Census of non-breeding Sarus Cranes in Cambodia and Vietnam 2010

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Contents

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Photo on title page of a group of Sarus Cranes at Ang Trapeang Thmor is by Eleanor Briggs.

Summary

This report presents the results of synchronized counts of Sarus Crane *Grus antigone* in Cambodia and Vietnam during the non-breeding season in 2010. Four censuses were conducted from January-April. The late March count forms the longest running part of the census, with additional counts in January and February introduced in 2008 and the additional count in late April conducted for the first time in 2010.

The highest count for 2010 was recorded in January with a total of 864 cranes counted across sites. This is the 2nd highest total count since records began in 2001. The March count, by contrast, was the third lowest for that month since records began. Peak counts for previous years have fluctuated between 700-900 birds, but there is no evidence of a clear trend since 2001.

The late March/early April count is usually presumed to give the closest estimate of the true crane population, but this year for the first time both the late March and late April counts were far lower than the January count, with around 150 birds 'missing'. It is therefore quite likely that at least one important feeding site, possibly in the Mekong Delta, was being missed in the census. This may also be a factor explaining some of the variation between counts in earlier years. We hope to address this issue in the 2011 counts.

Around 95% of the population counted in January was concentrated in just four sites: Boeung Prek Lapouv and Kampong Trach/Phu My in the Mekong Delta and Ang Trapeang Thmor and the Tonle Sap Grasslands in the Tonle Sap basin. In February the count was low, but several sites were not censused. In March 96% of the birds were found at Ang Trapeang Thmor, Kien Luong, Kampong Trach/Phu My and Tram Chim. By April the distribution had shifted again and the majority of cranes counted were found at Ang Trapeang Thmor, the Tonle Sap Grasslands, Kampong Trach/Phu My and Tram Chim (95% of total). Sarus Crane distribution across sites shifts within one season, but also between years. Another site where crane numbers have been higher in March/April in past census years is Hon Chong. This is partly due to the high mobility of cranes, using several different feeding sites throughout the dry season, but may also have been caused by changing ecological conditions.

Intensified land use and hydrological development within the wider Mekong Delta is impacting the suitability of feeding sites throughout the dry season habitats of this species. For example, within the last decade increasing irrigation needs for dry season farming around Boeung Prek Lapouv has led to the drying out of this wetland to such a degree that cranes now leave the site by the middle of the dry season and at Hon Chong, conversion of wetlands for intensive farming and shrimp production as well as the opening of a clay pit for cement production has caused the numbers of cranes visiting this site to decline dramatically. In addition, plans for intensified use of the Ang Trapeang Thmor Reservoir for irrigation need to be understood as they may also impact the cranes. Within the Tonle Sap grasslands land-use has been rapidly changing in the last five years, with the construction of numerous reservoirs for irrigation of dry season rice. However, these reservoirs have recently been ordered destroyed as the government is concerned that agriculture in important fisheries areas will result in further declines in Tonle Sap productivity.

អត្ថបទសង្ខេប

របាយការណ៍នេះរៀបរាប់ពីលទ្ធផល នៃការរាប់សរុបហ្វូងសត្វក្រៀលនៅក្នុងប្រទេសកម្ពុជា និងវៀតណាមនៅក្នុងរដូវមិនបន្តពូជនៅឆ្នាំ២០១០។ នៅឆ្នាំ ២០១០នេះ ការធ្វើជំរឿនត្រូវបានធ្វើឡើង ៤លើក ចាប់ពីខែមករាដល់ខែមេសា ចាប់តាំងពីឆ្នាំ ២០០១មក ការធ្វើជំរឿនសត្វក្រៀល ត្រូវបានគេធ្វើឡើងនៅចុងខែមីនាជារៀងរាល់ឆ្នាំ។ បន្ទាប់មកនៅឆ្នាំ ២០០៨ ការរាប់សត្វក្រៀល ត្រូវបានគេធ្វើឡើងបន្ថែមទៀតនៅក្នុងខែមករា និងខែកុម្ភៈ ហើយនៅក្នុងឆ្នាំ ២០១០នេះ ការជំរឿនសត្វក្រៀលត្រូវបានគេធ្វើឡើងបន្ថែមមួយខែថ្មីទៀតគឺនៅចុងខែមេសា។

ការរាប់ចំនួនសត្វក្រៀលខ្ពស់បំផុតសំរាប់ឆ្នាំ ២០១០ ត្រូវបានធ្វើឡើងនៅក្នុងខែមករា ដោយបានរាប់ឃើញសត្វក្រៀលចំនួន ៨៦៤ក្បាលទូទាំងតំបន់ទាំងអស់ ដែលមានវត្តមានសត្វក្រៀល ដែលនេះជាចំនួនខ្ពស់ខ្លាំងលំដាប់ទី២ ចាប់តាំងពីឆ្នាំ ២០០១ មក។ ផ្ទុយមកវិញចំនួនក្រៀល ដែលបានរាប់ឃើញមានចំនួនទាបជាងគេបំផុត គឺនៅក្នុងខែមីនា ការរាប់ឃើញក៏រីតខ្ពស់បំផុតនាឆ្នាំកន្លងមកបានប្រែប្រួលចំនួនសត្វក្រៀលក្នុងចន្លោះពី ៧00 ទៅ ៩00ក្បាល ប៉ុន្តែគេមិនទាន់មានភស្តុតាង នៃការបម្រែបម្រួលនេះច្បាស់លាស់ទេចាប់តាំងពីឆ្នាំ ២០០១មក។

ការរាប់នៅចុងខែមីនា និងដើមខែមេសាជារឿយៗត្រូវបានគេសន្មត់ និងប៉ាន់ប្រមាណថាជាពេលវេលាដែលអាចរាប់ចំនួនសត្វក្រៀលបានត្រឹមត្រូវពិតប្រាកដជាងពេលផ្សេងទៀត។ ប៉ុន្តែនៅក្នុងឆ្នាំ២០១០នេះការរាប់លើកដំបូងនៅចុងខែមីនា និងចុងខែមេសា បានរាប់ឃើញមានចំនួនទាបជាងការរាប់ក្នុងខែមករាយ៉ាងខ្លាំង ដែលការរាប់បានឃើញចំនួនប្រហែល ១៥0ក្បាលប៉ុណ្ណោះ (បាត់ច្រើនក្បាលជាងមុន)។ ដូច្នេះវាត្រូវបានគេសង្ស័យថា ប្រហែលជាមានជម្រកពងកូនមួយកន្លែងថ្មីទៀត នៅតំបន់ដីសណ្តរទន្លេមេគង្គដែលគេពុំទាន់រកឃើញ និងខកខានមិនបានធ្វើជំរឿន។ នេះក៏ប្រហែលជាអាចបណ្តាលមកពីកត្តាមួយផ្សេងទៀតផងដែរ ដែលអាចដឹងថា មកពីកត្តាប្រែប្រួលនៃការរាប់ក្នុងប៉ុន្មានឆ្នាំកន្លងមក យើងសង្ឃឹមថា បញ្ហានេះនឹងត្រូវបានគេដឹងច្បាស់នៅក្នុងពេលធ្វើជំរឿននៅឆ្នាំ ២០១១។

