded on visible trees

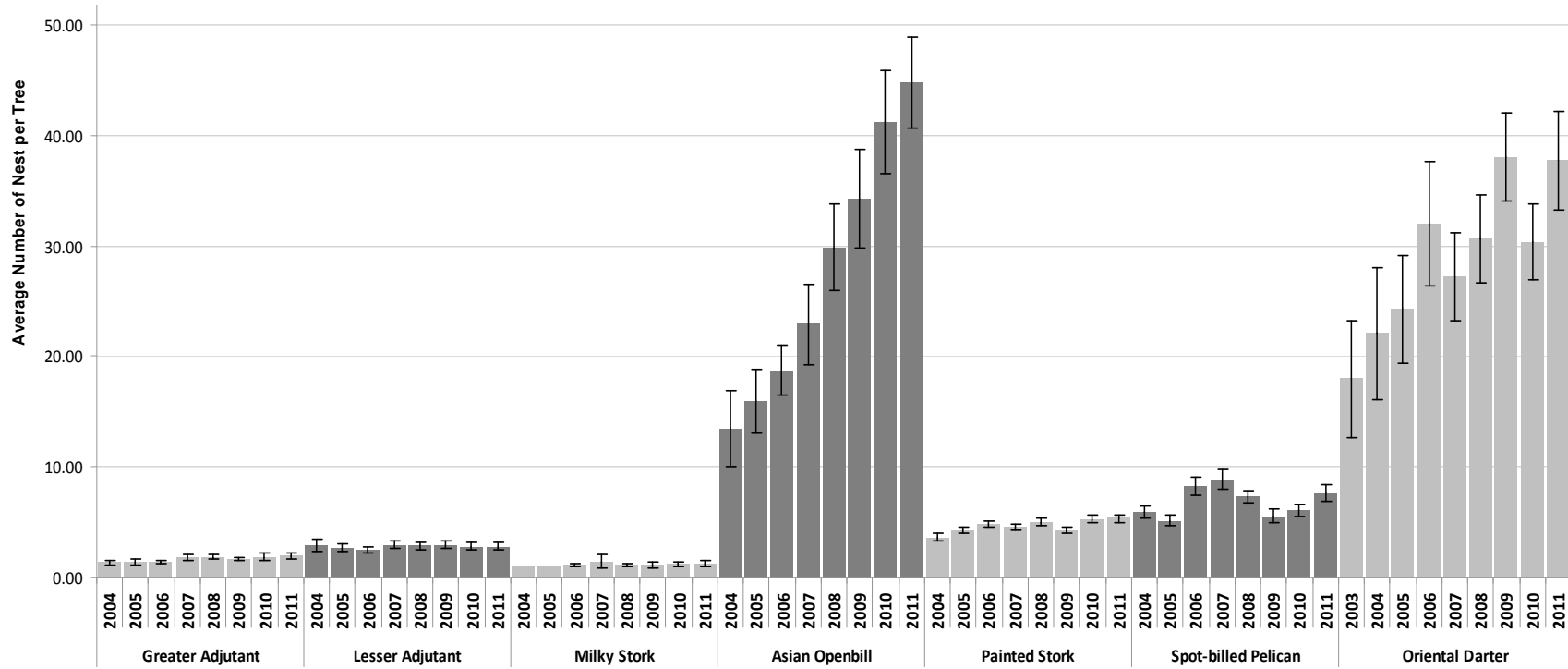


Figure 12. Graph showing mean number of nests counted per visible tree

#### 4.4. Other important bird species

##### 4.4.1. Grey-headed Fish Eagle *Ichthyophaga ichthyaetus*

Following the methodology used since 2005, a strip-transect survey was conducted in December (the peak nesting time for this species) to monitor former nesting trees and record new nesting sites. The data in Table 4 show the results of the Grey-headed Fish Eagle survey in the December 2010 breeding season of December 2010 in which there were 51 breeding pairs recorded in the area. Figure 13 shows the distribution of Grey-headed Fish Eagle in Prek Toal in December 2010.

