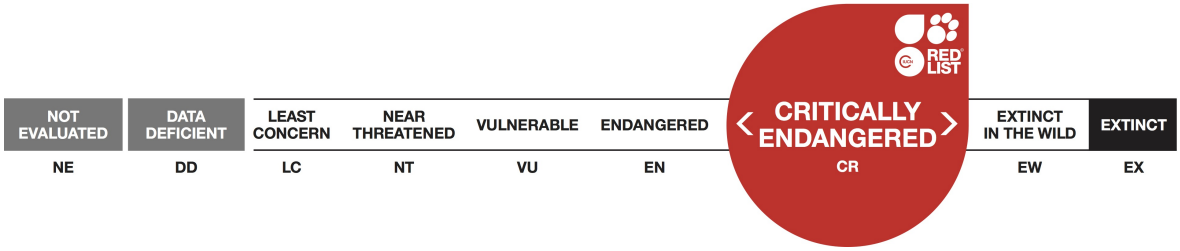
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Crocodylus siamensis, Siamese Crocodile

Assessment by: Bezuijen, M., Simpson, B., Behler, N., Daltry, J. & Tempsiripong, Y.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Reptilia	Crocodylia	Crocodylidae

Taxon Name: *Crocodylus siamensis* Schneider, 1801

Synonym(s):

- *Crocodilus planirostris*
- *Crocodilus galeatus*

Common Name(s):

- English: Siamese Crocodile
- French: Crocodile du Siam
- Spanish: Cocodrilo de Siam, Cocodrilo du Siam

Taxonomic Notes:

The only known extant population of *C. siamensis* outside mainland Southeast Asia, located in East Kalimantan Province (Indonesian Borneo), is genetically distinct and considered an 'Evolutionarily Significant Unit' (Gratten 2003).

Assessment Information

Red List Category & Criteria: Critically Endangered A2cd ver 3.1

Year Published: 2012

Date Assessed: February 23, 2012

Justification:

Crocodylus siamensis is among the most threatened crocodilians. In 1992 it was reported as virtually extinct in the wild (Thorbjarnarson 1992) and in 1996 was accorded the IUCN Red List status of 'Critically Endangered' (Baillie and Groombridge 1996). This status remains unchanged. Field surveys, nearly all conducted since 2000, have confirmed that extant populations persist, but that all are severely diminished and fragmented. Over the past decade new information on the ecology of the species has been documented, although *C. siamensis* remains one of the least known crocodilians. Commercial hunting for the skin trade and collection of live animals to stock crocodile farms, in the mid- and late-twentieth century respectively, are considered to be the principal causes for its decline. Current threats include illegal collection of eggs, juveniles and adults, habitat loss, incidental capture with fishing gear, and the inherent vulnerability of remnant populations due to their small size. This species qualifies as Critically Endangered. Global populations have been severely reduced, almost certainly by over 80% in the past 75 years / three generations (assuming a generation time of 25 years), principally due to hunting. All remnant subpopulations are small and fragmented. Most current threats, including illegal collection and habitat loss or degradation, are ongoing, suggesting that without conservation interventions, extant populations will continue to decline.

Previously Published Red List Assessments

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1996 – Critically Endangered (CR)

1994 – Endangered (E)

1990 – Endangered (E)

1988 – Endangered (E)

1986 – Endangered (E)

1982 – Endangered (E)

Geographic Range

Range Description:

Crocodylus siamensis historically occurred over much of mainland Southeast Asia as well as parts of Indonesia. Its current distribution is greatly diminished and fragmented. Extant populations are in Cambodia, Indonesia, Lao PDR, Thailand and Viet Nam. In Viet Nam, wild populations are possibly extirpated, the first range nation where this has occurred, although a reintroduction programme has been implemented in one site (see below). Most locations occur between 50 and 200 m elevation but localities in Cambodia at Veal Ven Marsh (560 m; Daltry *et al*. 2003) and the upper Tatai River (730 m; B. Simpson pers. comm.) are higher. Summaries of national distribution are as follows.

