



# The Status of Bengal Floricans in the Bengal Florican Conservation Areas: 2009/10 monitoring report

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## សេចក្តីសង្ខេប

សត្វឱ្យប គឺជាបក្សីមានម្រាមជើងបីរត់លឿន (មិនចេះទំលើមែកឈើ) និងចូលចិត្តរស់នៅក្នុងតំបន់វាលស្មៅ បឹងទន្លេសាប។ ឱ្យប គឺជាប្រភេទបក្សីដែលជិតផុតពូជបំផុតនៅលើពិភពលោក ដែលការជិតផុតពូជបំផុតនេះបណ្តាល មកពីការបាត់បង់ទីជម្រកលឿន និងការបរិបូណ៌។ ចំនួនច្រើនបំផុតនៅពិភពលោករបស់សត្វឱ្យប គឺត្រូវបានរកឃើញនៅតំបន់ វាលស្មៅនៅក្នុង និងជុំវិញតំបន់វាលទំនាបបឹងទន្លេសាប។ តំបន់ការពារធម្មជាតិថ្មី ត្រូវបានបង្កើតឡើងដើម្បីការពារចំនួន សត្វឱ្យបដែលមាននៅសល់តិចតួច ការពារប្រភេទសត្វព្រៃដ៏កម្រដទៃទៀត និងថែរក្សាតំបន់នានាដែលផ្តល់ផល ប្រយោជន៍ជួយធ្វើឱ្យជីវភាពរបស់ប្រជាជនក្នុងតំបន់កាន់តែប្រសើរឡើង ដោយអ្នកភូមិទទួលបានផលគ្រប់គ្រាន់ពីការ នេសាទ និងការធ្វើកសិកម្មនៅក្នុងតំបន់វាលស្មៅនេះ។

ក្នុងខែកុម្ភៈ ឆ្នាំ២០១០ តំបន់អភិរក្សកសិជីវចម្រុះ (IFBAs) ដែលធ្លាប់បានទទួលស្គាល់ដោយអាជ្ញាធរខេត្ត ត្រូវ បានប្រកាសទទួលស្គាល់ជាតំបន់អភិរក្សដែលមានតំលៃថ្នាក់ជាតិដោយក្រសួងកសិកម្មរុក្ខាប្រមាញ់ និងនេសាទ។ ហើយ បច្ចុប្បន្នតំបន់នេះដែលរួមមានទាំងតំបន់ជម្រកបន្តពូជ និងរកចំណីរបស់សត្វព្រៃសំខាន់ៗដែលមានទំហំ ៣១១៥៩ហិកតា ត្រូវបានប្រកាសទទួលស្គាល់ជាតំបន់គ្រប់គ្រង និងអភិរក្សសត្វឱ្យប និងជីវចម្រុះ នៃប្រព័ន្ធអេកូឡូស៊ីរួម (BFCAs)។ រីឯ តំបន់វាលស្រងែដែលពីមុនជាតំបន់មួយរបស់តំបន់អភិរក្សកសិជីវចម្រុះ(IFBAs) មិនត្រូវបានដាក់បញ្ចូលក្នុងតំបន់គ្រប់- គ្រង និងអភិរក្សសត្វឱ្យប និងជីវចម្រុះនៃប្រព័ន្ធអេកូឡូស៊ីរួម (BFCAs)នេះឡើយ ដែលបច្ចុប្បន្នត្រូវបានកាត់ចេញពី តំបន់អភិរក្ស។

ការសិក្សាស្រាវជ្រាវត្រួតពិនិត្យតាមដានចំនួនសត្វឱ្យបនៅក្នុងប្រទេសកម្ពុជា ត្រូវបានរៀបចំឡើងដោយអង្គការ សមាគមអភិរក្សសត្វព្រៃ(WCS) ដែលសកម្មភាពនេះស្ថិតនៅក្នុងគម្រោងអភិរក្សបឹងទន្លេសាប ដែលមានការគាំទ្រពី អង្គការមិនមែនរដ្ឋាភិបាល និងសម្បូរសជនម្ចាស់ជំនួយនានា ក្រោមកិច្ចសហការជាមួយរដ្ឋបាលព្រៃឈើ នៃក្រសួង កសិកម្មរុក្ខាប្រមាញ់ និងនេសាទ។ របាយការណ៍នេះសង្ខេបពីលទ្ធផលនៃការងារត្រួតពិនិត្យតាមដានសត្វឱ្យប និង ការងារពាក់ព័ន្ធសំខាន់ៗដទៃទៀត ដែលបានធ្វើឡើងនៅក្នុងចន្លោះខែកញ្ញា ឆ្នាំ២០០៩ និងខែសីហា ឆ្នាំ២០១០។

នៅក្នុងខែមីនា និងខែមេសាឆ្នាំ២០១០នេះ ការរាប់ចំនួនសត្វឱ្យបឈ្មោលតាមលក្ខណៈប្រព័ន្ធត្រូវបានធ្វើ ឡើងនៅតាមតំបន់ទីជម្រកវាលស្មៅបន្តពូជសំខាន់ៗចំនួន៤កន្លែងក្នុងតំបន់ BFCAs។ ក្នុងពេលជាមួយគ្នានេះដែរ សកម្មភាពនេះក៏ត្រូវបានធ្វើឡើងផងដែរនៅក្នុងតំបន់វាលស្រងែ ដែលកាលពីមុនជាតំបន់មួយរបស់តំបន់អភិរក្ស និងបាន ធ្វើឡើងនៅផ្នែកខ្លះទៀតដែលជាប់នឹងតំបន់វាលស្រងែនៅក្នុងខេត្តកំពង់ឆ្នាំង (តំបន់អភិរក្សជីវចម្រុះព្រៃកោះ)។ ការ សិក្សាស្រាវជ្រាវនេះត្រូវបានធ្វើឡើងសរុបចំនួន ៦៧កន្លែង ដែលកន្លែងនីមួយៗមាន ទំហំ១គីឡូម៉ែត្រក្រលា និងគ្រប ដណ្តប់តំណាងឱ្យ២៥%នៃផ្ទៃដីសិក្សាស្រាវជ្រាវសរុប។ ជាលទ្ធផលបានឱ្យដឹងថា ដង់ស៊ីតេសត្វឱ្យបឈ្មោលដែលមាន

វត្តមានក្នុងតំបន់BFCAs គឺមានចំនួន 0.៥១ក្បាលក្នុង១គីឡូម៉ែត្រក្រលា និងនៅទូទាំងតំបន់សិក្សាដែលបានរៀបរាប់ខាងលើគឺមានចំនួន 0.៤២ក្បាល ក្នុង១គីឡូម៉ែត្រក្រលា។ ជារួមគ្នាលេខនេះបានឱ្យដឹងថា ចំនួនសត្វខ្យីបឈ្មោលសរុបដែលមានវត្តមាននៅក្នុងតំបន់BFCAs គឺមានចំនួន ៨៨ ក្បាល ដែលក្នុងនោះលទ្ធផលវិភាគបានរកឃើញកំរិតចន្លោះនៃភាពជឿជាក់មានចំនួន ៩៥% និងចំនួនសត្វខ្យីបឈ្មោលមានចំនួនក្នុងចន្លោះពី ៥៧-១២០ក្បាល ។ លទ្ធផលនេះតំណាងប្រហែល ២០-៣០% នៃការប៉ាន់ប្រមាណចំនួនសត្វខ្យីបសរុបទូទាំងប្រទេស ។ ហើយយ៉ាងហោចណាស់ ៩០% នៃចំនួនសត្វខ្យីបមានវត្តមាននៅក្នុងតំបន់អភិរក្សនានាក្នុងប្រទេសកម្ពុជា ។

