the northern rhinos may eat more dicotyledons than the southern, and they have to survive in tall grasses he such as *Hyparrhenia* and *Loudetia* in the wet season, and in burnt areas during the dry season. Their social behaviour appears similar to that of the southern rhinos although ranges are about 10 times larger; this may be due to the very low population density in Garamba.

It was generally agreed that estimations of divergence times, subspecies designations and other phylogenetic/taxonomic aspects do not necessarily allow us to identify “evolutionary significant units” (ESU’s). Important ecological adaptations may remain hidden from biochemists investigating genetic material and blood proteins, and will almost certainly not be picked up through skull measurements, so it is necessary to investigate the range of habitats in Africa (with their varying selection pressures) in order to outline common-sense strategies for both continental and national rhino conservation initiatives. If a group of rhinos from one part of the species’ range is not likely to adapt to different environmental factors when moved to another part of the range, then it is obviously important to conserve representatives of the original populations of both regions.

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APPLICATION OF DECISION ANALYSIS TO BLACK RHINOS

Discussion Leader LYNN MAGUIRE

INTRODUCTION

Purpose

The presentation had three purposes: (if) to introduce several issues crucial to the management of small wild or captive populations; (ii) to propose for discussion some strategies for the coordinated management of wild and captive populations of black and white rhinos; and (ill) to examine two elements of the proposed strategies using formal methods for decision making under uncertainty. These methods have proved useful in developing management plans for other endangered species, including black-footed ferrets (Maguire, 1987a) and tigers (Maguire, 1987b).

Small population management

Several features of the demography and genetics of small populations have important implications for their management.

(I) The concept of *minimum viable population size* (MVP) (Schaffer, 1981) suggests that populations cannot be self-sustaining below some minimum level. Small populations are particularly vulnerable to extinction due to stochastic fluctuations: demographic (e.g. sex ratios at birth), environmental (e.g. variations in food supply), catastrophic (e.g. fire), and genetic (e.g. fixation of deleterious alleles).

(ii) Due to nonrandom mating systems, unequal family sizes, fluctuating population size, and other factors, real populations have an *effective population size* (Ne) that is often far lower than census size, which means that genetic variation Is lost much faster than would appear on the basis of total numbers. Loss of genetic variation is a concern because variation is the raw material for short and long term fitness, in the wild and in captivity.

(iii) Although a relatively small number of founders can capture most of the variation from a larger population initially, this variation will be lost quickly if the population stays small. Black rhinos have declined quickly, suggesting that the remaining animals may provide a good sample of previous levels of genetic variation, but not for long.

(iv) In long-lived species, such as rhinos, numbers may give a misleading impression of population status, because numbers may remain stable while reproductive rates and age structure show a population in serious difficulty.

Assumptions

Several assumptions about rhino taxonomic and population status coloured the decision analysis. I assumed that the designated subspecies of black rhinos (Groves, 1967) are part of a continuum of geographic variation over the species range, and that the two white rhino subspecies are likely more divergent than black rhino subspecies. The subspecies populations of black and white rhinos can be divided into two groups: those in immediate danger of extinction *(D.b. ladoensis, longipes, chobiensis, brucii,* and *C.s. cottoni)* and those with somewhat larger and/or more stable populations *(D.b. bicornis, michaeli, minor,* and *C.s. simum).* Either many of the sociopolitical factors contributing to the rapid decline of African rhinos will change in the next few years, or rhinos will become extinct: therefore, a very short time frame for rhino management decisions, say 15 years, seems appropriate. This is less than one rhino generation: genetic effects will not be evident within that period, but managers must be careful not to set up situations that may be successful in the short run, but disastrous in the longer term.

INTEGRATED STRATEGIES FOR WILD AND CAPTIVE MANAGEMENT

Objectives

Some of the possible objectives for rhino conservation include: (if) maximizing survival probability at the species, subspecies, or population levels; in the wild population, the captive population, or overall; (ii) maximizing retention of genetic variation for any of these categories; (iii) maximizing the number of subspecies or geographic populations surviving; (iv) maintaining the geographic range and habitat of rhinos; and (v) minimizing financial costs. Some of these goals may conflict.