Cambodia: Field surveys conducted since 2000; confirmed *C. siamensis* localities are from 35 sites in 21 river systems of 11 provinces, mainly in remote parts of southwest and northeast Cambodia (Daltry and Chheang 2000; Daltry *et al*. 2003; Platt *et al*. 2004, 2006; Simpson and Han 2004; Simpson *et al*. 2006a; Timmins 2007; Bezuijen *et al*. 2009). The largest remnant populations are in the Srepok, Sekong, Sre Ambel/Kampong Saom, Pursat, Koi, Kep, Tatai and Areng Rivers and Veal Veng Marsh.

Indonesia: Mesangat Lake in the Mahakam River system, East Kalimantan Province (Borneo), supports the only known extant population outside mainland Southeast Asia (Cox *et al*. 1993, Cox 2004, Ross *et al*. 1998; Kurniati *et al*. 2005). Research in 2010-2011 by N. Behler confirmed the persistence of this population. Unconfirmed local reports of *C. siamensis* are from Central Kalimantan Province (Ross *et al*. 1998). Museum specimens indicate the species historically occurred in Java (Ross 1990, 1992) but given the severe loss of wetland habitats there, it is unlikely any populations remain.

Lao PDR: Field surveys conducted between 2003 and 2008; confirmed *C. siamensis* localities are from nine river systems in five provinces, but extant populations are known from only seven river systems in four provinces (Bezuijen *et al*. in press). Surveys confirmed previous reports (Salter 1993, Sawathvong 1994) that many local populations are now extirpated. Extant populations are in the Xe Champhone, Xe Banghiang, Xe Bangfai and Xe Xangxoy river systems (Savannakhet Province), Xe Pian-Xe Khampho river systems (Attapu Province), Xe Don River (Salavan Province) and Phou Khaokhouay National Protected Area (Bolikhamxay Province) (Bezuijen *et al*. in press). Most wetlands in Lao PDR remain unsurveyed for crocodiles and it seems likely that other *C. siamensis* localities will be documented.

Malaysia: A single reference to a 'fresh-water crocodile' in northern Peninsular Malaysia (Robinson and Annandale 1904 cited by Smith 1919) was considered by Smith (1919) to be 'probably referable to this species'. There are no known records from Sarawak or Sabah (Sebastian 1993). There is no other

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information to suggest that *C. siamensis* occurred in Malaysia.

Myanmar: One record of crocodiles and eggs, from the Mekong River (Garnier 1885 - see Garnier 1996); no other known records, although most wetlands in Myanmar remain unsurveyed for crocodiles (Thorbjarnarson *et al*. 2006). The section of the Mekong in Myanmar (~200 km long) is currently under restricted access and off-limits to international surveys. Google satellite imagery indicates that much of it retains riverine forest and low human densities: it is possible that some crocodiles may persist (Bezuijen *et al*. in press).

