

INTERNATIONAL UNION
FOR CONSERVATION OF
NATURE AND NATURAL
RESOURCES

SPECIES SURVIVAL COMMISSION
Antelope Specialist Group

Volume 9, Number 3
September 1990

Edited by
Richard Estes, Chairman
5 Granite Street
Peterborough, NH 03458, USA

*Published with assistance from the
World Wildlife Fund—U.S.*



GNUSLETTER

In this issue. . .

ASG News1

ASG stands to gain a share of the \$1 million given to the SSC.....1

ASG to hold meeting at Perth, probably on November 271

Changes of address or title for Agoramoorthy, Belemsobgo, Carr, Hall-Martin.....2

Nairobi Conference on Wildlife Research for Sustainable Development.....2

Excerpts from Conference Paper Summaries:

Genetic diversity of the Bovidae, Pieter Kat and Nicholas

Georgiadis.....2

Research needs for sustainable wildlife use, Chris Gakahu.....3

Trial and error in wildlife management, Richard Bell4

The consumptive use of wildlife, Joshua Ginsberg.....4

Use of selected species: potential and options, Harald Roth5

Small-scale antelope farming and utilization in Africa.....5

Antelope News6

Captive Breeding: Artiodactyl survey and action plan, K. Sausman6

Giant sable update: what UNITA President Savimbi told Hall-Martin..6

Klipspringer may have social system like oribi's, Darryl Mason.....6

Gerenuk, report on the conclusion of a longterm Kenya study, W. Räder.....7

Mountain nyala conservation and a tragelaphine bibliography, Chris Hillman7

Sitatunga, observations in a Gambian nature reserve, Dawn Starin.....7

Duikers: estimating hunting offtake in Korup NP, Mark Infield.....8

Population densities in West and Central African forests, Rod East ..9

Desert antelopes at Fossil Rim, genetic analysis of addax, Ed Spevak10

Regional Rundown.....11

Zaire: the captive okapi project at Epulu, giant eland, S. Shurter11

Burkina Faso: report on the Nazinga Game Ranch, George Frame11

Djibouti: present and future of the wild bovids, Alain Laurent's12

Ethiopia: CBSG Workshop to assist Ethiopian conservation12

Uganda: opponent of Murchison Falls dam speak up.....13

South Africa: Darryl Mason suggests joining Kruger NP with reserves in Mozambique and Zimbabwe.....14

Natal: Michael Keep summarizes research in game reserves15

Namibia: large-scale commercial wildlife utilization, H. H. Berry.....15

Saudi Arabia: gazelle research at Thumamah, Doug Williamson17

ASG News

ASG MAY BENEFIT FROM SSC GIFT

In June the SSC was awarded \$1 million from the Peter Scott Memorial Appeal for Conservation, to help save endangered animals and plants throughout the world. The primary donor of this princely sum was the Government of Oman, with the approval of His Majesty the Sultan. In acknowledging the gift, SSC Chairman George Rabb paid tribute to Oman's conservation leadership, beginning with the re-introduction of the Arabian oryx.

In a letter (12 June 90) containing the press release, George said, "Obviously your group is one of the most productive and will qualify for support. Please think about how you might utilize [a share of the funds]." The time may soon be at hand when the ASG can actually initiate research projects and pursue action plans. Moreover, Chairman Rabb speaks of hiring an SSC fund-raising officer to take on the task of garnering additional resources.

SSC AND ASG MEETING IN PERTH

In the last *Gnusletter*, ASG members who will be attending the SSC meetings on 25 and 26 November, before the IUCN General Assembly, were asked to let me know in time to publish a list of attendees in this issue. The only member

who has said he is definitely going is Anthony Hall-Martin. Innocent Nganga (Congo Republic) and Urbain Belemsobgo (Burkina Faso) hope to go but need financial assistance. Rod East, unfortunately, will not be able to make it. The 27th has been set aside for specialist-group meetings.

CHANGES OF TITLE OR ADDRESS

Dr. G. Agoramorthy is a Visiting Scientist in the Department of Zoological Research, National Zoological Park, Washington, DC 20008.

Ing. Urbain Belemsobgo has been appointed Director of Nazinga Game Ranch, c/o BP 7044 Ministère de l'Environnement et du Tourisme, Ouagadougou, Burkina Faso. (More on the Nazinga project in the Regional Rundown.)

Richard D. Carr has been transferred from Nylstroom to the Directorate: Nature and Environmental Conservation, Transvaal Provincial Administration, Private Bag X209, Pretoria, 0001, South Africa.

Dr. Anthony Hall-Martin is no longer Chief Research Officer, as indicated on the May 1990 list of ASG members, but has been for some time Director: Special Services of the National Parks Board. At least we got his address right.

WILDLIFE RESEARCH FOR SUSTAINABLE DEVELOPMENT

A conference of this title was held in Nairobi last April 22-26, under the auspices of the National Museums of Kenya, the Kenya Wildlife Service, and the Kenya Agricultural Research Institute. The Conference Paper Summaries, Vol. 1 (73 pp), already printed (a copy of which Pieter Kat thoughtfully provided), lists six ASG members among the 21 authors and co-authors, including Pieter with Nick Georgiadis, Richard Bell, Chris Gakahu, Harold Roth, and Vivian Wilson. The ideas and information presented in the conference papers, if they receive the dissemination and attention they deserve, will have a major impact on the conservation of African wildlife habitats and communities. Some of the main points, extracted from the Conference Paper Summaries, are presented here, to

help spread these promising ideas and promote the sale of the conference volume, publication of which will be reported in the *Gnusletter*.

GENETIC DIVERSITY OF THE BOVIDAE, by P. W. Kat and N. Georgiadis, Molecular Genetic Section, National Museums of Kenya, Nairobi

"The Bovidae contains more species than any other large mammal family: there are approximately 124 species in 47 genera. About 79 species in 26 genera occur in Africa south of the Sahara, and this diversity represents one of the most important natural resources of the continent. Surprisingly, however, most of the scientific research performed on bovids in Africa has involved a few recently introduced domesticated species. This work has primarily focused on how to maintain animals susceptible to a variety of diseases in a hostile environment, and examples of environmental degradation directly attributable to overstocking of these domesticated animals abound. In sharp contrast, the native, well-adapted, diverse, and largely disease-resistant resource that constitutes most of the mammalian biomass in a variety of habitats is given little emphasis in the development plans of most African nations.

"Sustainable utilization of these African bovid species will require a multidimensional expansion of the available data base, especially in the areas concerning population regulation such as nutrition, reproduction, and disease. However, practical wildlife conservation and management should also utilize information on a diversity of population genetic attributes, and this area of knowledge is perhaps the least understood for bovids in particular and large mammals in general. In fact, only small-sized species have been studied well enough to reveal basic relationships among social systems, dispersal rates, patterns of population subdivision, and gene flow, but such data cannot be extrapolated to large mammals; for example, all ecological and life-history variables that affect population genetic processes are closely related to body size.

