



BIODIVERSITY MONITORING IN THE FLOODPLAIN OF THE TONLE SAP IN 2008-9



CRITICAL ECOSYSTEM PARTNERSHIP FUND



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 2007¹.

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 និងជុំវិញ តំបន់បឹងទន្លេសាប និងវាលទំនាបលិចទឹក ក្នុងកំឡុងពេលពីខែសីហា ឆ្នាំ២០០៨ ដល់ខែមិថុនា ឆ្នាំ២០០៩ ដែល រៀបចំចងក្រង ដោយអង្គការសមាគមអភិរក្សសត្វព្រៃ (WCS) ក្រោមកិច្ចព្រមព្រៀងអនុវត្តគម្រោងជាមួយគម្រោង អភិរក្សបឹងទន្លេសាប (TSCP) និងក្រសួងបរិស្ថាន (MoE) ហើយរបាយការណ៍នេះ នឹងឆ្លុះបញ្ចាំងពីលទ្ធផលការងារ ដែលសហការអនុវត្តជាមួយនឹងស្ថាប័នរាជរដ្ឋាភិបាលផ្សេងទៀត ជាពិសេសគឺរដ្ឋបាលជលផល និងអង្គការក្រៅ រដ្ឋាភិបាលជាដៃគូដទៃទៀត។ ការត្រួតពិនិត្យតាមដានដោយជាក់លាក់នេះ នឹងផ្តល់លទ្ធភាពដល់ក្រុមអភិរក្ស ធ្វើការត្រួតពិនិត្យតាមដានជីវចម្រុះនៅក្នុងតំបន់ ដើម្បីឈានទៅរកភាពជោគជ័យនៃកម្មវិធីអភិរក្ស តាមរយៈ ការទទួលបាននូវព័ត៌មានថ្មីអំពីសកម្មភាពតំបន់កំហែងនានា ដែលជះឥទ្ធិពលដល់សារៈសំខាន់របស់ប្រព័ន្ធអេកូឡូស៊ី បឹងទន្លេសាប និងផ្តល់ព័ត៌មានពីការគំរាមកំហែងទាំងនេះទៅដល់ក្រុមអ្នកគ្រប់គ្រងក្នុងការធ្វើសេចក្តីសម្រេចចិត្ត ប្រកបដោយប្រសិទ្ធភាពខ្ពស់។ គម្រោងនេះនឹងអាចជាគម្រោងអនុវត្តដ៏សំខាន់បំផុតមួយ ដែលមានបច្ចេកទេស គ្រប់គ្រាន់ សំរាប់យកទៅអនុវត្តនៅតាមគម្រោងអភិរក្សប្រព័ន្ធអេកូឡូស៊ីស្រដៀងគ្នានៅថ្នាក់តំបន់ និងត្រូវម្សិម្សាជា ស្រេច ដើម្បីសហប្រតិបត្តិការចូលរួមពីគម្រោងអភិរក្សផ្សេងទៀត។

លទ្ធផលនៃការត្រួតពិនិត្យតាមដានជីវចម្រុះនេះ ពិពណ៌នាអំពីចំនួននៃប្រភេទសត្វស្លាបមានដោយកម្រ ដែលវត្តមានរបស់ពួកវា នឹងឆ្លុះបញ្ចាំងពីសារៈសំខាន់នៃជីវចម្រុះបឹងទន្លេសាប និងពិទ្ធិភាពទូទៅនៃគុណភាព ប្រព័ន្ធអេកូឡូស៊ីបឹងទន្លេសាប។ ទំហំការងារត្រួតពិនិត្យជាទៀតទាត់នៅក្នុងតំបន់ដែលមានជីវចម្រុះដ៏សំបូរបែប និងពិសេសបំផុតនេះ បានកើនឡើងក្នុងរយៈពេល១០ឆ្នាំកន្លងមក ក្រោមកិច្ចខិតខំអនុវត្តការងារផ្ទាល់នៅតាម គម្រោងតំបន់គោលដៅសំខាន់ៗ។ បច្ចុប្បន្នគម្រោងការងារនេះ បាន និងកំពុងធ្វើការការពារប្រភេទសត្វស្លាបសំខាន់ៗ ចំនួន ១៣ប្រភេទ រួមមាន ០៦ប្រភេទ ស្ថិតនៅក្នុងស្ថានភាពទទួលរងគំរាមកំហែងជិតផុតពូជជាសកល ដែលពួកវា មានវត្តមាននៅក្នុងតំបន់អភិរក្ស ០៧កន្លែង ស្ថិតក្នុងតំបន់បំប៉ននិយជីវៈមណ្ឌលបឹងទន្លេសាប និងតំបន់ទំនាបលិចទឹក ដ៏ធំល្វីងល្វើយ។ ចំពោះរបៀបណែនាំអំពីការត្រួតពិនិត្យតាមដាននេះភាគច្រើន ត្រូវបានចងក្រងនៅក្នុងឯកសារ យោងក្នុងឆ្នាំ២០០៧^១ ។

ប្រព័ន្ធត្រួតពិនិត្យតាមដានស្របគ្នានឹងគម្រោងខាងលើផងដែរ ការសិក្សាស្រាវជ្រាវអំពីសត្វពស់ទឹក និង ប្រភេទសត្វរស់នៅក្នុងទឹកដទៃទៀត ត្រូវបានអនុវត្តដោយរដ្ឋបាលជលផល ក្រសួងបរិស្ថាន និងស្ថាប័នពាក់ព័ន្ធជា

^១ WCS (២០០៧) ឯកសារណែនាំអំពីរបៀបនៃការត្រួតពិនិត្យតាមដានជីវចម្រុះបឹងទន្លេសាប -Tonle Sap Biodiversity Monitoring Protocols. Wildlife Conservation Society, Phnom Penh, Cambodia.

ច្រើនទៀត។ ជាលទ្ធផលរបាយការណ៍នៃសកម្មភាពដែលបំពេញឱ្យគ្នាទៅមកនេះ ត្រូវបានបោះពុម្ពផ្សព្វផ្សាយជា បន្តបន្ទាប់។ នៅពេលអនាគត យើងសង្ឃឹមថាការងារនេះ នឹងអាចពង្រីកការសិក្សាបន្តថែមទៀត អំពីពួក ថនិកសត្វ និងសត្វល្អិត ដែលកំពុងតែទទួលរងគំរាមកំហែងខ្លាំងជាសកល ហើយពួកវាក៏មានវត្តមានក្នុងតំបន់បឹង ទន្លេសាបនេះផងដែរ។

របាយការណ៍លើកដំបូង នៃឯកសារបោះពុម្ព ៤វគ្គ រៀបរាប់អំពីលទ្ធផលនៃការត្រួតពិនិត្យតាមដានការ បន្តពូជរបស់សត្វស្លាបទឹកនៅតាមបន្ទាយពងកូនក្នុងតំបន់ស្ងួលព្រែកទាល់ នៃតំបន់បំបិទជីវៈមណ្ឌលបឹងទន្លេសាប។ នេះជាលទ្ធផលនៃការរកឃើញបន្ទាយពងកូនដ៏ធំបំផុត និងមាននៅសល់តិចតួចបំផុត នៅក្នុងតំបន់ភូមិភាគ អាស៊ីអគ្នេយ៍ សំរាប់ប្រភេទសត្វស្លាបទឹកមានដោយកម្រដែលត្រូវបានសិក្សាត្រួតពិនិត្យតាមដាននេះ។ ហើយដែល ទិដ្ឋភាពដ៏សំខាន់បំផុតនេះ នឹងថែរក្សាភាពសុខសាន្តរបស់ប្រភេទសត្វស្លាបទឹកទាំងនេះឱ្យរស់នៅគង់វង្សបន្តទៀត។ ការសិក្សានេះបានត្រួតពិនិត្យតាមដាននៅតាមបន្ទាយពងកូនរបស់ប្រភេទសត្វស្លាបដូចជា ត្រដក់ធំ ត្រដក់តូច រនាលពណ៌ រនាលស ចង្កៀលខ្យង ទុងប្រផេះ និងស្មៅព្យ។ រីឯចំនួនសំបុករបស់អកត្រីក្បាលប្រផេះក៏ត្រូវបានធ្វើ ការត្រួតពិនិត្យតាមដានក្នុងតំបន់ព្រែកទាល់ផងដែរ និងមានលទ្ធផលជាសង្ខេបនៅក្នុងរបាយការណ៍នេះ។