**Table 4: Grey-headed Fish Eagle nests in Prek Toal**

Species	Year	Total Number of Nests
Grey-headed Fish Eagle	2005	32
	2006	43
	2007	52
	2008	58
	2009	48
	2010	51



**Photograph 6. Grey-headed Fish Eagle on the nest in Prek Toal Core Area, by Ruth Tingay**

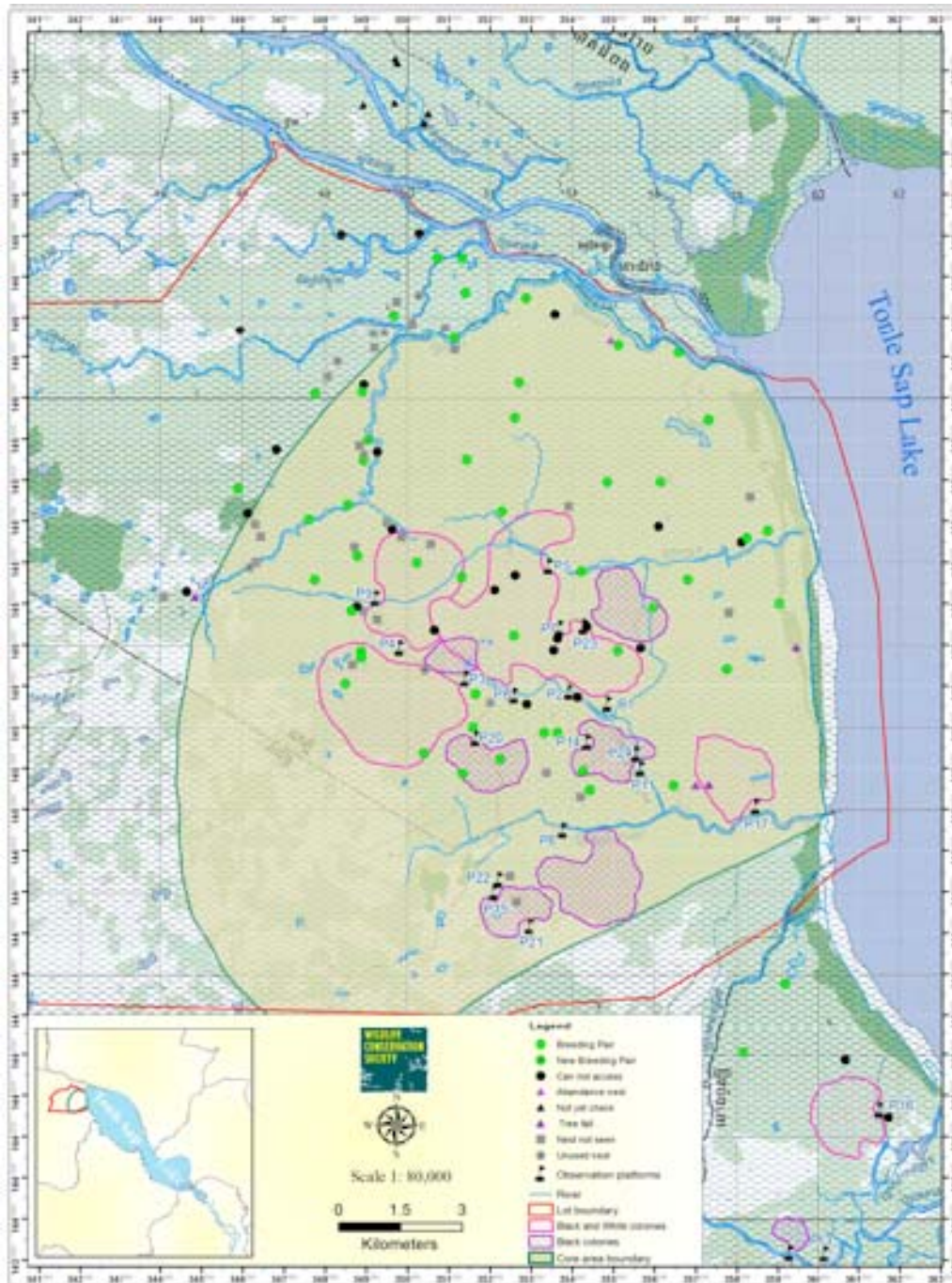


Figure 13. Distribution map for Grey-headed Fish Eagle, December 2010.

