

Conservation Commission of the Northern Territory
Environment 90 Conference, Darwin, March 8, 1990

Wildlife Worldwide - Strategies for Species Survival

by Peter Dollinger, Swiss Federal Veterinary Office

Differently from **plants** which need only sunshine, air, water and minerals from the soil to exist, **animals** have to exploit other species - vegetal or animal - for survival.

Since our own species, *Homo sapiens*, is not a plant but belonging to the Animal Kingdom, it is quite logical, that also mankind **has** to exploit other species. The question is not whether or not we should do it, the question is **how** we should do it.

If, in the course of evolution, a new animal species appears, it will have to compete with or to predate on other animals. Its struggle for live may sometimes result in the extinction of other species.

But once the new species has definitely found its place in the ecosystem, a **balance** between competitors, predators and preys is established which normally guarantees the survival of all species involved for as long as the environmental conditions, such as climate, geological and tectonical situation, remain essentially unchanged.

< Later this day, Bill Freeland will tell you more about the interaction of species and the balance of nature. >

When I placed the human race in the Animal Kingdom, nobody objected. I didn't wonder, for we are assembled in a place called **Darwin**. However, even if we follow Darwin's theories on our own roots, we have to recognize, that man is a very special kind of animal.

This is reflected among others in our relationship to other animal species which historically can, to my believe, be divided into four different phases:

During **phase one**, the position of *Homo sapiens* in the ecosystem was very much comparable to that of any other large predator: Human population **density** was low, the **means** for catching and killing animals were not very sophisticated, hence limited, and human population **dynamics** closely followed the availability of food. In other words, man lived in a balance with nature and did very rarely pose a threat to the survival of other species, although locally he killed certain species in large numbers, as is shown by the

1000 skeletons of mammoths discovered at Predmost in Czechoslovakia or the remains of about 100'000 wild horses found at Solutré in France.

There are however a few species which have been exterminated by man already under these original circumstances, for example the moas of New Zealand, or the elephant bird of Madagascar, but these were the exceptions which confirmed the rule.

The situation changed drastically in **phase two**, beginning with the renaissance period, when science flourished, human population numbers increased in Europe, and when ships fit for overseas travel and firearms became available to Europeans.

The white man spread all over the earth: In 1427 the Portuguese reached the Azores, and in 1484 the Cape of Good Hope. In 1492, Columbus discovered America, six years later Vasco da Gama found the sailing route to India, in 1513 Balboa walked with his men across Panama, reaching so the Pacific Ocean, from 1519 to 1522, Magellan sailed around the world, and in 1606 the Dutch Janszoon set foot on Australia's Cape York Peninsula.

These **explorations** already had a negative impact on genetic diversity, especially on the wildlife of smaller islands. The sailors, needing supplies on their long trips, killed for meat in great numbers those animals which were the easiest available, such as land tortoises or flightless birds. For the same purpose they released domestic pigs and goats on many islands which became feral and, in the case of goats, destroyed the natural vegetation or, in the case of pigs fed on birds eggs and nestlings. Rats, constant companions of sailors, also became established worldwide, and their effects on island ecosystems can hardly be described as beneficial. The consequence of all of these influences is that over the past 350 years at least 80 % of mammal, bird, reptile and amphibia extinctions have taken place on islands. The introduction of domestic animals and rats alone accounts for the extinction of more than 20 % of all bird species which disappeared since 1600.

< In the afternoon session you will hear more details on problems related with feral animals from Goff Letts. >

Let's look in this context somewhat closer at the **dodo** as an example: The dodo (*Raphus cucullatus*), a turkey-sized, heavy bird, lived exclusively on the island of Mauritius. It was flightless and not afraid of humans - or maybe only to clumsy to escape. Mauritius was discovered in 1505. Subsequently, sailors collected dodos and stockpiled them live on their ships where they were slaughtered and eaten one by one. In 1598, a convicts colony was established on Mauritius, and of course also the settlers collected dodos. Pigs released on

the island destroyed the eggs of the ground-breeding species. Around 1681 the last specimen ended in the pot - and earth had lost one of the most phantastic creatures ever to have lived on this planet.

