

# **SIAMESE CROCODILE REINTRODUCTION AND REINFORCEMENT STRATEGY AND ACTION PLAN**

**For the Royal Kingdom of Cambodia**

**2012-2031**



**National Crocodile Conservation Network**

**Ministry of Agriculture, Forestry and Fisheries**

**Fauna & Flora International**

**Wildlife Conservation Society**

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## Executive Summary in English

### Conserving the Siamese Crocodile

The Siamese crocodile *Crocodylus siamensis* is indigenous to rivers, lakes and swamps throughout Cambodia, living in family groups and colonies from almost sea level up to 600 metres. Historically, this freshwater crocodile was also widespread throughout Thailand, Vietnam, Malaysia, Laos and Indonesia.

This crocodile is an exceptionally important species for Cambodia, with major cultural, economic and ecological values. For example, many people – including the *Khmer Daeum* [Original Khmer] communities in the Cardamom Mountains – believe these crocodiles bring good fortune and must never be harmed. Siamese crocodiles used to be kept in moats around the temples at Angkor, and they appear in many of the bas-reliefs. In the wild, the crocodiles help people, as well as other wildlife, by digging and maintaining ponds to provide water throughout the dry season.

Siamese crocodiles tend to be shy animals and are not normally aggressive towards people. Extensive research, including more than 12 years of interviews and field work by government and international NGOs throughout in Cambodia, has found these crocodiles do not regard humans as prey. Villagers in the Cardamom Mountains and other parts of Asia still routinely fish, swim and bathe with Siamese crocodiles without apparent danger. These freshwater crocodiles can reach 3.5 metres in length, but feed mainly on small animals, including snakes, frogs and fish.

After many decades of habitat loss, hunting and collection for crocodile farms, the Siamese crocodile is at very high risk of extinction in the wild throughout Asia and is listed as Critically Endangered and on Appendix I of CITES. Cambodia still holds the biggest known wild population (up to 250 adults), and has made good progress to strengthen the protection of this species in the wild. Community-based initiatives have proved to especially effective. However, Cambodia's crocodile population is severely fragmented and still faces many pressures, including accidental drowning in fishing nets and loss of critical habitat to hydropower dams. Fewer than five nests are recorded in the wild every year, which is not enough to ensure the survival and recovery of Cambodia's famous crocodiles.

### The Purpose of the Reintroduction and Reinforcement Plan

This plan sets out to **re-establish viable, breeding populations of Siamese crocodiles in Cambodia** by using both *reintroduction* (releasing crocodiles into areas from which the species has been completely wiped out) and *reinforcement* (adding crocodiles to existing, severely depleted colonies).

Siamese crocodiles have been successfully reintroduced to protected sites in Vietnam and Thailand, and similar species of crocodiles have been successfully reintroduced in other countries (e.g. The Philippines, India and Venezuela). These releases have shown that captive-bred crocodiles are capable of surviving and breeding in the wild, and releasing crocodiles is a very effective way of boosting wild populations.

The plan identifies suitable locations for releasing pure-bred Siamese crocodiles, and is intended to serve as a 'roadmap' to guide and evaluate this programme for at least 20 years.

The **short term goal** of the Reintroduction and Reinforcement Programme (RRP) is to double the size of the wild population in Cambodia within five years. The **long-term goal** is to "*establish a fully viable wild population of at least 10,000 Siamese crocodiles for the benefit of this species, its environment and the people of Cambodia*". This wild population should be spread across a number of well-protected locations.

This target may take more than 20 years to achieve, but is necessary to ensure the survival of this important species. Re-establishing this population will bring multiple benefits to Cambodia, including: (i) Keep waterways open and prevent ponds and lakes from silting up and drying out; (ii) Fulfil the crocodiles' role as sacred animals in Buddhist and animist beliefs and customs; (iii) attract overseas funding to generate new jobs, education and training opportunities, and potentially become a tourist attraction; (iv) demonstrate Cambodia's commitment to the sustainable management of CITES-listed wildlife.

To achieve its goals, this Plan identifies the following objectives. Every objective and its main component activities are described in turn in this plan:

**Objective 1 – PROJECT MANAGEMENT: An effective management structure established and equipped to implement the Reintroduction and Reinforcement Plan**

The reintroduction and reinforcement programme should be led by a multi-disciplinary team with access to the best available technical expertise, both nationally and internationally. It is proposed this body will be the National Crocodile Conservation Network, formed from the Ministry of Agriculture, Forestry and Fisheries (specifically, Forestry Administration and Fisheries Administration) and the Cambodian offices of Fauna & Flora International, Wildlife Conservation Society and other relevant organisations. Additional technical assistance will be sourced from the IUCN-SSC Reintroduction Specialist Group, IUCN-SSC Crocodile Specialist Group and other experts.

**Objective 2 – SITE SELECTION: Wetlands short-listed for reintroduction or reinforcement**

Siamese crocodiles should be released only in sites where their habitat requirements can be met for the foreseeable future. In most cases these sites will be in remote areas with no or very few people. Every release site must be capable of supporting a large breeding population. For every site, a threats analysis and stakeholder analysis must be conducted and preliminary consultations must be held with any local communities that live nearby or use the site. This plan sets out criteria for choosing sites, and also lists sites that are already known to meet these criteria, including six sites in the Cardamom Mountains.

**Objective 3 – STAKEHOLDERS: Approval and co-operation secured from stakeholders**

Crocodiles should not be released without first gaining the full understanding, acceptance and approval from local communities and other legitimate stakeholders. For all sites that are near or used by people, recommended activities include: (i) Conducting Participatory Rural Appraisals, focusing especially on local use of wetland resources; (ii) Delivering a tailored education and outreach campaign to local communities; (iii) Discussing the potential impacts, costs and realistic benefits of re-establishing/increasing the local crocodile population; (iv) Developing a livelihoods assistance programme for local communities, where appropriate; (v) Obtaining the written, informed consent of local communities, local government and other key stakeholders before proceeding with a release. Local stakeholders should also be integrally involved in the management of the sites (Objective 4).

**Objective 4 – SITE MANAGEMENT: Suitable reintroduction and reinforcement sites are secured and managed**

All reintroduction and reinforcement sites should be protected by law. Ideally, such protection should apply to the entire wetland and adjacent forests, as well as corridors or linkages between areas occupied by crocodiles. If local communities are present, participatory methods should be used to identify management zones through consensus, and develop locally-agreed regulations or by-laws. A management plan should be produced for every release site to balance the needs of the local people with the needs of the crocodiles (e.g. restrict the types of fishing gear that can be used crocodile breeding sites). Jobs to manage and monitor the sites should preferentially be awarded to local persons.

**Objective 5 – SOURCE STOCK: Cambodian Siamese crocodiles obtained and prepared for release**

All of the crocodiles released will be pure-bred Siamese crocodiles of Cambodian origin. This stock will come from: (1) captive-bred stock from the Phnom Tamao Wildlife Rescue Centre; (2) captive bred stock from other participating zoos and crocodile farms in Cambodia; and (3) wild crocodiles confiscated from poachers and fishermen or rescued from sites that are being destroyed. Although Cambodia has many thousands of crocodiles in captivity, a significant percentage are hybrids; the offspring of Siamese crocodiles mated with Cuban crocodiles *Crocodylus rhombifer* or saltwater crocodiles *C. porosus*. It is vitally important that only purebred Siamese crocodiles are released. Activities described in the full plan include: (i) Develop and maintain the crocodile breeding facility at Phnom Tamao Wildlife Rescue Centre to breed and rear Siamese crocodiles for release; (ii) Identify well-managed crocodile farms or zoos to participate in the breeding programme; (iii) Produce healthy stock suitable for release, and use genetic analysis to confirm they are purebred Siamese crocodiles; (iv) Establish a marking system for all crocodiles used for breeding or release; (v) Prepare the captive-bred crocodiles for life in the wild.

### **Objective 6 – RELEASE: Crocodiles released and at least four breeding colonies established**

For every site, the number and size of crocodiles will be determined in advance, but as a general rule, the project will release immature crocodiles aged between two and five years. Most sites will require the release of at least 800 hatchlings *or* 175 one-year-olds *or* 80 two-year olds *or* a smaller number of older animals. Standard procedures for assessing the health of crocodiles must be developed, as well as safe and effective transportation and release protocols. All persons involved in handling crocodiles must have the necessary training and equipment. The project also requires a clear policy on whether to intervene after the releases, for example if a crocodile is injured or people subsequently complain about the crocodiles.

### **Objective 7 – MONITORING: Monitoring and evaluation mechanisms implemented**

Monitoring is important for demonstrating and evaluating the project's progress, and to improve the plan where necessary. All captive stock in breeding facilities should be marked, sexed and measured, and a stock book or database established, taking great care to ensure pure-bred Siamese crocodiles are kept apart from hybrids. At every release site, habitat quality, threats, and the survival, growth, dispersal and, ultimately, reproduction of the released crocodiles should be monitored closely: All released crocodiles will be marked with microchips and by clipping prominent tail scales, and a sample will be radio-tracked for at least 12 months after release. Regular meetings should be held with local communities and other stakeholders to evaluate progress and adjust management where necessary.

### **Objective 8 – DISSEMINATION: The Reintroduction and Reinforcement Plan has popular support, and benefits other conservation initiatives**

Project personnel must work to strengthen popular support and address any misconceptions or concerns about releasing Siamese crocodiles, using mass media as well as targeted approaches to key individuals and organisations. Techniques and lessons learned will also be shared with other crocodile conservationists, especially those working to conserve Siamese crocodiles in neighbouring countries. Hosting and conducting exchange visits with other wildlife managers will also be useful to build the skills of the members of the National Crocodile Conservation Network.

## **Potential Risks and Mitigation**

This plan identifies some potential risks, and explains how they will be avoided or minimised. These include:-

*Risk 1. Released crocodiles are a perceived or actual threat to local communities.* This risk will be mitigated by: (i) Genetic testing to ensure no hybrid stock are released (hybrids tend to be larger and more aggressive than purebred Siamese crocodiles); (ii) reintroduction sites will be situated far from settlements where possible, deep inside the core zones of protected landscapes; (iii) Even in sites where crocodiles already occur, no individuals will be released without the informed consent of local communities, and precautions taken to minimise conflict (e.g. through fishing regulations); (iv) Captive crocodiles must not be tamed nor encouraged to associate people with food. In the unlikely event that a released Siamese crocodile becomes aggressive towards people, it should be relocated.

*Risk 2. Unacceptably high mortality of crocodiles in captivity and during and after release.* Captive facilities must be carefully managed to ensure the health and well-being of crocodiles for release. Standard operational procedures for health screening and transportation will lower mortality risk and raising individuals until they are 1 metre long will improve survival in the wild. Post-release monitoring will monitor mortality rates and allow adaptation of the programme if necessary.

*Risk 3. New colonies succumb to poaching, habitat degradation and other hazards.* To mitigate this risk the project will select only the safest sites, ensure they are fully and effectively guarded, and ensure the strictly protected status of crocodiles is widely known. As a general rule, release sites should not be publicised to minimise disturbance and risk of poaching.

## **Approximate Timeframe and Costs**

This plan contains a timetable for the period 2012-2031. More detailed operational plans and budgets should be prepared at least every two years.

The first release is scheduled to take place during the 2012-2013 dry season, using approximately 20 young captive-bred stock from the Phnom Tamao Wildlife Rescue Centre. Additional releases will take place annually for at least 10 years, depending on the availability of suitable stock, with the aim of populating at least five different sites.

The programme will cost between \$100,000 and \$200,000 per year, with costs tapering after the tenth year. Much of this sum will be secured from regular sponsors of the Cambodian Crocodile Conservation Programme, but it is advisable to develop a diverse funding base and seek in-kind support where possible.

## Development and Revision of the Plan

The Reintroduction and Reinforcement Plan was developed using a participatory process at national, provincial, commune and village levels (at potential release sites). It builds on the fast-growing knowledge and experience within the Ministry of Agriculture, Forestry and Fisheries of managing Siamese crocodiles, both in captivity and in the wild, and incorporates advice and case studies from the IUCN-SSC Re-Introduction Specialist Group and the IUCN-SSC Crocodile Specialist Group. It is recommended that the Plan is periodically reviewed and, where necessary, updated and improved.

The plan is designed to be fully compliant with national laws and policies, as well as international conventions. For example, Article 8 of the Convention on Biological Diversity (CBD) requires Cambodia to *“promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies”* and Article 9 calls on Cambodia to *“Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions”*. Under the Convention on International Trade in Endangered Species (CITES), Cambodia is also obliged to ensure that its internationally traded species, including the Appendix I Siamese crocodile, are effectively conserved in the wild.



Crocodiles appear on many bas-reliefs on the ancient temples of Angkor and still hold a great religious significance for many people in Cambodia (Jeremy Holden, FFI).

## សេចក្តីសង្ខេប

### ការអភិរក្សក្រពើត្រីឫក្តង

ក្រពើត្រី (*Crocodylus siamensis*) មានដើមកំណើតនៅតាមស្ទឹង ត្រពាំង និងវាលភក់ ទូទាំងប្រទេសកម្ពុជា រស់នៅជាក្រុមគ្រួសារ និងទីជម្រករបស់វាមានរយៈកំពស់រហូតដល់ ៦០០ម៉ែត្រធៀបនឹង នីវ៉ូសមុទ្រ។ ប្រវត្តិនៃក្រពើទឹកសាបប្រភេទនេះត្រូវបានគេដឹងថាមានវត្តមាននៅប្រទេសថៃ វៀតណាម ម៉ាឡេស៊ី ឡាវ និង ឥណ្ឌូនេស៊ីផងដែរ។ ក្រពើប្រភេទនេះគឺមានលក្ខណៈពិសេសដោយឡែកសម្រាប់ប្រទេសកម្ពុជា វាជាវប្បធម៌ដ៏មានតម្លៃសំខាន់ផ្នែកសេដ្ឋកិច្ច និងអេកូឡូស៊ី សម្រាប់ប្រជាពលរដ្ឋជាច្រើន រួមទាំងសហគមន៍ ជនជាតិខ្មែរដើមនៅតំបន់ជួរភ្នំក្រវាញ ដែលមានជំនឿថាក្រពើនាំមកនូវសំណាងល្អ និងមិនបង្កឲ្យមានគ្រោះ ថ្នាក់ឡើយ។ ក្រពើធ្លាប់បានចិញ្ចឹមនៅតាមប្រឡាយទឹកជុំវិញប្រាសាទអង្គរវត្ត ហើយបានលេចចេញជារូប ចំលាក់យ៉ាងច្រើន។ នៅក្នុងព្រៃក្រពើជួយមនុស្ស និង សត្វព្រៃដទៃទៀតផងដែរ ដូចជា៖ ដឹក និង ថែរក្សាផ្លូវទឹក សម្រាប់ផ្តល់ទឹកប្រើប្រាស់នៅរដូវប្រាំង។ ក្រពើត្រីជាប្រភេទសត្វផ្តើល និង មិនកាចសាហាវដល់មនុស្ស ឡើយ។ ការស្រាវជ្រាវយ៉ាងល្អិតល្អន់ក្នុងរយៈពេលជាង១២ឆ្នាំ តាមរយៈការសម្ភាសន៍ជាមួយសហគមន៍មូលដ្ឋាន និង សិក្សានៅទីវាលផ្ទាល់ដោយមន្ត្រីរដ្ឋាភិបាល និងអង្គការអន្តរជាតិនានាទូទាំងប្រទេសកម្ពុជាបាន អះអាងថា ក្រពើប្រភេទនេះមិនស៊ីមនុស្សជាអាហារឡើយ។ ប្រជាពលរដ្ឋនៅតំបន់ជួរភ្នំក្រវាញ និងតំបន់ដទៃទៀតក្នុង ភូមិភាគអាស៊ីនៅតែមានទំលាប់នេសាទត្រី ហែល និងមុជទឹកជាមួយក្រពើដោយគ្មានគ្រោះថ្នាក់។ ក្រពើទឹក សាបប្រភេទនេះអាចមានប្រវែងរហូតដល់៣.៥ម៉ែត្រ ប៉ុន្តែចំណីអាហាររបស់វាភាគច្រើនជាប្រភេទសត្វតូចៗ រួមមាន៖ ពស់ បង្កែប និងត្រី។

បន្ទាប់ពីការបាត់បង់ទីជម្រកជាច្រើនទសវត្ស ការប្រមាញ់ និងប្រមូលក្រពើពីព្រៃមកចិញ្ចឹមក្នុងកសិដ្ឋាន បានធ្វើឲ្យក្រពើត្រីមានហានិភ័យខ្ពស់ក្នុងការបាត់បង់ពីធម្មជាតិទូទាំងតំបន់អាស៊ី និងត្រូវបានចុះបញ្ជីជា ប្រភេទ រងនូវការគំរាមកំហែងយ៉ាងធ្ងន់ធ្ងរ និងឧបសម្ព័ន្ធ១នៃអនុសញ្ញាសាយតេស។ ប្រទេសកម្ពុជាត្រូវបានគេដឹងថា នៅមានវត្តមានក្រពើប្រភេទនេះច្រើនជាងគេនៅក្នុងធម្មជាតិ(ក្រពើពេញវ័យប្រហែល២៥០ក្បាល) និងកំពុង មានវឌ្ឍនភាពល្អដល់ការពង្រឹងការការពារប្រភេទនេះនៅក្នុងធម្មជាតិ។ ការផ្ដួចផ្ដើមអភិរក្សដោយ មានការ ចូល រួមពីសហគមន៍មូលដ្ឋានបានបង្ហាញពីភាពជោគជ័យមួយយ៉ាងសំខាន់ ទោះបីយ៉ាងណាក៏ដោយ ក៏ចំនួន ក្រពើនៅកម្ពុជាមានការរាយប៉ាយនៅតាមតំបន់តូចៗនិងនៅមានបញ្ហាប្រឈមជាច្រើនដូចជា៖ ការគ្រោះថ្នាក់ ដោយជាប់មង និងបាត់បង់ទីជម្រកសំខាន់ៗដោយសារការសាងសង់ទំនប់វារីអគ្គិសនី។ សំបុកក្រពើតិចជាង ចំនួន៥ត្រូវបានរកឃើញនៅក្នុងធម្មជាតិជារៀងរាល់ឆ្នាំ ដែលចំនួននេះមិនគ្រប់គ្រាន់ ដើម្បីធានានូវការរស់នៅ និងស្ដារចំនួនក្រពើនៅក្នុងប្រទេសកម្ពុជាឡើងវិញឡើយ។

### គោលបំណងនៃផែនការ និងយុទ្ធសាស្ត្រលែង និងស្ដារក្រពើត្រីឡើងវិញ

នេះគឺជាការសង្ខេបខ្លីនៃផែនការលំអិតចំនួន៧០ទំព័រ ដើម្បីដាក់ចេញឲ្យបានសម្រេចឡើងវិញនូវតំបន់ បន្តពូជនៃក្រពើនៅក្នុងប្រទេសកម្ពុជាតាមរយៈការលែងទៅក្នុងធម្មជាតិ (លែងក្រពើទៅក្នុងតំបន់ដែលមាន ការបាត់បង់ក្រពើទាំងស្រុង) និងស្ដារឡើងវិញ (បន្ថែមចំនួនក្រពើនៅតំបន់ដែលមានស្រាប់ ប៉ុន្តែទីជម្រក របស់

វាត្រូវបានបំផ្លាញ)។ ការលែងក្រពើត្រីត្រូវបានទទួលជោគជ័យនៅតំបន់ការពារក្នុងប្រទេសវៀតណាម និង ថៃឡង់ និងការលែងក្រពើប្រភេទផ្សេងៗទៀតដែលប្រហាក់ប្រហែលនឹងក្រពើទឹកសាបនេះ ក៏ទទួលបាន ជោគជ័យនៅក្នុងប្រទេសដទៃទៀតដូចជា៖ ហ្វីលីពីន ឥណ្ឌា និង វេណេហ្សូអេឡា។ ការលែងទាំងនេះបាន បង្ហាញថាការបង្កាត់ពូជក្រពើគឺមានលទ្ធភាពរស់និងបន្តពូជបាននៅក្នុងធម្មជាតិនិងជាមធ្យោបាយមួយដ៏មាន ប្រសិទ្ធភាពដើម្បីបង្កើនចំនួនសត្វក្រពើក្នុងធម្មជាតិឡើងវិញ។ ផែនការនិងយុទ្ធសាស្ត្រនេះ រកឲ្យឃើញនូវទីតាំង សមស្របសម្រាប់លែងក្រពើត្រីពូជសុទ្ធ និងជាគោលបំណងដើម្បីបំពេញមុខងារ ជាផែនទីបង្ហាញផ្លូវសម្រាប់ ណែនាំ និងវាយតម្លៃកម្មវិធីនេះសម្រាប់រយៈពេលយ៉ាងតិច២០ឆ្នាំ (២០១២-២០៣២)។