Management strategies

The options for managing wild and captive rhinos may be organized into a hierarchy, ranging from least to most intensive: (ion) control of poaching and protection of habitat for wild rhinos; (ii) intensive management of wild populations. including translocation of animals among isolated populations; (ii) semicaptive (intensive *in situ)* management of rhinos in heavily protected, often fenced, areas; and (iv) captive management in zoos *(ex situ* management). Ideally, all levels of management should be coordinated, allowing exchange of animals as needed to maximize effective population size of each management unit. To date, most movements have been from the less to the more intensively managed situations. The challenge for rhino conservation is to develop a coordinated management plan using all levels in the hierarchy.

Because the focus of this workshop was the use of captive management in rhino conservation, the decision analyses presented here deal with the allocation of zoo space to the geographic units of African rhinos. The special strengths of zoos are: (I) reducing mortality, including human predation; (ii) enhancing reproduction through intensive management of captive breeding; and (iii) maximizing retention of genetic variability through intensive genetic and demographic management of captive animals.

For the near future, about 400 to 450 spaces are available for African rhinos in zoos which can be considered part of an SSP program. At present, of the seven extant black rhino subspecies, only *D.b. michaeli* (143 animals) and *D.b. minor* (5 animals) are represented in the captive populations. Only 11 *C.s. cottoni,* but 370 *C.s. simum,* represent the two white rhino subspecies. Given the relative status of the subspecies In the wild, this allocation of captive space is far from optional. Given also that a population size of around 100 animals per Interbreeding unit is desirable for long term captive management (to retain genetic variability), and that there are only about 450 spaces for nine African rhino subspecies, allocation of available space is difficult.

In weighing the reallocation of captive space among subspecies, several considerations arise. Because there is not enough captive space to maintain viable populations of each of the nine subspecies, it will be necessary either to exclude some subspecies from the captive program or to mix some subspecies in a single management unit.

Considerations in mixing subspecies, or even geographic populations, include the potential for outbreeding depression and the loss of genetic and nongenetic adaptations to particular environments. For example, *D.b. bicornis* in the southwestern deserts exhibits behavioural adaptations to the harsh climate. Availability of founders is a concern for the severely endangered black subspecies, none of which are currently represented in captive populations, It is generally undesirable to initiate a captive program with fewer than 15 to 20 founding animals (not necessarily obtained simultaneously). It may be impossible to obtain such a founding population for any of the moat endangered black subspecies: indeed, it may be difficult to obtain 20 founders for a mixed population of these subspecies, even at great expense. Maintaining fewer than about 100 animals in a captive management unit may be justified if continued opportunity for exchange of animals, or genetic material, with wild populations is likely. Therefore, for those subspecies with more stable wild populations, such as *C.s. simum,* a smaller captive program may be desirable. In any case, maximizing the productivity and the retention of genetic variability from all captive rhino populations is a priority, toward which redistribution of current captive animals and research on better captive management of reproduction and mortality should be aimed.

To make the captive program better serve the needs of rhino conservation, substantial reallocation of space will be required over a period of years. The plan should be adaptive, responding to changes in both wild and captive status during the transition period. The important points for the near term are to understand what initial steps are required, and what events in the wild should dictate a change in captive strategy.

CAPTIVE PRIORITIES

Capture of additional wild rhinos seems unavoidable if the captive program is to serve as a repository of genetic material and a source of animals in the future. in view of the current holdings of subspecies in captivity and the status of subspecies populations in the wild, priorities for additional captures are: (I) up to about 20 animals from the four most endangered black subspecies; (ii) two or three *C.s. cottoni,* perhaps over several years; (iii) *D.b. minor* and *bicornis,* about 10 animals each from a range of locations; and (iv) several *C.s. simum* and *D.b. michaeli* from regions not well-represented currently. Fortunately, with the possible exception of C.s. *cottoni* from Garamba, capturing additional wild rhinos raises little conflict between the needs of the wild and the needs of the captive populations. Most wild subspecies' populations are either large and stable enough to withstand the removal of several animals without harm, or so small and imperil lied that they seem doomed even without any removals. it is the intermediate situation, where removals would decrease the stability of the wild population, where a dilemma arises (Maguire, 1986).

DECISION ANALYSIS ——MIXED CAPTIVE POPULATIONS OF BLACK RHINOS

Preliminary versions of two decision analyses of aspects of the captive management of black rhino subspecies were presented for discussion. The management questions addressed were: (I) which subspecies should be included in the captive program, and at what population sizes; and (ii) why choose captive management in zoos over semicaptive (intensive *In situ)* management of the most endangered subspecies?