"Large mammal genetic studies, especially those concerned with population genetics, require the availability of intact

populations and large sample sizes. Such intact populations can generally still be found in Africa in contrast to other continents, where wild animal populations have been through bottlenecks, translocations, and other manipulations that have either altered or destroyed underlying patterns of genetic differentiation among populations. Similar alterations are already in progress in Africa as well, however: rhino translocation programs have now largely obliterated genetic differences that might have existed between populations derived from different geographic areas, and wildlife reintroduction schemes rarely take into account potential genetic differences between introduced and resident populations.

Genetics of the Bovidae

"Research programs have been initiated at the National Museums Department of Molecular Genetics with the purpose of characterizing genetic diversity of the Bovidae, with emphasis on species interrelationships and populations currently being utilized in a variety of settings such as zoos and game ranches, and the provision of data suitable for management of wild populations.

"The morphologic diversity among the African Bovidae has led to the construction of a variety of taxonomic schemes, and controversy exists over which version most accurately reflects evolutionary relationships. A molecular phylogeny of this family has been lacking, and an initial priority of the laboratory was to construct such a phylogeny based on allozyme electrophoresis." [See report in January 1988 *Gnusletter*, page 5.]

"Large mammal species such as the bovids are predicted to exhibit fewer disjunct populations than small mammal species for which even a small river can constitute a formidable geographic barrier. However, it is interesting to note that a variety of races have been described over the geographic range of bovid species such as Grant's gazelle, hartebeest, and blue duiker, based on differences in pelage color, body size and horn shape. For conservation, management, and utilization purposes it is therefore critical to be able to establish the extent to which these morphological differences represent genetic division within

species. Along these lines, it is also necessary to establish how the total amount of genetic diversity is distributed among the constituent populations of a species. Within some species, such variability can be entirely represented in a single population, but more usually, variability is distributed across populations. Proper management should attempt to preserve the maximum amount of this variability, and therefore should maintain viable populations in different parts of the species' range. Once such variability has been characterized, the results should be of interest to managers of captive populations as well as utilized populations: both run the risk of losing genetic variability through processes such as inbreeding and artificial selection."

RESEARCH NEEDS FOR SUSTAINABLE WILDLIFE USE, by C. G. Gakahu, *Wildlife Conservation International, Nairobi.*

General Evaluation of Past Wildlife Research

"The FAO/UNDP Kenya Wildlife Management Project in the early seventies whose focus was sustainable use of wildlife in the Athi-Kapiti Plains is an example of past wildlife research. The specific objective of the project was to harvest wildlife for income to the local pastoral landowners in order to retain the diverse migratory wildlife populations vital for dynamics of Amboseli and Nairobi National Parks. The project failed due to poor management, lack of follow-up activities and public relations on the one hand, and pressure from conservationists on the other. The latter have been strongly protectionist and anti-management in their approach to wildlife. Due to this pressure the government has always drawn back from consumptive uses of wildlife despite the fact that this topic has been discussed in Kenya for the last 25 years. Time has, however, now come for actions to convert wildlife outside conservation areas into marketable products if wildlife is to be economically viable.

"Alongside past major projects, individuals and institutions have conducted research in taxonomy, physiology and ecology in line with their interests and

academic pursuits. Most of this research has been in protected areas, partly because researchers want undisturbed sites and partly because they like to take stock of protected areas rather than the vulnerable modified areas. In addition, this research has not addressed management needs or use of wildlife, and as a result has not been beneficial to Kenya.

"Due to the failure of wildlife authorities to appreciate [the] value of research like their counterparts in other natural resource sectors, [the] required institutional arrangements for wildlife research have not been established or have remained weak and non-operational. In addition, most of the research has been done by foreigners. This has been due to inadequate advanced level training in [the] wildlife resources sector. This gap will, however, be filled in the near future when the wildlife authority starts absorbing graduates from the wildlife management degree programme at Moi University, for example."

Future Needs and Challenges

"Kenya's wildlife policy recognizes two categories of wildlife areas. Firstly, those set aside exclusively for wildlife such as parks and sanctuaries, and secondly, areas such as private land where development of wildlife is encouraged. This conference focuses on utilization of wildlife in the second category of areas. These areas are characterized by unreliable rainfall. Because of the precarious ecological balance, these areas require careful management. The challenge is how to ensure sustained use and productivity without adverse effects on the delicate ecological balance. Research is needed to establish and to improve strategies to confront problems, make rational decisions and predict future trends and needs."

"There is an urgent need to review wildlife research policy and to expedite the establishment of an institution for wildlife research which is currently in the seminal discussion stage under the Kenya Wildlife Service.

"Though largely inadequate, past wildlife research must be documented and a central database established to avoid repetition and duplication of research.

"Productivity of ecosystems together with factors that limit it is a priority area that needs special attention. Productivity research must be cognizant of fluxes. Past research in this sector has been of short duration with data and results of limited generality and therefore of limited predictive power for systems behaviour.

"Future research must aim at understanding of ecosystem structure and function in response to environmental changes and must be linked to monitoring systems that measure direction and rates of those changes and responses."

"Harvesting management uses the fact that the greater the availability of food and other resources per head, and . . . the greater the rate of increase, the greater the harvest. In most cases, focus is on the species being harvested with little regard for unharvested species. In addition to research on [the] best harvesting schemes, information and data are needed on the impacts of harvesting on behaviour and ecology of the species being harvested and on other species living in the same habitat.

"One constraint to development and use of wildlife is that wildlife belongs to the state and the state controls its utilization. However, the local people on whose land wildlife resides should have a say in the formulation of government's utilization policy. This calls for a revision of current legal mechanisms involving wildlife utilization.

"People sharing land with wildlife must be involved in its management. Research is therefore needed to develop a system to reach and educate the people about the value of wildlife, and involving people in the management and use of wildlife.

"The above identified research areas and needs can only be realized with adequate resources. If resources are made available we will develop better tools to help us look further than ever before, and to develop better techniques for sustained use of wildlife. By so doing we will save wildlife, a resource which is vulnerable and difficult to replace."



TRIAL AND ERROR IN WILDLIFE MANAGEMENT, by R. H. V. Bell, *Luangwa Integrated Resource Development Project, Zambia*.

"Before we establish a system of adaptive management, we need to identify the objectives of the overall system. We need to work towards a clear definition of objectives, based on a system of zonation of each country, where firstly the primary form of land use for each zone is defined, be it urbanization, or intensive agriculture, or emphasis on the use of non-agricultural resources, or minimal intervention (i.e., national parks).