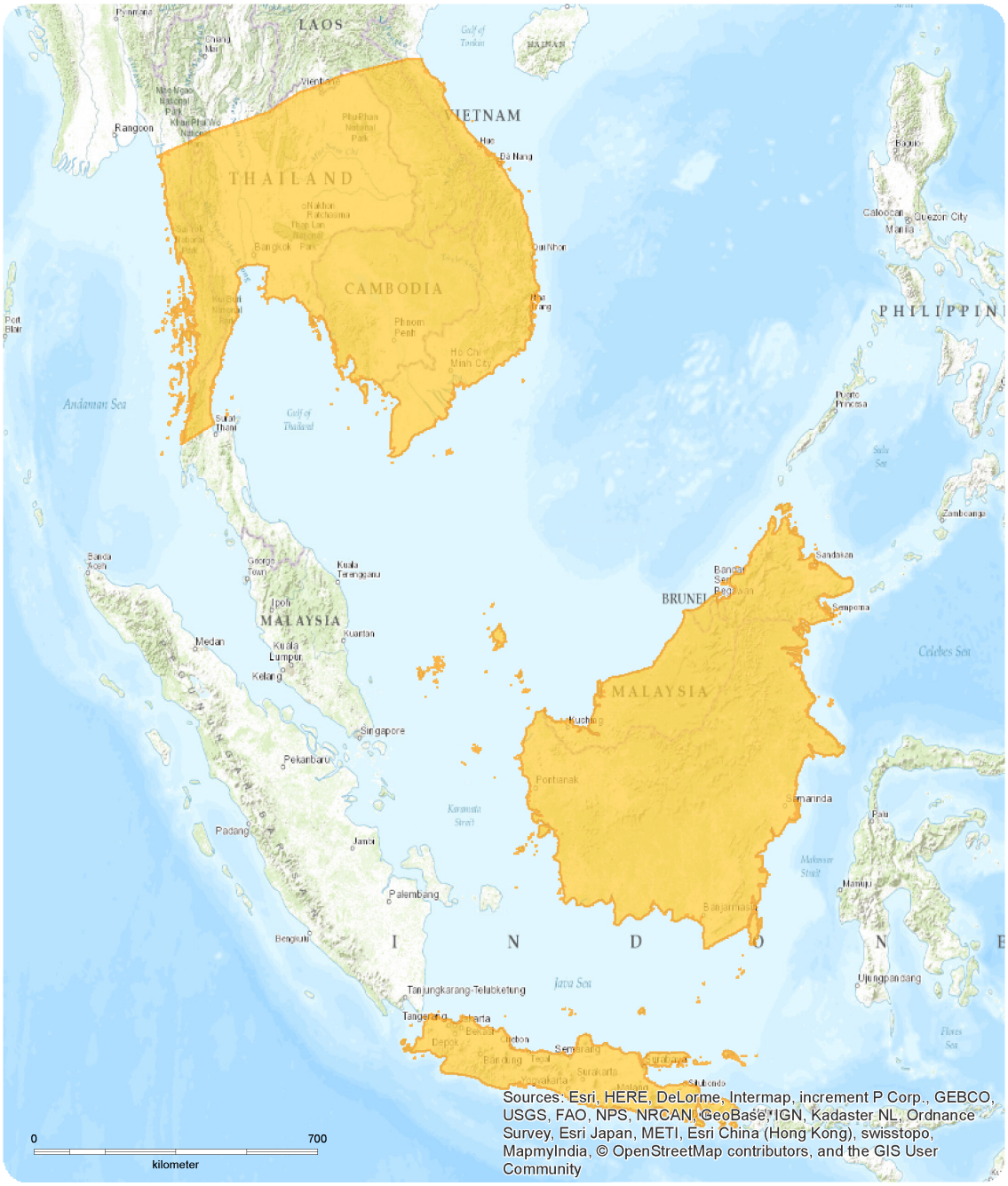
Thailand: Historically common and widely distributed (Smith 1919, Platt *et al*. 2002); extant populations are in a small number of scattered localities in central and western Thailand (Kreetiyutanont 1993, Ratanakorn *et al*. 1994, Platt *et al*. 2002, Temsiripong 2003). Confirmed sites include Pang Sida and Kaengkrachan National Parks (Platt *et al*. 2002, Temsiripong 2003). Viet Nam: Historically present in southern Viet Nam (Cuc 1994, Cao and Jenkins 1998); wild populations possibly extirpated. Surveys over the past two decades have failed to detect crocodiles in sites they were reported to occur (Platt and Tri 2000, Stuart *et al*. 2002) except one site, Ha Lam Lake (Phu Yen Province), where at least two individuals were present in 2005 (Nguyen *et al*. 2005). A single reintroduced population is at Cat Tien National Park (Polet 2006, Murphy *et al*. 2004), where breeding occurs (J. Thorbjarnarson in litt. July 2009, Pahl 2012).