Exploration was very soon followed by **exploitation**. European settlements and colonies were established on all continents with the primary purpose of acquiring precious metals and stones, spices, ebony, ivory, furskins and reptile skins, bird feathers, baleen, seal and whale oil and other valuable substances, but also live animals and slaves, and shipping them to Europe.

The effect on wildlife was disastrous again. Just a few examples:

The **Juan Fernandez fur seal** (*Arctocephalus philippii*), once living on five islands off the coast of Chile, and discovered in 1563, was extremely abundant. In 1687 the first sealing operation started. In 1792 the crew of the ship *Eliza* clubbed 38'000 seals on *Mas Afuera* and sold their skins in China for about 40 cents per skin. Five years later, the seal population on *Mas Afuera* was still estimated at two to three million animals. Then, in the course of seven years only, three million animals were killed and their skins shipped to Canton. In 1801 one single cargo from the island *Mas a Tierra* - another island of the archipelago - contained one million skins. In 1824 the species was commercially dead and the sealers left the islands. Very similar stories could be told about the **Northern**, the **Galapagos**, and the **Guadalupe fur seal**.

In general, marine resources are especially susceptible to overexploitation. Apart from fur and hair seals which are hunted primarily for their skins, **elephant seals** have been excessively exploited for their blubber, with the result that the **Northern Elephant Seal** (*Mirounga angustirostris*) was commercially dead by 1860, and the **Southern Elephant Seal** (*Mirounga leonina*) so much depleted by 1900 that hunting was no longer profitable.

Also the history of **whaling** is a history of overexploitation. Whales provide man with oil, meat, baleen, spermaceti wax, teeth and ambra. One species after another was hunted to commercial extinction which means to levels where whaling operations were no longer profitable. The first species to suffer from indiscriminate hunting was the **Atlantic Right Whale** (*Balaena glacialis*) whos western population was practically exterminated by 1910. Whalers then pursued the **Pacific Right Whale**, **Sperm Whale** (*Physeter macrocephalus*), and **Bowhead Whale** (*Balaena mysticetus*), until too/they neared extinction. **Humpback** (*Megaptera novaeangliae*) and **Blue Whales** (*Balaenoptera musculus*) became the main targets of whalers from the beginning of this century until World War II, and when they were depleted the whaling industry turned to the exploitation of the **Fin Whale** (*Balaenoptera physalus*). About

30'000 Fins were taken annually during the 1950ies which led to the collapse of the species between 1960 and 1965. The whalers directed then their main efforts to the much smaller **Sei** (*Balaenoptera borealis*) and **Bryde Whales** (*Balaenoptera edeni*), and after the decline of these species, the **Minke Whale** (*Balaenoptera acutorostrata*) which is only 10 meters long became the economic backbone of the whaling industry of the 1970ies.

In the case of **terrestrial mammals**, predominantly species with a limited range became completely extinct. Also here a few examples:

The **Bluebuck** (*Hippotragus leucophaeus*) whos range was limited to the western Cape Province was the first African mammal to be exterminated by white settlers. This was at about 1799 or 1800. The **Falkland Islands Wolf** (*Dusicyon australis*) begun to be hunted for its fur in 1839 and became extinct in 1876 after considerable amounts of pelts had been auctioned in London. The **Quagga** (*Equus quagga quagga*) of the Cape Province and Orange Free State disappeared from the wild in 1878 while the last zoo specimen died five years later at Amsterdam. The **Sea Mink** (*Mustela macrodon*) with a rather small range along the North American east coast was heavily exploited for its fur and definitely disappeared in 1894.

Mammals with a larger range were often heavily depleted but could survive either in remote areas - which often represented suboptimal habitats, in national parks or under captive conditions. Well documented cases are the **European and American Bisons** (*Bison bonasus*, *Bison bison*) and the **Alpine Ibex** (*Capra ibex ibex*), but similar examples are numerous, including for instance all **rhinos**, most **equids**, the **Milu Deer** (*Elaphurus davidianus*) or the **Arabian Oryx** (*Oryx leucoryx*).