របាយការណ៍លើកទី២ បានប្រមូលចងក្រងទិន្នន័យនៃការត្រួតពិនិត្យតាមដានលើពួកសត្វស្លាបទឹក ដែល មិនបន្តពូជនៅតំបន់ទន្លេសាប ដែលពួកវាមានវត្តមានផងដែរនៅក្នុងតំបន់សំខាន់ៗចំនួន ០៧កន្លែងគឺ តំបន់ស្ងួល ព្រែកទាល់ បឹងទន្លេឆ្មារ ស្ទឹងសែន និង៤កន្លែងទៀតក្នុងតំបន់កសិដីវចម្រុះ រួមផ្សំជាមួយការកត់ត្រានៅតាមតំបន់ ផ្សេងទៀតដែលស្ថិតនៅក្បែរតំបន់ទាំងនោះ។ ប្រភេទសត្វស្លាបទឹកដែលរស់នៅក្នុងតំបន់ទាំងនេះរួមមាន ត្រដក់ធំ ត្រដក់តូច រនាលពណ៌ រនាលស អង្កត់ខ្មៅ កុកពាក់អំបោះ(សត្វកស) ចង្កៀលខ្យង ត្រយ៉ងចំកកស ត្រយ៉ងខ្លួនស ទុងប្រផេះ និងស្មៅព្យ។ មានការដឹងតិចតួចនៅឡើងអំពីព័ត៌មាននៃការ បំលាស់ទីរបស់ប្រភេទ សត្វស្លាប ទឹក ទាំងនោះ ក្នុងការ បកស្រាយទាក់ទងទៅនឹងការប្រែប្រួលបរិស្ថាននៃវដ្តប្រចាំឆ្នាំដ៏ធំធេងរបស់បឹងទន្លេសាប ប៉ុន្តែ ការត្រួតពិនិត្យតាមដានពីតំបន់កម្រិតរបស់សត្វស្លាបទឹកនៅតាមតំបន់នានាទូទាំងតំបន់វាលទំនាបលិចទឹក ជួយ យើងឱ្យដឹងកាន់តែច្បាស់អំពីការប្រែប្រួលនៃចំនួន និងរបាយរបស់សត្វស្លាបទឹកនៅក្នុងតំបន់នេះ។

របាយការណ៍លើកទី៣ រៀបរាប់អំពីសត្វខ្យីបដែលជាប្រភេទសត្វស្លាបទទួលរងគ្រោះជិតផុតពូជខ្លាំងបំផុត ហើយដែលចំនួនរបស់វានៅលើពិភពលោកគឺមានភាគច្រើនក្នុងប្រទេសកម្ពុជា។ ពួកវារស់នៅតាមតំបន់វាលស្មៅ លិចទឹកតាមរដូវ ដែលជាតំបន់លាតសន្ធឹងយ៉ាងធំក្នុងប្រព័ន្ធអេកូឡូស៊ីបឹងទន្លេសាប ហើយដែលតំបន់នេះបាន ទទួលរងការគំរាមកំហែងយ៉ាងខ្លាំង។ ចំនួនប្រមូលផ្តុំរបស់សត្វខ្យីបភាគច្រើន ត្រូវបានគេឃើញមាននៅតាមតំបន់ កសិដីវចម្រុះ ដែលជាតំបន់ថ្មីត្រូវបានបង្កើតឡើងជាបណ្តាញនៃតំបន់ការពារវាលស្មៅ។ នៅឆ្នាំ២០០៩ គឺជាឆ្នាំ ដំបូងដែលការធ្វើជំរឿនពេញលេញមួយ ត្រូវបានគេធ្វើឡើងដើម្បីរាប់ចំនួនទិដ្ឋភាពរបស់សត្វខ្យីបឈ្មោល

ដែលមាននៅក្នុងតំបន់នេះ ។ ការស្រាវជ្រាវត្រួតពិនិត្យតាមដានក៏ត្រូវបានធ្វើឡើងផងដែរ នៅតាមតំបន់ទីជម្រក ផ្សេងទៀតដែលមិនមែនជាតំបន់ពងកូនរបស់ពួកវា ដែលស្ថិតនៅជាយឆ្ងាយពីវាលទំនាបលិចទឹក ។

របាយការណ៍លើកទី៤ រៀបរាប់អំពីស្ថានភាពថ្នាក់តំបន់របស់សត្វក្រៀល ។ នៅចុងរដូវប្រាំង សត្វក្រៀល ប្រមូលផ្តុំនៅតាមតំបន់ដីសើមសំខាន់ៗមួយចំនួន ដែលជារៀងរាល់ឆ្នាំ ចាប់តាំងពីឆ្នាំ២០០១មក បណ្តាញអង្គការ អភិរក្សធម្មជាតិក្រៅរដ្ឋាភិបាល និងស្ថាប័នរដ្ឋាភិបាល បានរាប់សត្វក្រៀលក្នុងពេលតែមួយ នៅតាមតំបន់ប្រមូលផ្តុំ សំខាន់ៗ ទាំងនៅក្នុងប្រទេសកម្ពុជា និងប្រទេសវៀតណាម ។ ឆ្នាំថ្មីៗនេះ ការរាប់បន្ថែមច្រើនដងត្រូវបានគេធ្វើ ឡើងនៅដើម និងពាក់កណ្តាលរដូវប្រាំង ដើម្បីសិក្សាតាមដានឱ្យកាន់តែច្បាស់អំពីចលនាបំណាស់ទីខ្លាត់ខ្លែងទៅមក របស់សត្វក្រៀល ដែលការប្រែប្រួលនេះគឺអាស្រ័យទៅតាមការផ្លាស់ប្តូរនៃកំរិតកំពស់ទឹក ។

សូមផ្តល់អំណរគុណ និងដឹងគុណយ៉ាងជ្រាលជ្រៅចំពោះ គំរោងអភិរក្សបឹងទន្លេសាបUNDP/GEF មូលនិធិ Critical Ecosystem Partnership មូលនិធិអភិរក្សសត្វព្រៃDisney និងសម្បុរសជននានា ដែលបាន ជួយឧបត្ថម្ភគាំទ្រថវិកា ជំរុញឱ្យការងារដែលបានរៀបរាប់ក្នុងរបាយការណ៍នេះសម្រេចបានជោគជ័យ និងបាន បង្ហាញនូវការប្តេជ្ញាចិត្តយ៉ាងមុះមុត ដើម្បីចូលរួមចំណែកពង្រឹងការអភិរក្សសត្វព្រៃនៅក្នុងប្រទេសកម្ពុជា ។

BENGAL FLORICANS IN THE INTEGRATED FARMING AND BIODIVERSITY AREAS: 2008/9 MONITORING REPORT

September 2009

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¹ The Critical Ecosystem Partnership Fund is a joint initiative of l'Agence Française de Développement, Conservation International, the Global Environment Facility, the Government of Japan, the MacArthur Foundation and the World Bank. A fundamental goal is to ensure civil society is engaged in biodiversity conservation.

SUMMARY

The Bengal Florican *Houbaropsis bengalensis* is a species of bustard that is Critically Endangered with extinction due to rapid habitat loss and hunting. The majority of the world's population of Bengal Florican is dependent on grasslands located in and near to the floodplain of the Tonle Sap lake. Integrated Farming and Biodiversity Areas (IFBAs) have been set up in such grasslands in order to safeguard a part of the population, to conserve other rare species and to protect the access of local villages to key livelihood resources such as fisheries, agricultural land and pasture.

In late 2008 the IFBA network in Kampong Thom was revised by Provincial declaration and now covers 380 km². Two IFBAs were added in non-breeding areas and one floodplain IFBA was removed. This increased the total area of IFBAs, but the area of breeding habitat included was reduced significantly.

Florican population monitoring in Cambodia is conducted by the Wildlife Conservation Society under contract to the Tonle Sap Conservation Project, with support from other donors and in partnership with the Forestry Administration, the Ministry of Environment, the University of East Anglia, BirdLife International and the Angkor Center for the Conservation of Biodiversity. This report summarises results of monitoring work and related activities conducted between August 2008 and July 2009.

A systematic sample count of displaying males in the four IFBAs located within breeding grounds (floodplain grasslands) was conducted during March-April 2009. A total of 62 1x1 km blocks was included in the survey, representing 25% of the total area. Displaying males were estimated to occur at an overall density of 0.28 per km² within IFBAs. Extrapolating this figure gives an overall estimate of 68 territorial males (with a 95% confidence interval of 44-105 territorial males). This represents 23% of the estimated national population and at least 90% of those inside conservation areas in Cambodia. This is the first comprehensive estimate of densities for the areas within current IFBA boundaries and will form the baseline for detection of future long-term trends. Very similar estimates were made on the basis of national surveys in 2005-7 that covered the same broad habitat blocks, but the results are not precisely comparable.