Country Occurrence:

Native: Cambodia; Indonesia (Jawa - Possibly Extinct, Kalimantan); Lao People's Democratic Republic; Thailand

Reintroduced: Viet Nam

Distribution Map



Crocodylus siamensis

NE DD LC NT VU EN CR CRITICALLY ENDANGERED EW EX

Range

Extant (resident)

Compiled by:
IUCN (International Union for Conservation of Nature)



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

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Population

No global population estimate is available for *C. siamensis* and national population estimates are available for only one range state, Cambodia. Between 100 and 300 wild adults may remain in Cambodia, based on footprints and other evidence (Simpson and Han 2006a, Simpson and Bezuijen 2010 and references therein). Lao PDR may support a similar number of adults (Bezuijen *et al*. in press). The largest known population at any single site is 55-60 individuals, in Cambodia (Starr *et al*. 2010), but in both nations most known sites support only one or several individuals. In Thailand, one to several individuals persist in a small number of scattered localities, and nests are sometimes documented (Platt *et al*. 2002, J. Thorbjarnarson in litt. cited in Bezuijen *et al*. in press). In Viet Nam, the species may have been extirpated from the wild but a reintroduced population based on 60 individuals released between 2001-2004 at Cat Tien National Park had an estimated population of 100-150 individuals in 2010-2011. A maximum of 80 non-hatchlings was observed and 10-15 adults estimated (Pahl 2012). At Mesangat Lake in East Kalimantan, Indonesia, mark-recapture surveys in 2010-2011 indicated that fewer than 30 individuals may be present, although nearby areas remain unsurveyed (N. Behler unpubl. data). Wild nests and successful recruitment (i.e. presence of hatchlings) have been documented in all range states, but in low numbers. In Cambodia, nesting has been recorded at 10 localities in eight provinces since 2001, but the number of nest sites is declining and only one to three nests are documented annually (Simpson *et al*. 2006a). Veal Veng Marsh and the Areng River, both in the Cardamom Mountains, hold the largest wild populations, and each produces one to three nests annually (J.C. Daltry unpubl. data). In Lao PDR, nesting has been documented at eight localities but successful recruitment was confirmed at only five sites (Bezuijen *et al*. in press). Of four clutches examined in Lao PDR, three were infertile (Bezuijen *et al*. in press), indicating low female fertility and/or the absence of males. In Thailand, fewer than five wild nests and few hatchlings have been recorded over the past five years, suggesting low clutch fertility (J. Thorbjarnarson in litt. cited by Bezuijen *et al*. in press; Y. Temsiripong unpubl. data). In Viet Nam, hatchlings observed at Cat Tien National Park in 2010-2011 confirm that breeding persists there (Pahl 2012). At Lake Mesangat in Indonesia, juvenile crocodiles have been observed and one nest has been located (N. Behler unpubl. data). On the basis of these limited data, the global wild population of *C. siamensis* may comprise fewer than 1,000 mature individuals.

Current Population Trend: Decreasing

Habitat and Ecology **(see Appendix for additional information)**

Crocodylus siamensis occurs in a wide range of lowland freshwater habitats, including slow-moving rivers and streams, lakes, seasonal oxbow lakes, marshes and swamps (Smith 1931; Daltry *et al*. 2003; Platt *et al*. 2002, 2006; Bezuijen *et al*. in press). During the wet season, individuals disperse across flooded landscapes (one radio-tracked individual in Cambodia moved up to 25 km before returning to a dry season site; Simpson *et al*. 2006b). The species has been recorded up to 600 m elevation (Daltry *et al*. 2003).

Crocodylus siamensis is a medium-sized species, with most individuals attaining a total length of less than 3.5 m (Smith 1919). Nesting ecology is poorly documented and fewer than a few dozen wild nests have been located to date. Wild nests recorded in Cambodia, Lao PDR and Thailand were mounds located on floating vegetation mats or on the banks of lakes or rivers (Platt *et al*. 2006, Simpson *et al*. 2006a, Starr *et al*. 2010, Bezuijen *et al*. in press). Nesting occurs in the late dry season and and wet season. Clutch size observed in wild nests ranged from 11-26 eggs (Simpson and Han 2004, Starr *et al*.

