LAST ANIMALS AT THE ZOO

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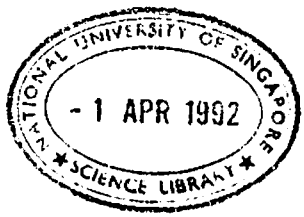
How Mass Extinction Can Be Stopped



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of indefinite size is not easy. To conserve it within a population that is deliberately kept within (usually fairly modest) bounds requires tight management and cooperation. Sometimes the problems of numbers seem to arise almost as soon as those of reproduction are solved. Such was the case with the golden lion tamarin, as we will see. But within virtually all successful breeding programmes, demography rapidly becomes a pressing concern.

When the captive population is at least self-sustaining, reintroduction becomes an option. To be sure, this option will not necessarily be acted upon; or at least not immediately. Successful reintroduction is far from simple, and there are many obstacles to overcome before it can begin. There is also a logical constraint. Ideally, captive breeding should begin before, and preferably well before, the wild population is beyond redemption. Neither should captive breeding be seen as a substitute for habitat protection or for management in the wild. Thus, in general, captive breeding and protection in the wild should proceed side by side. Ideally, both programmes would succeed, in which case the option of reintroduction would not need to be exercised, although individual animals might be exchanged between the wild and captive populations to ensure that each is genetically enriched. It is an inescapable and oft-demonstrated fact, however, that protection in the wild does not always succeed – and probably, for many species, it cannot succeed in the short term; and of course, if it does not succeed in the short term, then there will be no long term. In many regions, the possibility of war alone is enough to justify captive breeding programmes elsewhere.

Even if reintroduction is deemed necessary and desirable, then in many cases – most – this phase is held up, because there is nowhere safe or suitable to return the animals to. In many cases we must simply wait until – as suggested in chapter 2 – the human population falls (one hopes of its own volition) and wilderness again becomes available. But sometimes, even now, space can be made available. Sometimes all that is required is a change of heart among the local people or government (sometimes governments lead, and sometimes the people lead). So it is that more than 100 introduction schemes are already in progress worldwide – which between them raise and illustrate a whole spectrum of new problems.

Finally, the animals, once returned, must constantly be monitored; to ensure that they are fit enough as individuals – perhaps after several generations as captive animals – to cope with the wild; to ensure that the habitat that has been prepared for them is truly suitable – for it will not always be the one they originally lived in, and in any case will generally have changed since they left it; and then to ensure that the wild herds (which will usually be smaller and more confined than the original wild herds) do not run into further genetic problems. The reintroduced herd,

in short, will inevitably be managed to a greater or lesser extent; which indeed must be the case for most large animals (and many small ones) if we truly value their survival. Increasingly, there will be a flow of genes (either individuals or simply of gametes – see chapter 6) between the wild and captive populations.

All this, at least, is the ideal. It is hard to find a single convincing example in which the entire logical sequence has been worked through from beginning to end – mainly because these are still early days. To be sure, several species have been rescued from the wild, bred in captivity, and then returned, including the European bison, Père David's deer of China, the Arabian oryx, the Hawaiian goose, the red wolf of North America, the gold lion tamarin of Eastern Brazil, and several more. Several more have been bred successfully in captivity and are now on the point of return: Przewalski's horse of Central Asia, the black-footed ferret of North America, and perhaps the California condor are among them.

But the programmes of capture and reintroduction that are already well advanced are obviously the ones that began some years ago; and none of those mature examples began under ideal circumstances. There was no PVA to decide whether a captive breeding programme was really required, and how this would leave the remaining animals, and which animals should be taken out. The classic examples were not cool exercises in applied conservation science. They were last-ditch rescues. The last few Arabian oryx were about to be shot when they were captured; the last few California condor were being poisoned; and the last few black-footed ferret were threatened with canine distemper. All of them were simply snatched from the jaws of oblivion. Furthermore, some reintroductions (for example of the Hawaiian goose) cannot be considered an unequivocal success. On the other hand, those animals that have been subject to modern PVA and all that follows – such as the Javan rhinoceros and the Florida panther – are not yet involved in up-and-running breeding programmes. But at least now, as the 1990s get under way, we know (or think we know) what ought to be done.

I will look at the various stages of an ideal captive breeding plan in turn, to see how things are progressing; and to see whether and to what extent reality can ever match up to our ideals.

Decision time for the Javan rhino

A contentious issue at the beginning of 1991 is what to do about the Javan rhino. This is one of the three species of rhinos in Asia. Like the Indian, but unlike the Sumatran and the two African species (the white and black), it has only one horn. It is probably the rarest species of large

animal in the world. There are probably 50 left in Java (no one is quite sure), all in the tiny peninsula of Ujung Kulon to the west of the island; and perhaps ten in Vietnam. There are none in captivity, in Java or anywhere else.