Major land use changes were monitored through regular patrolling and use of satellite images. Dry season rice expansion destroyed 2% of the area of the IFBAs during 2008/9 and construction began on dams that will destroy a further 6% if they become operational in 2009/10. These are very significant threats.

In 2009 a baseline was also set for more detailed habitat monitoring in the breeding season IFBAs. Percentages of various land-cover types were recorded at the center of each monitoring square. The average percentage of grassland cover at the sampled locations varied between 50-75% for the different IFBAs.

Two nests were reported by villagers through the nest protection scheme and one (with two eggs) was successful. Reporting payments and success bonuses to the villagers amounted to \$40. There continues to be low uptake of these incentives. To increase the number of nests reported it is recommended to conduct intensive outreach for the nest protection program among dry season rice farmers in the floodplain, immediately prior and during the harvesting season.

In the non-breeding season 93 line transect surveys were conducted, from August to November, focusing on the two new IFBAs, Tuol Kreul-Phan Nheum and Trea-Samaki. Encounter rates were 0.17 and 0.13 floricans per transect in September and October respectively (the peak months of florican

presence). Records of florican mostly came from the south-eastern section of Trea-Samaki and an area just outside Tuol Kreul-Phan Nheum. The latter is a proposed plantation site and is rapidly being cleared. The distribution of Bengal Florican in the non-breeding season overlaps to some extent with community forests, for instance both of the newly designated IFBAs overlap with community forests.

It is recommended to continue this monitoring program on an annual basis. The same breeding season sample squares and non-breeding season transect locations should be included in future years to ensure comparability and repeat visits to each square should be made to allow estimation of detectability. More detailed land-cover monitoring should be put in place based on satellite images. If resources allow, grassland habitat and florican status should be monitored in the relevant parts of Prey Koh Conservation Area.

Detailed conservation recommendations are outside the scope of this report since it does not include a review of the many conservation activities already underway. However, the 2009 results reveal the severe threat faced by the Bengal Florican, other grassland species and the human communities using these sites. Key recommendations are:

- Strengthen legal protection for the existing IFBA network in order to prevent inappropriate large scale destructive development projects and reverse those that have begun, where possible.
- Improve management systems for the IFBAs to strengthen boundary demarcation, law enforcement, community participation and local benefits from tourism etc.
- Continue ecological research to clarify the needs of breeding females and of birds in the non-breeding season, and to better understand vegetation dynamics such as scrub invasion.
- Increase the total size of the florican population under some kind of conservation management, for example through expansion of the IFBAs where possible and through other approaches such as cooperation with community forestry committees, agreements with companies, habitat improvement inside IFBAs etc

សេចក្តីសង្ខេប

សត្វឱបគឺជាប្រភេទសត្វមួយប្រភេទដែលទទួលរងការគំរាមគំហែង និងឈានទៅរកការវិនាសផុតពូជដោយសារ ការប្រមាញ់ និងការបាត់បង់ទីជីវកយ៉ាងរហ័ស ។ ចំនួនសត្វឱបភាគច្រើននៅលើពិភពលោក គឺមាននៅតាមវាលស្មៅ ក្នុង និងក្បែរបឹងទន្លេសាប ។ តំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះត្រូវបានបង្កើតឡើងនៅក្នុងតំបន់វាលស្មៅ ក្នុងគោលបំណងការពារសត្វឱប អភិរក្សប្រភេទសត្វកំរង់ទៃទៀត និងការពារក្នុងការចូលទៅរកធនធានផ្សេងៗសំរាប់ជីវភាពរស់នៅរបស់អ្នកភូមិ ដូចជាការនេសាទ ធ្វើកសិកម្ម និងរកស្មៅជាដើម ។

នៅចុងឆ្នាំ ២០០៨ តំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះក្នុងខេត្តកំពង់ធំត្រូវបានកែប្រែដោយដីកាខេត្ត ដែលមានទំហំ ៣៨០គម^២ ។ តំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ ២កន្លែងត្រូវបានបន្ថែមទៅក្នុងតំបន់ដែលមិនធ្វើការបន្តពូជ ហើយតំបន់ទំនាបលិចទឹកមួយផ្សេងទៀតត្រូវបានកាត់ចេញ ។ វាធ្វើអោយតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះធំជាងមុន ប៉ុន្តែកន្លែងបង្កាត់ពូជបានថយចុះ ។

ចំនួនសត្វឱបក្នុងប្រទេសកម្ពុជាត្រូវបានតាមដានដោយអង្គការសមាគមអភិរក្សសត្វព្រៃ ក្រោមក្នុងត្រាគំរោងអភិរក្សបឹងទន្លេសាប ដែលសហការជាមួយរដ្ឋបាលព្រៃឈើ ក្រសួងបរិស្ថាន សាកលវិទ្យាល័យ East Anglia អង្គការសត្វស្លាបអន្តរជាតិ និងមជ្ឈមណ្ឌលអង្គរដើម្បីអភិរក្សជីវសាស្ត្រចម្រុះ ។ របាយការណ៍នេះសង្ខេបពីលទ្ធផលនៃការងារតាមដាន និងសកម្មភាពដែលទាក់ទង ដែលបានធ្វើចាប់តាំងពីខែ សីហា ឆ្នាំ ២០០៨ ដល់ ខែកក្កដា ឆ្នាំ ២០០៩ ។

កំរិតនៃការរាប់ចំនួនសត្វឈ្មោលជាប្រពន្ធ ៤តំបន់ ក្នុងកន្លែងបន្តពូជ (វាលស្មៅ ទំនាបលិចទឹក) នៃតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះត្រូវបានគេធ្វើចាប់ពីខែមិនា ដល់ ខែមេសា ឆ្នាំ២០០៩ ។ ការស្រាវជ្រាវមានសរុបចំនួន ៦២ប្លុក ស្ទើរនឹង ២៥% នៃតំបន់ទាំងមូល ដែលក្នុងមួយប្លុកមានទំហំ ១គម^២ ។

ចំនួនសត្វឈ្មោលត្រូវបានគេធ្វើការប៉ាន់ស្មានថាមានដង់ស៊ីតេ ០.២៨/គម^២ នៅក្នុងតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ ។ និយាយរួមគ្នាលេខនេះប៉ាន់ស្មានសរុបថាមានសត្វឈ្មោលចំនួន៦៨ (ទំនុកចិត្ត ៩៥%មានសត្វឈ្មោលពី ៤៤-១០៥) ។ វាមានប្រហែល ២៣% នៃចំនួនទូទាំងប្រទេស និងយ៉ាងហោចណាស់ ៩០% ក្នុងតំបន់អភិរក្សនៃប្រទេសកម្ពុជា ។ នេះជាការប៉ាន់ស្មាននូវដង់ស៊ីតេជាលើកដំបូងនៅក្នុងតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ

ហើយវាជាមូលដ្ឋានមួយសំរាប់យកព័ត៌មាននៅថ្ងៃអនាគត ។ ការប៉ាន់ស្មានស្រដៀងគ្នានេះដែរត្រូវបានគេធ្វើ
ជាមូលដ្ឋានក្នុងការធ្វើការស្រាវជ្រាវថ្នាក់ជាតិនៅក្នុង ឆ្នាំ២០០៥-២០០៧ ដែលធ្វើឡើងនៅតាមទីជំរកដូចគ្នានៅក្នុង
តំបន់យ៉ាងធំទូលាយ ប៉ុន្តែលទ្ធផលយើងមិនអាចធ្វើការប្រៀបធៀបបានច្បាស់លាស់ទេ ។

ការប្រែប្រួលនៃការប្រើប្រាស់ដីសំខាន់ៗត្រូវបានគេតាមដានតាមរយៈការចុះល្បាតជាទៀងទាត់ និងតាមរយៈ
រូបភាពផ្កាយរណប ។ ការពង្រីកស្រែនៅរដូវប្រាំង ធ្វើអោយប៉ះពាល់ដល់តំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ ប្រមាណជា ២%
នៅក្នុងឆ្នាំ ២០០៨/២០០៩ លើសពីនេះការកសាងទំនប់ទឹកនឹងធ្វើអោយមានផលប៉ះពាល់ច្រើនជាង ៦% ប្រសិនបើពួក
គេធ្វើនៅក្នុង ឆ្នាំ២០០៩/២០១០ ។ កត្តាទាំងអស់នេះហើយដែលបង្កអោយមានការគំរាមគំហែងយ៉ាងខ្លាំង ។