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2010, Bezuijen *et al*. in press). Captive *C. siamensis* produce clutches of 6-50 eggs (Youngprapakorn *et al*. 1971, Platt *et al*. 2011). Hatchlings emerge in the wet season after 70-80 days incubation (Brazaitis and Watanbe 1983, Platt *et al*. 2011, Bezuijen *et al*. in press). Fidelity to nesting sites has been recorded (Simpson *et al*. 2006a).

Similar to many other crocodilians, *C. siamensis* feeds on a wide variety of prey such as invertebrates, frogs, reptiles, birds and mammals, including carrion (Daltry *et al*. 2003, Bezuijen 2010). Other scientific studies of *C. siamensis* have included information on phylogeography and population genetics (Gratten 2003), seasonal sperm cycles (Kitiyanant *et al*. 1994) and the antimicrobial properties of its blood (Merchant *et al*. 2006). Hybridization of captive *C. siamensis* with *C. rhombifer* and *C. porosus* occurs (Chavananikul *et al*. 1994, Thang 1994), and the chromosome number of *C. siamensis* and hybrids, as well as DNA methods to distinguish them, has been identified (Youngprapakorn 1991, Fitzsimmons *et al*. 2002, Srikulnath *et al*. 2012). ..

Systems: Terrestrial, Freshwater

Use and Trade (see Appendix for additional information)

Crocodylus siamensis is listed under Appendix I of CITES. The species is well represented in captivity, with possibly one million individuals in farms in Thailand, Cambodia and Viet Nam (Temsiripong *et al*. 2004; Jelden *et al*. 2005, 2008), and smaller numbers in farms in China and zoos in Europe and North America. In Thailand, 799 farms were operating in 2010 (Getpech 2011). Getpech (2011) reports 552,000 captive specimens in 2010 for Thailand, Sovannara (2011) reports 257,000 in Cambodia, and Truyen (2011) reports 584,000 in Viet Nam. Caldwell (2010) reports 63,500 skins in international trade in 2008. The UNEP-WCMC trade database indicates much higher levels of international trade in more recent years (e.g. in live animals and skins). In 2010, Thailand alone reported exports of 106,039 "heads" (see Getpech 2011). However, the captive population in Indochina includes an unknown number of individuals hybridized with *C. porosus* and *C. rhombifer*, including back-crosses (Chavananikul *et al*. 1994, Thang 1994, FitzSimmons *et al*. 2002, Jelden *et al*. 2008). In Cambodia, more than 900 local crocodile farms or raising facilities with *C. siamensis* are present, mostly at the Tonle Sap Great Lake (Jelden *et al*. 2005, Sovannara 2011). Testing has revealed that many *C. siamensis* on farms in Cambodia are hybrids, and animals from Cambodia have in turn been used to stock farms in neighbouring countries (J.C. Daltry unpubl. data). In southern Viet Nam, over 1,000 crocodile farms and raising facilities with almost exclusively *C. siamensis* are present (Jelden *et al*. 2008, Truyen 2011). In Lao PDR, the only known captive population is at Ban Kuen Zoo, which contains around 1,000 individuals, most of which are suspected to be hybrids (Phothitay *et al*. 2005, Cox and Phothitay 2008). Opportunistic collection of eggs or crocodiles continues in Cambodia, either for local use or sale to crocodile farms (Simpson *et al*. 2006). In Lao PDR, infrequent and low-level trade of captive crocodiles or products has been recorded, although surveys between 2003 and 2008 did not detect any evidence of trade (Bezuijen *et al*. in press). At Cat Tien National Park in Viet Nam, crocodiles are hunted for local consumption (see Threats) but apparently not for trade (Pahl 2012). No hunting or trade of *C. siamensis* has been observed at Lake Mesangat in Indonesia, although it is possible that local residents sometimes collect eggs (N. Behler unpubl. data).

