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Cranes of the World: Australian Crane (*Grus rubicundus*)

Paul A. Johnsgard

University of Nebraska-Lincoln, pajohnsgard@gmail.com

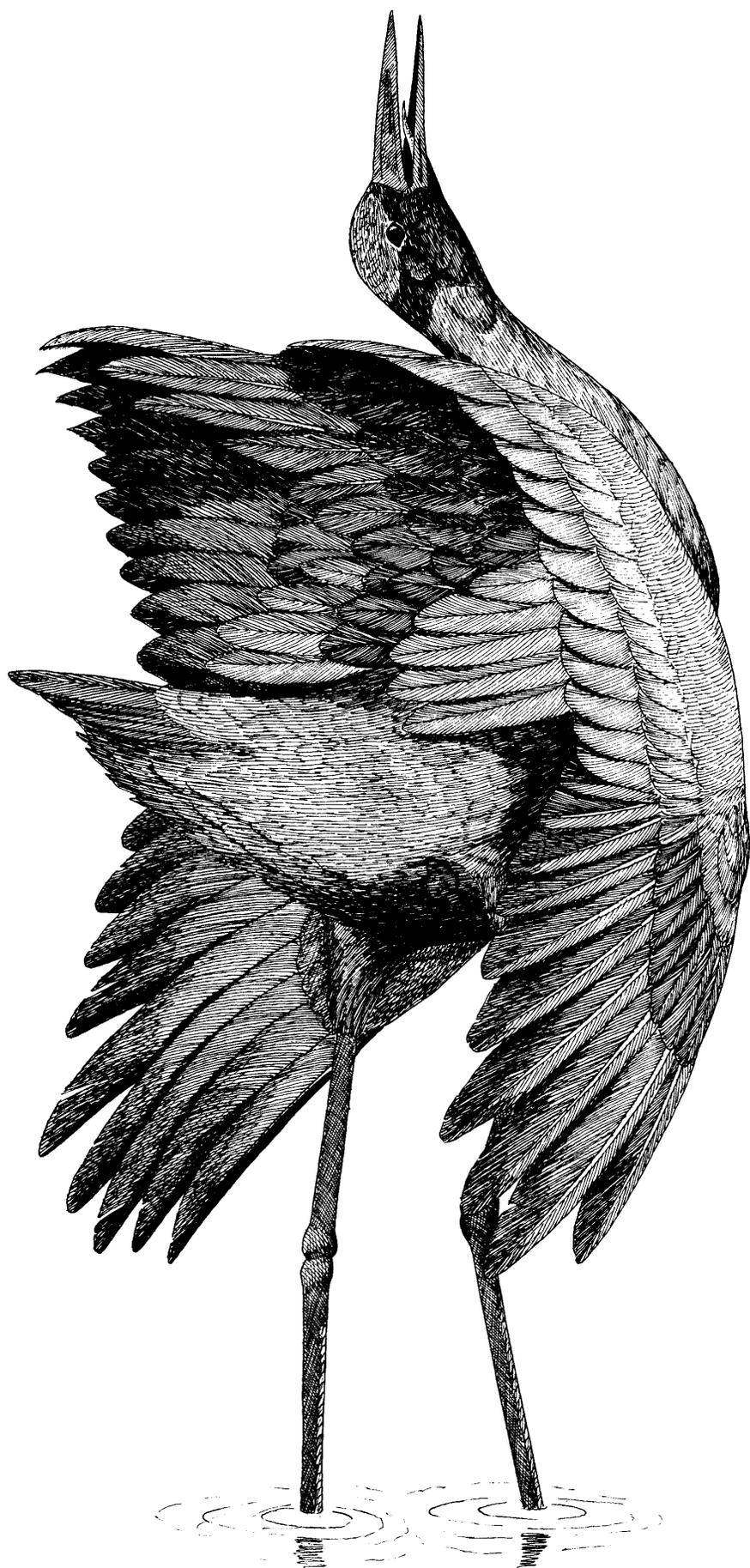
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Australian Crane

Grus rubicundus (Perry) 1810

Other Vernacular Names. Brolga, Native companion (Australia); Grue d'Australie (French); Australischer Kranich (German); Goshu zuru (Japanese); Australiyka zhuravl (Russian); Grulla Australiana (Spanish).

Range. Resident in grassland habitats in lowland New Guinea and northern and eastern Australia, more rarely to southern and southeastern Australia.

Subspecies.

G.r. argentea: Northern Australian Crane. Resident in the north of Western Australia and Northern Territory, intergrading to the east with *rubicundus*.

