

New Guinea Freshwater Crocodile

Crocodylus novaeguineae

Jack H. Cox

¹ 2919 Colony Road, Charlotte, NC 28211-2635, USA (jackcoxjr@yahoo.com)

Common Names: New Guinea crocodile, New Guinea freshwater crocodile, buaya air tawar, buaya hitam, freswara pukpuk, blakpela pukpuk, Wahne huala

Range: Papua New Guinea (mainland only), Indonesia (Papua Province)



Figure 1. Distribution of *Crocodylus novaeguineae*.

Conservation Overview

CITES: Appendix II

CSG Action Plan:

Availability of Survey Data: Adequate
Need for Wild Population Recovery: Moderate
Potential for Sustainable Management: Highest

2009 IUCN Red List: LRLc (Lower Risk, least concern. The species appears to remain abundant throughout much of its extensive habitat; IUCN 2009) (last assessed in 1996).

Principal threats: Illegal hunting, habitat disruption

Ecology and Natural History

The New Guinea freshwater crocodile is a medium-sized crocodylian restricted to the island of New Guinea and Pulau Kimaam off the southwestern coast of Papua, Indonesia (Cox *et al.* 2003). Maximum documented adult size is approximately 3 m for females and 3.5 m for males (Hall 1991b), but larger animals and corresponding skins are regularly reported to originate from the Sepik River region.

Hall (1989) described morphological differences in cranial features and scalation between populations north and south of the main cordillera in New Guinea, and their putative similarities to the Philippine crocodile *Crocodylus mindorensis*. This work, and other differences in scalation and reproductive biology suggest that the southern population of *C. novaeguineae* may be a distinct taxon. This could merit DNA research to define any genetic differences.



Figure 2. *Crocodylus novaeguineae*. Photograph: Jack Cox.

Crocodylus novaeguineae prefers freshwater habitats, and is found throughout most of New Guinea's vast system of freshwater rivers, swamps and marshes.

Females become sexually mature from 1.6 to 2.0 m length, and lay eggs in mound nests. The northern population oviposits during the annual dry period (August-October) (Jelden 1981, 1985), whereas the southern population nests during the wet season. Northern crocodiles also lay larger clutches of smaller eggs than southern animals. Among northern animals, nests were usually found on floating mats of vegetation in densely overgrown channels, lake fringes and scroll swales, and occasionally on stream banks or scroll levees (Cox 1985). Nests in the southern population are more frequently located on land (Hall and Johnson 1987).

Populations of *C. novaeguineae* have benefited from the vast areas of wetland habitats and low human population density on New Guinea. Adequate survey data and inferences from skin trade data indicate the presence of fairly abundant

Cox, J.H. (2010). New Guinea Freshwater Crocodile *Crocodylus novaeguineae*. Pp. 90-93 in Crocodiles. Status Survey and Conservation Action Plan. Third Edition, ed. by S.C. Manolis and C. Stevenson. Crocodile Specialist Group: Darwin.

populations in both Papua Province (Indonesia) and Papua New Guinea. Commercial hunting of this species commenced after World War II and peaked in the 1960s. Management programs have been developed in both countries, and for practical reasons both *C. porosus* and *C. novaeguineae* are subject to the same regulations. The aim of the management programs in Indonesia and Papua New Guinea is to regulate harvests of wild skins and eggs or small juveniles for ranches at sustainable levels, while providing equitable economic incentives to indigenous landowners.

Conservation and Status

In Papua New Guinea, recognition of unregulated hunting taking place led the Department of Environment and Conservation (DEC) to: introduce legislative controls in the late 1960s; and, and establish a regulated program in the 1970s based on cropping and ranching. Crocodiles are managed at sustainable levels for the benefit of customary landowners who own most of the land in Papua New Guinea. Crocodiles can be legally harvested by landowners for personal use (food and ritual), but commercial sale and export of hides is restricted to the size range of 18-51 cm belly width, which corresponds to approximately 0.9-2.1 m total length.