In the case of birds also species with a wide distribution are susceptible to complete extermination by hunting, especially if they concentrate seasonally for breeding or on migrations. A species with a large range which has been exterminated at its breeding areas was the **Great Auk** (*Alca impennis*), the last pair of which was killed in 1844 at Eldey island off Iceland. The most famous example of a migratory species which became extinct through hunting, is North America's **Passenger Pigeon** (*Ectopistes migratorius*). The population may have totalled more than one billion birds which used to migrate to new feeding grounds or breeding areas in flocks of several million specimens. These birds were heavily hunted by sport hunters. Already in the 17th century a certain decline could be observed. Around 1860 still millions were killed each year, but around 1880 the figures had dropped to several hundred-thousands annually. The last known free-living specimen was shot on 24

March 1900. The last captive passenger pigeon died on 1 September 1914 at 1.00 p.m. at Cincinnati zoo.

An account on accelerated species extinction in Australia, resulting from human activity will be given by Harry Butler following my presentation.

Let us come now to **phase three**, the rational utilization of wildlife.

In Europe, there have been **regulations** restricting the taking of wildlife already in the Middle Ages and earlier modern times. However, these regulations usually were **not** conceived with a view to conserving wildlife per se or to ensure its long-term sustainable use. Hunting was the privilege of the nobility, and the regulations were intended to protect this privilege. The first hunting law of **England**, released in the year 1016 is a typical example: While permitting the landlords to hunt without any restrictions on their own land, it prohibits hunting on crown land on pain of death.

An exception was **Switzerland** where the member states of the Confederation were mostly ruled under various democratic or republican systems, and where wildlife was considered a common property. Hunting regulations are reported from as early as the 14th century. In the 15th century licensing requirements and close seasons were introduced by some states. The 16th century saw the establishment of two large game reserves by Glaris, which exist still today. In the 17th century the use of traps and snares for the catching of birds and ungulates was banned by Lucerne, etc.

But as said earlier, Switzerland was rather the exception on a continent where land use was governed mostly under **feudal systems** and where hunting rights were closely linked with the privileges of the ruling class or the crown. In the course of the French revolution of 1789 and the subsequent conquest of a greater part of the continent by Napoléon Bonaparte, the feudal hunting regulations - and unfortunately also those of Switzerland - were resumed, interpreting the term "égalité" in the way that hunting was considered a **basic right** of all citizens. The same happened in **Austria** and **Germany** as a consequence of the 1848 revolution. You imagine that, following this deregulation, the wildlife populations collapsed in the major part of Europe.

After a few decades the European states, reestablished as republics or constitutional monarchies, faced themselves confronted with a landscape emptied from wildlife, and now efforts were undertaken to build up again the game populations and to **ensure a sustainable utilization** of wildlife on the old continent. In other words, phase three of the man-wildlife relationship began, at a larger scale, in the middle of the 19th century.

To illustrate what happened, I would like to refer again to my own country, Switzerland:

When in 1875 the first **Federal Law on Hunting and the Protection of Birds** became effective, ibex, red deer and wild boar had completely disappeared. The roe deer was restricted to some limitrophe areas to the north, and the chamois was the only ungulate species having a wider distribution in the alps, although its density was low. The large carnivores, bear, wolf and lynx were still present but since they had to rely on the killing of sheep and goats, they had been severely persecuted and their numbers were low. The new law aimed at increasing the stocks of herbivore animals and game birds by affording total or far reaching protection to juveniles and females and by establishing a network of 19 Federal Game Reserves in montane habitats. Also for other species the hunting seasons were restricted. The use of traps and snares was banned, except for fox, marten, polecat and otter trapping, and the use of poison was generally prohibited. The effects of this and the two subsequent laws were the following: The chamois populations recovered and totals 80'000 heads today. The roe deer spread over all suitable areas and its population may now be in the magnitude of 150'000 animals. The red deer immigrated from Austria, and roughly 30'000 animals occupy the whole eastern half of the country today. The wild boar, having immigrated from France, is now widely distributed in the western and northern parts of the country, and the ibex which was reintroduced since the beginning of the century has now a total population of 12'500 heads. Also the marmots, the snow hares and until 1960 the brown hares developed good populations. On the other hand, the large carnivores disappeared completely, while the rather low level of protection was sufficient to allow the smaller predator species to survive.