ទិសដៅសម្រាប់រយៈពេលខ្លីគឺជាដើម្បីធ្វើឲ្យចំនួនក្រពើកើនឡើងទ្វេដងនៅក្នុងប្រទេសកម្ពុជាក្នុងរយៈ ពេល៥ឆ្នាំ។ ទិសដៅសម្រាប់រយៈពេលវែងគឺ "បង្កើតឡើង ដើម្បីសម្រេចបាននូវចំនួនក្រពើយ៉ាងតិច ១០,០០០ក្បាលក្នុងធម្មជាតិសម្រាប់ផលប្រយោជន៍ប្រភេទនេះ បរិស្ថានរបស់វា និងប្រជាពលរដ្ឋកម្ពុជា។ ចំនួននៅក្នុងធម្មជាតិនេះអាចពង្រាយតាមតំបន់ដែលមានការការពារបានប្រសើរ។ ទិសដៅនេះនឹងត្រូវការ រយៈ ពេលជាង២០ឆ្នាំ ដើម្បីសម្រេចតាមគោលដៅ ប៉ុន្តែវាសំខាន់ដើម្បីធានានូវការរស់នៅរបស់ពួកវា។ ការធ្វើ ឲ្យមានចំនួនក្រពើឡើងវិញនេះ វានឹងនាំមកនូវអត្ថប្រយោជន៍ជាច្រើនដល់ប្រទេសកម្ពុជា រួមមាន៖ (១) ធ្វើឲ្យ ផ្លូវទឹកស្រឡះល្អ និងការពារត្រពាំង/បឹងពីការហូរចាក់បំពេញដោយដីល្បាប់ និង ភាពស្ងួត (២) ក្រពើដើរតួនាទី ជាសត្វសម្រាប់គោរពបូជាផ្នែកព្រះពុទ្ធសាសនា ជំនឿផ្នែកវិញ្ញាណ និងទំនៀមទម្លាប់ផ្សេងៗ។ (៣) ទាក់ទាញ ជំនួយពីប្រទេសដើម្បីបង្កើតការងារថ្មីៗ ឱកាសសម្រាប់អប់រំ និង បណ្តុះបណ្តាល មានអានុភាពទាក់ទាញ ទេសចរ និង(៤) បង្ហាញពីការប្តេជ្ញារបស់រដ្ឋាភិបាលកម្ពុជាទាក់ទងនឹងការគ្រប់គ្រងដោយចីរភាពនៃការចុះ បញ្ជីសត្វព្រៃនៅក្នុងអនុសញ្ញាសាយភេស។

ដើម្បីសម្រេចគោលដៅរបស់វា ផែនការនេះកំណត់នូវគោលបំណងដូចខាងក្រោម។ គោលបំណង នីមួយៗមានសមាសភាពសកម្មភាពសំខាន់ៗ មានពិពណ៌នាតាមលំដាប់លំដោយនៅក្នុងផែនការនេះ៖

**គោលបំណងទី១-ការគ្រប់គ្រងគម្រោង៖**បង្កើតរចនាសម្ព័ន្ធគ្រប់គ្រង ដែលមានប្រសិទ្ធភាពមួយ និង ផ្តល់នូវបរិក្ខារសម្រាប់អនុវត្តផែនការលែង និងស្តារក្រពើឡើងវិញ៖

កម្មវិធីលែងនិងស្តារក្រពើឡើងវិញ នឹងដឹកនាំដោយក្រុមចម្រុះមួយ និង មានការវាយតម្លៃពីអ្នកជំនាញ បច្ចេកទេសដែលមានប្រយោជន៍យ៉ាងសំខាន់ទាំងថ្នាក់ជាតិ និង អន្តរជាតិ។ ស្ថាប័នដែលនឹងត្រូវស្នើសុំនេះ គឺជាបណ្តាញការងារអភិរក្សក្រពើថ្នាក់ជាតិ បង្កើតឡើងដោយក្រសួងកសិកម្មរុក្ខាប្រមាញ់និងនេសាទ (រដ្ឋបាល ជលផលនិងរដ្ឋបាលព្រៃឈើ) ព្រមទាំងមានការចូលរួមពីអង្គការសត្វព្រៃ និង រុក្ខជាតិអន្តរជាតិ សមាគម អភិរក្សសត្វព្រៃ និង បណ្តាញអង្គការពាក់ព័ន្ធដទៃទៀតដែលមានការិយាល័យនៅក្នុងប្រទេសកម្ពុជា។ ក្រៅពីនេះ នៅមានជំនួយបច្ចេកទេសពីក្រុមអ្នកជំនាញលែង IUCN/SSC-Re-introduction Specialist Group (RSG) ក្រុមអ្នកជំនាញសត្វក្រពើ IUCN/SSC- Crocodile Specialist Group (CSG) និងអ្នកជំនាញដទៃទៀត។

**គោលបំណងទី២-ការជ្រើសរើសតំបន់៖**តំបន់ដីសើមត្រូវបានជ្រើសរើសសម្រាប់លែង និងស្តារក្រពើ ឡើងវិញ៖

ក្រពើត្រី គួរលែងតែនៅក្នុងតំបន់ដែលមានតម្រូវការទីជម្រកសមស្រប និងអាចមើលឃើញក្នុងពេល អនាគតដ៏ខ្លីៗ។ តំបន់ទាំងនោះគួរនៅជាប់ស្រយាល គ្មានមនុស្សរស់នៅ ឬមានចំនួនតិចតួច និងត្រូវតែមាន លទ្ធភាពសម្រាប់ពួកវាធ្វើការបន្តពូជបានច្រើន។ តំបន់នីមួយៗគួរធ្វើការវិភាគពីការគំរាមកំហែង វិភាគពីស្ថាប័ន ពាក់ព័ន្ធ និងជាចំបងត្រូវធ្វើការពិភាក្សាជាមួយសហគមន៍មូលដ្ឋានដែលរស់នៅក្បែរ និងប្រើប្រាស់តំបន់ទាំង

នេះ។ ផែនការនេះ បានដាក់ចេញឡើងសម្រាប់ជ្រើសរើសតំបន់ និងចុះបញ្ជីតំបន់ដែលបានដឹងរួចផងដែរ ដើម្បីបំពេញនូវលក្ខណៈវិនិច្ឆ័យទាំងនោះ ដូចជា៖ តំបន់ចំនួន៦នៅជួរភ្នំក្រវាញ។

**គោលបំណងទី៣-ស្ថាប័នពាក់ព័ន្ធនានា៖ ឯកភាព និងសហប្រតិបត្តិការពីស្ថាប័នពាក់ព័ន្ធនានា៖**

ក្រពើមិនគួរលែងដោយគ្មានការផ្តល់នូវចំណេះដឹងពេញលេញ ការទទួលស្គាល់ និងយល់ព្រមពីសហគមន៍មូលដ្ឋាន និងស្ថាប័នស្របច្បាប់ដទៃទៀតឡើយ។ ចំពោះតំបន់ទាំងឡាយណាដែលនៅជិត ឬប្រើប្រាស់ដោយប្រជាពលរដ្ឋត្រូវធ្វើការពិចារណាលើសកម្មភាពមួយចំនួន រួមមាន៖ (១) ធ្វើការវាយតម្លៃដោយមានការចូលរួមពីជនបទដោយផ្ដោតជាសំខាន់លើការប្រើប្រាស់ធនធានតំបន់ដីសើម (២) ចែករំលែកនូវការអប់រំនិងធ្វើយុទ្ធនាការផ្តល់សេវាបម្រើសហគមន៍ដើម្បីប្រយោជន៍សហគមន៍មូលដ្ឋាន (៣) ពិភាក្សាពីអានុភាពនៃហេតុផលប៉ះពាល់ តម្លៃ និងអត្ថប្រយោជន៍ពិតប្រាកដក្នុងការបង្កើតឡើងវិញ/បង្កើនចំនួនសត្វក្រពើក្នុងតំបន់ (៤) បង្កើតនូវកម្មវិធីផ្តល់ជំនួយផ្នែកលើកកម្ពស់ជីវភាពសហគមន៍មូលដ្ឋាននៅទីកន្លែងសមស្រប (៥) ទទួលបាននូវការយល់ព្រមពីសហគមន៍ អាជ្ញាធរមូលដ្ឋាននិងស្ថាប័នពាក់ព័ន្ធសំខាន់ៗដទៃទៀត មុនដំណើរការលែងក្រពើតាមរយៈលិខិតសរសេរជាលាយលក្ខណ៍អក្សរ។ ស្ថាប័នពាក់ព័ន្ធនានានៅថ្នាក់មូលដ្ឋានត្រូវចូលរួមយ៉ាងសំខាន់ក្នុងការគ្រប់គ្រងតំបន់ទាំងនោះផងដែរ (គោលបំណងទី៤)។

**គោលបំណងទី៤-ការគ្រប់គ្រងតំបន់៖ តំបន់លែងនិងស្ដារសត្វក្រពើឡើងវិញដែលសមស្របបំផុត គឺត្រូវមានសុវត្ថិភាព និងការគ្រប់គ្រង៖**

តំបន់លែងនិងស្ដារក្រពើឡើងវិញទាំងអស់ត្រូវបានការពារដោយច្បាប់។ ជាការប្រសើរបំផុត ការការពារគួរដាក់ស្នើសុំសម្រាប់ការពារតំបន់ដីសើមទាំងមូល និងតំបន់ព្រៃដែលជាប់ទាក់ទង ក៏ដូចជាច្រករបៀង ឬតំបន់ដែលតភ្ជាប់ទៅនឹងតំបន់ដែលក្រពើប្រើប្រាស់។ បើសិនជាមានវត្តមានសហគមន៍ វិធីសាស្ត្រចូលរួមគួរ ប្រើប្រាស់ដើម្បីកំណត់ការគ្រប់គ្រងតំបន់តាមការយល់ព្រម និងបង្កើតកិច្ចព្រមព្រៀងថ្នាក់មូលដ្ឋាន ឬលក្ខន្តិកៈ។ ផែនការគ្រប់គ្រងមួយគួររៀបចំឡើងសម្រាប់តំបន់លែងក្រពើនីមួយៗដើម្បីឲ្យមានលំនឹងរវាងតម្រូវរបស់សហគមន៍មូលដ្ឋាននឹងតម្រូវការរបស់សត្វក្រពើ (ឧទាហរណ៍៖ វិធីបង្កើននូវប្រភេទឧបករណ៍នេសាទដែលប្រើប្រាស់នៅកន្លែងក្រពើបន្តពូជ)។ ការងារគ្រប់គ្រង និងតាមដានតំបន់គួរផ្តល់ជាង្វាន់ដល់ប្រជាសហគមន៍មូលដ្ឋាន។

**គោលបំណងទី៥-ក្រពើសម្រាប់លែង៖ ក្រពើត្រីនៅប្រទេសកម្ពុជាត្រូវបានប្រើប្រាស់ និង រៀបចំសម្រាប់លែង៖**

ក្រពើសម្រាប់លែងទាំងអស់ជាប្រភេទក្រពើត្រីពូជសុទ្ធដែលមានប្រភពនៅក្នុងប្រទេសកម្ពុជា និងបានមកពី៖ (១) ក្រពើបង្កាត់នៅឧទ្យានសួនសត្វនិងមជ្ឈមណ្ឌលសង្គ្រោះសត្វព្រៃភ្នំតាម៉ៅ (២) ក្រពើចិញ្ចឹមដែលបានមកពីការចូលរួមតាមបណ្តាកសិដ្ឋាននិងសួនសត្វនៅក្នុងប្រទេសកម្ពុជា និង (៣) សត្វក្រពើរឹមអូសពីអ្នកប្រមាញ់និងអ្នកនេសាទឬសង្គ្រោះពីតំបន់ដែលទីជម្រករបស់វាមានការបំផ្លាញ។ ទោះបីប្រទេសកម្ពុជាមានក្រពើចិញ្ចឹមរយៈពេលពេញលេញក៏ដោយក៏មានក្រពើកូនកាត់ច្រើនដែរ ដែលបានមកពីកូនចៅរបស់ក្រពើត្រីបន្តពូជជាមួយក្រពើគុយបា (C.rhombifer) និងក្រពើទឹកប្រៃ(C.porosus)។ វាជាការសំខាន់ណាស់ ដែលមានតែប្រភេទក្រពើត្រីពូជសុទ្ធមួយគត់ត្រូវលែង។ សកម្មភាពទាំងនេះបានពិពណ៌នាក្នុងផែនការលំអិត៖ (១) បង្កើត និង ថែរក្សាកន្លែងបង្កាត់ពូជនៅឧទ្យានសួនសត្វនិងមជ្ឈមណ្ឌលសង្គ្រោះសត្វព្រៃភ្នំតាម៉ៅ ដើម្បីបង្កាត់ និងចិញ្ចឹមក្រពើត្រីសម្រាប់លែង (២) កំណត់ពីការគ្រប់គ្រងកសិដ្ឋាននិងសួនសត្វចិញ្ចឹមក្រពើឲ្យបានច្បាស់លាស់ដើម្បីចូលរួមក្នុងកម្មវិធីបង្កាត់ពូជនេះ (៣) ផលិតនូវក្រពើចិញ្ចឹម ដែលមានសុខភាពសមស្របសម្រាប់លែង និងប្រើប្រាស់ការវិភាគសេនេទិចដើម្បីបញ្ជាក់ថាគឺជាប្រភេទក្រពើត្រីពូជសុទ្ធ (៤) បង្កើតប្រព័ន្ធសម្គាល់មួយសម្រាប់ប្រើប្រាស់ក្នុងការបង្កាត់ពូជ និងលែង (៥) រៀបចំបង្កាត់ពូជក្រពើសម្រាប់ជីវិតរស់នៅក្នុងព្រៃ។

**គោលបំណងទី៦-ការលែងក្រពើ:ក្រពើលែង និង បង្កើតកន្លែងសម្រាប់ពួកវាបន្តពូជឲ្យបានយ៉ាងតិច ចំនួន៤៖**

សម្រាប់តំបន់លែងនីមួយៗ ចំនួន និងទំហំក្រពើត្រូវបានកំណត់ជាមុន ប៉ុន្តែក្នុងករណីចាំបាច់ បំផុត នោះ គម្រោងនឹងធ្វើការលែងក្រពើមិនទាន់ពេញវ័យដែលមានអាយុពី២-៥ឆ្នាំ។ តំបន់ភាគច្រើននឹងតម្រូវឲ្យ លែងយ៉ាងតិចកូនក្រពើចំនួន៨០០ក្បាល ឬ ក្រពើអាយុ១ឆ្នាំចំនួន១៧៥ក្បាល ឬ ក្រពើអាយុ២ឆ្នាំ ចំនួន ៨០ក្បាល ឬក៏ក្រពើពេញវ័យចំនួនតិចតួច។ ដំណើរការស្តង់ដារសម្រាប់វាយតម្លៃសុខភាពក្រពើ ក៏ដូចជា សុវត្ថិភាព ប្រសិទ្ធភាពនៃការដឹកជញ្ជូន និងពិធីការលែងផងដែរ។ អ្នកចូលរួមលែងក្រពើទាំងអស់ចាំបាច់ត្រូវ បានបណ្តុះបណ្តាល និងបំពាក់នូវគ្រឿងបរិក្ខារ។ គម្រោងក៏តម្រូវឲ្យមានគោលនយោបាយមួយច្បាស់លាស់ ស្តីពីការអន្តរាគមន៍ក្រោយពេលលែង ឧទាហរណ៍ បើសិនជាក្រពើមានរបួស ឬមនុស្សតវ៉ាក្រោយពេលលែង។

**គោលបំណងទី៧- តាមដានត្រួតពិនិត្យ: អនុវត្តយន្តការតាមដានត្រួតពិនិត្យ និង វាយតម្លៃ៖**

តាមដានត្រួតពិនិត្យគឺមានសារៈសំខាន់ណាស់ សម្រាប់ចង្អុលបង្ហាញនិងការវាយតម្លៃពីការរីកចម្រើន គម្រោង ព្រមទាំងធ្វើឲ្យផែនការកាន់តែប្រសើរឡើងត្រង់កន្លែងចាំបាច់។ ក្រពើចិញ្ចឹមទាំងអស់នៅកន្លែងបង្កាត់ ពូជ គួរមានសញ្ញាសម្គាល់មីក្រូហ្វេប (Microchips) ភេទ និង ប្រវែង ព្រមទាំងសៀវភៅកត់ត្រា បង្កើតប្រព័ន្ធ គ្រប់គ្រងទិន្នន័យ ថែទាំឲ្យបានប្រសើរ ដើម្បីធានាថាក្រពើត្រីពូជសុទ្ធ ត្រូវបានរក្សាទុកដាច់ដោយឡែកពី ក្រពើពូជកាត់។ នៅតាមតំបន់លែងក្រពើនីមួយៗត្រូវធ្វើការតាមដានត្រួតពិនិត្យឲ្យបានច្បាស់លាស់ពីលក្ខណៈ ទីជម្រក ការគំរាមកំហែង អត្រាស្លាប់ និងលូតលាស់ ការបែកខ្ចាត់ និងចុងបញ្ចប់ គឺការបន្តពូជរបស់វាក្រោយ ពេលលែង។ ក្រពើសម្រាប់លែងទាំងអស់ត្រូវមានសញ្ញាសម្គាល់ដោយមីក្រូហ្វេប (Microchips) និងកាត់ កន្ទុយសម្គាល់ ព្រមទាំងតាមដានតាមរយៈការបំពាក់ឧបករណ៍វិទ្យុទទួលសម្លេងលើក្រពើនីមួយៗយ៉ាងតិច ចំនួន១២ខែក្រោយពេលលែង។ ការប្រជុំនឹងធ្វើឡើងជាទៀងទាត់ជាមួយសហគមន៍មូលដ្ឋាន និងស្ថាប័ន ពាក់ព័ន្ធនានា ដើម្បីវាយតម្លៃពីការរីកចម្រើននិងកែតម្រូវពីការគ្រប់គ្រងនៅ កន្លែងណាចាំបាច់។

**គោលបំណងទី៨-ការចែករំលែកព័ត៌មាន: កម្មវិធីលែង និងស្តារសត្វក្រពើឡើងវិញត្រូវមានការគាំទ្រ យ៉ាងពេញទំហំនិងមានផលប្រយោជន៍សម្រាប់ផ្ដួចផ្ដើមការអភិរក្សជីវទេវៈ**

មន្ត្រីគម្រោងត្រូវធ្វើការងារដើម្បីបង្កើនការគាំទ្រឲ្យកាន់តែខ្លាំង និងដោះស្រាយនូវការកាន់ច្រឡំណា មួយ ឬព្រួយបារម្ភពីការលែងក្រពើត្រី ការប្រើប្រាស់ប្រព័ន្ធផ្សព្វផ្សាយឲ្យបានទូលំទូលាយ ក៏ដូចជាវិធីសាស្ត្រ គោលដៅដល់បុគ្គល និងស្ថាប័នសំខាន់ៗ។ បច្ចេកទេស និងបទពិសោធន៍នឹងត្រូវចែករំលែកដល់អ្នកអភិរក្ស ក្រពើដទៃទៀត ជាពិសេសការងារទាំងនេះ គឺសម្រាប់យកទៅធ្វើការអភិរក្សក្រពើត្រីនៅប្រទេសជិតខាង។ ទទួលនិងធ្វើទស្សនកិច្ចចែករំលែកបទពិសោធន៍ជាមួយអ្នកគ្រប់គ្រងសត្វព្រៃដទៃទៀត ដែលជាប្រយោជន៍ដើម្បី កសាងជំនាញនៃក្រុមបណ្តាញការងារអភិរក្សក្រពើថ្នាក់ជាតិផងដែរ។

**ហានិភ័យ និងការកាត់បន្ថយសំខាន់ៗ**

ផែនការនេះកំណត់ពីហានិភ័យសំខាន់ៗមួយចំនួននិងពន្យល់ពីវិធីសាស្ត្រ ដើម្បីឲ្យមានការប្រុងប្រយ័ត្ន ចំពោះហានិភ័យទាំងនោះ និងកាត់បន្ថយឲ្យនៅកម្រិតអប្បបរមា។ វិធីសាស្ត្រទាំងនោះ រួមមាន៖

**ហានិភ័យទី១-លែងក្រពើគឺត្រូវដឹងថា ឬ ពិតជាមានការគំរាមកំហែងដល់សហគមន៍មូលដ្ឋាន:**

ហានិភ័យនេះនឹងត្រូវកាត់បន្ថយដោយ៖ (១) ការវិភាគសេនេទិចដើម្បីធានាថាគ្មានការលែងក្រពើពូជកាត់ (ក្រពើកូនកាត់មានទំហំ និងកាចសាហាវជាងក្រពើត្រីពូជសុទ្ធ) (២) តំបន់លែងត្រូវសមស្រប នៅឆ្ងាយពី លំនៅដ្ឋានរបស់ប្រជាពលរដ្ឋនិងស្ថិតនៅក្នុងតំបន់ស្នូលនៃតំបន់ការពារទេសភាព (៣) ទោះបីជានៅតំបន់ ដែល

មានក្រពើក៏ដោយ ក៏មិនត្រូវលែងបន្ថែមដោយគ្មានការយល់ព្រមពីសហគមន៍មូលដ្ឋាន និងមានការប្រយ័ត្នទុកជាមុន ដើម្បីកាត់បន្ថយជំនឿអវិជ្ជា (ឧទាហរណ៍៖ តាមរយៈលក្ខន្តិកៈនៃការនេសាទត្រី) (៤) ក្រពើដែលចាប់បានពីព្រៃមិនត្រូវធ្វើឲ្យសាំង ឬ លើកទឹកចិត្តឲ្យមានទំនាក់ទំនងជាមួយមនុស្ស ដោយផ្តល់ជាចំណីឡើយ។ ចំពោះករណីមើលទៅទំនងជាក្រពើត្រីដែលលែងនោះមានការប្រែប្រួលទៅជាកាចសាហាវ គឺត្រូវធ្វើការបំបាត់ទីជាបន្ទាន់។