"However, equally important is the decision *within each zone as to who should actually make the decisions* on the use of the zone. This is where we begin to see the major divergence in point of view [of] the Eastern African approach from the Southern African approach. The Eastern African position has tended to be centralized, with most decisions relating to the use of wildlife in the hands of central government. Equally, the distribution of access and benefits to wildlife resources tends to be centralized to the national treasury.

"The Southern African position, by contrast, has tended to emphasize decentralization of decision-making over non-agricultural resources to various types of local authority, that is to District Councils, communities, or private land owners. Part and parcel of that decentralization is that the central governments have accepted the decisions of those local authorities, communities and individuals as to the form of wildlife use, be it consumptive or otherwise, and there has been a progressive move towards consumptive use of wildlife.

"The key question that the system of adaptive management has to test is which of these approaches is more likely to lead to sustainable use of resources. If these tests are to be real and serious, then central government authorities must genuinely give away authority until the tests have shown clearly what the outcome will be.

"What is meant by wildlife utilization? Centrally controlled tourism or culling are only small parts of the whole spectrum of wildlife utilization, and for the most part, the least successful. The spec-

trum includes crop protection, traditional subsistence utilization, illegal commercial utilization, various forms of licensed hunting, and culling. Each of these headings can be subdivided.

"Each form of use has different implications from the point of view of the amount of money generated, and how much money and products are distributed, between the government, communities and individuals.

"Key institutional questions have to be addressed before any system of wildlife utilization is embarked upon. Who are the beneficiaries? Who gets what? Who decides who gets what? In our experience, it is the institutional aspect that looms much larger than most of the other aspects of wildlife management. Zambia is currently in the process of testing the decentralization of the control of wildlife use to the community level, through a series of different programs, including ADMAD, the Wetlands program and the LIRDP.

"The theory being tested by these programs, and again one which the adaptive management community as a whole should examine seriously, is that, *through the decentralization of control of wildlife resources to local communities, those communities will acquire incentives for the sustainable use of wildlife and other non-agricultural resources in their areas.*

"Similar programs are well advanced in Zimbabwe and others are being developed in Botswana. We believe that the evidence to date indicates that the theory that we are testing, if not absolutely correct, shows a high level of promise in encouraging sustainable utilization of non-agricultural resources."

THE CONSUMPTIVE USE OF WILDLIFE: HARVESTING, SOCIOBIOLOGY, AND IMPLICATION FOR POPULATION DYNAMICS, by Joshua R. Ginsberg, *Department of Zoology, Oxford University (and member, SSC Equid Specialist Group)*.

Ways in which game cropping and sport hunting can impact genetic diversity and social organization of wildlife populations are outlined in the summary of this paper.

"The harvesting of wildlife is rarely a random process. Candidate individuals

for slaughter are chosen by a variety of methods, the composition by sex and age class being a result of the priorities of the cropping scheme employed. For example, in ranching and farming, sex ratios are often intentionally skewed towards females to increase the rate of reproduction. In hunting, artificial selection is often made for prime or trophy males: those males exhibiting the most developed secondary sexual characteristics such as horns, or tusks.

"Sociobiological theory predicts that such alterations of sex ratio and age structure will have a strong and lasting effect on an animal's social organization and breeding biology. In turn, changes in social organization and breeding biology may have an unintentional negative effect on rates of recruitment, or recruitment into the population of a desired sex ratio of young. The magnitudes of such effects will, of course, vary from species to species and depend on such variables as: bonds among and between females and males; synchrony of breeding; the socionomic sex ratio (breeding males:breeding females) found in nature; natural rates of disturbance of social structure through disease/predation.

"Despite the clear implications of various methods of harvesting on social behavior and patterns of recruitment, little research has been done to elucidate the effects of cropping. In this paper, I will discuss the theoretical and potential consequences of cropping on social behavior, how changes in social behavior may affect parameters of interest to game users (e.g., sex ratio of young, stocking rates), and how changes in social-ecology may affect breeding success and recruitment into an animal population."

"Obviously, the need for studies to elucidate the possible pitfalls of artificial selection through cropping is great if we are to maximize the inherent potential of wildlife as a source of protein and income for Africa."



USE OF SELECTED SPECIES: HISTORY, POTENTIAL AND OPTIONS — AN INTRODUCTION TO SINGLE SPECIES WILDLIFE UTILIZATION,
by Harald H. Roth, FGU-Kronenberg, Consultants for Natural Resource Management, W. Germany.

"In some countries of Eastern and Southern Africa single species utilization has become an important economic activity, as for example farming of spring-buck, blesbuck, impala, and other smaller antelope, capture and translocation of larger antelope, and ostrich farming in South Africa and Namibia; crocodile farming in Zimbabwe, Zambia and more recently also Malawi; and trophy hunting and viewing of large game animals in Botswana, Zimbabwe, Zambia, and Tanzania. Although certainly significant, the contribution of single species utilization is difficult to quantify as it is difficult to assess this separate from other wildlife utilization. However, economic production data are now becoming available from individual enterprises.

"Generally the potential for the development of selected species use is unlimited and depends mainly on markets for specific wildlife products and the cost-benefit ratios of their production. However, use of selected species is also governed by socioeconomic factors, such as land tenure and ownership, as well as culture and emotion which have traditionally given rise to differing legal concepts and constraints."

Management Options

"The options to utilize selected species ranges from extensive forms of management over semi-intensive to highly intensive ones. Accordingly the use of selected species can be incorporated into broader wildlife utilization programs, be carried out semi-intensively in conjunction with other wildlife management, or be developed completely separately from wildlife management in the framework of agricultural activities. Some of the existing options are as follows:

1. Extensive selective hunting of certain desired species in terms of quota systems to ensure sustainability;
2. Capture of juveniles or collection of selected species for rearing . . . in fenced areas or cages to adults which may then

be used in different ways (cropping, periodic harvesting of their products, sale of live animals);

3. Propagation in semi-captivity (large fenced but rather natural areas) of relatively large herds of one or several selected species for sustainable cropping (game farming);

4. Domestication or semi-domestication of particularly suitable species by long-term selective and strictly controlled breeding and animal husbandry.

"The last option is somewhat controversial and requires discussion. Although often referred to, there have been very few true efforts at domesticating game species. Usually the game animals (such as elephants, zebra, buffalo and various antelope) were merely tamed and propagated into small manageable herds which invariably required recruitment from the wild if [they were] to be utilized. Only ostriches, eland and more recently, cane rats, have been subjected in some areas to controlled animal husbandry with genetic selection over successive generations. It is of course an open question whether there is real advantage in such long-term selective breeding, and whether this would not result in the loss of those physiological and ethological characteristics which render wild animals biologically more productive than domestic stock. From my own research it seems preferable to limit the breeding process to 'semi-domestication', i.e., selective breeding under rather extensive natural conditions with maintenance of the species ethio-sociology.

