Population and Habitat Viability Assessment for the Wattled Crane in South Africa

EXECUTIVE SUMMARY

Executive Summaries of the 5 working groups
Results and Recommendations

1) Executive Summary of the Land-use Patterns Group.

The group was tasked to assess the past, present and future land-use patterns and how these have affected and may affect crane habitat and thus crane numbers. The group followed the standard methodology of:

1) identifying the problems related to land-use patterns and habitat;
2) gathering and assessing all available information and unwritten knowledge with respect to crane habitat;
3) setting goals to overcome the problem;
4) the development of tasks and action plans to achieve the goals

Based on sighting figures, the group concluded that wetlands (76%) and grasslands (10%) are the most important components of wattled crane habitat. As breeding only takes place in wetlands, and based on the fact that both total numbers and the number of breeding sites are dropping, the group concluded that breeding habitat (including associated foraging areas) are of vital importance.

The main threats to breeding habitats have been the drainage of wetlands through canalisation, cultivation, direct afforestation, inundation and inflow reduction, amongst others. In the future, it is thought that some historical threats will be mitigated while others, especially stream flow reduction activities, continuing expansion of cultivation and inundation will become more serious.

The group assessed information on rate of habitat decline and concluded that information is scanty, resulting in us having a poor understanding of the rate of decline. We decided to work on the basis that approximately two breeding sites are being lost per year. We also concluded that breeding sites were abandoned because of habitat loss – this being based on the existence of a relatively large floater flock. The following goals were thus set:

Minimum Goal: to reduce the loss of active sites to zero over a five-year period, with a maximum loss not exceeding six sites

Maximum Goal: to halt the loss of active sites immediately, have no further reduction and establish at least one new potential site per year.

In order to achieve this goal, five major tasks with broad action plans were identified. Our recommendations are thus:

TASK 1
Develop an accurate description of what constitutes viable wattled crane habitat - must include breeding habitat and foraging habitat with correct nutrition.

TASK 2
Gain a clear understanding of how fast wetlands are lost in total and in terms of wattled crane requirements (deducing the historical rate of change).

TASK 3 a
Complete a risk assessment of all breeding sites using the following actions.

TASK 3 b
Develop an action plan to reduce the risk at "high risk" sites – thereby ensuring that they are not lost.

TASK 4
Survey all wetlands that fall within the area delineated under Task 2 above, and assess them for breeding suitability. Then classify these wetlands according to their suitability and risk (acquired from task 3).

TASK 5
To heighten the awareness of the plight of the wattled crane using a publicity and awareness programme.

2) Executive Summary of the Distribution and Habitat Group.

The brief of the group was to examine the history of the wattled crane, its habitat characteristics and management, minimum area requirements, food selection and energetics, breeding biology and the establishment of a single database.

Ten courses of action were identified :

1) Document the decline of the wattled crane. This will include description of the ancestral range (the Type Specimen came from the Western Cape) through to the modern fragmentation of the remaining habitat.
2) Create a model of potential habitat for the wattled crane. By overlaying environmental data sets on wattled crane localities its environmental tolerances can be measured. Extrapolation pinpoints areas outside the known range that may yet harbour cranes or be amenable to management for cranes.
3) Determine the biophysical characteristics of wattled crane nest sites. Detailed accounts of many wetlands are already published. Multivariate comparison of current wattled crane sites with abandoned sites and all other documented wetlands should identify vital components.

4) Determine optimum management for wattled crane habitat. Data on burning, grazing and water level regimes can be related to crane presence and breeding success.
5) Determine minimum area requirements for wattled cranes. The measurements required are of nesting wetlands, foraging ranges of breeding pairs and floating ranges of non-breeders.
6) Investigation of hatching failure of full term eggs. Failure of eggs to hatch is not a serious problem, but needs monitoring, for example to detect onset of infertility.
7) Analyze chick productivity as a function of rainfall and other climatic factors. Losses from purely climatic causes need quantification in order to detect and monitor losses from other sources.
8) Investigate the role of predation in chick productivity. About half of hatched chicks die before fledging, most from unknown causes. The role of predators needs quantification, and methods of reducing chick loss may then become apparent.
9) Determine the diet and energy requirements of the wattled crane. Very little is known of food selection, nor of how essential harvest leftovers are for nonbreeders. Captive studies will be used to supplement observations in the wild.
10) Central database establishment. It is essential that not only all field data be assembled in one database, but that it also contains a complete bibliography.

