Biodiversity Monitoring In The Floodplain Of The Tonle Sap In 2008-9

PREFACE

This document presents the results of annual biodiversity monitoring activities in and around the Tonle Sap lake and floodplain for the period August 2008 - June 2009. Compiled by WCS, under contract to the Tonle Sap Conservation Project and MoE, the document draws on work by a consortium of other government agencies, notably the Forestry and Fisheries Administrations, and a number of NGOs. Accurate monitoring of this kind enables conservationists to monitor the success of our programs, detect new threats as they arise and communicate the importance of the Tonle Sap ecosystem to decision-makers. It probably represents one of the most ambitious and technically rigorous programs of its kind for any ecosystem in the region and is a testament to the cooperation and dedication of the participants.

The monitoring described here focuses on populations of rare birds, partly because they form one of the most significant aspects of the biodiversity of the lake and partly because they indicate the health of the Tonle Sap ecosystem more broadly. The scope of monitoring in this unique and biologically rich area has grown over the past ten years, hand in hand with the growth of a series of on-the-ground conservation projects at key sites. There is now monitoring in place for thirteen key species, six of them globally threatened, at seven key conservation areas in the Tonle Sap Biosphere Reserve and across the wider floodplain. Most of the protocols used for the described monitoring work were printed in a reference document in 2007[1].

A parallel system of monitoring for fish, watersnakes and other aquatic species is conducted by the Fisheries Administration, Ministry of Environment and many other stakeholders, with the results published in a separate series of reports. In future it is hoped that monitoring work may be expanded to include some of the highly threatened mammal and reptile species found in the Tonle Sap ecosystem.

The first report of the four in this volume presents results from the monitoring of the breeding waterbird colonies in the Prek Toal Core Area of the Tonle Sap Biosphere Reserve. These are the largest and in some cases only known colonies in Southeast Asia for the species monitored, and they continue to remain in buoyant good health. Colonies were monitored for the following species: Greater and Lesser Adjutant, Painted and Milky Stork, Asian Openbill, Spot-billed Pelican and Oriental Darter. The number of Grey-headed Fish Eagle nests is also monitored in Prek Toal and results are briefly summarized in this report.

The second report compiles monitoring data on non-breeding waterbirds from the seven key sites: Prek Toal, Boeung Tonle Chhmar and Stueng Sen Core Areas and four Integrated Farming and Biodiversity Areas (IFBAs), as well as incidental records from other sites. The species covered here are: Greater and Lesser Adjutant, Painted, Milky, Black-necked and Woolly-necked Stork, Asian Openbill, White-shouldered and Black-headed Ibis, Spot-billed Pelican and Oriental Darter. Little is yet known about bird movements in response to the Tonle Sap's extreme annual cycle of environmental fluctuations but the monitoring of feeding birds at various sites across the floodplain helps us to better understand fluctuations in numbers and distribution.

[1] WCS (2007) *Tonle Sap Biodiversity Monitoring Protocols*. Wildlife Conservation Society, Phnom Penh, Cambodia.

The third report covers Bengal Floricans, a Critically Endangered bird for which Cambodia holds the majority of the world population. They live in the highly threatened, seasonally inundated grasslands that were once so extensive in the Tonle Sap ecosystem. Key florican populations are found in the Integrated Farming and Biodiversity Areas, a recently established network of grassland reserves and 2009 was the first year that a complete census of the number of territorial male Bengal Floricans was undertaken in these reserves. Monitoring also takes place in the areas used by this species outside the breeding season, just beyond the limits of the floodplain.

The fourth report describes the regional status of Sarus Cranes. In the late dry season cranes aggregate at a small number of wetlands, and every year since 2001 a network of NGOs and government agencies has made counts at this time of year at all key sites across both Cambodia and Vietnam. In recent years additional counts have been conducted in the early and mid dry season to clarify the complex movements that cranes make as water levels change.

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អត្ថបទសង្ខេប

របាយការណ៍នេះរៀបរាប់ពីលទ្ធផលនៃសកម្មភាពសិក្សាត្រួតពិនិត្យតាមដានជីវចម្រុះនៅក្នុង និងជុំវិញតំបន់បឹងទន្លេសាប និងវាលទំនាបលិចទឹក ក្នុងកំឡុងពេលពីខែសីហា ឆ្នាំ២០០៨ ដល់ខែមិថុនា ឆ្នាំ២០០៩ ដែលរៀបចំចងក្រង ដោយអង្គការសមាគមអភិរក្សសត្វព្រៃ (WCS) ក្រោមកិច្ចព្រមព្រៀងអនុវត្តគំរោងជាមួយគំរោងអភិរក្សបឹងទន្លេសាប (TSCP) និងក្រសួងបរិស្ថាន (MoE) ហើយរបាយការណ៍នេះ នឹងឆ្លុះបង្ហាញពីលទ្ធផលការងារដែលសហការអនុវត្តជាមួយនឹងស្ថាប័នរាជរដ្ឋាភិបាលផ្សេងទៀត ជាពិសេសគឺរដ្ឋបាលជលផល និងអង្គការក្រៅរដ្ឋាភិបាលជាដៃគូដទៃទៀត។ ការត្រួតពិនិត្យតាមដានដោយជាក់លាក់នេះ នឹងផ្តល់លទ្ធភាពដល់ក្រុមអភិរក្សធ្វើការត្រួតពិនិត្យតាមដានជីវចម្រុះនៅក្នុងតំបន់ ដើម្បីឈានទៅរកភាពជោគជ័យនៃកម្មវិធីអភិរក្ស តាមរយៈការទទួលបាននូវព័ត៌មានថ្មីអំពីសកម្មភាពគំរាមកំហែងនានា ដែលជះឥទ្ធិពលដល់សារៈសំខាន់របស់ប្រព័ន្ធអេកូឡូស៊ីបឹងទន្លេសាប និងផ្តល់ព័ត៌មានពីការគំរាមកំហែងទាំងនេះទៅដល់ក្រុមអ្នកគ្រប់គ្រងក្នុងការធ្វើសេចក្តីសម្រេចចិត្តប្រកបដោយប្រសិទ្ធិភាពខ្ពស់។ គំរោងនេះនឹងអាចជាគំរោងអនុវត្តន៍ដ៏សំខាន់បំផុតមួយ ដែលមានបច្ចេកទេសគ្រប់គ្រាន់ សំរាប់យកទៅអនុវត្តន៍នៅតាមគំរោងអភិរក្សប្រព័ន្ធអេកូឡូស៊ីស្រដៀងគ្នានៅថ្នាក់តំបន់ និងត្រៀមរួចជាស្រេច ដើម្បីសហប្រតិបត្តិការចូលរួមពីគំរោងអភិរក្សផ្សេងទៀត។