G.r. rubicundus: Southern Australian Crane. Resident from eastern (Queensland) to southeastern (Victoria and eastern South Australia) Australia, and in lowland New Guinea from Frederik-Hendrik Island to the Fly River-Sepik River basin.

Measurements. Wing (flattened), males 570-595 mm (average of 5, 585-7 mm); females (525-551 mm (average of 5, 538.4 mm) (specimens in American Museum of Natural History). Exposed culmen, males 157-170 mm (average of 10, 164.4 mm); females 145-163 mm (average of 10, 156.1 mm). Tarsus, males 295-317 mm (average of 10, 304.9 mm); females 258-299 mm (average of 10, 278.4 mm). Eggs, average 90.6 × 60.9 mm (85-99.8 × 56.4-67.3 mm) (Walkinshaw, 1973).

Weights. Ten adult males ranged from 6,265.3 to 8,278.2 grams, averaging 6,996.8 grams, and ten adult females ranged from 5,244.7 to 6,350 grams, averaging 5,721 grams (Walkinshaw, 1973). Blackman (1971a) reported that 321 males averaged 6,383 grams (range 4,761-8,729), and 217 females averaged 5,663 grams (range 3,628-7,255). The estimated egg weight is 185 grams. Walkinshaw (1973) states that five eggs averaged 190.9 grams and three chicks 103.2 grams.

Description

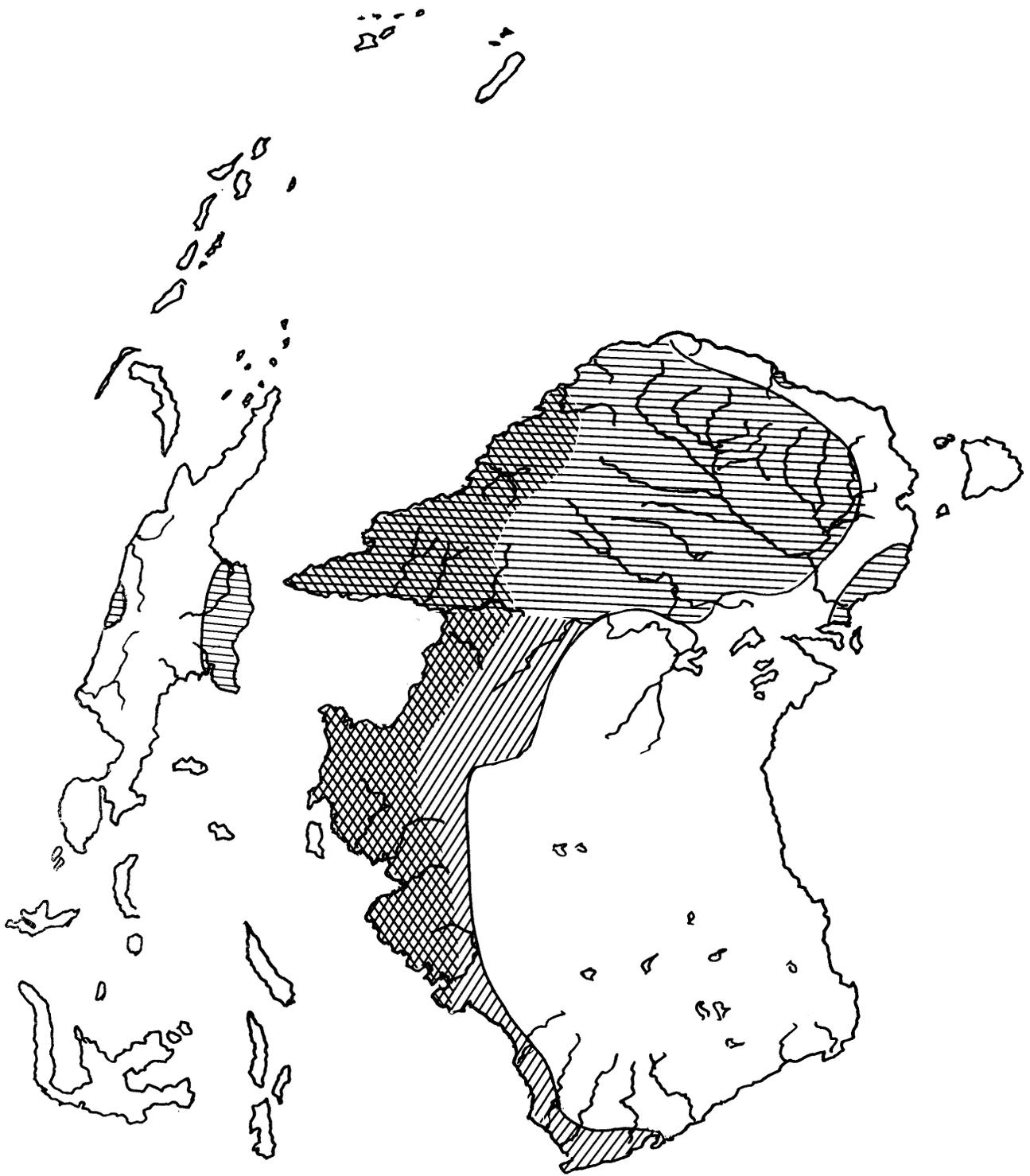
Adults of both sexes are alike and have a bare crown covered with greenish gray skin. The face, cheeks, occiput, and pendulous throat pouch are also bare, and are coral red to bright orange up to about the eye. The rest of the face to the bill is covered by fine blackish bristles, and is olive green. The area around the ears is covered by grayish feathers, and the rest of the body plumage is also light bluish gray, with the feathers of the back and wing coverts having light margins. The primaries are blackish; the secondaries are gray, with the inner one somewhat pendant and elongated. The iris is orange, orange yellow, or yellow, the beak is greenish gray to olive green, and the legs and toes are black to dark grayish black.