Priorities:

1) Determine biophysical characteristics of wattled crane nest sites (Action 3).
2) Determine diet and energy requirements of the wattled crane (Action 9).
3) Central database establishment (Action 10).
4) Determine minimum area requirements for wattled cranes (Action 5).

3. Executive Summary of the Threats Group.

The group was tasked with assessing the threats to the wattled crane population. The threat of impacts on habitat, however, was not assigned to this group, but to the group tasked with habitat loss. There are three sets of data available to assess these threats:

1) Reported incidents of mortality (section 9 of the briefing document);
2) Population data for both breeding and non breeding birds for the years 1982, 1988, 1994, and 1999
3) Independent subset of the reported incidents of known wattled crane individuals.

Reported incidents of mortality: The data set shows that collisions with power lines (mainly 22Kv lines) account for a mortality of 1.04% of the population per annum. The ratio of adults : immature : juveniles killed by power lines is 4,16 : 1 : 1,16. Mortalities through poisoning account for 0,19% of the population per year at an adult : immature : juvenile ratio of 4 : 3 : 0. Collisions with fence lines account for 0,15% mortality of the population. All birds killed were juveniles. Miscellaneous threats (hunting, illegal chick and egg removal, dogs) account for 0.24% of the mortality of the population at an adult : immature : juvenile ratio of 3 : 0 : 5. The accumulated percentage of these threats amounts to less than 2%, which we feel is far too low. The model also supports this in that a 2% mortality does not show a decline in the modelled population.

Population decline versus known mortalities: The loss of adult birds in the population during the periods 1982-1988, 1989-1994 and 1995-1999 was compared with the incidents of known mortality during the same periods. This revealed that virtually all adult mortality remained unexplained; it also suggested that adults may move from breeding sites to floater flocks.

Independent subset of the mortality data: Eight captive bred birds released in Mpumalanga were monitored until their deaths. The causes of their mortality (poisoning, collisions, etc) differed significantly in their relative frequency from the mortalities reported in the first data set.

Before the threats to wattled crane populations can be assessed, a clearer understanding of what causes crane mortality is needed. We recommend that addressing this shortcoming is a priority; we also recommend various mitigating actions in the areas where mortalities have been reported.

Recommendations:

1. There is a proposal to ESKOM to proactively fit mitigating measures to power lines in the vicinity of 36 wattled crane nests. We recommend that this is extended to the other nest sites as well as the areas utilized by the non-breeding flocks.
2. Reduce the mortality caused by fences, by reducing the disturbance around the nest site and making landowners and inhabitants on the farm aware of the problem
3. Accepting that there is a need for the use of agrochemicals, there is definite requirement to reduce the misuse of these chemicals.
4. The reduction of the illegal exploitation of wattled cranes through education and awareness programmes as well as prosecution.
5. Establish an effective network of informants and an efficient reporting procedure to determine the effects of threats on the population in terms of mortality rates and increase the rate of effective reporting of mortalities

4) Executive Summary of the Captive Population and Modeling Group.

The group assessed the validity and need for a supplementation (release) programme and a captive wattled crane breeding programme. The conservation value of these programmes was examined and various management scenarios for both programmes were modeled using Vortex. The issues of maintaining the genetic integrity of the South African population and the development of alternatives to captive breeding were also discussed.

Supplementation

Key question: Can a supplementation program play a significant role in the longterm survival of the wild South African population of wattled cranes?