Generally spoken, the Swiss hunting legislation proved to be extremely successful in the way that game populations could be built up which allow for an annual take of more than 100'000 mammals and slightly less birds. Where a species was declining, it was never because of hunting but always due to other factors.

The same situation applied to most other European states, except some in the Mediterranean area. In the less densely populated countries even the large predators had a chance to survive.

Bird protection was a slightly different case. The original Swiss hunting law contained a list of protected birds, comprising 116 species which were considered as **useful** for agriculture. Similar provision for the protection of

useful birds existed also in other countries. In 1880 the **United Kingdom** adopted the "Wild Bird Preservation Act" under which **all** bird species were totally protected, with a few designated exceptions, and also in the second Swiss hunting law of 1904 the reference to the usefulness was deleted and the range of protected species was extended.

As a consequence, birds were now protected without a view to getting some measurable profit in exchange, but solely for their **intrinsic value** - because they are nice little creatures, because people like their singing, because hobby-ornithologists like to watch at them. This is, what I would consider **phase four** of the man-wildlife relationship and which we could call **the post-rational approach** because it is largely founded on sentiments.

Bird protection and also the creation of **national parks**, beginning in North America with the Yellowstone in 1872, were the first successes of **nature conservation NGOs**. Other animal groups which were less able to attract the attention of these NGOs were afforded legal protection much later.

While the four phases in the human-nature relationship **appeared** more or less in a historical sequence, they did not **disappear** consecutively. To the contrary, all four types of relationship are still present today:

There are still people living as part of an almost undisturbed ecosystem in a balance with nature, like some of the aborigines in your country < - you remember Dan Gillespies presentation of yesterday on that topic > .

Overexploitation is still a major problem in many parts of the world, and especially where marine resources are concerned. Rational utilization is the official Government doctrine in most countries and is successfully implemented in a number of them. The post-rational, emotional approach, finally, is becoming increasingly important in industrialized countries and more and more overrides the scientifically accepted principles of rational utilization.

A very interesting example, to which all four approaches apply, is the **African elephant** (*Loxodonta africana*): In parts of their Central African range, elephants are still hunted by tribal people unsystematically, with primitive means and on a sustainable base. In East Africa, overexploitation, illegally but in some cases apparently encouraged by very high officials of the countries concerned, has led to a massive reduction in elephant numbers in recent years. In the southern part of Africa utilization is based on the principle of sustainability and the enforcement level is quite high which allowed the elephant populations to remain stable or even to increase - and at the last CITES meeting in 1989 the decision to ban all international trade in elephant

products was taken after an extremely emotional debate and against the advice of IUCN, leaving those states which had successfully managed the species by rationally utilizing the stocks in a rather uncomfortable situation.

So far we have spoken only about the **direct impact** of man on wildlife. But there are also **indirect** influences which are even more important than activities like hunting, fishing, or collecting of specimens.

Indirect influences include human-induced changes of the natural ecosystems, such as clearing of forests, draining of wetlands, building of large dams for hydroelectric plants, converting of grasslands into intensively cultivated agricultural areas, establishment of human settlements with a concentration of buildings, cutting the landscape into small pieces by fences, railways and roads, or introducing foreign species.

In Europe, agricultural production has been intensified since the 1950ies. Wetlands were drained, hedges cleared, large monocultures replaced the former patchwork of small fields. The grass is no longer cut only twice a year, but more frequently at short intervals, and extensive use of fertilizers led to the disappearance of many flowering plants. As a consequence, a wide range of animal species have become rare or locally extinct. Some of them were, however, able to shift their distribution area to the east, as did the **white stork** (*Ciconia ciconia*) and the **Brown hare** (*Lepus europaeus*) which have considerably extended their ranges and increased their populations in the Soviet Union.

