Crocodile Conservation, Management and Farming in Indonesia: a Preliminary Review with Recommendations

Summary Report of the IUCN-SSC Crocodile Specialist Group Review Mission to Indonesia (23 August-17 September 2014)

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EXECUTIVE SUMMARY

With full cooperation from the Government of Indonesia, the IUCN-SSC Crocodile Specialist Group (CSG) conducted a limited review of some aspects of crocodilian conservation, management, ranching and farming within Indonesia (25 August-17 September 2014; Annex 1: timetable). The four main issues were:

1. The extent to which Indonesia's current ranching program and skin exports were compliant with CITES;

2. Options for the conservation of crocodiles at Lake Mesangat, East Kalimantan, where Siamese crocodiles (*Crocodylus siamensis*) and Tomistoma (*Tomistoma schlegelii*) co-exist in an area threatened by encroachment of oil palm plantations; and,

3. Increasing human-crocodile conflict (HCC).

4. Productivity in farm production

The CSG review team at various times was accompanied by representatives of the Indonesian Ministry of Forestry (KK-PHKA), the Indonesian Institute of Science (LIPI), the Indonesian Crocodile Farmers Association (ICFA) and Yayasan Ulin (YU). It is clear that there are strong concerns and commitments to the conservation and management of all four of Indonesia's crocodilian species by the Government of Indonesia and the ICFA. Following the mission, one team member (BS) visited areas where research on the status and ecology of *T. schlegelii* has been funded by the CSG's Tomistoma Task Force (Annexes 1 and 4).

The CSG review team first visited Jakarta (25 August 2014), and met with representatives from KK-PHKA, LIPI and ICFA (Annex 2). Compliance with CITES, Human-Crocodile Conflict and the factors associated with increased protection of Lake Mesangat were discussed. A second meeting (Annex 3) was held opportunistically at the conclusion of the extended mission by BS (17 September 2014)(Annex 4). Four crocodile farms were visited during the review: Ekandinya Karsa (Jakarta), Alian Ruswan (Medan), Yakita Malia (Medan), Surya Raya (Balikpapan).

The team met with the Provincial Forestry Department (BKSDA) in Samarinda (East Kalimantan), and discussed various options for protecting the Lake Mesangat wetlands. They then visited Lake Mesangat, where with the assistance of YU staff, conditions surrounding the wetlands were examined, interviews conducted with local fishermen and other villagers, and some spotlight surveys conducted.

Based on the knowledge and experience gained, a series of recommendations were made by the CSG review team.

Recommendations

1. Ranching and Compliance with CITES

Indonesia needs to review the degree to which it is complying with the reporting requirements of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and may benefit greatly from discussion with the CITES Secretariat. Indonesia's inability to comply with Resolution Conf. 11.16 (Rev. CoP15) threatens the long term viability of the ranching program. Areas that may need to be considered in that review are:

a. Changes in the ranching program since CITES approved Indonesia's program (1994) need to be reported to the CITES Secretariat.
b. Implementation of monitoring programs for wild populations of *C. porosus* and *C. novaeguineae* subject to ranching and/or wild harvest need to be reviewed and upgraded to ensure compliance with CITES.
c. Improved reporting by farms on the numbers, sizes and species of crocodiles acquired and held, and by tanneries of the species and sizes of skins produced and exported, would add considerably to the ability to comply with CITES reporting requirements.
d. Consideration should be given to whether the current Appendix-II listing under the ranching criteria should be amended to an unqualified Appendix-II listing, despite ranching remaining the primary form of use.

2. Conservation of crocodiles in the Lake Mesangat area

a. Indonesia represents the last global stronghold for wild *C. siamensis*, and this species meets all the criteria for listing as a Priority Species for conservation by the Ministry of Forestry.
b. *T. schlegelii* is much more widespread in Indonesia, but there may be advantages in affording the population in Lake Mesangat increased levels of protection, hand in hand with *C. siamensis.*
c. Habitat modification and destruction at Lake Mesangat for oil palm plantations should cease as a matter of urgency.
d. The local government should reclaim the area from PT. REA KALTIM and designate it as an Essential Ecosystems Area under Indonesian law.
e. A Conservation Action Plan for *C. siamensis* (but perhaps both species) in the Mesangat area needs to be developed in consultation with relevant stakeholders. This should include ongoing monitoring of population status,

and exploratory surveys aimed at determining whether *C. siamensis* is more widespread in East Kalimantan.

f. The CSG should contact the parent company of PT. REA KALTIM with a view to obtaining their ongoing support for improved conservation of Lake Mesangat.

3. Management of Human-Crocodile Conflict

a. Investigate whether crocodile exclusion barriers at high use areas would be a practical mechanism for reducing attacks.
b. Increased education through signage, the media and at schools about the predatory nature of *C. porosus* and the ways in which risk of attack can be reduced.
c. Removal of large *C. porosus* from urbanized or high use areas.
d. Abandon the practice of relocating *C. porosus* once they have been captured given the overwhelming evidence that many return to the site of capture after relocation.
g. Establish a central register for HCC problems, mainly with *C. porosus* but also with *T. schlegelii*, so that management solutions can keep track of events and gain a better understanding of the problems.
e. Amend Indonesian restrictions that only F1 captive-bred stock can be harvested for skin or other products by farms, so that problem crocodiles can be marketed.
f. That when basic information on HCC is compiled, that Indonesia host a National workshop on Human-Crocodile Conflict, similar to those that have been held in Malaysia in recent years, in which national approaches to HCC can be refined.

4. Improving farm productivity

a. Better control of egg temperatures before collection and during incubation, particularly avoiding high temperatures (>33ºC).
b. Within the current raising facilities provision of hide areas for hatchlings up to one year of age, and the provision of variable environmental temperatures (24-36ºC) within enclosures.
c. Organize a veterinary workshop to extend to farmers new information that may exist on the treatment of common diseases and other constraints on health.
d. Review the efficiency and effectiveness of captive breeding technologies and possible constraints on single breeding pairs or smaller breeding groups due to inadequate visual barriers in enclosures, especially around designated nest sites.
e. Review the economic ramifications of the current laws prohibiting the export of raw skins. Raw *C. porosus* skins generally command higher prices than skins exported at the wet blue stage (required under current Indonesian law).

f. Review the extent to which the farming industry, as key stakeholders in the management program, may be able to contribute more to national management obligations, particularly monitoring.

5. Workshop to discuss findings

a. That the CSG send another representative to Indonesia to discuss the findings of this report and seek guidance from Indonesia about how best the CSG can assist with the recommendations.

1. INTRODUCTION

Four species of crocodilian are found in Indonesia (Fig. 1): the Estuarine or Saltwater crocodile (*Crocodylus porosus*), the New Guinea freshwater crocodile (*C. novaeguineae*), the Siamese crocodile (*C. siamensis*), and Tomistoma (*Tomistoma schlegelii*). Each species is protected under both Act No. 5/1990 (Biodiversity Conservation and its Ecosystems) and Government Regulation No. 7/1999 (Presentation on the wild fauna and flora).

1. *Crocodylus porosus* (Buaya muara or laut – saltwater, estuarine or marine crocodile): formerly distributed throughout the Indonesian archipelago, but now restricted to the more remote undeveloped wetlands. Declared a protected species by the Government of Indonesia in 1980, and since 1994 listed on Appendix II of CITES subject to the ranching criteria with some "special conditions" [Resolution Conf. 11.16 (Rev. CoP15)].
2. *Crocodylus novaeguineae* (Buaya air tawar – New Guinea, freshwater or river crocodile): restricted in Indonesia to the rivers and freshwater swamps of Papua and West Papua Provinces (previously Irian Jaya) where it is considered abundant. Declared a protected species by the Government of Indonesia in 1978 and listed on Appendix II of CITES.
3. *Tomistoma schlegelii* (Buaya sumpit or sinyulong – Tomistoma or False Gharial): distributed at low densities throughout Sumatra and Kalimantan. Declared a protected species by the Government of Indonesia in 1978 and is listed on Appendix I of CITES.
4. *Crocodylus siamensis* (Buaya kodok – Siamese crocodile or frog crocodile): in Indonesia occurs only in East Kalimantan although historical populations may have been more widespread. Protected under Indonesian regulation and listed on Appendix I of CITES. Possibly occurs in Central and South Kalimantan.

Figure 1. Indonesia comprises 34 Provinces, which are further divided into regencies and cities, which in turn are subdivided into districts. Red dots refer to locations visited during the Review Mission. These included Jakarta City (Jakarta), Medan (North Sumatra), Balikpapan, Samarinda and Mesangat (East Kalimantan).

On 9 August 2014, the CSG chairman wrote to the Directorate General of Forest Protection and Nature Conservation in Jakarta with concerns about: (a) the extent to which Indonesia may be complying with its Appendix-II (ranching) listing for *C. porosus*; and, (b) the desirability of reviewing options for the improved conservation of *C. siamensis*, and to a lesser extent *Tomistoma schlegelii*, in the Lake Mesangat region of East Kalimantan. The Chairman offered to send a CSG review team to assist the Government of Indonesia in a preliminary way with these matters, which was accepted. The review team arrived and had its first meeting in Jakarta (25 August 2014), where the four main issues to be addressed were finalized:

1. Ensuring compliance with obligations under CITES with respect to ranching *C. porosus* and exporting skins.

2. Developing a plan for the conservation of Siamese crocodile (*C. siamensis*), and to a lesser extent Tomistoma (*Tomistoma schlegelii*) in the Mesangat region of East Kalimantan.