#### 4.4.2. Woolly-necked Stork *Ciconia epicopus*

Every year since 2004, a single pair of Woolly-necked Storks has been observed to return to Prek Toal to breed. Each year, the birds arrive in January and leave in June. 2011 was the first year since records begun when the pair failed to breed in Prek Toal. In 2011 the former nesting tree (#111) was used by Oriental Darter, so in 2011

although the birds were seen near the tree the Woolly-necked Storks couldn't use the tree for nesting.

#### **4.4.3. Black-headed Ibis *Threskiornis melanocephalus***

In Prek Toal Black-headed Ibis tend to breed low down in locations which are hidden deep in the scrub. Therefore in 2011 it was only possible to count adult birds at two main colonies which could be observed from platform 5 and 16. Table 5 shows the number of nesting trees, adults, nests and chicks counted from 2008 to 2010 and the number of adults counted from 2008-2011.

**Table 5. Counts of Black-headed Ibis in Prek Toal**

<b>Year</b>	<b>No. nesting trees</b>	<b>Adults</b>	<b>Nests</b>	<b>Chicks</b>
2008	4	539	62	303
2009	3	469	43	181
2010	3	176	111	98
2011	-	345	-	-

#### **4.4.4. Black-necked Stork *Ephippiorhynchus asiaticus***

No Black-necked Storks bred in Prek Toal in 2011. This species has not bred in Prek Toal since a single pair nested in 2004 and 2005.

### **4.5. Notes on mammal and reptile species**

In 2011 records of sightings of some globally threatened or Near Threatened mammal species were kept. This section details those observations.

#### **4.5.1. Otters *Lutra* spp.**

Two species of otter occur in the Tonle Sap Biosphere Reserve, Hairy-nosed Otter *Lutra sumatrana* and Smooth Otter *Lutrogale perspicillata*, both documented with photographs (Poole 2003). Otter sightings by rangers are listed in Table 7 and Figure 14. Rangers identified otters based primarily on colour (they report that Hairy-nosed Otter is black and Smooth Otter is grey), the shape of the tail (Laterally flattened in Smooth Otter) and muzzle details (if views permitted). However, owing to difficulties in field identification of otters to species level, especially from a moving boat, identification of otters as recorded here should be treated as provisional.

There are two apparent clusters of records, one to the south-east of the area protected by platforms, and the other in the north-west. However these may relate more to distribution of observers (or observers who reported records) rather than distribution of otters.



**Table 7. Records of otters in Prek Toal in 2011**

Date	Location	No.	Activity
<b>Hairy-nosed Otter</b>			
13 January	O'spot	4	Feeding
28 January	At platform4	5	Feeding
11 February	At platform5	5	Feeding
5 March	Near P5	5	Feeding
<b>Smooth Otter</b>			
11 February	Near platform 4	5	Feeding
27 February	At platform 1	1	Feeding
26 February	Near platform 4	3	Feeding
11 March	At platform 9	5	Feeding
4 April	Near P16	6	Feeding
16 April	Near ranger camp of P16	13	Feeding
<b>Unidentified Otter</b>			
5 March	Prek Proh-Aphai	3	Feeding



**Photograph 7. Hairy-nosed Otter confiscated from fishermen, May 2011, Sun Visal**

#### **4.5.2. Fishing Cat *Prionailurus viverrinus***

No records of Fishing Cat were made during 2011.

#### **4.5.3. Germain's Silvered Langur *Trachypithecus germaini***

No records of Germain's Silvered Langur were made during 2011.



#### 4.5.4. Long-tailed Macaque *Macaca fascicularis*

Most records were made from or near the observation platforms and on the trees along the main rivers. Table 6 shows the recorded sightings of Long-tailed Macaque during the year.