Juveniles have fully feathered heads that are buffy or gray, dark brown iris coloration, and dark gray legs. The adult iris color is attained in the second to third year of life, when grayish green skin also appears on the crown.

Downy chicks are mostly gray, becoming darker above and lighter below, and buffy on the head and neck. The iris is dark brown, the bill is greenish gray with a pink tip, and the legs are pinkish gray (Walkinshaw, 1973).

Identification

In the field, this is the only crane found in eastern and southern Australia and New Guinea. In northern Australia, it may be separated from the very similar sarus by its dewlap, its blackish rather than reddish legs, and its more silvery gray general appearance. Both species utter similar grating and trumpeting calls, but that of the Australian crane is of much lower pitch.



Residential distributions of the southern (vertical hatching) and northern (diagonal hatching) Australian cranes. Areas of greatest abundance are indicated by cross-hatching.

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In the hand, the wholly bare head, which is gray to reddish, with a small gray ear patch, and a slight dewlap at the throat, separates this species from all others except the sarus, which has bare skin extending down to the upper neck, is generally more reddish on the cheeks, and also has reddish legs. Hybrids are occasionally found in the area of geographic overlap in northern Australia. In both species the trachea is convoluted within the sternum. At least in the Australian crane, all adult males have two vascularized erectile papillae about 2.5 mm in height just lateral to the opening of the vas deferens. Many 2-year old males (7 of 12 examined) also showed this trait, as did a small number (2 of 9) of yearling males, but no birds of the year exhibited it (Blackman, 1971a). It is thus likely that the trait serves as a useful guide for sexing birds in the hand.

DISTRIBUTION AND HABITATS

Historical and Current Ranges

The present and past ranges of this species are limited to Australia and portions of New Guinea, with some apparent retractions in southern Australia, but no major changes of ranges in recent times except for some expansion in Western Australia.

In New Guinea, the species has long been known to occupy the lowlands of the south, from Frederik-Hendrik Island to Fly River, and a limited area of northern New Guinea, in the middle Sepik River. At least at one time it was apparently common in the Morehead River area near the Dutch border, and on the middle Fly River (north of Timbunke) in the extensive marshes and grass habitats of that area. However, at the time of the Archbold Expedition to southern New Guinea the birds were found only a few times, and in very small numbers near the coast. Some captive birds were also found in the possession of natives, who had apparently hand-reared them, indicating that nesting must have been occurring (Rand and Gilliard, 1968). Little is known of the abundance and present distribution of this population, but in 1980 the birds were observed to be fairly common along the Bensback River from Balam downstream, with some juvenile and immature birds present (*Papua New Guinea Bird Society Newsletter* 171-172, September, October 1980).

In Australia, the species has been known to be widespread and locally common since the early 1800s, when it was initially described from Botany Bay, in New South Wales. It probably has never occurred in the driest interior areas of Australia, and has been absent over much of Western Australia as well. Serventy and Whittell (1967) reported that the brolga was never observed in Western Australia in earlier historical periods, and first appeared there during the 1920s

(apparently near Onslow, on the coast near North West Cape). This general area still represents the approximate limits of the species' Australian range, but the birds have evidently become much more common, particularly after an influx in the early 1950s, and birds have been recorded as far south as Beacon (150 miles northeast of Perth). However, there seems to be no record of breeding south of the Kimberly Division.