**ហានិភ័យទី២-មិនទទួលយកនូវអត្រាស្លាប់ច្រើនពេករបស់ក្រពើនៅក្នុងការបង្កាត់ និង ក្រោយពេលលែងឡើយ៖** កន្លែងបង្កាត់ពូជក្រពើត្រូវគ្រប់គ្រងដោយប្រុងប្រយ័ត្ន ដើម្បីធានាសុខភាពនិងជីវិតរស់នៅរបស់ពួកវាឲ្យបានល្អប្រសើរសម្រាប់លែង។ ដំណើរការប្រតិបត្តិស្តង់ដារសម្រាប់ពិនិត្យសុខភាព និងជីកជញ្ជូនក្រពើត្រូវឲ្យមានហានិភ័យស្លាប់ទាប និងចិញ្ចឹមរហូតដល់ពួកវាមានប្រវែង១ម៉ែត្រដែលអាចមានលទ្ធភាពរស់នៅក្នុងព្រៃបាន។ ការតាមដានត្រួតពិនិត្យក្រោយពេលលែង នឹងត្រូវតាមដានពីអត្រាស្លាប់និងផ្តល់ឲ្យពួកវាបន្ស៊ាំទៅនឹងកម្មវិធីលែង បើសិនជាចាំបាច់។

**ហានិភ័យទី៣-ក្រពើងាប់នៅទីជម្រកថ្មី ដោយសារការបរបាញ់ បំផ្លាញទីជម្រក និង គ្រោះថ្នាក់ផ្សេងៗទៀត៖** ដើម្បីកាត់បន្ថយហានិភ័យនេះ គម្រោងនឹងជ្រើសរើសតំបន់ដែលមានសុវត្ថិភាពបំផុតដើម្បីធានាថាតំបន់ទាំងនោះមានការការពារយ៉ាងតឹងរឹងនិងមានប្រសិទ្ធភាព ព្រមទាំងធានាបាននូវការការពារយ៉ាងតឹងរឹងពីស្ថានភាពក្រពើដែលបានដឹងទៀតផង។ ជាទូទៅការគ្រប់គ្រងតំបន់លែងក្រពើនឹងមិនគួរផ្សព្វផ្សាយឡើយ គឺដើម្បីកាត់បន្ថយការរំខាន និងហានិភ័យនៃការប្រមាញ់ឲ្យនៅកម្រិតទាបបំផុត។

**ប៉ាន់ស្មានគម្រោងពេលវេលា និង តម្លៃ**

ផែនការនេះ មានគម្រោងពេលវេលាសម្រាប់រយៈពេលពីឆ្នាំ២០១២-២០៣២។ ផែនការប្រតិបត្តិលំអិត និងថវិកាគួររៀបចំយ៉ាងយូរជាងរៀងរាល់ពីរឆ្នាំម្តង។

ការលែងដំបូងនឹងគ្រោងធ្វើនៅរដូវប្រាំងក្នុងកំឡុងឆ្នាំ២០១២-២០១៣ ដោយប្រើប្រាស់ក្រពើបង្កាត់ពូជតូចៗចំនួនប្រមាណ២០ក្បាលពីឧទ្យានសួនសត្វនិងមជ្ឈមណ្ឌលសង្គ្រោះសត្វព្រៃភ្នំតាម៉ៅ។ ក្រៅពីនេះនឹងមានការលែងជាប្រចាំឆ្នាំសម្រាប់រយៈពេលយ៉ាងតិច១០ឆ្នាំ អាស្រ័យទៅតាមលទ្ធភាពសមស្របនៃចំនួនក្រពើដែលបង្កាត់បាន ជាមួយនិងគោលបំណងនៃការធ្វើឲ្យមានក្រពើយ៉ាងតិចចំនួនប្រាំតំបន់ផ្សេងៗគ្នា។ កម្មវិធីនឹងត្រូវការថវិកាសរុបពី១០០,០០០ ទៅ ២០០,០០០ ដុល្លាក្នុងមួយឆ្នាំ ជាមួយនិងតម្លៃកើនឡើងបន្ទាប់ពីឆ្នាំទី១០។ តម្លៃសរុបដ៏ច្រើននេះនឹងទទួលបានមកពីម្ចាស់ជំនួយជាទៀងទាត់នៃគម្រោងអភិរក្សក្រពើកម្ពុជា ប៉ុន្តែអ្វីដែលគួរធ្វើបាន គឺដើម្បីបង្កើនប្រភពថវិកាឲ្យបានច្រើន អាស្រ័យទៅនឹងការស្វែងរកជំនួយពីសប្បុរសជនផ្សេងៗទៅតាមលទ្ធភាពដែលអាចធ្វើទៅបាន។

**ការអភិវឌ្ឍ និងកែប្រែផែនការឡើងវិញ**

ផែនការលែង និងស្តារឡើងក្រពើវិញ បង្កើតឡើងដោយប្រើប្រាស់ដំណើរការចូលរួមថ្នាក់ជាតិ ខេត្ត ស្រុក ឃុំនិងភូមិ (នៅតំបន់លែងដែលមានអាទិភាព)។ វាកសាងនូវចំណេះដឹង និងបទពិសោធយ៉ាងឆាប់រហ័សនៅក្នុងក្រសួងកសិកម្មរុក្ខា ប្រមាញ់ និងនេសាទ ក្នុងការគ្រប់គ្រងក្រពើត្រីទាំងនៅក្នុងកសិដ្ឋាន និងនៅក្នុងព្រៃ ព្រមទាំងរួមបញ្ចូលនូវជំនួញ និងករណីសិក្សាពីក្រុមអ្នកជំនាញលែង IUCN/SSC-Re-introduction Specialist Group និងក្រុមអ្នកជំនាញសត្វក្រពើIUCN/SSC- Crocodile Specialist Group។ វាជាអនុសាសន៍ដែលផែនការនេះនឹងត្រូវធ្វើការកែប្រែឡើងវិញយូរៗម្តង ព្រមទាំងធ្វើបច្ចុប្បន្នភាព និងធ្វើឲ្យកាន់តែប្រសើរឡើងនៅកន្លែងណាចាំបាច់។

ផែនការនេះរៀបចំឡើង គឺស្របតាមច្បាប់ និងគោលនយោបាយជាតិទាំងស្រុង ក៏ដូចជាអនុសញ្ញាអន្តរជាតិនានាដែរ ដូចជាមាត្រា៨ នៃអនុសញ្ញាស្តីពីជីវចម្រុះ(CBD)តម្រូវឲ្យប្រទេសកម្ពុជា “លើកកម្ពស់ការស្តារឡើងវិញនូវប្រភេទដែលងាយទទួលរងនូវការគំរាមកំហែង និងប្រភេទដទៃតាមរយៈការបង្កើតនិងអនុវត្តផែនការ ឬយុទ្ធសាស្ត្រគ្រប់គ្រងផ្សេងៗ” និងមាត្រា៩អំពាវនាវឲ្យកម្ពុជា “បញ្ញៀតវិធានការសម្រាប់ស្តារ និងធ្វើឲ្យប្រសើរឡើងវិញនូវប្រភេទទទួលរងនូវការគំរាមកំហែង និង សម្រាប់លែងពួកវាទៅក្នុងទីជម្រកធម្មជាតិវិញក្រោមលក្ខខណ្ឌសមស្រប។ ក្រោមអនុសញ្ញាស្តីពីពាណិជ្ជកម្មអន្តរជាតិលើប្រភេទសត្វ និង រុក្ខជាតិព្រៃដែលកំពុងទទួលរងគ្រោះថ្នាក់ជិតផុតពូជ (CITES)កម្ពុជាក៏មានតាតព្វកិច្ច ដើម្បីធានាថាការធ្វើពាណិជ្ជកម្មនូវប្រភេទសត្វព្រៃរបស់ខ្លួនស្របតាមលក្ខខណ្ឌអន្តរជាតិផងដែរ រួមទាំងប្រភេទក្រពើត្រីនៅក្នុងឧបសម្ព័ន្ធ១ ដែលកំពុងត្រូវបានធ្វើការអភិរក្សនៅក្នុងធម្មជាតិ។

## Letters of Support

### **IUCN/SSC Re-introduction Specialist Group**

C/o Environment Agency – ABU DHABI

P.O. Box 45553

Abu Dhabi,

United Arab Emirates (UAE)



19 September 2012

H.E. Chheng Kimsun  
Delegate of the Royal Government of Cambodia  
Director General of the Forestry Administration  
Ministry of Agriculture, Forestry and Fisheries,  
Royal Government of Cambodia

H.E. Nao Thuok Ph.D.  
Delegate of the Royal Government of Cambodia  
Director General of the Fisheries Administration  
Ministry of Agriculture, Forestry and Fisheries  
Royal Government of Cambodia

Your Excellencies,

### **Letter of Endorsement for the Siamese Crocodile Reintroduction and Reinforcement Plan**

The Re-introduction Specialist Group was established by the IUCN Species Survival Commission to use re-introductions as a responsible tool for the management and restoration of biodiversity through actively developing and promoting sound interdisciplinary scientific information, policy, and practice to establish viable wild populations in their natural habitats. The Re-introduction Specialist Group comprises more than 200 independent experts in this field, and publishes guidelines and case studies to enable wildlife managers to achieve success. Worldwide, there are now hundreds of species that have benefitted from carefully planned re-introduction and reinforcement programmes, including crocodilians.

The Re-introduction Specialist Group welcomes the “*Siamese Crocodile Re-introduction and Reinforcement Plan for the Royal Kingdom of Cambodia*”, which has been prepared in accordance with our guidelines and draws on lessons learned from releasing captive-bred crocodilians in many other countries. Siamese crocodiles are classed by IUCN as Critically Endangered and their wild populations are now worryingly small and severely fragmented. We understand and agree with the intention of this plan to release healthy, non-hybrid, captive-bred Siamese crocodiles into well-managed locations as part of the strategy to conserve this magnificent species in Cambodia.

On behalf of the Re-introduction Specialist Group, I commend the Fisheries Administration, Forestry Administration and other agencies and communities who have supported the development of this plan, which demonstrates a sincere commitment to the conservation of Cambodia’s globally important biodiversity. I strongly encourage the Royal Government of Cambodia to permit and facilitate the implementation of this reintroduction project as a matter of both national and international interest and importance.

Yours sincerely,

Dr Frédéric Launey, Chair  
Re-introduction Specialist Group

IUCN • Species Survival Commission

**Crocodile  
Specialist  
Group**



Chairman: Dr Grahame Webb; Vice-Chairman: Dr. Dietrich Jalden and Mr. Alejandro Lariara.  
Executive Officer: Mr. Tom Dacey, PO Box 530 Sanderson, NT 0813, Australia. E-mail: [gwebb@wmi.com.au](mailto:gwebb@wmi.com.au)

3 October 2012

National Crocodile Conservation Network  
Phnom Penh  
Cambodia

Dear Network members,

**re: Siamese crocodile reintroduction and reinforcement  
strategy and action plan for the Royal Kingdom of  
Cambodia (2012-2031)**

Thank you for providing the IUCN-SSC Crocodile Specialist Group with an advanced final draft of the strategy and action plan for boosting the wild population of Siamese crocodiles (*Crocodylus siamensis*) in Cambodia.

This is an excellent and thorough review of current knowledge about the status of the wild populations of this highly depleted species in Cambodia, and of the social, cultural and economic context within which the conservation problems exists and where the conservation solution ultimately lies.

I am particularly impressed with the pragmatic and accountable short-term goal: *to double the size of the wild population in Cambodia within five years*. I believe this can be achieved by having a united approach from all interests, Government, NGO and private, and by concentrating all efforts initially on the totally protected areas as outlined in the strategy. In the international world of crocodilian conservation this is a truly exciting initiative and project.

In the process of achieving the short-term goal, a great deal of new knowledge about conservation will be gained. More so about the social, cultural and economic variables and constraints, upon which the successful rebuilding of populations will depend. This new knowledge will allow the National Crocodile Conservation Network to adapt the strategy and program as it progresses. For example, sustaining community support for the program today, when numbers are highly depleted, may well involve completely different incentives than in 5 to 10 years time, when species abundance has hopefully increased by a factor of ten (10).

The commitment to adaptation, which recognises knowledge gaps, rather than prescription, which seems to assume perfect knowledge, has proved fundamental in other crocodilian conservation efforts around the world.

Biologically, the issue of paramount importance, as correctly identified, is quantifying the real survival rates of different sized animals released in different areas. The current estimates are a great and logical starting point, but once real data are obtained, from the short-term activities, it could profoundly alter the approach taken to achieving the short-term goals.

This is truly a remarkable program and all involved in Cambodia's National Crocodile Conservation Network deserve great credit. The IUCN-SSC Crocodile Specialist Group very much looks forward to receiving progress reports.

With best wishes,

A handwritten signature in black ink, appearing to read 'G Webb', with a stylized flourish extending from the bottom.

Professor Grahame Webb  
Chairman  
IUCN-SSC-Crocodile Specialist Group

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A wild Siamese crocodile basks on a very large log in the Steung Areng valley, Koh Kong Province (© Blaise Droz).

# 1 Introduction

## Purpose and Rationale of this Plan

The need for a national Siamese crocodile Reintroduction and Reinforcement Plan was first identified by the Fisheries Administration (FiA), Forestry Administration (FA), Fauna & Flora International (FFI), and other colleagues in the IUCN/SSC Crocodile Specialist Group. The Regional Species Meeting of the Crocodile Specialist Group held in April 2011 to discuss the management needs of the Siamese crocodile throughout Southeast Asia, called upon Cambodian delegates to “*Expand, complete and agree to a reintroduction and reinforcement plan for Cambodia*” as a matter of urgency<sup>18</sup>.

The Siamese crocodile (*Crocodylus siamensis*) is a species of outstanding cultural and ecological importance in Southeast Asia, but is now Critically Endangered and facing extinction in the wild. During the past century, this species vanished from almost all parts of its distribution range, including much of Cambodia<sup>17</sup>. Its wild stocks have been reduced to the low hundreds and become severely fragmented<sup>88</sup>. With no more than 10 nests reported annually in the wild in Asia - and no more than five of these in Cambodia - Siamese crocodiles are not breeding fast enough to recover without help<sup>88</sup>.

***Cambodia has the potential to be the leader in conserving this important species.*** Cambodia still holds most of the known wild population in Asia and, unlike neighbouring countries, still has large and relatively intact areas of natural habitat. Furthermore, recent efforts to safeguard several wild colonies have achieved success. There is now significant crocodile management expertise within Cambodia, especially in the Ministry of Agriculture, Forestry and Fisheries<sup>45</sup>.

***Cambodia has an incredible opportunity to utilise its large captive population*** to boost its wild stocks. The country already has thousands of crocodiles in farms and zoos. It would, however, be irresponsible to release captive-bred crocodiles without first weighing up the risks to local communities, to the existing wild stocks, and to the crocodiles themselves. Before embarking upon any reintroduction scheme, it is good practice to first understand and eliminate, or mitigate, the reasons the species disappeared in the first place<sup>42</sup>. This plan therefore examines the threats and risks, and sets out measures to maximise success when returning captive crocodiles to the wild.

***Cambodia has an international responsibility to conserve its biodiversity, including crocodiles.*** As a Party to the Convention on Biological Diversity (CBD), Cambodia has pledged to “*Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies*” (Article 8h) and to “*Adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction into their natural habitats under appropriate conditions*” (Article 9a). Under the Convention on International Trade in Endangered Species (CITES), Cambodia is also obligated to ensure that internationally traded species, including the Appendix I Siamese crocodile, are conserved in the wild. The IUCN/SSC Crocodile Specialist Group has pointed out that Cambodia could face an economically damaging CITES trade ban unless it demonstrates tangible progress in conserving wild crocodiles.

It is understood that the Cambodian Government has limited human and financial resources for conservation, and the management of species and habitats is frequently constrained by low technical capacity, poor infrastructure, low education, corruption, and extreme poverty among the rural human population. To be successful, this action plan must be tailored to Cambodia’s own context and capacity. Reintroduction models that have succeeded in more developed countries will not necessarily work here.

The goal and objectives were developed through a series of workshops and consultations in Cambodia between 2009 and 2012, and the methods build directly on in-country experience of managing wild and captive Siamese crocodiles. This plan also draws heavily on guidelines developed by the IUCN/SSC Reintroduction Specialist Group<sup>42</sup> and the lessons learned from previous attempts to reintroduce crocodiles in other developing countries. Its content has also been greatly improved by discussions with other members of the Crocodile Specialist Group and government and non-governmental experts within Cambodia.

This plan is primarily intended to be a step-by-step guide *for individuals and organisations responsible for implementing the reintroduction and reinforcement programme*, including FA, FiA, FFI, WCS and collaborating organisations, consultants and students. It is also intended to *inform other stakeholders*, including government leaders and funding organisations, about the process including the risks, benefits and mitigation measures. Although great effort has been made to ensure this plan is complete, it is a *working document* that should be reviewed and improved as more information and opportunities arise.

**Box 1. Definition of terms used by the IUCN/SSC Re-introduction Specialist Group**

- **Introduction:** an attempt to establish a species outside its native distribution range.
- **Reintroduction:** An attempt to establish a species in an area that was once part of its historical range, but from which it has been extirpated or become extinct.
- **Translocation:** The deliberate movement of wild individuals from one part of their range to another.
- **Reinforcement (Supplementation):** Addition of individuals to an existing population of the same species.

## Siamese Crocodile – Essential Background Information

*The IUCN recommends that prior to releasing individuals, “detailed studies should be made of the status and biology of wild populations to determine the species' critical needs” and “Overall, a firm knowledge of the natural history of the species in question is crucial to the entire reintroduction scheme”<sup>42</sup>. Extensive research has already been carried out in Cambodia, the main findings of which are summarized below.*

### Status

The Siamese crocodile (*Crocodylus siamensis*) is among the most endangered reptiles on the planet, internationally recognised as Critically Endangered<sup>17</sup>. Once common and widespread throughout Southeast Asia, including Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand, and Vietnam, its numbers crashed during the 19<sup>th</sup> and 20<sup>th</sup> centuries due to habitat loss, hunting and collection for crocodile farms. By the early 1990s, the Siamese crocodile was reported to be effectively extinct in the wild<sup>109</sup>. Fortunately, scattered individuals and a few small breeding groups have since been discovered in several countries, especially Cambodia<sup>86</sup>.

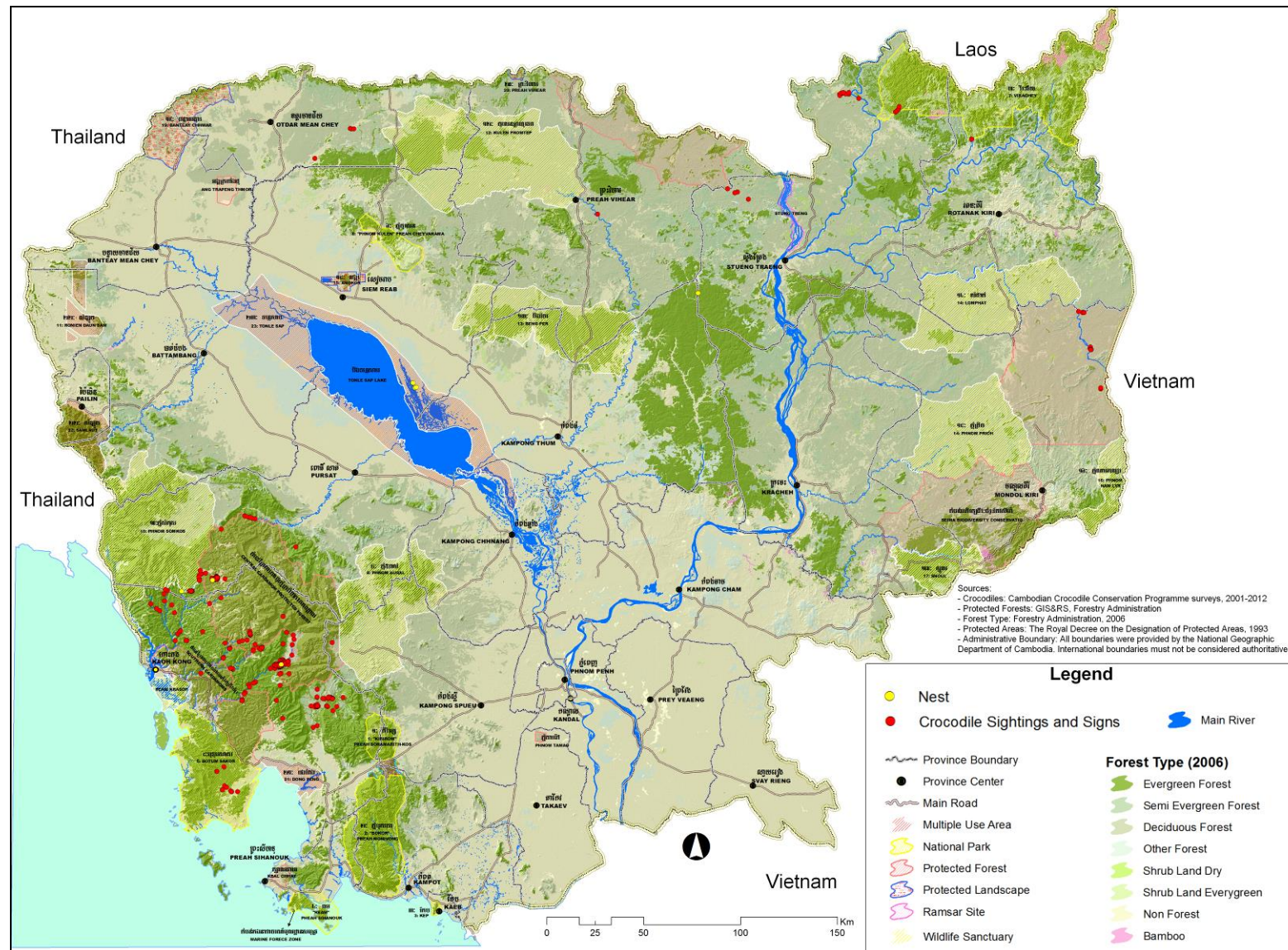
Historical records suggest this species was common in the Tonle Sap Great Lake and Mekong River<sup>a</sup>, but Cambodia's remaining wild crocodiles are now largely confined to much smaller water bodies in remote areas. Since the year 2000, crocodiles have been confirmed in approximately 35 sites on 21 river systems in 11 provinces, but many of these sites contain only one or two individuals. No more than 100 adults have been identified in field surveys nationwide, and we estimate that the total population could comprise between 100 and 250 adults<sup>88</sup>, plus a similar or larger number of immature individuals.