Research Needs

"Each management option has specific areas in which research is needed for further development:

Option 1. Census methods, population modelling, and computerization of administrative control

Option 2. Capture methods, rearing methods and nutrition, prevention of juvenile mortality, harvesting methods, marketing of products

Option 3. Reproductive biology and ethology, harvesting and processing, wildlife disease epidemiology, marketing of products

Option 4. Genetics, ethology and animal husbandry techniques

"Most of these research needs are common to all countries of the region, although there are great differences in the development of the different management options from country to country."

SMALL-SCALE ANTELOPE FARMING AND UTILIZATION IN RURAL AFRICA,
by V. J. Wilson, Chipangali Wildlife Trust, Zimbabwe.

"The more I visit the 'bush-meat' markets in West and Central Africa, the more I see how important duiker meat is to tens of thousands of people in many African countries. . . . Presently the rural people of the many under-developed countries in Africa rely very heavily on mini-antelopes, cane rats (grass cutters), and primates as a source of protein. However, it is the duikers which are utilized throughout the continent, whereas the primates and cane rats are only used in certain parts of Africa. In southern Africa the steenbok is also very important.

"These mini-antelopes are trapped more and more, in many places to a point where several species are on the verge of extinction. This brings us to the crux of the whole problem. We have to face the fact that the numbers and the range of the small antelopes are still tending to diminish despite wise measures being taken to halt that decrease. It is therefore too much to expect that they will all go on occupying their present ranges indefinitely."

"Since very little is known of the effects of the hunting of most of these species, traditional hunting and its influence on the populations should be investigated more thoroughly and urgently.

"We need to know more about:

- a. The distribution and numerical status of the various species in Africa
- b. The densities at which they occur in many African countries in a wide range of habitat types
- c. Their reproductive biology, and understanding something about their food and feeding habits
- d. The correct utilization of duikers and other mini-antelopes as 'farm-animals' for rural areas and in the wild
- e. Captive breeding and mini-antelope husbandry and the suitability of several species for domestication.

"In short, we need to carry out detailed surveys throughout the range of these small antelopes in Africa. These field surveys and captive breeding research should not be regarded as a luxury or only of academic interest."

The fact that Wilson is engaged in a decade-long Pan-African Survey of the duikers is well-known to *Gnusletter* readers, and his pioneering efforts to breed

duikers and other antelopes at his Chipangali zoo was reported in the September 1989 *Gnusletter*. He has learned enough about breeding these animals to assert at the conclusion of his summary, "... it has already been established that the klipspringer and blue duiker are very suitable 'farm-animals', and that other species, like the gray duiker, are unsuitable."

Antelope News

CAPTIVE BREEDING

Karen Sausman, Director of The Living Desert, Palm Desert, California, has produced a *Survey and Action Plan for Artiodactyls in Captivity* for the Captive Breeding Specialist Group, an update on the *Artiodactyl Survey* she completed only a year ago, which covered 527 species and subspecies with a total captive population of some 34,600 animals (cited in report of Aridland Antelope Workshop, September, 1989 *Gnusletter*). The update covers 536 forms representing over 37,100 captive individuals. As ISIS, the International Species Information System census of these same taxa totalled only 15,555 individuals, Karen's survey of the global holdings of captive artiodactyls is clearly much more comprehensive.

Quoting from the Introduction, "The 1990 Artiodactyl Survey incorporates summary data for each of the 536 taxa reviewed, a new Action Plan list of priority taxa and individual reviews of the status of each of the priority forms." Over 1/4 (138) of the 536 taxa covered in the plan are either listed in the Red Data Book as endangered, or in CITES as category 1, or are considered at risk or as priority taxa by the ASG or CBSG. Karen Sausman notes in the Introduction that the reports on priority species "need to be expanded to provide more information on the status of wild populations and in situ conservation programs, if any, for each form as well as detailed action plans."

The 1990 Action Plan List of Priority Species has four priority levels:

1. Top priority: immediately threatened taxa needing captive propagation;
2. Urgent: create or expand captive

populations; create and/or expand in situ and captive breeding programs;

3. Threatened taxa with very small or no captive populations and little chance of establishing captive programs for various reasons; OR taxa that need additional field or taxonomic work to ascertain their status more clearly;

4. Threatened taxa that have current captive programs that need to be maintained.

There are 123 species/subspecies on the 1990 priority list, of which 49 forms are considered priority 1, 36 forms as priority 2, 23 as priority 3, and 15 (including 8 species) as priority 4. The antelopes, giraffe, and okapi (for which the ASG is also responsible) in the list of priority species are shown in table 1.

The kinds of information included for priority species/subspecies can be shown by taking one example from the Artiodactyl Survey (table 2).

The survey introduction reports that the first edition of the addax studbook has been published, and that several new studbooks have been started, for genenuk, dik-dik, lesser kudu, and reticulated giraffe. There are requests before the AAZPA's Wildlife Conservation Monitoring Centre committee to establish regional studbooks for a series of desert antelopes, including Cuvier's, Mhorr, and sand gazelles, and to establish an Antelope Working Group and a Desert Gazelle Species Survival Program. The promoters of this last project should get into contact with the Gazelle Research Group of the ASG (see ASG News, January, 1989 *Gnusletter*), chaired by Chris Furley.

GIANT SABLE UPDATE

Anthony Hall-Martin^{ASG}, who as Director of Special Services is involved in international relations on behalf of South Africa's National Parks Board, has provided information about the giant sable (in lit. 6 Jun 90).

"I also would like to comment on your note about the giant sable [in the May 1990 *Gnusletter*]. On a recent visit to Angola, I was informed by President Savimbi and several of his senior officers that most of the giant sable in the MPLA [i. e. Government] controlled areas had been shot by troops and this undoubtedly explains the availability of giant sable horns in Havana. According to the UNITA sources, there were still several herds of giant sable in areas controlled by UNITA. Strict instructions have been given that none were to be shot. Judging by the discipline exhibited by UNITA forces in other matters, I would think it quite likely that these instructions were carried out and that the giant sable in UNITA areas are in good health."