To answer this question a number of scenarios were modeled with assistance from the Life History, Population Dynamics and Modeling Group using the Vortex software. The management scenario that had the most significant, positive impact on the wild population was the discontinuation of the supplementation programme for a period of 5-8 years. During this period, the size and breeding success of the captive population could be improved and would allow time for other research and field conservation efforts to take effect (e.g. reduction of wild chick / juvenile mortality, habitat restoration / preservation, etc.). After 6-8 years, as many as 6 birds every 3 years could be produced for release from captive produced birds.

Recommendations:

1. Discontinue the supplementation program for the next 5 years.
2. Focus on building the captive program for the next 5 – 8 years.
3. Review and revise the Wattled Crane Recovery Team, strategy, roles, ownership and resource allocation.
4. Develop a mechanism for biannual review of strategy in the light of continuing research into all aspects of wattled crane conservation.

The success of the supplementation program depends on improved knowledge of the wild population with respect to:

1. Hatch and fledge rates of wild birds
2. Future availability of breeding habitat
3. Density dependence effects
4. Age class structure
5. Factors impacting size of non-breeding flock
6. Movements
7. Threats

Captive Breeding

Key question: Is a South African captive breeding program necessary?

This was answered in the affirmative following the Vortex modeling of the supplementation programme. It was recognized that the captive population would need to be larger than the one currently held and strategies to accommodate the increased captive population size and management needs were discussed. Vortex modeling was used to establish optimum captive population size in terms of retained heterozygocity, acceptable inbreeding coefficient, limited resources and its potential to produce enough birds to support a viable supplementation programme.

The management scenario that had the most relevancy based on limited resources for captive breeding in South Africa was to increase the captive flock to 40 birds as quickly as possible using second eggs collected from wild nests. After 8-10 years, carrying capacity will be reached and the flock can begin to produce offspring for a release programme.

The group supports the existence of a captive breeding programme for 2 reasons:

- To serve as a genetic reservoir in the case of catastrophic extinction of birds in the wild.
- To provide birds for a supplementation programme if required in the future.

<u>Recommendations:</u>

1. Replace 2 females in the captive flock (improper sexual imprinting may prevent these individuals from reproducing).
2. Keep all wild, second eggs collected in 2000 as captive stock.
3. Review and redirect resources for the current supplementation programme.
4. Examine the role of the current isolation rearing facility, which includes the role of Mpumalanga Parks Boards' continued participation; resources; personnel; and logistics of transport of chicks in light of the shift in focus from the supplementation programme to building a captive flock.
5. Identify alternative isolation rearing facilities at the KwaZulu-Natal Crane Foundation (KZ-NCF) / Treehaven / Umgeni River Bird Park.
6. Hold workshop to determine KZ-NCF / SACWG roles in light of the PHVA recommendations.
7. Arrange a workshop to review logistics and strategy of maintaining of captive flock issues including:
   - Ownership/directorship of program
   - Memorandum of participation and terms and conditions thereof and management protocols
   - Identification of additional facilities and holding space
   - A biannual review of the captive breeding program as research continues into all aspects of crane conservation

   - Investigate alternative housing of U.S. birds and non-productive adults. It is recommended that the U.S. birds be maintained in pens less suitable for breeding and that other potential uses for them are identified (e.g. used for educational display, foster incubator/parent role, disposition to other captive breeding programmes).

8. After 5 years, remodel the contribution that a supplementation programme would make to the wild population based on conditions in the wild. If review indicates supplementation would make a significant contribution, resources could be redirected after 3 years into a limited supplementation programme to further refine release techniques.

<u>Genetics</u>

In 1996, 6 adults were imported from the U.S. in an effort to increase the number of captive Wattled Cranes in South Africa. In 1999, 4 chicks were imported. In 1995, South Africa signed the Convention of Biodiversity. In an effort to protect the genetic integrity of South African species, in 1999, the South African CITES authorities placed a moratorium on the import and use wattled cranes and their eggs not of South African origin. In response, SACWG initiated a genetic survey to determine if the South African population exhibits genetic distinctness from populations in other range countries. Samples sizes were too small to make any definitive conclusions but preliminary results indicate that Botswana and Zimbabwe samples show very little divergence, whereas the South African and Zimbabwean populations show significant divergence. It has been recommended that the South African population of wattled cranes should be considered and managed as a distinct population unless future mixing of the populations becomes necessary to maintain viability.

