PROCEEDINGS OF THE INTERNATIONAL SARUS CRANE WORKSHOP

12 January 2023

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Editor

Tran Triet

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Cover photo: Sarus Cranes at Tram Chim National Park, Vietnam, 2018.
Photo credit: Mr. Nguyen Truong Sinh, Ho Chi Minh City, Vietnam.

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PREFACE

The International Sarus Crane workshop was held online on 12 January 2023. There were 200 workshop registrants, many of whom were members of the Sarus Crane Conservation Group. The workshop began with a welcome speech from Dr. Richard Beilfuss, International Crane Foundation's President and CEO. The scientific program consisted of 7 presentations, covering most countries where Sarus Cranes are present.

The proceedings contain reports provided by the authors of the workshop presentations. The reports present detailed information about populations, habitats, threats and conservation strategies of Sarus Cranes in Australia, Cambodia, India, Myanmar, Nepal, Thailand and Vietnam. A study of crane movements in Cambodia was also included.

We thank Ms. Keren Becker and Ms. Sara Moore, International Crane foundation, for their help with English editing of the manuscripts.

Tran Triet, Ph.D
Southeast Asia Program Director, International Crane Foundation
December 2023.

OPENING REMARKS

Dr. Richard Beilfuss
President and CEO
International Crane Foundation
Baraboo, Wisconsin, USA

Dear Fellow Participants in this first meeting of the Sarus Crane Conservation Group:

It is an honor to welcome you today to this important meeting. I serve as President and CEO of the International Crane Foundation, and share in your passion for the iconic Sarus Crane, the world's tallest flying bird and flagship species for wetland conservation from South Asia to Australia.

I want to express my gratitude to Dr. Tran Triet for organizing this meeting. Dr. Tran Triet serves as Southeast Asia Program Director for the International Crane Foundation and has been a leader in Sarus Crane conservation in the Mekong Delta region for more than 20 years and a co-founder of the Mekong University Network.

This meeting is of great personal importance to me. My first work with the International Crane Foundation started in Vietnam during the 1980s, when we committed to securing the Sarus Crane and natural wetland conditions at Tram Chim nature reserve. I spent many years working at Tram Chim and came to love the wetland, the cranes, the surrounding communities, and the local champions who worked very hard to restore this wonderful place.

In 1990, we held an international Sarus Crane meeting at Tram Chim– including presentations from colleagues in India, Nepal, Vietnam, Cambodia, Thailand. At the time of that meeting, there were nearly 1000 Sarus Cranes in the wetlands of Tram Chim.

Over the 32 years since that time, the Sarus Crane situation has changed. Some of the changes are very worrying:

- The Southeast Asia population of Sarus Cranes in Cambodia and Vietnam has undergone a very rapid decline of more than 80% to fewer than 200 individuals today, with serious degradation of the Sarus Crane breeding grounds in northern Cambodia.
- The Southeast Asia population of Sarus Cranes in Myanmar is perhaps stable at about 500, but their breeding stronghold in the Ayeyarwady Delta is undergoing rapid transformation from traditional floating rice to industrialized rice production, the same transformation that led to the loss of more than a million hectares of Sarus Crane and waterbird habitat in the Mekong Delta during the 1980s and 1990s. The current political situation in Myanmar also makes it very difficult to advance the kinds of conservation efforts there that were successful in Vietnam.

- The Indian Sarus Crane population of India and Nepal remains the stronghold for the species, but we are increasingly concerned about impacts of climate change, wetland degradation, and other land use changes in the densely populated agricultural landscapes where they breed.
- The Australia Sarus Crane population status and trends are poorly known and range-wide research and monitoring is needed to determine if this secondary stronghold for the species is secure or in need of deeper conservation action.

We've also seen some amazing progress for Sarus Cranes over that past thirty year:

- In Vietnam, Tram Chim nature reserve is now Tram Chim National Park and the most significant wetland remnant protected in the Mekong Delta.
- The Phu My Lepironia Wetland Project is a global model for wetland conservation and sustainable livelihoods, linking Sarus conservation with wetland health, local income and employment, and natural wetland services.
- In Cambodia, several new protected areas are benefitting cranes and other wildlife. Many organizations are actively trying to secure the Sarus on their breeding grounds, testing innovative approaches.
- The Lumbini Crane Sanctuary was established in Nepal and supports several pairs of breeding Sarus Cranes and educational outreach to Buddhist pilgrims visiting Lumbini, the Birthplace of Buddha.
- Long-term research and monitoring in India indicate that diverse, productive farming landscapes even in very densely population human landscapes support large numbers of Sarus Cranes and many other species of conservation concern.
- The Sarus Crane reintroduction project in Thailand has been very successful. There is now a growing, self-sustaining population of Sarus Cranes in the wild. I am also excited that the successful Thai reintroduction effort can be now expanded to support Sarus Crane reintroductions in Vietnam to reestablish a breeding population in Vietnam that was lost during the war and bolster this declining population overall.
- The Mekong University Network is celebrating its 20th anniversary, with training in wetland management and research for many hundreds from government, universities, and NGOs.

I look forward to hearing all your presentations today, as you cover the key countries of the Sarus Crane range including India, Nepal, Australia, Myanmar, Cambodia, Vietnam, and Thailand. I hope that the presentations and discussions today will lead to better understanding of the population status, distribution, and trends of Sarus Cranes. I also hope new collaborations and ways forward will emerge to secure Sarus Cranes across their entire range, especially where urgent action is most needed in Cambodia and Vietnam. The International Crane Foundation is committed to providing technical expertise, conservation experience, and core funding towards ensuring a better future for Sarus Cranes throughout the region.