Wild harvests declined from over 20,000/year in 1977-1980 to 12,000-20,000/year in 1981-1989, then fluctuated between 10,000-20,000/year (1997-2005) (Solmu and Sine 2009). Until the mid-1990s hatchlings and eggs were collected and raised in centralized ranches. Harvests for this purpose ranged from 2500 to 10,000. Early attempts to establish village level ranches floundered due to technical limitations, particularly feed (locally caught fish), water and management deficiencies. Trade in live juveniles and eggs to centralized raising facilities continued until 1995 when the largest farm halted purchases of the species due to market prospects and its Saltwater crocodile-oriented management strategy.



Figure 3. Ranched *C. novaeguineae* being raised on commercial crocodile farm. Photograph: Grahame Webb.

Surveys of nests in a representative area of the middle and upper Sepik River suggest the population declined insignificantly from 1981 to 1999. After a 4-year halt in

nest counts, numbers increased steeply from 2003 to 2007, probably as a synergistic result of strengthened protection measures for breeding crocodiles linked to *C. porosus* egg harvests (Cox 2009; Cox *et al.* 2006).

An extensive harvest database on this species has not been fully analyzed. Harvest data or skulls of harvested animals are useful for monitoring populations especially in areas where spotlight or aerial surveys are logistically and economically impractical [for detailed analyses see Hall (1990a,b); Hall and Portier (1994); Solmu (1994)]. Population trends may also be inferred from local records of trade in skins, eggs, juveniles, but the purchase docket reporting system has not been fully implemented.

Manolis (1995) reviewed the monitoring program in Papua New Guinea and found it basically sound. Recommendations were made to improve the standardization of data collection and the availability of trained personnel, to provide timely and pertinent analyses.

A similar management program is in place in Papua Province, Indonesia. Basic surveys and development of egg and hatchling collection systems and ranches was undertaken during an extensive FAO-funded project from 1986 to 1992 (Cox 1992). In the same period, extensive illegal hunting and smuggling of skins was addressed and aggressive enforcement of regulations initiated.

Beginning in 1991, crocodile management in Indonesia underwent a detailed re-design in response to concerns raised by CITES, CSG and other NGOs (Messel 1993; Thomsen 1993). With the assistance of expert consultancies (Webb and Jenkins 1991) and reviews by CSG teams (Messel *et al.* 1992; Messel 1993), a coordinated management plan for both *C. porosus* and *C. novaeguineae* was developed.

A Crocodile Management Task Force (Satgas Buaya) was subsequently created in the CITES Management Authority (PHKA), resulting in the adoption of enabling legislation for crocodile conservation regulations, the development of a tracking system for both ranched and wild skins, and the establishment of an interlocking system of licenses, permits and tags intended to regulate collection, movement, trade, ranching, processing and export of crocodilian products. During a period from late-1994 to 1998, Indonesia imposed a moratorium on exports of all crocodile products (except personal effects) while implementation of the new system was under way. In 1997 a revised Crocodile Management Program for Indonesia was approved (PHKA 1997).

In both Indonesia and Papua New Guinea, trade in wild skins is subject to an upper size limit which aims to protect the proportion of the adult breeding population which typically exceeds that size. In Papua New Guinea, trade occurs as salted skins with 18-51 cm belly widths. In Indonesia trade involves 25-51 cm belly widths, but these size limits apply to wet blue processed skins. Salted skins shrink during processing by an average of 10%. As a result the Indonesian size limits translate to around 28-57 cm belly width of salted skins.

The consequences of these upper limits and differences between these neighbouring Range States differences need to be analyzed. Harvest data from Papua New Guinea suggest that between 40% and 75% of nesting *C. novaeguineae*, as well as some nesting *C. porosus*, are smaller than the upper skin size limit, and are thus subject to harvest (Hall 1991b; Hall and Johnson 1987; Montague 1983, 1984; Cox 1985, 1992). The smaller lower size limit in Papua New Guinea may be biologically defensible, but it is economically wasteful due to the low prices offered for those sizes of skin.

In 1998 a quota system was decreed by PHKA for harvests of juveniles and wild skins of *C. novaeguineae*. Quotas for skins have ranged from 3500 to 15,000/year. Quotas for juveniles under 80 cm long harvested for ranching were reduced in 2005 from 60,000 (mostly unutilized) to 15,000/year (Kurniati 2008).