Recommendations:

1. Conduct further genetics research to clarify relationship of wattled crane populations.
2. Consulting geneticists (Ken Jones and Dr. Paulette Bloomer) should meet / communicate to decide upon future strategy, costs, and feasibility of sample collection and analysis.
3. The captive breeding team should regularly review new information emerging from the genetics studies to determine appropriate management strategies.

Alternative Methodologies

Recommendations:

1. Explore cryopreservation of sperm to determine it's potential contribution to wattled crane conservation and feasibility.
2. Monitor development of egg or embryo freezing technology for birds (not available at present).
3. Do not pursue translocation of adult birds from within the South African population. It was decided that this technique would not be supported by the relevant conservation authorities and is inappropriate at this time.

5) Executive Summary of the Life History, Population Dynamics and Modeling Group.

The Modeling Working Group was tasked with developing a baseline model which best approximates the current population dynamics of the wattled crane population in South Africa, taking into account knowledge of the current population parameters, genetic structure and carrying capacity.

The model was then used to predict the outcome of different scenarios on the population so as to improve decision-making in respect of management to maintain a viable wattled crane population. The wattled crane population parameters were modelled using the VORTEX simulation model, a simulation programme designed to aid the understanding of the effects of deterministic, demographic, environmental, and genetic stochastic events on the dynamics of a wild population.

Baseline Model

As recorded mortality data was found to be inadequate to account for the observed decline in the wattled crane population, the post-fledgling mortality rate was estimated by adjusting the mortality rate in the model until the model results mimicked the observed populations sizes from 1980 until 2000. A mortality rate of 6 % resulted in a close fit of the model with the actual wild population data.

Based on the available data, the baseline model was developed with the following criteria : starting population size = 379 individuals (1980 population estimate); age at first breeding = 8 years old; juvenile mortality = 74%; immature and adult mortality at all ages 1 years old to adult = 6%; maximum breeding age = 45 years old; carrying capacity = 500 individuals; and no supplementation.

Notes on the Output Baseline Model

The resulting trend in this population model has shown that a 6% immature / adult mortality rate best approximates the real population trend over the past 20 years, assuming all other population parameters entered in the model are correct. Year 0 in Figure 2 represents the year 1980 while year 20 approximates the current time of year 2000. This population has a negative deterministic growth rate (r = -0.028), indicating that the population is in deterministic decline (the numbers of deaths outpace the numbers of births), and will become extinct even in the absence of any stochastic fluctuations. Following the model simulation, the stochastic growth rate becomes more negative (-0.0347) indicating that stochastic fluctuations further affect the population negatively. In summary, a significant finding of this baseline model is that the South African wattled crane population (without any management of the population) currently has a negative growth rate, and together with stochastic fluctuations, will go extinct in approximately 93 years' time (from 1980).

The baseline model was then used to model different scenarios, including :

- the effect of different mortality rates, and
- the effect of different supplementation strategies

For these scenarios, the sensitivity of the model to the age at first reproduction and age at last reproduction (reproductive senescence) was tested using the following values for these parameters :

Age at first breeding – 7, 8 and 9 years old
Reproductive senescence – 30, 45 and 60 years old

The aim of the modelling was to determine the characteristics of the population which could be manipulated (through management) that would result in the reduction of the decline in the wattled crane population and the ensured survival of the population into the long-term. Therefore, the conservation objectives were as follows :

- Reverse the current negative growth rate, to result in a positive growth rate for the population,
- Have a population that has a greater than 50% chance of survival over the next 100 years,
- Maintain a population with 95% genetic heterozygosity.