Threats (see Appendix for additional information)

Commercial hunting in the mid-twentieth century for the skin trade is considered to be the principal

cause for the historical decline of *C. siamensis*. Current and ongoing threats in virtually all range states include the illegal collection of eggs and crocodiles, habitat loss and degradation, and incidental capture/drowning in fishing gear. In Cambodia, most river systems with extant *C. siamensis* are targeted for large-scale hydroelectric dams. Construction of some of these dams has already begun and has resulted in the loss of breeding habitat and increased collection and killing of crocodiles (J.C. Daltry unpubl. data). Illegal capture of wild crocodiles to supply local crocodile farms continues in Cambodia. In Viet Nam, over 19 crocodiles were apparently poached at Cat Tien National Park between 2001 and 2012, mainly for local consumption (Murphy *et al*. 2004, Pahl 2012). Potential threats in some or all range states include climate change, the potential hybridization of wild populations due to inter-breeding with escaped hybrids, and the risk of genetic depression due to severely low numbers (Jelden *et al*. 2005, 2008; Bezuijen *et al*. in press). Viet Nam appears to be the first range state where wild *C. siamensis* has been extirpated; in 2006, the last known site to support wild *C. siamensis* (Ha Lam Lake in Phu Yen Province; Nguyen *et al*. 2005) was flooded for construction of a hydroelectric dam. At Mesangat Lake in Indonesia, key threats to *C. siamensis* are the incidental capture of crocodiles in fishing gear and disturbance due to electro-fishing activities (N. Behler unpubl. data).

Conservation Actions **(see Appendix for additional information)**

Most conservation efforts for *C. siamensis* were initiated in the past decade and are relatively recent. More conservation work for the species has been conducted in Cambodia than any other range state, including extensive status surveys and a long-term programme by the Government of Cambodia's Forestry Administration and Fauna & Flora International. This programme has achieved the monitoring and protection of breeding sites, training of ranger patrols, and community-based conservation initiatives (Daltry *et al*. 2006, Simpson and Ratanapich 2007, Simpson *et al*. 2006a). Veal Veng Marsh, the Areng River, and the Sre Ambel/ Kampong Saom River are the focus of enforcement patrols and community-based conservation management, which have demonstrated success in reducing poaching since 2001 (Daltry *et al*. 2006, Simpson and Ratanapich 2007, Simpson *et al*. 2006a, Oum *et al*. 2010). Additional community sanctuaries are planned in northeast Cambodia and a national re-introduction program will be launched in 2012 (Daltry and Starr 2010, Siamese Crocodile Task Force in prep.). Elsewhere, status surveys were conducted in Lao PDR between 2003 and 2008, conservation priorities were identified (Bezuijen *et al*. in press) and a management plan to protect breeding sites was prepared for one province (Cox and Somvongsa 2008). Community workshops were held in 2006 and 2007 to document local knowledge of crocodiles (Bezuijen *et al*. 2006, Mollot *et al*. 2007). Most *C. siamensis* localities in Lao PDR are outside the national protected area system and conservation will rely on community-based approaches. In Thailand, a re-introduction programme was initiated by the Royal Thai Forest Service and Crocodile Management Association of Thailand, with 20 crocodiles released in Pang Sida National Park in 2005 and 2006 (Temsiripong 2001, 2007). Few crocodiles were detected during subsequent monitoring (Temsiripong 2007) and further releases are being considered. Severe flooding in Thailand in 2011 hindered the implementation of some re-introduction plans (Y. Temsiripong pers. obs.). In Viet Nam, 60 captive individuals were released in Cat Tien National Park between 2001 and 2004 (Polet 2006) and the population has been irregularly monitored since then. The most recent surveys (2010-2011) confirmed that the population has increased in size, but that crocodiles continue to be hunted by local residents (Pahl 2012). In Indonesia, Mesangat Lake is owned by an oil palm company, and in 2010 the company entered into a partnership with a local foundation, Yayasan Ulin, to jointly manage habitats at the lake (R. Stuebing in litt.). The large captive populations of *C. siamensis* held on farms (see Use and Trade) represent a potential source for re-introduction programs, and farms in Thailand and Viet Nam have donated *C. siamensis* for this purpose. Genetically pure *C. siamensis* have