In general, Indonesian conservationists such as Widodo Ramono, and Charles Santiapillai of WWF who is based in Indonesia, would like conservation efforts to focus on Ujung Kulon itself, primarily to protect against poachers.[4] A second population should be established, they say, but within Indonesia. The population has appareently been stable for the past 15 years, they say. The composition of the present population (how many males, how many females, how many of breeding age, how many in breeding condition) is unknown; and so, too, is the actual and potential breeding rate. Any animals that were caught for captive breeding would have to be caught randomly – they are difficult enough to see, let alone catch – and those that were left might well be a non-sustainable rag, tag and bobtail. Among captive rhinos in general only blacks are now breeding reasonably reliably. In particular, the attempted rescue of the Sumatran rhino has not so far set an encouraging precedent. Sumatran rhinos in the wild are now reduced to around 600 animals – not so parlous as the Javan but none the less already split into sub-populations that in general are not individually viable. Small captive herds of Sumatrans have now been established in Sumatra, and divided among several zoos in America (including San Diego and Cincinnati) and Port Lympne in England; but none have bred, and several have died during or after capture. No Javan has ever bred in captivity, and at present there are none in captivity. Capture, transport and captive breeding are horrendously expensive (each Sumatran in captivity has cost hundreds of thousands of dollars) and, say Drs Ramono and Santiapillai, the money would be better spent on local protection than on captive breeding schemes that they perceive to be highly speculative. On the face of it, the conservative school seem to have a very strong argument.

Ulie Seal of CBSG concedes that these arguments are indeed strong; that all the dangers of capture and shortcomings of captive breeding must be taken into account. Nevertheless, he feels that future strategies for the Javan rhino must include captive breeding. In practice he recommends that between 18 and 26 animals should be removed from Ujung Kulon, and these should found two more captive herds in Indonesia, and one in some remote area, safe from any war or natural disaster that might overtake Indonesia itself – which in that part of the world could include volcanoes.

This recommendation rests upon several lines of thought. First, there is the general notion that emerges from the theory in chapter 4: that a population of 60 is more or less bound to go extinct within a few decades, if it is simply left to itself. If it does not fall foul of natural disaster in the

short term, then it will become increasingly inbred. In small populations that remain small for several generations the rate of genetic drift is enormously high. Ulie Seal advocates, indeed, that the population of Javan rhinos should be raised as rapidly as possible to 2000 animals. Even without the insight from detailed ecological studies, however, it seems highly unlikely that the Ujung Kulon population could ever rise above 100; and perhaps the present 50 or so is near the upper limit. It is tempting to calculate the area that an exotic species needs by drawing comparisons with familiar animals in familiar circumstances. Thus we may observe that a domestic cow can get by on about half a hectare, even when it is lactating and its energy needs are high. Javan rhinos are roughly five times as heavy as a cow – so we might casually suggest that one rhino could get by on about two and a half hectares. But cows have evolved to eat grass, whereas Javan rhinos are browsers. The grass that cows eat on modern farms has been bred to be nutritious and palatable, and every non-edible species is rigorously excluded from the pasture. Perhaps only one in 100 of the plants that surround Javan rhinos are edible. *All* those plants in general do their best to avoid being eaten, and are liable to be tough and probably toxic. Only a small part of each plant can be eaten. So if a cow needs half a hectare of lush pasture, we might conservatively estimate that a rhino in a wild forest would need five times more (to take account of size difference); another 100 times more (to take account of the proportion of plants that are edible); and 100 times more again (to take account of the proportion of each edible plant that can actually be eaten at any one time). So we have two-and-a-half times a hundred times a hundred = 250,000 hectares of forest per animal. The real figure is bound to be much less than this, for browsing animals know their own business better than I do. But the principle holds: the area each animal requires is liable to be vast.

The rhino population of Ujung Kulon has apparently been steady for the past 15 years. This might be a good thing – or not. Rhinos are not rapid breeders by some animals' standards, but if they are protected and conditions are good, then their populations can and do expand rapidly. Thus Kenya now has roughly 300 rhinos among 11 dedicated reserves. Rob Brett of the Kenya Wildlife Service and the Zoological Society of London reports that between 1986 and 1989 black rhino populations within those reserves have grown by as much as 15 per cent per year; while the slowest rate of increase was 3 per cent. Over the whole 11 reserves, the average increase has been around 10 per cent per year. Dr Brett estimates that Kenya's dedicated reserves could hold about 600 animals, and that this number – which is beginning to achieve comfortable dimensions – should easily be achieved in ten years.[5]

So why isn't the Ujung Kulon Javan rhino population increasing?