Which black rhino subspecies, and how many?

The decision problem addressed by this analysis is how to allocate the approximately 220 captive spaces potentially available for black rhinos (assuming an equal number of captive white rhinos) among the seven extant subspecies. The alternatives considered are: PLAN 1 ——a mixed population of the four most endangered subspecies *(ladoensis, chobiensis, brucii,* and *longipes)* of about 100 animals, and about 40 each of *bicornis, minor* and *michaeli;* PLAN 2 ——a mixed population of the four most endangered subspecies of about 220 animals; and PLAN 3 ——two captive populations consisiting of about 110 animals each of—*minor* and *michaeli.* The major uncertainty affecting how well each of these plans might serve the needs of rhino conservation is survival of *bicornis, minor* and *michaeli* in the wild. The first plan stresses including all subspecies in the captive program, even if some must be held in mixed populations, or in smaller management units than would be desirable in the tong term. The justification for maintaining *bicornis, minor* and *michaeli* at only 40 animals each is optimism about exchanging animals with surviving wild populations of these subspecies. The second plan emphasizes using available captive space to enhance the survival of those subspecies least likely to survive in the wild; it also assumes some optimism about the survival in the wild of the other three subspecies. The third plan concentrates on managing those subspecies currently represented In the captive population, probably with the addition of new founders for *minor,* at least. It emphasizes using the captive plan to bolster the subspecies with the best prospects for survival in the wild. It reflects a more pessimistic (some may want to say realistic) view of what can reasonably be accomplished by rhino conservation efforts. The subspecific groups used in this analysis correspond roughly to the four management units proposed in the workshop recommendations, with the southwestern unit being *bicornis* (and *chobiensis?),* the southern-central unit being *minor,* the eastern unit being *michaeli,* and the northern-western unit being *brucii, ladoensis* and *longipes.*

Objectives and criteria

The criteria for weighing which plan is best reflected several rhino conservation objectives. First, to maximize the number of distinct “lines”, or subspecies, surviving. This objective recognizes local adaption of geographic populations and coadaptation of gene pools. Second, to maximize the genetic variation represented by the founder populations for the captive program. This objective emphasizes the role of captive propagation in conserving the raw material for adaptation, genetic diversity. In calculating the proportion of genetic variation from the wild population represented by each subspecies, I assumed that the subspecies share one-half of their variation, which is probably an underestimate. Initial variation, rather than retention of variability, was used as a criterion because in the short time scale of 15 years, little or no variability is lost. The third objective is to minimize the rate at which variability is lost from the captive population due to drift and inbreeding. The concern here is that a captive plan should be tenable over the long, as well as the short, term, except in situations where the peril to a species is clearly temporary. In calculating the inbreeding coefficient for each plan, expressed as the percent variation lost per generation, I have assumed that the effective population size for captive populations will be about half the census size, which may be a little optimistic; that the effective population size of each of the surviving wild populations will be about 30, due to the fragmented nature of these populations and the lack of genetic management in semicaptive populations; and that there will be continued interchange among captive and surviving wild populations, so that the total effective population size for each subspecies is the sum of the captive and wild segments. The final objective is to minimize dollar costs. Since the same number of captive rhinos will be managed in each plan, the major difference among them is in the cost of acquiring new founders. The cost estimates are based on capturing about 20 of the northern-western animals for plans 1 and 2, about 10 *bicornis* for plan 1, and about 10 each of *minor* and *michaeli* for plans 1 and 3.

Decision tree

The preceding information about the three management alternatives, sources of uncertainty, and evaluation of outcomes according to the four decision criteria is represented in graphical form on the decision tree in Figure 1. The decision points are represented by squares, with branches of the tree for each management alternative. The sources of uncertainty are represented by branches emerging from circles, denoting random nodes, where the manager has no control over events. The values of the decision criteria associated with each combination of management action and random event (survival or extinction of *bicornis, minor* and *michaeli)* are listed to the right of the corresponding branches of the tree.