3. Management of human-crocodile conflict throughout Indonesia.

4. Improve efficiency of farming operations involving *C. porosus* and *C. novaeguineae*.

2. FINDINGS AND RECOMMENDATIONS

The CSG has worked closely with the Government of Indonesia on crocodilian conservation and management issues since 1990, and has participated actively in many meetings and forums about crocodiles in Indonesia.

The first meeting for this review mission (25 August 2014) was held at the Manggala Wanabakti Building, Ministry of Forestry (Jakarta), and involved representatives from Indonesia's Ministry of Forestry (KK-PHKA), Research Center for Biology (LIPI), Crocodile Farmers Association, and the IUCN-SSC Crocodile Specialist Group (CSG). It included the Director (Bambang Dahono Adji) and Deputy Director of Forestry (Agus Priambudi) and the CSG Chairman (Grahame Webb) (Fig. 2; Annex 2). The meeting was a very amicable one with all participants showing strong concern for and commitment to the conservation and management of Indonesia's crocodilians. The management context in Indonesia is particularly challenging, because it is comprised of some 17,000 islands (8000 inhabited) over a vast area, with high diverse cultures, traditions and levels of economic development. Of all the issues at stake, the ongoing conservation of *C. siamensis* was the highest priority for the CSG. The global population is almost completely gone, and the remnant population in Indonesia, only recently found, has global significance.

Figure 2. Initial meeting of the CSG Review Mission (25 August 2014) was at the Ministry of Forestry (Jakarta) involved representatives from Indonesia's Ministry of

Forestry (KK-PHKA), Research Center for Biology (LIPI), Crocodile Farmers Association, and the IUCN-SSC Crocodile Specialist Group (CSG).

2.1. Ranching and compliance with CITES

The Government of Indonesia acceded to CITES by presidential decree in 1978, and in 1985 was permitted to trade internationally in *C. porosus* skins in accordance with an annual export quota agreed by the Conference of Parties to CITES. However, Indonesia was criticized by the international community for failing to comply with the requirements for an Appendix-I quota. In response, the Government of Indonesia requested support from the CSG, which conducted a series of reviews with recommendations (Webb and Jenkins 1991; Messel *et al.* 1992; Messel 1993), which ultimately assisted Indonesia with a successful amendment proposal to CITES in 1994 (CoP9. Prop R2; Fort Lauderdale, USA).

The Indonesian proposal accepted by the Parties was reasonably complex, and reflected the diverse contexts across Indonesia in which the conservation and management of crocodilians occur. It was essentially a ranching proposal, restricting use of the wild population to eggs and juveniles, under the then ranching Resolution Conf. 3.15 [now Resolution Conf. 11.16 (Rev. CoP15)], but it also included "special conditions" allowing some wild harvest for skins of larger animals, even though at that time a specific resolution (Resolution Conf. 8.22) discouraged the introduction of a wild harvest within a program approved under the ranching resolution. However, the Parties found the case put forward by Indonesia to be a compelling one.

According to the proposal agreed by the Parties (Section A, Proposal and Rational; Section 433, Harvest Regulations), the Indonesian program that resulted allowed the following:

1. The complete Indonesian population of *C. porosus* would be on Appendix II of CITES pursuant to Resolution Conf. 3.15 (ranching), which would allow the collection of wild eggs and juveniles <80 cm total length. Within Sumatra and Kalimantan these are the only approved harvests.

2. Outside of Papua Province (then Irian Jaya) wild harvesting for skins was prohibited.

3. Within Papua Province, the "special conditions" agreed to by the Parties were that in addition to ranching, a wild harvest of *C. porosus* for skins, subject to quota, would be permitted with a minimum skin size limit of 25 cm belly width (which prevents export of small animals) and a maximum skin size limit of 51 cm belly width (which approximates the female size at

maturity, protects adults and is consistent with the regulations that apply to wild harvest for skins in neighbouring Papua New Guinea).

4. Production through captive breeding could occur throughout Indonesia.

The provisions of Resolution Conf. 11.16 (Rev. CoP15) on ranching obligate Indonesia in various ways:

Regarding changes to the ranching programme described in the proposal to transfer a species from Appendix I to Appendix II.

RECOMMENDS that:

a) Parties achieving or having achieved the transfer of their populations of a species to Appendix II under the provisions of this Resolution limit the manner of exploitation of wild populations to those techniques described in their proposals and not, for example, later initiate new short-term programmes for taking wild animals without notifying the Secretariat;

Regarding monitoring and reporting in relation to species transferred from Appendix I to Appendix II for ranching.

RECOMMENDS that:

a) Annual reports on all relevant aspects of each approved ranching operation are submitted to the Secretariat by the Party concerned, including the following:

i) status of the wild population concerned established by monitoring at an appropriate frequency and with sufficient precision to allow recognition of changes in population size and structure owing to ranching;

ii) number of specimens (eggs, young or adults) taken annually from the wild and the percentage of this offtake used to supply ranching operations; and,

iii) details of the annual production levels, product types and quantity produced for export;

b) The following information should be maintained by the Party and made available to the Secretariat upon request:

i) estimate of the percentage of the annual wild production of eggs, neonates of other life stages taken for the ranching operation;

ii) number of animals released and their survival rates estimated on the basis

of surveys and tagging programmes, if any;

iii) mortality rate in captivity and causes of such mortality;

iv) conservation programmes and scientific experiments carried out in relation to the ranching operation or the wild population concerned; and,

v) estimation of the percentage of the distribution area of the species where the ranching is operating;

Although these requirement of the ranching program are extensive, and compliance with them by many countries is problematic (Jenkins *et al.* 2006), Indonesia met the challenge (see Proposal 421 below) by creating an Indonesian Crocodile Conservation Task Force:

"The Indonesian Crocodile Conservation Task Force (ICCTF) was formed by PHPA decree on 22 December 1991. A high proportion of operational funding comes from the industry. ICCTF has members from LIPI and industry and is a management unit for crocodiles. Responsibilities include co-ordination of monitoring (farms/wild), extension, recording, reporting and enforcement assistance. ICCTF was restructured by PHPA Decree of 27 September 1993, and is functioning with increasing efficiency."

Representatives from the Indonesian Ministry of Forestry (KK-PHKA) confirmed that no wild harvest of *C. porosus* was occurring outside of Papua, but confirmed that there were difficulties complying with the monitoring and reporting procedures of Resolution Conf. 11.16 (Rev. CoP15). These obligations are designed in part to ensure the ranching program continues to generate "conservation advantages" rather than "non-detriment". Indonesia's inability to comply with Resolution Conf. 11.16 (Rev. CoP15) threatens the long term viability of the ranching programme within the country. It is important to note that the last report submitted to CITES was in 2006, nearly 10 years ago.

The review team found that there had been no real contemporary attempt to comply with these provisions in Sumatra or Kalimantan, and that compliance for the program in Papua had been sporadic. Hence the two options are:

1. For Indonesia to review the obligations with a view to reinstating compliance, or;

2. As forewarned in Resolution Conf. 8.22, that Indonesia considers its program may now deserve an unqualified Appendix-II listing, with less stringent reporting, under Resolution Conf. 9.24 (Rev. CoP16).

In recent years the Parties to CITES have become concerned about whether the source codes used on CITES Export Permits truly reflect the production systems used to produce exported products. Concerns about the misuse of source codes was discussed at the 61st meeting of the CITES Standing Committee (SC) in 2011 (SC61 Doc. 27), which lead to the establishment of a SC intersessional working group (WG). At the 62nd SC meeting, the WG submitted Document 26 on source codes adopted at the 16th CoP of CITES (Bangkok, Thailand): Decisions 16.63 to 16.66. This is another area in which Indonesia may well need to review.

Recommendations

It is strongly recommended that Indonesia review the management program as a whole, and the degree to which compliance obligations with Resolution Conf. 11.16 (Rev. CoP15) are or can be met in an efficient and cost-effective way.

As a general index of abundance, the increasing rates of Human-Crocodile Conflict (see below) are consistent with a population of *C. porosus* that is increasing rather than decreasing, but it is important to independently establish the current status of wild populations of *C. porosus* (and *C. novaeguineae*) - are they increasing, decreasing or remaining stable? It is also important to address whether there have been any changes in the size and/or age structure attributable to harvesting, that sheds light on conservation advantage or non-detriment. This can potentially be achieved by various direct survey methods, or perhaps indirect methods, linked to records generated from the ranching and harvest programs (although an increase in record keeping and reporting may be needed).

As part of the review, it is recommended that Indonesia consider:

1. Changes in the ranching program since CITES approved Indonesia's program (1994) need to be reported to the CITES Secretariat.

2. Implementation of monitoring programs for wild populations of *C. porosus* and *C. novaeguineae* subject to ranching and/or wild harvest need to be reviewed and upgraded to ensure compliance with CITES.

3. Improved reporting by farms on the numbers, sizes and species of crocodiles acquired and held, and by tanneries of the species and sizes of skins produced and exported, would add considerably to the ability to comply with CITES reporting requirements.

4. Consideration should be given to whether the current Appendix-II listing under the ranching criteria should be amended to an unqualified Appendix-II listing, despite ranching remaining the primary form of use.

The results of these reviews should allow Indonesia to determine whether to retain their Appendix-II listing pursuant to ranching, or to request a transfer to an unqualified Appendix-II listing. As it stands, CITES annual reports are an important compliance tool and survey program for wild and commercial stocks may need to be designed and managed to make that reporting easier. This may well require high levels of cooperation within Indonesia at National and Provincial levels.