Partly because it is being poached (slowly; but a few losses make a big difference to such a population); and partly – indeed certainly – because the area simply is not large enough to accommodate more. Thus, if any new rhino is born (and we do not know how many have been born) then, sooner or later, that newcomer or some other rhino will be pushed out; which means it will die.

All these factors – the likelihood of disaster, such as an erupting volcano; the breeding potential of the remaining animals (in so far as this can be judged); the holding capacity of the environment; the rate of genetic loss by genetic drift and the effect of this (if known) upon subsequent breeding success – are quantified as far as is possible, and all these quantities are fed into a computer to become part of the Population Viability Analysis. If all the relevant factors could be quantified exactly, then the PVA would give precise bookmaker's odds on the population's chances of survival over a given period. In practice many of the important parameters can only be guessed (albeit sensibly), so PVAs give only a range of likelihood – which in the case of the Javan rhino is quite a wide range. None the less, the conclusion from PVA is that the Ujung Kulon population left to itself is doomed. It cannot expand within its present confines; but unless it expands, extinction will inexorably ensue.

There is one last common-sense argument to suggest that some animals must be removed from Ujung Kulon: one that underpins the world's most sensibly controlled fisheries. If a population is as big as its habitat will allow – if it is at 'carrying capacity' – then, by definition, it cannot expand. So fishermen who wish to take the 'maximum sustainable yield' – which again by definition is the most that can be produced over an open-ended period of time – must first *reduce* the parent population. If they do not, then there is no room for expansion; there will be no 'yield' for them to take. If they first reduced the parent population by only about 10 per cent, then they would not get a large sustainable yield, because there would not be much room for expansion. If on the other hand they first took out 90 per cent of the parent population, then they would not get the greatest sustainable yield either, because the parent population would then be too small to produce many offspring. It transpires, indeed, that the maximum yield is produced by first removing about half the original population; the natural compromise between too few and too many.

I take this line of thinking as independent evidence that Ulie Seal's PVA of the Javan rhino is at least sensible. The aim is to produce 2,000 animals as quickly as possible. The Ujung Kulon population cannot expand unless some animals are removed. If about half of them are removed (Seal's 18–26) then this will allow the remaining animals to expand at the maximum rate possible. If the animals that are taken out also breed, as

they should, then that will be a bonus. Even if they did not, however, then – if fisheries are any precedent – the population in Ujung Kulon could be the same in ten years' time as it would have been if none had been taken out. By this argument, there might be nothing to lose by removing some of the animals.

What of the lack of success so far in the Sumatran captive breeding programme? Is this not a discouraging precedent? Certainly it is; but there is no reason to suppose the present problems cannot be overcome. Sumatran rhinos have been caught in the wild so far by digging pits, and some have been injured along the way, which is a terrible thing to do to an endangered animal (or any animal). In Africa, both black and white rhinos are commonly caught and translocated from place to place, and they are usually caught by anaesthetic darts. In fact, although this whole process nowadays generally works wonderfully, anaesthesia cannot be taken for granted, particularly in the field; for example, the effect of an anaesthetic depends very much on the animal's state of mind. We cannot assume, therefore, that 'chemical restraint' is necessarily preferable to mechanical constraint, and if mechanical constraint can be made to work well (holding the animal 'gently but firmly') then it is probably preferable. In short, it is not unreasonable to catch rhinos in pits if they have to be caught at all; but we should be very careful how we design those pits. Method of capture, in general, is still an issue.

It is true, too, that Sumatran rhinos have not bred well in captivity, and indeed that among rhinos, only the black seems to be breeding satisfactorily in zoos. But it is hard to conceive that this state of affairs will persist. As we will see in the next chapter, scientists at London's Institute of Zoology are now providing the basic physiological insights that should make it possible to encourage breeding with far more certainty; and Cincinnati's Center for the Reproduction of Endangered Wildlife (CREW) plans to apply the advanced techniques of artificial insemination and embryo transfer. CREW's successes so far suggest that these plans are not unrealistic. We have already seen, too, that black rhinos in Kenyan reserves breed well. It will be surprising, in short, if captive rhinos in general are not breeding reliably by the late 1990s.

At one time it seemed as if the discussion between the CBSG, and the Indonesia-based biologists, was becoming rancorous. The discussion was indeed caricatured by some outside observers, who represented CBSG as gung-ho interventionists, and the Indonesians as stick-in-mud romantics. Yet at the Rhinoceros Symposium held in San Diego in May 1991, both groups made it clear that they favoured the establishment of a second Javan rhinoceros population – initially in Indonesia. The debate was only about timing and numbers. The committee that was to decide the strategy for Javan rhinos was due to meet early in 1991, but was

delayed by the Gulf War. It should convene later in 1991. It will be surprising, though, if captive breeding does not play some part in saving the Javan rhino – though centred, for the forseeable future, in Indonesia.