CURRENT KNOWLEDGE GAPS FOR CONSERVATION OF THE AUSTRALIAN SARUS CRANE

Timothy D. Nevard[1] & Elinor C. Scambler[2]

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1. Introduction

The Australian subspecies of Sarus Crane *Grus antigone gillae* differs significantly from extant Asian populations genetically and has a current unreliable population estimate of 5,000–10,000 birds (Mirande & Harris 2019, Nevard et al. 2021). The only reliably counted population of the Australian Sarus Crane (ASC), which winters on the Atherton Tablelands, is 826–3,255 birds (Scambler et al. 2020), constituting up to 19.5% of the estimated global population of 13,550–20,650 (Mirande & Harris 2019).

The ASC lives, forages and breeds in the same area and often alongside the much commoner Brolga *Grus rubicunda* (population estimate 50,000–100,000 birds: Mirande & Harris 2019) and its conservation therefore cannot be considered in isolation. Using genetic techniques, the current level of introgression between the species has been estimated at potentially 2.58% of the north Queensland population of ASCs and Brolgas (Nevard et al. 2020a: see Figure 8 below).

Figure 1: Australian Sarus Cranes (left) and Brolgas (right) at Kaban, on the Atherton Tablelands. (Photographer: TD Nevard).

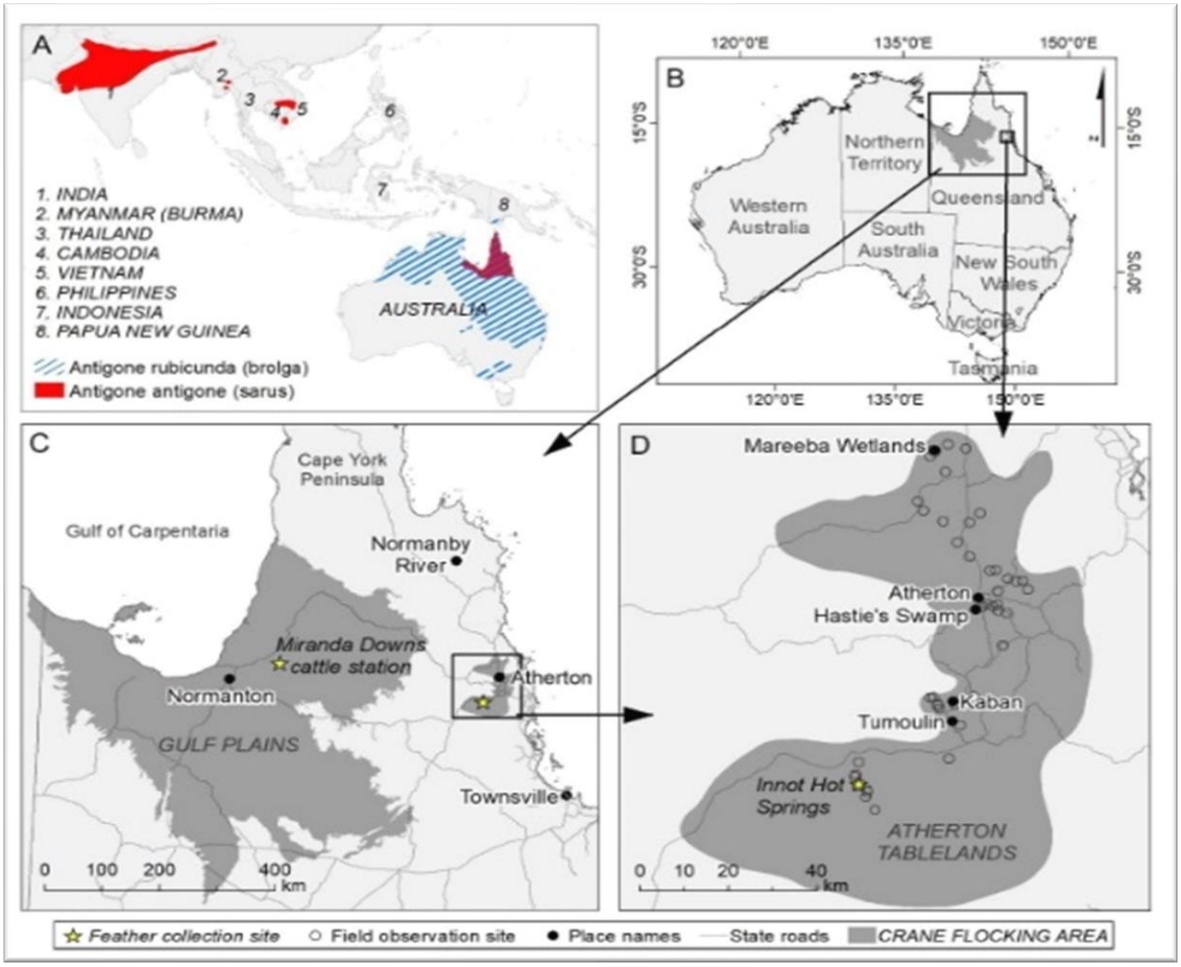

Figure 2: Distribution of Australian Sarus Cranes & Brolgas (A), with key localities in north Queensland (B, C & D) (Nevard et al. 2020a).