នៅក្នុងឆ្នាំ ២០០៩ វិធីសាស្ត្រត្រូវបានបង្កើត ដើម្បីធ្វើការតាមដានលំអិតទៅលើទីជំរកនៅក្នុងរដូវបន្តពូជ នៃ
តំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ ។ ចំនួនភាគរយនៃប្រភេទគំរប់ដីមួយចំនួនត្រូវបានកត់ត្រារាល់ពេល ដែលយើងធ្វើការ
អង្កេតនៅចំណុចកណ្តាលនៃក្រលាការេ ។ ភាគរយជាមធ្យមនៃដីវាលស្មៅនៅក្នុងតំបន់ធ្វើសំណាកប្រែប្រួលពី ៥០%-
៧០% នៅក្នុងតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះផ្សេងៗគ្នា ។

សំបុក២ ដែលត្រូវបានរាយការអោយដឹងពីអ្នកភូមិតាមរយៈផែនការណ៍ការពារសំបុក ហើយនៅក្នុងនោះមាន
សំបុកមួយមានពងចំនួន ២ ត្រូវបានញាស់ជាស្ថាពរ ។ ការចំណាយទៅលើការរាយការណ៍ និងការថែរក្សា សំបុក សត្វ
ខ្សឹបសំរាប់ អ្នកភូមិមានចំនួន ៤០ដុល្លា ក្នុងមួយសំបុក ។ ដើម្បីបង្កើនចំនួនសំបុកដែលត្រូវបានគេរាយការណ៍អនុសាសន៍
ត្រូវធ្វើការផ្សព្វផ្សាយពីកម្មវិធីការពារសំបុកដល់កសិករដែលធ្វើស្រែនៅរដូវប្រាំងនៅតំបន់ទំនាបសិច ទឹកអោយបានឆាប់
រហ័សមុននៅក្នុងអំឡុង ពេលច្រូតកាត់ ។

ត្រង់ស៊ុចចំនួន ៩៣ ត្រូវបានគេធ្វើការស្រាវជ្រាវ នៅក្នុងរដូវមិនបន្តពូជចាប់ពីខែសីហា ដល់ ខែវិច្ឆិកា ដោយផ្ដោត
លើតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះធ្វើចំនួន ២ គឺទួលគ្រើលជាន់ព្រើម និងតំបន់ទ្រា-សាមគ្គី ។ អត្រាឃើញសត្វគឺ ០.១៧ និង
០.១៣ នៃចំនួនសត្វខ្សឹបក្នុងមួយត្រង់ស៊ុចនៅក្នុងខែកញ្ញា និងខែតុលា ខុសពីខែដែលមានវត្តមានសត្វខ្សឹបច្រើនជាងគេ ។
ភាគច្រើននៃការស្រង់ទិន្នន័យគឺនៅផ្នែកអគ្គេយ៍នៃតំបន់ទ្រា-សាមគ្គី និងនៅក្រៅតំបន់ទួលគ្រើលជាន់ព្រើម ។ ចុងក្រោយ
គឺនៅតំបន់ចំការដែលកំពុងត្រូវគេកាប់ឆ្ការយ៉ាងឆាប់រហ័ស ។ របាយសត្វខ្សឹបនៅរដូវ មិនបន្តពូជមាននៅតាមសហគមន៍
ព្រៃឈើ ព្រោះតំបន់ធ្វើទាំង ២នោះត្រួតស៊ុតជាមួយនឹងតំបន់សហគមន៍ព្រៃឈើ ។

គួរតែបន្តកម្មវិធីអង្កេតតាមដានជាប្រចាំឆ្នាំ ។ គំរូជាក្រលាការនៅក្នុងរដ្ឋប័ណ្ណបញ្ជី និងបន្ទាត់ត្រង់ស៊ុចនៅរដ្ឋមិនបន្តពូជ គួរតែរៀបចំធ្វើនៅឆ្នាំក្រោយៗទៀតដើម្បីធ្វើការប្រៀបធៀប ព្រមទាំងការធ្វើការស្រាវជ្រាវជាក្រលាការជាដំបូងដើម្បីធ្វើការប៉ាន់ស្មានពីចំនួន ។ ការតាមដានលំអិតពីគំរូបដីបន្ថែមគួរតែពឹងផ្អែកលើរូបភាពផ្កាយរណប ។ ជំរកនៅតាមវាលស្មៅ និងស្ថានភាពសត្វខ្លីបត្រូវធ្វើការអង្កេតតាមដាននៅតាមផ្នែកមួយចំនួននៃតំបន់អភិរក្សព្រៃកោះ ។

មានអនុសាសន៍ក្នុងការអភិរក្សផ្សេងទៀតក្រៅពីក្នុងរបាយការណ៍នេះ ដោយមិនគិតពីសម្បត្តិអភិរក្សដទៃទៀតដែលកំពុងអនុវត្ត ។ ទោះបីយ៉ាងណា លទ្ធផលឆ្នាំ ២០០៩ បង្ហាញថាមានការគំរាមគំហែងយ៉ាងខ្លាំងចំពោះសត្វខ្លីបប្រភេទវាលស្មៅមួយចំនួន និងសហគមន៍ដែលប្រើប្រាស់តំបន់នេះ ។ អនុសាសន៍សំខាន់ៗគឺ :

- ពង្រឹងច្បាប់ការពារដោយបណ្តាញតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ ក្នុងគោលបំណងដើម្បីទប់ស្កាត់នូវគំរាមអភិវឌ្ឍន៍ធំៗមិនសមស្របមួយចំនួនដែលធ្វើអោយមានការបំផ្លិចបំផ្លាញ និងកែប្រែកន្លែងខ្លះអោយដូចដើមតាមដែលអាចធ្វើទៅបាន ។
- ធ្វើអោយប្រសើរឡើងនូវប្រព័ន្ធគ្រប់គ្រងតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះ ដើម្បីពង្រឹងការបោះព្រំប្រទល់ ការអនុវត្តច្បាប់ ការចូលរួមពីសហគមន៍ និងការទទួលបានប្រយោជន៍ពីទេសចរណ៍ដោយសហគមន៍ជាដើម ។
- បន្តការស្រាវជ្រាវផ្នែកអេកូឡូស៊ី ដើម្បីបញ្ជាក់ពីតំរូវការរបស់មេពូជ និងបក្សីដទៃទៀតនៅរដ្ឋមិនបន្តពូជ និងយល់អោយកាន់តែច្បាស់ពីបំណាស់ប្តូររុក្ខជាតិដូចជាការរាតត្បាតដោយស្បាត ។
- បង្កើនចំនួនសត្វខ្លីបតាមរយៈការគ្រប់គ្រងការអភិរក្ស ឧទាហរណ៍ដូចជាការពង្រីកតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះតាមកន្លែងដែលអាចធ្វើទៅបាន និងតាមរយៈវិធានដទៃទៀតដូចជា ការសហការណ៍ជាមួយគណកម្មាធិការសហគមន៍ព្រៃឈើ កិច្ចព្រមព្រៀងជាមួយក្រុមហ៊ុននានា និងការធ្វើអោយមានទីជម្រកប្រសើរនៅក្នុងតំបន់គ្រប់គ្រងកសិ-ជីវចម្រុះជាដើម ។

INTRODUCTION

The Bengal Florican *Houbaropsis bengalensis* is a large grassland bird that is Critically Endangered with extinction² due to rapid habitat loss and hunting. It occurs patchily from India to Vietnam, with the majority of the world's population breeding around the Tonle Sap Great Lake (Gray *et al.* 2009). It is therefore one of the highest priorities for species conservation in Cambodia.

Bengal Florican is also an important and useful species for monitoring because:

- It and the Tonle Sap grasslands are the target of ongoing conservation, habitat protection and education work
- It is an obligate grassland specialist; monitoring may therefore detect changes in grassland quality affecting many other species
- The display behaviour of territorial males makes them obvious and relatively easy to survey

In Cambodia the florican breeds on floodplain grasslands in the late dry season, then moves to open upland forests with a grassy understorey in the rainy season. Therefore Florican monitoring in the Tonle Sap consists of five aspects, all designed to provide information to guide management:

- Long-term population monitoring at breeding sites to detect and assess trends in numbers
- Breeding season habitat assessment
- Nest monitoring and protection
- Rapid surveys of additional grassland to detect new breeding florican populations
- Surveys of non-breeding season distribution and habitat choice

Florican population monitoring in Cambodia is conducted by the Wildlife Conservation Society under contract to the Tonle Sap Conservation Project, and in partnership with the Forestry Administration, the Fisheries Administration, the Ministry of Environment, the University of East Anglia and the Angkor Center for the Conservation of Biodiversity. This report summarises results from non-breeding season surveys in August-November 2008 and surveys of displaying males, habitat monitoring and the results of a nest protection incentive scheme carried out between March and July 2009. It builds on the first annual monitoring report, for 2007-8 (Evans *et al.* 2009).