លទ្ធផលសិក្សាស្រាវជ្រាវនៅឆ្នាំ២០១០ បានរកឃើញសត្វខ្យីបចំនួន៨៨ក្បាល គឺមានចំនួន ៥៤% ខ្ពស់ជាងចំនួនខ្យីបដែលបានឃើញ ៥៧ក្បាល នៅក្នុងឆ្នាំ២០០៩។ លទ្ធផលនៃការកើនឡើងនៅក្នុងតំបន់សិក្សាស្រាវជ្រាវនេះ គឺមានទិន្នន័យស្ថិតិច្បាស់លាស់ភាគច្រើនក្នុងចំនួន p ស្មើ 0.0២ ។ ការប្រែប្រួលភាគច្រើនឃើញមាននៅតំបន់ BFCAs ស្មោង និងជីក្រែង ដែលការបង្ហាញខ្លួនរបស់ខ្យីបឈ្មោលបានកើនឡើងពី ៣៧ក្បាល ដល់ ៦៦ក្បាល (p ស្មើ 0.0២) ។ មូលហេតុនេះ ដោយសារតែសកម្មភាពការងារអភិរក្សបានអនុវត្តនៅក្នុងតំបន់នេះ មានរយៈពេលវែងជាងតំបន់ដទៃទៀត ។ ការកើនឡើងនៃការបង្ហាញខ្លួនរបស់សត្វខ្យីបឈ្មោល ប្រហែលក៏បង្ហាញពីការកើនឡើងនៃចំនួនសត្វខ្យីបទូទាំងតំបន់ផងដែរ (ដោយសារតែការរាប់សត្វខ្យីបញ្ជី និងសត្វខ្យីបឈ្មោលដទៃទៀតដែលមិនបង្ហាញខ្លួន គឺពិបាកខ្លាំងណាស់) ។ ការកើននេះ ក៏អាចប្រហែលមកពីភាពរីកចំរើននៃសកម្មភាពត្រួតពិនិត្យតាមដានរបស់គម្រោងអភិរក្សក្នុងតំបន់នោះផងដែរ ។ រីក៏អាចមកពីកត្តាផ្សេងទៀតផងដែរដូចជា មកពីមានការបំលាស់ទីមកពីតំបន់ក្បែរនោះដោយសារតែមានការរំខានពីសកម្មភាពធ្វើកសិកម្ម និងមកពីការផ្លាស់ប្តូរអាកាសធាតុជាដើម ។ ដូច្នោះមានតែសកម្មភាពសិក្សាស្រាវជ្រាវត្រួតពិនិត្យតាមដានចំនួនសត្វខ្យីបរយៈពេលវែងទេ ដែលនឹងអាចធ្វើឱ្យយើងដឹងកាន់តែច្បាស់ពីចំនួនពិតប្រាកដរបស់សត្វខ្យីបនៅក្នុងតំបន់នេះ ។ ជារួមលទ្ធផលខាងលើមិនអាចបង្ហាញច្បាស់ពីការកើនឡើងនៃចំនួនសត្វខ្យីបនៅទូទាំងប្រទេសកម្ពុជាបានទេ ប្រសិនបើចំនួនសត្វខ្យីបភាគច្រើននៅមានវត្តមានក្រៅតំបន់ការពារ ហើយប្រហែលជាអាចបន្តថយចុះដោយសារតែការបាត់បង់ទីជម្រក និងសកម្មភាពបរិបូណ៌នៅតែបន្តកើតឡើង ។ ប៉ុន្តែទោះបីជាណាក៏ដោយ វាជាព័ត៌មានបង្ហាញពីលទ្ធផលវិជ្ជមាននៃសកម្មភាពអភិរក្ស ដែលហាក់បីដូចជាបង្ហាញឱ្យដឹងថា ចំនួនរបស់សត្វខ្យីបបាននិងកំពុងកើនឡើង ។

ការត្រួតពិនិត្យតាមដានការកែប្រែទីជម្រកទៅជាដឹកសិកម្ម ត្រូវបានធ្វើឡើងតាមរយៈការចុះត្រួតពិនិត្យទៀងទាត់នៅក្នុងតំបន់អភិរក្សផ្ទាល់ និងការប្រើប្រាស់រូបភាពដែលថតដោយផ្តោតយល់ ។ ក្នុងនោះលទ្ធផលការវិភាគក្នុងឆ្នាំ២០០៩ និង២០១០បានឱ្យដឹងថា សកម្មភាពធ្វើស្រូវប្រាំងបានបំផ្លាញទីជម្រកនៅតំបន់ BFCAs ចំនួន ៤% និង ២% ទៀតត្រូវបានបំផ្លាញដោយសកម្មភាពបន្តសាងសង់ទំនប់ ។ តំបន់ទាំងនេះត្រូវបានទទួលរងការគំរាមកំហែងយ៉ាងខ្លាំង ។ ប្រហែល ២០% នៃតំបន់ BFCAs បច្ចុប្បន្នស្ថិតនៅក្នុងតំបន់ដែលគ្រោងនឹងអភិវឌ្ឍវិស័យកសិកម្មអតិថិជន ។ ចំណែក

ការទន្ទ្រានពង្រីកនៅតំបន់ព្រៃវាលគុម្ពោត មិនត្រូវបានធ្វើការត្រួតពិនិត្យទេ ប៉ុន្តែតំបន់ទាំងនេះក៏ធ្វើឱ្យអ្នកអភិរក្សមាន ការព្រួយបារម្ភអំពីសកម្មភាពបំផ្លិចបំផ្លាញ ដែលអាចកើតមានឡើងនាពេលអនាគតផងដែរ ។

ចំពោះគំរោងការពារសំបុកពងកូនរបស់សត្វខ្យីប មានសំបុកចំនួន ១០សំបុក ត្រូវបានរាយការណ៍ដោយ ប្រជាជន និងចុះត្រួតពិនិត្យជាក់ស្តែងដោយក្រុមការងាររបស់គំរោងអភិរក្ស ។ ប៉ុន្តែទោះបីជាមានការការពារសំបុកពងកូនក៏ដោយ ភាពជោគជ័យនៃការភ្ជាប់កូនរបស់សត្វខ្យីបនៅតាមសំបុកនីមួយៗនៅមានបរិមាណទាបនៅឡើយគឺព្យាសបានតែ ២៥% ប៉ុណ្ណោះ ដោយផ្អែកលើសំបុកដែលគេបានឃើញសំបុកពងដែលទើបតែព្យាសហើយ ។ ការផ្តល់ប្រាក់រង្វាន់ចំពោះការ រាយការណ៍ពីទីតាំងសំបុក និងការការពារសំបុកបានជោគជ័យត្រូវបានផ្តល់ជូនអ្នកភូមិដែលបានចូលរួមក្នុងសកម្មភាពនេះ ជាក់ស្តែងក្នុងឆ្នាំ២០១០នេះ គំរោងបានចំណាយទឹកប្រាក់សរុបចំនួន ១៥៣ ដុល្លារសហរដ្ឋអាមេរិច ។ កាលពីឆ្នាំមុន មានសំបុកតែ ២ប៉ុណ្ណោះ ត្រូវបានរាយការណ៍ឱ្យដឹង ។ ប៉ុន្តែឆ្នាំនេះមានការរាយការណ៍ចំនួនសំបុកបានកើនឡើង យើង នៅមិនទាន់ដឹងច្បាស់នៅឡើយទេ ថាតើការកើនឡើងនេះវាបណ្តាលមកពីវត្តមាននៃការបង្កើនសកម្មភាពគ្រប់គ្រងរបស់ គណៈកម្មាការគ្រប់គ្រងធនធានធម្មជាតិក្នុងសហគមន៍ រឺសកម្មភាពបន្តពូជរបស់សត្វខ្យីបបានកើនឡើងច្រើនជាងមុន រឺក៏មកពីការរួមផ្សំនៃកត្តាទាំងពីរនេះ ។ នៅក្នុងឆ្នាំនេះរដូវបន្តពូជរបស់សត្វខ្យីបក៏អាចរីករាលដាលជាងឆ្នាំមុនផងដែរ ដោយសារ តែភាពរាំងស្ងួតនៅតាមតំបន់វាលទំនាប ។

នៅក្នុងរដូវមិនបន្តពូជរបស់សត្វខ្យីប ការសិក្សាស្រាវជ្រាវនៅតាមខ្សែបន្ទាត់ត្រង់ស៊ុកចំនួន ១០២ខ្សែ ត្រូវបាន ធ្វើឡើងចាប់ពីខែកញ្ញា ដល់ខែវិច្ឆិកា ដោយផ្តោតនៅក្នុងទីតាំងថ្មី២កន្លែង របស់តំបន់ BFCAs រួមមាន **ទួលត្រើល- ផាន់ព្រើម និងទ្រា-សាមគ្គី** ។ ទោះបីជាការសិក្សានេះបានឃើញសត្វខ្យីបតែ ១ក្បាលនៅលើខ្សែបន្ទាត់ត្រង់ស៊ុកក៏ដោយ ប៉ុន្តែមានសត្វខ្យីបចំនួន ៨ក្បាលផ្សេងទៀត ត្រូវបានប្រទះឃើញនៅពេលធ្វើដំណើរនៅចន្លោះរវាងខ្សែបន្ទាត់ត្រង់ស៊ុក ។ ការបូកបញ្ចូលគ្រប់ទិន្នន័យសត្វខ្យីបនៅក្បែរ និងក្នុងតំបន់ BFCAs (ទាំងទិន្នន័យដែល បានកត់ត្រាពីការដាក់វិទ្យុតាម ដាន និងដាក់ឧបករណ៍តាមដានដោយផ្តោតយល់) បានបង្ហាញឱ្យឃើញថា ទីជម្រកដែលសត្វខ្យីបរស់នៅច្រើនជាងគេ គឺស្ថិតនៅផ្នែកខាងត្បូងឈៀងខាងកើតនៃតំបន់អភិរក្សសត្វខ្យីបទ្រា-សាមគ្គី និងមួយផ្នែកតូចផ្សេងទៀតនៅក្រៅតំបន់ BFCAs និងមួយផ្នែកធំទៀតនៅខាងត្បូងនៃតំបន់អភិរក្សសត្វខ្យីប ទួលត្រើល-ផាន់ព្រើម ។ និងមានតំបន់ដទៃដែលមាន សត្វខ្យីបរស់នៅផងដែរហើយដែលបច្ចុប្បន្នគឺជា តំបន់កសិដ្ឋានដែលកំពុងធ្វើការអភិវឌ្ឍន៍កសិកម្មនៅទីនោះ ។ ទោះបីជា យ៉ាងណាក៏ដោយនៅមានតំបន់ដទៃទៀតដែលមានទំហំសមល្មមសំរាប់ជាជម្រករស់នៅរបស់សត្វខ្យីប ដែលមានទីតាំង នៅក្រៅតំបន់ដីសម្បទានអភិវឌ្ឍន៍វិស័យកសិកម្មទាំងនេះ ។ របាយរបស់សត្វខ្យីបនៅក្នុងរដូវមិនបន្តពូជអាចរាយប៉ាយ និង ជាន់គ្នាទៅក្នុងតំបន់សហគមន៍ព្រៃឈើនិងតំបន់របស់គំរោងនានាដែលកំពុងរៀបចំបង្កើតជាតំបន់សហគមន៍ព្រៃឈើថ្មី ក្នុង គោលបំណងដើម្បីដាក់បញ្ចូលការអភិរក្សសត្វព្រៃទៅក្នុងការគ្រប់គ្រងរបស់ពួកគេ ។