2.2. Conservation of crocodiles in the Lake Mesangat area

Background

Lake Mesangat is part of the Mahakam River system, East Kalimantan Province, Borneo. It is a heavily vegetated freshwater swamp formed at the confluence of several small rivers and creeks from the north (Secgoi and Mesangat Rivers), and east (Telen/Kedang Kepala Rivers). The region around the Lake has experienced extensive deforestation through timber exploitation historically and more recently through habitat modification for palm oil plantations. Only small patches of remnant forest remain. The area was extensively burnt by local farmers and immigrants during the El Nino Southern oscillation events of 1982-1983 and 1997-1998 (Chokkalingam *et al*. 2005).

The lake itself is vegetated with shrubs, grasses (*Salivinia cucullata*, *Eichornia crassipes*) and aquatic vegetation (*Hanguana malayana*, *Leersia hexandra*, *Thoracostachyum sumatranum* and *Scleria* spp.). Exotic species such as water hyacinth (*Eichornia crassipes*) and giant salvinia (*Salvinia molesta*) also exist in the lake along with Amazon sailfin catfish *(Pterygoplichthys pardalis*), and Giant snakehead (*Channa micropeltes*) (Stuebing *et al*. 2015). Water in the swamp is reportedly between 1 and 3 m deep depending on the season.

Despite extensive habitat degradation, the Siamese crocodile (*C. siamensis*) and Tomistoma (*T. schlegelii*) both live in the swamp, and appear to be in "reasonable numbers" compared to elsewhere in the range of both species (Stuebing *et al.* 2015). The Siamese crocodile is particularly significant to Indonesia and to the world. It is listed as Critically Endangered by the IUCN Red list of Threatened Species (2014), because wild populations, once thought restricted to mainland Southeast Asia, are either extinct or very severely depleted.

The population of *C. siamensis* recently found in the Mesangat region of East Kalimantan (Ross *et al*. 1998) is the only known wild population outside of mainland Southeast Asia, and is considered an important stronghold for the global population of this species. While the population within Lake Mesangat is low, estimated at fewer than 30 individuals (N. Behler, unpublished data), it is high relative to other known surviving populations. Furthermore, local

knowledge suggests *C. siamensis* may inhabit other wetlands in the general area of Lake Mesangat.

Tomistoma schlegelii, although listed on Appendix I of CITES, is reasonably widespread in Kalimantan and Sumatra, although invariably at low densities. It is considered Vulnerable by the IUCN Red List of Threatened Species (2014). Tomistoma occurs in Lake Mesangat at densities ranging from 0.2-1.6 individuals/km in flooded forest and open water habitats (Staniewicz 2011). While there is some overlap between the two species within Lake Mesangat, *C. siamensis* primarily occupies freshwater swamps, rivers, and lakes (Cox 2004), while *T. schlegelii* is found mainly in peat swamp forests and adjacent wetlands (Stuebing *et al.* 2006).

The majority of Mesangat wetlands were leased to private enterprise for development into oil-palm plantation by 2007, with PT. REA KALTIM owning the largest area, which is currently under a 30-year lease (Stuebing *et al*. 2015). However, the land within Lake Mesangat itself was unsuitable for oil palm development due to permanent inundation with water.

Due to international concern for the future of the population of *C. siamensis* in Lake Mesangat, REA was contacted by the CSG Chairman to consider potential conservation options. In response to this request, REA restricted development within Lake Mesangat itself and agreed to allocate sections of the lake for conservation (Stuebing *et al*. 2015). In 2009, REA set up a conservation group, Yayasan Ulin (YU), to promote wetland and crocodile conservation. YU also supported work on Tomistoma in conjunction with the CSG's Tomistoma Task Force.

Samarinda meeting

On 29 of August 2014, a meeting was held in Samarinda, East Kalimantan, between the CSG review team and the provincial forestry department (BKSDA), to discuss options for further protection of Lake Mesangat.. The local government held the belief that the population in Lake Mesangat was a consequence of captive release by crocodile farmers, but no evidence to substantiate these claims is known. All available evidence supports the view that *C. siamensis* was native to Indonesia and may have been more widely distributed historically (Ross *et al*. 1998). The conservation significance is thus very much a global one rather than a local, provincial or national one. This species is virtually extinct in Thailand and Vietnam, and is represented by a few small, remnant wild populations in Cambodia and Laos.

Options for enhancing the protective status of Lake Mesangat were discussed. They included designation of Lake Mesangat as an *Essential Ecosystem* under Indonesian law, which would still enable local people to utilize the area, or a

Conservation Area, which results in total protection and exclusion of fishing and other activities carried out by local people. The responsibility for such a declaration lies mainly with BKSDA.

One of the issues discussed was that *C. siamensis* is currently not recognized as one of the 14 'Priority Species' for conservation by the National Ministry of Forestry, making it more difficult bureaucratically to prioritize protection. However, the list of Species of Importance has recently been reviewed and now includes 25 species, one of which is *T. schlegelii*. The case for adding *C. siamensis* is very compelling indeed, and its exclusion to date may simply reflect the relatively recent discovery of the species in Indonesia. [Subsequent to the mission it appears the process to get *C. siamensis* listed as a priority species for conservation within Indonesia is underway: see Annex 3]

As happens often with crocodilians around the world, species that are not part of economically viable utilization programs tend to be relegated to a lower conservation and management priority by local government relative to those in trade or with the potential to be utilized as a commercial resource.

Lake Mesangat visit

The following day (30 August 2014) the CSG review team travelled to Lake Mesangat, arriving at the Yayasan Ulin office in Muara Ancalong, from where it departed by boat to a floating raft at Long Toh, in the southwest corner of Lake Mesangat (Fig. 2).

Due to the unavailability of some provincial government officials at the Samarinda meeting, Widodo Ramono remained in Samarinda to arrange a meeting with them. In Muara Ancalong village, the team met an elderly woman who had been keeping a *C. siamensis* as a pet, in a wooden box, for over 20 years. The crocodile was 2-2.5 m long and was captured from the wild as a hatchling. She informed us that the individual sometimes produces eggs.

A spotlight survey of Lake Mesangat swamp and the adjacent peat swamp forest was conducted by the CSG review team, including representatives of KK-PHK and LIPI, with assistance from Yayasan Ulin staff and local fishermen. The survey was undertaken in Bakung to the north-west of Long Toh (Fig. 3).

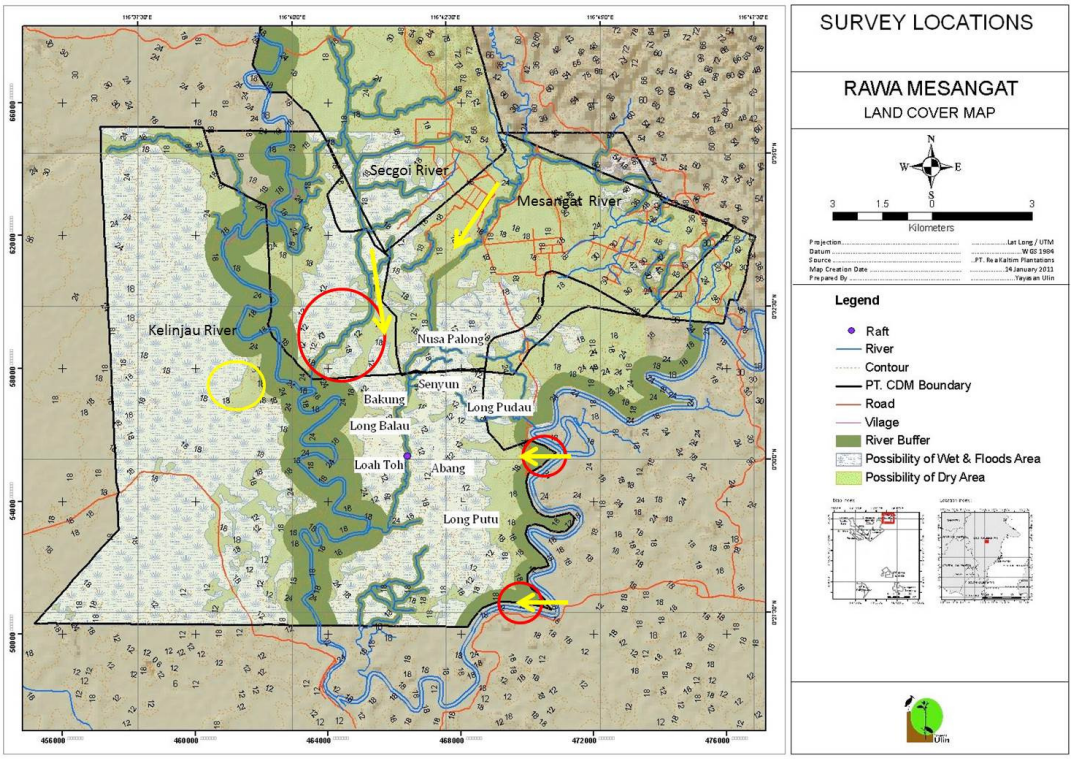

Figure 3. Lake Mesangat and surrounding river systems. Yellow arrows indicate important water flows into Lake Mesangat. Yellow circle indicates inaccessible swamp with potential for *C. siamensis*. Red circles indicate reported habitat modification to restrict or divert water flow in to the lake. Source of initial map: Staniewicz 2011.