ប្រមាណ ៩៥% នៃចំនួនសត្វក្រៀលដែលបានរាប់ឃើញនៅក្នុងខែមករា ត្រូវបានគេរាប់ឃើញដោយសត្វក្រៀលបានប្រមូលផ្តុំនៅក្នុង ៤តំបន់សំខាន់ៗគឺ **បឹងព្រែកល្ពៅ** និង**កំពង់ត្រាច ឬភូមិ** នៅតាមតំបន់ដីសណ្តរទន្លេមេគង្គ និងនៅ**អាងត្រពាំងថ្ម** និង**វាលស្មៅបឹងទន្លេសាប**នៅក្នុងតំបន់អាងបឹងទន្លេសាប។ នៅខែកុម្ភៈការរាប់បានឃើញចំនួនទាប ដោយសារតែតំបន់ជំរឿនផ្សេងទៀតពុំបានធ្វើការរាប់។ នៅក្នុងខែមីនាសត្វក្រៀល ៩៦% ត្រូវបានរាប់ឃើញនៅ ក្នុងអាងត្រពាំងថ្ម ក្បៀនលុង កំពង់ត្រាច ឬភូមិ និងត្រាំជីម រហូតដល់ខែមេសា រប៉ាយរបស់សត្វក្រៀលបានប្រែប្រួលជាថ្មីម្តងទៀត ហើយចំនួនសត្វក្រៀលភាគច្រើនបានរាប់ឃើញនៅអាងត្រពាំងថ្ម វាលស្មៅបឹងទន្លេសាប កំពង់ត្រាច ឬភូមិ និងត្រាំជីម (៩៥% នៃចំនួនសរុប)។ រប៉ាយហ្វូងសត្វក្រៀលនៅតាមតំបន់ជម្រកសំខាន់ៗបានប្រែប្រួលនៅក្នុងរដូវតែមួយ ហើយពេលខ្លះក៏មានការប្រែប្រួលនៅក្នុងឆ្នាំនីមួយៗផងដែរ តំបន់ដទៃទៀត គឺតំបន់ហុនចុងចំនួនសត្វក្រៀលបានកើនឡើងខ្ពស់នៅក្នុងខែមីនា ឬមេសានាប៉ុន្មានឆ្នាំកន្លងមក។ នេះបណ្តាលមកពី

មានភាពតបំលាស់ទីរបស់សត្វក្រៀលមានការផ្លាស់ប្តូរខ្លាំង ដោយសារមានហ្វូងក្រៀលមួយចំនួន បានប្រើប្រាស់ទីជម្រកកចំណី ខុសៗគ្នាពេញរដូវប្រាំង ប៉ុន្តែប្រហែលជាអាចមកពីមានការផ្លាស់ប្តូរលក្ខខណ្ឌអេកូឡូស៊ី។

ការប្រើប្រាស់ដីកាន់តែទូលំទូលាយ និងការអភិវឌ្ឍន៍លើប្រព័ន្ធជលសាស្ត្រ នៅតាមតំបន់ជុំវិញបឹងទន្លេសាប និងតំបន់ដីសណ្តរទន្លេមេគង្គបាននឹងកំពុងតែរំខានដល់កន្លែងរកចំណីរបស់ហ្វូងសត្វក្រៀលពេញក្នុងរដូវប្រាំង។ ជាក់ស្តែងនៅក្នុងទសវត្សកន្លងមក ការកើនឡើងនៃប្រព័ន្ធធារាសាស្ត្រសំរាប់ស្រោចស្រពស្រូវប្រាំងនៅជុំវិញបឹងព្រែកល្ពៅ បានធ្វើឱ្យតំបន់ដីសើមនេះគោករាក់ក្នុងភាពមួយ ដែលធ្វើឱ្យហ្វូងសត្វក្រៀលបានចាកចេញទៅកាន់តំបន់ដទៃទៀតនៅពាក់កណ្តាលរដូវប្រាំង។ រីឯតំបន់ហុនចុង ការប្រែក្លាយតំបន់ដីសើមទៅជាកសិកម្មអតិផល កសិដ្ឋានចិញ្ចឹមបង្កា និងការដំណើរការរោងចក្រស៊ីម៉ង់ត៍ បានរំខានដល់ហ្វូងសត្វក្រៀលដែលធ្លាប់រកចំណីនៅតំបន់នោះ និងធ្វើឱ្យបរិមាណរបស់សត្វក្រៀលថយចុះយ៉ាងខ្លាំង។ បន្ថែមលើសពីនេះ គំរោងអភិវឌ្ឍអាងស្តុកទឹកអាងត្រពាំងថ្មសំរាប់ផ្គត់ផ្គង់ដល់តម្រូវការប្រព័ន្ធធារាសាស្ត្រ និងត្រូវបានគេដឹងថា អាចប៉ះពាល់ដល់ហ្វូងសត្វក្រៀលផងដែរ។ ការប្រើប្រាស់ដីធ្លីនៅតំបន់វាលស្មៅបឹងទន្លេសាបបាននឹងកំពុងផ្លាស់ប្តូរយ៉ាងលឿនក្នុង ៥ឆ្នាំកន្លងមកនេះ ដោយតំបន់នេះត្រូវបានគេសាងសង់អាងប្រព័ន្ធធារាសាស្ត្រជាច្រើនកន្លែង ដើម្បីស្តុកទឹកធ្វើស្រែប្រាំង។ ទោះបីជាយ៉ាងណាក៏ដោយ អាងទប់ទឹកទាំងនេះត្រូវបានបញ្ជាឱ្យបំផ្លាញចោលវិញ ដោយសារតែរាជរដ្ឋាភិបាលមានការព្រួយបារម្ភពីផលប៉ះពាល់ នៃការអភិវឌ្ឍន៍កសិកម្មនៅក្នុងតំបន់ដ៏មានសារៈសំខាន់សំរាប់វិស័យជលផលនេះ នឹងធ្វើឱ្យផលិតផលធនធានជលផលនៅបឹងទន្លេសាបកាន់តែបន្តធ្លាក់ចុះ ដែលធ្វើឱ្យប៉ះពាល់ដល់ការអភិវឌ្ឍនិវិស័យជលផលរបស់ប្រទេសកម្ពុជានៅពេលអនាគត។

Introduction

Since 2001, a coordinated census of Sarus Cranes *Grus antigone* has been held each year during the late dry season in Cambodia and Vietnam. Early in the dry season cranes are widely distributed, but as water sources dry up, birds are concentrated at the few remaining suitable wetlands. The Wildlife Conservation Society (WCS) in Cambodia and the International Crane Foundation (ICF) in Vietnam, coordinate a synchronized census at key wetlands each year that aims to assess the population levels and distribution of Sarus Cranes in the region. From 2001-2007 the census was held once a year in late March/early April, at the height of the dry season (Triet *et al.* 2006; Nguyen Phuc Bao Hoa *et al.* 2007). In 2008 and 2009 the number of counts conducted on a yearly basis was increased to three, to assess distributional changes within the dry/non-breeding season (van Zalinge *et al.* 2009a; van Zalinge *et al.* 2009b). The current report describes the results of the dry season census in 2010. In 2010 a fourth count was added in late April after it was observed from site data that there are further shifts in distribution during this month.