ជាអនុសាសន៍កម្មវិធីត្រួតពិនិត្យតាមដានសត្វខ្យីបនេះ គួរតែបន្តធ្វើឡើងជារៀងរាល់ឆ្នាំ ។ ហើយវិធីសាស្ត្រសិក្សាស្រាវជ្រាវនៅក្នុងរដូវបន្តពូជនៅតាមទីតាំងដែលបានកំណត់ជាអាណត្តិក្រលាបូនជ្រុងមានទំហំ ១គីឡូម៉ែត្រក្រលា គួរតែត្រូវបានធ្វើឡើងដូចគ្នាសំរាប់ការស្រាវជ្រាវនៅឆ្នាំក្រោយៗទៀត ដើម្បីងាយស្រួលក្នុងការប្រៀបធៀប ។ វិធីសាស្ត្រដូចគ្នាចាំបាច់ត្រូវតែបង្កើតឡើង ដើម្បីងាយស្រួលក្នុងការដាក់បញ្ចូលតួលេខសត្វខ្យីបដែលបានប៉ាន់ស្មាន និងអាចគណនារកឃើញនូវចំនួនជាក់លាក់នៃវត្តមានរបស់វា ។ ប្រសិនបើអាចមានលទ្ធភាព តំបន់អភិរក្សព្រៃកោះ គួរតែចុះទៅសិក្សាម្តងទៀតដើម្បីស្រាវជ្រាវបន្តនៅក្នុងរដូវបន្តពូជ ។ ចំពោះវិធីសាស្ត្រស្រាវជ្រាវនៅក្នុងរដូវមិនបន្តពូជ ប្រហែលជាត្រូវធ្វើការផ្លាស់ប្តូរចំណុចខ្លះដើម្បីបង្កើនអត្រានៃការឃើញសត្វខ្យីប ព្រោះលទ្ធផលក្នុងឆ្នាំនេះបានឱ្យដឹងពីវត្តមានរបស់សត្វខ្យីប ប៉ុន្តែការស្រាវជ្រាវតាមខ្សែបន្ទាត់ត្រង់ស៊ុកពុំបានឃើញសត្វខ្យីបឡើយ ។ ការត្រួតពិនិត្យតាមដាននៅឆ្នាំក្រោយចាំបាច់ត្រូវធ្វើការពង្រីកតំបន់ស្រាវជ្រាវបន្ថែមទៀតនៅតាមតំបន់សហគមន៍ព្រៃឈើនានាដែលនៅក្បែរនោះ ។ ការត្រួតពិនិត្យតាមដានគំរូបដីព្រៃដោយការវិភាគលើរូបភាពផ្កាយរណបគួរតែធ្វើឡើងនៅពេលណាផ្កាយរណបអាចថតបានរូបភាពតំបន់ស្រាវជ្រាវច្បាស់ ។ អនុសាសន៍សំខាន់ៗសំរាប់ពង្រឹងការងារត្រួតពិនិត្យតាមដានសត្វខ្យីបមានដូចតទៅ៖

- ពង្រឹងកិច្ចការពារដោយច្បាប់នៃបណ្តាញរបស់តំបន់ BCCA ដើម្បីការពារកុំឱ្យមានគំរោងអភិវឌ្ឍដែលមានការបំផ្លាញទីជម្រកសត្វខ្យីបជាទ្រុឌទ្រាយធំដូចមុនទៀត ។
- ធ្វើការកែប្រែ រឺពង្រីកបន្ថែមតំបន់ដែលត្រូវការពារសត្វខ្យីបនៅតាមតំបន់ដែលមិនមានការបន្តពូជ ដើម្បីដាក់បញ្ចូលតំបន់ទីជម្រកដទៃទៀតដែលមានសត្វខ្យីបរស់នៅច្រើន ។
- ផ្តួចផ្តើមសកម្មភាពនានាបន្ថែមទៀតដែលរួមចំណែកការពារសត្វខ្យីប ជាពិសេសនៅតាមទីជម្រកសត្វខ្យីបទាំងនៅក្នុង និងនៅខាងក្រៅតំបន់អភិរក្ស ។
- បន្តការសិក្សាស្រាវជ្រាវដើម្បីបញ្ជាក់ឱ្យកាន់តែច្បាស់អំពីតំរូវការលក្ខខណ្ឌរស់នៅតាមបែបធម្មជាតិរបស់សត្វខ្យីប ទាំងនៅក្នុងតំបន់បន្តពូជ និងមិនបន្តពូជ ។ ព្រមទាំងធ្វើការស្រាវជ្រាវអំពីឥរិយាបថនៃការបន្តពូជរបស់វា និងបង្កើនការយល់ដឹងឱ្យកាន់តែច្បាស់អំពីប្រភេទរុក្ខជាតិទីជម្រកដែលខ្យីបចូលចិត្តរស់នៅដូចជា ប្រភេទវាលស្មៅ និងតំបន់វាលព្រៃគុម្ពាតជាដើម ។

## 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 is dependent on grasslands located in and near to the floodplain of the Tonle Sap lake. Protected areas have been set up in order to safeguard a part of the population, conserve other rare species and maintain the access of local villages to key livelihood resources such as fisheries, agricultural land and pasture.

In February 2010 the existing provincial Integrated Farming and Biodiversity Areas (IFBAs) were recognized as conservation sites of national importance by the Ministry of Agriculture, Forestry and Fisheries (MAFF) and 312 km<sup>2</sup> of breeding and non-breeding habitat are now protected and managed by MAFF as Bengal Florican Conservation Areas (BFCAs). The former Veal Srongai IFBA was however not included in the BFCA network and is now unprotected.

Florican population monitoring in Cambodia is conducted by the Wildlife Conservation Society as an activity under the Tonle Sap Conservation Project, with support from other organizations and donors and in partnership with the Forestry Administration. This report summarises results of monitoring work and related activities conducted between September 2009 and August 2010.

During March-April 2010 a systematic sample count of displaying males was conducted in the four BFCAs located within breeding grounds (floodplain grasslands), as well as the former Veal Srongai IFBA and an adjacent sector of the Veal Srongai grassland block in Kampong Chhnang (in the Prey Kohs Biodiversity Conservation Area). A total of 67 1x1 km blocks was included in the survey, representing 25% of the total study area. Displaying males were estimated to occur at an overall density of 0.51 per km<sup>2</sup> within BFCAs and 0.42 per km<sup>2</sup> over the entire study area. Extrapolating this figure gives an overall estimate of 88 territorial males in the BFCAs (with a 95% confidence interval of 57-120 territorial males). This represents 20-30% of the estimated national population and at least 90% of those inside conservation areas in Cambodia.

The 2010 result is 54% higher than the 57 estimated in 2009, and represents a statistically significant change ( $p=0.02$ ). Most of the change took place in Stoung and Chikraeng BFCAs (an increase from 37 to 66 displaying males,  $p=0.02$ ). This is the area where conservation work has been running longest. The increase in displaying males probably indicates a similar increase in the overall BFCA population, but females and non-displaying males are extremely difficult to count. The increase is probably due in part to increased productivity in the BFCAs as a result of conservation measures. Other factors may include the arrival of displaced birds from areas of destroyed habitat elsewhere, and an increase in the proportion of males that displayed this year due to unusual weather conditions. Longer-term monitoring will help to clarify these issues. The results cannot be taken to indicate an increase in the overall Cambodian population, since the majority is still in areas outside the reserves and is probably declining due to continued habitat loss and hunting. However, it is undoubtedly positive news that the protected element of the population seems to have increased.