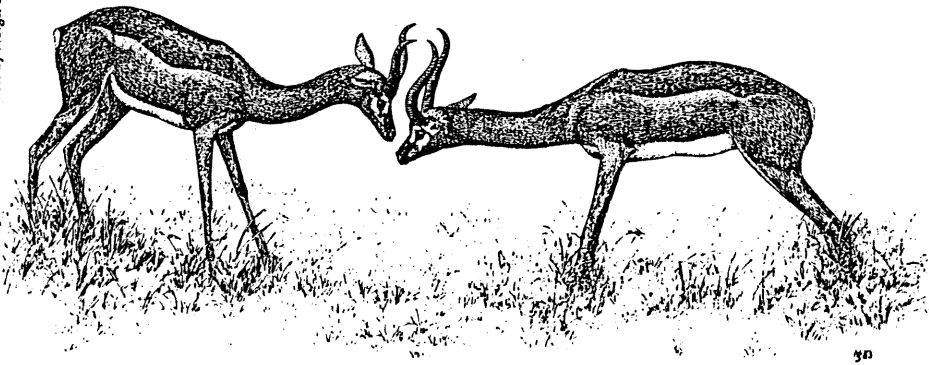
If the information reported earlier that Cangandala NP and the Luando Reserve are now both under UNITA control is accurate, then there are no longer any giant sable in areas controlled by the MPLA. [Ed.]

KLIPSPRINGER

Peter Arcese's finding that some oribi territories are defended by male coalitions, reported in the last *Gnusletter*, prompted this response from Darryl Mason (in lit. 27 July 90; more of Mason under Regional Rundown, South Africa).

"In the last *Gnusletter* (Vol. 9, No. 2) I was excited to read the abstract of the article on oribi social organization by Peter Arcese and Gwen Jongefan. I have noted similarly complex social groups in klipspringer, which may have a parallel system of subordinate adult males on the same territory, and I would like to draw attention to the situation by submitting a short article for publication. Accordingly, I would be grateful if you could kindly let me know the address of Peter Arcese or the journal where the oribi article is to appear, as I would like to have both the reference and the full text."

Illustration by Helga Schulze



GERENUK

Wilhelm Räder of Braunschweig University, a student of Hans Klingel's, the equid specialist, has completed a long-term naturalistic study of the gerenuk in Kenya's Northern Frontier District. A copy of his final report to the Kenya Wildlife Conservation and Management Department (now reorganized as the Kenya Wildlife Service) was kindly forwarded to Rod East by Räder's good friend, Jan Smielowski of the Poznan Zoo. Only the summary can be given here.

"On the social organization, behavior and ecology of gerenuk (*Litocranius walleri* Brooke 1878).

Summary

From April 1984 until December 1987 observations have been carried out on the social organization, behavior and ecology of gerenuk in an area of 37.5 km² in the Samburu National Reserve. The project linked up with a preliminary study of 1980/81 [for which Räder earned an M.Sc.—Ed.].

Gerenuk males are territorial and each territory covers the permanent home range of a female group. The boundaries of the territories are invariable in spite of all changes of territory ownership.

The females form permanent groups which inhabit mutually exclusive home ranges. They establish a linear dominance hierarchy [in which] individual rank [correlates with] age and the period of local residence.

The dominant females are relatively independent in their daily movements. This often causes the formation of subgroups, because each one . . . is normally

followed by some subordinate group members.

The females become aggressive towards their subadult daughters before giving birth to the next infant. The daughters consequently leave the group and settle in another territory after a period of migration [dispersal]. But there they are only accepted under certain conditions; normally, subordinate females oppose their integration and contribute to the regulation of group size in this way.

[Yearling] males are not tolerated anymore by their territorial fathers. . . , but usually they leave the territories voluntarily some months earlier in order to join a bachelor group.

There is a linear rank order among the bachelors and the most dominant males start to [compete]. . . for territories by the age of 3.5—4 years. The territorial males are particularly aggressive towards. . . a bachelor group in the territory.

The strongest competition among adult males is for the territories with the highest number of resident females. Accordingly, changes of territory ownership are much more frequent there than in the other territories."

MOUNTAIN NYALA AND A TRAGELAPHINE BIBLIOGRAPHY

The note about a paper in Italian on mountain nyala kept at the Rome Zoo prompted Chris Hillman^{ASG}, Adviser to the Ethiopian Wildlife Conservation Organization, the Government agency in charge of Ethiopia's parks and sanctuaries, to write (21 Jun 90) the following correction/clarification.

"I had it [the paper] translated a while

back and enclose a copy here to be forwarded to Mr. Jones. It does not in fact refer to a mountain nyala in the Rome Zoo, but [is] rather a superficial account of observations on three young mountain nyala captured and held briefly here in Ethiopia, by someone associated with the Rome Zoo. The only information it gives of any consequence concerns actual site locations of the species at that time."

Chris goes on to say, "If it is of interest to anyone, I have an extensive bibliography of the tragelaphine tribe of antelopes, dynamic since it is on disk (Wordstar 5 Professional). I am willing to provide copies to anyone interested for a 3.5" (2S2D) exchange disk, or the cost of photocopying and postage. It is currently about 60 pages long.

"It might also interest people to note that Ethiopia is in the process of establishing a further Wildlife Sanctuary, expressly aimed at the conservation of the mountain nyala. It is to include the two hills, Kuni and Muktar, near Asebe Teferi in the Ahmar Mountains between Aswah and Harer City. It will also protect a good population of the endemic subspecies *Tragelaphus scriptus meneliki* — Menelik's bushbuck. The need for such a further Mountain Nyala Wildlife Conservation Area was stressed in the Bale Mountains Management Plan in 1985, and its reality has come about through the expressed wish of the Harerghe Regional Administration. They forbade further hunting in the area and expressed the wish for their own Wildlife Conservation Area of a protective nature, rather than consumptive utilization. At present, the Sanctuary is administered under the auspices of the Awash National Park, being the closest geographically. The present Park Biologist — Abdirahiman Kubsa — is carrying out an inventory survey of the area, towards advising on suitable and possible boundaries for the new Sanctuary.

SITATUNGA

While studying monkeys in The Gambia's Abuko Nature Reserve, for her doctoral dissertation at the City University of New York, anthropologist Dawn Starin made opportunistic observations

of an introduced population of sitatunga. At the suggestion of Jane Thornback, who keeps the Red List of Mammals at the World Conservation Monitoring Centre in Cambridge, Starin sent the draft of a paper entitled, Notes on introduced sitatunga in the Abuko Nature Reserve, The Gambia. "Here I report some observations on sitatunga (*Tragelaphus spekei gratus*) made during a 5 1/2 year-long study of Temminck's red colobus (*Procolobus badius temminckii*). . . In a covering letter (19 Apr 90), she writes, "If these were monkey data I'd never write them up. But I don't know what it means in terms of sitatunga data." "I have been told. . . that there is virtually nothing available on sitatunga and [I] should therefore get the enclosed information out to the public."

Some of the highlights of Starin's findings are summarized here.