The Sarus Crane ranges from India to Australia and has been classified as Globally Threatened (Vulnerable) (BirdLife International, 2009). It was once distributed throughout mainland South-East Asia, but has undergone a severe decline over the past 50 years through habitat loss and hunting, and is now restricted to parts of Cambodia, extreme southern Laos, southern Vietnam and parts of Myanmar (BirdLife International 2008). The population of Sarus Crane in Cambodia, Vietnam and Lao PDR, although not a distinct sub-species, is now isolated (Barzen and Seal 2001) and the severity of threats to Sarus Cranes across most of their range warrants conservation strategies to focus upon preventing further extinction of such fragmented populations (Jones *et al.* 2005). The census in Cambodia and Vietnam covers a large part of the known regional dry season distribution and is therefore a valuable monitoring tool. Most breeding areas of the surveyed population are located in northern and eastern Cambodia with a few nests likely to exist in southern Lao PDR, the Central Highlands of Vietnam, and in southern Cambodia (Barzen 2004; ICF, unpubl. Data).

With the exception of Koh Thom, all of the census sites are within Important Bird Areas (IBAs) and meet the criteria for category A1 for Sarus Cranes, being sites that 'regularly hold significant numbers of a Globally Threatened species' (Seng Kim Hout *et al.* 2003, Tordoff *et al.* 2002). In addition, Ang Trapeang Thmor, Boeung Prek Lapouv, Kampong Trach/Phu My, Tram Chim National Park and conservation areas in the Ha Tien plain (including Hon Chong, Hon Dat, Phu My and Kien Luong grasslands) also meet the criteria of category A4(i) reserved for sites that 'hold on a regular basis ≥ 1% of a biogeographic population of a congregatory waterbird species' (Tordoff 2002, Seng Kim Hout *et al.* 2003).

Most of the sites have some kind of protected status. Ang Trapeang Thmor (ATT) and Boeung Prek Lapeuv are both designated as Sarus Crane Conservation Areas. Tram Chim is a National Park. In 2010 four sites in the Tonle Sap Grasslands: Stoung, Chikraeng, Baray and Chong Dong, were upgraded from a provincial to a stronger ministerial level designation as Bengal Florican Conservation Areas. Two other sites in the Tonle Sap Grasslands, Krous Kraom and Preah Net Preah, are unprotected. Lang Sen Protected Area and other sites within the Ha Tien Plain are protected under provincial authority.

Methods

Crane counts were conducted across Cambodia and Vietnam on four dates in 2010 (Table 1, Figure 1): 15-18 January (eight sites), 26-27 February (six sites), 24-28 March (twelve sites) and 24-25 April (eleven sites). These include most of the sites where cranes are known to occur in the dry season, and almost all the most important sites were covered for each census. For discussion and analysis, the regions covered were grouped in three broad ecological areas: the Tonle Sap Lake basin, the Mekong delta, and the deciduous forests of northern and eastern Cambodia (Table 1).

Sarus Cranes are more consistently recorded at some sites than others, requiring two survey approaches. ATT, Kampong Trach-Phu My and most of the sites in Vietnam are relatively small and Sarus Cranes congregate predictably in large numbers at the time of the census; in these areas coordinated surveys were carried out using teams of observers to perform synchronized counts covering the whole area. These counts were held at key times when the local population was likely to be grouped and not mobile - such as first thing in the morning or late in the afternoon when birds are present at roost sites.

At the other sites where the location of the cranes is less predictable, the survey approach was to travel around the area to make opportunistic crane observations during the day. For sites where observations were made on several different days, the highest count on any single day was used, but dates, times and locations of opportunistic observations were evaluated to avoid multiple counts of the same individuals. Where there was suspicion of double-counting, we were conservative in estimating our final total to avoid excessive measures of population size.

Due to logistical and organizational constraints in conducting a region-wide census it was not always possible to conduct surveys at all sites for all of the dates and therefore effort was not constant for all months. Within a single month, surveys were also conducted over a small range of dates at all sites. Except for Preah Vihear Protected Forest in January, Mondulkiri Protected Forest in March and Preah Vihear PF/Kulen Promtep WS in April, records from the various sites came from a period of only two-four days and we believe the effects of double-counting were minimized. Normally, areas counted on different days were sufficiently distant for it to be unlikely that individuals would have travelled from the first sites to be counted a second time. If sites were close enough to have allowed cranes to move from one site to another between counts, a conservative approach was adopted by taking the count from one site only.

The crane site of Kompong Trach-Phu My is situated on the Cambodia-Vietnam border, and the cranes use feeding and roosting sites on both sides of the border. To avoid cross-border double-counting, the two teams coordinated the date and time of the census, and any observed movement of cranes across the border during the count was recorded. For clarity, a single count is presented for the whole site.

Observers counted the total number of cranes seen. Observers were also asked to record details of crane behavior, such as whether they were feeding, roosting, flying overhead, etc., as well as basic information about the site where the cranes were observed. As most counting teams did not have telescopes it was not possible to separate juveniles from adults in all counts.

Some supplementary records of cranes were available from other times in the dry season, and these have been mentioned where useful.

Table 1. Sites surveyed during the 2010 Sarus Crane census (see Figure 1 for locations)

Site name	Country[x]	Count 1	Count 2	Count 3	Count 4	Organizations^
		Date of Count				
Tonle Sap basin						
Ang Trapeang Thmor SCCA[y]	C	16-17/1	27/2	27/3	25/4	FA/WCS
Tonle Sap Grasslands	C	16-17/1[a]	-	28/3[a]	24-25/4	FA/WCS/ACCB
Mekong delta						
Boeung Prek Lapouv SCCA[y]	C	15-16/1	27/2	28/3	24/4	FA/BL /WCS
Koh Thom	C	-	-	27/3	-	WCS
Kampong Trach/Phu My‡	C/V	15-17/1	27/2	28/3	24/4	FA/BL/ICF
Tram Chim National Park	V	17/1	27/2	28/3	25/4	NP
Lang Sen	V	-	-	28/3	25/4	ICF
Hon Chong	V	16-17/1	27/2	28/3	25/4	ICF
Kien Luong	V	-	-	28/3	25/4	ICF
Hon Dat	V	-	-	28/3	25/4	ICF
Northern/Eastern Deciduous Forests						
Preah Vihear Protected Forest	C	10/1	-	-	30/4	FA/WCS
Kulen Promtep Wildlife Sanctuary	C	-	26-27/2	27-28/3	30/4	MoE/WCS
Western Siem Pang	C	18/1	-	-	-	FA/BL
Mondulkiri Protected Forest	C	-	-	24/3	-	FA/WWF