The currently accepted range of the ASC is shown in Figure 2 above (also Mirande & Harris 2019, p 324), with c.95% of this lying within north tropical Queensland. As can be seen, its range overlaps with that of the north Queensland distribution of Brolgas. Occasional outlier records of the ASC have also come from: (i) Kakadu, Northern Territory [c.7]; (ii) scattered on the northeast Queensland coast e.g., Townsville [c.10]; (iii) central Queensland [c.30]; and (iv) northern Western Australia [c.3] (Tanner & Jaensch 1988, Birdata 2023, eBird 2023).

2. Characteristics of Australian Sarus Crane

As indicated above, the ASC has a distinct genetic character, as well as certain phenotypic characteristics which distinguish it from Asian subspecies (see Figure 3 below). These include an often pronounced black 'beard' of filamentous feathers on its lower cheeks and throat; a variable length of red neck comb (sometimes barely extending below its throat); and is usually without any white plumage, which, if present, is not visually pronounced.

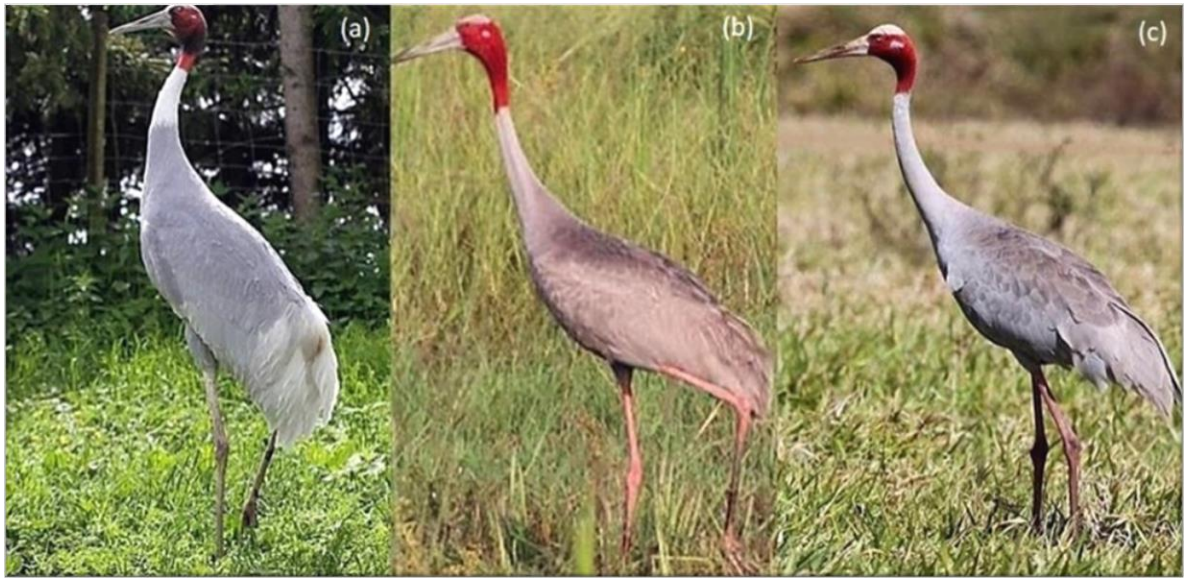

Figure 3: Extant Sarus Crane subspecies: (a) Grus antigone antigone South Asia; (b) G. a. sharpii Myanmar and Indochina; (c) G. a. gillae Australia. (Photographers: TD Nevard [a,c], R van Zalinge [b]).

Figure 4 below illustrates the genetic relationships between Sarus Crane subspecies (Nevard et al. 2020b). Samples are ordered by cluster, subspecies within clusters and a membership coefficient Q (y-axis). The diagram shows the marked genetic difference of the Australian *(gillae)* population from extant Asian subspecies and although only based on a single museum specimen (from the Smithsonian Institution) it shows potential evolutionary clustering with the extinct Philippine (*luzonica*) subspecies.

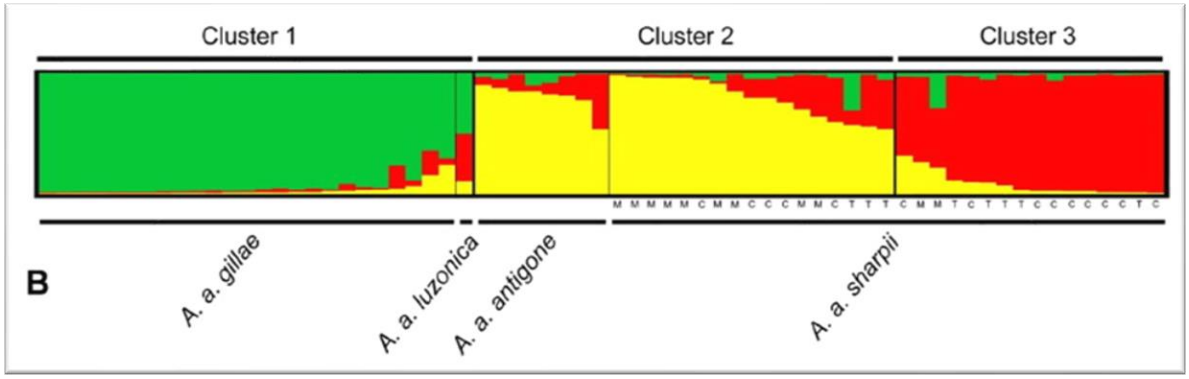

Figure 4: Bayesian cluster analyses of microsatellite data of Sarus Crane subspecies (Nevard et al. 2020b).