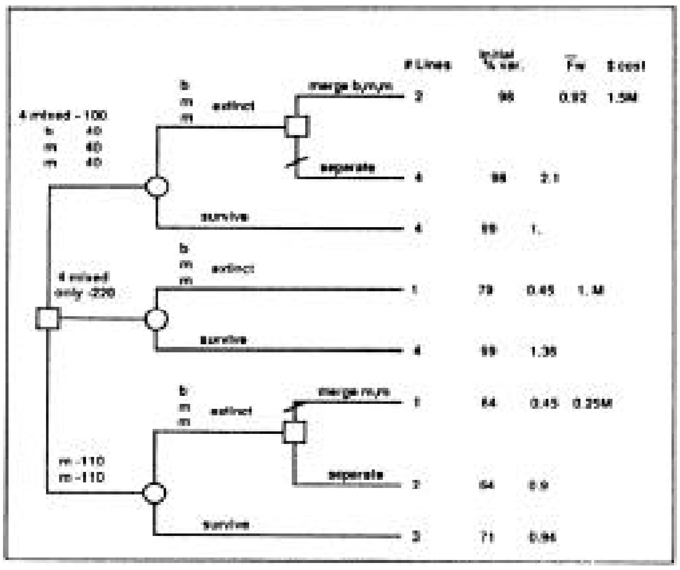

Figure 1. *Decision tree for analyzing how many black rhino subspecies to include in the captive program and at what population sizes. Fw = inbreeding coefficient; b, m, m =* bicornis, minor *and* michaeli.

Two additional decision points have been added on the branches representing plans 1 and 3. If *bicornis, minor* and *michaeli* go extinct in the wild, merging the captive populations of these subspecies may be desirable to maintain a larger effective population size for each management unit. For simplicity, I have assumed that this merger *will* take place under plan 1, reducing the inbreeding coefficient in the captive population from 2.1 to 0.92, but not in plan 3, where the separate populations are large enough to have an inbreeding coefficient less than 1 percent (which is often used as a maximum in breeding programs). The rejected alternatives are denoted by slashes on the corresponding branches of the tree (Figure 1).

Analysis of the tree

The first thing to notice from the decision tree is that for two of the decision criteria, dollar cost and initial genetic variation, there is no decision problem. One alternative is clearly best, regardless of the survival of *bicornis, minor* and *michaeli:* plan 1 for initial variation and plan 3 for dollar cost. Note also that for number of lines surviving, plan 1 always doss at least as well as any other plan, regardless of the random event, with 4 lines surviving if *bicornis, minor* and *michaeli* survive, and 2 lines surviving if they do not, i.e. plan 1 dominates the other plans for this criterion. In contrast, which plan is best for minimizing inbreeding depends on the random event: if the three survive in the wild, then plan 3 is best (0.94), but if they go extinct, then plan 2 is best (0.45).

To determine which plan is optimal in an uncertain environment, the probabilities of survival and extinction of *bicornis, minor* and *michaeli* are used to weight the criteria associated with the possible outcomes. These weighted values, or expected values, of the four criteria are listed in Table 1 for three estimates of probability of extinction, which may be viewed as ranging from optimistic (0.25) to pessimistic (0.75). the principles of decision theory suggest that the best decision under uncertainty is the one with the best expected outcome. For each of the four criteria, the optimal decision is starred in Table 1. Note that for pessimistic views of extinction in the wild, plan 2 minimizes Inbreeding whereas, for optimistic views, plan 3 is best.

Tradeoffs

The major remaining hurdle in selecting one option as superior is resolving tradeoffs among the four criteria. Maximizing number of lines and maximizing initial variation conflict with minimizing dollar cost and minimizing inbreeding, In some instances, it is easy to resolve these tradeoffs informally. For example, it seems obvious that plan 1 is superior to plan 3, for number of lines, initial variation, and inbreeding, because a small increase in inbreeding nets a large increase in the other two criteria. Other tradeoffs may not be obvious: is it worth half a million dollars to raise initial variation from an expected value of 89 to **98.5%** (for p = 0.5)? Structured series of questions can be used to help managers articulate how much of one criterion they are willing to sacrifice to gain in another dimension (Maguire, 1986; Behn and Vaupel, 1982). As an initial strategy, I propose capturing as much of the genetic variation as financial constraints allow (plan 1), coping with inbreeding later by merging the captive populations as necessary. Meanwhile, studying the structure of genetic variation among geographic populations, in conjunction with the capture program, will help reduce uncertainty about outbreeding depression or loss of coadaptation in merged populations.