**Table 6: Records of Long-tailed Macaque in Prek Toal in 2011**

Date	Location	No.	Activity
7 January	At Platform 6	5	Feeding
19 January	O'pakantail	12	Feeding
4 February	At Platform 2	2	Feeding
10 April	O'pos Veak	3	Feeding

#### 4.5.5. Siamese Crocodile *Crocodylus siamensis*

No records of Siamese Crocodile were made during 2011.



**Figure 14. Map of locations of otter sightings in 2011**

## 5. Discussion

Data collected in the 2010/11 breeding season continue to show a positive trend for populations of almost all of the key large waterbird species in Prek Toal. Data indicate that all six species of conservation concern have increasing or stable populations. Painted and Milky Stork populations remained stable compared with 2010. Because aerial surveys conducted in 2006-7 indicated that platform based counts under-estimated total population size by up to 50%, the total number of Painted Stork nests in Prek Toal might be over 4,000. Based on a world population estimate of 25,000 individuals (BirdLife International 2012), the population at Prek Toal is likely to constitute perhaps one third of the global population.

Of particular interest are the populations of the two adjutant species, since Prek Toal is the largest colony in the world for these two species, and their populations continue to gradually increase, in contrast to their fortunes elsewhere in their ranges. Although estimates of the overall populations of the more abundant storks can be extrapolated using data from aerial surveys conducted in 2006 and 2007, the number of Greater and Lesser Adjutant nest are insufficient to allow interpolation, although it can probably be assumed that true populations are higher than the number of nests counted (Clements *et al.* 2007). The population of Greater Adjutant in Prek Toal now constitutes at least half of the global population of that species, and is therefore of the highest concern in a conservation context.

The populations of Asian Openbill at Prek Toal are huge. Using aerial over flights Clements *et al.* (2007) estimated that only 50% of the Asian Openbill colony was visible from the platforms, therefore, the current population may be 26,000 pairs, and at the end of the breeding season the number of birds may be approximately 100,000 individuals.

Between the 2010 and 2011 breeding seasons, the number of Asian Openbill nests visible from the platforms remained stable. However, during this time there was also one recorded case of egg collection from an Asian Openbill colony during the data collection period. Six poachers visited a colony during the day and night close to platforms 4, 9 and 5. They were arrested and the eggs were confiscated. However egg collection and associated disturbance may have caused some birds to leave Prek Toal during 2011.

The poaching incident serves as a warning to remain vigilant to the threat posed by egg and chick collection. In August 2011 the Fishing Lots system which provided incidental protection to the large waterbird colonies was abolished. An increase in the number of fishermen in the Core Area in the 2011/12 breeding season is likely. Data collected between 2004-2011 will be vital in assessing the impact on the large waterbird colonies because it can serve as a baseline against which future trends can be monitored.

It is probable that the protection afforded to the large waterbird colonies is also of benefit to Black-headed Ibis, although an effective method for monitoring this species at Prek Toal continues to prove elusive. In 2012 we will investigate the potential of using monthly waterbird count data from Ang Trapeang Thmor, since some of the birds from Prek Toal congregate at that site in the non-breeding season.

Population trends in Grey-headed Fish Eagle are unclear, although the population might be stable and fluctuating slightly. Prek Toal remains the single most important site for this species globally, supporting the highest density of breeding pairs.

The project has begun to collect ad-hoc data on the occurrence of other globally Threatened species in Prek Toal core Area. It is hoped that these data can be used to identify important areas for these threatened species, within the Prek Toal Core Area. However, only Long-tailed Macaque, and otters were recorded in 2011. The complete lack of records of Germain's Silvered Langur is a concern. Although two species of otters have been confirmed from Prek Toal Core Area, owing to identification difficulties the assigning of records to either of the two species (as attempted in Table 5) should be treated with caution. The continued presence of the Critically Endangered Hairy-nosed Otter was confirmed with a photograph (page 26, this report) of an individual confiscated from a fisherman and released by Sun Visal.

This year the large waterbird monitoring report presented graphs showing the trend towards earlier peak nesting dates. The change has been dramatic, on average the peak nesting date is now nearly two months earlier than in 2004, an average rate of change of nearly one week per year. The driving factor behind this trend is unknown.



**Photograph 8. Painted Storks, by Eleanor Briggs**

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