លទ្ធផលនៃការត្រួតពិនិត្យតាមដានជីវចម្រុះនេះ ពិពណ៌នាអំពីចំនួននៃប្រភេទសត្វស្លាបមានដោយកម្រដែលវត្តមានរបស់ពួកវា នឹងឆ្លុះបញ្ចាំងពីសារៈសំខាន់នៃជីវចម្រុះបឹងទន្លេសាប និងពីទិដ្ឋភាពទូទៅនៃគុណភាពប្រព័ន្ធអេកូឡូស៊ីបឹងទន្លេសាប។ ទំហំការងារត្រួតពិនិត្យជាទៀតទាត់នៅក្នុងតំបន់ដែលមានជីវចម្រុះដ៏សំបូរបែប និងពិសេសបំផុតនេះ បានកើនឡើងក្នុងរយៈពេល១០ឆ្នាំកន្លងមក ក្រោមកិច្ចខិតខំអនុវត្តន៍ការងារផ្តាល់នៅតាមគំរោងតំបន់គោលដៅសំខាន់ៗ។ បច្ចុប្បន្នគំរោងការងារនេះ បាន និងកំពុងធ្វើការការពារប្រភេទសត្វស្លាបសំខាន់ៗចំនួន ១៣ប្រភេទ រួមមាន ០៦ប្រភេទ ស្ថិតនៅក្នុងស្ថានភាពទទួលរងគំរាមកំហែងជិតផុតពូជជាសកល ដែលពួកវាមានវត្តមាននៅក្នុងតំបន់អភិរក្ស ០៧កន្លែង ស្ថិតក្នុងតំបន់បំបនិយជីវៈមណ្ឌលបឹងទន្លេសាប និងតំបន់ទំនាបលិចទឹកដ៏ធំល្វឹងល្វើយ។ ចំពោះរបៀបណែនាំអំពីការត្រួតពិនិត្យតាមដាននេះភាគច្រើន ត្រូវបានចងក្រងនៅក្នុងឯកសារយោងក្នុងឆ្នាំ២០០៧[1] ។

ប្រព័ន្ធត្រួតពិនិត្យតាមដានស្របគ្នានឹងគំរោងខាងលើផងដែរ ការសិក្សាស្រាវជ្រាវអំពីសត្វពស់ទឹក និងប្រភេទសត្វរស់នៅក្នុងទឹកដទៃទៀត ត្រូវបានអនុវត្តន៍ដោយរដ្ឋបាលជលផល ក្រសួងបរិស្ថាន និងស្ថាប័នពាក់ព័ន្ធជា

[1] WCS (២០០៧) ឯកសារណែនាំអំពីរបៀបនៃការត្រួតពិនិត្យតាមដានជីវចម្រុះបឹងទន្លេសាប –*Tonle Sap Biodiversity Monitoring Protocols*. Wildlife Conservation Society, Phnom Penh, Cambodia.

ច្រើនទៀត។ ជាលទ្ធផលរបាយការណ៍នៃសកម្មភាពដែលបំពេញឱ្យគ្នាទៅមកនេះ ត្រូវបានបោះពុម្ពផ្សព្វផ្សាយជាបន្តបន្ទាប់។ នៅពេលអនាគត យើងសង្ឃឹមថាការងារនេះ នឹងអាចពង្រីកការសិក្សាបន្ថែមទៀត អំពីពពួកថនិកសត្វ និងសត្វល្មូន ដែលកំពុងតែទទួលរងគំរាមកំហែងខ្លាំងជាសកល ហើយពួកវាក៏មានវត្តមានក្នុងតំបន់បឹងទន្លេសាបនេះផងដែរ។

របាយការណ៍លើកដំបូង នៃឯកសារបោះពុម្ព ៤វគ្គ រៀបរាប់អំពីលទ្ធផលនៃការត្រួតពិនិត្យតាមដានការបន្តពូជរបស់សត្វស្លាបទឹកនៅតាមបន្ទាយពងកូនក្នុងតំបន់ស្នូលព្រៃកទាល់ នៃតំបន់ឋបនីជីវៈមណ្ឌលបឹងទន្លេសាប។ នេះជាលទ្ធផលនៃការរកឃើញបន្ទាយពងកូនដ៏ធំបំផុត និងមាននៅសល់តិចតួចបំផុត នៅក្នុងតំបន់ភូមិភាគអាស៊ីអគ្នេយ៍ សំរាប់ប្រភេទសត្វស្លាបទឹកមានដោយកម្រដែលត្រូវបានសិក្សាត្រួតពិនិត្យតាមដាននេះ។ ហើយដែលទីជំរកដ៏សំខាន់បំផុតនេះ នឹងថែរក្សាភាពសុខសាន្តរបស់ប្រភេទសត្វស្លាបទឹកទាំងនេះឱ្យរស់នៅគង់វង្សបន្តទៀត។ ការសិក្សានេះបានត្រួតពិនិត្យតាមដាននៅតាមបន្ទាយពងកូនរបស់ប្រភេទសត្វស្លាបដូចជា ត្រដក់ធំ ត្រដក់តូច រនាលពណ៌ រនាលស ចង្កៀលខ្យង ទុងប្រផេះ និងស្មោញ។ រីឯចំនួនសំបុករបស់អកត្រីក្បាលប្រផេះក៏ត្រូវបានធ្វើការត្រួតពិនិត្យតាមដានក្នុងតំបន់ព្រៃកទាល់ផងដែរ និងមានលទ្ធផលជាសង្ខេបនៅក្នុងរបាយការណ៍នេះ។

របាយការណ៍លើកទី២ បានប្រមូលចងក្រងទិន្នន័យនៃការត្រួតពិនិត្យតាមដានលើពួកសត្វស្លាបទឹក ដែលមិនបន្តពូជនៅតំបន់ទន្លេសាប ដែលពួកវាមានវត្តមានផងដែរនៅក្នុងតំបន់សំខាន់ៗចំនួន ០៧កន្លែងគឺ តំបន់ស្នូលព្រៃកទាល់ បឹងទន្លេឆ្មារ ស្ទឹងសែន និង៤កន្លែងទៀតក្នុងតំបន់កសិជីវចម្រុះ រួមផ្សំជាមួយការកត់ត្រានៅតាមតំបន់ផ្សេងទៀតដែលស្ថិតនៅក្បែរតំបន់ទាំងនោះ។ ប្រភេទសត្វស្លាបទឹកដែលរស់នៅក្នុងតំបន់ទាំងនេះរួមមាន ត្រដក់ធំ ត្រដក់តូច រនាលពណ៌ រនាលស អង្គត់ខ្មៅ កុកពាក់អំបោះ(សត្វកស) ចង្កៀលខ្យង ត្រយ៉ងចំកសស ត្រយ៉ងខ្លួនស ទុងប្រផេះ និងស្មោញ។ មានការដឹងតិចតួចនៅឡើងអំពីព័ត៌មាននៃការ បំលាស់ទីរបស់ប្រភេទ សត្វស្លាប ទឹកទាំងនោះ ក្នុងការ បកស្រាយទាក់ទងទៅនឹងការប្រែប្រួលបរិស្ថាននៃវដ្តប្រចាំឆ្នាំដ៏ធំធេងរបស់បឹងទន្លេសាប ប៉ុន្តែការត្រួតពិនិត្យតាមដានពីតំបន់រកចំណីរបស់សត្វស្លាបទឹកនៅតាមតំបន់នានាទូទាំងតំបន់វាលទំនាបលិចទឹក ជួយយើងឱ្យដឹងកាន់តែច្បាស់អំពីការប្រែប្រួលនៃចំនួន និងរបៀបរបស់សត្វស្លាបទឹកនៅក្នុងតំបន់នេះ។