Among the most important known sites in Cambodia are Veal Veng Marsh (Pursat Province) and the following rivers: the upper Areng, Kampong Saom (Sre Ambel), Kep, Koi, Pursat, Sekong, and Srepok. Veal Veng Marsh and the Areng River, both in State Forestlands in the Cardamom Mountains, hold the largest known colonies in Cambodia and each produces between one and three nests annually. Nests have been found 10 sites nationwide since 2001, but the number of active breeding sites is falling<sup>91</sup> and no longer enough to maintain the wild population. Fewer than five nests are reliably reported nationwide annually.

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<sup>a</sup> Some historical records may have confused this species with the saltwater or estuarine crocodile *Crocodylus porosus*, which is superficially similar in appearance and might have occupied the Tonle Sap in the past. This species is now extremely rare in Cambodia, and all recent reports have been confined to coastal areas.

FIGURE 1 – MAP SHOWING THE CURRENT DISTRIBUTION OF SIAMESE CROCODILES IN CAMBODIA



## Taxonomy

The Siamese crocodile is a member of the Order Crocodylia, Family Crocodylidae. No subspecies or races of the Siamese crocodile have been described. Siamese crocodiles appear to show some variation in colour and body shape in Cambodia, but it is not known whether this has a genetic basis and/or reflects important adaptations to local environments. Only limited information is available on this species' genetics<sup>40</sup>, but as a general precaution, it may be wise to avoid mixing crocodiles from different regions.

In captivity, Siamese crocodiles have been hybridised with Cuban crocodiles *Crocodylus rhombifer* and saltwater crocodiles *Crocodylus porosus* multiple times<sup>11,108</sup>. The hybrid offspring are fertile and their descendants may look very similar to pure-bred Siamese crocodiles. Genetic markers have been developed to distinguish such hybrids from pure-bred *C. siamensis*<sup>36,118</sup>. Hybrids are widespread in Cambodian crocodile farms, but it is not known whether any of these have escaped or been released into the wild.

## Ecology

All crocodiles are capable of growing throughout their lives. Adult male Siamese crocodiles can attain a total length of 3.5 metres, exceptionally 4 metres<sup>94</sup>. Females are typically smaller, at less than 2.7 metres long<sup>86</sup>.

Siamese crocodiles inhabit a wide range of freshwater ecosystems, including slow-moving rivers (especially the deep-water sections, called '*anlong*' in Khmer language), ponds, lakes and marshes<sup>4,31</sup>. The smallest water body found to contain at least one adult crocodile throughout the year was less than one hectare<sup>121</sup>. This species favours water bodies with banks that are gently sloping and offer a mixture of open and heavily shaded areas. In southern Cambodia, Siamese crocodiles have recorded up to 600 metres above sea level<sup>30</sup>, but this is primarily a lowland species: the cooler uplands are probably associated with slower growth and reproduction. Adult Siamese crocodiles sometimes use burrows in the banks of rivers or lakes, with up to five individuals sharing a single burrow<sup>93</sup>.

Radiotelemetry studies have revealed that adult Siamese crocodiles occupy well defined, overlapping home ranges<sup>93</sup>. On rivers, these may extend up to 25 km during the rainy season, but most individuals have much smaller home ranges, remaining within a short (2-3 kilometres) section of the river. This suggests this species is unlikely to re-colonise vacant areas without human intervention. The movements of juveniles above the age of two years have not been studied yet, and it is possible that these may disperse considerable distances from their birthplace<sup>41,50</sup>. A study of American crocodiles *C. acutus* reported hatchlings traveling up to 2 km per day<sup>72</sup>, while saltwater crocodiles *C. porosus* between the ages of two and six years typically travel many tens of kilometres from their nest site, with young males tending to travel further than their female counterparts<sup>112</sup>.

In Cambodia, nesting commences towards the end of the dry season, between February and April. The female constructs a large mound nest on floating vegetation mats or, more commonly, beneath trees on the banks of lakes or rivers. Females have been observed re-using the same nesting sites in multiple years<sup>92</sup>. Around 20-30 eggs are laid in the nest<sup>4,20,14,54,67,89</sup> (larger clutch sizes have been recorded only in captivity<sup>119</sup>) and the female typically remains close to the nest throughout the 70-80 day incubation. In Cambodia, approximately three out of every five nests is destroyed by flooding or predators. Hatchlings emerge during the rainy season and may remain as a group near their mother for more than a year<sup>121</sup>. In captivity, both parents have been observed to vigorously defend their nest and young when threatened by humans<sup>120</sup>. In the experience of researchers in Cambodia, however, wild adults immediately retreat from view when approached and remain hidden even when their eggs are handled or their offspring make alarm calls.

Siamese crocodiles are a rather sociable species, and even though individuals appear to use fixed home ranges, no territorial fighting has been reported in the wild. Colonies typically contain a mixture of age groups and genders, and it is not unusual to see multiple individuals within a few metres of one another. Cambodia's largest colony, in Veal Veng Marsh, is estimated to contain 40-50 individuals, and it is

probable that larger water bodies could potentially support hundreds of individuals. Unlike certain other species of crocodiles, there appears to be no evidence of cannibalism.

Siamese crocodiles feed on a very wide variety of prey, including crabs and other large invertebrates, fish, frogs, snakes and other reptiles, birds and mammals, including carrion<sup>1,30</sup>. An analysis of 139 faecal samples in Southwest Cambodia found 28.8% contained snake scales and 43.9% fish<sup>31</sup>. The largest documented prey is adult wild boar *Sus scrofa*<sup>20,31</sup>. Wild boar in turn prey on the eggs of crocodiles, and crocodile nests are also susceptible to predation by monitor lizards (*Varanus* spp.). Adult Siamese crocodiles have no known natural predators, but juveniles may be easily attacked by monitor lizards, large snakes, storks and other large wetland predators. Natural mortality rates are uncertain but a study of 23 Siamese crocodile hatchlings in a well-protected lake in the Areng valley in 2007 found only five (21.7%) remaining one year later<sup>87</sup>. Low rates of hatchling survival are not unusual in crocodiles, with some studies having reported fewer than 2% of hatchlings surviving their first year<sup>41</sup>.

How Siamese crocodiles interact with other wetland predators is poorly understood. There is anecdotal evidence from Cambodia that otters are more abundant in areas from which crocodiles have been depleted.

No information is available on diseases in the Siamese crocodile in the wild.

### ***Interactions with humans***

During more than 10 years of research in Cambodia, including over 1,600 interviews nationwide, there is no record of wild Siamese crocodiles preying upon or otherwise attacking a human<sup>16</sup>. Both in Cambodia and Laos, communities that have lived in areas with Siamese crocodiles for generations continue to wash, fish and swim in the same locations without apparent fear of injury<sup>3,31</sup>.

It is noteworthy that most of the largest remaining colonies in Cambodia today are adjacent to the settlements of indigenous peoples, who traditionally revere crocodiles<sup>31</sup>. This suggests these colonies benefitted from human protection when crocodiles elsewhere were hunted or persecuted. Members of certain ethnic minority groups, including the 'Por' people of the Cardamom Mountains, believe that crocodiles bring good luck and, conversely, that the crocodiles' demise would bring terrible misfortune on their communities.

Serious conflicts can arise, however, when crocodiles break fishing nets and other equipment, or prey on hunting dogs and small livestock<sup>16</sup>. There have been multiple reports in Cambodia of crocodiles being killed in retaliation for killing dogs. Like most wild animals, crocodiles will also bite in self-defence when trapped, and some people have reportedly been bitten while attempting to catch crocodiles or disentangle them from fishing nets.

### ***Current management of wild crocodiles***

Reports published in the early 1990s suggested that Siamese crocodiles may still be widespread in Cambodia<sup>59</sup>, but large parts of the countryside were inaccessible to scientists at that time. It was not until the late 1990s that nationwide field surveys and field-based conservation actions began in earnest.

In recent years, a number of national and international organisations have invested effort in finding and protecting Cambodia's remaining Siamese crocodiles. The presence of Siamese crocodiles in the Cardamom Mountains was first confirmed in 2000 by the Forestry Administration (FA) and Fauna & Flora International (FFI), who promptly formed the Cambodian Crocodile Conservation Programme (CCCP). This programme has maintained at least five permanent staff (most FA), together with 20 community wardens and additional advisers and consultants to study and conserve Siamese crocodiles. Using survey methods designed to detect even solitary individuals, the CCCP has conducted systematic status assessments in almost all of the country's major waterways<sup>9,20-31,91,99</sup> and provided training and materials to enable other individuals and organisations to detect and monitor this species<sup>86</sup>. Three of the most important sites discovered by the CCCP – Veal Veng Marsh, the upper Areng River, the Kampong Saom (upper Sre Ambel) River – are now the focus of community-based conservation schemes that have created crocodile

sanctuaries, raised the living standards of local people, and demonstrably reduced habitat loss and poaching<sup>25,32,33,59,90,92,98,99</sup>. With reference to the present plan, the CCCP has also conducted original research on the behaviour and ecological needs of Siamese crocodile<sup>24,30</sup>, raised awareness of Cambodia's Siamese crocodiles locally, nationally and internationally, evaluated a number of potential release sites, identified captive stock suitable for breeding and release, and developed and tested methods to protect wild crocodiles and their habitats in Cambodia<sup>28</sup>.

Targeted surveys of Siamese crocodiles have also been conducted by researchers from the Fisheries Administration (FiA), Wildlife Conservation Society (WCS), IUCN and other organisations<sup>5,67,68,107</sup>. During the 2000s, WCS and FiA collaborated on a nest protection project near Sre Ambel and conducted a radiotelemetry study of Siamese crocodiles released in the Tonle Sap Great Lake. The FiA has a specific responsibility for crocodiles in Cambodia, and has established a Crocodile Conservation Office. More information on its work can be found in FiA updates to the IUCN/SSC Crocodile Specialist Group.

Additional important records of crocodiles been obtained during biodiversity surveys and enforcement operations by many other agencies, including Conservation International (CI), Frontier, Ministry of Environment (MoE), Wildlife Alliance (WA – which previously operated in Cambodia under the name of WildAid) and World Wide Fund for Nature (WWF). CI, working in partnership with FA, has also invested substantial resources into strengthening the protection of Siamese crocodiles in the Central Cardamom Mountains, notably the upper Areng valley. Other organisations, including MoE, WWF, and WA, are now usefully taking Siamese crocodiles into account when developing patrolling and protection programmes in the field.

### ***Threats to Cambodia's crocodiles***

**Poaching** - Illegal trade continues to be a threat to Cambodia's crocodiles, with wild adults fetching up to US\$1,000. At least 61 wild crocodiles were illegally captured in Cambodia between January 2001 and March 2004<sup>29</sup>, more than 10% of the estimated wild population at that time. This rate has fallen – only three individuals were reported as killed or removed alive in 2010<sup>98</sup> – but could resume at any time, driven by the ongoing global demand for Siamese crocodile meat and leather. A contributing factor to illegal trade is that Cambodia has many hundreds of crocodile farms that are permitted to rear Siamese crocodiles, and there is little to prevent farmers from purchasing and laundering wild-caught crocodiles<sup>45</sup>. Illegal cross-border trafficking is also ongoing, despite this species being on CITES Appendix I. However, it is obvious that most of the many tens of thousands of crocodiles exported from Cambodia in recent years were captive-bred, because they far exceeded the number of crocodiles in the wild.

**Drowning and injuries inflicted by fishing gear** - Fishing takes place in most waterways across Cambodia. Even in protected area zones that prohibit the collection of wild animals, fishers are typically at liberty to catch fish, frogs and other small aquatic animals. Indeed, fishing is an essential subsistence and economic activity for many rural Cambodians. Crocodiles are at risk from a variety of fishing practices. The most destructive methods, such as electrofishing and the use of explosives or poisons, are banned by law, but continue in some areas. Gill nets and hooks, which are lawfully used in most areas, can drown even large crocodiles, and many deaths have been reported and confirmed<sup>29,87,99</sup>. The transition by most fishers to using modern nylon nets and lines, instead of natural fibres, makes it harder for crocodiles to break free, and has enabled fishers to leave their equipment in the water for longer than they did in the past.

**Habitat loss and degradation** - The loss and conversion of wetlands and adjoining habitats for rice farming and other forms of agriculture is ongoing. Besides subsistence-level farming, economic land concessions have been awarded that could lead to substantial areas being converted to rubber, oil palm, banana and other enterprises. Protected areas are no exception to this threat: between 1 February and 1 April 2011, 1,100 square kilometres in 10 environmental protected areas in Cambodia were granted to private companies. For Siamese crocodiles, of greatest concern is the large number of hydrodams planned or proposed, both within Cambodia and in neighbouring countries upstream. This has already resulted in some waterways becoming uninhabitable for crocodiles (for example, the Steung Atay on the border between Pursat and Koh Kong Provinces) and will constrain the choice of areas suitable for reintroduction. Importantly, such developments are not only associated with habitat loss, but are

associated with new roads, in-migration of workers, and other changes that can make wildlife more vulnerable to illegal activities. In 2011, for example, Forestry Administration rangers found a young wild-caught Siamese crocodile in the possession of Chinese builders of the Steung Atay dam.

**Hybridization with other species of crocodiles** – On crocodile farms and zoos throughout Cambodia and elsewhere in the region, captive Siamese crocodiles have been hybridized with two other species of crocodiles, the Cuban crocodile (*C. rhombifer*) and saltwater or estuarine crocodile (*C. porosus*), on multiple occasions<sup>11,45,108</sup>. Hybrid offspring are fully fertile (they are capable of breeding with one another or with other species) and tend to grow larger and may behave more aggressively than pure-bred *C. siamensis*. The number of farms containing hybrids is unknown, but a recent genetic study in Phnom Tamao Wildlife Rescue Centre found 49% of individuals were hybrids (most of the Centre's stock were derived from farms in Cambodia)<sup>97</sup>. It is not known whether any hybrids have been released or escaped into the wild, but they pose a clear danger to the genetic integrity of the Siamese crocodile and appear to be more likely to attack people and other crocodiles. In posing a greater danger to humans, hybrids could also seriously harm public perceptions of crocodiles in Cambodia. Unfortunately, hybrids may look similar in appearance to pure-bred Siamese crocodiles, and the only reliable way to identify them is using genetic analysis. Currently, these tests are expensive and can only be conducted overseas<sup>36,118</sup>.

**Risks associated with small and fragmented populations** – Cambodia's wild crocodiles are scattered across approximately 30 different waterways (Figure 1), but the total population numbers in the very low hundreds (not including hatchlings and juveniles). Few waterways are known to contain breeding adults and radiotelemetry studies in the Cardamom Mountains suggest that Siamese crocodiles are so sedentary that even animals from different sections of the same river might never meet and breed<sup>89</sup>. Low numbers and high levels of fragmentation makes these crocodiles intuitively vulnerable to local extinctions due to natural disasters and other stochastic (chance) hazards and loss of genetic diversity (linked to such problems are lower fertility and reduced resistance to disease). Isolated crocodiles could potentially live for decades without having the opportunity to breed before they die.

## Previous Reintroductions of Crocodiles

*The IUCN recommends "thorough research into previous reintroductions of the same or similar species... should be conducted prior to and while developing reintroduction protocol"*<sup>42</sup>. This section summarises a few of the previous crocodile reintroductions and the lessons we can draw from these.

### Siamese crocodiles

In Vietnam, Siamese crocodiles were reintroduced to Cat Tien National Park in 2001-2004 by releasing 60 adult and sub-adult crocodiles from a crocodile farm<sup>57,69</sup>. Some lessons we can learn from this include:

- Genetic analyses are essential to verify that the farm-bred crocodiles are not hybrids. Farmers should not be relied upon to identify pure-bred stock.
- Captive-bred sub-adult Siamese crocodiles are capable of surviving and breeding in the wild without special prior training;
- The release of a relatively small number of sub-adult crocodiles is an effective strategy for boosting wild populations;
- Reintroduced crocodiles can become a tourist attraction.

Although the Cat Tien project has been successful in re-establishing a breeding population (the first nest was reported in 2005), many individuals disappeared after being released. It was inferred that some of the animals dispersed downstream out of the protected area and were poached by people.

In Thailand, Pang Sida National Park is the focus of a reintroduction project, which began with the release of 20 captive-bred juveniles in 2005 and 2006<sup>105</sup>. The crocodiles were checked by a veterinarian and housed within the park for three months before being released. Survival in the first year was at least 20%.

While it is too early to know whether these released crocodiles will give rise to a viable breeding population, lessons identified by the project implementers include:

- It is important to engage support from local communities.
- Local rangers must acquire knowledge and skills in crocodile biology and handling.

Siamese crocodile reintroductions to other parts of Thailand are currently being considered.

### ***Other related species***

There has been many dozens of programmes involving the release of captive-bred or headstarted crocodilians into the wild, many of them driven by reintroduction or reinforcement goals<sup>84</sup>.

In the Philippines, for example, young captive-bred Philippine crocodiles *Crocodylus mindorensis* have been released into “semi-wild conditions” on Mindanao and in the wild in Luzon’s Northern Sierra Madre Natural Park<sup>116</sup>. Head-started juvenile crocodiles have also been released into the wild in San Mariano on Luzon since 2005 to reinforce the small population there<sup>117</sup>. While it is too soon to determine whether the released animals will form a viable breeding colony, lessons identified by the project team include:

- The longer that crocodiles have been extirpated from an area, the harder it is to gain public acceptance of their reintroduction;
- This reintroduction/ reinforcement programme benefitted from building on the team’s previous experiences and achievements of managing an in situ conservation programme;
- Captive rearing crocodiles that have been collected as hatchlings from wild nests is easier and cheaper than constructing facilities to house and breed adults;
- Juveniles should ideally not be released at less than 18 months of age, because smaller juveniles are vulnerable to many predators;
- Even crocodiles that have lived in captivity for many years can adapt to wild conditions.

This project invested heavily in raising local awareness, building local capacity, and designating crocodile sanctuaries.

In India, 1,193 captive-bred mugger crocodiles *Crocodylus palustris* were released into 28 national parks, wildlife preserves, and crocodile sanctuaries between 1978 and 1992<sup>43</sup>, and this species is now relatively secure in the wild. While very successful in conservation terms, this programme has highlighted two problems:-

- It is unwise to breed too many animals in captivity before suitable release sites are identified. As this programme ran out of wild sites to release crocodiles, many thousands accumulated in breeding centres, at great expense.
- In parts of India that have become densely populated by people, human-crocodile conflict has become a serious problem for local communities and hence wildlife authorities<sup>44</sup>. Release sites should ideally be in remote areas with few or no human occupants.

In Venezuela, thousands of headstarted Orinoco crocodiles *Crocodylus intermedius* have been released into the wild. A one year radiotelemetry study of eight released crocodiles (between 1.0 and 1.4 metres total length) found that the animals moved up to 11.6 km upstream after being released, but after an initial period of dispersal, they became more sedentary. The main lessons learned from this project are:

- Post-release monitoring is important for evaluating project success
- Crocodiles cannot be expected to remain within the chosen release sites.

## 2 Goal and Objectives

### Goal of the Siamese Crocodile Reintroduction and Reinforcement Programme (RRP)

***To establish a fully viable wild population of at least 10,000 Siamese crocodiles for the benefit of this species, its environment and the people of Cambodia***

Justification:

Small populations are vulnerable to extinction. Even when protected against human threats, small populations often die out due to genetic inbreeding, natural disasters and other stochastic (chance) events. According to an analysis of a wide range of species, wildlife populations need, on average, 4,169 individuals to have a 99% probability of surviving another 40 generations<sup>111</sup>. This is a median estimate, and for some species the minimum viable size is considerably higher.