Speaking of the Soviet Union, I would like to quote another example of man-induced change of habitat:

By using the waters of the Amu-Darya and Syr-Darya rivers for irrigating cotton, rice and melon fields, the Soviets are sacrificing the **Lake Aral**. This lake had a surface of 26'000 sq.miles in 1960. To date it has lost 40 % of its surface, and by the year 2020 it may be completely dry. Already today the salinity of the remaining water is so high, that 24 species of endemic fish have disappeared.

The most heavy environmental changes however are taking place in the tropics. The clearing of large parts of the tropical rainforests in Amazonia and South-East Asia results not only locally in a tremendous loss of genetic diversity which one has to call dramatic, but it will affect also the climatic conditions of our whole planet. < You recall Ann Henderson-Sellers presentation of yesterday. >

Another aspect is **environmental pollution**. Industrial waste includes huge quantities of **heavy metals**, such as mercury, lead and cadmium, and a large number of artificial **organic substances** has been developed by the chemical industry. Some of these substances, the organochloric pesticides, like DDT and its relatives, have been designed to kill certain animals, predominantly insects, but proved to have unexpected side effects, since they were accumulated in the fat and organs of insectivorous and carnivorous vertebrates. Others, having a very low acute toxicity, like the PBBs were used for other purposes, but when set free to the environment were also accumulated in the body of wild animals where they negatively affect the fertility, as do some heavy metals and the organochloric pesticides. Two examples:

In the 1960ies and 70ies a steady decline of the **peregrine falcon** (*Falco peregrinus*) was observed in most of Europe and North America. This decline was due to the embryotoxic effect of DDT. In Switzerland the bottom was hit in 1974, when in the Jura mountains only four pairs survived. Four years earlier, the use of DDT had been banned, but there were still large quantities in the environment. As the DDT contamination, first of the insects, then of the insectivorous birds, decreased, the peregrine recovered, and today we have again a contiguous population of more than 150 peregrine pairs in the whole Jura chain.

PCBs are contained in waste waters. They get into the rivers and lakes where they are accumulated in the fat of fish and frogs. **River otters** (*Lutra lutra*) eating fish and frogs become sterile, and today the otter is on the verge of extinction in Europe, except in some limitrophe areas in northern Scandinavia, the northern British Isles, Portugal and parts of eastern Europe. This situation is even more problematic than the DDT situation was for the peregrine, because the PCBs are extremely inert and therefore persist for an extremely long time in the environment. The only way to preserve the otter in Europe is captive breeding whereby the animals have to be kept on a diet consisting mainly of ground meat, small mammals, birds eggs and some vegetables.

What should be the **strategies for species survival** under these circumstances now ?

As far as the **direct impact of man** on wildlife is concerned, we certainly can't go back to phase one. There are too few people still living under stone age or similar conditions, and many of them don't want to live in National Parks or Musea, but wish to participate in what usually is called progress.

It is foreseeable that **future discussions** will focus mainly on whether sustainable utilization is an appropriate tool for conserving wildlife, or whether species should be totally protected, as requested by many North American and European NGOs.

The **total protection** of species for ethical reasons or because of their intrinsic value can be a good approach where it is generally accepted by a society. However, the possibilities of this approach are limited. It can be applied on **smaller species** which do not negatively interfere with legitimate needs of the human population, which means that they are no competitors of man feeding on domestic livestock or damaging agricultural crops, and in which the population figures are limited by a number of natural factors. It can be applied also on the remaining species, especially predators and ungulates, **in certain areas**, such as national parks or game reserves. But taking into account the steady growth of human populations, the availability of such areas will become more and more limited. In Switzerland with an average population density of 160 people per sq.km., the National Park, the Federal Hunting Reserves and the Ramsar Waterfowl Reserves cover slightly more than 4 % of the total area, and there is no way how this protected surface could be substantially increased.