របាយការណ៍លើកទី៣ រៀបរាប់អំពីសត្វខ្សឹបដែលជាប្រភេទសត្វស្លាបទទួលរងគ្រោះជិតផុតពូជខ្លាំងបំផុត ហើយដែលចំនួនរបស់វានៅលើពិភពលោកគឺមានភាគច្រើនក្នុងប្រទេសកម្ពុជា។ ពួកវារស់នៅតាមតំបន់វាលស្មៅលិចទឹកតាមរដូវ ដែលជាតំបន់លាតសន្ធឹងយ៉ាងធំក្នុងប្រព័ន្ធអេកូឡូស៊ីបឹងទន្លេសាប ហើយដែលតំបន់នេះបានទទួលរងការគំរាមកំហែងយ៉ាងខ្លាំង។ ចំនួនប្រមូលផ្តុំរបស់សត្វខ្សឹបភាគច្រើន ត្រូវបានគេឃើញមាននៅតាមតំបន់កសិជីវចម្រុះ ដែលជាតំបន់ថ្មីត្រូវបានបង្កើតឡើងជាបណ្តាញនៃតំបន់ការពារវាលស្មៅ។ នៅឆ្នាំ២០០៩ គឺជាឆ្នាំដំបូងដែលការធ្វើជំរឿនពេញលេញមួយ ត្រូវបានគេធ្វើឡើងដើម្បីរាប់ចំនួនទីជម្រករស់នៅរបស់សត្វខ្សឹបឈ្មោល

ដែលមាននៅក្នុងតំបន់នេះ។ ការស្រាវជ្រាវត្រួតពិនិត្យតាមដានក៏ត្រូវបានធ្វើឡើងផងដែរ នៅតាមតំបន់ទីជម្រកផ្សេងទៀងដែលមិនមែនជាតំបន់ពងកូនរបស់ពួកវា ដែលស្ថិតនៅជាយឆ្ងាយពីវាលទំនាបលិចទឹក។

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សូមថ្លែងអំណរគុណ និងដឹងគុណយ៉ាងជ្រាលជ្រៅចំពោះ គំរោងអភិរក្សបឹងទន្លេសាបUNDP/GEF មូលនិធិ Critical Ecosystem Partnership មូលនិធិអភិរក្សសត្វព្រៃDisney និងសម្បុរសជននានា ដែលបានជួយឧបត្ថម្ភគាំទ្រថវិកា ជំរុញឱ្យការងារដែលបានរៀបរាប់ក្នុងរហាយការណ៍នេះសម្រេចបានជោគជ័យ និងបានបង្ហាញនូវការប្តេជ្ញាចិត្តយ៉ាងមុះមុត ដើម្បីចូលរួមចំណែកពង្រឹងការអភិរក្សសត្វព្រៃនៅក្នុងប្រទេសកម្ពុជា។

MONITORING OF LARGE WATERBIRDS AT PREK TOAL, TONLE SAP GREAT LAKE 2009

August 2009

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SUMMARY

The Prek Toal bird colonies are the only remaining breeding site in South-east Asia for two Globally 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)*.

In 2003 a comprehensive monitoring program was put in place, aiming to monitor the population size and detect the annual population trends of the above mentioned key species at Prek Toal. This report presents the result from the 2008/09 colony monitoring work.

There were nine main large waterbird colonies at Prek Toal in the 2008/9 season. The breeding season started in August 2008, and the last birds left the colonies in June 2009. The total number of nests counted in the peak surveys in 2009 increased significantly from the previous year for Asian Openbill (2008: 9340 nests, 2009: 11364 nests, confidence interval: 9892-12836). The number of nests of Oriental Darter increased from 5447 (confidence interval: 4745-6149) in 2008 to 7308 (confidence interval: 6537-8079) in 2009. The number of nests also significantly increased for Lesser Adjutant from 220 (confidence interval: 189-251) in 2008 to 348 (confidence interval: 312-384) in 2009. Little change of nest numbers for Greater Adjutant, Milky Stork and Spot-billed Pelican were seen between 2008 and 2009.

Overall, between 2004 and 2009 the average number of nests per trees has increased steadily for Asian Openbill, Oriental Darter, Lesser Adjutant and Painted Stork, while increasing slightly for Greater Adjutant and Milky Stork, and generally fluctuating for Spot-billed Pelican.

The shift towards earlier peak nesting periods observed for Lesser Adjutant, Oriental Darter and Asian Openbill is something that merits further study. A detailed analysis of the arrival, nesting and departure times of colonies over the past six years could establish whether there are real changes in nesting times for the majority of species, or whether this is simply due to small fluctuations over a relatively long peak breeding period. If this is the result of a real change in bird behaviour, an investigation into the possible causes would be necessary to identify any potential threats for these species. Possible reasons include a decrease in disturbance to nests and chicks, climate change (WWF 2006; Jonzén et al. 2007), water level change (Kummu & Sarkkula 2008), or changes in non-breeding habitats causing birds to migrate to the breeding colonies earlier.

សេចក្តីសង្ខេប

បន្ទាយពងកូនសត្វស្លាបទឹកនៅតំបន់ព្រៃកទាល់ គឺជាទីជម្រកបង្កាត់ពូជដែលមាននៅសល់តែមួយគត់ស្ថិតនៅក្នុងតំបន់ភូមិភាគអាស៊ីអគ្នេយ៍ ជាពិសេសប្រភេទសត្វទុងប្រផេះ និងរនាលសដែលជាប្រភេទត្រូវបានទទួលរងការគំរាមកំហែង ជិតផុតពូជនៅលើពិភពលោក។ មិនតែប៉ុណ្ណោះតំបន់នេះក៏ជាទីជម្រកដ៏ធំបំផុត ដែលនៅសល់សំរាប់ប្រភេទសត្វស្លាបទឹក០៦ប្រភេទទៀត ដែលបានទទួលរង រឺជិតទទួលរងការគំរាមកំហែង ជិតផុតពូជជាសកលផងដែរ ដូចជាសត្វស្មោញ ត្រដក់តូច ត្រដក់ធំ ត្រយ៉ងខ្លួនស រនាលពណ៌ និងអកត្រីក្បាលប្រផេះ។