Five individuals were sighted, including two *C. siamensis* (30-40 cm total length) and 3 eyeshines in the open lake area. One 30-40 cm juvenile *C. siamensis* was captured by hand (Fig. 4). It was noted during the survey that the lake was heavily congested with aquatic vegetation.

Figure 4. Juvenile *C. siamensis* captured during spotlight survey of Lake Mesangat.

The following day (31 August) the team met with and interviewed a number of people from the local villages surrounding the lake (Benoa Baru Village in Abang, Temaring Village in Sekgoi). They reported that the water level in Lake Mesangat has decreased significantly over recent years making it difficult for fisherman to access parts of the lake except during times of flooding.

Local fishermen that were interviewed believed reduced water levels were linked to reduced fish numbers, and both were due to restricted water flow from dams being constructed by REA in two tributaries that enter Lake Mesangat from the southeast corner.

In an interview conducted with a Yayasan Ulin employee, it was explained that local people thought REA was building dams and diversion canals to dry out the lake for increased oil palm plantation, which is a matter of considerable concern to them (and to the CSG).

Many local fishermen are upset with these activities, but are scared to say much for fear of reprisal. However, they report daily fish catches have reduced by up to 90%, to the extent that a number of local fishermen have had to change profession due to the lack of fish. On top of this, people from outside the area are coming into the lake, when water levels are low, and engage in electro-fishing, further reducing fish stocks. Whether the electro-fishing adversely affects the crocodiles is unknown.

Members of the group (MB, BS, LM) were taken to one tributary by boat where they found a high bank constructed in the middle of the waterway, which had reduced water flow into Lake Mesangat and redirected it along ditches into an adjacent oil palm plantation.

The remains of a dam and two bridges constructed from large logs and earth were observed in this river (Fig. 5). A dam was reported to have been built in the other tributary, although it was not observed by the team.

Indonesian law does not allow agricultural development within 50 m of a river (buffer zone). However, it is unclear whether the Lake Mesangat wetland portion of the area is officially designated as a river.

Figure 5. Tributary that flows in from the east to Lake Mesangat. Remnants of a dam washed away during recent flooding. The northern bank had reportedly been extended and built up, which effectively constricted flow into Mesangat.

Local people from the village to the immediate north of Lake Mesangat claimed that a large channel had been created by PT. Cipta Davia Mandiri, a branch of REA, to divert water flow from the Secgoi River away from Lake Mesangat. Apparently it was constructed to benefit local people by providing access back and forth with the main river: the canal was not observed by the team.

Local fishermen reported *C. siamensis* in the Secgoi River to the north of the Mesangat wetlands and thought, but could not confirm, that they existed in another relatively inaccessible freshwater swamp to the west of Lake Mesangat and in the Kelinjau River (Fig. 3). They reported a couple of non-fatal attacks by *C. siamensis* on humans. In one instance, a small (1-1.5 m long) crocodile bit a fisherman on the leg when he stepped on it while retrieving a fish trap.

While no direct hunting or trade in crocodilians is believed to occur within Lake Mesangat, Stuebing *et al.* (2015) reported that local people raided nests of both

C. siamenis and *T. schlegelli* and sold the eggs for food. We were informed by Yayasan Ulin representatives that local fisherman regularly encountered both species of crocodile in the lake, capturing them incidentally in fishing nets and on fishing lines. While animals will occasionally drown in fishing nets, they are usually released by the local fishermen, who believe it is bad luck to interfere with or kill crocodiles.

Recommendations

To ensure the long-term viability of *C. siamensis* in Lake Mesangat area, consideration should be given to:

1. Indonesia represents the last global stronghold for *C. siamensis*, and this species meets all the criteria for listing as a Priority Species for conservation by the Ministry of Forestry.

2. *T. schlegelii* is much more widespread in Indonesia, but there may be advantages in affording the population in Lake Mesangat increased levels of protection, hand in hand with *C. siamensis.*

3. Habitat modification and destruction at Lake Mesangat for oil palm plantation should cease as a matter of urgency.

4. The local government should reclaim the area from PT. REA KALTIM and designate it as an Essential Ecosystems Area under Indonesia law.

5. A Conservation Action Plan for *C. siamensis* (but perhaps both species) in the Mesangat area needs to be developed in consultation with relevant stakeholders. This should include ongoing monitoring of population status, and exploratory surveys aimed at determining whether *C. siamensis* is more widespread in East Kalimantan.

6. The CSG should contact the parent company of PT. REA KALTIM with a view to obtaining their ongoing support for improved conservation of Lake Mesangat.

2.3. Management of Human-Crocodile Conflict

At the meeting in Jakarta (25 August 2014), the Ministry of Forestry estimated that throughout Indonesia hundreds of people are killed annually by crocodiles, in particular by *C. porosus*.

The CrocBITE website, which assembles data from various reported sources, lists 279 crocodile attacks in Indonesia between 2007 and 2014, 139 of which

were fatal. The attacks occurred in 27 of Indonesia's 34 provinces. The majority of these attacks were attributable to *C. porosus*, but *T. schlegelii* were responsible for 10 attacks and 4 deaths, and *C. siamensis* for a single non-fatal attack. The CrocBITE figures are based on online reports, and given the remoteness of many communities, underestimates the numbers of attacks.

Within the CrocBITE data, East Kalimantan had the highest number of reports (40 attacks, 25 deaths), followed by East Nusa Tengarra, which includes West Timor (28 attacks, 14 deaths), Bangka-Belitung Islands off Sumatra (33 attacks, 11 deaths), Riau in Sumatra (25 attacks, 12 deaths), Lampung in Southern Sumatra (19 attacks, 9 deaths), followed by Central Kalimantan and West Kalimantan (each reporting 12 attacks resulting in 7 deaths). The majority of people were attacked while fishing (36.8%), bathing (17.6%) and swimming (14.7%). The highest fatality rates came from the 1-10 year old and 11-20 year old (children and teenagers) age groups. Within Indonesia, financial compensation is provided for the victims killed and injured or that suffer permanent disability as a result of HCC.

The Indonesia Forestry Department considered that the numbers of people attacked in the Provinces of East and West Nusa Tenggara, which includes West Timor and Flores, had increased significantly in the last 5 years and was something of a "hotspot" for attacks. In the adjoining nation of Timor Leste (East Timor), the frequency of crocodile attacks on people is also reported by the Timor Leste Government to be increasing. CrocBITE lists 45 attacks resulting in 37 deaths between 2007 and 2014.

Currently, management of problem crocodiles in Indonesia is guided by National Government Regulation No. 7 (1999): Preservation of Plants and Animal Species, Chapter VII, Article 27: Animals which Endanger Human Life:

1) *Animals, which in certain circumstances, escape from their habitat and endanger human life must be herded or captured alive to return them to their habitat, or if it is impossible to release them into their habitat, the animals must be sent to a conservation organization/institution for keeping in captivity.*
2) *However, if the procedure as meant in paragraph (1) cannot be carried out, the animal, which is directly a threat to human life, can immediately be killed.*
3) *For a protected animal capture and killing as meant in paragraph (1) and paragraph (2) is carried out by an official.*
4) *Further principles concerning the treatment of an animal which endangers human life as meant in paragraph (1), (2) and (3) is regulated by the Minister.*

While in some instances, crocodiles that have attacked humans have been killed, the majority of crocodiles responsible have been relocated to national parks (Fig. 6) or placed in farms. The problem with relocation to national parks is that *C. porosus* is capable of returning long distances to their original capture location (eg Read *et al.* 2007). Relocated individuals are now known to become highly mobile after release, and are considered more dangerous, as they are using more energy, need more food, and transit through areas where crocodiles are rarely encountered (Webb and Manolis, unpublished data).

Deriving management options for reducing HCC throughout Indonesia is clearly a challenging task, made more difficult in some areas by cultures that see people and crocodiles as relatives of each other. Many people believe it is bad luck to kill crocodiles.

Figure 6. Crocodiles that come into conflict with people are often captured (a) and either relocated to a national park (c), or placed in a farm. Signs (b) placed in high use areas warning of the dangers of crocodiles are important. (Images courtesy of KK-PHK).

While it is assumed by authorities that the populations of wild *C. porosus* in Indonesia and Papua are stable or increasing, based on the number of attacks, there are no survey data allowing this assumption to be tested or verified. There does not appear to be any real pressure on populations of *C. porosus*, and the killing of real or potential nuisance animals is apparently rare. Crocodiles that are captured in fishing nets or are otherwise causing problems are sometimes

collected and or captured by the Conservation officers within the Ministry of Forestry and either relocated or sent to farms.

However, farmers report that it often requires many months to acclimate these animals to captive conditions, especially if they are injured during the capture process. The cooperation of farms as receiving stations for relocated problem animals is constrained by current laws restricting commercial use to F1 generated stock: that is, problem animals on farms can only be used for captive breeding. Several farms have also reported that they are now unable to receive further individuals as they are at full capacity.

Recommendations

The livelihoods of many people living in many different parts of Indonesia depend on regular use of waterways for transport, fishing, bathing, washing and drinking. Given these same areas are or may be inhabited by *C. porosus*, the potential for HCC, causing death or injury, is higher than in countries where much less use of waterways takes place.

Mitigating the risk of HCC in the variable Indonesian contexts in which it occurs is clearly a challenging task, and no simple, nationwide solution can be suggested. Therefore, consideration should be given to mitigating the risk through:

1. Removal of large *C. porosus* from urbanized or high use areas.

2. Abandon the practice of relocating *C. porosus* once they have been captured given the overwhelming evidence that many return to the site of capture after relocation.