² www.redlist.org

PREVIOUS INFORMATION ON FLORICAN STATUS IN CAMBODIA

Floricans were first recorded in Cambodia in 1928 and there were scattered records up until the 1960s (Gray *et al.* 2009). After the period of civil unrest, they were rediscovered by scientists in 1999 in Banteay Meanchey Province (Goes and Sam Veasna 1999). Since then several surveys have been conducted, culminating in a major systematic breeding season survey across the whole Tonle Sap floodplain and nearby areas during 2006 and 2007 (Gray *et al.* 2009).

This survey found 20 areas with displaying floricans in six provinces and on the basis of available habitat estimated the total population to be 416 territorial males in 2005, about half of them in Kampong Thom Province. Elsewhere in Cambodia fewer than ten displaying males were known from two small sites, Ang Trapeang Thmor and Boeung Prek Lapouv. Very rapid habitat loss was recorded in most of the main areas during this period and so by 2007 the Tonle Sap population (based on extent of suitable grassland) was estimated as only 294 displaying males. Habitat is known to have declined further since then.

The principal threats to the florican are habitat loss and hunting. Habitat loss occurs due to scrub growth and expansion of intensive farming. Floricans can survive in some areas of low intensity farming, seasonal burning appears to be beneficial (Gray *et al.* 2007), and indeed occasional clearing and ploughing may help to reduce scrub growth and maintain suitable habitat on richer soils. Since 2004 there has been a rapid expansion of large scale intensive farming including irrigated rice (with associated channels and earth dams) and

eucalyptus plantations. Such areas are wholly unsuitable for floricans and also displace existing traditional human uses. Hunting has reportedly declined due to conservation measures at some sites but it is still a serious concern with occasional incidents still being found by the project team. In response to these threats, the Forestry Administration worked with NGO partners to develop proposals for a solution in the form of a new land-use designation - Integrated Farming and Biodiversity Areas (IFBAs).

These protect existing grassland management systems. New large-scale earth dam projects are not permitted, but economic land concessions already given by the provincial government were allowed to continue operating. Uses by local communities are encouraged to continue under co-management frameworks. This will benefit threatened wildlife and protect resources used by local communities (Evans and Prak Sereyvath 2008), and it is also expected to bring wider benefits by maintaining land-use diversity in these districts, leading to better ecological and economic stability. Some of the sites also overlap with Fishing Lots, Community Fisheries and Community Forests.

This report covers six IFBAs, covering 24,390 ha of breeding habitat and 13,828 ha of non-breeding habitat in Kampong Thom Province and Siem Reap Province. They are summarised in Table 1 and marked on Figure 1. As discussed by Evans *et al.* (2009), the IFBA system was revised by provincial decision in September 2008, adding the two non-breeding IFBAs and removing protection from Kouk Preah-Boeung Trea IFBA.

Table 1. Name and Size of IFBAs

IFBA	Province	Established	ha
<i>Bengal Florican Breeding Habitat</i>			
Chikraeng	Siem Reap	January 2007	4,068
Stoung	Kampong Thom	August 2006	2,823
Veal Srangai	Kampong Thom	August 2006	5,698
Baray	Kampong Thom	August 2006	11,801
Sub-total Breeding Habitat			24,390
<i>Bengal Florican Non-breeding Habitat</i>			
Trea-Samaki*	Kampong Thom	September 2008	11,138
Toul Kreul-Phan Nheum*	Kampong Thom	September 2008	2,690
Sub-total Non-breeding Habitat			13,828
Grand Total			38,207

METHODOLOGY

Methods are detailed in Gray and Hong Chamnan (2007) and summarised here with some alterations.

Long-term monitoring at breeding sites

Floricans occupy their breeding sites from at least December to June or July, although the period may be longer in years in which the extent of flooding is less. From approximately February onwards the males begin to make conspicuous mating displays and can easily be counted. The trend in density of displaying males is probably a good index of overall trends in the breeding population in the area surveyed. During the peak display season (mid-March to early May) a systematic sample of 1 km x 1 km grid squares with random start point is surveyed by one or more trained observers. In 2009 we attempted to survey all sample squares within the IFBAs, even if habitat was suboptimal. This allows estimation of the total number of displaying males for the IFBAs.

Each square was visited three times and presence/absence of displaying (territorial) males recorded by different observers on each visit in order to calculate the detection parameter (MacKenzie *et al.* 2006). Analysis of occupancy, taking account of detectability, is still underway and so in this report we present results following the earlier established protocols, which assume 100% detectability after two visits (Gray and Hong Chamnan 2007). Results using the new framework will be published at a later date.

Displaying birds are detected visually, with wing flapping and calls sometimes aiding their detection. To confirm the presence of a displaying male within the boundaries of the survey square the display location is recorded with a GPS. The number of non-displaying floricans and other large

waterbirds seen during monitoring activities is also recorded.

This was the first full year of surveys following creation of the IFBAs. Sixty-two sample survey squares were placed in a systematic grid with random start, evenly across all IFBAs with breeding habitat. This sample size should give adequate power to detect relatively small long-term trends in total population across the whole IFBA network with statistical confidence, but only major changes will be detectable within each individual IFBA.

Breeding season habitat assessment

Gray and Hong Chamnan (2007) recommend sampling habitat data simultaneously with the breeding surveys. This was done for the first time this year, although the sampling approach was slightly revised. Habitat sampling is done at the central point of accessible survey squares used for florican monitoring (see above).

One key form of land-use change, construction of dams/channels and expansion of irrigated rice, has been mapped as comprehensively as possible from patrol team observations and inspection of satellite images. The 2009 data are presented in this report. Other forms of change (such as intensified ploughing for deep water rice production and increased scrub cover) are difficult to map with this approach so a new systematic habitat cover assessment was begun in 2009 and will be used to prepare a land cover map based on satellite imagery (L. Packman pers. comm.).

Nest monitoring and protection

Floricans nest on the ground during the late dry season but nests often fail. Giving cash incentives to individuals to protect nests that they find is a conservation measure that has been tried successfully on a small scale with the floricans (since 2004) and on a

larger scale with some other species in Cambodia (Clements *et al.*, 2007). It can potentially improve nest success, increase community support for conservation and generate useful biological information.

The protocol stresses the need to set up an efficient system for advertising the scheme and collecting reports of nests found. Once found a date and the number of eggs is recorded by the finder, who receives a finder's fee. A conservation officer visits as soon as possible to verify the location. The nest is guarded continuously or, at a minimum, revisited every 2-3 days by the conservation officer or the finder until the fate of the nest is decided (i.e. the chicks hatch and leave the nest or the eggs are predated, destroyed or abandoned). If successful hatching is shown by eggshell fragments without any trace of predation, or the presence of a female with chick nearby, then the finder receives a success fee. After the nest is empty, habitat variables are measured.

In 2007 and 2008 the concept of the nest protection scheme was widely publicised during more general village level extension meetings held across all the IFBAs. This was continued in 2009, mainly in the Stoung-Chikraeng area. All members of the team are open to receive reports, which are then passed on to the project manager as the focal person who then notifies the conservation officer to monitor the nest.

Surveys of non-breeding season habitat

Floricans leave the breeding areas at some point after the breeding season, as the grasslands slowly flood. Non-breeding season records only come from a few areas, all within Kampong Thom, but it seems likely that there are other sites yet to be found, here and in other provinces (Gray and Hong Chamnan 2007). Known sites are in grasslands, grassy scrub and short, open

deciduous forests, but precise habitat preferences are less well understood than for breeding areas, and it is not known whether birds move between sites through the non-breeding season. Floricans are much less conspicuous in the non-breeding season so surveys are very laborious, as well as taking place when access conditions are difficult. It is not feasible to monitor population sizes or densities given current resources and limited biological knowledge. Therefore the aim of the non-breeding season surveys is simply to:

- determine non-breeding season distribution (in particular, finding sites with high concentrations of floricans)
- identify broad-scale habitat preferences
- improve understanding of threats, particularly land-use changes

Transect-based presence/absence data were collected from multiple 1.5 km transects. Transects were placed within and in close proximity to the two new IFBAs in non-breeding habitat and they will be monitored annually from now on.

Surveys generally take place between late July-early November, but September and October are considered the months of peak floricant presence. Surveys involve a team of 3-4 observers forming a line perpendicular to the direction of movement, with observers keeping a distance of approximately 20 meters between each other, following the protocol set out by Gray and Hong Chamnan (2007). The transect surveys have a very limited effective strip width with floricans being flushed from the grasslands in the immediate vicinity of the researchers. The distance of the floricant to the middle of the transect line is measured for each observation.