Sensitivity Analysis

At mortality rate of 6% (current level):

- Individuals with age of senescence of 30 all lead to extinction, including those at 45 with age at first breeding at 9 years of age (therefore age of senescence is significant).
- At mortality rate of 6% all population iterations maintain a negative growth rate, implying that in all these cases the population will eventually become extinct.

At mortality rate of 5%:

- Irrespective of the age at first breeding, all populations with age of senescence of 30 all become extinct within 100 years.
- At mortality rate of 5%, the only scenarios which generate a positive growth rate is a supplementation of 6 individuals per year after an initial 8 year period.

At mortality rate of 4%:

- Reducing the mortality rate to 4% (with no supplementation) results in a reduced probability of extinction (except for age of first breeding at 9 years of age and age of senescence at 30 years).
- In all cases (except where age of senescence = 30 years) the reduced mortality rate to 4% allows for supplementation of either 4 or 6 to result in a positive growth rate.

VORTEX Modeling of Effect Supplementation Programme has on Wild Population

The goal of the supplementation programme is to significantly increase the number of Wattled Cranes in the wild in South Africa and to develop supplementation techniques in case of catastrophic event. The following scenarios were modeled with assistance from the Life History Modeling Group using VORTEX.

- No supplementation
- Supplementing 4 birds (2 males / 2 females) every year from the first year
- Supplementing 6 birds (3 males / 3 females) every year starting at year 9
- Supplementing 12 birds (6 males / 6 females) every alternate year starting at year 9
- Supplementing 4 birds (2 males / 2 females) every year for the first

20 years ○ Supplementing 4 birds (2 males / 2 females) every third year from year 9

- Supplementing 5 birds (2 males / 3 females) every third year from year 9
- Supplementing 6 birds (3 males / 3 females) every third year from year 9

Recommendations Based on Model Results:

- Discontinue the supplementation program for the next 5-8 years and focus current efforts into developing the captive flock as a genetic reservoir.
- After 5 years, the status of the bird in the wild should be reviewed and the contribution a supplementation programme would make should be reevaluated.
- If modeling indicates supplementation would significantly contribute to the wild flock, then 3 years prior to a full-scale release effort, resources could be directed into the refinement of release methodologies and techniques.
- Length of time needed to continue supplementation should be examined.

Overall Recommendations:

The use of Vortex to model the wattled crane population allows for the interpretation of the effects of different ranges of factors and different management actions on the population. This allows for the setting of conservation management goals, which are more likely to reverse the population decline.

The baseline model shows the current trend of the wild wattled crane population in South Africa, using the most current information on population demographic parameters. This model shows that the population is in steep decline, a process that needs to be reversed in ensure the long-term survival of this wetlanddependent species.

Therefore, the following model shows the overall result of several management actions, which will result in the long-term conservation of the species, i.e. a positive growth rate in the wild wattled crane population.

The factors, which result in this model, are as follows, and form the basis of work required in the future on the wild wattled crane population :

- The reduction of immature / adult mortality by 4 individuals per year, thereby reducing the mortality rate to 4%.
- Implement long-term habitat management plans to safe-guard breeding sites, thereby allowing breeding pairs to successfully occupy a site for up to 45 years (several pairs in the past may have had the potential to utilize sites for longer periods due to their long life spans, but have been prevented through serious habitat degradation where breeding sites have become unsuitable).
- Supplementing the wild population with 6 captively bred individuals every second year, after an initial 8 years where the focus is placed on establishing a viable captive flock within recognised breeding institutions. The modelling of the captive

flock has shown that after the initial 8 year period, between 4 and 6 chicks will become available for supplementation every three years. Therefore, this more intensive release of 6 birds every second year will mean that the individuals available from the captive breeding programme will need
to be supplemented with second eggs from the wild to increase the number available for release every second year.

Additional research required into the population to refine our understanding of the species includes :

- Determining the age of reproductive senescence.

Determining the actual age of first reproduction.