[x] C - Cambodia, V – Vietnam

^Participating organizations/institutions: ACCB- Angkor Center for Biodiversity Conservation; BL- BirdLife International in Indochina; FA- Forestry Administration, Cambodia; ICF- International Crane Foundation; MoE- Ministry of Environment, Cambodia; NP- National Park staff, Vietnam; WCS- Wildlife Conservation Society; WWF – Worldwide Fund for Nature

[y] Sarus Crane Conservation Area

[a] Stoung, Chikraeng, Baray and Chong Doung Bengal Florican Conservation Areas (BFCAs), as well as grasslands in Krous Kraom and Preah Net Preah

[b] Stoung, Chikraeng, Baray and Chong Doung BFCAs plus Krous Kraom

‡ The Kampong Trach (Cambodia) and Phu My (Vietnam) sites are considered a single site for the purpose of the crane census and counted simultaneously due to their close proximity. Cranes move back and forth across the border each day between feeding and roosting site

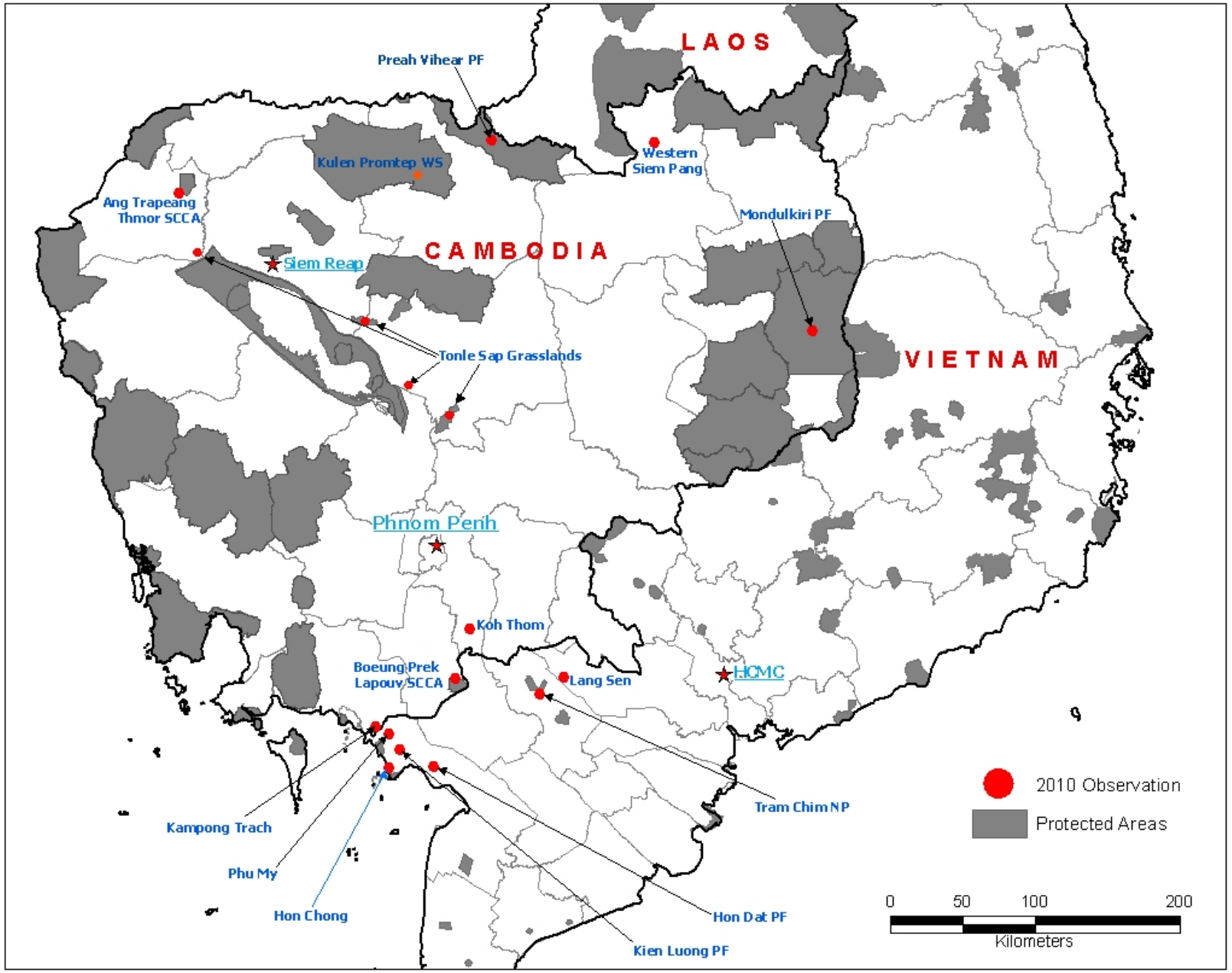

Figure 1. Map of Sarus Crane count sites in 2010

Results

This is the first year since multiple counts throughout the dry season began in 2008 that the highest count did not occur around late March (Table 2). January had the highest number with 864 cranes counted across all eight sites surveyed. In late March 715 cranes were counted at ten of the twelve sites covered. The bulk of the population counted in January was concentrated in just four sites: Boeung Prek Lapouv and Kampong Trach/Phu My in the Mekong Delta and Ang Trapeang Thmor and the Tonle Sap Grasslands in the Tonle Sap basin (95% of total, Figure 2). In February the count was low but several sites were not censused, including the Tonle Sap grasslands (Appendix 1). In March most of the birds located were found at Ang Trapeang Thmor, Kien Luong, Kampong Trach/Phu My and Tram Chim (96% of total). By April the distribution had shifted again and the majority of cranes counted were found at Ang Trapeang Thmor, the Tonle Sap Grasslands, Kampong Trach/Phu My and Tram Chim (95% of total). Ang Trapeang Thmor alone supported 52% of the entire population.

Table 2. Minimum number of Sarus Cranes present at each site during the four 2010 censuses

Site	Jan	%	Feb	%	Mar	%	Apr	%
Tonle Sap basin								
Ang Trapeang Thmor	**199**	*23*	**275**	*47*	**313**	*44*	**366**	*52*
Tonle Sap Grasslands	**125***	*14*	**-**	*-*	**6^**	*1*	**66^^**	*9*
Mekong delta								
Tram Chim	**9**	*1*	**47**	*8*	**85**	*12*	**37**	*5*
Boeung Prek Lapouv	**265**	*31*	**0**	*-*	**0**	*-*	**0**	*-*
Kampong Trach/Phu My	**229**	*27*	**214**	*37*	**140**	*20*	**203**	*29*
Hon Chong	**15**	*2*	**32**	*6*	**2**	*<1*	**0**	*-*
Lang Sen	**-**	*-*	**-**	*-*	**13**	*2*	**3**	*<1*
Kien Luong	**-**	*-*	**-**	*-*	**143**	*20*	**12**	*2*
Hon Dat	**-**	*-*	**-**	*-*	**4**	*1*	**0**	*-*
Koh Thom	**-**	*-*	**-**	*-*	**0**	*-*	**-**	*-*
Northern/Eastern deciduous forests								
Preah Vihear Protected Forest	**18**	*2*	**-**	*-*	**-**	*-*	**11**	*2*
Kulen Promtep Wildlife Sanctuary	**-**	*-*	**11**	*2*	**7**	*1*	**11**	*2*
Western Siem Pang	**4**	*<1*	**-**	*-*	**-**	*-*	**-**	*-*
Mondulkiri Protected Forest					**2**	*<1*	**-**	*-*
Total	**864**		**579**		**715**		**709**	