3. Key regions for the Australian Sarus Crane

As identified in Figure 2 above, two key areas for ASC conservation are the Atherton Tablelands (concentrated winter flocking) and Gulf Plains (breeding and dispersed winter flocking). The

Atherton Tablelands (see Figure 5 below) are just inland from Cairns and the Great Barrier Reef and are separated from the coast by the rainforest of the Wet Tropics World Heritage Area. The Tablelands form one of Australia's most biodiverse regions, as well as having its most diverse agricultural cropping (Nevard et al 2019b). The north, centre and extreme south of the region are characterised by irrigated agriculture, which is used by both ASCs and Brolgas for foraging and flocking during the post-breeding 'dry' season (June-December), mainly on waste maize, sorghum and peanuts following harvesting (Nevard et al. 2019a). Roosting of both species is principally in man-made wetlands, with only two – Hasties Swamp, a natural wetland, and the Mareeba Wetlands, man-made – with a conservation tenure (Scambler et al. 2020). The maximum number of roosts counted in the annual (since 1997) Birdlife Australia Atherton Tablelands Crane Count is 19 (Scambler et al. 2020) but it is likely that a few small roosts remain unknown in at least some years.

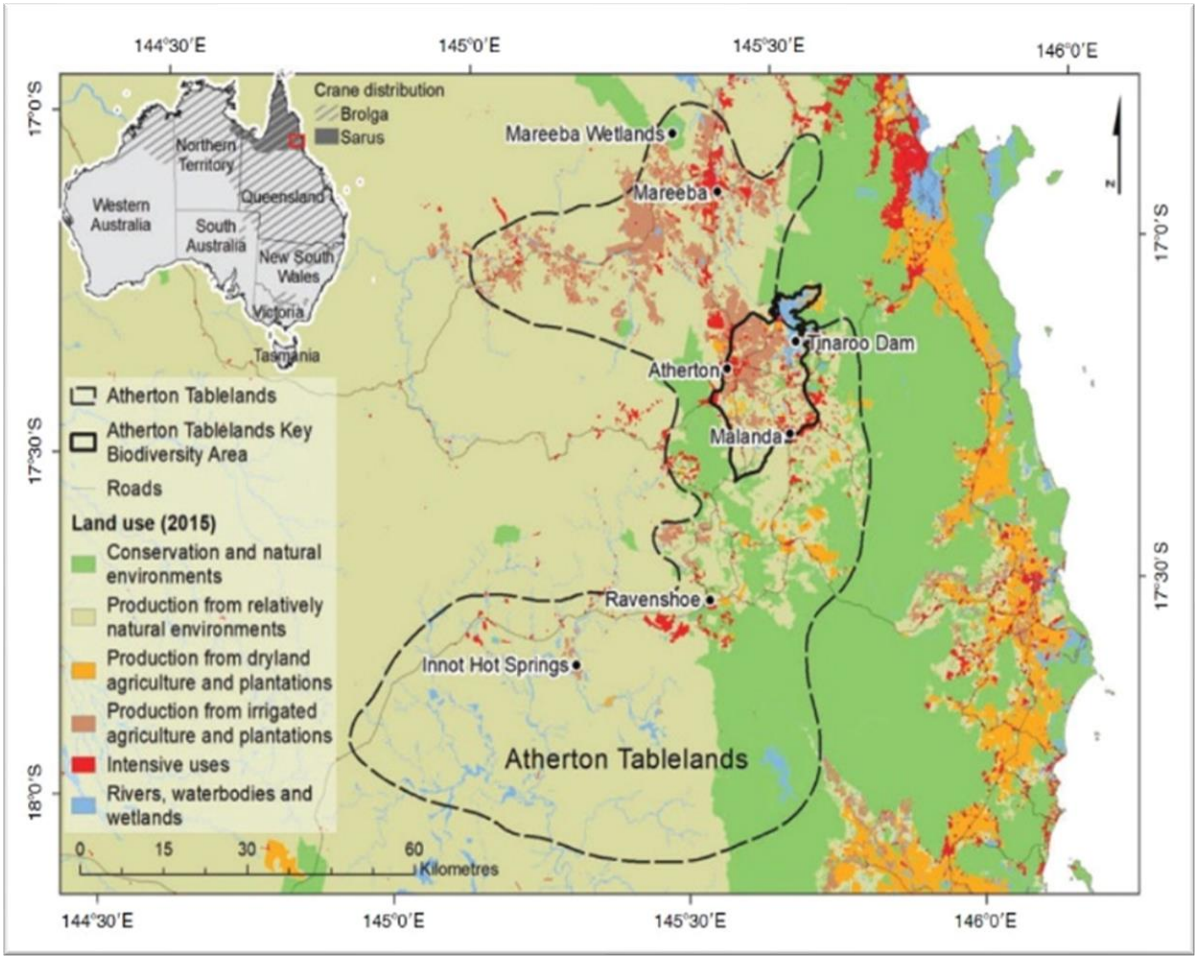

Figure 5: Land use on the Atherton Tablelands (Nevard et al. 2019a).