In 1978, when the study began, there were 2 adult males and 1 adult female living in the 107 ha reserve, which has been protected as a water source since 1911. "Observations made on these individuals, and subsequent offspring, over the next 5 1/2 years, were usually brief, although some observations lasted as long as 30 minutes. Information was collected on habitat use, diet, interactions and demography whenever a sitatunga was seen.

"*Habitat Use.* Table 1 [not included here] lists the number of observation made on both sitatunga and the sympatric harnessed antelope [bushbuck] (*Tragelaphus scriptus*). Clearly, sitatunga made use of more habitat types, more frequently than the harnessed antelopes, which spent over 71.9% of its time in the savanna. The habitat use in Abuko also contrasts greatly with that reported from Kenya (Owen 1970) and Botswana (Williamson 1986), where the animals rarely left the swamps. This may be due to the fact that the hunting/poaching/carnivore free zone of Abuko made it possible for the sitatunga to frequently leave the swamp for the more open habitats."

Of 33 sightings of feeding sitatunga, the animals chose their food from the savanna 13 times, the swamp 11 times, clearings 3 times, and riverine forest once.

"*Birth Seasonality.* There was a clear birth season. The only adult female in the reserve gave birth four times during this study: a son in May, 1979; the first daughter in January 1979, a second in December, 1980 and a third between October and December, 1982. Each birth occurred in the dry season (October through May) where there is only the odd sprinkle of rain. This is similar to the Botswana population where there is also a dry-season birth peak (Williamson 1986).

"The calves hid out for a period of about six weeks and then tagged very closely behind their mother, feeding when she fed, resting when she rested, never straying very far. . . On two occasions the mother was seen to groom mutually with her son (licking each other's necks and heads). The son began to stray off on his own when he was eight months old and began to develop small bud-size horns. The daughters began to stray between eight and nine months when the males first began to take an interest in them."

"*Social Interactions.* The adult female was observed with the adult male on six occasions and during all these occasions the male was courting the female. . . Outside the courtship period, the male and female were not seen to associate together.

"Social interactions between males were observed twice. Both of these interactions involved a young adult male approaching an old adult male and horn-wrestling for up to 15 minutes. Both of these duels appeared to end in a draw with the combatants going off in opposite directions to feed. These male horn-wrestling bouts may have fatal consequences. During one of the courtship periods I came upon the just-dead body of the old adult male. The vegetation around him was flattened down and the earth was scarred with hoof marks. In the dead body were two deep puncture wounds, probably caused by horn stabs. There was only one mature female in the reserve at the time and it is possible that these two males met again and fought for sexual access to the lone female, the younger male inflicting a fatal wound on the older male."

References

Owen, R. E. A. 1970. Some observations on the sitatunga in Kenya. *E. Afr. Wildl. J.* 8:181-95.

Williamson, D. T. 1986. Notes on sitatunga in the Linyanti Swamp, Botswana. *Afr. J. Ecol.* 24:293-97.

Background Information. Unlike the great majority of antelopes, but as in other members of the Bovinae (Bovini, Boselaphini), tragelaphines are non-territorial. Mating rights are determined by absolute dominance (as opposed to site-dominance in territorial systems). This more rigorous test of fitness places a premium on size and weapons, leading to extreme sexual dimorphism (males up to twice the biomass of females), achieved through late maturation and in at least some species post-maturational growth. [Ed.]

DUIKERS

Observations of Mark Infield

In a letter to Rod East (29 Jun 90), Mark Infield, WWF Program Officer for Africa, reports on a study of human predation in Korup NP, and asks for information on normal duiker densities in the lowland rain forest.

"As part of a study carried out some time ago for WWF-UK in the Korup National Park, Cameroon, I collected data on the off-take of various species of duiker by hunters and trappers living and operating within the Park. Though, as I am sure you are aware, collecting data through a mixture of direct observation and interviews on a subject as sensitive as hunting within a declared national park will, inevitably, produce data of uncertain reliability, none the less I used my data to estimate the annual harvest of species from the park area. By dividing these figures by the area of the park, I produced annual harvest/species/hectare figures. These were:

Blue duiker	0.0576/ha
Bay duiker	0.0588
Ogilby's duiker	0.0069
Yellow-backed	0.0013

"By summing all of the off-take figures for all the species of animal taken by hunters, including primates, and converting them to approximate biomass figures, I was able to estimate that the annual biomass off-take was 2.17 kg per

hectare. This figure seemed to be within the possible range of standing biomass figures for rain forest given by Eisenberg (The density and biomass of tropical mammals, in Soulé and Wilcox's *Conservation Biology*, 1980).

"Unfortunately, I was unable to relate these figures to probable species density figures, as there was no information available on species densities for Korup or, to my knowledge, for other West or Central African moist tropical rain forest. Without such data I was unable to reach any firm conclusions regarding the sustainability of off-take, though the evident reduction in hunting activity in surrounding areas as a result of lack of prey and the total terrestrial biomass off-take suggested that local hunting techniques were likely to result in severe population reductions.

"If one assumes that the above figures represent a 10% harvest of the standing densities, for example, we end up with approximately 0.6 blue and bay duiker/ha. Is there any information available to indicate whether this is within the margins of possibility or probability? If the above figures represented a 20% harvest, then the standing densities would be only 0.3/ha and there is no way of knowing which is the case. Nonetheless, it would be interesting to be able to relate the off-take figures to some idea of possible densities."

Rod East's Reply (in lit. 6 August 1990):

Population Densities of Duiker Species in West and Central African Moist Tropical Forest

As you point out, little is known about the population of duikers in the African equatorial forests (or anywhere else for that matter). We have been able to gather some preliminary information from a few countries during the preparation of part 3 of the ASG's Antelope Survey and Regional Action Plans (part 3, which covers West and Central Africa, is now at the printer).

LIBERIA. Karl Kranz's survey information from eastern Liberia suggests the following decreasing order of species abundance:

Maxwell's > bay > zebra > Ogilby's > Jentink's > yellow-backed

Apart from the zebra duiker, which is very rare in the two other countries in which it is known to occur (Sierra Leone and Ivory Coast), this general pattern of relative abundance seems to apply more or less throughout the moist lowland forests of West and Central Africa with variations from country to country in the species which are present. Maxwell's or the allopatric blue duiker is consistently the most numerous species, with yellow-backed the least numerous. Besides the blue duiker, other species which do not occur in Liberia are Peters' and Weyns' duikers (relatively common in countries where they occur), black-fronted duiker (locally common but restricted to suitable habitat such as swamp forest), and white-bellied duiker (generally uncommon).

Information on population densities is generally lacking for Liberia, but Kranz suggests that Jentink's duiker may occur at a density of about 1/km².

IVORY COAST. No estimates of population densities are available for the moist lowland forest zone. Information obtained by Harald Roth and B. Hoppe-Dominik indicates the following population densities within savanna parks (Table 3).