Table 1. Expected values of the four decision criteria for each of the three management alternatives from Figure 1, calculated for three values of p = probability that bicornis, minor *and* michaeli *become extinct in the wild. Fw = inbreeding coefficient. The best expected values for each criterion and each value of p are starred.*

	Expected values			
Alternative	No. Lines	Initial Var.	Fw	$(M)
	P =0.25			
mixed, b, m, m	m 3.5*	98.75*	0.98	1.5
mixed only	3.25	94	1.13	1
m, m	2.75	69.25	0.93*	0.25*
	p = 0.5			
mixed, b, m, m	3*	98.5*	0.96	1.5
mixed only	2.5	89	0.905*	1
m, m	2.5	67.5	0.92	0.25*
		p = 0.75		
mixed, b, m, m	2.5*	98.25*	0.94	1.5
mixed only	1.75	84	0.68*	1
m, m	2.25	65.75	0.91	0.25*

CAPTIVE VERSUS SEMICAPTIVE MANAGEMENT OF THE MIXED POPULATION

The preceding analysis argued in favour of starting a mixed captive population of the four most endangered subspecies, as a means of capturing and retaining genetic variation represented (temporarily) by the surviving remnants of these subspecies. Why should this mixed captive population be maintained in zoos, rather than in a semicaptive situation? Why should the four subspecies be mixed, rather than being maintained separately?

In a decision analysis to address these questions, four alternatives were considered. First, controlling poaching and protecting habitat for these subspecies in the wild: the major uncertainty here is whether these severely fragmented populations will survive even with increased protection. Second, maintaining a mixed, semicaptive population of about 100 animals: the major uncertainty is the possible impact of outbreeding depression on effective population size. I assumed that if outbreeding depression is a problem, the ratio of Ne to N may be as low as 0.05, rather than the 0.2 assumed for semicaptive management in the absence of outbreeding depression. The third alternative is maintaining separate zoo populations of the four subspecies with about 25 animals each: the major uncertainty is whether there will be sufficient founders to successfully establish each subspecies in captivity. The fourth alternative is a mixed zoo population of about 100 animals: the major uncertainty is that outbreeding depression could reduce the Ne to N ratio from about 0.5 to perhaps 0.1. The same four criteria were used to evaluate possible outcomes as in the preceding analysis.

Decision tree

These alternatives, uncertainties and criteria are represented by the decision tree in Figure 2. The dollar costs are listed on the decision branches, rather than to the right of the tree, In assigning probabilities to random events, I have assumed that the fates of the wild population of different subspecies are independent (which may not be the case if the same factors are leading to decline everywhere), and that the probability of a single subspecies surviving in the wild *for* 15 years is 0.16. Similarly, in assigning probabilities for success in establishing separate captive populations, I have assumed that the different subspecies behave independently (which may not be the case if the same husbandry problems afflict all), and that the probability of successful establishment of a single subspecies is about 0.1 (mainly because of the difficulty in obtaining sufficient founders; only about half the wild caught rhinos have bred in captivity). I have assumed that the probability of outbreeding depression In the mixed populations is about 0.1, which, given the small differences among subspecies observed in genetic studies so far, may be an overestimate. The probabilities are listed on the random events branches in Figure 2.

In calculating the inbreeding coefficients from effective population size, I have assumed an Ne for surviving wild populations of 3, which is probably realistic for these very fragmented remnants, in assigning initial variation captured by different plans, it is not strictly true that 20 wild founders would capture 100% of the variation from the wild population, but this figure is close enough for comparison with the other alternatives and it simplifies calculations.