Figure 6 below is based on 44,554 visual observations over three years (Nevard et al. 2019b): 27,361 (61.4%) being Brolgas; 13,381 (30.0%) ASC; and 84 (0.2%) hybrids (3,728/8.4% of observations were unidentifiable to species). Brolgas are commoner on less fertile soils in the

south of the Atherton Tablelands and ASC commoner on the fertile, volcanic soils in the north (within the Atherton Tablelands KBA). Hybrids ('Sarolgas') are more common in areas where Brolgas dominate, especially in the far south of the Tablelands. However, a recent (2021/2022) factor to note is that cotton has replaced maize and peanuts in the far south of the Tablelands, and numbers of Brolgas wintering there have abruptly declined from almost 2,000 to as few as 45 and numbers of wintering Sarus Cranes have fallen from an average of 58 to as few as 4 (Scambler et al. 2020, TD Nevard unpublished data), although unpublished data from 2023 indicate that numbers may have picked-up with the reintroduction of grain cropping .

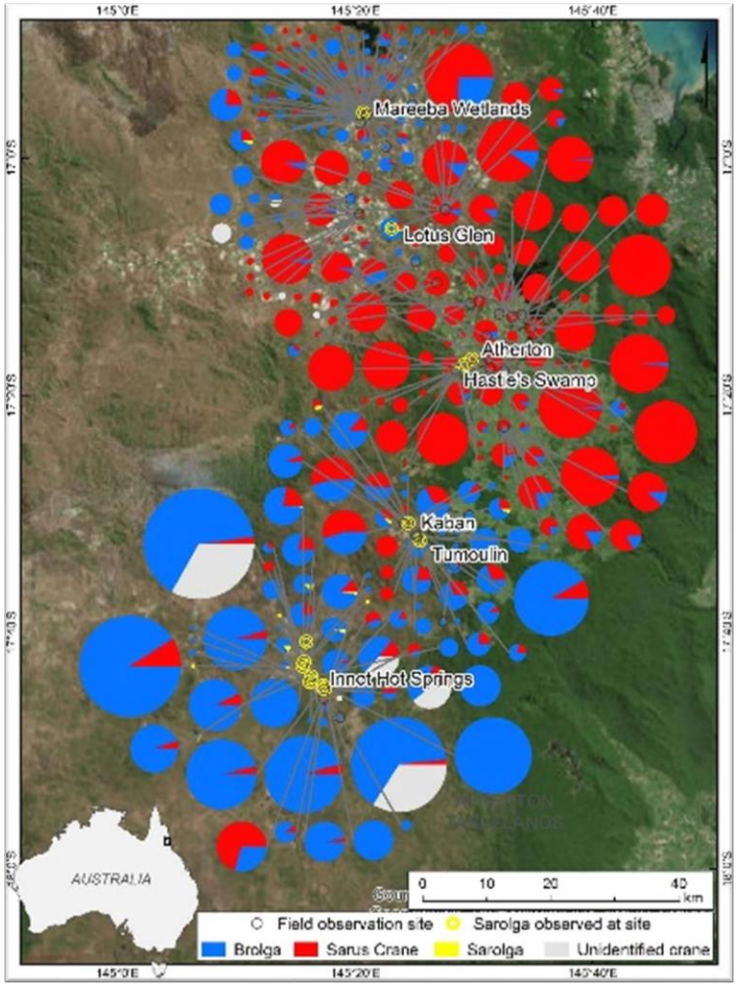

Figure 6: Visual observations of Australian Sarus Cranes and Brolgas and their hybrids (Sarolgas) on the Atherton Tablelands (based on Nevard et al. 2020a).

The other key region for the ASC is the Gulf Plains (see Figure 2 and Sundar et al. 2019), which abuts the Gulf of Carpentaria some 500 km west of the Atherton Tablelands. ASCs and Brolgas breed on the Gulf Plains (ASC are also suspected to breed in Cape York Peninsula) from January to March and remain with their fledged young until late May/early June, when they either

disperse within the Gulf Plains region or migrate to the Atherton Tablelands (Mirande & Harris 2019, Sundar et al. 2019, Nevard et al. 2020a). A key breeding location for both ASCs and Brolgas is Delta Downs cattle station on the coast of the Gulf of Carpentaria, north of Karumba and Normanton (see Figure 7 below), where survey work undertaken by George Archibald of ICF (Archibald & Swengel 1987), and others (TD Nevard unpublished data), indicates that ASC nest in thicker woodland and Brolgas in more open habitats (see also Sundar et al. 2019). Both appear to have a symbiotic relationship with cattle, which graze the margins of small wetlands, making them more suitable as nesting sites.

Figure 7: Nest locations of ASCs (red), Brolgas (blue), unidentified cranes (fawn) on c.100km² of Delta Downs cattle station, Gulf Plains. A further eight Brolga nests (no ASC nests) were located 10-30km to the NE of Karumba, in open swampy grassland habitat. (TD Nevard, from data collected during an ICF helicopter reconnaissance survey in 2019)

4. **Introgression**

Figure 8 below shows the degree of introgression identified in Brolgas and ASCs in north Queensland (Nevard et al 2020a). The black rectangle encloses 9 clear hybrids (Sarolgas) and the basal bar indicates the origin of the samples: green - Atherton Tablelands; orange - Gulf Plains; blue - captive Brolgas; magenta - captive Indian Sarus Cranes; and red - captive Australian Sarus Cranes.