Walkinshaw (1973) summarized numerous locality records of brolgas for Western Australia, as well as for Northern Territory and Queensland, where the species is most common. It occurs essentially throughout Queensland, and in all of Northern Territory excepting the driest interior areas. In New South Wales, although the birds are now largely limited to the northern portions of that state, with old nesting records for Maitland and Tumut, there are also more recent records of Yanko Creek, Moree, and Goondublu (Walkinshaw, 1973), which are east-central and south.

In Victoria there are old nesting records for Bendigo, Turkeith, and other areas, but it is uncertain as to whether the species still ever nests in that state. Certainly there is a regular influx of birds into Victoria and adjoining South Australia in the nonbreeding season, and there is at least one early nesting record for South Australia (Teatree Lake) (Walkinshaw, 1973). The species apparently still breeds very locally in the area south of Lake Eyre (*South Australian Ornithologist* 28: 47, 1980), as well as in northern Victoria (*Australian Bird Watcher* 4: 100, 1971; 6: 195, 1976). However the Tropic of Capricorn seems to represent the approximately southern limit of large flocks of brolgas, and only occasionally are flocks of more than ten birds seen to the south of Fitzroy River in Western Australia or Rockhampton in Queensland. Currently, the largest populations, numbering in the thousands of birds, are found only on suitable habitats from "Waverly Plains" near St. Lawrence in Queensland northwards to Rocky River near Princess Charlotte Bay. The densest concentrations, numbering about 12,000 birds, are at Cromarty, about 25 miles south of Townsville (Lavery and Blackman, 1969).

Habitat Requirements and Densities

The general habitat spectrum of brolga primarily includes fresh waters, grasslands, cultivated lands, open forests, and saline areas. The majority of the birds prefer freshwater swamps dominated by bulkuru sedges (*Eleocharis dulcis*). These areas are occupied for most of the year and are used for breeding. This habitat type is also favored by magpie geese (*Anseranas semipalmatus*). However, brolgas are more common in the eastern areas, and magpie geese in Northern Territory. The edges of deep-water lagoons are commonly used only during the months of lower rainfall, when the birds also

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disperse widely into grasslands, cultivated lands, and sometimes other habitat types. Where sarus and brolgas overlap in Northern Territory the birds usually do not greatly intermingle, since the sarus is largely confined to freshwater areas and cultivated lands. However, they sometimes do forage together and roost together locally (Lavery and Blackman, 1969).

Specific information on breeding densities seems to be lacking. Blackman (1978) provided a map showing the distribution of brolga nests in a small area near Clevedon, of which over 80 percent were associated with freshwater swamp habitats, and most of the rest were in brackish saline swamps, and a very small proportion in saltpan areas. Mangrove and upland habitats did not support any nests. A favored area of approximately three square kilometers of freshwater swamps supported over 40 nests, suggesting a maximum breeding density of roughly 13 nests per square kilometer. However, much nesting is done in inaccessible areas of the swamp, where there is only very limited visibility, and thus it is very difficult if not impossible to accurately survey these habitats.

Nonbreeding Range and Habitats

Nonbreeding habitats are much more diverse and widespread than breeding habitats, and include a variety of wetland and dryland areas, such as pastures, croplands including cornfields, brackish and saltwater wetlands, and even relatively dry habitats. Thus, during droughts the species has been reported moving into prickly pear (*Opuntia*) areas to consume the fleshy fruits. However, major concentrations during the dryer periods occur in the bulkuru sedge swamps, where both the brolgas and the magpie geese concentrate, feeding on the tubers of bulkuru. As large portions of the emergent vegetation die back during the drying out of the area, the surface of the swamp becomes a mass of decaying vegetation. This is eventually removed by the cranes and geese, reducing the swamp to open areas of slushy mud. As long as these remain damp the magpie geese continue to feed on the tubers, but as they dry out the geese usually abandon them to move into deeper water. However, the brolgas remain and, by virtue of their sharp, stabbing bills, can excavate holes in the drying swamp to locate bulkuru tubers. This is especially true in areas of alluvial black soils which dry to great hardness, which the magpie geese are unable to penetrate with their rounded bills, but which the cranes can easily deal with. This dry-season habitat association is well established by the end of October, when large flocks of brolgas occur on the drying swamps, whose surfaces are crumbling in the sun (Blackman, 1978).