Habitat conversion was monitored through regular field visits and use of satellite images. Dry season rice expansion destroyed 4% of the habitat in the BFCAs during 2009/10 and construction continued on a dam that destroyed a further 2%. These are very significant threats. Around 20% of potential breeding season habitat in the BFCAs is now under some form of intensive agriculture. Expansion of scrub was not monitored but is also of potential concern.

Under the nest protection scheme ten nests were reported by villagers and confirmed by the project team. However, nest success was low at 25% for nests whose fate was determined. Reporting payments and success bonuses to the villagers amounted to \$153. Only two nests were reported last year; it is not clear if the increase is due to the presence of active community management committees, higher breeding activity or a combination of the two. The breeding period may also have been longer this year due to drier conditions in the floodplain.

In the non-breeding season 102 line transect surveys were conducted, from September to November, focusing on the two new BFCAs, Toul Kreul-Phan Nheum and Trea-Samaki. Despite this effort only one florican was encountered on transects, but eight floricans were also encountered when travelling between transects. Combining all available data of known florican records in and nearby the BFCAs (including data from radio and satellite tracked birds) shows the south-eastern section of Trea-Samaki, including a small area outside of the BFCA, as well as a larger area south of Toul Kreul-Phan Nheum, to be the most used. Most of the latter is now a plantation site under development. However there is still a sizeable area of suitable habitat outside of this concession. The distribution of Bengal Florican in the non-breeding season may overlap to some extent with community forests and a project is being undertaken to examine the scope for certain community forests to integrate wildlife conservation objectives into their management.

It is recommended to continue this monitoring program on an annual basis. The same breeding season sample squares should be included in future years to ensure comparability. A compatible method needs to be developed that will make it possible to incorporate estimation of detectability into calculations of absolute abundance. If resources allow, the Prey Koh Conservation Area should be included again in breeding season surveys. In non-breeding areas, the survey methodology may need to be revised in order to increase encounter rates as this year's results seem to indicate that birds are present, but very rarely detected on randomly-placed transects. Monitoring needs to be expanded next year to include several community forest sites with suitable non-breeding habitat. Land-cover monitoring based on satellite image interpretation should be introduced as soon as feasible.

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, recommendations that can be made on the basis of findings from the monitoring work are:

- Strengthen legal protection for the existing BFCA network in order to prevent inappropriate large scale destructive development projects and reverse those that have begun, where possible
- Modify or expand the protected areas in non-breeding habitat to encompass sites that hold the highest number of floricans
- Initiate further florican conservation activities at other sites occupied by floricans in- and outside of existing protected areas
- Continue research to clarify the ecological requirements of Bengal Floricans in both breeding and non-breeding areas, as well as studying breeding behaviour and developing a better understanding of vegetation dynamics such as grassland regeneration and scrub invasion

## Introduction

The Bengal Florican *Houbaropsis bengalensis* is a large grassland bird that is Critically Endangered with extinction<sup>2</sup> due to rapid habitat loss and hunting. It occurs patchily from Nepal to Vietnam, with the majority of the world's population breeding around the Tonle Sap Great Lake (Gray *et al.* 2009). It is one of the highest priorities for species conservation in Cambodia.

The 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, so monitoring may 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 four aspects, all designed to provide information to guide management:

- Long-term population monitoring at protected breeding sites to detect and assess trends in numbers
- Breeding season habitat assessment
- Nest monitoring
- Surveys of non-breeding season distribution and habitat choice

Florican population monitoring in Cambodia is conducted by the Wildlife Conservation Society 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 September-November 2009 and surveys of territorial males, habitat monitoring and the results of a nest protection incentive scheme carried out between March and August 2010. Two previous annual monitoring reports have been produced, for 2007-8 (Evans *et al.* 2009) and for 2008-9 (van Zalinge *et al.* 2009). An annual project report summarises all conservation activities in 2009-10 (Sum Song 2010).

## 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 refound 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 are known

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<sup>2</sup> [www.redlist.org](http://www.redlist.org)

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 at 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 has largely been due to expansion of intensive farming. 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 uses by local communities. Floricans can survive in some areas of low intensity farming and seasonal burning appears to be beneficial (Gray *et al.* 2007). 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 February 2010 the existing provincial Integrated Farming and Biodiversity Areas (IFBAs) were recognized as conservation sites of national importance by the Ministry of Agriculture, Forestry and Fisheries (MAFF) and 312 km<sup>2</sup> of breeding and non-breeding habitat are now protected and managed by MAFF as Bengal Florican Conservation Areas (BFCAs). This was a major step forward. The former Veal Srongai IFBA was however not included in the BFCA network and is now unprotected. A part of the Baray protected area was also excised (see Figure 1).

The BFCAs 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. Use by local communities is encouraged to continue under co-management frameworks. Some of the sites also overlap with and strengthen Fishing Lots and Community Forests.

Table 1. Name and size of current Bengal Florican Conservation Areas

BFCA	Province	Size (ha)
<i>Bengal Florican Breeding Habitat</i>		
Chikraeng	Siem Reap	4,636
Stoung	Kampong Thom	2,812
Chong Doung	Kampong Thom	2,569
Baray	Kampong Thom	7,314
Sub-total Breeding Habitat		17,331
<i>Bengal Florican Non-breeding Habitat</i>		
Trea-Samaki	Kampong Thom	11,138
Toul Kreul-Phan Nheum	Kampong Thom	2,690
Sub-total Non-breeding Habitat		13,828
Grand Total		31,159

## 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, with the actual period depending on the timing of the annual inundation of the floodplain grasslands. From approximately February onwards the males begin to make conspicuous mating displays, allowing density to be estimated. The males display in territories that have previously been estimated at around 1.6 km<sup>2</sup>, therefore a systematic sampling design with a random start point comprising 1km<sup>2</sup> grid squares with two kilometer spacing between centre points of each survey square was considered appropriate for surveys. Survey squares were originally chosen in 2008 and the same squares are monitored on an annual basis during the peak display season (mid-March to early May). The trend in density of displaying males is probably a good index of overall trends in the breeding population in the area surveyed, although this assumption should be tested periodically, if possible. Changes between years were tested for significance using two-tailed paired samples t-tests at the 5% significance level.

We attempted to survey all sample squares within the BFCAs, even if habitat was suboptimal. This allows estimation of the mean density of displaying males across the whole area of the BFCAs. Each sample square was visited three times and presence/absence of displaying (territorial) males recorded by different observers on each visit. Based on earlier studies this was expected to give a very high probability of recording any displaying males present at least once since earlier established protocols assume 100% detectability after two visits (Gray and Hong Chamnan 2007). The survey design also allows analysis under an occupancy framework (MacKenzie *et al.* 2006) which gives complementary information.

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 a ranger finder and compass was used to estimate location of the bird from known observer location. If there was no point of reference near to the bird for targeting with the range finder, actual display locations were checked with a GPS. The number of non-displaying floricans and other large waterbirds seen during monitoring activities was also recorded.

Although some former conservation areas were not included in the final declaration creating the Bengal Florican Conservation Areas in February 2010 and some boundary changes were made to others, we chose to conduct a full repeat of the 2009 survey and added five extra squares in a previously unsurveyed section of the Veal Srongai grasslands. Sixty-seven sample survey squares were included in the 2010 survey.

### Breeding season habitat assessment

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. 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 is under development and will be used to prepare an updated 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 on a small scale with 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.

When a nest is reported, the nest is checked by the project team and the date of finding and the number of eggs is recorded, while the finder is paid a reward of \$15 per egg. The finder is told that if he or she keeps the nest site a secret a similar reward will be available if the eggs hatch successfully. Normally, the monitoring officer will then check the nest at intervals of 3-5 days together with 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). However, this year we have started weighing and measuring eggs found, whenever possible, so as to get an approximate lay date and work out a rough date of hatching. The calculation of the lay date follows formulae prepared for Houbara Bustard (Combreau *et al.* 2002) and so only gives an approximation for Bengal Floricans, however, it does allow the monitoring officer to better time visits to the nest and minimize disturbance and risk from repeat visits. Hatching is considered successful when eggshell fragments are found at the nest site without any clear indication of predation, or of course if a live chick is found on or near the nest, but this rarely occurs. 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 BFCAs. 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. In 2010, for the first time, BFCAs community management committees were active in the Stoung-Chikraeng area and were in most cases the first to receive information of a nest having been found, which was then passed on to the project team.

## 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, almost 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 open deciduous forests, but precise habitat preferences are less well understood than for breeding areas. 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 count data were collected from multiple 1.5 km transects. Transects were placed within and in close proximity to the two new BFCAs in non-breeding habitat in 2008 and most of these transects were surveyed again in both September and October 2009 (as these are peak

months for florican presence in non-breeding areas) and also in November (although some floricans may be moving back to the floodplains at this time).

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 florican to the middle of the transect line is measured for each observation.