3. Establish a central register for HCC problems, mainly with *C. porosus* but also with *T. schlegelii*, so that management solutions can keep track with a better understanding of the problems.

4. Amend Indonesian restrictions that only F1 captive-bred stock can be harvested for skin or other products by farms, so that problem crocodiles can be marketed.

5. That when basic information on HCC are compiled, that Indonesia host a National workshop on Human-Crocodile Conflict, similar to those that have been held in Malaysia in recent years, in which national approaches to HCC can be refined.

2.4. Improving farm productivity

Indonesia has a Crocodile Farmers Association (ICFA), the current chairman of which is Erik Wiradinata (Raflo, PT. Ekanindya Karsa). There are at present 15 crocodile farming facilities within Indonesia, located in Medan, northern Sumatra (UD. Alian Ruswan, PT. Yakita Mulia, PT. Pelita Alam Lestari), Riau Islands (PT. Perkasa Jagat Karunia), southern Sumatra (CV. Budiman), Jakarta (PT. Ekanindya Karsa; CV. Anugerah Maro Permai; CV. Ramlie), western Java (Perum Perhutani), eastern Kalimantan (PT. Makmur Abadi Permai; CV. Surya Raya; PT. Harapan Kaltim Utama), and Papua (CV. Bintang Mas, PT. Lucas Croco, CV. Mitra Lestari Abadi).

Four farms were visited by the CSG with representatives of LIPI during the review. These included PT. Ekanindya Karsa (Jakarta: 25 August), UD. Alian Ruswan (Medan: 26 August), PT. Yakita Mulia (Medan: 27 August) and CV. Surya Raya (Kalimantan: 28 August).

All farms have large communal breeding pens, and some have single pair breeding. Low numbers of hatchlings and skins are produced each year relative to the number of breeding adults held in captivity, due to high levels of infertility and hatchling mortality on most farms.

Unitized concrete pens are used for raising stock at the final stage of production just prior to culling. All farms are required by Indonesian regulations to process skins through to the wet blue stage. This may actually reduce the value of those skins to the tanneries seeking *C. porosus* skins because they prefer to control the entire tanning process. Farms are not allowed to use F1 stock for skins according to Indonesian law. Food on most farms is fish or chicken.

Farming in Papua has become problematic with little infrastructure and declining food supply as more and more fish are required to feed the growing population of people. It was reported that a security problem exists with local people stealing crocodiles from farms and then reselling them to farms.

In 2014, Indonesia reported to CITES, export quotas for wild taken *C. novaeguineae* of 13 500 skin products (22 000 in 2013) and 8 500 ranched skin products; and for *C. porosus*, 9 300 skin products in 2014 (15 000 in 2013).

Although ranching is permitted throughout Indonesia, the extent of ranching outside of Papua and West Papua Provinces remains unclear. The majority of *C. porosus* nesting occurs within the borders of National Parks outside of Papua, where ranching is not permitted. No data are available for numbers of animals ranched from the wild throughout Indonesia.

Farms visited

PT. Ekanindya Karsa (Jakarta): established in 1990, the business raises crocodiles through to finished product (belts, handbags, etc.) on site. It also have a small transit farm in Papua for ranched *C. novaeguineae*. Current raising stock of 3000 *C. porosus* (captive raised) and 1000 *C. novaeguineae* (ranched), with 700 adult *C. porosus* (480 female) and 12 adult *T. schlegelii*. An average of 3000 *C. porosus* eggs are laid each year, of which 800 (27%) are fertile and 640 (21%) produce hatchlings. Between 500-600 *C. porosus* skins are exported annually at a total length of 150-200 cm. See Fig. 7 below.

Figure 7. Facilities at PT. Ekanindya Karsa (Jakarta) showing adult breeding ponds (a), hatchling raising enclosure (b), juvenile raising enclosure (c), and tannery with skins in wet blue form (d).

UD. Alian Ruswan (Medan): established in 1990s. Current raising stock of 20,000 *C. porosus* (captive raised) with 3000 adults (2000 female). Egg fertility is reported at 60% with an average of 8000 hatchlings produced annually. A total of 2000-3000 skins are exported annually at a total length of 180-230 cm. Massive infrastructure constructed and experimental trials with different raising pens ongoing. Also trialling single breeding pens (see Fig. 8 below).

Figure 8. Facilities at UD. Alian Ruswan (Medan) showing communal adult breeding ponds (a), single pair breeding ponds (b,c), and incubators (d).

PT. Yakita Mulia (Medan): established 1990s. Current raising stock of 3000 crocodiles includes ranched *C. porosus* and *C. novaeguineae* housed together. There are currently 1000 adult *C. porosus* (mostly male) and 500 adult *C. novaeguineae* (mostly male). However, while adults are mature, no breeding is occurring as breeding pens are currently still under construction. A total of 1000 hatchlings are ranched from Papua annually. Between 300-500 skins are exported annually at a total length of 150-200 cm.

CV. Surya Raya (Kalimantan): established in 1990s. The farm contains large numbers of adult *C. porosus* in communal pens, along with a small group (24) adult *C. siamensis* and 14 adult *T. schlegelii* (2 females). A total of 700-800 eggs are laid each year with 300-500 hatching (37-63%). A total of 300-500 skins are exported annually at a total length of 150-200 cm.

General observations made by the CSG Review Team about farm production were:

a. Better control of egg temperatures before collection (high nest temperatures due to the vegetation provided to females for constructing nests may be a problem) and during incubation. Avoiding high temperatures (>33ºC) may help reduce embryo mortality.

b. Provision of hide areas for hatchlings up to one year of age, and the provision of variable environmental temperatures (24-36ºC) within enclosures, may help reduce the numbers of hatchlings that fail to thrive.

c. Organize a veterinary workshop to extend to farmers such new information that may exist on the treatment of common diseases and other constraints on health.

d. Review the efficiency and effectiveness of captive breeding technologies and possible constraints on single breeding pairs or smaller breeding groups due to inadequate visual barriers in enclosures, especially around designated nest sites.

e. Review the economic ramifications of the current laws prohibiting the export of raw skins. Raw skins generally command higher prices than skins exported at the wet blue stage (currently required under current Indonesian law).

f. Review the extent to which the farming industry, as key stakeholders in the management program, may be able to contribute more to national management obligations particularly monitoring.

2.5. Future Actions

The CSG Review Mission was the first conducted for over 20 years. It was limited in scope, and in addition to examining issues pertaining to CITES, the mission tried to focus on options for improving the conservation of the critically endangered *C. siamensis,* in the one location from which it is known, a single area of swamp in East Kalimantan (Lake Messangat). The growing problem of Human-Crocodile Conflict was a further and serious national problem

It is recommended that:

1. The CSG be send another representative to Indonesia to discuss the findings of this report with Indonesian authorities, and seek guidance from Indonesia about how and if the CSG can further assist with any of the recommendations.

2. In preparation for that meeting, it would be helpful if Indonesia could assemble more information on Human-Crocodile Conflict and potential strategies for reducing risks.

3. Bring the current status of Lake Mesangat to the attention of the broader IUCN community, in the hope that international support will assist Indonesia in taking actions to conserve the small but important population

of *C. siamensis* in Lake Messangat.

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ANNEX 1: Timetable for CSG Fact Finding Mission

Grahame Webb (GW), Widodo Ramono (WR), Bruce Shwedick (BS), Matthew Brien (MB), Lonnie McCaskill (LM). Itinerary for BS between 4 and 16 September is within Annex 4.

Day	Date	Notes
1	Sat 23 Aug	BS and LM arrive Jakarta (2330 h)
2	Sun 24 Aug	GW and MB arrive Jakarta (1405 h and 0825 h respectively) Participants meet at Hotel Ibis
3	Mon 25 Aug	AM: meeting with KKH-PHKA (CITES Management Authority), LIPI (CITES Scientific Authority, and ICFA PM: visit to Ekandinya Karsa (farm) with Erick and Rachmat Wiradinata
4	Tue 26 Aug	Depart for Medan (morning), and visit Alian Ruswan (farm)
5	Wed 27 Aug	AM: meeting with BBKSDA Sumatra Utara PM: depart to Jakarta
6	Thu 28 Aug	AM: GW departs for Australia; WR, BS, MB, LM depart to Balikpapan PM: Visit Surya Raya Crocodile Farm with Adrian and Tarto Sugiarto; depart for Samarinda; meetings with Mr. Yohanes Hendradi (BKSDA) and Governor Awang Faroek, Yasiwa
7	Fri 29 Aug	AM: depart for Desa Kelinjau Village PM: meet with Yayasan Ulin (Soeimah Darmanshah) and REA (Sophie Persey and Ade Irvan); leave for Raft/Rakit; spotlight survey of Mesangat
8	Sat 30 Aug	AM: daytime survey of Mesangat PM: depart for Desa Kelinjau Village, overnight in YU lodgings
9	Sun 31 Aug	AM: leave for Samarinda. PM: leave for Balikpapan
10	Mon 1 Sep	WR, MB and LM depart for Jakarta; BS departs for TPNP and DSNP
11	Tue 2 Sep	MB departs for Australia
12	Wed 3 Sep	LM departs for USA
26	Tue 17 Sep	meeting with BS, WR and representatives of PKKA, ICFA
27	Wed 18 Sep	BS departs for USA