These duikers tend to be restricted to patches of forest within these parks, and the average population densities therefore bear little relation to population densities within continuous forest habitats. The red-flanked duiker (*Cephalophus rufilatus*), for example, reached densities of up to 6.6/km² in patches of dense vegetation with optimum habitat conditions within Marahoue NP (this duiker, of course, is a forest-edge species in the savanna zone and does not usually penetrate into the moist lowland forest, except where this has been opened up by agricultural development). Roth and

Hoppe-Dominik point out that the yellow-backed duiker reaches its highest population densities in the Guinean forest-savanna mosaic and is rare in primary moist lowland forest.

GABON. Blue duiker – Dubost (1980) recorded a population density of 70 animals/km² with an annual turnover of 7% to 10% in his study area at Ipassa-Makokou in the northeast of the country.

Peter's duiker – Dubost (1979) reported capturing 16 individuals in a 70 ha area at Ipassa, suggesting a possible local population density of > 20/km².

Bay duiker – Observations by Dubost (1979) suggest a local population density of > 15/km² in his study area at Ipassa.

ZAIRE. Studies by J. and T. Hart in the Ituri Forest in northeastern Zaire [see report in May 1989 *Gnusletter*] indicate that frugivorous species, duikers and the water chevrotain (*Hyemoschus aquaticus*), are the most abundant forest ungulates. Population estimates of this community (i. e. all species combined) ranged from < 20 to almost 40 (aver. 25.1) animals/km². These estimates were derived from drive counts on a 600 km² study area in central Ituri and are correlated with track and pellet group counts (Hart 1985; Koster & Hart 1988). In areas of comparable hunting history, both the density and local diversity of duikers were higher in mixed forests than in adjacent monodominant stands, especially those dominated by *Gilbertiodendron dewevrei* (Caesalpinaceae). Studies of the impact of hunting on duikers in central Ituri (Hart & Petrides 1987) indicated that dispersal from unexploited populations (distant from settlement) may be critical in maintaining heavily hunted populations (within 5 km of settlement). Flushing data on individual species in central Ituri give the following broad indications of species abundance:

TABLE 3. Densities of the most common duikers in Ivory Coast

National Park	Area (sq km)	Vegetation Zone	Duiker Spp.	Mean No./sq km
Marahoue	1010	Guinean	Maxwell's	2.7
			Red-flanked	2.0
Comoe	11,500	Sudanian	Maxwell's	0.5
			Red-flanked	1.3
			Yellow-backed	0.1

Table 4. Levels of abundance of forest duikers.

Level of Abundance	Species	No. of each sp. per sq. km.
Abundant	<i>C. maxwelli</i>	low to high 10s (e.g. 15-70)
	<i>C. monticola</i>	
Common	<i>C. dorsalis</i>	low 10s or less (e.g. 5-20+)
	<i>C. callipygus & weynsi</i>	
	<i>C. niger</i>	?
	<i>C. nigrifrons</i>	?
Uncommon	<i>C. ogilbyi</i>	?
	<i>C. leucogaster</i>	< 5
	<i>C. zebra</i>	?
Rare	<i>C. jentinki</i>	ca. 1?
	<i>C. silvicultor</i>	< 1

Blue duiker – accounted for 59% of all flushes, suggesting an average population density of ca. 15 animals/km².

Weyns', bay, and white-bellied duikers – These 3 upland 'red' duikers accounted for 31% of all flushes, suggesting population densities of the order 5 to 10 animals/km² for these 3 species combined. Both Weyns' and bay duikers are common in upland forest in Ituri, whereas the white-bellied duiker is widespread but uncommon.

Yellow-backed duiker – Widespread but uncommon in Ituri. It comprised < 3% of flushes during drive counts, suggesting a relatively low population density of < 1 animal/km².

The black-fronted duiker is restricted to swamp forests in Ituri; it is locally common in suitable habitat.

SUMMARY. The very limited available information suggests that population densities of individual duiker species where they occur within relatively undis-

turbed moist lowland forests in West and Central Africa may be of the following overall orders of magnitude (Table 4).

There are obviously local exceptions to this overall pattern, e.g., the white-bellied duiker is one of the most abundant antelope species in the Lope reserve of central Gabon. Population densities of most or all species will tend to be lower where hunting pressure is high and habitat modification through forest utilization/clearance is excessive.

KORUP NATIONAL PARK. Considering your data on off-takes in Korup and assumed harvests gives the following population densities (Table 5).

These population densities are clearly well within the margins of possibility. The figures for bay duiker seem a bit high, but perhaps this species is unusually abundant in Korup – or could it have been selectively harvested by the hunting methods used? Obviously we can only guess at the actual harvest percentage.

REFERENCES

- Dubost, G. 1979. *Afr. J. Ecol.* 17:1-17.
 Dubost, G. 1980. *Z. Tierpsychol.* 54:205-66.
 Hart, J. 1985. Ph. D. dissertation, Michigan State Univ.
 Hart, J. & G. Petrides 1987. In *People and the Tropical Forest*, U. S. Dept. of State, Man and the Biosphere Program.
 Koster, S. H. & J. Hart 1988. *Afr. J. Ecol.* 26:117-26.

DESERT ANTELOPES AT FOSSIL RIM

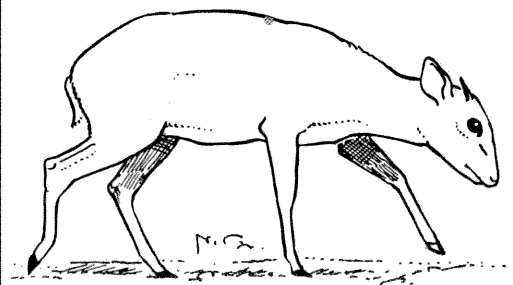
Ed Spevak, a molecular geneticist, is making a genetic analysis of the addax at the Fossil Rim Wildlife Center, Glen Rose Texas. He participated in the Aridland Antelope Workshop of the CBSG a year ago (reported in September 1990 *Gnusletter*). In a 27 Aug 90 letter, he writes:

"My addax project is going well. I've worked out the techniques for the genetic analysis so that when I go back to the University of Illinois next year the work should go quickly. Our main herd of addax is still around 50 animals and we are planning to establish another herd this year with fewer animals and a different sex ratio, probably 1:10. Our main herd has a sex ratio of 14:36 approximately. It is approximate as we are expecting more calves. Males range in age from over 8 years to one week. We presently have 6 to 7 potential breeders in the main herd. Two herds will allow me the opportunity to compare different sex ratios and densities of addax on social behavior."

"In the past two weeks we have had two greater kudu, two dama gazelle, and two addax calves born; we are expecting more damas and, of course, more addax."