Spotlight counts of *C. novaeguineae* in Papua Province were intermittently conducted in four river systems and 10 lakes from 1987-2002 (Kurniati and Manolis 2002). Results indicate an increase in non-hatchling density in the Jaro River and stable densities at other sites.

Priority Projects

High priority

1. **Internal review of crocodile management regulations and options in Indonesia:** An external review of the Indonesian crocodile management program (Webb and Jenkins 1991) provided specific guidelines for restructuring the existing program. The recommendations were incorporated into the proposals for crocodile management in Indonesia and formed part of its proposal for CITES Appendix-II listing of the *C. porosus* population in Papua Province (ROI 1994). Continued action and cooperation between the Indonesian CITES Management Authority (PHKA) and the CITES Scientific Authority (LIPI) is needed to fully develop and implement this program, and to assist Indonesia in establishing practical regulatory mechanisms for the sustainable use of its *C. novaeguineae* resource.
2. **Continued population monitoring and analysis of exploited crocodile populations:** Both Indonesia and Papua New Guinea should undertake the collection, collation and analysis of monitoring data with a view to deriving cost-effective long-term monitoring programs that can be sustained by Government, industry, and community-based organizations, and which will regularly determine the extent to which harvests are sustainable. Spotlight surveys of *C. novaeguineae* in Papua Province have not been undertaken since 2002 (Kurniati and Manolis 2004; Kurniati 2008), and it is recommended that these resume. Nest counts of *C. novaeguineae* in the Sepik River region of Papua New Guinea are now conducted on a biennial basis due to funding constraints. Results are inferred by DEC to represent population trends throughout

the country, which may be presumptive. Spotlight surveys in other river systems are recommended.

Moderate priority

3. **Standardize harvest size limits between Range States at biologically optimal sizes:** Different size limits for trade in crocodiles remain in effect in the two neighboring Range States. Both countries should review existing data, conduct any necessary additional studies, and adopt a size limit that ensures sustainable use, protects the breeding stock and encourages sound economic use of the resource.
4. **Taxonomic studies:** Molecular biology studies on northern and southern populations to quantify genetic differences.

Acknowledgements

David Wilken, Greg Mitchell, Godfrid Solmu (Papua New Guinea), Tonny Soehartono, Hellen Kurniati, Erick Wiradinata and Louis Gan (Indonesia) provided input into this plan.

References

- Cox, J.H. (1985). Crocodile nesting ecology in Papua New Guinea. Field Document No. 5 of the FAO/UNDP, PNG/74/029, Assistance to the Crocodile Skin Industry Project. Wildlife Division, Port Moresby, Papua New Guinea.
- Cox, J. (1992). Development of the Crocodile Industry on a Sustainable Basis Terminal Report. FAO-PHPA Project GCP/INS/060/JPN. Food and Agriculture Organization of the United Nations: Rome.
- Cox, J. (2009). Community-based crocodile and wetlands management in the Sepik Basin. Phase 1 Technical Report. Sepik Livelihoods Programme. WWF-West Melanesia Programme-European Union: Port Moresby.
- Cox, J.H., Middleton, N. and Wattimena, M. (2003). Occurrence of the New Guinea Freshwater Crocodile *Crocodylus novaeguineae* off the island of New Guinea. Crocodile Specialist Group Newsletter 22(2): 6-8.
- Cox, J.H., Gowep, B., Mava, A., Wana, J., Genolagani, J.M., Kula, V., Solmu, G., Sine, R., Wilken, D. and Langelet, E. (2006). The saltwater crocodile *Crocodylus porosus* egg harvest program in Papua New Guinea: linking conservation, commerce and community development. Pp. 133-154 in Crocodiles. Proceedings of the 18th Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland.
- Hall, P.M. (1990a). Crocodile Skin industry trade statistics from Papua New Guinea, 1969-1980. Pp. 268-330 in Crocodiles. Proceedings of the 9th Working Meeting of the