* 68 in Stoung-Chikraeng, 47 in Krous Kraom and 10 in Baray
^ 3 in Stoung-Chikraeng and 3 in Krous Kraom
^^20 in Stoung-Chikraeng and 46 in Baray

Tonle Sap basin

The number of cranes counted within the Tonle Sap basin fluctuated by no more than 49 cranes between January and March (Figure 2). However, in February, which represents the lowest count, the Tonle Sap grasslands were not covered. The difference between January and March is only five cranes or 1.5%. A sharp increase was observed in April, with an increase of 108 cranes or 33% from January numbers.

The January count at Ang Trapeang Thmor (ATT) was 199 cranes, increasing to 319 in March and 366 in April, both numbers being close to the average annual March/April count at ATT since 2001 (349 birds) and similar to the 2009 numbers (Table 3). The April 2010 count represented 52% of cranes counted across all sites. Conditions at ATT had improved this year, with the *Eleocharis*-rich wet grasslands and other areas of the reserve being accessible to the cranes, whereas most feeding areas were heavily inundated in 2009. This year cranes were more frequently observed feeding in the reservoir's grasslands rather than harvested rice fields below the reservoir, as had been observed in 2009 (Ngin Kamsan pers. comm.).

Within the Tonle Sap grasslands there are six sites (shown graphically as four sites in Figure 1 as some sites are adjacent to each other). Since cranes appear to be highly nomadic in this area, with unpredictable fluctuations at individual sites, it is helpful to consider total counts for the six sites together. The highest numbers have typically been found in January, when conditions are still wet. During January-March 2010 total numbers were substantially lower compared with last year and slightly lower than in 2008. However, the additional count in April this year found a slight increase in numbers towards the end of the non-breeding season.

The only site we know of where there is a more or less permanent group throughout the dry season is Stoung-Chikraeng. Stoung-Chikraeng normally holds a small population of <50 cranes throughout the dry season. Although 66 cranes were counted in January, this year almost all cranes seemed to have left the site as the dry season progressed (Doung Saroeun, pers. comm.) which is reflected in a very low count in March of only three. Numbers increased slightly in April as the rains began with 20 cranes counted at this site.

In the Krous Kraom area 47 cranes were counted in January, a substantial decrease from the 105 counted in 2009 and slightly lower than the 68 counted in 2008. Baray and Chong Doung are two adjacent sites included in the counts. No cranes were counted in any of the census periods in Chong Doung. Baray held ten cranes in January and 46 in April. The January count is substantially lower than previous counts of 45 in January 2009 and 49 in January 2008. In 2010 as in previous years no cranes were found in March. Preah Net Preah did not hold any cranes when it was surveyed in January and March. Ten birds had been counted here in March 2009, the first year in which this site was included in the census. On current evidence it appears to be of marginal importance for cranes.

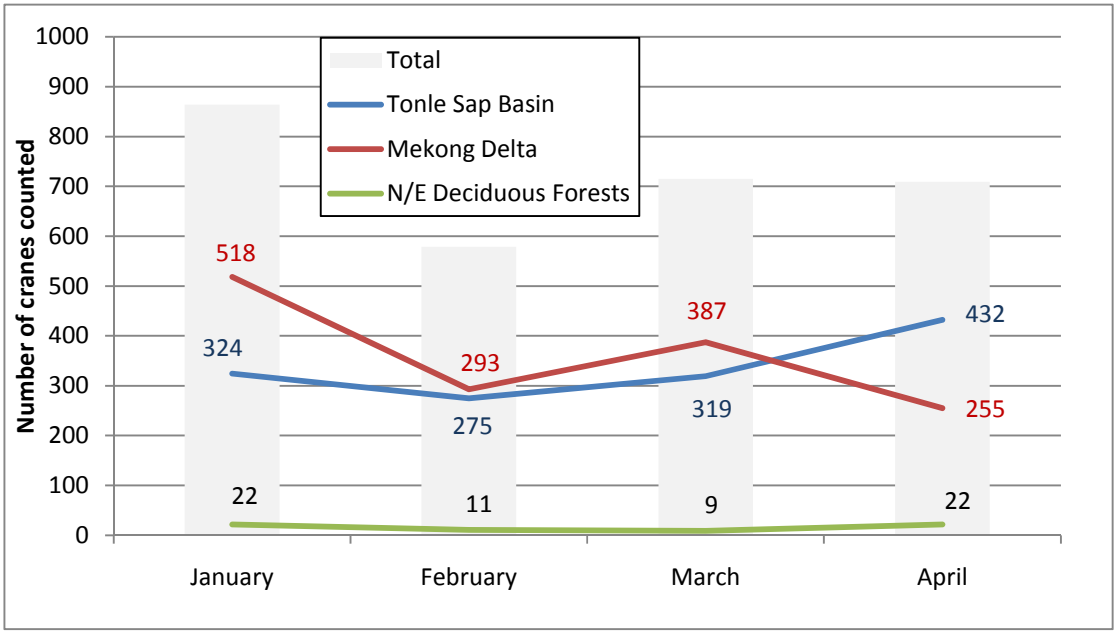

Figure 2. Fluctuations in crane numbers counted between census periods in 2010, by biogeographic region

Mekong delta

Within the Mekong Delta the overall number of cranes counted varied substantially between months (Figure 2). From an initial count of 518 in mid January, the number of cranes located during counts dropped to 255 by the end of April.

The 16 January count at Boeung Prek Lapouv (BPL) of 265 birds was used as this count was conducted at a similar time to other counts in the delta. A census conducted on 15 January counted 275 cranes. This is was also the highest count for the site in 2010 and is within the range of peak counts of 248-301 birds observed at BPL during the previous four years. The count represents 31% of all cranes recorded in January. Cranes start abandoning the site as it gets drier and the final

departure date of cranes from BPL in 2010 was 22 February, which is similar to other recent years. On 24 April, 21 cranes were observed flying over the site. This was however three hours after counts had finished at other sites in the delta and so this observation was not included.

The Kampong Trach - Phu My site held 229 cranes in January. This is an unusually high number for this month and also a record total for all Kampong Trach - Phu My combined synchronized counts. The previous January census peak count was 115 in 2005. The highest count at Kampong Trach was of 277 cranes on 6 February (outside the census period), a new record for the site. The lowest count this year was actually in March (140), which is normally when peak numbers occur. This is perhaps related to increased numbers at nearby Kien Luong where an unusually high count of 143 cranes was obtained in March. The previous highest total from Kien Luong during the census periods in March/April had been 29 cranes counted in 2003.