The proposed target of at least 10,000 individuals should be ample to ensure the species' long term survival and, if spread across multiple sites, would also contribute significant benefits (Box 2).

#### **Box 2. The benefits of reintroducing Siamese crocodiles: a keystone species**

- Control predatory fish, snakes and other animals.
- Clean up animal carcasses in and adjacent to waterways.
- Prevent ponds and lakes from silting up and drying out. Keep waterways open.
- Sacred animal in Buddhism, animism and other Cambodian cultural beliefs and traditions.
- Attract overseas funding to generate new jobs, education and training opportunities.
- A tourist attraction.

The following objectives and activities are proposed to achieve this long-term Goal. They draw on the extensive work that has already been carried out within Cambodia by the Forestry Administration, Fisheries Administration and their partners, and, in particular, the lessons learned from establishing three community-managed crocodile sanctuaries.

The activities below are intended to be guidelines, and not all of them will be applicable to every site.

### **Objective 1 – PROJECT MANAGEMENT: An effective management structure established and equipped to implement the Reintroduction and Reinforcement Plan**

*The IUCN<sup>42</sup> regards reintroductions as generally long-term projects that require long-term financial and political support. Reintroductions must take place with the full involvement of all relevant government agencies of the host country. They require a multidisciplinary team that has access to expert technical advice for all phases of the programme, and adequate funding must be secured for all phases. Professional training of individuals involved in the long-term programme is also warranted.*

Key activities:

- 1.a. Establish a multi-agency National Crocodile Conservation Network with the mandate to lead the RRP.** This group should include representatives from organisations with a vested interest in conserving Siamese crocodiles. The roles and responsibilities of the member organisations will be clarified and agreed through a Memorandum of Agreement, but could include: Publicising the RRP among all stakeholders; Leading a constant process of review to update the RRP Plan, work plan and budgets; Maintaining relationships with advisers and collaborating organizations; Developing funding

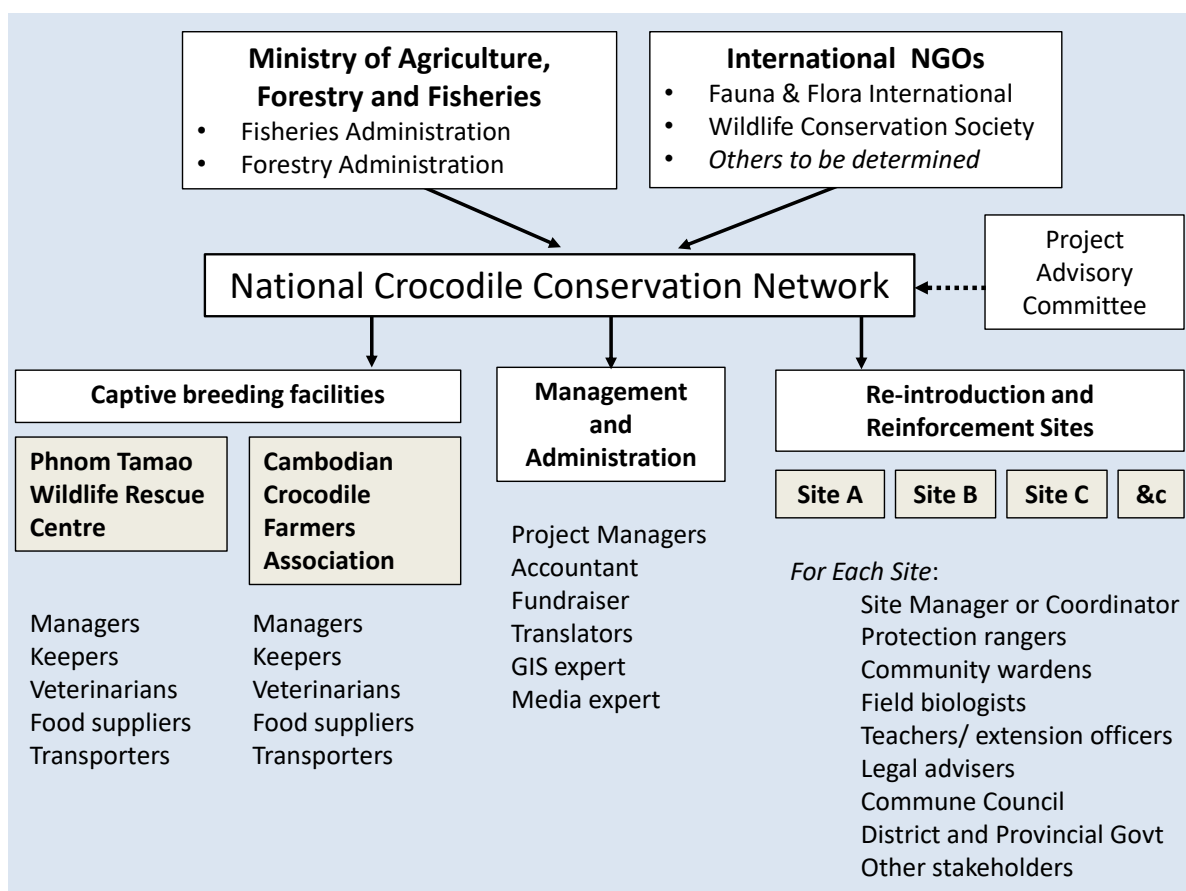
proposals; Political lobbying and consultations; and Reporting back to the Crocodile Specialist Group on a regular basis. It is important that members maintain close communication and meet regularly. Different members of the Network<sup>b</sup> may take responsibility for leading different components of the plan.

- 1.b. Form a wider network of organisations and individuals to provide expert advice and assistance.** The Siamese crocodile RRP is a diverse programme that would benefit from advice, training and other forms of assistance from other individuals and organisations in Cambodia and overseas. For example, improved methods for crocodile captive breeding and wetland management may be learned from other IUCN/SSC specialist groups, other NGOs and government agencies. This wider body of voluntary technical advisers may be formalised into a 'Project Advisory Committee', whose composition may change over time.
- 1.c. Develop annual or biennial operational plans and budgets.** While this document provides an overall framework, work plan and budget, more detailed plans are necessary to efficiently guide the activities, costs and staffing requirements on a monthly basis. The annual work plans and budgets of the Cambodian Crocodile Conservation Programme could serve as templates for these.
- 1.d. Raise funds to conduct all components of this programme.** This programme will require a diverse funding base and a continuous fundraising campaign. Annual costs may vary, but at least US\$1 million will be required for at least the first 10 years (Annex 1). Priority should be given to engaging with sponsors that can commit to multi-year support. While the Royal Government of Cambodia has limited funds of its own for conservation, it can assist in securing certain bilateral or multilateral grants. Note that fundraising for the RRP should complement, not compete with, funding to conserve the existing crocodile colonies in Cambodia (see Risk No. 5).<sup>c</sup>
- 1.e. Recruit, train and equip personnel to implement each component of the plan.** In addition to the Network members, this programme will require a substantial number of personnel to implement activities on the ground. These include community wardens, protected area rangers and/or military police (to protect and monitor release sites), biologists, teachers, fundraisers and zookeepers. Most personnel will require project salaries or stipends, but some may be voluntary or fully subsidized by other organisations. All posts should have a contract, a clear terms of reference, and health and accident insurance. For every person, vocational training, equipment and other needs will be assessed and provided according to their role. Training may be provided by Network members (1.a), project advisers (1.b) or consultants. Network personnel themselves should also seek external training or mentoring to advance their skills and knowledge to direct this programme successfully: study visits to other crocodile captive breeding and reintroduction programmes in other countries (e.g. the Madras Crocodile Bank in India, the Mabuwaya Foundation in the Philippines) could be highly instructive.
- 1.f. Produce project progress reports.** The Network will produce a technical report at least once a year to document project activities and achievements. Annual reports should also record total income and expenditure. Additional reports may also be required by the participating organisations and their donors.

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<sup>b</sup> The National Crocodile Conservation Network was initiated in July 2011 by a small group of staff from the headquarters of the Fisheries Administration, Forestry Administration and Fauna & Flora International's Cambodia Programme (the organisations that led the development of the present plan). Additional organisations will be encouraged to join as the reintroduction and reinforcement programme grows.

<sup>c</sup> A notable example is the breeding colony of Siamese crocodiles in Veal Veng Marsh (Ou Saom Commune, Pursat Province). Conserving existing colonies like this should take priority over establishing new colonies elsewhere.

**Box 3. Recommended management structure for implementing the RRP<sup>†</sup>**

<sup>†</sup> The structure can be adapted as needs and opportunities arise, and some individuals will have multiple roles. Additional government ministries will likely need to be consulted on site-based planning and management issues, e.g. Ministry of Environment, Ministry of Interior, Ministry of Industry, Mines and Energy, Ministry of Water Resources and Meteorology.

## **Objective 2 – SITE SELECTION: Wetlands short-listed for reintroduction or reinforcement**

*The IUCN<sup>42</sup> recommends reintroductions take place only where the habitat requirements of the species are satisfied, and likely to be sustained for the foreseeable future. The area should have sufficient carrying capacity to sustain growth of the new population and support a viable (self-sustaining) population in the long run. Previous causes of decline should be identified and eliminated or reduced.*

Note that the steps below should develop in parallel with other objectives, notably Objective 1, Objective 3 and Objective 4.

Key activities:

**2.a. Develop a draft list of potential sites for reintroduction or reinforcement<sup>d</sup>.** In the first stage, potential RRP areas within Cambodia could be identified on the basis of topographic maps, satellite images and existing survey data. Field surveys must be conducted to assess site suitability against the criteria shown in Box 4. Every site should be visited during the late dry season (February-March) and again during the peak rainy season (July-September) to determine whether it will satisfy these criteria year-round. Sites that lack the essential characteristics should be rejected.

<sup>d</sup> A preliminary list of possible reintroduction and reinforcement sites is shown in Annex III.

**Box 4. Criteria for Siamese crocodile reintroduction and reinforcement sites**Essential characteristics

- ✓ Situated within the species' natural distribution range
- ✓ Not more than 600 metres above sea level
- ✓ Large enough to support at least 100 adults and subadults<sup>†</sup>
- ✓ At least some parts of the waterbody retain not less than 1.5 metres depth of water all year
- ✓ Waterbody is surrounded by natural vegetation
- ✓ Diversity of prey, including snakes, fish and small mammals
- ✓ Ponds or other stagnant areas suitable as nursery areas for hatchling crocodiles (These could be constructed artificially)
- ✓ Low or zero fishing by people, especially in the prospective nursery areas
- ✓ Not downstream of any known or likely hydropower dam developments
- ✓ No (reintroduction) or very few (reinforcement) Siamese crocodiles remain

Preferred characteristics

- ✓ Less than 300 metres above sea level
- ✓ Large enough to support several thousand adults and subadults
- ✓ A lake, marsh or large river with adjoining oxbow lakes
- ✓ Located within a permanent protection area
- ✓ Remote from human settlements and roads
- ✓ Waterways with gentle, sandy banks
- ✓ Close to other existing or proposed Siamese crocodile colonies, to facilitate gene flow
- ✓ Not within the known or expected range of saltwater crocodiles *Crocodylus porosus*
- ✓ Evidence that the site historically contained a large breeding population of Siamese crocodiles
- ✓ Watershed is contained within Cambodia; the crocodiles are unlikely to cross the national border

<sup>†</sup> As a rule of thumb, a breeding colony of Siamese crocodiles requires 100 hectares of open water or 10 kilometres of river. A genetically viable population requires several thousand individuals, but not all of them need to inhabit the same site as long as there is occasional gene flow between them. Gene flow can be artificially maintained by moving a small number of animals or eggs between sites every few generations.

**2.b. Estimate the crocodile carrying capacity of each site, based on habitat area and quality.** Based on data from the Cardamom Mountains, one hectare of marsh or lake edge, or a 500 metre length of river, can support 1-2 adults, 2-4 subadults and 10-20 juveniles. Densities will vary, depending on the quality of habitat. Unless there are no alternatives, sites should be rejected if they are too small to sustain at least 100 adults and subadults.

**2.c. For each site, perform a stakeholder analysis and begin preliminary consultations with stakeholders.** For every shortlisted site, identify individuals or groups that use the area in any way and/or are responsible for its governance and management. These may include *inter alia* villagers, fishers, migrant workers, protected area rangers, MAFF and MoE officers, district government, provincial government, and national and international NGOs. In border areas, where animals might naturally move between countries, the stakeholders will include the relevant authorities and other

people in Thailand, Laos or Vietnam as appropriate. The Network will meet with stakeholders, formally or informally, to understand how the area is used, gauge their attitudes towards crocodiles, and identify those who may oppose or support crocodile reintroduction/ reinforcement. If one or more communities occupy the area, a Participatory Rural Appraisal is highly recommended (Activity 3.a). During these preliminary consultations, older residents can be questioned on the history of the area, whether it used to contain many crocodiles, and the reason(s) for their decline or disappearance.

- 2.d. For every site, conduct a thorough threat analysis.** For every shortlisted site, consult stakeholders at local, district, provincial and national levels to determine whether there are current or likely future threats or changes in the area, including heavy or destructive forms of fishing, commercial wildlife poaching and habitat degradation, and the likelihood of conflict with humans or livestock. This analysis should take into account national development plans and proposals for hydropower dams or major economic concessions. Sites with serious and intractable threats will be rejected.
- 2.e. Prepare descriptions of every site, with maps and photographs.** Including its geography, history, political boundaries, current governance, local people and other stakeholders, habitats, wildlife, current threats and information on its past and present crocodile population. There should be a summary of every site in Khmer language to support discussions with stakeholders and decision-makers.

### **Objective 3 – STAKEHOLDERS: Approval and co-operation secured from stakeholders**

*The IUCN<sup>42</sup> recommends that local people should be involved in the reintroduction programme where possible. Understanding the attitudes of local people to the proposed project is necessary. The programme should be fully understood, accepted and supported by local communities to ensure long term protection, especially if the species declined due to human factors (e.g. over-hunting, over-collection, loss or alteration of habitat). If the species poses potential risk to life or property, these risks should be minimised.*

MAFF has the authority to move wild animals and release them onto state land, but the willing consent of all local stakeholders - including resident villages (if present), the commune council and district and provincial government - will increase the chance of the animals surviving and thriving. Unless the reintroduction takes place in very remote, uninhabited areas, the cooperation of local people is crucial to protect the crocodiles from persecution, poachers, fishing nets, habitat loss and other human threats.

MAFF and its partners have gained invaluable experience from the participatory establishment of community co-managed crocodile sanctuaries in Southwest Cambodia, where villagers are employed as wardens and receive practical support to gain land tenure and improve their livelihoods. In rural Cambodia, however, the rights and interests of different stakeholders are often unclear, overlapping and even conflicting. Furthermore, most people are nervous of crocodiles and know very little about them. Gaining the trust and *informed* consent of people, especially local residents, is one of the most challenging aspects of this programme.

Note: Activity 2.b (*Conduct a stakeholder analysis and preliminary consultations*) should precede the following steps to identify the local actors that have an impact or influence over the site area, and assess their initial attitudes towards crocodiles. Many of the steps below are unnecessary for sites that are not occupied or used by people.

Key activities:

- 3.a. Conduct Participatory Rural Appraisal (PRAs) of every local community.** The use of a simple, rapid PRA will aid understanding of local livelihoods and, equally importantly, help to build relationships between local residents and the project team. Numerous PRAs have been conducted in Cambodia and appropriate methods have been developed and tested<sup>6,62</sup>. For the purposes of the RRP, particular attention should be paid to the history, size and composition of every community, their current use of wetlands and adjoining land areas, fisheries, and their attitudes towards crocodiles. The project team

should also endeavour to understand how the activities of local people may affect crocodiles, and vice versa. Box 5 indicates some general characteristics to look for in local communities, which will favour local cooperation in developing conservation programmes.

**Box 5. Community characteristics that facilitate crocodile conservation**

- ✓ Residents have previous experience of living in areas with crocodiles
- ✓ The number of households is small, and there is no or very little in-migration
- ✓ Community is united under respected leadership
- ✓ Most families have lived in this area for generations
- ✓ No or few households are heavily dependent on fishing and/or have multiple fishing sites available
- ✓ Religious beliefs against harming crocodiles or wetlands
- ✓ Livelihoods reasonably stable and secure. Most households have sufficient food and can afford the basic necessities
- ✓ Recognised tenure of lands and resources; no other groups claiming or exploiting the same area
- ✓ The crocodile programme could realistically bring noticeable economic or other benefits

**3.b. Deliver a tailored education and outreach campaign to strengthen local understanding of crocodiles and the importance of maintaining natural wetlands.** Beginning with an assessment of current knowledge and attitudes of men, women and children, identify gaps, concerns or misconceptions that need to be addressed with an education or awareness campaign. Standard messages may include how crocodiles live, how to avoid crocodile conflict (e.g. how to recognise and avoid a nest), and the laws that protect crocodiles and govern the management of wetlands. Buddhist, animist and other beliefs that urge respect for crocodiles may also be actively promoted, as appropriate to the community's religion(s). Education may take different forms in different areas, and will likely need to continue even after the first crocodiles have been released.

**3.c. With each group of stakeholders, discuss the potential impacts, costs and benefits of re-establishing/ increasing the local crocodile population.** These may change over time, as the crocodiles mature and increase in number, and as the community itself grows and changes. Impacts and costs may include damage to fishing gear, predation on dogs and livestock, and reduced access to areas allocated to crocodiles. Potential benefits may include jobs to monitor and protect crocodiles and access to development support. It is important not to build up unrealistic expectations, nor to ignore genuine concerns local people may have about crocodiles. Study tours to other villages near crocodile wetlands (e.g. Ou Saom Commune, Veal Veng District, Pursat Province) could help people to dispel myths and understand the real risks and benefits.

**3.d. Where appropriate, design and deliver measures to enhance the livelihoods of local communities.** The PRA (Activity 3.a) and other consultations might reveal needs that MAFF and its partners could help to meet, e.g. securing land tenure, establishing a community forest, or providing access to fisheries or agriculture expertise. Well considered assistance could go a long way towards building relationships and goodwill, and could usefully compensate the community for possible restrictions or conflicts in crocodile areas<sup>34</sup>.

**3.e. Actively encourage and enable stakeholders to participate in the RRP.** See Objective 4 below.

**3.f. Obtain the written, informed consent of local communities, local government and other key stakeholders before proceeding with a release.** Even though national government permission usually take precedence, it is prudent to ensure the local authorities understand the programme and give their consent before proceeding any further. The consent of local people and businesses is especially necessary if the reintroduction/ reinforcement site is on land lawfully owned or used by them. Local

signatories should include the official village leaders and commune council(s), but care should be taken to ensure the majority of residents genuinely agree to the release.

## **Objective 4 – SITE MANAGEMENT: Suitable reintroduction and reinforcement sites are secured and managed**

*The IUCN<sup>42</sup> recommends every reintroduction area should have long-term protection. Habitat protection and, where necessary, habitat restoration, should continue during and after release.*

Most of the reintroduction and reinforcement sites currently under consideration are inside a Forestry Administration protection forest, Ministry of Environment or Fisheries Administration protected area, but some zones within these areas are more strictly protected than others. While this programme should select sites that are unlikely to be affected by hydrodam developments or other threats (Objective 2), it would be prudent to secure the strongest possible level of protection.

Protection does not necessarily mean the area must become off-limits to people. On the contrary, some of the best crocodile sites in Cambodia have been used by local people for millennia. However, human uses must be sustainable and should not endanger the crocodiles and their habitat.

**4.a. For every RRP site in turn, identify the areas that require management and protection.** Ideally, all of the wetland and adjoining terrestrial areas that the crocodiles are likely to use should be managed and formally protected, as well as linkages or corridors between them (bearing in mind the population may not necessarily remain within the release site). As a rule of thumb, a breeding colony of Siamese crocodiles requires at least 100 hectares of open water or 10 kilometres of river to be safeguarded, including all known or expected breeding and nursery areas. The protected zone should extend for a minimum of 50 metres either side of river or pond banks at their maximum, rainy season level and extend upstream to include as much of the watershed as possible (because pollution or deforestation here could have negative impacts on the RRP site downstream). If any parts of the site have already been degraded, the Network may consider how they can be restored or substituted.

**4.b. If local communities are present, use participatory methods to identify management zones and develop locally-agreed regulations.** If local people live near or use the wetland, *Participatory Land Use Planning*<sup>73</sup>, or PLUP, will be used to resolve and negotiate which areas can be conserved for crocodiles and which areas can be subjected to more intensive use or development. Habitats suitable for crocodiles should ideally be left intact and relatively undisturbed, and fishing either banned or restricted to the methods that are less likely to catch and drown crocodiles (e.g. cast nets and fish traps are a preferred alternative to gill nets and hooks). In areas with resident villages, the zones and main “dos and don’ts” could take the form of community regulations or by-laws (see Annex II), discussed and agreed with all households. While local consultation and consent is crucial, it is important to involve Network members or other experts in this process to ensure that the crocodiles’ needs are recognised and incorporated.