នៅឆ្នាំ២០០៣ គំរោងបានសិក្សាស្រាវជ្រាវត្រួតពិនិត្យតាមដានស៊ីជំរៅមួយ ត្រូវបានដំណើរការអនុវត្តក្នុងគោលបំណង ដើម្បីត្រួតពិនិត្យតាមដានចំនួនបរិមាណ និងកំរិតបម្រែបម្រួលប្រចាំឆ្នាំ របស់ប្រភេទសត្វស្លាបទឹកសំខាន់ៗដែលបានរៀបរាប់ខាងលើ នៅក្នុងតំបន់ព្រៃកទាល់។ របាយការណ៍នេះនឹងបង្ហាញអំពីលទ្ធផលនៃការងារត្រួតពិនិត្យតាមដានសត្វទាំងនោះនៅតាមបន្ទាយពងកូន ក្នុងឆ្នាំ២០០៨-២០០៩។

មានបន្ទាយពងកូនចំនួន ០៩កន្លែងសំខាន់ៗ ដែលត្រូវបានកត់ត្រារកឃើញនៅក្នុងតំបន់ព្រៃកទាល់ នារដូវកាលសិក្សាក្នុងឆ្នាំ២០០៨-២០០៩។ ក្នុងនោះរដូវបង្កាត់ពូជ បានចាប់ផ្តើមពី ខែសីហា ឆ្នាំ២០០៨ រហូតដល់ខែមិថុនា ឆ្នាំ២០០៩។ ចំនួនសំបុកសរុបដែលបានរាប់មានកំរិតច្រើនបំផុតក្នុងឆ្នាំ២០០៩បើធៀបនឹងឆ្នាំមុនៗ។ ជាក់ ស្តែងចំពោះសត្វចង្កៀលខ្យង នៅឆ្នាំ២០០៨មានចំនួន៩៣៤០សំបុក ចំណែកនៅឆ្នាំ២០០៩មានចំនួនរហូតដល់ ១១៣៦៤សំបុក និងកំរិតភាពជឿជាក់មានចំនួនចន្លោះ ៤៧៤៥-៦១៤៩។ សត្វស្មោញមានចំនួនកើនឡើងពី ៥៤៤៧សំបុក(កំរិតភាពជឿជាក់ចន្លោះ៤៧៤៥-៦១៤៩)ក្នុងឆ្នាំ២០០៨ដល់ចំនួន ៧៣០៨សំបុក (កំរិតភាពជឿជាក់ចន្លោះ៦៥៣៧-៨០៧៩)ក្នុងឆ្នាំ២០០៩។សត្វត្រដក់តូចកើនឡើងពី២២០សំបុក(កំរិតភាពជឿជាក់ ចន្លោះ ១៨៩-២៥១)ក្នុងឆ្នាំ២០០៨ ដល់ ៣៤៨សំបុក (កំរិតភាពជឿជាក់ចន្លោះ៣១២-៣៨៤)ក្នុងឆ្នាំ២០០៩។ រីឯចំនួនសំបុករបស់ប្រភេទសត្វត្រដក់ធំ រនាលស និងសត្វទុងប្រផេះ គឺមានការប្រែប្រួលតិចតួច នៅចន្លោះឆ្នាំ ២០០៨-២០០៩។

ជារួមក្នុងចន្លោះឆ្នាំ២០០៤និង២០០៩ ចំនួនសំបុកជាមធ្យមក្នុងដើមឈើនីមួយៗ បានកើនឡើងយ៉ាងល្បឿនចំពោះប្រភេទសត្វចង្កៀលខ្យង ស្មោញ ត្រដក់តូច និងរនាលពណ៌ ខណៈពេលដែលចំនួនរបស់សត្វត្រដក់ធំ និងរនាលស មានការកើនឡើងតិចតួច។ ហើយដែលជាទូទៅចំនួនរបស់សត្វទុងប្រផេះ មានចំនួនប្រែប្រួលចុះឡើង។

ការប្រែប្រួលចំពោះពេលនៃការមកពងកូនច្រើនបំផុតដំបូង ដែលបានអង្កេតទៅលើសត្វត្រដក់តូច ស្មោញ និងសត្វចង្កៀលខ្យង គឺគួរតែធ្វើការសិក្សាស្រាវជ្រាវតាមដានឱ្យកាន់តែច្បាស់លាស់បន្តទៀត។ ការវិភាគលម្អិតលើពេលវេលា នៃការមកដល់ការកាច់សំបុកពងកូន និងការហើរចេញក្នុងរយៈពេល៦ឆ្នាំកន្លងមកគួរតែអាចនិទស្សន៍បានថាតើមានការប្រែប្រួលពិតប្រាកដក្នុងរដូវពងកូនសំរាប់ប្រភេទសត្វភាគច្រើន រឺក៏ថាតើនេះដោយសារតែមានការប្រែប្រួលតិចតួច តាមរយៈការប្រៀបធៀបរយៈពេលយូរលើក៏រិតច្រើនបំផុតនៃការមកដល់របស់ សត្វក្នុងរដូវបង្កាត់ពូជ។ ប្រសិនបើលទ្ធផលនេះបានរកឃើញនូវការផ្លាស់ប្តូរពិតប្រាដកមួយនៃតរិយាបទរបស់សត្វស្លាបទឹក នោះយើង នឹងអាចរកឃើញនូវកត្តាសមស្របនានាដែលចាំបាច់ក្នុងការកំណត់កត្តាគំរាមកំហែងចម្បងៗលើប្រ ភេទសត្វស្លាបទឹកទាំងនេះ។ មូលហេតុទាំងនោះអាចរួមមាន ការថយចុះនៃសកម្មភាពរំខានដល់សំបុកពង និង កូនសត្វ ការប្រែប្រួលអាកាសធាតុ (WWF 2006; Jonzén et al. 2007) ការប្រែប្រួលនៃកំរិតកម្ពស់ទឹក ((Kummu & Sarkkula 2008) រឺក៏ការប្តូរទីជម្រកពងកូនដោយសារតែសត្វទាំងនោះបំលាស់ទីទៅកាន់ទីជម្រកចាស់ដែលពួកវាធ្លាប់ពងកូនពីមុន។

INTRODUCTION

The Tonle Sap Great Lake in central Cambodia is the largest freshwater lake in south-east Asia and is recognised as being of 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: the three core areas, reserved for biodiversity conservation (70,837 ha in total); the buffer zone, designated as for sustainable fisheries management (510,768 ha); and the transition zone, which serves as an area for sustainable agricultural development (899,652 ha). 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 are the only remaining breeding site in South-east Asia for two Globally 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 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 and 2007/8 breeding seasons, as previously reported (Goes 2005; Clements et al. 2007; Sun Visal & Clements 2008). This report will provide the results of the 2008/9 breeding season for the large waterbird colonies at the Prek Toal Core Area.

METHODS

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

Platform Counts

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.

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.

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.

Counting procedure

Boat-based counts are used during high water level in wet season and 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.

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												
Pelican												
Greater Adjutant												
Lesser Adjutant												
Painted Stork												
Milky Stork												
Asian Openbill												
Grey-headed Fish Eagle												

Breeding season Peak counts

Photograph 1. Rangers counting birds from platform at Prek Toal

Photograph by Sun Visal

Marking of Nesting Trees

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) record 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 and 2008/09 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.