Forty-one genotypes were encountered twice, in 11 cases in both the Gulf Plains and Atherton Tablelands, proving migration between these areas. Four 'Sarolgas' had pure Brolga allele combinations, so were back-crosses.

As indicated above, 2.58% of birds sampled were hybrids, which does not indicate a critical issue for conservation but maintaining a periodic watch on the regional crane population using shed feathers could be helpful in monitoring any change.

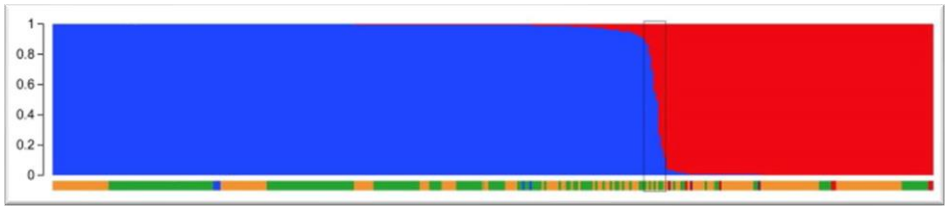

Figure 8: STRUCTURE plot of 348 Brolgas (blue) and Sarus Cranes (red) ordered according to decreasing Brolga membership coefficient (Q) (Nevard et al. 2020a).

5. Interactions between Australian Sarus Cranes and Brolgas

As ASCs and Brolgas occur in the same region and frequently alongside each other in the same habitat, understanding their behavioral and ecological relationships is important for ASC conservation. There has been little research around these relationships, especially in the vicinity of breeding locations, but it is important for the conservation of the ASC that its relationships with Brolgas are clarified.

Figure 9: ASCs and Brolgas are frequently together, with male Brolgas often dominant in pair-pair interactions. (a) At this dam in the Gulf Plains, the ASC pair retreated after being threatened by the male Brolga; (b) At the Mareeba Wetlands on the Atherton Tablelands, both species roost together and almost always avoid aggressive interaction. (Photographer: TD Nevard).

6. New Guinea

Brolgas are well-known in southern New Guinea (both in Papua New Guinea and Indonesia) and the presence of Sarus Cranes has been suggested for some years, but no direct photographic evidence yet exists. Figure 10 below shows the former Lake Carpentaria (bigger than current Lakes Victoria or Superior) and indicates the former geographic and ecological connection between northern Australia and southern New Guinea (Joseph et al. 2019). It is possible that both Sarus Cranes and Brolgas could have occupied Lake Carpentaria's northern (Papuan) shores as they do now on its former southern shoreline of the Australian Gulf Plains.

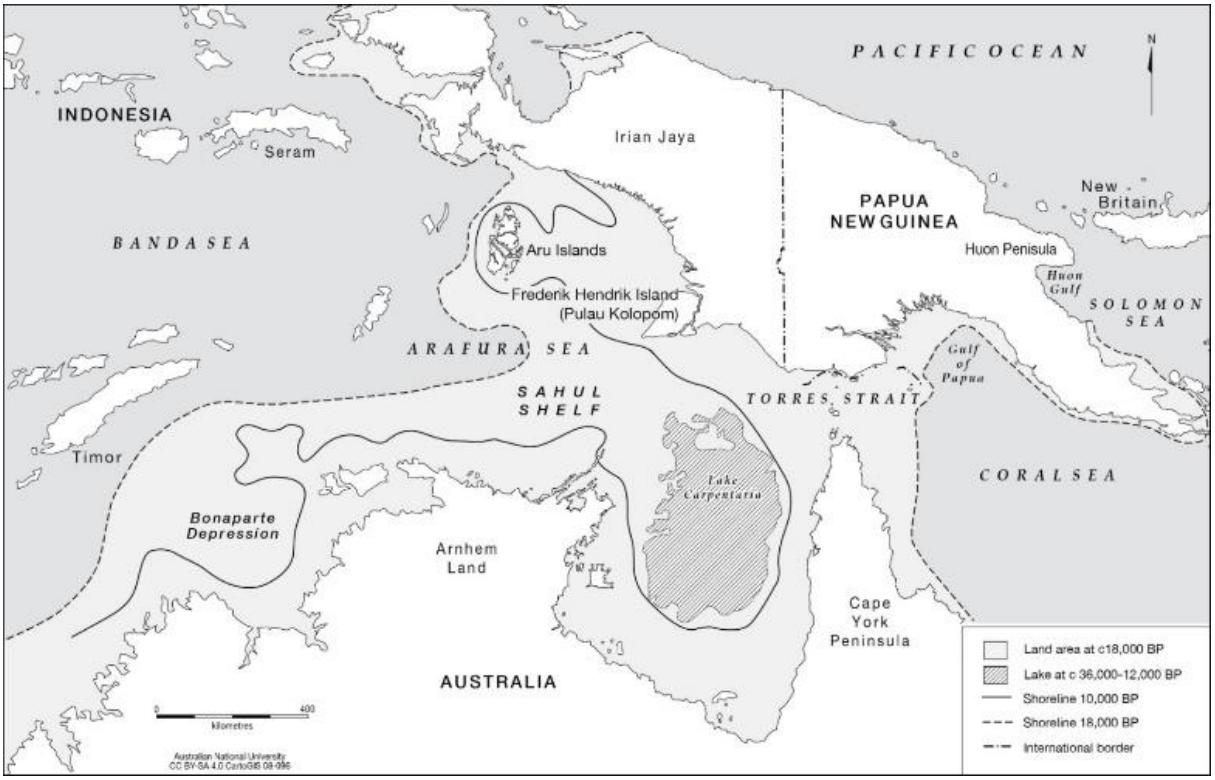

Figure 10: Shorelines of 'Lake Carpentaria', the Gulf of Carpentaria, Arafura Sea and Torres Strait 36,000-10,000 BP (CartoGIS Services, College of Asia and the Pacific, Australian National University, used under an Attribution-ShareAlike 4.0 International (CC BY-SA 4.0) licence).