**4.c. Secure high-level protected status for RRP sites.** Seek advice from the Director-General of MAFF on the process for securing the highest possible level of protection (e.g. a Royal or Prime Ministerial decree as a Crocodile Sanctuary). A useful precedent is the Ang Trapaing Thmor Crane Sanctuary. This process will proceed more smoothly if all relevant stakeholders, including any resident communities, have agreed to the RRP. Once approved, signage and boundary markers may be used to demarcate the area(s) under protection, especially at entry points that are likely to be used by people.

**4.d. Develop a concise management plan for every RRP site.** Every reintroduction and re-inforcement site should have a short management plan, developed in consultation with stakeholders. Plans may be brief - see Box 6 for a basic format. If the RRP site is part of a larger protected area, the site management plan should be integrated with the overall protected area management plan.

**4.e. Establish and support a field team to manage each site before, during and after crocodiles are released.** Personnel to protect and manage the crocodile sites will vary between sites and may include government officers, rangers, village wardens, NGO staff, military police, police, district

government, etc. If the RRP site is inside a larger protected area, the field team should establish close links with the protected area management staff. Very remote release sites may not require a permanent presence, but should be monitored periodically.

#### **Box 6. Contents of a site management plan**

The following format is recommended for small, simple sites.

##### **Part 1. Brief description of the site (= Activity 2.e)**

- Location (including map) and legal status
- Environmental conditions or habitats
- Socio economic conditions and stakeholder analysis
- Principal threats

##### **Part 2. Priority Action Plan**

Essential actions required to manage the site. The following categories might apply

- Essential research and survey work
- Wildlife and habitat protection
- Education and community projects (see Activities 3.b - 3.e)
- Habitat restoration or enhancement

##### **Part 3. Implementation**

- Governance and staffing responsibilities for implementing the plan
- Monitoring programme (including the crocodiles and condition of the site – see Activity 7.b)
- Work plan and costs

## **Objective 5 – SOURCE STOCK: Cambodian Siamese crocodiles obtained and prepared for release**

*The IUCN<sup>42</sup> recommends that the individuals to be reintroduced should preferably be of the same subspecies or race as those that were extirpated. While it is desirable that source animals come from the wild, the removal of individuals must not endanger the source population. If captive stock is used, it must be from a population that has been soundly managed. The source population should ideally be genetically closely related to the original native stock and show similar ecological characteristics (morphology, physiology, behaviour, habitat preference). Care should be taken to ensure that potentially dangerous captive-bred animals (such as large carnivores) are not too confident in the presence of humans.*

The release stock will be pure-bred Siamese crocodiles, preferably of Cambodian origin, from several sources: (1) captive-bred stock from the Phnom Tamao Wildlife Rescue Centre; (2) captive bred stock from other participating zoos and farms in Cambodia (to be identified) and, to a lesser extent, (3) rescued wild crocodiles (confiscated from poachers and fishermen or removed by conservationists from sites that are being destroyed). As indicated in Box 8 (Objective 6), if mainly juvenile crocodiles are to be released, it hundreds of individuals must be bred to ensure sufficient animals will survive to maturity in the wild.

Because very few animals currently remain in the wild, this plan does not condone collecting wild crocodiles or eggs unless there is a compelling reason to believe they will not survive in their current location. Nor does this plan currently recommend using captive-bred Siamese crocodiles from collections outside Cambodia, but this option should to be re-considered if it proves too difficult to produce sufficient stock locally. A number of good zoos in the USA and Europe would be willing to supply pure-bred Siamese crocodiles at their own expense to help conserve this species in the wild.

Key activities:

**5.a. Develop and maintain the Siamese crocodile captive facility at Phnom Tamao to breed and rear crocodiles for release.**<sup>e</sup> The Phnom Tamao Wildlife Rescue Centre has genetically-tested Siamese crocodiles and is rearing a mixture of age and size classes for release. It also has facilities to temporarily house rescued wild crocodiles (See Activity 5.d). Over time, new breeding stock should be introduced to diversify the blood lines of the breeding stock (ensuring they are purebred Siamese crocodiles<sup>42</sup>). Additional enclosures should be constructed to meet the RRP needs.

**5.b. Identify well-managed crocodile farms or zoos to participate in the breeding programme.** Some collections may be willing to donate<sup>f</sup> or exchange captive-bred crocodiles for release. The breeding stock, and a sample of progeny, must first be genetically tested to ensure they do not contain *Crocodylus rhombifer* or *C. porosus* DNA and to ensure they are not too closely related (interbreeding of siblings or of parents with offspring should be avoided). Ideally, the collection would not have other crocodile species or hybrids on its grounds, nor import animals from other collections (which would incur the need for more frequent, expensive genetic testing).

#### Box 7. Criteria for selecting Siamese crocodiles for reintroduction and reinforcement

##### Essential characteristics

- ✓ Genetically pure-bred Siamese crocodiles<sup>†</sup>
- ✓ In good physical condition – healthy body weight, disease-free, no major injuries or deformities
- ✓ Release group contains males and females
- ✓ Release group has a mixture of parents – not all descended from the same mother or father
- ✓ Not confident around humans – retreat when approached.

##### Preferred characteristics

- ✓ Originated from the same geographical area of Cambodia as the release site\*
- ✓ Born in the wild and/or has lived under semi-natural conditions
- ✓ Accustomed to feeding on a diversity of food, including live prey
- ✓ Not less than one metre in length - natural mortality is high among hatchlings in the wild<sup>+</sup>
- ✓ Release group contains an equal sex ratio of males and females
- ✓ Release group contains a mixture of size and age groups
- ✓ Have had minimal human contact

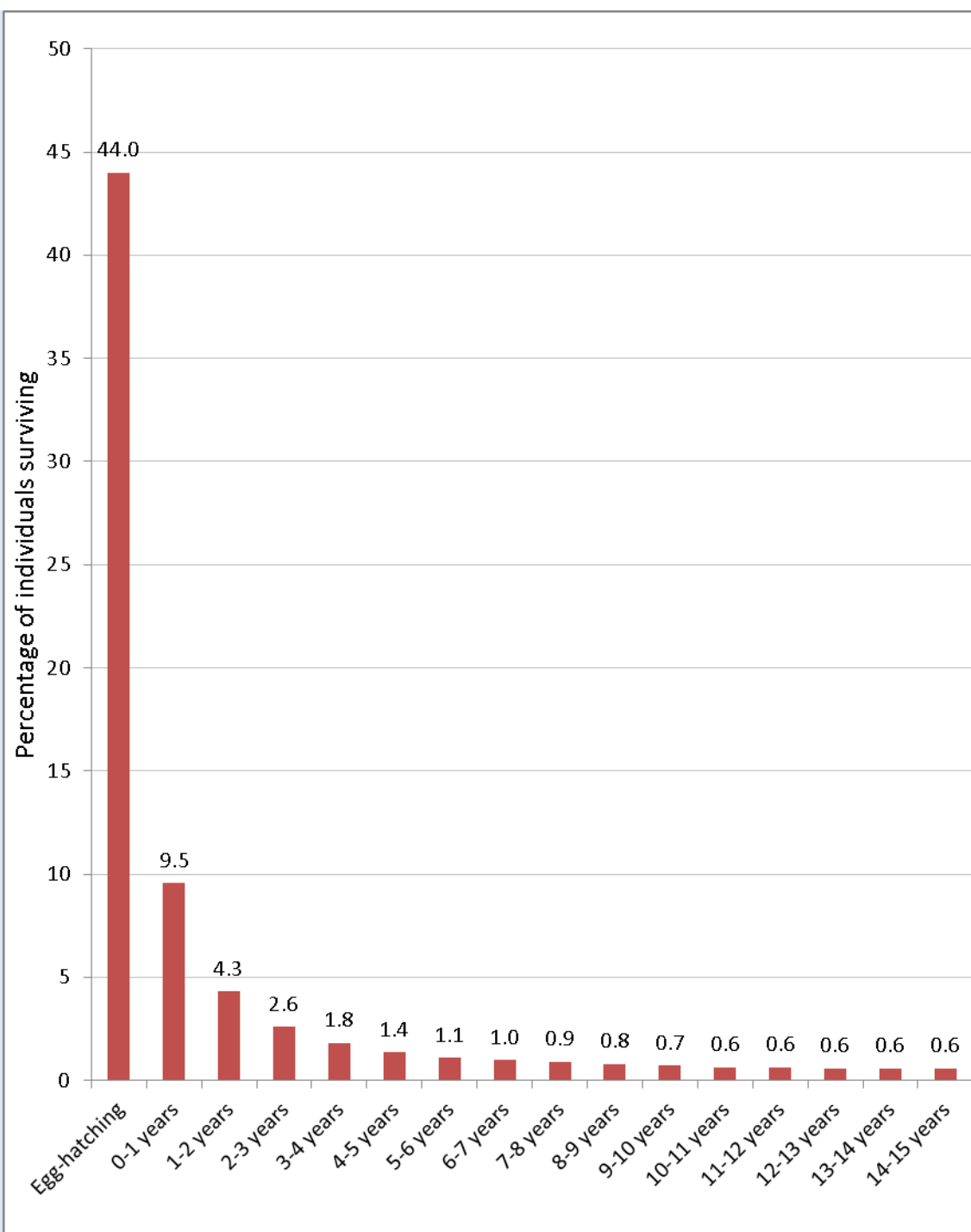
<sup>†</sup> No known or suspected hybrid crocodiles should be released. Hybrids could be significantly more dangerous to people and to other crocodiles.

\* Unless proven otherwise, Siamese crocodiles in Cambodian farms and zoos may have originated from any part of Cambodia; not necessarily from the same province in which the farm or zoo is located.

+ If hatchlings are used, a very large number (thousands) would need to be released to compensate for their likely low survival (Box 8). The only advantage of releasing hatchlings is they cost significantly less to produce than older animals. The disadvantages are they are difficult to monitor, suffer high mortality and will take a long time (c. 15 years) to establish a breeding colony. Furthermore, if all of the animals must be genetically tested to confirm they are not hybrids, the cost of releasing thousands of hatchlings could be prohibitively expensive.

<sup>e</sup> In August 2012, the Centre held 28 pure-bred Siamese crocodiles (2 adult males, 3 adult females, 12 sub-adults, 11 juveniles), which have been genetically tested<sup>97</sup> and marked with microchip tags. The breeding stock are known or inferred to have been wild-caught, but have spent many years in captivity.

<sup>f</sup> Donations of healthy, pure-bred stock should be welcomed, but donated stock are likely to be hatchlings, which have low rates of survival in the wild than crocodiles of a metre or more in length (Box 8).

**Box 8. Projected natural survival rates of Siamese crocodiles in the wild**

Data based on observed survival of Siamese crocodiles in Cambodia in *small wetlands* with *no crocodile hunting* and only *infrequent fishing*, and corroborated with data from other freshwater crocodilians, including *C. acutus*<sup>96</sup>. Approximately 60% of wild clutches are normally lost to floods and predators before hatching. Mortality rates are typically high among hatchlings and juveniles due to natural predators, and may be even higher among released hatchlings than wild-born ones<sup>101</sup>. After three or four years of age, survival rates improve as the crocodiles become too big for most predators. Mortality rates will vary among locations and years, but this graph suggests that to establish *one* mature Siamese crocodile in a well protected site in the wild it is necessary to release at least 80 hatchlings OR 18 one-year olds OR 8 two-year olds. These figures should be treated with caution, however, because significantly lower juvenile survival rates have been recorded in some species<sup>41</sup>. Generally, the more animals released, and the bigger they are, the better the chances of successfully establishing a breeding population.

**5.c. Produce healthy stock suitable for release.** For all captive collections involved in this programme, keepers and managers must have knowledge and skills in crocodile husbandry and be capable of maintaining accurate records of their stock, including all new births, deaths and stock purchases or transfers: Training, including refresher training, may be required. While all keepers should learn how to inspect the stock daily for signs of ill-health or injury, access to expert veterinary support is strongly recommended, especially to investigate the causes of any deaths, refusal to feed or poor breeding performance. Enclosures for breeding and rearing crocodiles, or temporarily housing rescued wild crocodiles, should meet the welfare and safety requirements of the animals and of their keepers, and must never be overcrowded. The American Zoo Association has developed guidelines for managing crocodilians in captivity, which could be adapted for Cambodia and translated into Khmer language.

**5.d. Establish policy on the release of rescued wild crocodiles that cannot be returned to their origin.** These include crocodiles that have been (i) confiscated from poachers or fishermen and whose capture locality is uncertain, or (ii) rescued from sites that will be destroyed. These animals will be released in one of the proposed release sites with minimal delay and stress. No wild crocodile shall be retained in captivity for breeding or other purposes unless there is a compelling reason to believe it cannot survive in the wild. If there is any doubt as to their origin<sup>8</sup>, animals should be genetically tested before being released.

**5.e. Establish a marking system for all crocodiles used for breeding or release.** All stock, including captive-bred and rescued wild crocodiles, should have a permanent mark to distinguish them from other captive or wild animals. As a minimum, this should entail the complete removal of at least one tail scute using a scalpel or sharp knife, which can be easily observed by eye. A microchip tag is also recommended, being harder to fake or misinterpret. All stock involved in this programme should be housed separately from hybrids or other new animals of uncertain origin.

**5.f. Prepare the captive stock for life in the wild.** Crocodiles generally need little or no training to adapt to life in the wild. However, crocodiles that have been held in captivity for long periods may become heavily imprinted on certain foods, physically weak, and/or fearless of people. Captive facilities should offer a diversity of foods, including live fish, frogs and other live prey to stimulate their hunting skills and encourage physical activity. Care should be taken to avoid the crocodiles associating people with food: the keeper should ideally be concealed from view when food is provided, and individuals that do not flee when approached by people should be given (humane) aversion therapy or rejected from the RRP.

## **Objective 6 – RELEASE: Crocodiles released and at least four breeding colonies established**

*The IUCN<sup>42</sup> advises that care must be taken to ensure that the stock is free from contagious diseases and non-native parasites before release: appropriate veterinary measures should ensure the health of released stock throughout the programme. Transport plans should be developed for delivering stock to the reintroduction site, with special emphasis on ways to minimize stress on the individuals during transport. It is also necessary to develop a release strategy, which may include the acclimatization of release stock to the release area; behavioural training; group size and composition; release techniques and timing. Reintroduction programmes should establish policies on interventions (see below).*

Key activities:

**6.a. For every RRP site, determine the number and sizes of animals for release.** If the release site contains wild crocodiles (i.e. reinforcement sites, or sites where the reintroduction process has already begun), the release of smaller, immature crocodiles is recommended to reduce the risk of

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<sup>8</sup> For example, any crocodiles confiscated in the vicinity of the Srepok River, the Cardamom Mountains or other areas with remote wild populations can probably be assumed to be pure-bred Siamese crocodiles. Crocodiles captured in the Tonle Sap River, the Great Lake or other waterways near crocodile farms, on the other hand, could potentially come from escaped farm stock and should therefore be genetically tested before being released.

them being attacked by territorial resident crocodiles. As a general rule, every site is likely to require the release of at least 800 hatchlings or 175 one-year-olds or 80 two-year olds (or a smaller number of older animals, if available). However, it is not yet known whether it would be better to release a mixture of size classes in each site (to replicate a natural colony structure) or release animals of equal size. Monitoring (Activity 7.c) will be essential to test and apply the best approach. While some animals may be siblings, it is important to ensure that some are unrelated to create a more diverse gene pool. As more data become available, the build-up of the released population could be usefully simulated using a *Population and Habitat Viability Analysis*<sup>82</sup> to specify the optimum number and composition of individuals to be released to establish a breeding population. (VORTEX software to conduct this analysis can be downloaded free of charge from <http://www.cbsg.org/cbsg/vortex/> and has been used in other crocodile management projects<sup>74</sup>).

- 6.b. Develop standard operational procedure to assess the health of the crocodiles to be released.** This SOP should be developed by veterinarians and use methods that can be learned and applied in Cambodia. Veterinarians with specialist crocodilian expertise may be found through the Crocodile Specialist Group. Generally, common visible signs of ill-health include lethargy, refusal to eat, changes in faeces or urine, vomiting, coughing, panting, lameness, and swellings on the body or legs. Wild caught crocodiles that have been recently rescued may refuse to feed in captivity, but should be released promptly if they otherwise appear healthy. Any animals found to be infected or which test positive for contagious pathogens will be removed from the release group, and the remainder will be placed in strict quarantine before a re-test.
- 6.c. Develop standard operational procedure for transporting and releasing crocodiles, and ensure all handlers are appropriately trained and equipped.** This SOP will define the mode of transport for each part of journey, safety measures for crocodiles and handlers, equipment needs (e.g. transport containers), and the number of people and their required skills. Crocodiles will be moved from their source (e.g. Phnom Tamao) to the release site by the quickest route possible. Because stress can be fatal, the animals must not be allowed to overheat, suffer extreme physical discomfort or be unduly frightened by people and loud noises. Their eyes should be covered and the jaws bound until release. One person should be nominated to lead the restraint, relocation and release of crocodiles.
- 6.d. Decide policy on post-release interventions.** Supplemental feeding of crocodiles post-release is unlikely to be necessary and is probably best avoided. However, if a released crocodile shows signs of being ill, injured or starving, moves to a hazardous location or presents a clear danger to people, the field-based personnel will require clear directives from the Network on whether and how they may recapture and relocate it.
- 6.e. Develop government policy on handling complaints about released wild crocodiles.** By definition, wild animals are not under anyone's ownership or control and, for this reason, there is no legislation in Cambodia requiring compensation for damage caused by wild animals. Government financial compensation schemes should generally be avoided, especially in developing countries where few of them have proved to be successful or sustainable<sup>34</sup>. However, the National Crocodile Conservation Network should consider establishing a rapid response team to investigate serious complaints and determine whether any problems can be alleviated (e.g. an unusually aggressive crocodile should be relocated). The FA/MoE/FFI Cambodian Elephant Conservation Group's Rapid Response Team provides a useful model for this approach. Importantly, the risk of complaints and claims can be significantly mitigated through education programmes (Activity 3.b), ensuring community members recognise both the risks and benefits before giving their consent (Activities 3.c-3.f), and establishing participatory site regulations (Activity 4.b) and management plans (Activity 4.d) to minimise the chance of conflicts happening in the first place.
- 6.f. Transfer release stock from captivity to each RRP site in turn (approximately one site initiated per year),** following the protocols established and agreed through the activities above. Before releasing crocodiles, the checklist in Annex I should be followed.

## Objective 7 – MONITORING: Monitoring and evaluation mechanisms implemented

*The IUCN<sup>42</sup> states that research is required, which should include: monitoring the health and survival of individuals (intervention may be necessary); demographic, ecological and behavioural studies of released stock; studies long-term adaptation by individuals and the population; and collection and investigation of mortalities. Monitoring data should be used to test methods and as a basis for making decisions to revise, reschedule or discontinue the programme where necessary. An evaluation of the cost-effectiveness and success of the reintroduction techniques would be useful for other practitioners.*

Research and monitoring are an important part of this programme. As more is learned about the crocodiles, sites, stakeholders, project team and methods, findings should be used to continually refine the plan and improve the way the RRP is carried out (i.e. “adaptive management”, Box 10). The lessons learned from implementing this RRP, including the techniques that worked or failed, will be useful for other conservation programmes in Cambodia and overseas (Objective 8).

Systematic monitoring and evaluation is also necessary to enable the Network to demonstrate to its sponsors and other contributors and decision-makers that the project is making effective use of resources. Section 3 outlines five main indicators to measure project success.

Key activities:

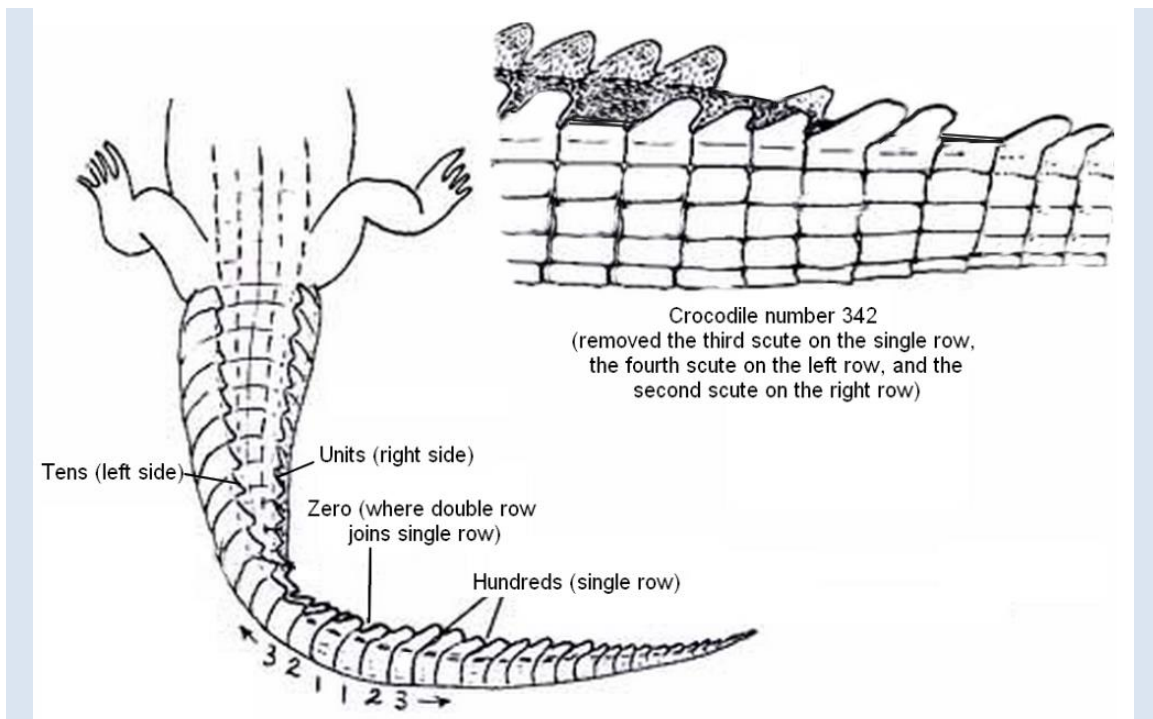
**7.a. Monitor the RRP stock in the participating breeding facilities.** Every captive facility should maintain a stock book or database, including eggs produced, eggs hatched, the individuals in each pen, and mortalities. Animals involved in the captive breeding programme should be marked (ideally using microchip tags and by clipping tail scutes – see Box 9) sexed, and measured (body mass, snout-vent length, tail length) annually. A complete database of all individuals, their marks, gender, body measurements and location should be held centrally by the Network. Every pen should be inspected at least once a day. Deaths, injuries and possible diseases should be reported to the Network and the cause identified. Management regimes - feed type and quantity, frequency of cleaning pools, egg incubation conditions, etc. - should be documented and any significant changes reported.