Analysis of the tree

In examining the decision tree, notice first that the mixed zoo and mixed semicaptive populations offer the "certainty"

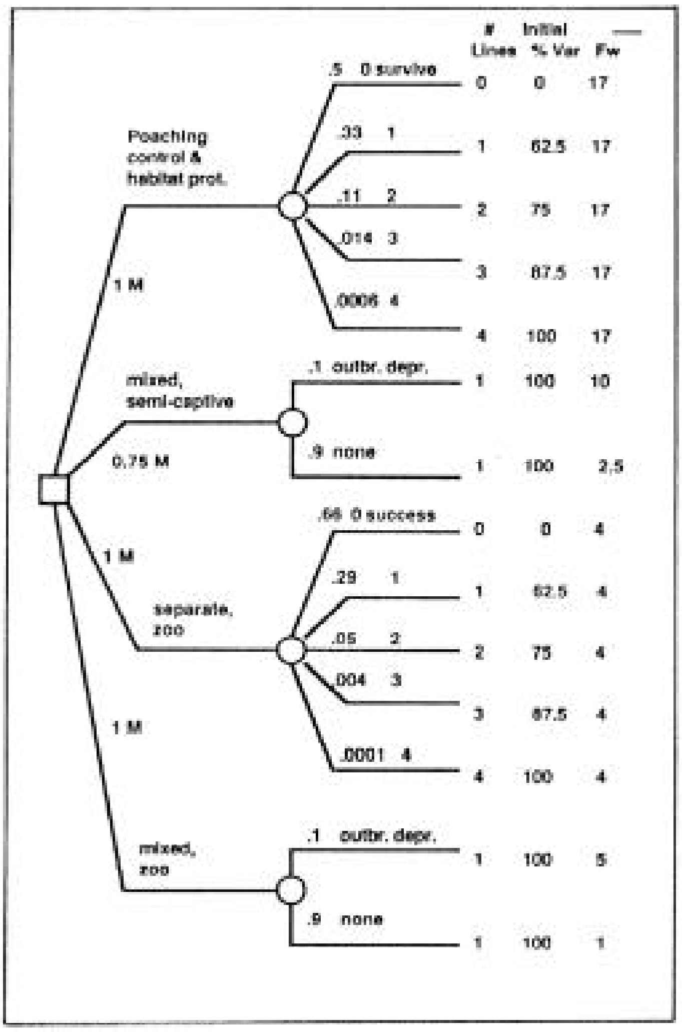

Figure 2. Decision tree for analyzing management alternatives for conserving the four most endangered black rhino subspecies (ladoensis, longipes, brucii, *and* chobiensis). *Dollar costs of each alternative are listed on the decision branches.*

Table 2. *Expected values for the four decision criteria for the four management alternatives in Figure 2.*

	Expected Values			
Alternative	No. Lines	Initial Var.	Fw	$(M)
Poaching control w/ habitat protection	0.63	38	17	1
Mixed, semicaptive	1*	100*	3.25	0.75*
Separate, zoo	0.4	26	4	1
Mixed, zoo	1*	100*	1.4*	1

that one line will survive against the gamble that from 0 to 4 lines might survive in the wild or in separate zoo populations. Which alternative is best depends on the probabilities for the uncertain events affecting survival In the wild and successful establishment of separate captive populations.

The expected values for each of the four decision criteria for the probabilities listed on the decision tree appear In Table 2. Notice that the probabilities of survival for the wild populations and of successful establishment of separate captive populations.

The expected values for each of the four decision criteria for the probabilities listed on the decision tree appear in Table 2. Notice that the probabilties of survival for the wild populations and of successful establishment of separate captive populations are so low that the expected values for number of lines surviving are much lower for plans 2 and 4 than for the mixed population options. The major advantage zoo management has over semicaptive management is the lower rate of inbreeding under more intensive management. Greater attention to manipulation of breeding stock and exchange of animals along semicaptive populations could reduce this advantage of zoos and make semicaptive management more attractive. The thrust of the captive program is to maintain genetic variation that would otherwise be lost; at present, zoos are best equipped to do this although there is certainly room for improvement in zoo management as well.

CRITIQUE OF ANALYSES AND RECOMMENDATIONS FOR FUTHER WORK

The advantages of decision analysis for endangered species management are discussed by Maguire (1986). in these examples, the conclusions (that all subspecies of black rhino should be included in the captive program, and that a mixed population of the most endangered subspecies should be maintained in zoos) should be taken less seriously than the form of the analyses, since they are based on very preliminary information. The formal decision tree structure helps to organize and display information pertinent to these rhino management problems. Scrutiny of the decision tree helps to identify which management alternatives are best under any conditions, and which depend critically on chance events; alternatives with "certain" outcomes can be distinguished from risky ones.