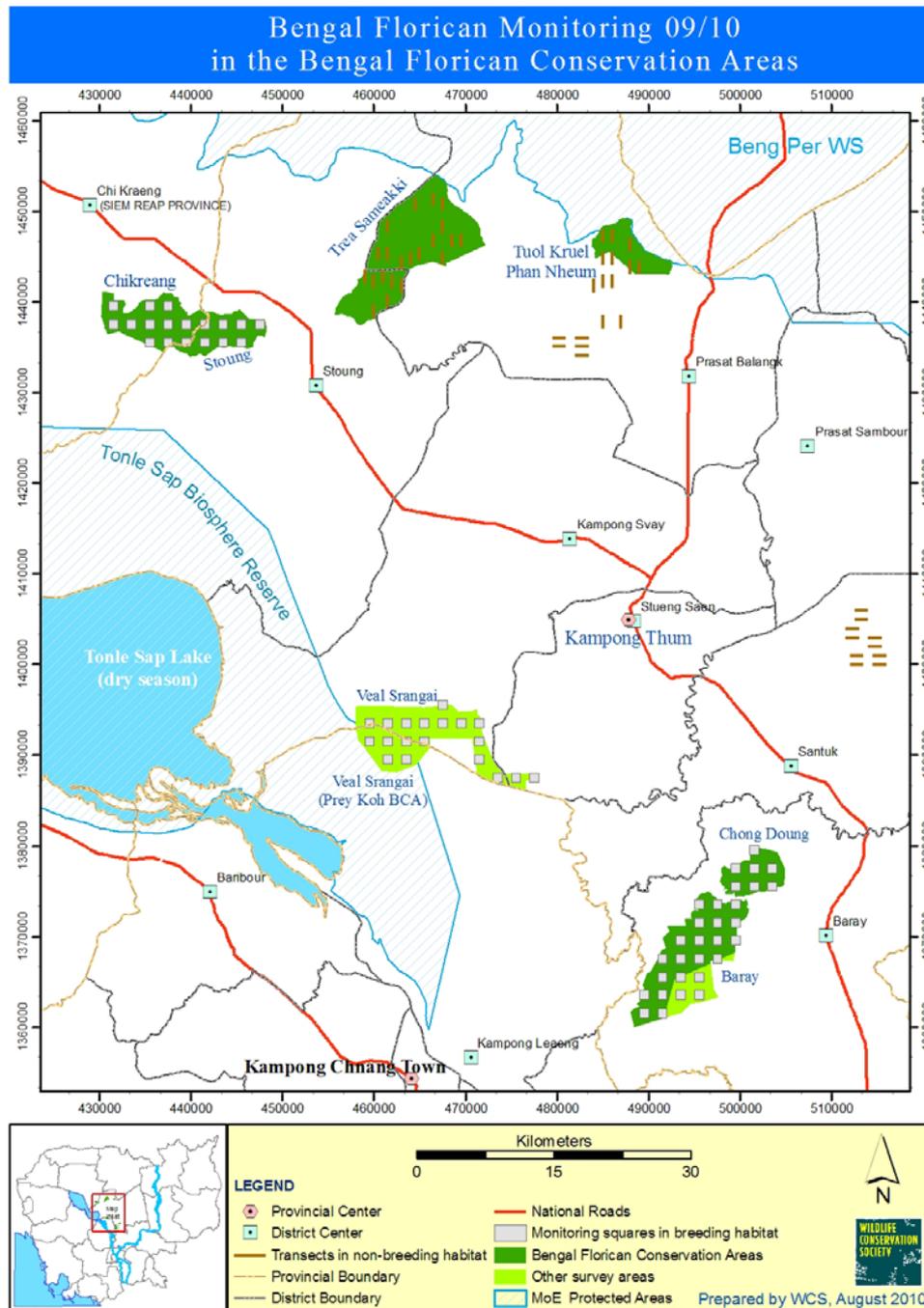


Figure 1. Location of 2010 breeding season monitoring squares and 2009 non-breeding season transects in relation to BFCAs.

## Results

### Long-term monitoring at breeding sites

Surveys ran from 12 March - 1 April 2010 with three surveyors participating on a continuous basis and assistance from a fourth surveyor in Veal Srongai and Chong Doung (Baray). Results are shown in Table 2, Figure 2 and Appendices 1-6. Of the 67 target squares, three squares were only surveyed once and then given a zero value (not occupied) as they were completely unsuitable for Bengal Florican presence (one square was recently ploughed, one square was all dry season rice with active harvesting operations ongoing, and one square was accessible by a small track, but was all scrub and very tall grass). A fourth square was not accessible and conservatively assumed to be unoccupied as it was all flooded forest/scrub (confirmed also by checking satellite images), a habitat unsuitable for floricans.

Table 2. Comparison of results from surveys in 2009 and 2010

Survey Area	Number of squares surveyed*		Density of territorial males per km <sup>2</sup>		Significance of change	Estimated number of territorial males <sup>^</sup>	
	2009	2010	2009 <sup>+</sup>	2010		2009	2010
Stoung-Chikraeng BFCAs	17 (18)	18	0.50	0.89	Significant (p=0.02)	37 (18 – 57)	66 (41 – 92)
Baray-Chong Doung BFCAs	26 (27)	26 (27)	0.22	0.26	Not significant (p=0.57)	22 (5 – 39)	26 (5 – 46)
Overall BFCAs	43 (45)	44 (45)	0.33	0.51	Significant (p=0.02)	57 (33 – 83)	88 (57 – 120)
Veal Srongai <sup>#</sup>	12	14	0.08	0.07	No change	5 (1 – 15)	4 (1 – 11)
Baray-outside BFCAs	3	3	0.67	0.67	-	-	-
Overall study area	58 (60)	58 (62)	0.30	0.42	Significant (p=0.02)	80 (50 – 110)	105 (67 – 142)

\* Numbers in parentheses are the total number of squares used in data analysis. Squares that were partially surveyed, but where conditions were unsuitable for Bengal Florican presence, were conservatively assumed to be unoccupied. Squares which were not accessed and site condition not determined on the ground, were left out of analysis (two squares in 2009).

<sup>+</sup>The 2009 density estimates have been re-calculated using results from all three visits to squares, rather than only analysing data from two visits as presented in the 2009 monitoring report (van Zalinge *et al.* 2009).

<sup>^</sup> Numbers in parentheses are the 95% confidence interval

<sup>#</sup> Results do not include the five extra squares surveyed (where no floricans were detected) in the Prey Koh Conservation Area sector in 2010, so as to allow better comparison with 2009.

The population estimate of 105 territorial males across the whole study area, increased from 80 in 2009, and the 88 estimated for the BFCAs alone, increased from 57 in 2009. These changes were statistically significant (p=0.02 in both cases). Much of the increase was attributable to Stoung-Chikraeng (rising from 37 to 66 displaying males, p=0.02). The small increase in Baray-Chong Doung was not statistically significant and no change was observed in the density at Veal Srongai. The area in Baray outside of the BFCAs contains only three squares, too small a sample for statistical analysis.

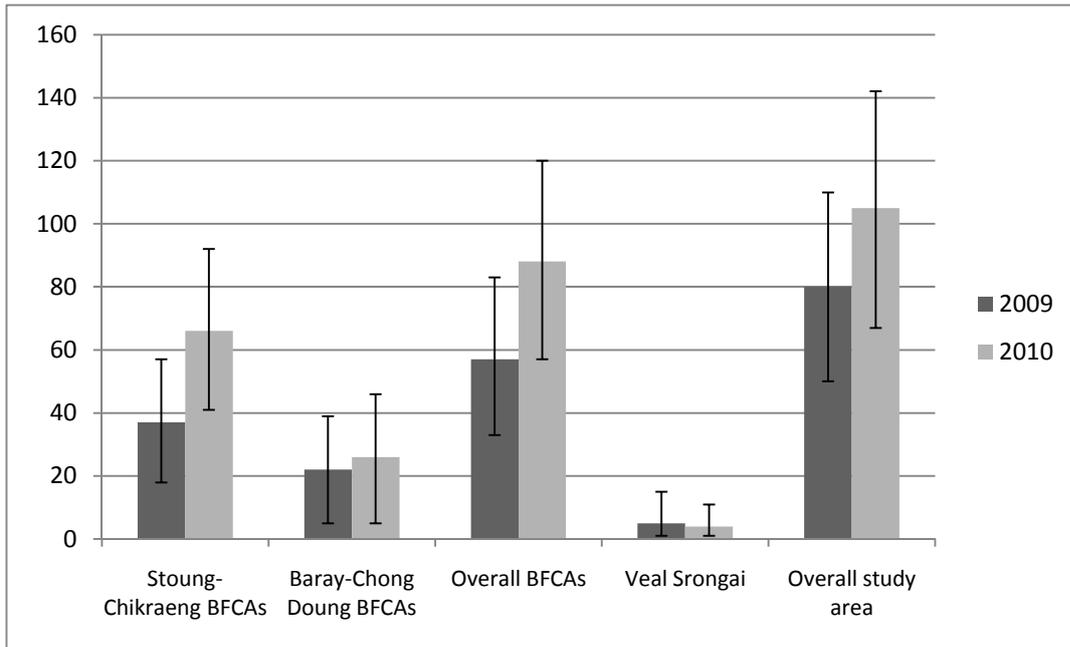


Figure 2. Graph of estimated number of territorial males, with 95% confidence intervals, for survey areas in 2009 and 2010

A preliminary analysis of the data in an occupancy framework was conducted (Appendix 7). Trends in the proportion of squares occupied were similar to those noted for estimated absolute density, although none of the changes were statistically significant in the preliminary models. The most notable finding was that detectability appears to be somewhat lower and more variable than assumed in previous surveys. Probability per visit of detecting at least one bird in a square that is occupied was 0.63 in 2010, increasing from 0.53 in 2009, although the change between years was not significant.