**7.b. Develop and implement a detailed monitoring plan for every reintroduction and reinforcement site.** In every RRP site, monitoring will follow a ‘Pressure-State-Response’ framework<sup>60</sup>. For each of the three components, a small number of indicators or variables will be selected that can be measured consistently and efficiently in the field. The monitoring methods may vary between sites, but possible examples include:

- i. Threats to the crocodiles and their habitats (=Pressure): e.g. the number of fishers that use the wetland monthly and annually; the number of snares found annually by wardens patrolling the wetland; the percentage of local people with negative attitudes towards the crocodiles;
- ii. The status of the crocodiles and their habitat (=State): e.g. the number of crocodiles observed per transect survey; the number of nests produced after the released animals reach maturity; annual variation in water levels;
- iii. The management actions taken (=Response): e.g. the number of crocodiles released every year; the number of person-hours of patrols conducted; percentage of local households participating in education activities.

Methods for collecting, filing and analysing these data must be prepared in advance and staff trained as necessary. Even if most of the work is delegated to field personnel, the Network members should conduct site visits to verify all is well.

**7.c. As far as possible, monitor released animals to assess growth, survival, dispersal and future reproduction.** All released crocodiles will be marked with microchip tags and by clipping up to three tail scutes. For at least the first six months after release and at least once a year thereafter, the crocodiles will be visually monitored using direct observations by day or by night. A sample of both sexes of the released crocodiles should also be radiotracked for at least one year, to determine whether their behaviour differs from non-released wild crocodiles<sup>93</sup> and remain in the intended area.

**Box 9. Example of a system used to individually mark a crocodile by clipping tail scutes**

Up to three scutes are marked by being cut off (most easily seen from a distance), punctured or branded. The point between the double row and single row of tail scutes is considered to be zero. Counting down the tail from this point, the single scutes represent hundreds. Counting forwards, the double scutes represent tens on the left and units on the right. It is recommended that at least one of the scutes on the 'double row' should be clipped as a precaution against the crocodile losing the end of its tail in a fight. In captivity, the clipped scutes will need to be periodically re-cut to keep them conspicuous. After release, the tail scutes should be re-clipped only if the crocodile is captured for other reasons. Figure adapted from Webb in Bolton (1989)<sup>7</sup>.

Crocodiles should be generally left undisturbed after release, but any individuals that are captured or found dead should be identified, measured and their location recorded. In reinforcement sites, any positive or negative interactions between the existing resident crocodiles and released stock should also be documented. Note that because wild crocodiles are naturally shy and most of the proposed release sites are remote and densely vegetated, project personnel should not expect to see all or even most of the crocodiles during site visits.

When the released animals are expected to attain maturity (by approximately 15 years of age), the RRP sites should be surveyed intensively for nests during the nesting season (April-June) and surveyed at least annually for hatchlings or juveniles. Hatchlings are most easily found by searching for their eyeshine by torchlight. If there are villages nearby, local people may be the first to detect nests and young. Any local reports should be investigated to confirm they are crocodiles and not, for example, water monitor lizards *Varanus salvator* or Indochinese water dragons *Physignathus cocincinus*.

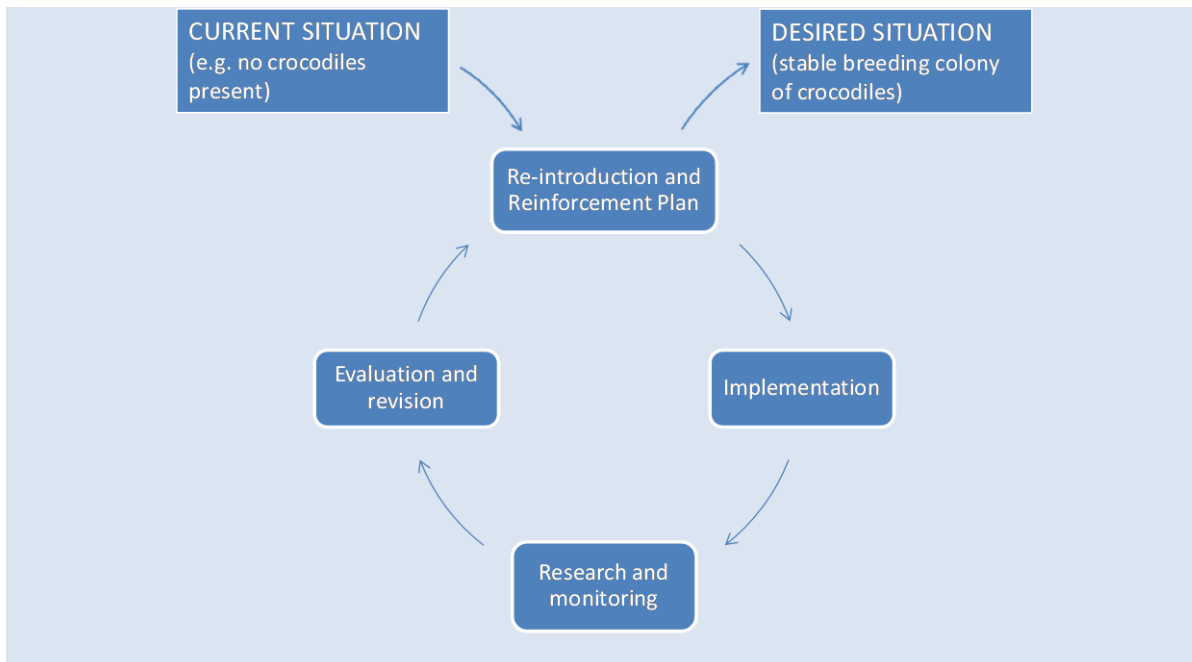
**7.d. Commission research studies to address critical management questions.** Information gaps will be identified as the programme develops. At the time of writing, important questions include:- What is the normal growth rate and mortality rate of Siamese crocodiles in the wild? At what age do male and female Siamese crocodiles mature in the wild? What are the attitudes of people towards crocodiles in each of the prospective RRP sites? What is the optimum size to rear a crocodile for release, taking into account production costs as well as post-release survival? While some of this research can be carried out by the project implementation team, certain topics can be allocated to students or consultant scientists.

**7.e. Evaluate the cost-effectiveness and success of the captive breeding and reintroduction techniques.**

Using the project's annual accounts, the Network will document the actual costs of implementing different components of this plan and, in particular, assess success against the main project indicators shown in Section 3. Additional indicators may be added at any time.

**7.f. Use findings and lessons-learned to refine and improve management decisions.** Regular (at least quarterly) team meetings should be held at both site-level and at national level to evaluate progress and decide how to resolve problems and improve the project plan. Emergency meetings may be called if a serious problem or major new opportunity is discovered.

**Box 10. The adaptive management cycle**



**Objective 8 – DISSEMINATION: The Reintroduction and Reinforcement Plan has popular support, and benefits other conservation initiatives**

*The IUCN<sup>42</sup> recommends regular publications in scientific and popular literature in order to disseminate techniques and lessons learned to other conservation practitioners. Provision should be made for publicity and public education about the project.*

While Activity 3.b addresses the education of local, site-specific stakeholders, the success of this RRP will undoubtedly benefit from winning the interest, understanding and support of high-level decision-makers, the wider public in Cambodia, as well as donor organisations. This will require both mass media coverage and targeted approaches towards key individuals and organisations. Members of the National Crocodile Conservation Network and their colleagues already have extensive experience in publicising Siamese crocodile conservation actions in Cambodia. While it is fortunate that crocodiles have enormous media appeal, the Network must work hard to address common misconceptions and misplaced fears that might otherwise undermine the RRP.

Sharing the methods and lessons learned from this RRP could also prove invaluable for other conservationists in Cambodia and overseas, especially those working to conserve Siamese crocodiles in other countries. Communicating with other conservationists will add even more value to this RRP, and will encourage sharing of their useful skills and knowledge in return.

Key activities:

- 8.a. Mass communication of important RRP activities and outputs.** Network members can utilise existing contacts in the Cambodian and international media to disseminate information and news about Siamese crocodiles and the RRP. Where possible, important announcements should take the form of a planned Press Release in which the Network can ensure the facts are correct and the appropriate organisations and individuals are credited. The Network should decide a policy on how to respond to unsolicited requests from journalists, and how to respond to potentially damaging or misleading information in the press - poorly handled media relations could make the team appear foolish, disorganised or evasive. Members of Network and field teams may benefit from media training to learn how to conduct clear and effective interviews.
- 8.b. Engage with priority audiences who can directly influence project success.** In particular, high-ranking government officials, donor organisations, local community leaders and landscape managers. Each audience will need to be engaged on their own terms, and this may range from holding personal meetings to inviting dignitaries to provide speeches at releases and other significant project events. The opportunity to visit project captive breeding facilities and field sites will help to foster a greater interest in supporting the RRP.
- 8.c. Publish methods and results in scientific periodicals and presentations.** Preference should be given to periodicals that are peer-reviewed and available for free, open access (e.g. the *Cambodian Journal of Natural History*, *Herpetological Conservation and Biology*, *Open Conservation Biology Journal*). The newsletter and meetings of the IUCN/SSC Crocodile Specialist Group are particularly effective in reaching other crocodile conservation practitioners. It is important to remember that conservationists can learn as much from the problems and failures as from the successes of a project.
- 8.d. Host and conduct exchange visits with other crocodile practitioners.** This can be an effective way to exchange knowledge and skills. As well as inviting visitors to visit this initiative in Cambodia, project personnel could gain new ideas and skills by visiting crocodile breeding facilities and reintroduction projects in developing countries overseas, including Cat Tien National Park (Vietnam), the Mabuwaya Foundation (The Philippines) and Madras Crocodile Bank Trust (India).



Community wardens, government staff and Buddhist monks preparing to release head-started Siamese crocodiles (© Jeremy Holden, FFI-CCCP).

### 3 Indicators of Success

*The IUCN<sup>42</sup> recommends short-term and long-term success indicators are identified for the duration of the reintroduction or reinforcement programme.*

#### **Indicator 1 – Released crocodiles exhibit comparable growth and survival to wild-born crocodiles**

**Rationale-** If released crocodiles show relatively poor growth and high mortality in the wild, this may indicate problems with the RRP site and its management, or flaws in the husbandry and preparation of crocodiles for release. In either case, the chance of establishing a viable breeding colony are poor, and the project team will need to urgently reconsider the site or methods.

**Measurement –** This indicator is difficult to apply accurately because crocodiles are often difficult to see and catch in the wild, and because there is considerable natural variation in growth and survival rates between habitats and between individuals. Some data on the sizes and fate of released crocodiles will be gained from Activity 7.c and compared to Box 8, which presents an approximate indication of annual mortality rates in the wild, but should be revised as more data become available. Under Activity 7.d, research effort should be invested in monitoring the growth and survival of marked young Siamese crocodiles in other sites in Cambodia, and exchange data with field researchers working on this species elsewhere in Southeast Asia.

#### **Indicator 2 – Released crocodiles are confirmed to reproduce in all sites by 15 years of age**

**Rationale –** A reintroduction or reinforcement operation can be considered successful only if the animals establish a breeding population. 15 years is considered the approximate age of maturity in wild Siamese crocodiles, but it is possible some individuals will grow and mature more rapidly, especially if reared under optimal conditions in captivity.

**Measurement –** Once the surviving released animals are expected to reach maturity, the RRP sites should be surveyed annually for nests, hatchlings and/or juveniles (Activity 7.c).

#### **Indicator 3 – All reintroduction and reinforcement sites are protected by law and have effective managers, enforcement personnel and regulations in place**

**Rationale –** Siamese crocodiles have vanished from most parts of Asia due to human activities, and all RRP sites will therefore require a high level of protection to prevent local extinction. Objective 4 focuses on protecting crocodiles and their habitats in the RRP sites and is underpinned by other Objectives, especially Objective 3.

**Measurement –** Activity 7.b must include systematic monitoring of the actions taken to protect the RRP sites and the crocodiles, as well as the status of the crocodiles and habitat, and evidence of threats. The Network should conduct site visits to evaluate field staff and verify the management and protection of the area is satisfactory.

#### **Indicator 4 – Sustained support from local stakeholders to conserve crocodiles and habitats**

**Rationale –** The long term success of this programme hinges on support from local stakeholders, including local communities, local government officials and protected area staff. Interest, cooperation and concerns may change over time (especially as the crocodiles become larger and more numerous), and the composition of local stakeholders is also liable to change.

Measurement – The attitudes and perceptions of local stakeholders, especially local communities if present, will be assessed before releases take place (Objective 3 activities) and should continue to be monitored for signs of change (Activity 7.b). While local knowledge and attitudes may be measured routinely using questionnaires, it is even more important to observe the behaviour of stakeholders, including any signs of them upholding or disregarding measures to protect crocodiles and their habitats.

**Indicator 5 – Reintroduction and/or reinforcement programmes are developed in other parts of the species range, citing lessons learned from this project**

Rationale – The Siamese crocodile has been largely extirpated throughout Southeast Asia, and several countries have begun or are planning reintroduction and reinforcement programmes. While this RRP is specific to Cambodia, the results could inform and guide other country programmes to conserve Siamese crocodiles.

Measurement – The Network will maintain contact with other conservationists in Southeast Asia, and keep a record of those who consult the project team or cite this programme in their publications. Published citations can be monitored using internet search engines, for example Google Scholar.



A Siamese crocodile egg in Sre Ambel District is examined by Heng Sovannara (FIA/WCS) and Boyd Simpson (FFI) to check it is fertile before carefully returning it to the nest  
(© Sam Han, FA-CCCP).

## 4 Risks and Mitigation

### Risk 1 – Released crocodiles are a perceived or actual threat to local communities

Summary of issues – Many people are nervous or frightened of crocodiles, especially those who do not live in areas with crocodiles. Importantly, there are no confirmed records of purebred Siamese crocodiles being ‘man-eaters’, even from historical times when this species was common and widespread throughout Southeast Asia. Siamese crocodiles normally prey on fish, snakes and other animals that are considerably smaller than a human. Nevertheless, any crocodile is capable of inflicting a nasty bite if trapped or otherwise provoked, and other species of similar size are known to have attacked people when under extreme stress. Hybrid crocodiles (*siamensis* x *porosus* or *rhombifer*) tend to be more aggressive and grow larger than purebred Siamese crocodiles, and could be serious threat to humans. Another important consideration for this project is that crocodiles that have been raised in captivity may be more confident around people than their wild counterparts, and therefore more likely to come into contact with humans and fishing gear. Crocodiles could have some negative impacts on rural livelihoods by damaging fishing equipment or preying on hunting dogs or small livestock. Even though some communities believe crocodiles are lucky, some households believe that to see a crocodile will bring misfortune. If people consider crocodiles a nuisance or danger to themselves, their families or their livelihoods, this could lead to the crocodiles being killed and complaints or demands for compensation from the organisations that released them.

Mitigation -

- **Genetic testing** of all captive stock involved in the RRP will ensure no hybrids are released (Activity 5.a, Activity 5.b).
- **Reintroduction sites** will be situated in areas far from human settlements, taking into account the fact that the crocodiles or their progeny may disperse upstream or downstream from the release site. Ideally, these will be in the existing core zones of protected landscapes, where people are not generally permitted to go (Activity 2.a).
- **Reinforcement sites**, which still have resident crocodiles, may be in areas used by people, but crocodiles should not be released without their prior informed consent. Special precautions should be taken where necessary to minimise conflict, such as enabling fishers to replace gillnets with cast nets, fish traps or other gear less likely to catch or be broken by crocodiles. Direct compensation pay-outs should be avoided, but the project team should seek other ways to enhance the livelihoods of these communities (Activity 3.d). If local communities report problems, their complaints should be investigated promptly.
- **Captive crocodiles for release** must not be habituated to people, and should flee when approached. Keepers must avoid ‘taming’ the crocodiles or encourage them to approach to be fed. Captive rearing facilities should be in quiet areas out of public view. In most cases, the trauma of being caught and transported to the release site should be enough to make even captive-bred crocodiles wary of human contact. During follow up monitoring of the released crocodiles, researchers should verify that crocodiles flee and dive underwater when approached, and make no attempt to habituate them. Individuals that show no fear of humans may have to be recaptured if they frighten local people or are at greater risk of being poached (Activity 6.d).

### Risk 2 – Unacceptably high mortalities of crocodiles in captivity and during and after release

Summary of issues – Crocodiles are actually quite fragile and sensitive animals, in spite of their armour. Being ectothermic, crocodiles cannot regulate their body temperature in the same way that most mammals and birds can, and prolonged exposure to extreme temperatures (far below or above 30°C) can be fatal. Extreme exertion – for example, when struggling to escape – can cause crocodiles to accumulate

fatal amounts of lactic acid. Crocodiles are also prone to a number of serious ailments, especially in captivity, including nutrient deficiency, stomatitis (mouth rot) and viral diseases. Overcrowding, overheating, excessive disturbance and other forms of stress can result in the crocodile refusing to feed. Other common causes of death include predation by other animals, hunting by humans and accidental drowning in fishing gear. It is unlikely this plan can be implemented without some individuals dying in captivity or during and after release, but it is important to minimise these losses. A high level of mortalities could result in negative publicity and, more importantly, failure to establish wild breeding colonies.

Mitigation -

- ***Captive husbandry procedures and facilities*** (Activities 5.a, 5.b) must put the welfare of the crocodiles first, and pay particular attention to avoid overcrowding, provide the right nutrition, provide access to both water and land areas, and ensure all individuals are able to achieve their preferred body temperature at all times. Quarantining of new arrivals or sick individuals will further ensure the stock remain healthy.
- ***Standard operational procedures for health screening*** (Activity 6.b) should help to ensure only healthy animals are moved and released.
- ***Standard operational procedures for translocation*** (Activity 6.c) will put the welfare of the animals first. Great care must be taken to protect the crocodiles from overheating while being transported on trucks or motorbikes: where possible, animals should be moved at night. The jaws of the crocodiles should be bound to prevent them from biting each other (or the handlers) and covering their eyes (e.g. with duct tape) will help to keep them calm.
- ***Rearing individuals*** in captivity until they are 1 metre long can help to avoid the naturally high mortality rates of small individuals in the wild (Box 8, Activity 6.a). This approach will incur higher production costs per individual, but fewer individuals will be required.
- ***Post-release monitoring*** (Activity 7.c) will help the project team to estimate mortality rates, and any carcasses should be examined for the cause of death. If losses are much higher than one would normally expect in a wild population (Box 8), the Network will re-examine the management strategy and perhaps reject the site from the programme.

### **Risk 3 – New colonies succumb to poaching, habitat degradation and other human hazards**

Summary of issues – The Siamese crocodile is a commercially valuable animal in a poor country that has high levels of corruption and inadequate understanding and enforcement of the law. Furthermore, this species depends on wetlands, many of which are seriously threatened by intensive fishing, agricultural conversion, pollution and hydropower dams and other factors. Because Siamese crocodiles have been wiped out from most of their range in Cambodia, even in remote areas, it would be irresponsible to release more crocodiles into areas where their chance of surviving is low.

Mitigation -

- ***Select the safest available sites***, where no dams or other major developments, planned or anticipated, will jeopardise the crocodiles and their habitat. The project team will conduct thorough research, including consultations at local, provincial and national government levels, before selecting sites (Activities 2.a-2.d). Waterways and wetlands used for fishing are best avoided, unless this threat can be realistically reduced or mitigated (e.g. converting fishers from modern gill nets and hooks to cast nets and traps, or to artificial fish farms).
- ***Ensure sites are fully and effectively protected*** before releasing any crocodiles. As well as being protected by law, even remote sites will require a management plan and regulations, enforced by rangers and with the active cooperation of local communities (if present). It may be prudent to avoid mentioning the names of project sites in public communications.

- **Publicise the strictly protected status** of crocodiles, both locally (Activity 3.b) and through mass media (Activity 8.a). It should become common knowledge that taking crocodiles from the wild is a criminal offence: no less serious than poaching tigers or elephants.