ANNEX 2: Jakarta Meeting Participants

Bambang Dahono Adji, Director of Biodiversity Conservation, Ministry of Forestry (bambang_bda@yahoo.com); Agus Priambudi, Deputy Director of Program and Convention, Ministry of Forestry (agus.priambudi61@gmail.com); Dr. Rosichon Ubaidillah, Head of Zoology Division, Research Center for Biology - LIPI (ubaidillah003@yahoo.com); Widodo Ramono, Yayasan Badak Indonesia (widodoramono@yahoo.com; wramono@badak.or.id); Badi'ah, Head of Convention Division, Ministry of Forestry (badi_phka@yahoo.com); Dr. Amir Hamidy, Research Center for Biology - LIPI (hamidyamir@gmail.com; amir.hamidy@lipi.go.id); Awal Riyanto, Research Center for Biology - LIPI (awal_lizards@yahoo.com); Hellen Kurniati, Research Center for Biology - LIPI (hkurniati@yahoo.com); Sri Ratnaningsih, Ministry of Forestry (sr.ratna@gmail.com); Agung Nugroho, Ministry of Forestry (agnugroho@gmail.com); Mugiharto, Directorate of Conservation Area and Protected Forest, Ministry of Forestry; Erick Wiradinata, Indonesian Crocodile Farmers Association (appbi@yahoo.co.id); Adrian Sugiarto, PT. Surya Raya (Crocodile Farm) (ckintegritas@gmail.com); Prof. Grahame Webb, Chairman IUCN-SSC Crocodile Specialist Group (gwebb@wmi.com); Lonnie McCaskill, CSG Regional Chairman for East and Southeast Asia (lonniem@centralfloridazoo.org); Bruce Shwedick, Chairman CSG-Tomistoma Task Force (bshwedick@aol.com); Matthew Brien, CSG (matthew_brien@hotmail.com).

ANNEX 3: Follow-up Meeting (Jakarta), 17 September 2014

On 17 September 2014, after one CSG Review Team member (Bruce Shwedick) returned from additional site visits in Kalimantan where the CSG-Tomistoma Task Force has been assisting various research and survey programs with *Tomistoma schlegelii*, a follow-up meeting was convened at the offices of the Ministry of Forestry (Jakarta). It was attended by Bambang Dahono Adji, Agus Priambudi, Agung Nugroho, Widodo Ramono, Erick Wiradinata, Adrian Sugiarto, Fajria Novaril and Bruce Shwedick.

Following general discussions about the shared experiences during the review and additional site visits, Bambang Dahono Adji (Director KKH-PHKA) presented a letter to Widodo Ramono, in his capacity as a representative of the CSG, indicating that *C. siamensis* would become a "priority species" for conservation in Indonesia. This letter was also being sent to the other relevant ministries and Government agencies in Indonesia.

The meeting was also informed that Agung Nugroho, Species Coordinator for the Ministry of Forestry, is now the key individual responsible for conservation actions related to *C. siamensis* within Indonesia. Part of the responsibility allocated to Agung Nugroho is the organization of a workshop focused on the conservation of *C. siamensis* and its remaining habitat in East Kalimantan.

Bambang Dahono Adji expressed his appreciation to the CSG, and the CSG members likewise thanked the Ministry of Forestry, LIPI, ICFA and the Sugiarto and Wiradinata families for their assistance, encouragement and hospitality during the review mission. The listing of *C. siamensis* as a "priority species" for conservation in Indonesia is an important step forward to the goals of the CSG Review Mission. It is now accepted within Indonesia that securing the ongoing survival of this species is a national priority, with global biodiversity conservation significance.

ANNEX 4: Site visits associated with ongoing *Tomistoma schlegelii* conservation

1. General

Following the CSG Review Mission to Lake Mesangat, in East Kalimantan, one of the CSG Review Members [Bruce Shwedick, Chairman of CSG-Tomistoma Task Force (CSG-TTF)] undertook site visits to two National Parks in which ongoing research on *T. schlegelii* is or has been conducted, with support from the CSG-TTF. At Danau Sentarum National Park (DSNP), in West Kalimantan (Fig. 1) he was accompanied by Imanul Huda, Director of an Indonesian NGO [People Resources and Conservation Foundation (PRCF-Indonesia)] and a member of the CSG and its CSG-TTF. Mr. Huda is a co-author of a report on Tomistoma abundance in parts of West Kalimantan (Bezuijen *et al*. 2004), supported by the CSG-TTF, and an investigator for the current DSNP/PRCF Tomistoma project, also supported by the CSG-TTF (Suriansyah *et al*. 2014). At Tanjung Puting National Park, he was accompanied by the Park's Director, Insan Kamil, and members of his staff, which included a Tomistoma researcher, Budi Suriansyah.

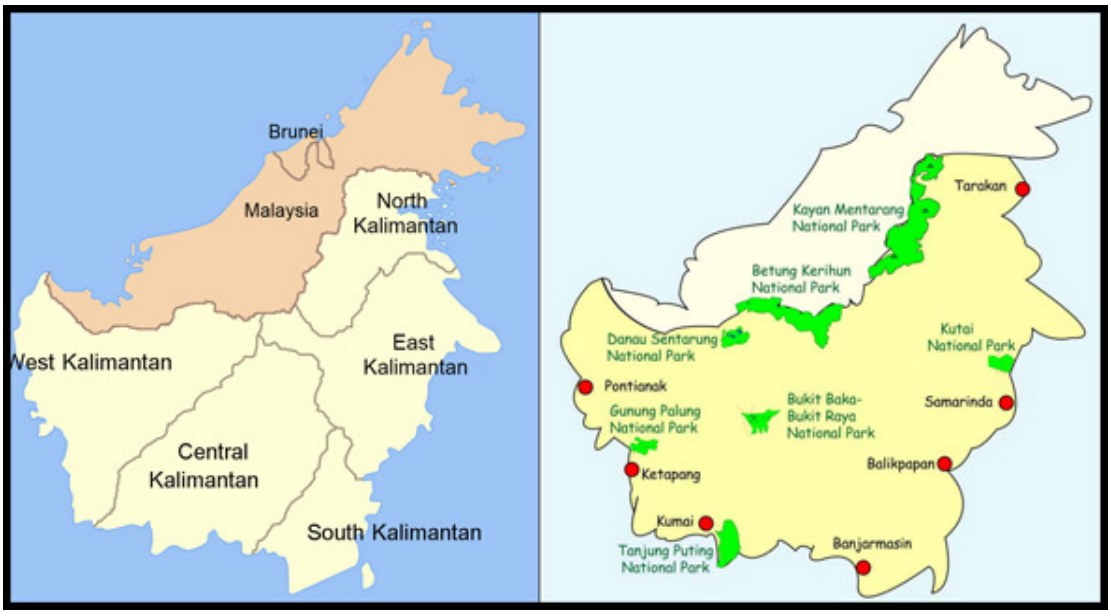

Figure 1. Location of Provinces and National Parks visited.

2. Site Visit to Danau Sentarum National Park

Danau Sentarum National Park (DSNP) is located in the north-east portion of the Province of West Kalimantan (Fig. 1). It comprises a series of vast, interconnected freshwater seasonal lakes, river channels, fresh water and peat swamp forest, amidst isolated hills covered in dry lowland forest within the floodplains of the Kapuas River (Fig. 2).

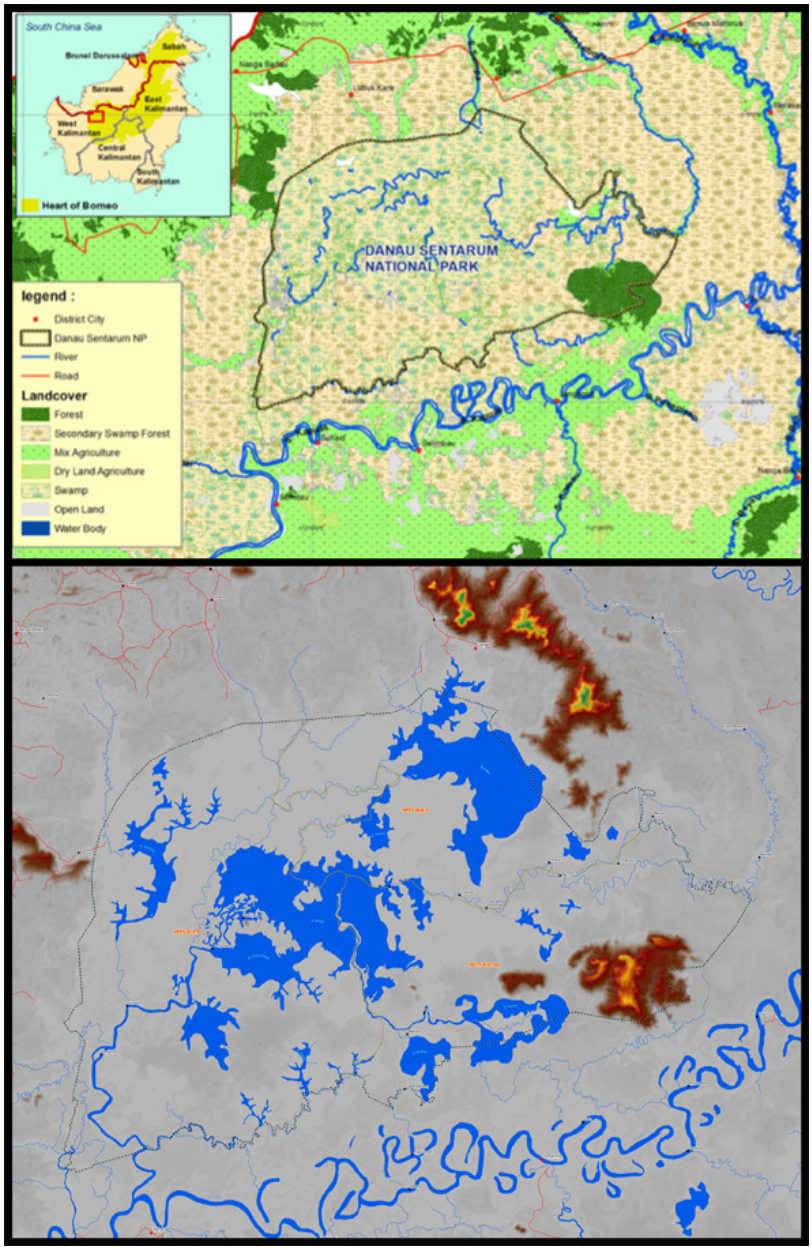

Figure 2. Overview of Danau Sentarum National Park, West Kalimantan.