Anecdotal statements by local people in some villages in the lower River Fly floodplain were made supporting the presence of both Brolgas and Sarus Cranes during a 2020 survey undertaken on behalf of the Ok Tedi Development Foundation (OTDF) and The Cairns Institute. Further fieldwork in October 2022 was again supported by OTDF and The Cairns Institute but three years of extreme flooding caused by La Niña conditions thwarted crane observations (although local people at Suki reconfirmed their belief in the presence of Sarus Cranes). An indication of the paucity of western ornithological knowledge in New Guinea is indicated by Figure 11 below. Local people know that Australian Pelicans *Pelicanus conspicillatus* nest in New Guinea, but the latest bird guides say they don't!

Figure 11: Australian Pelican Pelicanus conspicillatus eggshell in southern Trans-Fly region (Bensbach River floodplain), proving breeding occurs (Photographer: TD Nevard).

7. Key knowledge gaps for the conservation of Australian Sarus Cranes

1. Confirm ASC* population size in Australia.
2. Investigate ASC* breeding and population ecology and behaviour in Australia.
3. Investigate Gulf Plains ASC* dry season social model.
4. Confirm ASC* regional range (presence/absence in New Guinea).
5. Establish current and future threats to ASC*.
6. Establish diet flexibility for ASC*.
7. Establish roost site characteristics for ASC*.

*Australian Sarus Crane

7.1. Confirm Sarus Crane population size in Australia

The most critical 'unknown' for Australian Sarus Cranes (ASC) is the number remaining in the Gulf Plains and in Cape York Peninsula during the non-breeding season (rather than migrating to the Atherton Tablelands). The annual (early September) Atherton Tablelands roost count gives a reliable minimum estimate in the counted (wintering) area. However large numbers of cranes are known to remain in the Gulf Plains breeding areas and potentially Cape York Peninsula all year. A simultaneous or near-simultaneous survey, as widespread as possible, would give an additive estimate /number and greatly improve the overall population estimate. It would also add some data to the scarce information on precise wintering habitats. (e.g., Regional Ecosystems).

Conventional aerial surveys are not effective for Sarus Cranes in tropical Australia, as their presence is often obscured by vegetation and the problem of distinguishing them from Brolgas from the air is only possible in short-range surveys by helicopter (or ultralite). The Atherton Tablelands' (roost) survey technique is not applicable in the Gulf Plains and Cape York Peninsula, as: (i) few communal wintering roosts are known outside the Tablelands; (ii) there would be major resourcing issues across such a wide area; and (iii) there are access problems and dangers in isolated wetlands, especially from numerous Estuarine Crocodiles *Crocodylus porosus*.

Instead, we recommend a straightforward, well-structured, wide-scale roadside survey to be undertaken over a week to10 days by volunteer teams based out of Normanton (trialling the methodology in its first year, potentially extending subsequently to Cape York Peninsula). Timing would be immediately following the Atherton Tablelands' count in September, to ensure that no migration movement results in 'double counting'. We envisage the count being undertaken annually, for a minimum of three years.

7.2. Increase knowledge of breeding and population ecology of ASC

Surveys in six catchments in the Gulf Plains during fledging in 2017 (Sundar et al. 2019) found 60% of ASC pairs with chicks, an exceptional year with the highest breeding success of any crane species in the world. The long-term average is likely to be much lower: between 2013-16, Atherton Tablelands' Brolga flocks included 9.1% first year juveniles and ASC flocks 9.8% (Nevard et al. 2020a). Ironically however, nests and eggs of the ASC are very little known, with many features such as site selection, incubation period and time to fledging based mainly on overseas data; and (ii) although concentrated in the Gulf Plains, ASC breeding is strongly suspected but not yet proven on eastern and western Cape York Peninsula, such as Rinyirru (Lakefield) National Park and New Mapoon. Also unknown, are the limiting factors to population growth. Pre-fledging mortality is unknown. There is no perceptible attrition in first-year birds while wintering on the Atherton Tablelands (JDA Grant unpublished data 1997–2022) so we presume that unknown (possibly multiple) factors occur after juveniles separate from their parents in the following breeding season. Some of these factors must be significant, but the Gulf Plains (not including Cape York Peninsula) covers over 220,000 km^2 of tropical savanna and woodland, a vast area to survey and very sparsely settled.

We acknowledge that these are serious gaps in ASC conservation knowledge, but there are major safety and logistics issues in accessing Wet Season floodplains for ground-based surveys, including flooded roads and danger from Estuarine Crocodiles. Helicopter-based surveys are feasible but expensive. We therefore suggest that this work (or widespread Dry Season surveys of risks to immatures) should only become a priority if a major threat to ASC nesting, or immature survival, were to be become apparent. At this stage, unless land use radically alters, we see no immediate threats warranting such major investment.