Total protection of a certain range of species is usually well accepted in **developed countries** which are rich, have a highly productive agriculture, and which therefore can afford to partially renounce on the consumption of wildlife.

In the poor, **developing countries** the situation is different. If you are hungry, your understanding for the intrinsic value of wildlife will be rather limited. If you need meat and you cannot afford to buy it on the market, you have to take it from the bush surrounding your village. The phenomenon that large areas around the bigger African cities are completely depleted from wildlife is well known. So we are faced with the fact that wildlife will be consumed in developing countries, either legally or illegally, regardless of whether we like it or not.

It has been demonstrated for Zambia's Luangwa Valley that there is a **direct relationship** between the **rate of decrease** of rhino and elephant numbers and **patrol effort**. In other words, in the case of total protection, conservation success is directly linked with the resources which can be put into a conservation scheme. It was calculated that to prevent poaching effectively and to achieve a zero decline of rhinos, US dollars 230 per sq.km. per year

have to be spent, and that US dollars 215 are necessary for the African elephant. Thus protecting the African elephant efficiently over its entire range of 5.9 million sq.km. would cost 1 billion 357 million dollars US each year. It is obvious, that it is not possible to raise these funds annually in the industrialized countries. And the African elephant is only one species out of a large number for which conservation efforts have to be increased. In other words, wildlife must pay self for its protection, there must be **economic incentives for conservation**, as will be told by Grahame Webb.

In principle, there are **two ways of utilization** of wildlife: consumptive and non-consumptive.

Non-consumptive utilization means to use wildlife as a tourist attraction. People travel to Kenya to see wildlife, and they spend quite a lot of money in and around the national parks and game reserves, money from which the local population benefits. This non-consumptive utilization by tourism could still be increased to a certain extent, especially in the western part of Africa - but one must recognize that the costs of providing the infrastructure for international tourism are high and not always exceed the returns to the governments, that the tourist industry is highly vulnerable to economic factors outside the countries' control, and that mass tourism may exert a highly negative impact on the environment and on the local human communities. Also for another reason one cannot convert the whole of the African continent into a huge national park: There are human populations, which grow at a rate of more than four percent per year, and all these people need something to eat.

For the major part of the land the solution must therefore lay in a **consumptive, but sustainable utilization** of wildlife. In the southern part of Africa, there are already many farmers having replaced cattle by antelopes. It has been recognized that by a combination of cattle and antelopes, the biomass which can be kept within the carrying capacity of the land can be considerably increased. The income of the landowners from antelope cropping may be twice to three times as high as from cattle grazing. Including the elephant to the management scheme would make the revenues even five times higher. One cannot imagine a better incentive for species conservation. Pursuing this policy, Zimbabwe was able to cull 44'506 elephants from 1966 to 1988, while simultaneously the elephant population increased from 32'000 to 52'000 heads.

There are **three different ways** for sustainably utilizing wildlife: Game

cropping, game ranching and game farming.

Game cropping, where the only intervention is the culling of a certain percentage of the free living animals, requires some knowledge of population dynamics. It has especially to take care of the **reproduction strategies** of the species concerned. In species operating with early maturity, high fertility, high mortality and low life expectancy, hunting is often only one of several reasons for mortality which **compensate** each other. This means that the impact of hunting on the development of the population is rather low. A good example for this phenomenon which you know much better than I do, is the **wild rabbit** (*Oryctolagus cuniculus*), where Australian hunters were much less successful in reducing the population than was myxomatosis. In species, where the strategy is characterized by late maturity, low reproduction rate, low mortality and high life expectancy, hunting mortality is normally **added** to the natural mortality and the possibilities of the species to compensate it by an increased birth rate are limited. Constant monitoring, not only of the total numbers, but also of age distribution and sex ratio is required in these species. Otherwise detrimental effects are to be expected.