#### **Risk 4 – Personnel implementing the Reintroduction and Reinforcement Plan are injured or killed**

Summary of issues – Although Siamese crocodiles are not considered to be ‘man-eaters’, they are potentially dangerous animals and can inflict a serious bite. Any personnel involved in handling, catching or transporting crocodiles - when the animals will be extremely frightened - are at risk of being bitten unless they take due precautions. Even greater risks come from road accidents, when project staff travel to captive facilities and project sites. Most sites currently occupied by Siamese crocodiles or suitable for reintroduction are remote and have a number of hazards, including virulent strains of malaria, dangerous wild animals and unmarked minefields. Crossing rivers is especially dangerous during the rainy season.

Mitigation -

- **Conduct risk assessments** for every site and major project activity, to identify hazards to human health and safety, and practical measures to avoid them. (FFI has standard templates in English for risk assessments which could be translated for this purpose). The findings and mitigation measures should be discussed with all personnel.
- **Develop emergency rescue protocols** to ensure that if any personnel become seriously sick or injured, they will be evacuated from the field to receive medical care as quickly as possible. Protocols should be updated regularly.
- **Project personnel must be well-trained** and equipped to perform their work safely. For example: Crocodiles should be handled only by persons with the right training and equipment; Persons in the field should ideally work in groups of three or more and have a means of communicating in case of emergency; The location and contact details of the nearest hospitals or other medical facilities should be known to all personnel.
- **Project personnel must have accident and medical insurance.** This includes full time staff as well as short-term employees or volunteers.

#### **Risk 5 – The Reintroduction and Reinforcement Plan detracts resources from conserving existing wild populations**

Summary of issues – Cambodia’s existing wild breeding colonies need concerted attention to protect them from poaching, excessive fishing pressure and habitat degradation and loss. Many crocodile colonies are threatened by hydropower dams and other developments and are unlikely to survive without intervention. Between 2005 and 2011, the direct cost of protecting and managing three crocodile areas in the Cardamom Mountains, including local community outreach and support, exceeded \$80,000 per year. If human and financial resources are redirected from existing wild stocks, more wild crocodiles could disappear from the wild faster than the RRP can replace them.

Mitigation -

- **Coordinate planning** for the RRP and other ongoing initiatives: Seek opportunities to streamline and share costs (e.g. selecting RRP sites that are in the same region as existing wild stocks to enable the same staff to cover both more easily), but ensure existing breeding populations always take priority when resources are limited. This coordination will be aided by the fact that members of the Network are already leading the conservation of existing stocks in Ou Saom, Areng, Sre Ambel and elsewhere, and know what level of resources these need.

## Risk 6 – The Reintroduction and Reinforcement Plan lacks sufficient long term funding

Summary of issues – This is a major challenge: This plan will take approximately two decades to complete, at the cost of approximately US\$150-250,000 per year (US\$ 4 million total) to cover personnel costs, travel, equipment, food for captive stock etc. There will also be recurrent management costs thereafter, to protect and monitor the new wild colonies. It is likely that most of this funding will have to be secured from overseas. While a number of species conservation projects in Cambodia have operated successfully at this level for years, global conservation funding is increasingly competitive and most grants are smaller than \$20,000. Without sufficient funds, this RRP can only partially achieve its objectives and goal.

Mitigation -

- **Invest in developing a diverse funding base.** In addition to targeting traditional conservation donors, pursue corporate sponsorship (e.g. companies whose brand is linked to crocodiles, water or Cambodia) and explore fundraising through public 'adopt-a-crocodile' schemes, memberships and merchandise. Activities that involve and benefit local communities could qualify for rural development and education grants.
- **Encourage 'in-kind' support** from other organisations with an interest in wildlife conservation in Cambodia. For example, a number of international NGOs support the MAFF and MoE to manage protected landscapes, and could potentially contribute staff time, field equipment and other forms of assistance to support the reintroduction or reinforcement of Siamese crocodiles within these areas.



Villagers in Thmar Bang District gather in a well-known Siamese crocodile breeding site in the Cardamom Mountains which contains large adults and their young.

They say they have fished this pond in this way for over a thousand years without any danger from the crocodiles (© Boyd Simpson, FFI-CCCP).

## 5 Implementing Organisations

The implementing organisations will include, but not necessarily limited to:

### ***Ministry of Agriculture Forestry and Fisheries (MAFF)***

**Fisheries Administration (FiA):** The FiA is the government authority under the Ministry of Agriculture, Forestry and Fisheries responsible for the management of the fisheries industry and crocodile farms in Cambodia. It also has the jurisdiction for the management of all aquatic resources, including wetlands and inundated forests.

**Forestry Administration (FA):** The FA is the government authority under the Ministry of Agriculture, Forestry and Fisheries responsible for forests, forest resources and wildlife management in Cambodia. Most remaining colonies of Siamese crocodiles are in areas managed by the FA, and four staff are permanently attached to the Cambodian Crocodile Conservation Programme (CCCP). The FA is also responsible for Phnom Tamao Wildlife Rescue Centre, where a Siamese crocodile breeding facility is located.

### ***International conservation NGOs***

**Fauna & Flora International (FFI):** Founded in 1903, FFI was the world's first international conservation organization. FFI acts to conserve threatened species and ecosystems worldwide, choosing solutions that are sustainable based on sound science, and take account of human needs. FFI is active in over 40 countries and has its headquarters in Cambridge, UK. FFI has been active in Cambodia since 1996, working in partnership with the Ministry of Agriculture, Forestry and Fisheries, Ministry of Environment, and Ministry of Youth, Education and Sport.

**Wildlife Conservation Society (WCS):** The WCS, founded in the USA in 1895, has a commitment to protect 25% of the world's biodiversity, WCS addresses four of the biggest issues facing wildlife and wild places: climate change; natural resource exploitation; the connection between wildlife health and human health; and the sustainable development of human livelihoods. WCS is committed to this mission because it is essential to the integrity of life on Earth.



Sorn Piseth and a community Crocodile Warden in the Cardamom Mountains expertly attach a radiotransmitter to a wild Siamese crocodile (© Sam Han, FA-CCCP).

## 6 General Work Plan and Budget

This is a broad prediction for the period 2012-2031. More detailed operational plans and budgets should be prepared at least every two years. The symbols xxx (high), xx (medium), x (low) give an approximate indication of the frequency or intensity of effort needed in each year.

|                                                                                                                                               | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018-2021 | 2022-2031 |
|-----------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|-----------|-----------|
| <b>Objective 1 – PROJECT MANAGEMENT – An effective management structure established to implement the RRP</b>                                  |      |      |      |      |      |      |           |           |
| 1.a. Establish a multi-agency National Crocodile Conservation Network with the mandate to lead the RRP.                                       | xxx  | x    | x    | x    | x    | x    | x         | x         |
| 1.b. Form a wider network of organisations and individuals to provide expert advice and assistance.                                           | xx   | xxx  | x    | x    | x    | x    | x         | x         |
| 1.c. Develop annual or biennial operational plans and budgets.                                                                                | xx   |      | xx   |      | xx   |      | xx        | xx        |
| 1.d. Raise funds to conduct all components of this programme.                                                                                 | xxx  | xxx  | xxx  | xxx  | xxx  | xxx  | xxx       | xxx       |
| 1.e. Recruit, train and equip personnel to implement each component of the plan.                                                              | xxx  | xxx  | xxx  | xxx  | xxx  | xxx  | xx        | xx        |
| 1.f. Produce project progress reports (at least one per year)                                                                                 | x    | x    | x    | x    | x    | x    | x         | x         |
| <b>Objective 2 – SITE SELECTION – Wetlands short-listed for reintroduction or reinforcement</b>                                               |      |      |      |      |      |      |           |           |
| 2.a. Draft a list of potential sites for reintroduction or reinforcement.                                                                     | xx   | xx   | x    | x    | x    | x    | x         |           |
| 2.b. Estimate the crocodile carrying capacity of each site, based on habitat area and quality.                                                | xx   | xx   | xx   | x    | x    | x    | x         |           |
| 2.c. For each site, perform a stakeholder analysis and begin preliminary consultations with key stakeholders.                                 | xxx  | xxx  | xxx  | xxx  | xxx  | x    |           |           |
| 2.d. For each site, conduct a thorough threat analysis.                                                                                       | xx   | xxx  | xxx  | xxx  | xxx  | x    |           |           |
| 2.e. Prepare descriptions of every site, with maps and photographs.                                                                           | xx   | xxx  | xxx  | xxx  | xxx  | x    |           |           |
| <b>Objective 3 – STAKEHOLDERS – Approval and co-operation secured from stakeholders</b>                                                       |      |      |      |      |      |      |           |           |
| 3.a. Conduct Participatory Rural Appraisals (PRAs) of local communities.                                                                      | xxx  | xxx  | xxx  | xxx  | x    |      |           |           |
| 3.b. Deliver a tailored education and outreach campaign to strengthen local understanding of crocodiles.                                      | xxx  | xxx  | xxx  | xxx  | xx   | xx   | x         | x         |
| 3.c. With each group of stakeholders, discuss the potential impacts, costs and benefits of the RRP.                                           | xx   | xxx  | xxx  | xxx  | xxx  | x    | x         | x         |
| 3.d. If appropriate, design and deliver measures to enhance the livelihoods of local communities                                              | xx   | xxx  | xxx  | xxx  | xxx  | x    | x         | x         |
| 3.e. Actively encourage and enable stakeholder participation in the RRP.                                                                      | xx   | xxx  | xxx  | xxx  | xxx  | xxx  | xx        | xx        |
| 3.f. Obtain the written, informed consent of local communities, local government and other key stakeholders before proceeding with a release. | xxx  | xxx  | xxx  | xxx  | xxx  | xx   | xx        | x         |
| <b>Objective 4 – SITE MANAGEMENT – Reintroduction and reinforcement sites are secured and managed</b>                                         |      |      |      |      |      |      |           |           |
| 4.a. For every RRP site, identify the most important area(s) that require management and protection.                                          | xxx  | xxx  | xxx  | xxx  | xxx  | x    | x         | x         |
| 4.b. Use participatory methods to identify management zones and develop locally-agreed regulations.                                           | xx   | xxx  | xxx  | xxx  | xx   | xx   | xx        | x         |
| 4.c. Secure high-level protected status for RRP sites.                                                                                        | xx   | xxx  | xxx  | xxx  | xxx  |      |           |           |
| 4.d. Develop a concise management plan for every RRP site.                                                                                    | xx   | xxx  | xxx  | xxx  | xxx  |      |           |           |
| 4.e. Establish and support a field team to manage each site before, during and after crocodiles are released.                                 | xx   | xx   | xxx  | xxx  | xx   | xx   | x         | x         |

|                                                                                                                                                         | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018-2021 | 2022-2031  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|-----------|------------|
| <b>Objective 5 – SOURCE STOCK - Cambodian Siamese crocodiles obtained and prepared for release</b>                                                      |      |      |      |      |      |      |           |            |
| 5.a. Develop and maintain the Siamese crocodile captive facility at Phnom Tamao to breed and rear crocodiles for release.                               | xxx  | xxx  | x    | x    | x    | x    | x         | x          |
| 5.b. Identify well-managed crocodile farms or zoos to participate in the breeding programme.                                                            | x    | xxx  | xxx  | x    | x    | x    | x         | x          |
| 5.c. Produce healthy stock suitable for release.                                                                                                        | xxx  | xxx  | xxx  | xx   | xx   | xx   | xx        |            |
| 5.d. Establish policy on the release of rescued wild crocodiles that cannot be returned to their origin.                                                | xxx  |      |      |      |      |      |           |            |
| 5.e. Establish a marking system for all crocodiles used for breeding or release.                                                                        | xxx  | xxx  | xxx  | xxx  | xxx  | xxx  | xxx       |            |
| 5.f. Prepare the captive stock for life in the wild.                                                                                                    | xxx  | xxx  | xxx  | xxx  | xxx  | xxx  | xxx       |            |
| <b>Objective 6 – RELEASE - Crocodiles released and at least four breeding colonies established</b>                                                      |      |      |      |      |      |      |           |            |
| 6.a. For each RRP site, determine the number and sizes of animals for release.                                                                          | xx   | xxx  | xxx  | xxx  | xxx  | xxx  | xx        |            |
| 6.b. Develop standard operational procedures to assess the health of the crocodiles to be released.                                                     | xxx  |      |      |      |      |      |           |            |
| 6.c. Develop standard operational procedures for transporting and releasing crocodiles, and ensure all handlers are appropriately trained and equipped. | xxx  |      |      |      |      |      |           |            |
| 6.d. Decide policy on post-release interventions.                                                                                                       | xxx  |      |      |      |      |      |           |            |
| 6.e. Develop government policy on handling complaints about released wild crocodiles.                                                                   | xxx  |      |      |      |      |      |           |            |
| 6.f. Transfer release stock from captivity to each RRP site in turn (approximately one site per year).                                                  | xxx  | xxx  | xxx  | xxx  | xxx  | x    | x         | x          |
| <b>Objective 7 – MONITORING - Monitoring and evaluation mechanisms implemented</b>                                                                      |      |      |      |      |      |      |           |            |
| 7.a. Monitor the RRP stock in the participating breeding facilities.                                                                                    | xx   | xx   | xx   | xx   | xx   | xx   | x         |            |
| 7.b. Develop and implement a monitoring plan for every reintroduction and reinforcement site.                                                           | xxx  | xxx  | xxx  | xxx  | xx   | xx   | xx        | xx         |
| 7.c. As far as possible, monitor released animals to assess growth, survival, dispersal and future reproduction.                                        | xxx  | xxx  | xxx  | xxx  | xxx  | xxx  | xxx       | xxx        |
| 7.d. Commission research studies to address critical management questions.                                                                              | xx   | xx   | xx   | xx   | xx   | xx   | xx        | x          |
| 7.e. Evaluate the cost-effectiveness and success of the breeding and reintroduction techniques.                                                         |      |      |      |      | xxx  | xxx  | xxx       | xxx        |
| 7.f. Use findings and lessons-learned to refine and improve management decisions.                                                                       | xx   | xx   | xx   | xx   | xx   | xx   | xx        | x          |
| <b>Objective 8 – DISSEMINATION - The RRP gains popular support and benefits other conservation initiatives</b>                                          |      |      |      |      |      |      |           |            |
| 8.a. Mass communication of important RRP activities and outputs.                                                                                        | xx   | xx   | xxx  | xxx  | xx   | xx   | xx        | xx         |
| 8.b. Engage with priority audiences who can directly influence project success.                                                                         | xxx  | xxx  | xxx  | xxx  | xxx  | xxx  | xx        | xx         |
| 8.c. Publish methods and results in scientific periodicals and presentations.                                                                           |      | x    | xx   | xxx  | xxx  | xxx  | xxx       | xxx        |
| 8.d. Host and conduct exchange visits with other crocodile practitioners.                                                                               |      | x    | x    | x    | x    | x    | x         | x          |
| Minimum estimated cost per year (US\$ '000s)                                                                                                            | 150  | 200  | 200  | 200  | 200  | 200  | 150 (x 4) | 100 (x 10) |

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Hundreds of villagers have been consulted during the development of this Reintroduction and Reinforcement Plan. This photograph shows members of an indigenous 'Khmer Daeum' community in the Central Cardamom Mountains (© Hor Leng, FA-CCCP).

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Aerial view of the Ta Jiruk Crocodile Sanctuary, established by the people of Ou Saom Commune, Veal Veng District, in 2004 (© Boyd Simpson, CCCP).

## Annex I Checklist before releasing crocodiles

### ***Release site (for reintroduction or reinforcement)***

- ☐ Has the release site been surveyed and confirmed to meet all of the essential habitat criteria?:
  - ☐ Situated within the species' natural distribution range
  - ☐ Not more than 600 metres above sea level
  - ☐ Capable of supporting at least 100 adult and sub-adult crocodiles (i.e. c. 100 hectares of open water or 10 kilometres of river)
  - ☐ At least some parts of the water body retain not less than 1.5 metres depth of water all year
  - ☐ The water body is surrounded by natural vegetation
  - ☐ Evidence of a diversity of prey, including snakes, fish and small mammals
  - ☐ Ponds or other stagnant areas suitable as nursery areas
  - ☐ Low or zero fishing by people, especially in the prospective nursery areas
  - ☐ Not downstream of any known or likely hydropower dam developments
  - ☐ No (reintroduction) or very few (reinforcement) Siamese crocodiles remain
- ☐ Has a stakeholder analysis been completed? (Activity 2.c)
- ☐ Has a threat analysis been completed? (Activity 2.d)
- ☐ If villages are in or near the site, has there been
  - ☐ A socioeconomic study (e.g. PRA)? (Activity 3.a)
  - ☐ Education activities and consultations to ensure villagers understand the risks and benefits? (Activities 3.b, 3.c)
  - ☐ A zoning plan and regulations developed to enable crocodiles and people to avoid conflict? (Activities 4.a, 4.b)
  - ☐ A written agreement from villagers, consenting to the release? (Activity 3.f)
- ☐ Have other key stakeholders consented to the release? (Activity 3.f)
- ☐ Are important habitats within the site protected by law? (Activity 4.c)
- ☐ Does the site have a management plan, at least in draft? (Activity 4.d)
- ☐ Does the site have a nominated team of people responsible for its management and enforcement? (Activity 4.e)
- ☐ For each site, has a decision been made on how many crocodiles to release? (Activity 6.a)

### ***Crocodiles***

- ☐ If wild crocodiles are already present in the site, are their approximate number, size and distribution known? (Activity 2.a)
- ☐ Are the crocodiles intended for release confirmed to be pure-bred Siamese crocodiles of Cambodian origin? (Activity 5.a, 5.b, 5.c)
- ☐ Do the captive-bred crocodiles come from a number of different parents? (If the first batch are siblings, subsequent batches should come from different parents) (Activity 5.a, 5.b, 5.c)

- ☐ Have the crocodiles been marked, and their marks accurately logged on a database? (Activity 5.e)
- ☐ Have the crocodiles passed the health screening protocol? (Activity 6.b)
- ☐ Do the crocodiles appear nervous or fearful of people? (Activity 5.f)
- ☐ Do the crocodiles accept a variety of food, including live prey? (Activity 5.f)
- ☐ Will this operation abide by the project protocol for transportation and release? (Activity 6.c)

**Management**

- ☐ Is there an agreed policy on how to respond to any complaints about the crocodiles in this site? (Activity 6.e)
- ☐ Has a risk assessment been carried out and the results discussed with the project team? (page 29)
- ☐ Have all personnel responsible for catching, transporting and releasing crocodiles been trained and equipped? (Activity 1.e)
- ☐ Has a basic monitoring programme been designed to monitor the crocodiles and site before, during and after release? (Activity 7.b)
- ☐ Has a decision been made on whether or not to publicise the release, and whether or not to invite any dignitaries or media? (Activities 8.a, 8.b)



Camera trap photograph of a wild Siamese crocodile in Pursat Province (©CCCP).

## Annex II Example regulations for crocodile sanctuaries in areas used by people

### Extract from community by-laws developed for the Ta Jireuk Crocodile Sanctuary in Veal Veng Marsh (Ou Saom Commune, Veal Veng District, Pursat Province)

The following regulations were developed in 2004 by means of a participatory process that involved all households in Ou Saom (O'Som) Commune. While the sanctuary has continued to be used by people for fishing and other purposes, the community agreed to certain restrictions to protect the crocodiles and reduce the risk of conflict.

#### Areas for Crocodile Conservation: (291 ha)

To conserve the population of crocodiles in Veal Veng Marsh, the following areas form a crocodile sanctuary: *Boeung Mluch, Chrolong Svay, Romeas Ngoarb, Trapaing Kok, Spean Smach, Trapaing Sroh, Trapaing Arng Phleung, Ptool Wat* and *Koh Treah* [place names within the marsh].

#### Hunting, Possession and Sale of Crocodiles and their parts

- No hunting of crocodiles or all other forms of animals in the crocodile sanctuary area is permitted.
- It is forbidden to collect, buy, sell or trade crocodiles, crocodile eggs or products inside or outside the crocodile sanctuary.
- Offenders caught carrying out the above offences will be reported to the appropriate authority for prosecution under national law.

#### Fishing

- Prohibited equipment: The use of gill nets and fishing with hooks is prohibited in the crocodile sanctuary, as is all fishing equipment that is illegal under the Fisheries Law.
- Permitted equipment: Fishing with *ungrhut* (cone-shaped baskets), *samnung* (cast nets) and *chneang* (scoops) by commune members is permitted in the sanctuary area. Members must take care not to disturb crocodiles while fishing.
- The use of illegal fishing gear will incur penalties under Article 36, 37 and 38 of the Fisheries Law.

#### Preservation of Crocodile Habitat

- Changing of the crocodile habitat is not permitted. This includes:
  - Cutting of trees or plants
  - Changing water flow by digging new paddy fields, channels or building paddy bunds in the sanctuary
  - Making camps or buildings
  - Grazing buffaloes in the crocodile sanctuary
- Fires: No fires to be lit within 20 metres of the sanctuary boundary or within the sanctuary
- Disturbance of nesting areas: There must be no disturbance to nesting areas and nesting crocodiles. Nesting crocodiles are not to be approached, and nests must not be touched.