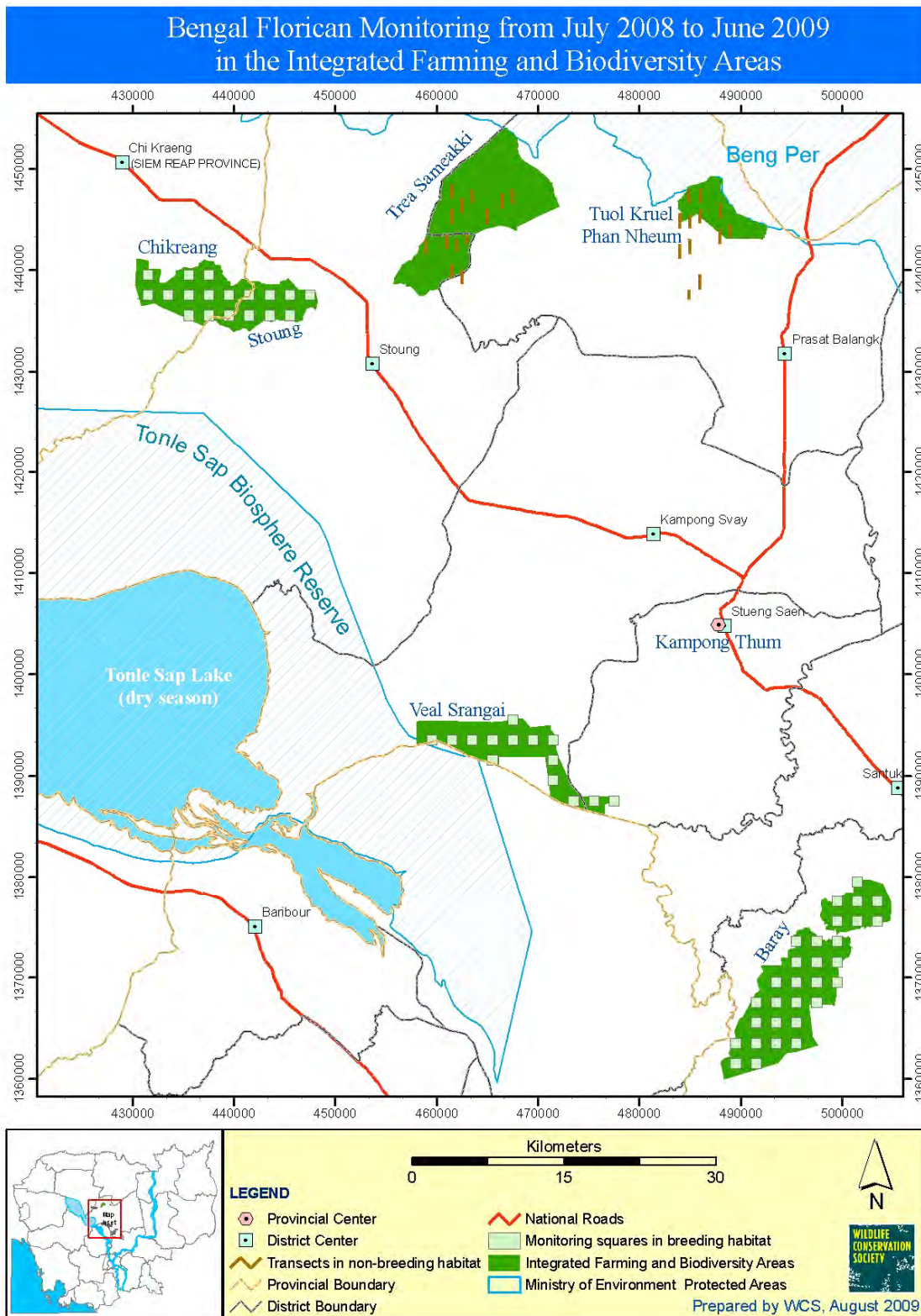


Figure 1. Location of breeding season monitoring squares and non-breeding season transects in relation to IFBAs.

RESULTS

Long-term monitoring at breeding sites

Surveys ran from 12 March - 6 April 2009 and nine surveyors participated. Of the 62 target squares, four were not surveyed due to difficulty in reaching the square. Two of these were confirmed to be located in scrub, which prevented access to most of the square and is unsuitable for displaying floricans, so these squares were conservatively given zero values. The other two squares may have contained grassland, but this could not be verified as it was not possible to get close to the squares and so they have been left out of the analysis.

Table 2 summarises effort and results, based on the methodology as suggested in the protocol put forward by Gray and Hong Chamnan (2007) as described above. As we surveyed each allocated grid square a total of three times rather than two as mentioned in the protocol, this provided us with two alternative density estimates when taking the

results from the first and second surveys and recalculating the results with data from the second and third visits. The total number of floricans detected (and hence the density estimates) remained the same in both analyses for all IFBAs and therefore only one density estimate is given in Table.

As shown in Table 2, extrapolation of our survey results for the total area of the IFBAs gives us an estimated total of 68 territorial males. The real figure could however range between 44 – 105 territorial males (as shown by the 95% confidence interval).

Breeding season habitat assessment

Table 3 shows major new land developments recorded inside the IFBAs during July 2008 - June 2009. These developments are in contradiction to the IFBA *Deika* and are being contended. None were found in Stoung or Chikraeng in this period, and this kind of development is not a threat in the upland IFBAs.

Table 2. Number of territorial males based on results of the 2009 breeding season surveys

IFBA	IFBA size (ha)	Squares accessed*	Territorial males recorded	Density (km ⁻²)	95% CI [^] Density	Est. total territorial males	95% CI Total terr. males
Stoung-Chikraeng	6,891	17/18	8	0.44	0.23 – 0.73	31	16 - 50
Veal Srongai [#]	5,698	12/14	2	0.17	0.03 – 0.49	10	2 - 28
Baray	11,801	29/30	7	0.23	0.11 – 0.44	27	13 - 52
Overall	24,390	58*/62	19	0.28	0.18 – 0.43	68	44 - 105

*Four squares were not surveyed. Of these, one square in Stoung-Chikraeng and one in Baray were conservatively assumed to have a zero occupancy as they were within thick scrub which made access impossible.

[^]CI = Confidence Interval, estimated from Figure 2.2 in Krebs (1999)

[#] Note that surveys did not cover the section of Veal Srongai grassland block lying within the Prey Koh Conservation Area, a subunit of the Tonle Sap Biosphere Reserve.

Table 3. Major new developments in the IFBAs during July 2008-June 2009

	Dams	Dry season rice
Baray	513+1028 ha (non-operational)	82 ha (community)
Veal Srongai		217 + 29 + 44 + 87 ha (four company schemes) 104 ha (community)
Total	1541 ha	563 ha

Table 4 below shows land cover and feature details as recorded in March and April 2009 from the center points of florican survey squares. These points will be monitored over time to give an impression of habitat dynamics within the IFBAs and to act as ground truth points for satellite analysis. The data is too limited in coverage (roughly 1.6 ha sampled) to extrapolate for the entire IFBA so the values below cannot be used as indicative of cover throughout the IFBAs. It was also not possible to access the exact center of all the squares that were monitored due to scrub or other obstructions, further decreasing the representativeness of these squares for overall habitat within the IFBAs

The categories “Dams” and “Plough” are not independent from the habitat type categories. Some dams are inactive and may contain grassland, some contain dry season rice, some are used for deep water- or wet season rice cultivation and others contain water (reservoir) used for providing water to crops in the dry season. Ploughed areas may have already reverted to grassland, may be active fields, or can have remained fallow. These categories have been included as an extra indicator of human use within the IFBAs.

From Table 4 it can be seen that the Stoung-Chikraeng area has a lot of human activity, with several dams and many tracks

overlapping with square centers. However, there is still a lot of grassland, whilst scrub coverage is low. Veal Srongai had the highest percentage of scrub and also dry season rice cultivation and thereby less grassland cover. Dry season rice is largely grown here using local water sources (the site is in the inner floodplain and conditions remain wet for most of the year) but additional water is supplied from reservoirs outside the IFBA. A large main irrigation channel has been built, but there are very few secondary channels. In Baray the percentage land under dry season rice is still relatively low, but several new dams have been constructed (Table 4) and there is also a strong risk that a company (with 2,000 ha of land) which did not grow dry season rice this year, will attempt to do so again in the next dry season. Baray had the highest percentage of grasslands of all IFBAs in 2009 and scrub cover was low.

Nest monitoring and protection

The results are shown in Table 5. Two nests were reported by villagers, one in Chikraeng IFBA and one from grasslands near Siem Reap (Puok). Two chicks from one nest successfully fledged. In total \$40 was paid to villagers for reporting and protecting the nests. One nest failed due to intensive ploughing around the nest and as the villagers had contributed to the failure only \$10 was given for reporting rather than \$15.