By **game ranching** we understand the taking of eggs or juveniles or of a limited number of reproducing animals, and rearing the offspring in captivity. Under controlled conditions juvenile mortality is much lower than it would be in the wild. This allows to harvest animals which otherwise would have perished. Game ranching has become an internationally well-accepted procedure for crocodile management, while for marine turtles its benefits are still under discussion.

In the case of **game farming**, the animals are not only reared, but bred over several generations in a controlled environment. Although game farming operations are by definition self-sustaining, they could have certain negative effects on wild populations. One of these effects is, that they reduce the habitat available to wild populations. Another, even more important aspect is that captive breeding of non-native subspecies implies the risk of genetic pollution of the wild population by animals which escape from the farm. But otherwise game farms are a tool in conservation whose importance is not yet fully recognized by many conservationists. A 1988 survey in Texas revealed a total of 164'257 exotic ruminants living on an area of 4866 sq.km. There are probably more **blackbuck antelopes** (*Antilope cervicapra*) behind fences in Texas than free-living in India, Pakistan and Nepal together. There are also more **Scimitar-horned oryx** (*Oryx dammah*) and **Addax** (*Addax nasomaculatus*), both highly endangered antelopes from Africa's Sahel zone

on Texas game farms than in all zoos of the world.

"Zoo" is the key word which leads us to non-commercial captive breeding, also an important tool in conservation. There is a number of species which have been exterminated in the wild, but which could survive in captivity, and eventually could be released again to the wild. Example are the **European Bison** or **Wisent** (*Bison bonasus*), the **Nene goose** (*Branta sandvicensis*), the **Arabian oryx** (*Oryx leucoryx*), the **Milu deer** (*Elaphurus davidianus*) and the **Przewalski's horse** (*Equus przewalskii*). Without captive breeding the successful reintroduction of the **Alpine ibex** (*Capra ibex ibex*) and of the **White stork** (*Ciconia ciconia*) in Switzerland would not have been possible, and also the current reintroduction project of the **Lammergeyer** (*Gypaetus barbatus*) in the Alps fully depends on captive bred specimens.

Non-commercial breeding however has three major problems: Keeping in zoos implies a certain risk of domestication, because those animals which do not adapt to captive conditions are automatically excluded from breeding. Then, keeping of animals in zoos is expensive, and finally, the number of animals which can be kept by zoos is limited. For an average mammal species, a zoo population of 800 animals is required in order to maintain 90 % of the genetic potential of the founder population for the next 200 years. This means that the zoos worldwide, theoretically, could ensure the survival of about 300 mammalian species or subspecies, which is more or less the number considered endangered or vulnerable by IUCN. In practice however, the capacity of zoos to keep such species is much more limited because they have, for various reasons, also to keep animals which are not endangered.

During the last years, zoological gardens have done a lot to improve their management of endangered species, by establishing **herd books** and internationally coordinated **captive breeding programs**. Under these auspices, the tendency of certain governments to make life difficult for zoos is not justified, and there are even zoo projects which should financially supported by nature conservation authorities. I mentioned earlier the **European otter**. This is very clearly a species which will depend on captive breeding for the next hundred or twohundred years and where in my view governments are under a moral obligation to subsidize a coordinated zoo-breeding program.

And now a few words on legislation: There is a trend towards international treaties: A number of wildlife conventions have been concluded since the 1970ies, like the **Ramsar Wetland Convention**, the **Washington Convention**

on International Trade (CITES), the Bonn Migratory Species Convention and a number of regional treaties. Currently a new Convention on Genetic Diversity is under discussion. The effects of these conventions are often overestimated. In the case of the very few treaties which are directly applicable, such as CITES, proper implementation of the letter of the convention is essential. Unfortunately, this is very often not the case, but there are obvious discrepancies between what governments tell and decide at meetings of the Conference of the Parties and what they do in practice back home. In the case of those conventions which have to be converted in national law for their execution, such as the Paris Bird Convention, the Ramsar, the Bonn or the Berne Conventions, the national follow-ups are often delayed or inadequate. I would not judge international conventions negatively, since they improve the intergovernmental cooperation and since they in many cases lead to an improvement and international standardization of national laws. But so far no species has been saved by the letter of a worldwide treaty, and success depended always on national legislation, sometimes combined with regional agreements, and on the way national laws were implemented.