From 2005-2008, the number of cranes at Tram Chim consistently peaked in April with peaks of 89 – 126 cranes (Nguyen Phuc Bao Hoa *et al.* 2007, van Zalinge *et al.* 2009a). For the synchronized counts in 2010, the highest number was 85 in March with only 37 counted in April.

In Hon Chong 32 cranes were counted in February and by April no more cranes were present. Peaks have occurred in February before (Nguyen Phuc Bao Hoa *et al.* 2007) but also in March and April (van Zalinge *et al.* 2009a). Counts in Hon Chong were low and represent a decline in abundance at this site. Peak counts at Hon Chong used to exceed 370 cranes but numbers have been declining since 2002 (van Zalinge *et al.* 2009b). It is possible that a combination of development pressures at Hon Chong, coupled with conservation activities at Kampong Trach – Phu My, has caused a shift in population between these two sites.

Crane numbers at Lang Sen and Hon Dat were very low with 13 and 4 cranes counted in each of the two respective sites in March. No cranes were found in the usual area surveyed in Koh Thom when the site was visited in March, but a local informant reported that there is a lake located near Sambok Chab Village in Koh Thom District, Kandal Province where cranes are sometimes seen.

Northern/Eastern dry forests

In the Preah Vihear Protected Forest 11-18 cranes were found in census months and 7-11 cranes in Kulen Promtep Wildlife Sanctuary. Similar to last year, four cranes were located in Western Siem Pang (in January). This year two cranes were also reported from Mondulkiri Protected Forest in March. These are all large, forested sites with scattered small wetlands (Barzen 2004) and any cranes that remain in the non-breeding season occur at very low densities. No complete dry season survey has been done of these dry open forest conservation areas so it is unknown how many cranes might utilize these areas in total in the dry season.

Discussion

Coverage and data quality

Coordinated counts of the main sites are intended to provide a minimum estimate of the total biogeographical population in the lower Mekong region. All the main known regularly used sites were covered during the 2010 census.

It has been an assumption since 2001 that late March/early April was the most efficient moment to conduct these counts, since the highest proportion of birds would then be concentrated in the smallest area of available habitat and the minimum estimate would be as close as possible to the true figure. Counts in other months supported this assumption in 2008 and 2009 but the assumption was clearly violated in 2010 when the peak count in January was much higher than in March, indicating that at least 150 birds had probably moved to unknown feeding areas by March. This was contrary to expectation as it had been a very dry year and it was thought that even more cranes than usual would be concentrated at the known feeding sites. The failure to detect these 150 cranes was despite an increase in effort from eight sites in January to twelve sites in March.

Counts from further years are required to clarify whether this is an isolated case or a frequent occurrence. Until this is clear, we suggest it is best to continue trend analysis using the late March/early April counts, since they are currently the most comparable long term dataset.

This strong evidence that there are other important feeding sites not yet covered by the census could partly explain the high degree of variation in total counts between years (see next section) as has long been suspected. Cranes could also be visiting sub-optimal sites for short periods.

The problem of possible gaps in coverage needs to be resolved to increase the usefulness of the monitoring program. One likely candidate area to support these 'missing cranes' has been identified in the Vietnamese part of the delta, but it is a military-controlled area and access for ornithologists is not straightforward, but enquiries are being made (Tran Triet pers. obs.).

Comments from the 2007 report regarding the difficulties of precise counting still hold, especially for large flocks. Numbers are probably often under-estimated, and if the level of under-estimate varies between years (due to e.g. observer differences, count timing, local movements, vegetation structure etc.) this could obscure gradual trends for several years.

Totals compared to previous years

The total number of cranes counted has fluctuated substantially between years. For example the total count decreased by 122 individuals between 2006 and 2007, but then increased by 160 in 2008 (Table 3). These are long-lived, slow-maturing birds so these short-term fluctuations are presumably due to changes in the proportion of birds counted during the census rather than absolute population size, but there may also be underlying trends in the true numbers which are important to track for management purposes.

The March count of Sarus Cranes in Cambodia and Vietnam in 2010 was the third lowest since 2001, but there is no clear evidence of any long term trend (Figure 2). Numbers were low in 2001, presumably because too few sites were covered in that first year, but since then minimum numbers have fluctuated between approximately 700 and 900 with no clear pattern. This is thought to indicate that there is no strong trend in the total population.

There are few comparative data from other sources. Mortality data are unavailable, although it is many years since there were reports of large-scale hunting or poisoning of cranes on their non-breeding grounds (Goes and Hong Chamnan 2001, Hong Chamnan, Seng Kimhout and Tran Triet, pers. comm.). Recruitment is also poorly known overall. The one section of the breeding population which is closely monitored is the Northern Plains of Cambodia in (Preah Vihear Protected Forest and Kulen Promtep Wildlife Sanctuary). This area experiences excellent protection and high output, with 52 nests guarded and 89 chicks leaving the nest during the 2009 rainy season (Clements *et al.* 2007, Rainey *et al.* 2009). It has not been possible to estimate reliably the proportions of juvenile birds in the non-breeding season population in recent years.

Trends in the two main sub-regions

March numbers within the Mekong Delta were slightly higher than last year, but fractionally below the average over the last decade (387 cranes in the delta in 2010 compared to an average of 402). Within the Tonle Sap basin March numbers dropped further to the lowest point since 2002. With 319 cranes counted in 2010 the basin is now below average numbers recorded since 2001 by 40.

The number of cranes present in March within the Tonle Sap basin versus the Mekong Delta has fluctuated in the last decade. Initially counts had been higher in the delta by as much as 183 birds (in 2001). In 2007 numbers in the Tonle Sap basin surpassed those in the delta, but by 2009 numbers were almost equal and this year in March more cranes were again counted in the delta. In 2007 certain sites within the Tonle Sap grasslands were properly surveyed for the first time, but the major increase within the basin was due to an increase in the number of cranes at Ang Trapeang Thmor towards the end of the dry season. Since 2009 numbers at ATT dropped by more than one hundred cranes, which could be due to construction work upstream and downstream of the reservoirs, affecting water levels and causing disturbance. These impacts from construction work may be temporary, but planned use of the reservoir still needs to be reviewed and future impacts determined.

There is a strong suggestion of net movements between the two main sub-regions over the course of the 2010 season. Total numbers in the Mekong Delta declined by 239 from January to April, and in the same period a compensatory increase of 108 cranes was observed in the Tonle Sap basin. As noted earlier, the destination of the remaining birds is not known. Furthermore, this year once again showed evidence of frequent local shifts between sites within the two main sub-regions from month to month, as discussed in more detail in van Zalinge *et al.* (2009b).

The key conclusion for site management based on the nomadic behavior of cranes discussed above (and reiterated from previous census reports) is that it is critical to maintain a trans-national network of protected sites to allow flexibility in feeding movements within and between dry seasons as water conditions change. This will become ever more important as climate change alters the water regimes at key sites in unpredictable ways.