Table 4. Percentage of squares containing specific land cover types and human modification features within 50 m of center of square

IFBA	Number of squares	Percentage of squares containing* within 50 m of center								
		Dams	Track	Plough	DSR	Fallow	Other	Grass	Scrub	Wet
Stoung-Chikraeng	16	13	25	19	7	13	0	67	5	8
Veal Srongai	9	8	0	17	21	0	0	52	28	0
Baray	26	10	3	14	4	6	4	75	8	3

* Dams = Dam, channel or reservoir; Track = Cart track or road; Plough = Ploughed within one year; DSR = Dry season rice; Fallow = Fallow fields (mostly deep water- or wet season rice); Other = Other types of agriculture (e.g. water melon, peanuts); Grass = Grassland; Scrub = Scrub and Flooded Forest; Wet = Natural wetland features (ponds, lakes, streams).

Table 5. Results of the florican nest protection program in 2009

Area	Month	Finder	In IFBA	No. of eggs	Fate Hatching	Paid	Notes
Puok	April	Villager	No	1	Unsuccessful	\$10	Ploughing too close to nest
Chikraeng	May	Villager	Yes	2	Successful	\$30	Hatched after 5 and 6 days
			1	2	2/3 successful	\$40	

There were two further sightings of chicks independent from the above. One chick was seen by a villager in Chikraeng IFBA (UTM: E 443514, N 1439282) in May, and one by the IFBA patrol team in Baray IFBA in April (UTM: E 494843, N 1368106).

Surveys of non-breeding season areas

In 2009 transect surveys were conducted each month between August and November and focused on the two new IFBAs, Trea-Samaki and Toul Kreul-Phan Nheum.

Floricans were only found on transects in September and October. Floricans that had been fitted with satellite transmitters in an ongoing PhD research project were also seen to move out of the floodplain only at the very end of August (L. Packman pers. comm.). In November no floricans were seen on transects, but three floricans (two males and one female) were found in nearby ricefields that were now dry and from which the rice was being harvested. The map below shows all records of Bengal Florican during the 2009 wet season.

No records were made within Toul Kreul-Phan Nheum IFBA, but several records were made in close proximity to the IFBA and local people also report floricans occurring in the area. Most of the records of floricans in Trea-Samaki IFBA were from the south-eastern portion. These records

came from a variety of sources, satellite- and radio fitted birds, transect and incidental sightings. This suggests that this part of the IFBA is of particular value to floricans in the wet season. The area is a mix of rice fields and grasslands with relatively little open deciduous forest.

Floricans are often seen in grasslands nearby ricefields in the wet season (pers. obs.), but at present we are unable to prove there is such a habitat association. Females are encountered more often during the non-breeding season than during the breeding season. In September five males and three females were observed, while in October and November two males and one female were observed each month. Within breeding areas males are far more conspicuous than females and the methods used for monitoring focus on territorial males. As a consequence females are rarely encountered.

As can be seen from Table 6, encounter rates on transects are typically low, *e.g.* 24 transects produced only four records in September, equalling 0.17 floricans per transect, while in October the encounter rate was 0.13.

Table 6. Transect results for the survey areas

Transect survey area	Dates	No of transects per period	Floricans seen on transect	Comments
Trea-Samaki	22-24/08/08 22-25/09/08 12-13 + 19-21/10/08 24-28/11/08	6;12;13;15	0;2;3;0	One male and one female also seen off transects in September.
Toul Kreul-Phan Nheum	16-21/08/08 16-21/09/08 8-11/10/08 19-22/11/08	11;12;11;13	0;2;0;0	Floricans on transects were seen outside IFBA. In both September and November, two additional males and one female were observed off transects and outside the IFBA. Informal interviews with local people confirm presence of floricans in the IFBA area.

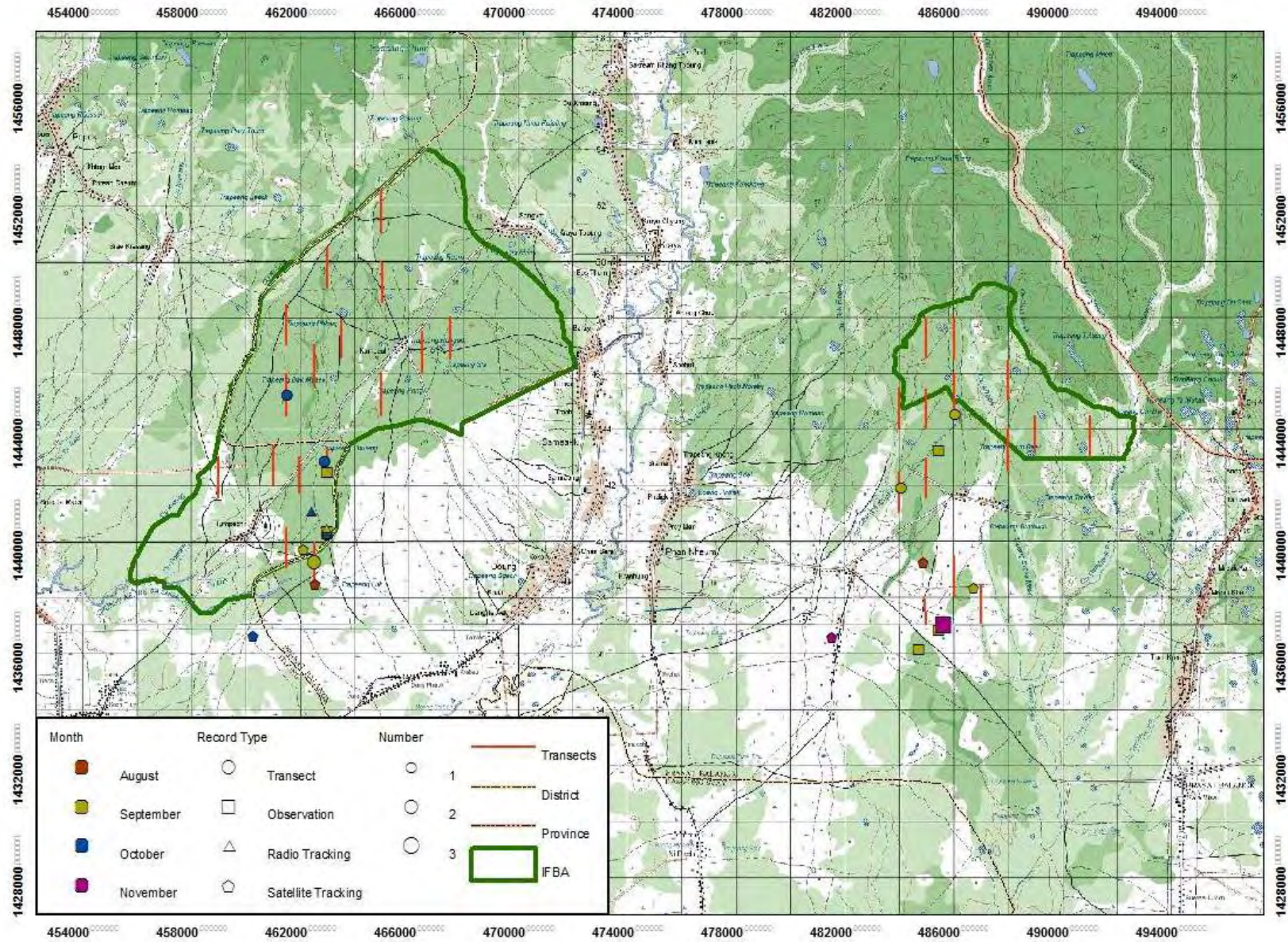


Figure 2. Bengal Florican records during the 2009 non-breeding season in the vicinity of the IFBA's

DISCUSSION

Breeding season densities

Extrapolation of our survey results for the total area of the IFBAs gives an estimated total of 68 territorial males (range 44 – 105 territorial males). This gives a clear, comprehensive, robust baseline for monitoring of future trends. Using the 2007 estimate of 294 territorial males in the floodplain (Gray *et al.* 2009) indicates that roughly 23% of the Tonle Sap breeding male population can be found in the IFBAs. This represents about 90% of the territorial males in conservation areas in Cambodia, making the IFBAs by far the most important part of the national strategy for florican conservation.