been found in captive holdings in Cambodia (Starr *et al*. 2009), Thailand (Srikulnath *et al*. 2012) and Viet Nam (Fitzsimmons *et al*. 2002). At the invitation of range states, the IUCN SSC Crocodile Specialist Group has conducted reviews and recommendations for the trade and management of captive *C. siamensis* and other crocodilians, in Cambodia (Jelden *et al*. 2005), Indonesia (Webb and Jenkins 1991a), Thailand (Webb and Jenkins 1991b) and Viet Nam (Jelden *et al*. 2008).

Credits

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Reviewer(s): Manolis, C. & Stuebing, R.

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External Resources

For Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
5. Wetlands (inland) -> 5.1. Wetlands (inland) - Permanent Rivers/Streams/Creeks (includes waterfalls)	-	Suitable	-
5. Wetlands (inland) -> 5.4. Wetlands (inland) - Bogs, Marshes, Swamps, Fens, Peatlands	-	Suitable	-
5. Wetlands (inland) -> 5.5. Wetlands (inland) - Permanent Freshwater Lakes (over 8ha)	-	Suitable	-
5. Wetlands (inland) -> 5.6. Wetlands (inland) - Seasonal/Intermittent Freshwater Lakes (over 8ha)	-	Marginal	-
5. Wetlands (inland) -> 5.7. Wetlands (inland) - Permanent Freshwater Marshes/Pools (under 8ha)	-	Unknown	-

Use and Trade

(http://www.iucnredlist.org/technical-documents/classification-schemes)

End Use	Local	National	International
Food - human	No	Yes	Yes
Wearing apparel, accessories	No	Yes	Yes
Establishing ex-situ production *	No	No	No

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
2. Agriculture & aquaculture -> 2.4. Marine & freshwater aquaculture -> 2.4.2. Industrial aquaculture	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 2. Species Stresses -> 2.3. Indirect species effects -> 2.3.1. Hybridisation		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.1. Intentional use (species is the target)	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.3. Persecution/control	Ongoing	Whole (>90%)	Slow, significant declines	Medium impact: 7
	Stresses:	2. Species Stresses -> 2.1. Species mortality		

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5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.3. Unintentional effects: (subsistence/small scale)	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.10. Large dams	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
8. Invasive & other problematic species & genes -> 8.3. Introduced genetic material	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	2. Species Stresses -> 2.3. Indirect species effects -> 2.3.1. Hybridisation		
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Future	Unknown	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Systematic monitoring scheme: Yes
In-Place Land/Water Protection and Management
Occur in at least one PA: Yes
In-Place Species Management
Successfully reintroduced or introduced beningly: Yes
Subject to ex-situ conservation: Yes
In-Place Education
Subject to recent education and awareness programmes: Yes
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
3. Species management -> 3.1. Species management -> 3.1.1. Harvest management

Conservation Actions Needed
3. Species management -> 3.1. Species management -> 3.1.2. Trade management
3. Species management -> 3.4. Ex-situ conservation -> 3.4.1. Captive breeding/artificial propagation
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.1. International level
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.2. National level

Additional Data Fields

Distribution
Number of Locations: 5
Continuing decline in number of locations: Yes
Extreme fluctuations in the number of locations: No
Upper elevation limit (m): 730
Population
Number of mature individuals: 500-1000
Continuing decline of mature individuals: Yes
Extreme fluctuations: No
Population severely fragmented: Yes
Extreme fluctuations in subpopulations: No
All individuals in one subpopulation: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 25

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