Site-specific conservation issues

Intensified land use and hydrological development within the wider Mekong Delta is impacting on the suitability of feeding sites in this area. For example, within the last decade increasing irrigation needs for dry season farming around Boeung Prek Lapouv has led to the drying out of this wetland to such a degree that cranes now leave the site by the middle of the dry season and at Hon Chong, the installation of a cement production plant has caused the numbers of cranes visiting this site to decline dramatically. Plans for intensified use of the Ang Trapeang Thmor Reservoir for irrigation need to be understood so that potential impacts can be identified and dealt with.

A positive recent improvement at Phu My has been the addition of a nearby roost site to the conservation area, while in the Tonle Sap grasslands four sites have now been recognized as protected areas under a ministerial decree. There has been a strong recent push to demolish water reservoirs within the Tonle Sap floodplain, that have been built for the cultivation of dry season rice. Although occasionally small groups of cranes have been found feeding around the water reservoirs and dry season rice fields, this does not seem to be a very important resource for them. It is however unknown how many cranes used such irrigated areas in recent years as the area is extensive and was only minimally covered during the census periods. Larger numbers of cranes have been recorded feeding in harvested deep water rice fields in the floodplain in December – January. Deep water rice cultivation may increase if water reservoirs are destroyed and the cultivation of dry season rice is reduced.

Table 3. Census results for 2001-2010 in Cambodia and Vietnam

	Sarus Crane numbers in end March/early April									
Location *Year*	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Tonle Sap basin	*228*	*345*	*339*	*365*	*334*	*373*	*402*	*475*	*367*	*319*
Ang Trapaeng Thmor SCCA	228	345	339	365	334	373	394	439	320	313
Tonle Sap Grasslands^		6				0	8	36	47	6
Mekong delta	*411*	*527*	*494*	*417*	*366*	*391*	*272*	*371*	*365*	*387*
Boueng Prek Lapeuv SCCA*	27	155	138	0	0	0			0	0
Koh Thom							4		0	0
Kampong Trach				126	56	136	131	183	225	140
Phu My			6							
Tram Chim National Park	48	11	61	96	82	89	125	103	78	85
Lang Sen			0	0	0	0	0	7	12	13
Kien Luong Protected Forest			29	0	0	0	0	7		143
Hon Dat Protected Forest			2	0	0	0	0	0		4
Hon Chong	336	361	258	195	228	166	15	71	50	2
Northern/Eastern forests	*11*	*0*	*4*	*2*	*21*	*43*	*14*	*6*	*15*	*9*
Lo Go Sa Mat NP		0	0	0	0	0		0		
Yok Don NP			0	1	0	0				
Preah Vihear Protected Forest						12	8	0	9	
Kulen Promtep WS	11		2			7		4	4	7
Western Siem Pang IBA				2	21	0	2	2	2	
Lomphat WS						24	4			
Mondulkiri Protected Forest			2							2
Regional Total	*650*	*878*	*837*	*785*	*721*	*814*	*692*	*852*	*747*	*715 (864)**
Number of Count Sites	*5*	*6*	*12*	*12*	*12*	*16*	*13*	*12*	*11*	*12*

* In 2010 the maximum regional total count was 864 and occurred in January.
^The Tonle Sap Grasslands actually consist of six sites: Stoung, Chikraeng, Kruos Kraom, Baray, Chong Doung and Preah-Net-Preah.
Blanks denote site not surveyed in that year. Source 2001-2007: Nguyen Phuc Bao Hoa *et al.* (2007). Source 2008: van Zalinge *et al.* (2009a). Source 2009: van Zalinge *et al.* (2009b)

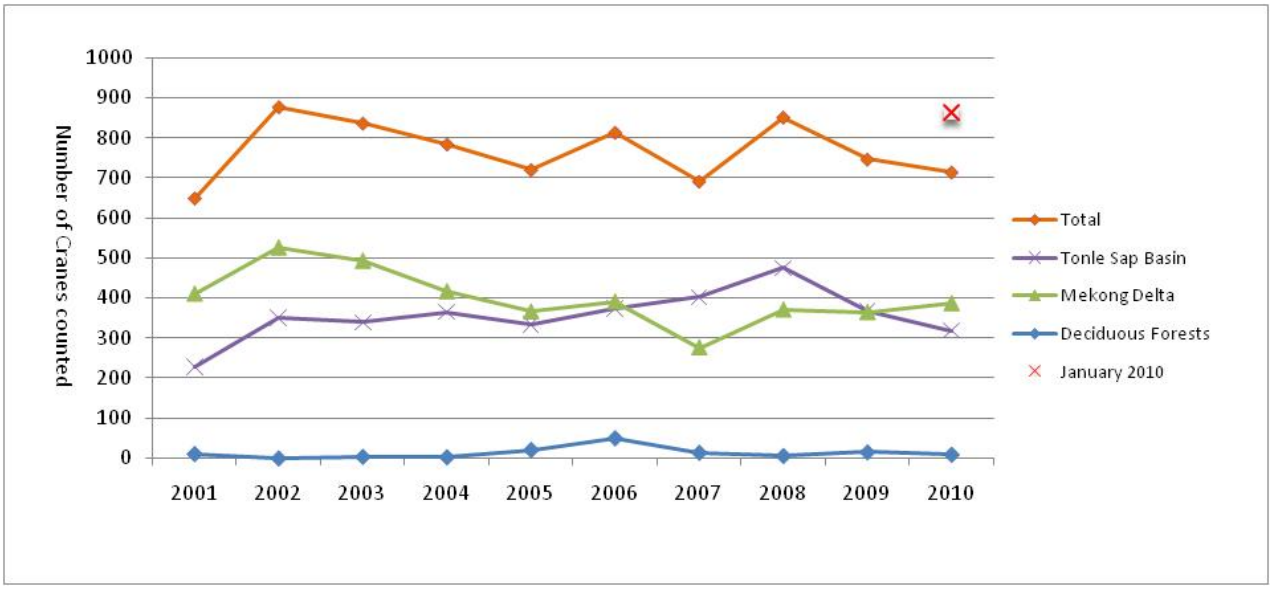

Figure 3. Chart showing number of cranes counted end March/early April in Cambodia and Vietnam from 2001 – 2010. "X" point shows the January 2010 total count.

Recommendations

Continue the January, February, March and April counts each year at the main wetland sites until migration patterns and seasonal fluctuations have become more clear. Continue to include as many deciduous forest sites as possible in at least the main late March/early April count, and other counts where possible.

The best location to count cranes at sites where large numbers aggregate in the dry season is at their roosts. There are usually very few locations within a site where cranes will roost and these sites are not changed often. Teams conducting counts should spend time ahead of each count confirming the roost sites currently used by cranes and target these areas in the count in the very early morning (5:30-7:30) and evening (16:30-18:30).

Strive to synchronize counts at all main wetland sites as much as possible and, especially within the main March count, try to conduct multiple consecutive counts within the census period (e.g. morning and evening counts over a 2-3 day period).

Expand coverage in 2011 to include other potential areas *e.g.* around Koh Thom, following up reports from local people, and at other sites in the Mekong delta as well as Sre Ambel in the southwest.