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 2. Tree marking in Prek Toal

Photograph by Sun Visal

RESULTS

Between 1980s and 1990s bird colonies at Prek Toal were disturbed and eggs and chicks collected every year. However, since the start of the project in 2001 the number of disturbance and collection incidences has declined dramatically, and there have no incidences of the disturbance and collection in recent years. The monitoring program continues to follow trends in the populations of large waterbirds and the evolution of the bird colonies in the area to evaluate the effectiveness of the conservation program. The 2008/9 breeding season has shown a continuation of the success of this program.

Timing of Peak Counts

The peak nesting dates for all species except the Spot-billed Pelican appear to be getting progressively earlier each year since 2004 when records began (see Table 2). This change is particularly pronounced for the Oriental Darter, followed by the Lesser Adjutant and the Painted Stork. However, with only six years of data, it is difficult to determine whether this is a significant and sustained change, or simply the result of random differences between years.

Table 2. Peak nesting dates

Species	2003	2004	2005	2006	2007	2008	2009
Asian Openbill		15-Mar-04	4-Mar-05	15-Mar-06	4-Mar-07	9-Mar-08	24-Feb-09
Greater Adjutant		24-Apr-04	6-Apr-05	8-Apr-06	18-Apr-07	22-Apr-08	16-Mar-09
Lesser Adjutant		21-Apr-04	24-Mar-05	12-Apr-06	22-Mar-07	11-Mar-08	12-Feb-09
Milky Stork		25-Mar-04	23-Apr-05	28-Mar-06	1-Apr-07	28-Mar-08	05-Mar-09
Painted Stork		10-Apr-04	13-Apr-05	6-Apr-06	15-Mar-07	08-Mar-08	12-Mar-09
Spot-billed Pelican		16-Mar-04	16-Feb-05	7-Feb-06	31-Jan-07	10-Mar-08	17-Mar-09
Oriental Darter	19-Jan-03	07-Dec-03	21-Nov-04	04-Nov-05	08-Nov-06	12-Oct-07	29-Oct-08

Bird Colonies

There were nine main large waterbird colonies at Prek Toal in the 2008/9 season. The breeding season started in August 2008, and the last birds left the colonies in June 2009

The main Black and White colonies at Prek Toal core area were located at platforms 1, 2, 3, 4, 5, 7, 8, 9 and 20. The birds arrived in November 2008 and left in June 2009. The species present included Oriental Darter, Spot-billed Pelican, Asian Openbill, Painted Stork, Milky Stork, Greater Adjutant, Lesser Adjutant and Black-headed Ibis. Asian Openbills were the most abundant.

There were eight Black (Darter and Cormorant) colonies in the core area in 2008/9 at platforms 3, 23, 24, 20, 14, 21, 22 and 17. The birds arrived in August 2008 with a peak time count in October, and the birds left the colonies in late February 2009.

There were four satellite colonies located at platforms 5, 6, 16 and 17 this year, composed of Asian Openbill, Painted Stork and Lesser Adjutant. The birds arrived in December 2008 and left in June 2009.

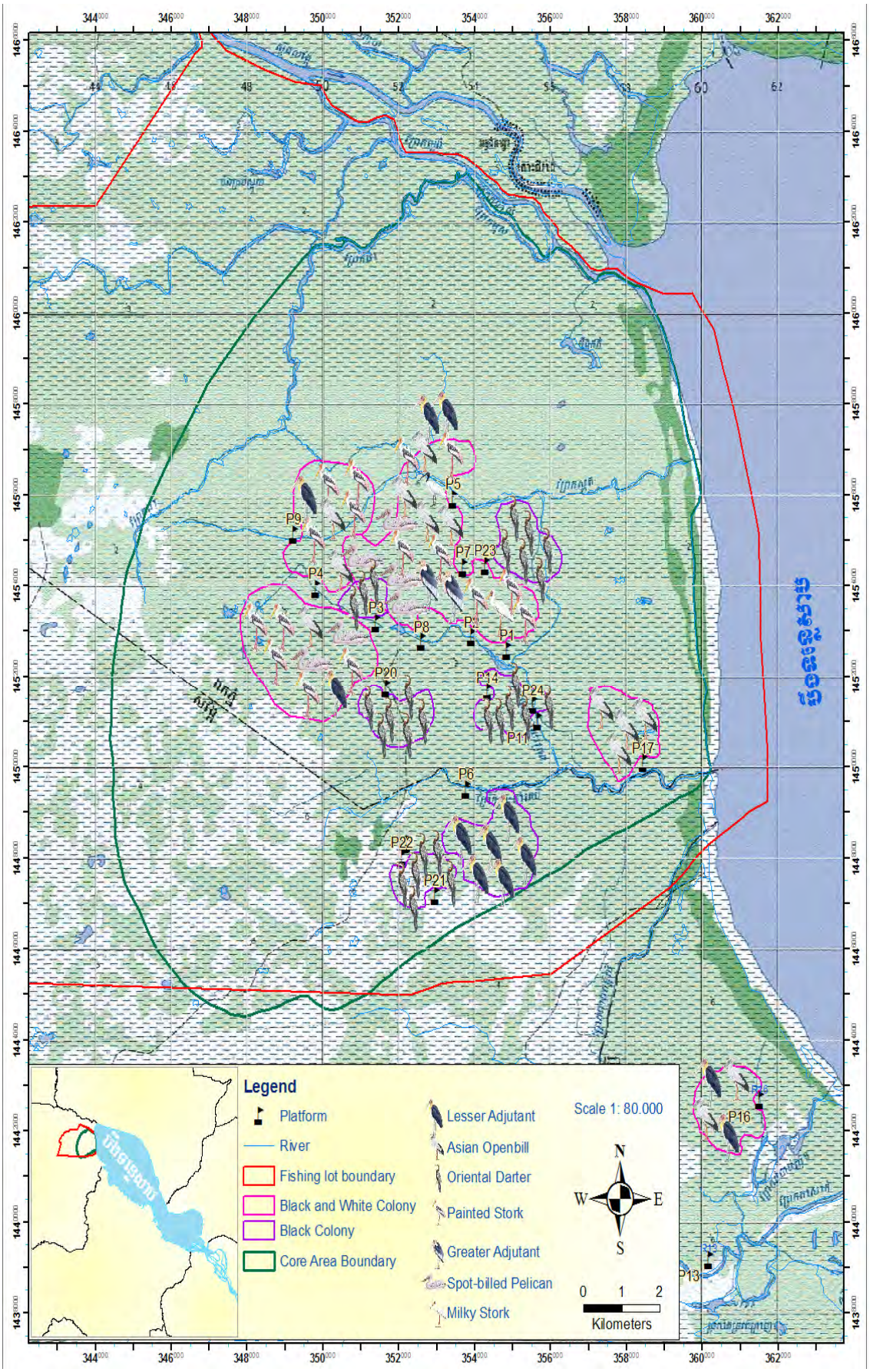

Figure 1. map of Prek Toal colonies 2009

Key Species

Figures 2, 3, 4 and Table 4 show the number of counted trees, the number of nests and the average nests per tree recorded during the peak platform counts for all seven species.