7.3. Confirm dry season social models/flocking areas for ASC

There are two social models for ASC populations in the non-breeding/Dry Season: (i) birds spread out widely across a region in pairs, family parties or small groups; and (ii) concentrated in specific areas, with foraging flocks and communal night roosts. Thus far, the only documented Dry Season flocking concentration of ASC is on the Atherton Tablelands.
It is important for ASC conservation that all flocking areas/sites are identified, and unpublished records published. Identification should be relatively straightforward, as the Gulf Plains and Cape York Peninsula are visited by significant numbers of birders, and local Indigenous rangers and conservation organisations now cover large parts of both areas and contact should be straightforward. Scambler (2022) identifies ways in which eBird volunteers can contribute to this knowledge.

7.4. Confirm presence/absence of Sarus Cranes in New Guinea

Rumours of the presence of Sarus Cranes in New Guinea have existed for some years. Recent surveys of potential range in the River Fly floodplain (Trans-Fly) have yielded no direct evidence but cause for optimism. Local hunters distinguish between Sarus and Brolga (which are well-recorded in New Guinea) and floodplain habitat is comparable to Australia (TD Nevard, pers. obs)., but no photographs or specimens have yet to emerge (efforts are in hand).
The Ok Tedi Development Foundation and its subsidiary, WestAgro Holdings are developing agricultural projects to replace mining income for local communities and are keen to partner with ICF and other conservation bodies to establish conservation-led branding for their produce in a similar way to 'Ibis Rice' and other initiatives (TD Nevard pers. obs.). Should Sarus Cranes be found in the Trans-Fly region, opportunities for the establishment of sustainable conservation measures should therefore be possible (as already intended for Brolgas). In the meantime, a genetic investigation of New Guinea Brolgas, potentially using shed feathers (as recently used successfully in Australia), could establish the extent of any differences with the Australian population and whether there has been introgression with Sarus Cranes.

7.5. Identify current and emerging threats for ASC

Threats include invasive weeds *Cryptostegia* and *Mimosa pigra are* affecting Gulf Plains wetlands e.g., Delta Downs (G. Archibald and TD Nevard pers. obs.). There are ongoing rumours of persecution of cranes in cropping areas but only one prosecution and conviction for poisoning (of Brolgas: Scambler 2015). Changes to cropping regimes are occurring in ASC range, with an accelerating move from arable to perennial crops (in which cranes do not forage) on the Atherton Tablelands, but extensive development of cropping in the Gulf Plains & Cape York Peninsula. Introgression with Brolgas is not yet at a critical level but should be monitored. The effects of nationally significant (200+ turbines) wind infrastructure development on the periphery of the ASC-listed Atherton Tablelands Key Biodiversity Area (KBA) have yet to be understood but could

be severe. Climate change-related sea level rise could also be a factor on the Gulf Plains. Egg collection has been flagged as an issue on Indigenous land, but no published data exists.

Given its extensive land range, current and emerging threats for Australian Sarus Cranes (ASC) are, as yet, unlikely to cause significant issues for the Australian population. However, the combined impact of nationally significant wind infrastructure development, climate change and cropping shifts on the Atherton Tablelands could be significant for the ASC's only currently recognised (and likely largest) Dry Season flocking area and ASC-led KBA. This could precipitate a relocation of flocking away from the Atherton Tablelands and towards newly cropped areas in the Gulf Plains and Cape York Peninsula, where crane/agriculture conflicts are already rumoured to be occurring.
Climate change-related sea level rise in the very flat Gulf Plains could eventually prove to be a significant factor for ASC, as the currently positive land level balance is tipped in favour of salt water encroachment. This could lead to the apparent symbiosis between extensive cattle grazing and crane occupancy being adversely affected by significantly diminishing access to flat, seasonally freshwater-inundated grazing land.

7.6. Investigate ASC diet and dietary flexibility

Dietary studies for both species of Australasian cranes are minimal. Brolgas can tolerate saline forage by excreting salts via a special gland but salinity tolerance in ASC food and nesting is unknown. Following on from Section 5 on Threats, the issue of ASC salinity tolerance is highly relevant if climate-related sea level rise occurs in the Gulf Plains, extensively affecting ASC breeding sites and feeding sites. The use of natural versus agricultural forage is also significant, as arable crop residues on the Atherton Tablelands, on which a very significant proportion [~50%] of the ASC population relies in the Dry Season, decline to unsustainable levels due to cropping shifts – especially if newly-developing alternative cropping areas prove unsuitable for cranes.

7.7. Identify ASC roost site characteristics

Differential characteristics of known roost sites on the Atherton Tablelands selected by Australian Sarus Cranes (ASC), as compared to those selected by or shared with Brolgas, are not understood. Without a much better understanding of this major crane distributional factor, appropriate conservation decisions cannot be properly made.
Identification of the key factors in crane roost configuration and location would require dedicated research, including the collection of data on roost features when actually in use e.g. water depth, extent, configuration, actual disturbance (not just proximity to dwellings or roads), proximity to cropping, adjacent land use, riparian and aquatic vegetation, etc. As only two roosts on the Atherton Tablelands are in a conservation tenure, voluntary protection by private landholders is hence a key element for the future of cranes on the Atherton Tablelands and probably across tropical Australia.

ACKNOWLEDGEMENTS, FUNDING & SELECTED REFERENCES

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