FOODS AND FORAGING BEHAVIOR

For most of the year, the bulkuru sedge, particularly its tubers, provides the major food of the brolga crane. The area of maximum abundance of this plant is between Darwin and Brisbane, and this corresponds to the area of maximum density of the brolga. Where there are no bulkuru sedges, another sedge (*Cyperus affinis rotundus*) is dug out in a similar fashion (Walkinshaw, 1973).

Besides the sedge tubers, the birds feed on insects that are found in the same habitats, such as grasshoppers, leafhoppers, and the like. In other habitats a wide variety of animal food is consumed, including a wide variety of insects (dragonflies, mantids, beetles, moths), freshwater and saltwater mollusks, crustaceans, spiders, and frogs. Dryland and wetland plants, including corn, are also consumed (Lavery and Blackman, 1969). Walkinshaw (1973) concluded that the birds fed on such crops as corn, wheat, rice, and peanuts, and also consumed at times considerable numbers of animals such as mud skippers (*Periophthalmus*), fiddler crabs (*Uca*), and freshwater crayfish (*Cherax*), when these occurred in waters where brolgas were foraging.

Foods of Young

Little information on foods of young birds is available, but Lavery and Blackman (1969) stated that indirect evidence suggested that downy chicks are fed on insect materials by the parents, who attract the chicks' attention to these items by uttering soft purring calls. As the young become older and move with their parents to the drying swamps, they have difficulty feeding because their bills are not so strongly developed as are those of the adults. At that time they often stand close to their parents, watching them dig and waiting for the adult birds to pass tubers on to them, (Blackman, 1978).

Foraging Behavior

Feeding in the brolga takes much the same form throughout the year, for during both wet and dry seasons it largely feeds on the tubers of sedges (*Eleocharis* and *Cyperus*), with supplemental food in the form of cultivated grains and some animal materials. Its bill is almost identical in shape to that of the sarus crane, and is an ideal digging and stabbing tool, adapting it to animal capture as well as to the consumption of vegetable matter. In some areas, the birds invade croplands of sorghum, and corn, improved pasturelands such as those of *Cynodon*, and other agricultural croplands, especially during the period of grain maturation, which occurs at about the time the birds are

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dispersing from breeding areas. In those areas some crop damage has been found to occur and control measures are occasionally required (Lavery and Blackman, 1969).

MIGRATIONS AND MOVEMENTS

Apparently all of the movements of the brolga in Australia are related to the timing and severity of the dry season. Nesting mostly occurs during the wet season, which in northern Australia begins in December, when the first heavy winter storms begin. At that time the brolgas range widely over the grasslands in small groups. By the end of February, the extensive flooding of lowlands subsides and all of the swamps and lagoons are full, and the birds have moved on to their nesting territories. Only a small proportion of the birds nest on the large coastal swamps; instead, the birds move into small, isolated freshwater swamps in the coastal hinterlands that allow for large territorial sizes and the relative isolation that is apparently required by the birds (Blackman, 1978).

Throughout June and July there is a slow drying out of the swamps, and it is during this period that the young are being reared. As the small wetlands of the hinterlands gradually dry up, the brolga families begin to move toward the larger coastal swamps, where they join the families that have nested on these areas. Throughout July the brolga population increases on the coastal swamps, and flocking begins. The aggressive behavior typical of the breeding season gradually diminishes, and communal roosting in shallow salt pans begins. The winter flocks of brolgas bring together a large proportion of the breeding population, and consist of family groups, pairs lacking young, and nonbreeders of various age-classes. The amount of water remaining in the swamps by August varies from year to year and depends on the amount of rainfall during the previous wet season (Blackman, 1978). Depending on the severity of the dry season, the brolgas may be forced to move varying distances.

In recent years, various developments have affected the distribution and movements of the brolgas. For example, water impoundments in some areas have increased surface water supplies for the birds, and increased their potential breeding grounds. On the other hand, with destruction of the bulkuru sedge marshes and their conversion to croplands, the birds have been forced to move into cultivated areas for foraging, especially during the drier months. Thus, large flocks previously moved south into Victoria during winter months, where they foraged on croplands and sometimes caused considerable damage. As a

result, poisoning campaigns were carried out, and now relatively few birds move this far south in winter (Walkinshaw, 1973).