Between 2004 and 2009 the average number of nests per trees has increased steadily for Asian Openbill, Oriental Darter, Lesser Adjutant and Painted Stork, increased slightly for Greater Adjutant and Milky Stork, and fluctuated for Spot-billed Pelican.

The total number of nests counted in the peak surveys in 2009 increased significantly from the previous year for Asian Openbill (2008: 9340 nests, 2009: 11364 nests, confidence interval: 9892-12836). The number of nests of Oriental Darter increased from 5447 (confidence interval: 4745-6149) in 2008 to 7308 (confidence interval: 6537-8079) in 2009. The number of nests is also significantly increased for Lesser Adjutant from 220 (confidence interval: 189-251) in 2008 to 348 (confidence interval: 312-384) in 2009. Little change of nest number for Greater Adjutant, Milky Stork and Spot-billed Pelican were seen between 2008 and 2009.

Photograph 3. Painted stork colony at Prek Toal Core Area

Photograph by Sun Visal

Photograph 4. Spot-billed pelican at feeding site in Prek Toal Core Area

Photograph by Sun Visal

Table 3. Species population estimates

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)
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)
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)
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)
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)
Spot-billed Pelican	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)
Oriental Darter	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)

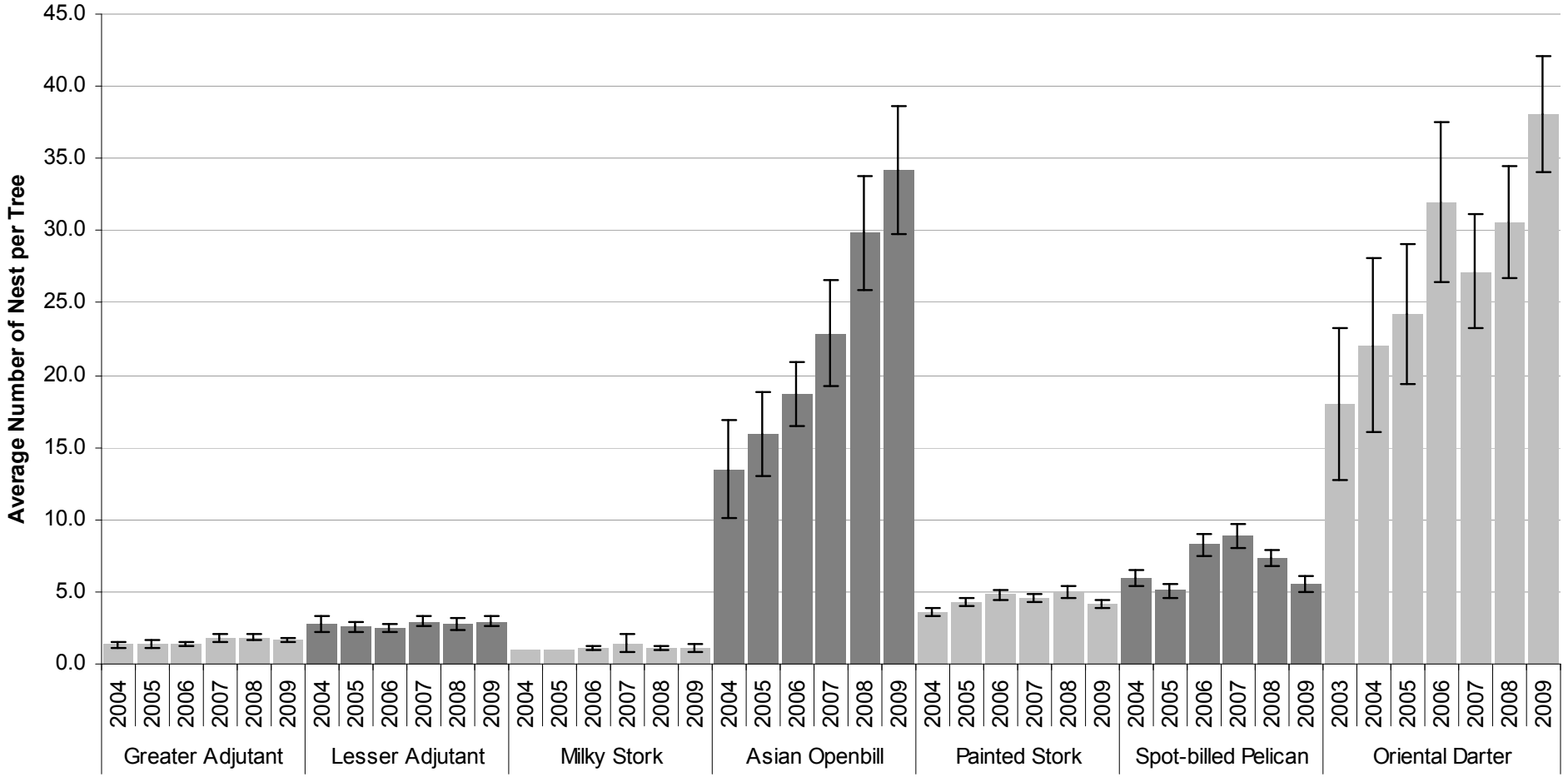

Figure 1. Graph showing average number of nests counted per tree, for colony count data