- IUCN-SSC Crocodile Specialist Group. IUCN: Gland.
- Hall, P.M. (1990b). Harvest patterns of New Guinea (*Crocodylus novaeguineae*) and saltwater (*C. porosus*) crocodiles in Papua New Guinea, 1969-1980. *Australian Wildlife Research* 17(3): 261-284.
- Hall, P.M. (1991b). Estimation of nesting female crocodilian size from clutch characteristics: correlates of reproductive mode, and harvest implications. *J. Herpetol.* 25(2): 133-141.
- Hall, P. and Johnson, D.R. (1987). Nesting biology of *Crocodylus novaeguineae* in Lake Murray District, Papua New Guinea. *Herpetologica* 43: 249-258.
- Hall, P.M. and Portier, K.M. (1994). Cranial morphometry of New Guinea (*Crocodylus novaeguineae*) crocodiles: ontogenetic variation in relative growth of the skull and an assessment of its utility as a predictor of the sex and size of individuals. *Herpetological Monographs* 8: 203-225.
- IUCN (2009). IUCN Red List of Threatened Species. Ver. 2009.1 (www.iucnredlist.org; viewed 30 September 2009).
- Jelden, D. (1981). Preliminary studies on the breeding biology of *Crocodylus porosus* and *Crocodylus n. novaeguineae* on the middle Sepik (Papua New Guinea). *Amphibia/Reptilia* 1 (3/4): 353-358.
- Jelden, D. (1985). Brutbiologie und Ökologie von *Crocodylus porosus* und *Crocodylus n. novaeguineae* am mittleren Sepik (Papua Neuguinea). *Stuttgarter Beitr. Naturk. Ser. A* 378: 1-32.
- Kurniati, H. (2008). Wild Harvest Management of New Guinea Freshwater Crocodile (*Crocodylus novaeguineae*) after Moratorium. Unpublished report. Research Center for Biology, Indonesian Institute of Sciences (LIPI), Cibinong, West Java, Indonesia.
- Kurniati, H and Manolis, C. (2004). Spotlight surveys of New Guinea Freshwater Crocodile (*Crocodylus novaeguineae*) in mid-zone Memberamo River (Memberamo and Rouffaer River systems) Papua Province, Indonesia. Pp. 496-510 *in* *Crocodyles*. Proceedings of the 17th Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland.
- Manolis, C. (1995). Monitoring *Crocodylus porosus* nests in Papua New Guinea: a review with recommendations. Unpublished CSG report.
- Messel, H., Jelden, D. and Hemley, G. (1992). Summary report of the Crocodile Specialist Group Review Committee on Crocodile Management in Indonesia. Pp. 55-70 *in* *Crocodyle Conservation Action*. A Special Publication of the Crocodile Specialist Group. IUCN: Gland.
- Messel, H. (1993). Indonesia Review. *Crocodyle Specialist Group Newsletter* 12(4): 7-10.
- Montague, J.J. (1983). Influence of water level, hunting pressure and habitat type on crocodile abundance in the Fly River drainage, Papua New Guinea. *Biol. Conserv.* 26: 306-339.
- Montague, J.J. (1984). Morphometric analysis of *Crocodylus novaeguineae* from the Fly River drainage, Papua New Guinea. *Aust. Wildl. Res.* 11: 395-414.
- PHKA (Directorate General of Forest Protection and Nature Conservation) (1997). Crocodile management program for Indonesia (revised). Jakarta. 28 pp.
- ROI (Republic of Indonesia) (1994). A proposal to maintain the Indonesian population of Saltwater crocodiles (*Crocodylus porosus*) on Appendix II of CITES. CITES proposal.
- Solmu, G.C. (1994). Status of *Crocodylus porosus* and *Crocodylus novaeguineae* population in Papua New Guinea, 1981-1994. Pp. 77-102 *in* *Crocodyles*. Proceedings of the 12th Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland.
- Solmu, G.C. and Sine, R.W. (2009). An update to the PNG country report on *C. porosus* and *C. novaeguineae* conservation and management 1982-2008. Pp. 309-316 *in* *Crocodyles*. Proceedings of the 19th Working Meeting of the IUCN-SSC Crocodile Specialist Group. IUCN: Gland.
- Thomsen, J. (1993). Traffic International comments. *Crocodyle Specialist Group Newsletter* 12(4): 8-9.
- Webb, G.J.W. and Jenkins, R.W.G (1991). Management of Crocodilians in Indonesia: a Review with Recommendations. Australian National Parks and Wildlife Service: Canberra.