A study should be initiated on the ecology of Sarus Cranes, distribution based on changes in environmental conditions, and movement patterns between breeding and non-breeding areas. Such knowledge would help identify other important wetlands on the Sarus Crane's migration route, identify key variables that might affect Sarus Crane distribution and make it possible to integrate measurement of such variables into the monitoring program.

Provide telescopes, so that the proportion of juveniles in the few key sites that hold large and mostly aggregated portions of the population can be counted in the March census, i.e. at Ang Trapeang Thmor, Kampong Trach/Phu My and Tram Chim.

Conservation recommendations are beyond the scope of this report, but it is clearly important to conduct an assessment of the possible future impact of the as yet unfinished irrigation projects on the Ang Trapeang Thmor wetland and implement mitigation measures if necessary.

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Appendix 1: List of all census records

January census

Landscape	Location	Site	UTM_E	UTM_N	Date	Time	Total	Adults	Juveniles	Lead Coordinators
Mekong Delta	Kampong Trach	Koh Treak	448712	1157403	17-Jan	6:22 - 7:05	182	168	14	BirdLife
	Phu My	Roost site			17-Jan	5:30 - 7:30	47			International Crane Foundation
	Boeung Prek Lapouv		502039	1187204	16-Jan	17:30 - 18:00	265	246	19	BirdLife
	Tram Chim				17-Jan	7:00 - 9:00	9			International Crane Foundation
	Hon Chong				17-Jan	5:30 – 7:00	15			International Crane Foundation
Tonle Sap Wetlands	Ang Trapeang Thmor	Dambok Anyou			16-Jan	17:00 – 18:00	164			WCS
		Prey Moan			16-Jan	17:00 – 18:00	35			
	Preah-Net-Preah				17-Jan	10:00 – 13:30	0			ACCB
	Kampong Thom Grasslands	Stoung-Chikraeng			17-Jan		68			WCS and University of East Anglia
		Kouk Preah Boeung Trea			17-Jan		47			
		Baray			17-Jan		10			
Northern Forests	Preah Vihear PF				10-Jan		18			WCS
	Western Siem Pang	Boeung Nava			18-Jan		4	3	1	Frederic Goes
	Kulen Promtep WS	Veal Chhrey Tial	485868	1533437	16-Jan	10:00	2	2		WCS
		O Teil	441350	1541712	16-Jan	9:30	2	2		
		Tnal Kror Sing	460686	1534141	16-Jan	10:20	2	2		
		Srei Lor Or	449473	1568212	16-Jan	8:00	3	3		
		Veal Tmat Chhrork	458684	1540020	17-Jan	15:10	1	1		

February census

Landscape	Location	Site	UTM_E	UTM_N	Date	Time	Total	Adults	Juveniles	Lead Coordinators
Mekong Delta	Kampong Trach				27-Feb	15:30-16:40	214	208	6	BirdLife
	Phu My				27-Feb	16:30-18:30				International Crane Foundation
	Boeung Prek Lapouv				27-Feb		0			BirdLife
	Tram Chim				27-Feb	7:00 - 9:00	47	38	9	International Crane Foundation
	Hon Chong				27-Feb	16:30 – 18:30	32			International Crane Foundation
	Lang Sen				27-Feb		0			International Crane Foundation
Tonle Sap Wetlands	Ang Trapeang Thmor				27-Feb	6:25 – 10:20	275			WCS
Northern Forests	Kulen Promtep WS	Veal Poo	453161	1542900	27-Feb	7:20	2	2		WCS
		Veal Kchong Hong	440477	1538573	27-Feb	9:30	2	2		
		O Ta Lick	464369	1537219	27-Feb	9:34	2	2		
		Srei La Or	449415	1568245	27-Feb	8:20	2	2		
		Viel Tmat Chhrork	458684	1540020	27-Feb	11:24	3	2	1	

March census

Landscape	Location	Site	UTM_E	UTM_N	Date	Time	Total	Adults	Juveniles	Coordinators
Mekong Delta	Kampong Trach	Koh Treak	448908	1157154	28-Mar	6:00 - 6:45	134			BirdLife
	Phu My				28-Mar	5:30 – 7:30	6			International Crane Foundation
	Boeung Prek Lapouv				28-Mar	6:30-9:30	0			BirdLife
	Koh Thom				27-Mar		0			WCS Global Health Program
	Tram Chim NP				28-Mar	5:30-7:30	85	70	15	International Crane Foundation
	Lang Sen				28-Mar		13			International Crane Foundation
	Hon Chong				28-Mar	5:30-7:30	2			International Crane Foundation
	Kien Luong				28-Mar	5:30-7:30	143			International Crane Foundation
Tonle Sap Wetlands	Ang Trapeang Thmor				28-Mar		313			WCS
	Preah-Net-Preah				28-Mar		0			ACCB
	Kampong Thom Grasslands	Stoung-Chikraeng			28-Mar		3	3		WCS
		Krous Kraom			28-Mar		3	3		
Northern Forests	Kulen Promtep WS	Baray Prey Veng	452512	1539438	27-Mar	7:20	3	3		WCS
		Veal Rolum Chrey	446460	1565554	28-Mar	9:30	2	2		
		O Ta Lick	464369	1537219	27-Mar	9:34	2	2		
		Viel Tmat Chhrork	458684	1540020	27-Mar	8:20	0	0		
	Mondulkiri PF				24-Mar		2	2		WCS

April census

Landscape	Location	Site	UTM_E	UTM_N	Date	Time	Total	Adults	Juveniles	Coordinators
Mekong Delta	Kampong Trach	Koh Treak	448712	1157403	24-Apr	6:00 - 6:40	203			BirdLife
	Phu My				25-Apr	5:30 – 7:30	10			International Crane Foundation
	Boeung Prek Lapouv				25-Apr		0			BirdLife
	Tram Chim NP				25-Apr	5:30-7:30	37			International Crane Foundation
	Lang Sen				25-Apr		3			International Crane Foundation
	Hon Chong				25-Apr	5:30-7:30	0			International Crane Foundation
	Hon Dat				25-Apr	5:30-7:30	0			
	Kien Luong				25-Apr	5:30-7:30	12			International Crane Foundation
Tonle Sap Wetlands	Ang Trapeang Thmor				25-Apr	6:02-6:39	366			WCS
	Kampong Thom Grasslands	Stoung-Chikraeng			25-Apr		20	3		WCS
		Baray			25-Apr		46	3		
Northern Forests	Kulen Promtep WS	Veal Chhrey Tial	485868	1533437	30-Apr	7:32	2	2		WCS
		Veal Sror Kum	458410	1544320	30-Apr	8:38	6	6		
		Veal Peak Chnang	449310	1541225	30-Apr	7:30	2	2		
		Veal Tmat Chhrork	458684	1540020	30-Apr	7:20	1	1		
		Srei Lor Or	449473	1568212	29-Apr	7:24	2	2		
		Veal Bak Kor	465138	1540065	29-Apr	9:34	1	1		
	Preah Vihear PF				29/30-Apr		13	13		WCS