Water levels in the park rise up to 12 m during wet seasons. Almost 50% of DSNP consists of swamp forest (Bezuijen *et al*. 2004) (Giesen and Aglionby 2000). It is a Ramsar Wetland of International Importance, and one of four areas designated for priority conservation action for *T. schlegelii* in the 2010 CSG Crocodile Action Plan (Bezuijen *et al*. 2010).

In 2004 the CSG-TTF, along with the PRCF and National Geographic Television, provided funding for surveys for *T. schlegelii* in DSNP, as well as other areas in West Kalimantan. In 2013, the project "Focused conservation of *Tomistoma schlegelii* in the landscape of Danau Sentarum National Park, West Kalimantan, Indonesia" was established between DSNP and PRCF. The first phase of this project (Suriansyah *et al*. 2014) was funded by the CSG-TTF and PRCF, with CSG-TTF support provided mainly from the Virginia Aquarium and Marine Science Center, the Los Angeles Zoo, the Toronto Zoo and the Crocodilian Conservation Institute.

On 3 September 2014 BS and IH met Ms. Lidia Lilly, Head of DSNP Administration at the DSNP office in Sintang, and Edy Zulkarnaen, Head of the Selimbau Section of the DSNP. BS and IH explained the purpose of their visit and were informed by the administrator that Orangutan and Tomistoma would be designated as priority species for conservation within DSNP in 2015. Despite conservation being a goal throughout the Park, specific zones would now be allocated in which human activities were permitted and not permitted. That evening there was a further meeting at the residence house, in the village of Gudang Hulu on the Selimbau River. The team discussed plans for three days of surveys, and shared experiences and observations of Tomistoma in the wild and in captivity.

DSNP staff described one area within the park where both *T. schlegelii* (3 m total length) and *C. porosus* (1.5 m total length) utilized the same floating mats of vegetation for basking, but were never observed doing so at the same time or on the same day. They said that the Iban people have a pact with the crocodile not to disturb each other, and that they only kill a crocodile if it has attacked a person.

On 4 September 2014, the team travelled by speedboat along with Jepri Irwanto to the Tekenang Field Station, and then on to the Semangit Field Station, on the Leboyan River. Zulkarnaen, the Semangit Village headman and Hermano, a local guide, joined the team and participated in the surveys. A spotlight survey was conducted that night in a longboat with a 3.3 HP motor from 1940 to 0010 h. A total of 5 Tomistoma were observed, ranging up to 2 m in length, in a section of the Leboyan River stretching from the Semangit Village upstream for 5.2 km. GPS locality data were recorded by Imanul Huda.

On 5 September 2014 a Semangit resident named Adeni, recommended an area along the river downstream from the village, where the team might find a Tomistoma nest. A search was conducted by the team that morning (0900-1130 h), but no nest was found. That afternoon (1330-1630 h) the team searched a larger area of peat swamp forest (approx. 700 X 150 m) surrounded on three sides by a bend in the river, which included dry streambeds within the peat forest. The team found burrows and other areas that could be used by Tomistoma for seclusion, such as hollow, fallen logs that had smooth, worn edges. Two sites that

seemed suitable for Tomistoma nesting, based on previous reports, were present but no old or new nests located. Bezuijen *et al*. (2004) suggested that within DSNP, Tomistoma may move to more remote locations during the dry season for nesting, well away from areas of human activity. Zulkarnaen informed us that a fisherman hunting turtles put his foot inside a submerged burrow, similar to those we observed, and was bitten in the ankle by a 3 m long Tomistoma.

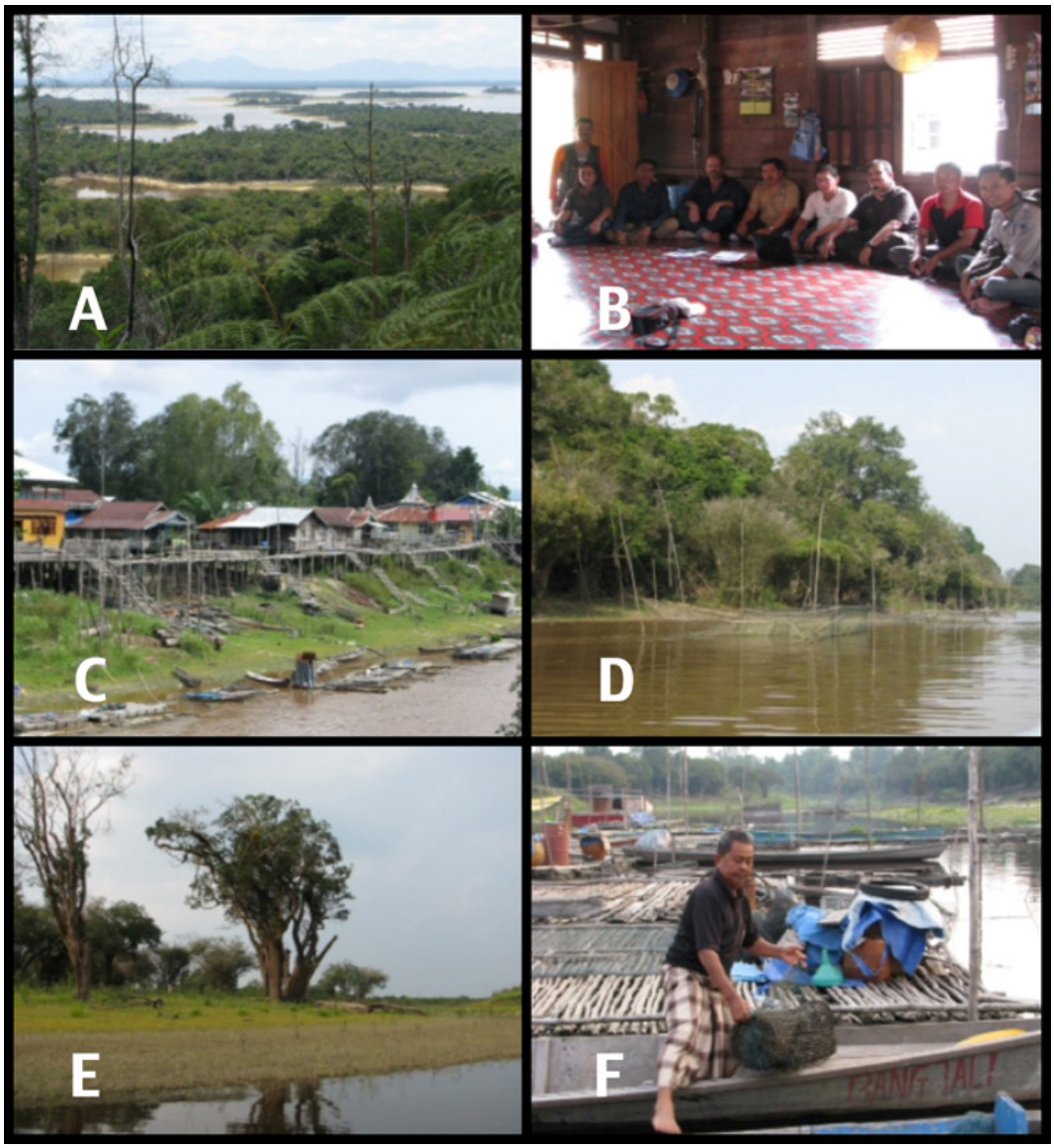

Figure 3. View of DSNP from Tekenang Field Station (A); Team meeting with DSNP Director and staff (B); Semangit Village on the Leboyan River (C); Large fish traps (D); Tengkidap River basking sites (E); Sumbu Fisherman Group leader with juvenile *T. schlegelii* in fish trap (F).

That evening the same team members conducted a spotlight survey from the village upstream for 14 km. Five Tomistoma, similar in size to those observed the night before, were observed but only within 5 km of the village. This included one animal that had been accidentally caught in a large fish trap. Measurements of distance were recorded by GPS along a straight line.

On 6 March 2014, the team met with Hasdin Siregar, Director of DSNP, and members of his staff including Lidia Lilly and Edy Zulkarnaen. The Director discussed plans for monitoring priority species in the park during 2015, which would include intensive monitoring of Tomistoma. He asked the team if a guidebook for Tomistoma was available that could assist them in their efforts to prioritize this species. The following suggestions were made:

a. DSNP could invite field experts to DSNP to provide staff training and assist with the development of protocols for crocodilian monitoring and research.
b. DSNP staff could travel to Sarawak to train with the Crocodile Team of the Sarawak Forestry Department.
c. Tomistoma accidentally caught in fish traps could be included in the monitoring program. If fisherman could be compensated in some way for reporting such captures to park staff, it would allow park staff to collect morphometric data and mark specimens for future identification before release, while increasing the level of engagement with local people.
d. DSNP staff should record opportunistic observations made on Tomistoma and their activities as they do other work.
f. DSNP should consider sending a key staff person to the upcoming Regional Meeting of the IUCN-SSC Crocodile Specialist Group to be held in Siem Reap, Cambodia.