In recent years, the major dry-season concentrations have occurred in Queensland, in such areas as Townsville, Pallarenda, Cromarty, Giru, and Clevedon, or only as far north as Ingham and as far south as Ayr. In some years when the rains fail to materialize, as was the case in 1968-1969, the birds may remain in the bulkuru sedge areas, but very few attempt to nest there. At such times the birds may do considerable damage to crops such as rice, sorghum, and corn, especially when these croplands are close to bulkuru sedge swamps (Walkinshaw, 1973).

During the dry season the birds are also often forced to fly some distances for daily water too. At times, hundreds will drink and roost at small dams, making the water supply so dirty that it can't be used by livestock. Many such dams, created to provide water supplies for cattle, occur throughout Queensland and Northern Territory, and probably allow for greater inland migration during the dry season than was true before the establishment of these small reservoirs.

Daily Movements

Like the other cranes, brolgas typically spend the nonbreeding season in flocks, roosting communally in shallow water whenever possible, and feeding during the daylight hours. There is much foraging during the daylight hours, with intensive searching until mid-morning and extensive searching during late afternoon (Lavery and Blackman, 1969). Walkinshaw (1973) observed that during October to December, near Pallarenda, the birds flew from tidal flat roosting areas to bulkuru sedge marsh regions about a quarter mile away, beginning as early as about 5:00 a.m.; all had left the roost by 5:50 a.m. On another day the birds left between 5:00 and shortly after 6:00 a.m. Some of the birds flew as far as three to seven miles away to obtain fresh water at dams or ponds.

In the evening, the birds generally moved into a nearby feeding region that was located about a half mile from the roost during the afternoon. Sunset was at 6:00, and by 5:50 the first birds began moving into the tidal salt flats or the muddy areas beside it. By 7:02 p.m. it was nearly completely dark, and only a few birds were arriving. The peak numbers of more than 700 arrived between 40 and 50 minutes after sunset.

At a small freshwater lake about a mile from a saline roosting site, Walkinshaw observed that the first cranes arrived to drink at 9:01 a.m., or almost four hours after sunrise (5:33 a.m.). A total of 447 arrivals were counted, most of which remained until 10:35 a.m., when they began to depart.

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GENERAL BIOLOGY

Sociality

Walkinshaw (1973) made various counts of social groups of brolgas as they arrived at and left roosting sites. Counts on October 21 and November 6 indicated the following breakdown of over 200 group sizes flying into or out of roosts: singles, 4 percent; pairs, 35 percent; triples, 25 percent; groups of four, 15 percent; larger groups, 21 percent.

These data suggest that even during the nonbreeding season the commonest social groupings are of from two to four birds, presumably primarily representing pairs and families with one or two dependent young. Certainly many, if not most, of the larger groups also represent assemblages of such social units as well.

While roosting or feeding, each bird in a family group stands or feeds about 5 to 7 feet from the others, and each family group in turn forages or roosts about 7 to 25 feet from their nearest neighbors (Walkinshaw, 1973).

Daily Activities

As described under "Daily Movements," this species is highly diurnal, and spends much of the daylight hours during the nonbreeding season in foraging. Photographs of nonbreeding birds suggest that they do not maintain separate foraging territories during that time of year, but instead move about in rather closely associated groups, only a few feet apart from one another. During the dry season the birds also drink water frequently. Walkinshaw (1973) stated that he occasionally saw roosting birds on tidal flats sip saline water, but not often. Instead, during the hottest days and during the driest periods there was a constant stream of birds moving from feeding areas to watering sites between midday and about 5:00 p.m. After drinking, the birds would return to forage again, until it was nearly dark.

Interspecific Interactions

Lavery and Blackman (1969) reported that the native dingos (*Canis dingo*) and introduced foxes (*Vulpes vulpes*) both prey on young birds, and that red-backed sea eagles (*Haliastur indus*) prey on eggs.

In northern Australia there is now a limited amount of contact between the self-introduced sarus crane and the native Australian crane, and hybridization between the two species has been discovered (Archibald, 1981b). He suggested that since the sarus is a larger species and thus tends to dominate the native birds, it could well displace them from their primary nesting habitat. However, the sarus tends to occupy the more upland and agriculturally associated areas of northern Australia, while the brolgas are more associated with the

coastal marshes, at least during the nonbreeding season. Should the sarus crane begin to occupy the sedge marsh habitats of the brolga for its major breeding areas, serious interactions between these two species could well result.

BREEDING BIOLOGY

Age of Maturity and Time of Breeding

Little specific information on the age of maturity in captivity is available, but Blackman (1978) states that male brolgas do not breed until their fourth or fifth year, while females probably breed their third year of life.