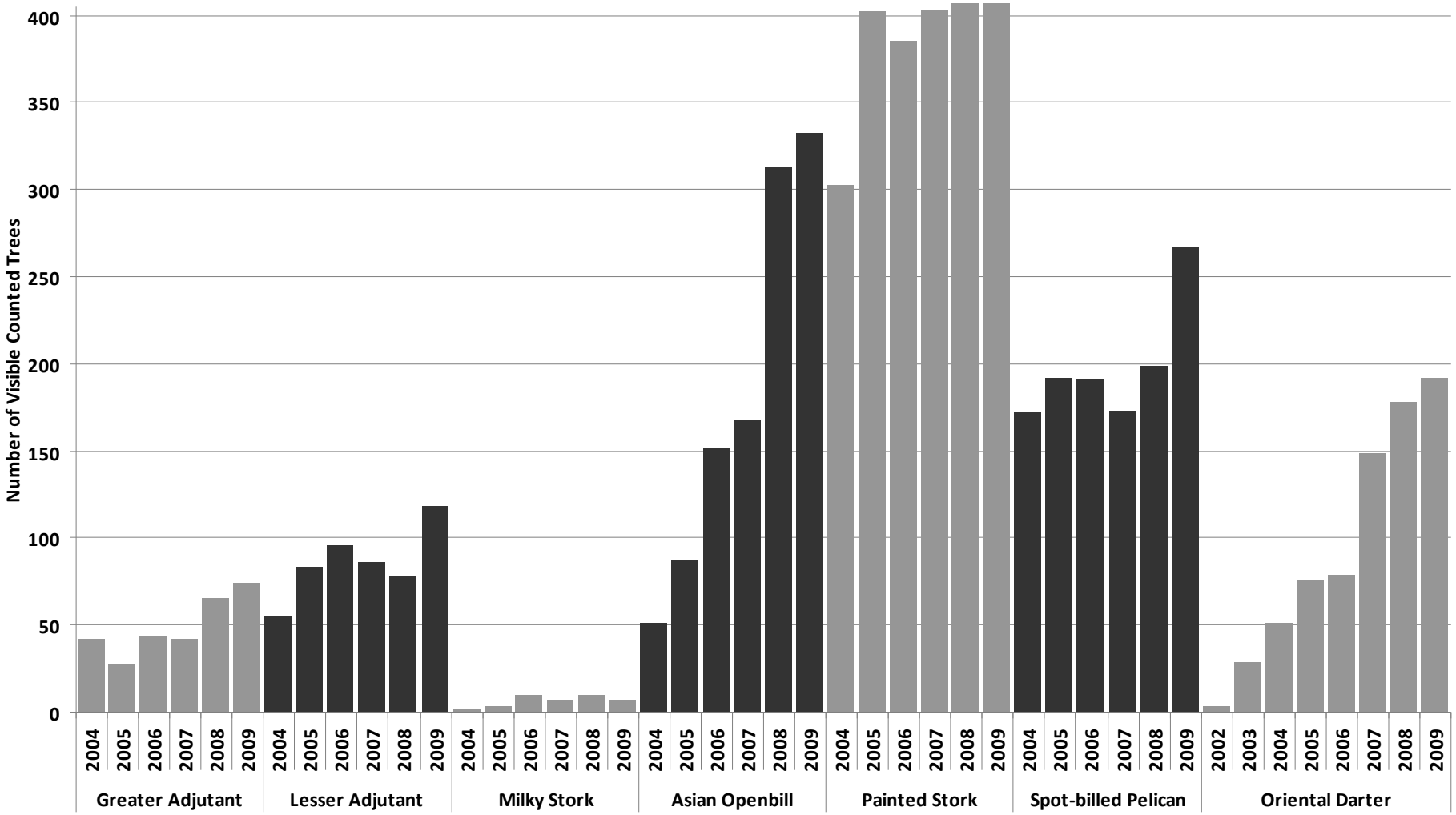

Figure 2. Graph showing number of visible counted trees

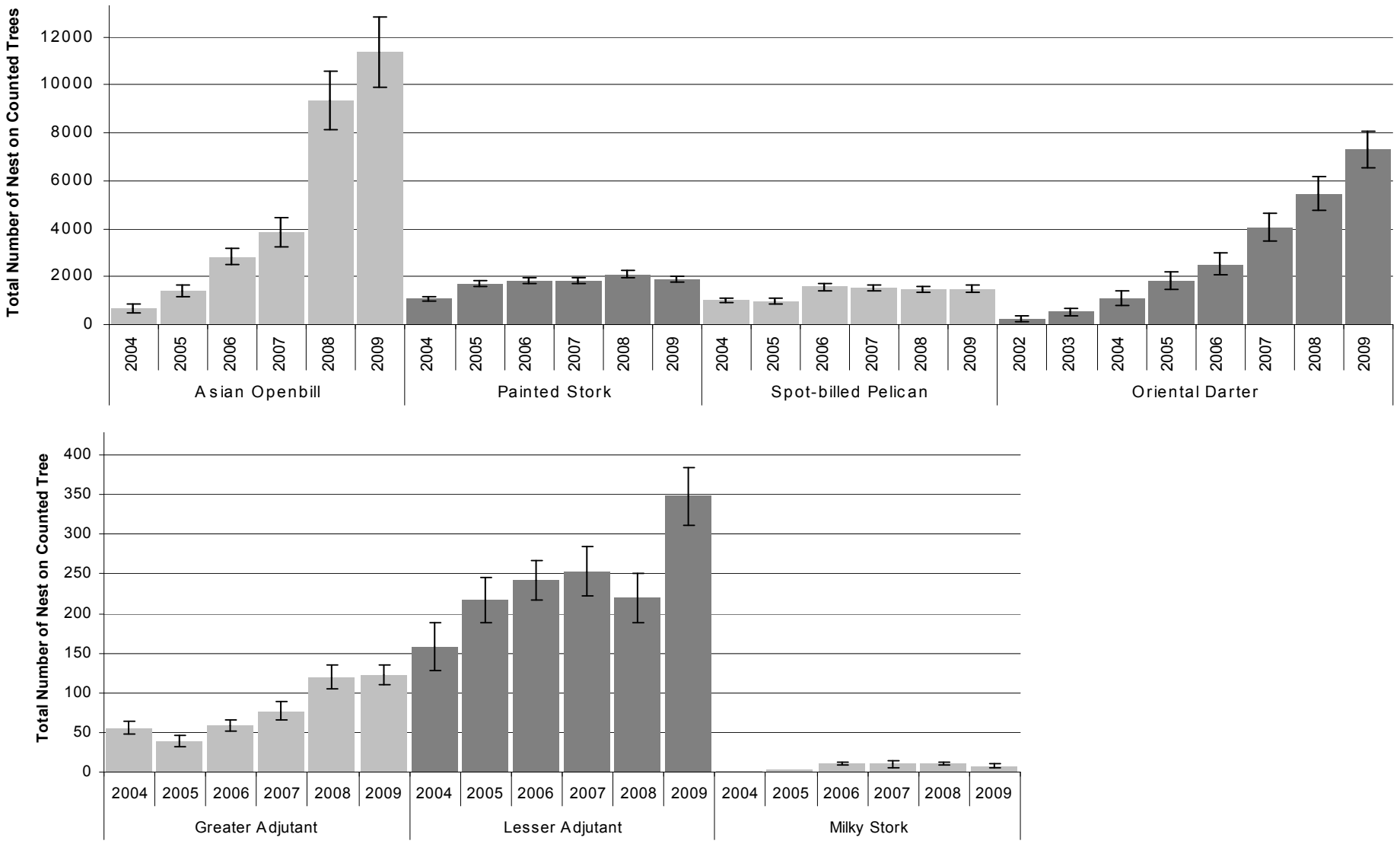

Figure 3. Graph showing number of nests recorded, colony count data

Other Species

Grey-headed Fish Eagle
Ichthyophaga icthyaetus

This species can be seen year round in Prek Toal, particularly close to ponds and along river channels. Annual strip transect surveys have been conducted in December (the peak time for this species) every year since 2005. The eagles usually start breeding in late October. They are territorial, and the nesting trees are distributed across the core area (Figure 5)Approximately 58 pairs were record in Prek Toal area in 2008/9, one of the highest known densities for Grey-headed Fish Eagle.