## Breeding season habitat monitoring

Table 4 shows total land conversions recorded inside the BFCAs during July 2009 - June 2010 by type. It can be seen that the main cause of land conversion was the expansion of community dry season rice fields, particularly in the Baray area. Chong Doung suffered from a new company that ploughed a large area for deep water rice. The total of land converted represents roughly 6% of the BFCAs in breeding habitat. No major land conversions were recorded in non-breeding BFCAs.

Table 4. Major new developments in the BFCAs during July 2000-June 2010\*

	Deep water rice	Dry season rice
Baray		462 ha
Chong Doung	408 ha	
Stoung		97 ha (64 ha + 33 ha)
Chikraeng		113 ha
Total	408 ha	672 ha

\* Source is a combination of field data and satellite imagery (Landsat 7 from May 2010)

The total area of potential breeding habitat that is now under intensive cultivation within the BFCAs is around 3300 ha, almost 20%.

## Nest monitoring

Table 5 summarises the results for each nest monitored.

Table 5. Results of the florican nest protection program in 2010

BFCA	Date found	Date of fate	Eggs	Fate Hatching	Paid	Notes
Stoung	18 April	2 May	1	Successful	\$30	Chick seen
Stoung	1 May	17 July	1	Unsuccessful	\$20	Egg determined to have spoiled
Chikraeng	9 May	24 May	1	Successful	\$30	Egg fragments seen within nest site
Stoung	16 May	9 July	2	Unsuccessful	\$20	Eggs disappeared
Chikraeng	23 May	7 July	1	Unsuccessful	\$15	Egg disappeared
Stoung	1 June	11 June	1	Undetermined	\$23	Egg fragments found, but also away from nest
Stoung	9 July	17 July	1	Undetermined	-	Egg fragments found, but also away from nest, female never seen at nest
Stoung	9 August	26 August	2	Unsuccessful	\$5	Egg determined to have spoiled
Stoung	5 August	26 August	2	Unsuccessful	\$5	Egg determined to have spoiled
Baray	15 July	26 August	1	Unsuccessful	\$5	Outside BFCA. Egg determined to have spoiled.
			13	2/10 successful	\$153	

Ten confirmed nests were reported by villagers. Two other nests were not found when the team came to check and are not reported here. There was an average of 1.3 eggs per nest. The fate of two nests was undetermined as fragments of egg shell (some quite large) were found scattered around the nest and it was possible the eggs might have been predated or hatched naturally. Excluding these the nest success rate was 25%. For the six unsuccessful nests eggs either disappeared (two nests), possibly a sign of human predation, or spoiled, perhaps due to wet conditions (three in August) or heat (one in May). In total \$153 was paid to villagers who reported nests. Amounts paid were variable depending on outcome and certainty, *e.g.*, if the nest was confirmed by a member of the project team, if a female was seen at or near the nest confirming an active nest, *etc.*

### Surveys of non-breeding season areas

In September and October 2009, the period in which most Bengal Floricans have moved from the floodplain, thirty-two fixed transect surveys were repeated each month in and near to the Trea-Samaki and Toul Kreul-Phan Nheum BFCAs in non-breeding areas (wet season habitat). Twenty-three of these were surveyed again in November. In September an additional five transects were conducted in Toul Kreul commune, in the vicinity of Thnal village and ten transects in Ti Po commune, Santuk district.

Table 6. Transect results for 2009 survey areas

Transect survey area	Dates	Number of transects	Floricans seen on transect	Floricans seen off transect
Trea-Samaki BFCA, Prasat Balang District	26/9-3/10	21	0	3 males
	18-24/10	21	0	3 males
	10-14/11	15	0	0
Toul Kreul-Phan Nheum BFCA, Prasat Balang and Stoung Districts	11-14/9	11	0	0
	14-17 + 25/10	11	0	2 females
	15-17/11	8	0	0
Thnal village, Toul Kreul commune, Prasat Balang	5-6/9	5	1 female	0
Ti Po commune, Santuk District	1-3/9	10	0	0
Totals		102	1 female	6 males 2 females

The earliest date of movement towards the upland areas was on the 31<sup>st</sup> July for Bengal Floricans that had been fitted with satellite transmitters in an ongoing PhD research project, while the latest presence in upland areas was on 28<sup>th</sup> December (L. Packman pers. comm.). The peak months in which floricans with transmitters stayed in the upland non-breeding areas were September and October. Figure 3 shows all records of Bengal Florican during the 2008 and 2009 non-breeding seasons, collated from satellite and radio-tracking positions, transect records and sightings.

There are, as yet, no confirmed records within Toul Kreul-Phan Nheum BFCA, although local people report that they do occur. The area directly south-west of the BFCA had many records, but about half of these records are in a concession area. Most of the records of floricans in Trea-Samaki BFCA were from the southeastern portion of the BFCA and further south-east just beyond the borders of the BFCA. This suggests that this part of the BFCA is of particular value to floricans in the wet season. The area is a mix of rice fields and grasslands with relatively few trees.

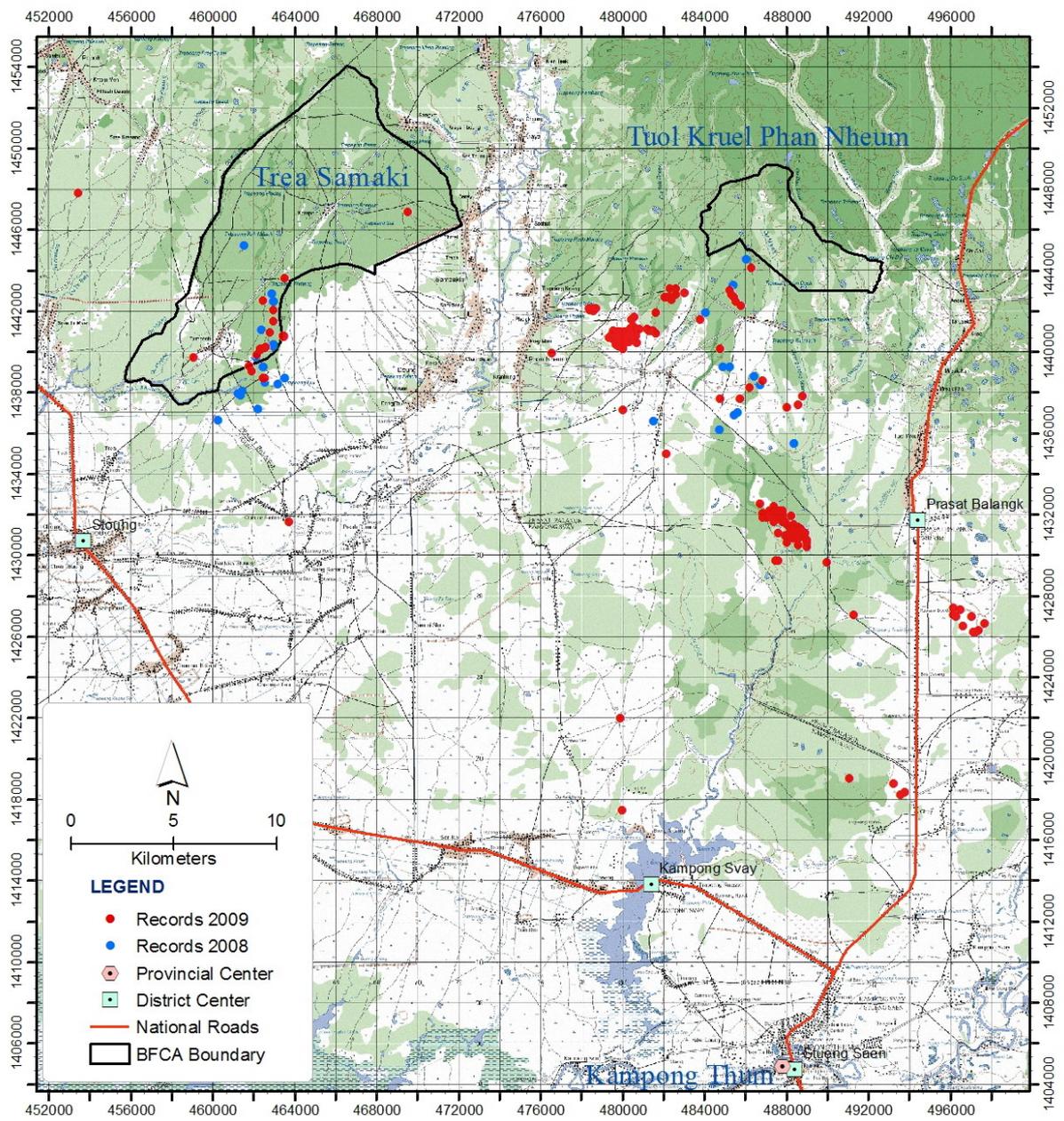


Figure 3. Bengal Florican records during the 2008 and 2009 non-breeding seasons in the vicinity of the Trea Samaki and Toul Kreul Phan Nheum BFCAs