Throughout Australia as a whole, the breeding season is rather distinctly concentrated in the wet season, but some records extend into the dry season as well. Walkinshaw (1973) reported that 27 records from Queensland range from September to June, with a peak in February and March. Nine nest records from Northern Territory range from January to June, with a peak in March. There is a February nest record from Western Australia, four October and November records from New South Wales, and Victoria records extending from August to November (Walkinshaw, 1973).

Pair Formation and Courtship

Pair formation in this species apparently occurs in wintering flocks, in which dance-like displays are common and a conspicuous aspect of these flocks. Many such displays are initiated by young, unpaired males in search of mates, according to Blackman (1978). Their displays are sometimes misdirected toward other males or toward females of established pairs, but eventually become directed toward a receptive female and the displays are reciprocated. Such activities are the start of casual attachments, which may or may not lead to permanent pair bonding. However, an important point is that these activities occur at a time when the food is normally abundant, when there is maximum contact with prospective mates, and when the young birds can direct much of their energy toward pair formation.

There do not seem to be any specific descriptions of copulatory behavior in this species, but the unison call is performed in a manner very similar to that of the sarus crane. According to Archibald (1975, 1976) the associated call is also very much like that of the sarus, but is of a much lower pitch. This low pitch is perhaps associated with the large gular sac of the male, which is inflated during the display and quite possibly helps to resonate low-frequency sounds. The final calls at the end of the display, when the gular sac is inflated, are particularly long, broken, and low-pitched. Sometimes the males raise and lower the humeri in synchrony with the call, while at other times the humeri are stiffly raised

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and the wrists similarly lowered throughout the entire display sequence. As with the sarus crane and the white-naped crane, the dark primaries are at that time especially conspicuous, and at times the male's raised wings actually touch the female's back. The female remains with her neck held near the vertical throughout the display sequence, but does not raise her humeri or expose the primaries. Typically the two birds stand nearly side by side and motionless during the display, rather than walking about as do Japanese cranes and whooping cranes for example.

According to Walkinshaw (1973) the call of the male during the unison display is one in which the second note is much the loudest, and thereafter the call gradually tapers off: *kawee-kreee-kurr-kurr-kurr-kurr*. The female similarly utters an extended series of *kuk* notes immediately following each syllable of the male's call.

According also to Walkinshaw, dancing in this species occurs most commonly during the onset of the wet season, and is similar to that of the sarus crane in that both birds in a dancing pair sometimes bring their throats close together. He also observed tossing behavior during dancing, and noted that dancing occurred in a variety of situations, as for example when he approached a flock or went to a nest.

Territoriality and Early Nesting Behavior

With the onset of the wet season, a series of ecological changes begin to occur in the swamp. As storms become more frequent, the male cranes became more antagonistic and hostility becomes more evident within the flock. Young birds of the previous year are among the first birds to be affected, and are driven away. Such young birds soon begin to associate and form small flocks, which spend the breeding season outside the nesting areas as outcasts.

As the established pairs move into the nesting areas, they select territories that offer food, nest sites, and areas of very dense vegetation that can hide the young. The nests are located in such a way as to provide a panoramic view of the environment.

Nest construction usually begins with the birds pulling up plant materials and throwing them backwards. Materials are gathered from an area about three meters in diameter and are heaped into a mound. Nests are often constructed from grasses, especially saltwater couchgrass (*Sporobolus*), on the moist ground of an island in the swamp. Nests that are built on moist ground sites are composed of grasses and earth clods, with a shallow cup in the center. However, such nests do not float, and thus may be flooded with the heavy rains. Early-nesting birds benefit by constructing floating nests of the stems of sedges, sometimes in water up to 300 millimeters deep. Such nests are able to accommodate to minor increases in water levels during

periods of flooding (Blackman, 1978).

Various other nests described by Walkinshaw (1973) were constructed of para grass (*Brachiaria*), *Cyperus*, and even water hyacinth (*Eichornia*); seven nests averaged 86 centimeters across at the base, but ranged from 57 to 142 centimeters. Lavery and Blackman described the nests as averaging about four feet in diameter, with little or no lining of feathers.

According to Blackman (1978), nearly all the nest sites in the large coastal swamps are ones that have been used previously. Additionally, several unused nests are sometimes apparent in the vicinity of an active nest. It would thus appear that birds tend to return to the same territory year after year, or perhaps there are certain habitat features that tend to attract cranes to a particular nesting site.