Precisely comparable data do not exist for earlier years due to changing survey areas, but earlier data from the key sites do allow some comparisons. In 2009 site densities were estimated as 0.47 males/km² for Stoung-Chikraeng, 0.17 for Veal Srongai and 0.24 for Baray. In 2006 densities of displaying males at and around these sites were found to be 0.68 males/km² at Stoung-Chikraeng, 0.5 at Veal Srongai and 0.24 at Baray (Gray *et al.* 2009), while an earlier study conducted between 2002 and 2004 found 0.48 males/km² at Stoung-Chikraeng and 0.41 males/km² at Veal Srongai (Davidson 2004). Hence previous estimates are broadly similar for Stoung-Chikraeng and Baray but somewhat higher for Veal Srongai, hinting at a decline. However, the confidence intervals on these estimates were broad, and previous studies were biased towards grasslands, while our surveys included all habitat types within the IFBAs, including grasslands, agricultural fields, scrub and flooded forest. This especially influences the density estimate in Veal Srongai, which consists of patches of grassland within flooded forest (see also Table 5 below).

Habitat change

Grassland habitats in the Tonle Sap floodplain remain very highly threatened, both inside and outside the IFBAs. Within the four breeding season IFBAs that remained protected, at least 2% of the total area was converted to dry season rice fields in 2009, most notably in Veal Srongai. New dams were also constructed in Baray with a total area representing about 6% of the IFBAs. These dams will become operational in the next dry season if not strongly opposed. Expansion of industrial farming in the floodplain is also causing major changes in the patterns of burning, grazing, hunting, water flow and human disturbance, most of which are expected to cause negative effects on the floricans.

It is expected that more companies will attempt to build dams/channels or expand fields in the grasslands in 2010. The provincial authorities in Kampong Thom have not acted decisively to stop this in previous years. It is hoped that a proposal to obtain a Prakas from the Ministry of Agriculture, Forestry and Fisheries will be accepted soon and that this will result in better protection of the IFBAs.

Nest protection

The response to the nest protection scheme remains low despite high publicity in 2007 and 2008 and some in 2009. Florican nests are extremely hard to find opportunistically. Eggs are simply laid on the ground and females will remain motionless while incubating. Reports often come from Chikraeng, which may be due to the higher prevalence of dry season rice in this area. Floricans sometimes lay their eggs in dried out rice fields and the harvesting season for dry season rice coincides with the breeding period. It may therefore be worthwhile to inform people working on dry season rice

farms (in the field) just before and as people start to harvest their crop about the nest protection program and what they need to do when they find a nest in their fields.

The case in Puok whereby people harvested their crop too close to the nest, is difficult to avoid, particularly as this location is far removed from our target areas. There is also a potential bias within the nest protection program that should be noted, as reported nests are likely to be high risk nests that are in areas frequently used by people. Thus, continuing to offer people incentives to protect florican nests when found seems to be a suitable strategy.

The activity is relatively cheap (maximum \$30 per year per nest). However it is a large sum to many villagers and well appreciated. It is much more than the villager could make from selling the parent or egg/chick.

One male florican that had been fitted with a satellite transmitter was caught by local people in Sralau commune, Baray district. The people in the village of the young man who caught the bird then contacted the project to inform that a florican with a device on its back had been caught and was being kept alive. Unfortunately the man who caught the florican had already pulled out almost all of its flight feathers. The Angkor Center for Conservation of Biodiversity then picked it up and brought it to their wildlife rescue centre in Kbal Spean. However, the florican died a few days later, likely from stress related problems. Floricans are notoriously difficult to keep in captivity and if its flight feathers had not been removed it would have been released immediately.

Surveys of non-breeding season habitat

Records of florican mostly came from the southeastern section of Trea-Samaki and an area south of Toul Kreul-Phan Nheum. The pattern of distribution and low encounter rates were comparable to those from previous years. Florican presence at other known non-breeding sites was not assessed this year and we still have no clear information on what proportion of the population uses the two non-breeding IFBAs. A much larger survey effort would be required to assess this as the birds are so rarely encountered.

The non-breeding sites are being threatened by large scale land conversion, for now mainly outside the designated IFBAs, but at times impacting prime habitat (e.g. south of Toul Kreul-Phan Nheum IFBA). Rice farming and agro-industrial plantations of acacia, eucalyptus, jatropha and other crops are expanding rapidly in this landscape, and land sales/land concessions are common.

Floricans were often found in grassland patches near to rice fields in the non-breeding season, but further research is needed to confirm whether this is a genuine habitat preference. Research is also needed to confirm villagers' reports that floricans occur in some so-called 'non-breeding' areas, year-round and possibly even breed there occasionally (Evans *et al.* 2009).

The distribution of Bengal Florican in the non-breeding season overlaps to some extent with community forests, for instance both of the newly designated IFBAs overlap with community forests. There may be potential to enhance conservation efforts if further community forests that are used by Bengal Floricans in the non-breeding season can be identified and managed appropriately. Extending surveys to include certain community forests could therefore be considered in future.

RECOMMENDATIONS

Monitoring recommendations

The 2009 monitoring program was a good model for action in future years and we recommend it should be repeated in similar style in future years.

The 2009 monitoring program was based on a systematic allocation of grid squares with random starting point and we recommend that at least these same squares are included in surveys each year, to maintain comparability.

It is recommended to include estimation of the detection probability in survey design in the future, as was done in 2009.

It is recommended to produce satellite-based land cover maps for the IFBAs on a regular basis (ideally annually) that allow calculation of the area of land cover types within the IFBAs.

It is recommended that grassland habitat and florican status should be monitored in the relevant parts of Prey Koh Conservation Area.

Conservation recommendations

Detailed conservation recommendations are outside the scope of this report since it does not include a review of the many conservation activities already underway.

However, the 2009 status assessment clearly reveals the severe threat faced by the Bengal Florican, other grassland species and the human communities using these sites. Key recommendations are:

- Strengthen legal protection for the existing IFBA network in order to prevent inappropriate large-scale destructive development projects and reverse those that have begun, where possible.
- Improve management systems for the IFBAs to strengthen demarcation, law enforcement, community participation and local benefits from tourism etc.
- Continue ecological research to clarify the needs of breeding females and of birds in the non-breeding season, and to better understand vegetation dynamics such as scrub invasion.
- Increase the total size of the florican population under some kind of conservation management, for example through expansion of the IFBAs and other approaches such as cooperation with community forestry committees, agreements with companies, habitat improvement inside IFBAs etc

REFERENCES

- Clements, T., Garrett, L., Tan Setha, Kong Kim Sreng, Pech Bunnat, Thong Sokha, Rours Vann (2007) *Bird Nest Protection Programme in the Northern Plains*. Unpublished report.
- Davidson, P. (2004) *The distribution, ecology and conservation status of the Bengal Florican *Houbaropsis bengalensis* in Cambodia*. M. Sc. Thesis, University of East Anglia, Norwich, UK.
- Evans, T., van Zalinge, R., Hong Chamnan, Ro Borei, Seng Kimhout and Packman, C. (2009) *Bengal Floricans in the Tonle Sap floodplain: 2007/8 monitoring report*. Report to the Tonle Sap Conservation Project. Wildlife Conservation Society Cambodia Program, Phnom Penh.
- Goes, F. and Sam Veasna (1999) The rediscovery of the Bengal Florican. *Cambodia Bird News* 3: 22-31.
- Gray, T. and Hong Chamnan (2007) Protocols for monitoring Bengal Florican populations and grassland habitat within the Tonle Sap Floodplain, Cambodia. Chapter 4 in WCS (2007) *Tonle Sap Biodiversity Monitoring Protocols*. Wildlife Conservation Society, Phnom Penh, Cambodia.
- Gray, T. N. E., Collar, N. J., Davidson, P. J. A., Dolman, P. M., Evans, T. E., Fox, H. F., Ro Borey, Hong Chamnan, Seng Kim Hout and van Zalinge, R.N. (2009) Distribution, status & conservation of Bengal Florican *Houbaropsis bengalensis* in Cambodia.. *Bird Conservation International* 19: 1-14.
- Gray, T. N. E., Hong Chamnan, Ro Borey, Collar, N. J. and Dolman, P. M. (2007) Habitat preferences of a globally threatened bustard provide support for community-based conservation in Cambodia. *Biological Conservation* 138: 341-350.
- Hong Chamnan, Ly Sophea, Sin Sienglay, Sin Polin, Ro Borey, Ly Sothea, Tan Thara, Seng Kim Hout, Robert van Zalinge and Tom Evans (2008) *Integrated Farming and Biodiversity Area Project Progress report, January-December 2007*. WCS Cambodia Program, BirdLife in Indochina, Wildlife Protection Office and Cambodian Centre for Agricultural Development and Research.
- Krebs, C. J. (1999) *Ecological methodology*. Addison Wesley Longman, Menlo Park, California, USA.