The fire brigade approach to captive breeding

In the Javan rhino programme (if and when it gets going) only a proportion of the wild animals will be taken for captive breeding, and the captive and the wild herd will complement each other. Often, in the past, captive-breeding programmes have begun much less tidily and (though at the time there may have been no alternative), much less satisfactorily.

Sometimes, captive-breeding programmes have begun by default. The wild (or more or less wild) species has disappeared, and suddenly it was realised that the only individuals left were in some park or zoo. The classic example is Père David's deer – a large, lugubrious, splay-hoofed relative of the red deer. It was once widespread in China. It is versatile, and in the words of one scientist who has worked on it, it is 'as tough as old boots'. But China has long been a hungry and crowded country, and by the end of the last century Père David's deer had been hunted to extinction almost everywhere. Then came the Boxer uprising; and the last few were killed in the Emperor's garden in Peking. (That at least is how it seems; for it is at least conceivable that some survived elsewhere.) But Britain's Duke of Bedford had already taken some into captivity at Woburn. They have bred in Britain and Europe throughout this century – albeit not in accord with the kind of genetic theory outlined in this book, because such theory did not exist until Père David's captive breeding was well advanced. Instead, natural selection was more or less allowed to take its course. Those that survived harsh winters gave birth to the next generation and somehow or other they came through. Some animals, after all, are relatively free of deleterious alleles, and survive genetic bottlenecks; and the Père David's evidently belongs to this fortunate minority.

Now Père David's can be found in captivity worldwide. In New Zealand it is a commercial animal, favoured for venison because of its large size. Britain's farmers would like to farm it too – and perhaps to cross it with the red deer, though the hybrids are not as fertile as is desirable – partly for their large size, and partly because they give birth in April rather than in June as the red deer do, and so their calves are much bigger by the autumn and can be sold for venison before their first winter, like lamb. This book is not about farming, however. The point here is merely that animals *can* be snatched from the grave by captive breeding, and sometimes recover to become positively common. In 1986 London Zoo and Whipsnade Wildlife Park cooperated with Chester, Glasgow,

Longleat, Knowsley Park and Marwell to return Père David's deer to the specially created Da Feng Milu reserve in China. With luck, Père David's deer will be a wild animal (or semi-wild) again. But its survival so far has depended on the collector's instinct – the whim – of a 19th-century English aristocrat.

Several 20th-century captive-breeding plans have begun not so much by default, but as an inescapably necessary last-ditch attempt to save a species from oblivion. Four outstanding cases are the Arabian oryx, the black-footed ferret, the California condor, and the red wolf. It certainly is not ideal for captive breeding to begin so precipitately, with the wild population reduced to the point of disaster. To intervene before that point is reached – as is proposed for the Javan rhino – is obviously preferable. But the last-ditch rescue of the Arabian oryx has become one of the folk-tales of 20th century conservation, and is worth relating in detail.

How the Arabian oryx was snatched from the grave

Arabian oryx are beautiful creatures, the size of a small pony, with long sweeping horns. The ancient Arabs used to bind their horns together; which, according to Aristotle, gave rise to the myth of the unicorn. This is recorded, too, in *Deuteronomy* 33:17: 'His glory is like the firstling of his bullocks and his horns are like the horns of unicorns.' Arabian oryx are marvellously adapted to the desert; so much so that they once occupied the entire Arabian Peninsula, north into Mesopotamia. But the adaptations that suit them so well to the desert – and the openness of their territory – make them very easy to hunt. They are white, and they deliberately make themselves conspicuous, standing on hillocks so they can be seen by their fellows; and thus they avoid being lost. They are not rapid movers, for that would not be appropriate in the desert heat. They move to new grazing lands by night; and they travel along routes they have travelled before, for that too helps to avoid being lost. They are easy to see, then, and easy to ambush. The Arabs have hunted them from time immemorial.

But so long as the Arabs hunted only from horseback and camelback, and with bows and spears, the oryx had little to fear; and they were plentiful, until well into the last century. Then the British, the Germans, and French brought in rifles, by the million. By the end of the 19th century, very few oryx remained in the north of their range. World War I and the Turkish occupation wiped out the oryx from most of Arabia. By 1935 only two populations remained: one in the northern Nafud (on the borders of present-day Jordan and Saudi Arabia); and one in the south, along the border of Saudi Arabia and Oman, in the desert of the Rub-al-Khali.