I would like to conclude by saying that **preservation of habitats** is a prerogative for species survival. All species conservation legislation will become *lettre morte* if there is no space left where the species may live.

Regarding the **direct impact of man** on wildlife, government strategies for the survival of species must lay in a combination of total protection, partially combined with non-consumptive utilization, and wildlife consumption which is based on sound management practices, which is sustainable, and which should include as well game cropping as ranching and extensive game farming. Maintenance of species under zoo conditions should be encouraged where appropriate, but its overall impact will remain restricted to a limited number of species.

When dealing with the **public**, we have two major challenges before us. On one hand we have to convince the rural people of the necessity of preserving wildlife on their land, to convince them of the importance of intact ecosystems < - to get the message through, as Stuart Traynor said yesterday - > and on the other hand we have to teach the urban population that killing of individual animals is often necessary in order to ensure the survival of species. The urban population, living in a more or less artificial environment, must learn that nature conservation cannot be based on emotions, but that it needs a scientific background. They must become aware of the complexity of species interactions. They must know that that the paradise has never existed, but that

animal species always compete with or predate on another. And they must accept that there is now way how our own species could abstain from the game - also we have to interact constantly with other species.

This Conference seems to me to be an important step in this education process which is absolutely necessary if we want to succeed in species conservation.

Bibliography:

- Brander, M. (1978) Die Jagd von der Urzeit bis heute. 3rd ed. BLV, München.
- Bauer, K. & Spitzberger, F. (197X) Vogelparadiese der Welt. Pinguin Verlag, Innsbruck.
- Dollinger, P. (1983) Lohnt sich Artenschutz ? Mitt. Naturforsch. Ges. Bern N.F. **40**, 83-90.
- Dollinger, P. (1990) Der Elefant in CITES - eine Bilanz. Jagd und Hege.
- Dörtl, F. (1978) Die historische Entwicklung des Jagdrechts in Österreich. Kat. NÖ Landesmuseum N.F. **77**, 43-49.
- Ellis, W.S. (1990) The Aral - A Soviet Sea Lies Dying. Nat. Geogr. **177**, No. 2, 71-93.
- Fuller, E. (1987) Extinct Birds. Viking/Rainbird, London.
- Govt. of Zimbabwe (1989) Policy for Wildlife. Dept. Nat. Parks and Wildlife Mgmt., Harare.
- Groombridge, B. (1988) World Checklist of Threatened Amphibians and Reptiles. NCC, London.
- Inskipp T. & Barzdo, J. (1987) World Checklist of Threatened Mammals. NCC, London
- King J.E. (1983). Seals of the World. Oxford University Press.
- Leader-Williams, N. (1990) Black rhinos and African elephants: Lessons for conservation funding. Oryx **24**, No. 1, 23-29.
- Martin, R.B., Craig, G.C. & Booth, V.R. (1989) Elephant Management in Zimbabwe. Dept. Nat. parks and Wildlife Mgmt., Harare
- Nilsson, G. et al. (1983) The Endangered Species Handbook. Animal Welfare Institute, Washington D.C.
- Novak M. et al. (eds., 1987) Wild Furbearer Management and Conservation in North America. Min. of Natural Resources, Ontario, Toronto.
- Schenk, P. (1966) Jagd und Naturschutz in der Schweiz. Schwabe, Basel.

- Smithers, R.H.N. (1983) The Mammals of the Southern African Subregion. University of Pretoria.
- Stuart, S. & Johnson, T. (draft) World Checklist of Threatened Birds, NCC, London.
- Windl, J. (1978) Die urzeitliche Jagd in Europa. Kat. NÖ Landesmuseum N.F. 77, 7-20.
- Ziswiler, V. (1965) Bedrohte und ausgerottete Tiere. Springer, Berlin/Heidelberg/New York.