The team travelled by speedboat with DSNP staff to the Tengkidap River and Pengulan Village. Along the way they observed the basking areas near Pengulan Lake, where staff had reported observing both *T. schlegelii* and *C. porosus*: no crocodilians were observed during this daytime survey. A local villager informed the team that a juvenile Tomistoma had recently been captured in a fish trap at the nearby village of Sumbu on the parks boundary. Here they met Aloy, the head of the Sumbu Fisherman Group, who allowed the team to examine and photograph the specimen, and take morphometric data.

Upon returning to Tekenang Field Station that evening the team once again met with the DSNP Director and staff. The director reminded everyone present of the unique situation in DSNP, which has more than 10,000 people living inside its boundaries that are dependent on its natural resources for their livelihoods: fishing, honey collecting, and small logging activities for home construction and maintenance. The team was then asked to present a demonstration on crocodile handling and restraint techniques, using a small taxidermy specimen of Tomistoma kept at the field station as the subject.

Recommendations

1. DSNP could utilize materials previously prepared for West Kalimantan Province (Bezuijen *et al*. 2004) and in Sumatra (eg Bezuijen *et al*. 1997, 1998, 2001) for monitoring Tomistoma populations and for community outreach and awareness programs within DSNP. It is perhaps important to build up a library of known publications on Tomistoma.

2. In coordination with the PRCF-Indonesia team, currently involved with the PRCF/DSNP project for *T. schlegelii*, the Park should try to solicit visitation by national and international experts for additional training and capacity building. Helen Kurniati (LIPI) is very experienced with crocodilian surveys in Indonesia, and there are many people, mostly CSG members, outside Indonesia who may be available.

3. The Tomistoma population within DSNP, where conservation and livelihoods are both priorities, makes a great case history consistent with the recent goals of the Nagoya Protocol, under the Convention on Biological Diversity.

3. Meeting with Provincial Forestry Organization (BKSDA) in Pontianak

On 9 September 2014, BS met with Mr. Sustyo Iriyono, Director of the BKSDA office in Pontianak, West Kalimantan. The opportunity was taken to discuss the CSG Review Mission and the recent site visit to DSNP. One of the main points of discussion was HCC in the area.

It was reported that there have been several fairly recent (2012) incidents of people being attacked and bitten by *C. porosus* in NW Pontianak, but that the injuries were not fatal.

4. Site Visit to Tanjung Puting National Park

Tanjung Puting National Park (TPNP) is located in Central Kalimantan (Fig. 4) and is considered an important refuge for many of Indonesia's endangered wildlife species, due to its expansive coastal tropical heath and peat swamp forests (Galdikas and Simpson 1994; Auliya *et al*. 2006). The CSG-TTF, along with other project sponsors, has provided funding and technical support for *T. schlegelii* research within TPNP, including a short-term assessment of the population in 2005 (Auliya *et al*. 2006) and a study of population ecology in 2008 (Bonke *et al*. 2008).

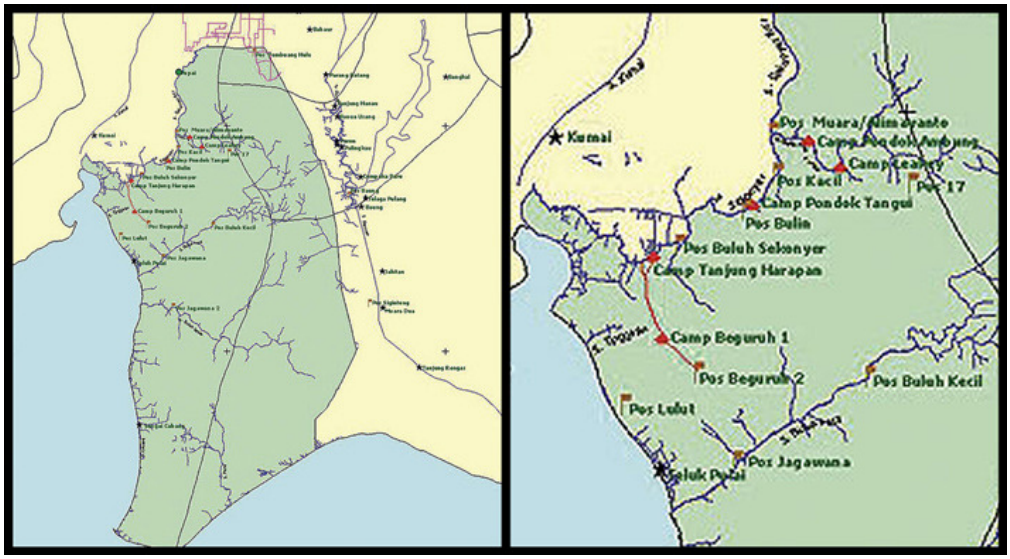

Figure 4. Tanjung Puting National Park with close-up (right) of the northern part.

During the Review Mission BS made a site visit to TPNP with the Park's Director, Insan Kamil, with a Tomistoma researcher, Budi Suriansyah, and with other Park staff, including Lukman Hakim, Darham and Masrani. The primary objective was to determine the degree to which Tomistoma may be able to be incorporated into TPNP's existing tourism and conservation programs and infrastructure, focused primarily on Orangutans. If so, annual monitoring and reporting of *T. schlegelii* population trends within the park and surrounding region could become part of the package used to promote the conservation activities of TPNP. One 3 m *C. porosus* was observed by the team during the day, basking on the bank of the Sekonyer River, several kilometres inside the boundary of the park. The team conducted spotlight surveys on 9 and 10 of September, each evening at 2000 h.

On the evening of 9 September 2014, the team travelled from Camp Leakey on the Sekonyer Kenan, a tributary of the Sekonyer, for approximately 3.7 km, and observed 10 *T. schlegelii* that were <2 m long. Tourist activities clearly included *T. schlegelii,* with several park guests accompanied by a guide, traveling either by longboat or speedboat, locating crocodilians by spotlight and hand-capturing some as well to show the guests. One guide offered to show the team a 1 m long Tomistoma that he had captured, and had inside his boat, wrapped in a towel.

Figure 5. *Crocodylus porosus* observed in the Sekonyer river in TPNP (A); *C. porosus* basking site (B): Houseboats used for tourist conveyance and lodging (C); *T. schlegelii* caught by tour guide (D); Freelance tour guide demonstrating for tourists (E); Releasing *T. schlegelii* (F).

On 10 September 2014 the team conducted a daytime search for nests in a more inaccessible portion of Sekonyer Kenan beyond Camp Leakey. This involved periodically poling and pushing a long boat over patches of dense vegetation. No nests or nesting activity was observed, but during the search a juvenile *T. schlegelii* surfaced next to the longboat and then quickly submerged and swam out of view. In and around Camp Leakey, the team had an opportunity to interview tour guides and the staff of NGO's involved in Orangutan research and rehabilitation, as well as habitat monitoring and restoration, and found that there

was serious interest among them for conducting or participating in Tomistoma monitoring activities. The team also met a group of international tourists who were they were surprised to learn that the crocodiles they had been observing in the park, where members of a truly unique species.

On the evening of 10 September 2014, the team traveled by speedboat from Camp Leakey in the Sekonyer Kenan, a distance of approximately 7.6 km, and then entered the Sekonyer River, travelling upstream for several additional kilometres. Eleven (11) *T. schlegelii* were observed, primarily juveniles: only one was sighted in the Sekonyer River.

On 11 September 2014 before departure, the team photographed two additional juvenile Tomistoma that had been captured by freelance guides during tourist spotlight activities. Several of the park's tour guides released one of the Tomistoma that had been captured the night before, and guests were given an opportunity to witness and photograph or videotape the release.

Recommendations

1. Based on the observations and interviews conducted during the site visit to TPNP, an opportunity does exist to upgrade the use of *T. schlegelii* as an iconic species, and to implement various programs that provide ongoing monitoring indices of the population over time.

2. This program should be developed and managed by TPNP, and include participation from the Park's freelance guides and the NGOs which operate within park borders.

3. With relatively minor changes, increased reporting associated with current activities could provide useful data to assess population trends, document movements, gain further information on the absolute size and structure of the population, and add significantly to our knowledge of natural history and ecology.

6. Meeting with Provincial Forestry (BKSDA) in Pangkalan Bun

On 13 September, BS and TPNP Director Insan Kamil met with Mr. Hartono, at the BKSDA office in Pangkalan Bun. Opportunistically, the team was able to examine the remains of a 5 m long *T. schlegelii* that had died after being captured when it came into contact with people earlier that week in Lamandau. They also observed a live 4 m *C. porosus* held in a concrete water tank in the BKSDA compound, captured after coming into conflict with people and awaiting relocation.

Mr. Hartono explained that the primary focus of this BKSDA facility was controlling forest fires. The BKSDA compound had a temporary holding enclosure for orangutans, but no proper holding enclosure for crocodiles. The tank where the *C. porosus* was being held was a reservoir for water, to be used in forest fire control. The compound, surrounded by a large brick wall, is sufficiently spacious to build a holding facility for large crocodilians, or perhaps even an education facility, given that preventing HCC was the main reason for capturing crocodiles.

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