Egg-laying and Incubation

Within a few days of the completion of the nest, the first egg is laid. Normally two eggs constitute the clutch; Walkinshaw (1973) reported that 20 or 27 clutches contained two eggs, and a single nest contained three. Both sexes incubate, and while one bird is on the nest the other frequently flies some distance away to forage. During changeovers in incubation the birds typically utter a bugling unison call, which Blackman attributes to the establishment and maintenance of dominance in the nesting territory.

The responses to intrusion into their nesting territories are quite variable. Blackman noted that the nests are often located in inaccessible parts of the swamp, with searches requiring tedious wading through heavy vegetation, and thus it is unlikely that many nests would be disturbed either by humans or by dingoes. Large intruders, however, are either driven off, or attempts are made to lure them away by the use of broken-wing displays and loud alarm calls. When the intruder leaves the area the birds return, examine the nest, and then call in duet to signify their regaining of territorial control. Only seldom do the birds abandon their nests because of such intrusions, in Blackman's experience.

The eggs are incubated for 28 to 30 days, according to Blackman, while most records of cranes hatched in captivity indicate an incubation period of from 32 to 36 days. Perhaps the tropical environment in which the birds breed results in somewhat faster development than occurs in temperate climates where periodic cooling might occur.

Hatching and Postbreeding Biology

Blackman (1978) reported that the chicks hatch by using a well-developed egg-tooth, and emerge from the egg within 36 hours of pipping. The adults offer bits of food to the chicks during the first 24 hours, but it is probable that such feeding is not important at that

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stage, while the yolk sac is being resorbed. By the third day after hatching the young chicks are moving away from the nest to hide in nearby cover whenever disturbance occurs. At that time the surrounding cover is extremely dense, and offers great protection for hiding birds. It is probable that the birds remain in the wet swamps for as long as enough water remains to provide protection and easy foraging. Finally, however, the drying ponds force the birds to move to more coastal areas. The young cranes continue to be fed by their parents for as long as an entire year, but begin to supplement their diet of insects, spiders, mollusks, and vegetable materials with independent foraging almost from hatching.

As the chicks grow, the nesting territory becomes a home range that progressively expands in size and eventually is vacated completely. Birds nesting in brackish areas have larger territories and home ranges than do those nesting in the freshwater swamps, and also vacate their areas earlier. As the birds become more mobile they tend to encounter the home ranges of other pairs and families, but there is usually little conflict during this stage of the nesting cycle. The first contour feathers appear at 4 to 5 weeks, and fledging occurs when the young birds are about 14 weeks old (Lavery and Blackman, 1969).

Presumably during the time that the young birds are being reared, the adults also undergo their general body molt, but there does not seem to be any specific information on this. Most probably it occurs before the birds leave their heavy swamp cover, where they can fairly safely spend their flightless period.

Lavery and Blackman (1969) reported that the young birds remain with their parents into the third year of their life, although they are of course evicted from the nesting territory during the breeding season. Predation causes some losses of young, in which case the parent birds re-nest. Second re-nestings have also been reported, in which case only a single egg is laid.

RECRUITMENT RATES, POPULATION STATUS, AND CONSERVATION

There is still surprisingly little information available

on recruitment rates for this species. Blackman (1971a) reported that young birds comprised 17 percent of the birds in flocks observed between 1968 and 1970, although sample sizes were not indicated. This is a relatively high recruitment rate, and might be related to the opportunities for re-nesting during the relatively long potential breeding season in northern Australia. The cranes are protected in Queensland, but dead cranes are often encountered during the dry season. The majority of these are young of the year, suggesting that juveniles associated with family groups that remain together have an increased probability of survival (Blackman, 1978).

The population of the Australian crane is impossible to estimate with any degree of certainty at the present time; no census figures have yet been published. Some crop depredation problems involving cranes on agricultural lands have generated poisoning efforts. However, most of the Queensland birds are still distributed in a few large and relatively remote swamps, and furthermore the construction of water impoundments in the drier areas is actually increasing potential breeding habitat in some parts of the Australian continent. Further, the increase in grain crops in some areas serves as a food supply in times of drought, although of course this sometimes leads to conflicts between agricultural interests and those of conservationists.

At present, the Australian crane is still quite secure, at least as compared to most of the temperate-zone Asian cranes.

EVOLUTIONARY RELATIONSHIPS

On the basis of both the unison call and general social behavior (Archibald, 1975, 1976) and its general and skeletal anatomy (Wood, 1979), the Australian crane and sarus crane can be confidently called very close relatives, a fact that is further indicated by natural hybridization occurring between them in an area of recent secondary contact in northern Australia, and by the fertility of the resulting hybrids.