## Discussion

### Breeding season densities

The 2010 survey gives an estimate of 88 territorial males (range 57 – 120) within the BFCAs. This is 20-30% of the entire Cambodian breeding male population reported by Gray *et al.* (2009). Only 1-2 males are thought to survive in each of two other protected areas outside the Tonle Sap floodplain (Hong Chamnan pers obs. and Seng Kimhout pers. comm.). Hence the best current estimate of florican numbers in protected areas in Cambodia is approximately 90 displaying males.

The 2010 result for the BFCAs is 54% higher than the 57 estimated in 2009, and represents a statistically significant change ( $p=0.02$ ). The increase in displaying males probably indicates a similar increase in the overall population, but females and non-displaying males are extremely difficult to count so this cannot be confirmed.

The increase is probably due in part to increased productivity within the BFCAs as a result of conservation measures. Most of the change took place in Stoung and Chikraeng BFCAs (an increase from 37 to 66 displaying males,  $p=0.02$ ). This is the area where conservation work has been running longest and has had most success. However, it is unlikely that increased productivity alone would lead to such a sharp increase and so other factors are probably also responsible. One factor may be the arrival of birds displaced by habitat loss elsewhere. Grassland habitat has been declining rapidly in the last five years (Gray *et al.* 2009, van Zalinge *et al.* 2009) and is still occurring even within the BFCAs (this report), but the Stoung-Chikraeng area is least affected, without any new dams successfully constructed or other large agricultural projects successfully initiated, and this might make them an attractive refuge for displaced birds. It is also possible that there was an increase in the proportion of males that displayed this year, due to the unusual weather conditions. Longer-term monitoring will help to clarify these issues.

The results cannot be taken to indicate an increase in the overall Cambodian population, since the majority is still in areas outside the reserves and is probably declining due to continued habitat loss and hunting. However, it is undoubtedly positive news that the protected element of the population seems to have increased.

Some longer-term data exist, although changing survey area boundaries and slight variations in survey design call for caution in interpreting the figures. In 2009-2010 densities were estimated as 0.5-0.89 displaying males/km<sup>2</sup> for Stoung-Chikraeng, 0.08-0.07 for Veal Srongai and 0.27-0.30 for Baray (this report). In 2006 densities of displaying males at and around these sites were found to be 0.68 males/km<sup>2</sup> 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/km<sup>2</sup> at Stoung-Chikraeng and 0.41 males/km<sup>2</sup> at Veal Srongai (Davidson 2004). Hence the 2010 density of displaying males is apparently the highest at Stoung-Chikraeng so far. Both 2009 and 2010 densities were normal for Baray, but substantially lower for Veal Srongai, suggesting a recent decline. However, the confidence intervals on these estimates are broad, and previous studies were biased towards grasslands, while our monitoring includes all habitat types within the BFCAs, including grasslands, agricultural fields, scrub and flooded forest. This especially could influence the density estimate in Veal Srongai, which consists of patches of grassland within flooded forest.

Surveying floricans is highly challenging and we are continuously working to refine our survey techniques. The densities are probably a slight under-estimate because even after three visits to each square some displaying birds will have been overlooked. We cannot estimate the level of bias directly, but since the great majority of squares are occupied by either one or zero displaying males we can use the results of the preliminary occupancy analysis conducted this year to obtain a rough measure by analogy. The average per-visit detectability of 0.63 in 2010 implies that after three visits there is an approximate risk of  $(1-0.63)^3 = 5\%$  of failing to detect any birds in a square that is, in fact occupied. Hence the under-estimate in the density surveys may be at least 5% this year, and may also vary somewhat from year to year.

## Habitat change

Grassland habitats in the Tonle Sap floodplain remain very highly threatened, both inside and outside the BFCAs. Within the four breeding season BFCAs that remained protected, at least 6% of the total area was converted to intensive agriculture in 2010, most notably in Baray and Chong Doung. In Chong-Doung a company that started in 2009, but which the BFCA patrol team stopped at that time, was eventually able to plough around 400 ha within the BFCA after receiving provincial permission and is currently growing deep-water rice. In Baray, dry season rice cultivation by communities expanded over a large area, again with provincial support.

Recently the prime minister has been calling for stronger protection of natural habitat within the Tonle Sap floodplain due to the importance of this area for the nation's fish production (Van Roeun 2010, Van Roeun and Vrieze 2010). This has led to the demolition of sections of reservoirs in a few areas, including in Baray BFCA, where twenty meter sections of two dams were destroyed. One of the dams belongs to a community that greatly increased the extent of dry season rice cultivation in 2010. These two are among the largest affecting the BFCAs and if they are slated for complete destruction this will allow a large area of grassland to regenerate. A subdecree is also being prepared that will designate three management zones around the whole Tonle Sap Great Lake, one for protection, a buffer zone where certain developments are allowed and an agricultural zone. It is not yet sure how this will affect the BFCAs or the Bengal Florican population.

## Nest monitoring

Ten nests were reported this year, containing thirteen eggs. This is a significant increase from 2009, when only two nests were reported. The higher number of nests reported may in some way be due to the presence of active community management committees (these had only recently been established in 2009), who facilitate the reporting of nests to the project team. However, coupled with the apparent increase in the number of territorial males this year it is likely that this year was also a better than average breeding year for Bengal Floricans, particularly in the Stoung-Chikraeng BFCAs.

Nest success was 25%. This seems low, despite the nest protection system in place. Nesting success for Houbara Bustards has been reported as 58%, with annual variation from 35-88% (Combreau *et al.* 2002) and as 50% for Great Bustard in a single study year (Ena *et al.* 1987 in Combreau *et al.* 2002). However, human predation was not cited in either study.

The current method is for finders to keep nest sites secret from other villagers in order to maximise the chance of it succeeding. The assumption is that the finder is the main threat to the female and nest. Nests are, however, left unguarded. In Preah Vihear nest protection for another ground-nesting bird, the Sarus Crane, is done by employing nest protectors that remain at the

nest site until the chicks hatch and leave the nest. The situation is quite different however as nest sites in Preah Vihear are relatively remote and secluded, with forest to provide cover to the guard, while in the grasslands setting up a camp would draw people's (and potentially a predator's) attention and could increase risk of failure. The camp would probably also have to be very far from the nest to avoid disturbing the nesting female directly. Therefore currently it is felt that the best approach is to have finders sworn to secrecy (which is in their best interest too) and only visit the nest site when accompanied by a project team member. If the same nest is found and reported by another person, it would need to be protected continuously as the project will only pay a reward to one nest finder per nest in order to avoid potential scams taking place.

## **Surveys of non-breeding season habitat**

Records of florican in the area around the upland BFCAs mostly came from the southeastern section of Trea-Samaki and the wider area south of Toul Kreul-Phan Nheum. Results this year prove again how low encounter rates can be, with only one record from transect surveys plus eight other sight records off-transect. No floricans were found in Ti Po commune, Santuk district, but the number of transects was small. No non-breeding monitoring work was done in the Baray area. Gaining a better understanding of florican distribution in the Baray area is a part of the research being conducted by PhD student Charlotte Packman (which is currently in the final writing up stage). The results of this research will be used to improve surveys for Bengal Floricans in non-breeding habitat.

Non-breeding habitat is threatened by large scale land conversion, for now mainly outside the designated BFCAs, but at times impacting prime habitat (e.g. the area south of Toul Kreul-Phan Nheum BFCAs). 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.

The distribution of Bengal Florican in the non-breeding season overlaps to some extent with community forests, for instance both of the newly designated BFCAs overlap with community forests. A project has recently been initiated in collaboration with a local NGO that aims to look at the potential to integrate wildlife conservation objectives into the management of community forests, specifically in those that are used by Bengal Floricans in the non-breeding season. Surveys in several community forests are being planned.