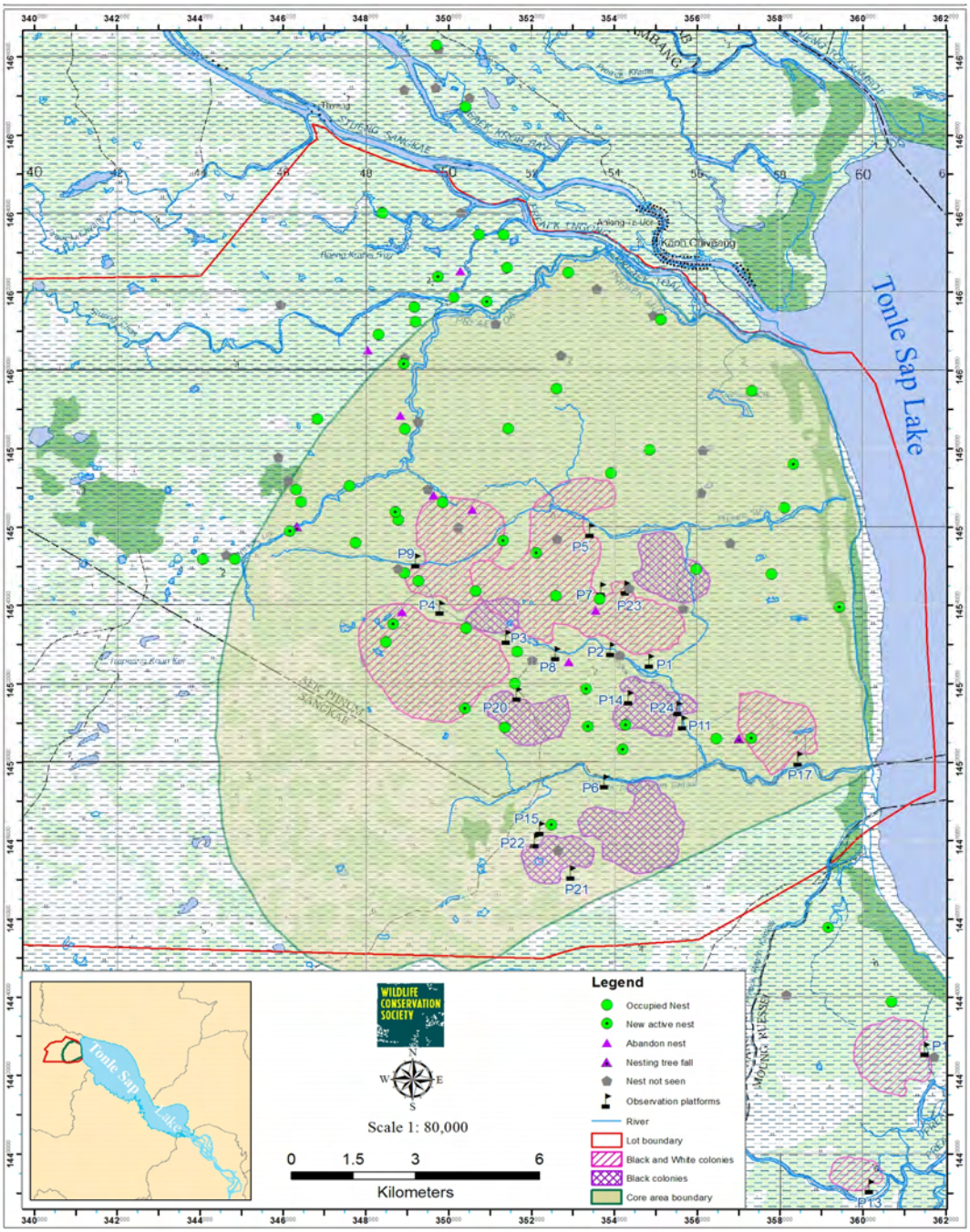

Figure 5. Distribution Map for Grey-headed Fish Eagle in Prek Toal, December 2008

Woolly-necked Stork
Ciconia epicopus

This species has come to breed every year at Prek Toal since 2004, especially near platform six, breeding from January to June. A single pair with two chicks was recorded in 2009. The Wooly-necked Stork does not breed in colonies, so it is unsurprising that small numbers were observed.

Black-headed Ibis
Threskiornis melanocephalus

It is hard to locate the nests of this species because they breed low down, hidden by scrub, breeding between January and June. Although data has been recorded every year for this species since 2001, the breeding colony was not located between 2004 and 2007, despite large numbers of birds recorded flying over the colonies and feeding along the lake shore. It is therefore assumed that the ibis did nest in these years. The breeding colony was found again in 2008, located at platform five, with four nesting trees sufficiently visible, giving a count of 539 adults, 303 chicks and 62 nests. In 2009, this species returned to the breeding colony at platform five where three nesting trees were visible for population counts. There were 469 adults, 181 chicks and forty three nests in total this year.

Black-necked Stork
Ephippiorhychus asiaticus

This species has been record every year since 2002, particularly at feeding sites along lakeshore. In 2004, there was the first recorded of breeding of this species in Tonle Sap when a single pair with two chicks were observed from platform 16, returning to the same nest in 2005 *(Cambodia Bird News No.13)*. Since 2005, these birds have not been observed breeding in Prek Toal. As with the Wooly-necked Stork, the Black-necked Stork is not a colonial breeder, so high numbers would not be expected.

DISCUSSION

This year, further improvements to the management of the Prek Toal Core Area have included an extension on a sub-degree, now preventing fishermen from using covered fishing gear within the Core Area (gear which sometimes traps large water birds), increased environmental education in schools and continued law enforcement. The data from the 2008/9 breeding season continue to show increased or stable populations for all seven water bird species of significance. This is in line with data from annual monitoring over the last six years, reflects the success and effectiveness of the new and continuing measures for the Prek Toal monitoring and management program.

Despite the lack of total population estimates, the continuing monitoring of bird species outside of the main water bird colonies is an important indicator of biodiversity. The successful location and monitoring of nests or breeding colonies of the Woolly-necked Stork, Black-headed Ibis, and Grey-headed Fish Eagle, and feeding populations of Black-necked Stork this year demonstrates that the Prek Toal Core Area continues to be important for a wide range of bird species.

The earlier peak nesting periods observed for Lesser Adjutant, Oriental Darter and Asian Openbill is something that merits further study. A detailed analysis of the arrival, nesting and departure times of colonies over the past six years could establish whether there are real changes in nesting times for the majority of species, or whether this is simply due to small fluctuations over a relatively long peak breeding period. If this is the result of a real change in bird behaviour, an investigation into the possible causes would be necessary to identify any potential threats for these species. Possible reasons include a decrease in disturbance to nests and chicks, climate change (WWF 2006; Jonzén et al. 2007), water level change (Kummu & Sarkkula 2008), or changes in non-breeding habitats causing birds to migrate to the breeding colonies earlier. Similar changes in peak annual (non-breeding) bird counts have been observed in Sarus Cranes in Cambodia (Evans et al. 2009).

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