Sensitivity analyses, showing how the decision might be affected by changes in the probabilities assigned to random events or by the values assigned to the decision criteria, are important for building confidence in a particular course of action or directing further study. in the first example, different probabilities of extinction of *bicornis, minor,* and *michaeli* were used to show how the decision strategy might change. In the second example, sensitivity of the decision to the probabilities of outbreeding depression, of survival in the wild, and of successful establishment of separate captive populations can help identify the circumstances under which semicaptive management would be better than zoos.

A structured analysis shows where additional information about chance events could reduce uncertainty and lead to a better decision. Genetic analyses of rhino subspecies can help reduce uncertainty about outbreeding depression in mixed populations, guiding the sampling of geographic regions for founders of captive and semicaptive populations and the merging of these populations in the future.

Tradeoffs among conflicting criteria, particularly between financial and biological criteria, are typical of endangered species management decisions. The two examples presented here raise the difficult question of how the value of obtaining founder animals from the northern-western subspecies of black rhino should be weighed against the difficulty and expense of doing so.

in addition to the two questions addressed by these preliminary examples, many other rhino management decisions might benefit from formal analysis:

(i) Under what circumstances is wild, intensive *In situ,* or *ex situ* management best? Among the criteria to be used for this decision are: biological impacts, including disruption of behavioural adaptations or coadapted gene pools; political impacts on local and national support for conservation; socio-economic impacts on local economies; and likelihood of sub-species survival.

(ii) How many founders are required to justify maintaining a separate subspecies population? At what point should some subspecies populations be merged for semicaptive or captive management? Among the issues here are the genetic and demographic risks of few founders weighed against the irreversibility of merger.

(iii) What are the optimal strategies for translocating animals among semicaptive and/or captive populations? Which sexes and ages should be moved, what size groups, how frequently? The concerns here are the relative genetic and demographic contributions of different sexes and ages, social disruption caused by moving animals, risks of mortality during and after translocation, financial cost, and hazards of inbreeding in isolated populations. Some of these issues are addressed in Maguire (1986) and in previous analyses of translocations to augment grizzly bear populations (Maguire, unpublished report to U.S. Forest Service).

(iv) What are the risks and benefits of ongoing exchanges of animals, or genetic material, among captive, semicaptive and wild populations? Social disruption, impact of removals, transmission of disease, risks of injury or death to individual animals, disruption of local adaptation, and loss of genetic variation from drift and inbreeding are among the considerations here.

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SMALL POPULATION MANAGEMENT OF BLACK RHINOS

Session Chairman DAVID CUMMING

STATUS OF BLACK RHINOS IN THE WILD

The black rhino has declined more rapidly over the past 20 years than any other large mammal. In 1970 there were about 65 000 black rhinos in Africa; the total is now under 4 000, a decline of 94%. The population sizes in the various African countries within this decade are roughly as shown in Table 3. The remnants of a number of the populations are scattered as individuals or in very small groups over vast areas. For instance, the estimated 200 rhinos remaining in the Selous Game Reserve of Tanzania are dispersed over 55 000 km^2.

The recent decline of the species is due almost entirely to commercial poaching for rhino horn. The decline in South Africa, due to natural factors in the Umfolozi-Hluhluwe complex, appears to be the one exception (the 1984 figure was probably an overestimate). In the early 1980's about half of the horn put onto the world market went to North Yemen where it is used for making dagger handles, while the remaining half went to eastern Asia for the production of traditional medicines. Most of these rhino horn mixtures are produced because they are believed to lower fevers, not because of alleged aphrodisiac properties. North Yemen has recently strengthened some controls on the import and use of rhino horn, so there may be changes in the relative importance of the markets.

Prices for African rhino horn have risen from about $30 per kg wholesale in 1970 to about $900 per kg today. Asian rhino horn is believed to have more potent medicinal properties and therefore commands much higher prices in eastern Asia. To halt and reverse the precipitous decline in the numbers of black rhinos will require concerted action by many individuals and organisations. International, national and local conservation efforts will be most effective and make the best use of scarce resources if they are part of a planned campaign. To achieve this coordination of effort, a broad framework of policies on rhino conservation (i.e. a continental rhino conservation strategy) must be agreed upon by the principal agencies involved, and plans of action ——with clear priorities ——must also be elaborated in line with—these policies, and kept updated as the black rhino situation changes. The African Elephant and Rhino Specialist Group (AERSG) is currently developing a continental black rhino conserva-