## Recommendations

### Monitoring recommendations

- Continue to monitor the same grid squares in 2011, including, if possible, the additional squares placed in the Prey Kohs area in 2010
- Identify methods compatible with the ongoing grid square-based framework that can give density estimates that incorporate detectability
- Continue the nest monitoring, but with finders only visiting nest sites together with project staff and switching to full protection only if more than one person knows the nest location
- Expand the area covered by non-breeding surveys to include promising new sites identified through the use of satellite transmitters (including Baray) and in community forests where records exist
- Examine alternative methods that increase encounter rates during non-breeding season surveys
- Develop an accurate system to monitor land cover changes using satellite imagery

### 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, recommendations that can be made on the basis of findings from the monitoring work are:

- Strengthen legal protection for the existing BFCAs network in order to prevent inappropriate large scale destructive development projects and reverse those that have begun, where possible
- Modify or expand the protected areas in non-breeding habitat to encompass other sites that hold high numbers of floricans
- Initiate florican conservation activities at other occupied sites in and outside current protected areas
- Continue research to clarify the ecological requirements of Bengal Floricans in both breeding and non-breeding areas, as well as studying breeding behaviour and developing a better understanding of vegetation dynamics such as grassland regeneration and scrub invasion

## 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. WCS Cambodia Program, Phnom Penh.
- Combreau, O, Qiao, J., Lawrence, M., Gao, X., Yao, J., Yang, W. and Launay, F. (2006) Breeding success in a Houbara Bustard *Chlamydotis [undulata] macqueenii* population on the eastern fringe of the Jungar Basin, People's Republic of China. *Ibis* 144: 45-56.
- 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.
- Ena, V., Martinez, A. & Thomas, D.H. (1987) Breeding success of the Great Bustard *Otis tarda*, Zamora Province, Spain, in 1984. *Ibis* 129: 364–370.
- 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*. Unpublished 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. 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. 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., 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, van Zalinge, R. and Evans, T. (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.
- MacKenzie, D.I., Nichols, J.D., Royle, J.A., Pollock, K.H., Bailey, L.L., and Hines, J.E. (2006) *Occupancy estimation and modelling – inferring patterns and dynamics of species occurrence*. Elsevier Academic Press publications, Oxford.
- Sum Song (2010) Bengal Florican Conservation Areas Annual Project Report June 2009 – July 2010. Wildlife Conservation Society Cambodia Program, Phnom Penh.
- Van Roeun (2010) PM encourages efforts to protect Tonle Sap. *Cambodia Daily*, 20 July 2010.
- Van Roeun and Vrieze, P. (2010) Flooded forest around Tonle Sap to be protected. *Cambodia Daily*, 10 June 2010.
- van Zalinge, R., Evans, T., Son Virak, Hong Chamnan, Ro Borei and Packman, C. (2009) Bengal Floricans in the Integrated Farming and Biodiversity Areas, 2008/9 monitoring report. In: *Biodiversity monitoring in the floodplain of the Tonle Sap in 2008/9*. pp.57-75. Wildlife Conservation Society Cambodia Program, Phnom Penh.

## Appendixes

Appendix 1. History of number of males holding territories in current survey squares in Stoung-Chikraeng between 2002 - 2010

Square	2002	2003	2004	2005	2006	2008**	2009*	2010*
1	-	-	-	-	-	0	0	0
2	-	-	-	0	-	0	1	2
3	-	-	-	-	-	0	0	2
4	-	-	-	-	-	0	0	0
5	1	0	0	1	1	0	0	1
6	-	-	-	0	-	1	0	1
7	-	0	0	0	0	0	0	0
8	1	1	1	1	0	0	1	1
9	-	0	0	2	1	1	1	2
10	1	1	1	1	1	0	1	1
11	1	0	0	1	1	0	0	0
12	-	-	-	-	-	1	1	1
13	-	-	-	-	-	0	0	1
14	-	2	2	1	0	0	1	1
15	-	-	-	0	-	0	1	1
16	0	1	1	1	0	0	1	1
17	1	1	1	1	0	0	1	1
18	1	0	0	0	0	0	0	0
<i>Total</i>	<i>6</i>	<i>6</i>	<i>6</i>	<i>9</i>	<i>4</i>	<i>3</i>	<i>9</i>	<i>16</i>

\* Squares visited three times; \*\* Squares visited once

Appendix 2. Coordinates (UTM Indian 1960) for centers of survey squares in Stoung-Chikraeng BFCAs

Square	UTM N	UTM E	Square	UTM N	UTM E
1	431500	1439500	10	443529	1437487
2	435500	1439500	11	445504	1437539
3	437500	1439500	12	447555	1437549
4	431500	1437500	13	435487	1435489
5	433500	1437500	14	437514	1435487
6	435500	1437500	15	439460	1435488
7	437500	1437500	16	441496	1435483
8	439500	1437500	17	443482	1435463
9	441500	1437500	18	445520	1435526

Appendix 3. History of number of males holding territories in current survey squares in Veal Srongai between 2009 – 2010

Square	2009	2010	Square	2009	2010
19	1	1	29*	-	0
20	-	0	30	-	0
21	0	0	31	0	0
22	0	0	32*	-	0
23	0	0	33*	-	0
24	0	0	34	0	0
25	0	0	35	0	0
26	0	0	36	0	0
27*	-	0	37	0	0
28*	-	0	<i>Total</i>	<i>1</i>	<i>1</i>

\* squares in Kampong Chhnang (only surveyed in 2010)

Appendix 4. Coordinates (UTM Indian 1960) for centers of survey squares in Veal Srongai

Square	UTM N	UTM E	Square	UTM N	UTM E
19	467500	1395500	29*	463500	1391500
20	469500	1393500	30	465500	1391500
21	461500	1393500	31	471500	1391500
22	463500	1393500	32*	461500	1389500
23	465500	1393500	33*	463500	1389500
24	467500	1393500	34	499500	1377500
25	469500	1393500	35	473500	1387500
26	471500	1393500	36	475500	1387500
27*	459500	1391500	37	477500	1387500
28*	461500	1391500			

\* squares in Kampong Chhnang (only surveyed in 2010)

Appendix 5. History of number of males holding territories in current survey squares in Baray-Chong Doung between 2008 – 2010

Square	2008*	2009	2010
38	1	0	0
39	0	0	0
40	0	1	0
41	0	0	0
42	0	0	0
43	0	0	0
44	0	0	0
45	-	0	0
46	-	0	0
47	-	0	0
48	-	0	0
49	-	0	0
50	-	0	0
51	-	0	0
52	-	0	0

Square	2008*	2009	2010
53	-	1	1
54	-	1	1
55	-	1	1
56	-	0	0
57	-	0	1
58	-	0	0
59	-	0	0
60	-	0	0
61^	-	0	0
62	-	0	0
63	-	0	0
64^	-	1	1
65^	-	1	1
66	-	1	1
67	-	1	2
<i>Total</i>	<i>(1)</i>	<i>8</i>	<i>9</i>

\* Two repeat visits to square

^Squares not part of current BFCAs

Appendix 6. Coordinates (UTM Indian 1960) for centers of survey squares in the Baray-Chong Doung survey area

Square	UTM N	UTM E	Square	UTM N	UTM E
38	501500	1379500	53	497500	1369500
39	499500	1377500	54	499500	1369500
40	501500	1377500	55	491500	1367500
41	503500	1377500	56	493500	1367500
42	499500	1375500	57	495500	1367500
43	501500	1375500	58	497500	1367500
44	503500	1375500	59	491500	1365500
45	495500	1373500	60	493500	1365500
46	497500	1373500	61^	495500	1364500
47	499500	1373500	62	489500	1363500
48	495550	1371500	63	491500	1363500
49	497500	1371500	64^	493500	1363500
50	499500	1371500	65^	495500	1363500
51	493500	1369500	66	489500	1361500
52	495500	1369500	67	491500	1361500

^Squares not part of current BFCAs

Appendix 7 Results of a preliminary analysis under an occupancy framework

Analysis was conducted using the program Presence.

Survey Area	Naive occupancy rate		Detection probability*		Occupancy corrected for detection rate**	
	2009	2010	2009	2010	2009	2010
Stoung-Chikraeng BFCAs	0.50	0.72	0.53	0.56	0.56 (0.23-0.88)	0.79 (0.50-1.00)
Baray-Chong Doung BFCAs <sup>^</sup>	0.22	0.22	0.56	0.63	0.24 (0.06-0.43)	0.23 (0.01-0.48)
Overall BFCAs	0.33	0.42	0.54	0.59	0.37 (0.21-0.54)	0.45 (0.29-0.62)
Veal Srongai	0.08	0.07	0.62	1.00	0.09 (0.01-0.29)	0.07 (0.01-0.23)
Overall study area	0.30	0.35	0.53	0.63	0.34 (0.21-0.53)	0.38 (0.25-0.50)

\* For simplicity detection rates were assumed to be equal for all three visits and for all observers.

\*\* Numbers in parentheses are the confidence intervals of the occupancy estimate.

<sup>^</sup>The three squares outside the BFCAs are not shown in this table as the sample is too small for further analysis. Two of the three squares were occupied.