Table 5. Estimated duiker densities in Korup NP.

Species	No. harvested/ km ² /annum	Pop. density (no./km ² @ assumed harvest of standing crop of:	
		10%	20%
Blue	5.76	57.6	28.8
Bay	5.88	58.8	29.4
Ogilby's	0.69	6.9	3.4
Yellow-back	0.13	1.3	0.6



Regional Rundown

ZAIRE

The following letter (dated 1 May 90) from Stephen Shurter (White Oak Plantation, Rte. 3, Box 224, Yulee, Florida 32097), which came "out of the blue", is a model of what is needed to keep *Gnusletter* readers informed about wildlife conservation and research in the different countries where antelopes occur. Purists who would argue that news about the okapi is irrelevant to the ASG should bear in mind (as noted earlier) that the Giraffidae have been assigned to our group, and so have the status of honorary antelopes.

"I recently received a copy of the ASG *Gnusletter* from a colleague in the U. S. and was pleased to learn of your group's effort to coordinate information on the animals which have meant so much to my work.

"I am currently working in Epulu, Zaire, with a captive okapi project. It is a joint project with the Institute in Zaire for the Conservation of Nature [IZCN] and my employer, White Oak Plantation, a private rare animal breeding center located in Northern Florida. I work as a captive ungulate specialist there but have been in Zaire on and off for 24 of the last 36 months. We started reconstructing the captive okapi breeding and research center in 1987 that was originally built by the Belgians in the 1950s but had been unmaintained for the last 25 years. We are currently housing 11 okapi here, of which two were captively born, one of which was bred here on the station. Our goals are conservation assistance through wild habitat preservation and tourist education. We are also working with the captive zoo okapi specialist group and plan to export okapi to some zoos in the U.S. and Europe."

Derby eland

"In November, 1989 I made a short [trip] to northern Zaire to inquire into the status of the giant eland (*Taurotragus derbianus gigas*). There is a hunting reserve, Bili-Uele, near the border of the C.A.R. where the eland have been seen in the past and hunted. The IZCN last

made a census there in '72 so the status could have changed drastically since then. [As it was] the height of the rainy season and therefore the grass [was high], it was literally impossible for me to make explorations into the reserve at that time. IZCN has a station and some patrol posts there and I spoke with several of the guards and the conservator. Their last actual sighting was in 1986 of 11 animals. [There was] another sighting of a lone animal in the Garamba NP in 1989 but this is not an animal normally found there. I plan to make a further foray into this area in the future, during a more accommodating time of the year, to speak to local hunters and do some prospecting myself. At this time it is impossible to say what the eland's status is in Zaire but due to the size of this reserve and its remoteness, there is very little protection available. [Taking this together] with the rare sightings, it is doubtful there are many left there."

Horned and hornless blue duiker females

"Another note for your own studies: I was interested to find that blue duiker . . . females in Zaire can be found with and without horns. My own observations are [that] females caught in the Epulu area (eastern Zaire) have no horns and females found in the Kinshasa area or even near Kisangani have horns. The animals in Kinshasa may come in by boat, as the ones I have seen were for sale for meat, but at any rate they would still be coming from the western part of their range in Zaire. These have been only casual observations but if you are interested I could look into this in more depth.

"I would also be interested in obtaining a copy of your paper on horn occurrence in female bovids. This has been an intriguing question to our research on okapi. Why does this giraffid female, which is larger than the male, have no horns?"

The answer (according to Estes, R. D. in press. The evolution of horns and other male secondary sexual characters in female bovids. *Appl. Anim. Behav. Sci.*): there has been no selection for the

female okapi to develop horns. The more interesting question is why female giraffes have evolved horns. The fact that they are not used in fighting supports the hypothesis that female giraffe horns function to mimic the horns of males, thereby disguising their gender and buffering them against the aggression of mature males, which in giraffes as in most other polygynous, gregarious societies, evict males from female society when developing secondary characters make their gender too obvious to ignore.

BURKINA FASO

The fate of the Nazinga Project, which was reported as in doubt in the January 1990 *Gnusletter*, has been clarified by George Frame, Chief of Research (in lit. 29 July 90).

Update on the Nazinga Game Ranch, Burkina Faso

In October, 1989, the Ministry of Environment and Tourism (MET) and the African Wildlife Husbandry Development Association (AWHDA) could not agree on the details of a new contract for the operation of the Nazinga Game Ranch. AWHDA had presented a plan to turn over the entire management and ownership of the ranch step by step during a five year transition period. The MET, however, didn't want to wait so long; they wanted to accelerate the schedule of personnel changes in the management hierarchy, because some people in the MET had different ideas about how to run the ranch. AWHDA was unable to reach a compromise with MET, so it became impossible to sign a contract for a continuation of AWHDA's management of the ranch. The existing contract expired on 30 November 1989, which is when all AWHDA personnel left the ranch.

AWHDA's personnel are spending all of 1990 working in the Ouagadougou office, where they are writing administrative, financial, and scientific reports, as well as a Management Plan for the Nazinga Game Ranch. The Canadian International Development Agency is still funding AWHDA to finish this work.

The Nazinga Game Ranch is presently a government-owned conservation area of 940 sq km. The ranch is bordered by

a one-kilometer-wide buffer zone, which is mostly free of cultivation. Surrounding areas are being developed as village hunting zones by an IUCN project. The purpose of the ranch is to develop the sustainable utilization of natural resources for the benefit of the local residents. The ranch is earning money from tourism, sport hunting and cropping. The benefits to the local residents are (1) jobs and job training, (2) cash payments to village councils, (3) development of roads, dams, schools, and clinics, (4) free or low-cost meat, fish, plants, firewood, and building materials, and (5) the preservation of the ecosystem upon which their local culture and society are founded.

The Nazinga Game Ranch contains 11 ungulate species (roan antelope, hartebeest, warthog, oribi, common duiker, red-flanked duiker, bushbuck, bohor reedbuck, defassa waterbuck, African buffalo, and Buffon's kob), totalling about 12,000 individuals. There are also about 400 elephants on the ranch. Large carnivores are scarce because of illegal shooting and poisoning, although an occasional lion or spotted hyena is seen. The smaller Carnivora, such as civet, side-striped jackal, and several species of mongoose, are abundant. Baboon, vervet, and the red patas monkey also are common.

The ranch's vegetation is dense bushland and woodland, with grasses that are 2 to 4 meters tall. This makes animal viewing difficult, but the visibility is improved for 4 or 5 months by burning the grasses at the end of the wet season. Eleven small dams on the ranch have improved the area for the wildlife and tourism (particularly elephant watching). A by-product of the construction of dams has been the development of a subsistence fishery with 37 local fish species. The populations of crocodile and monitor lizard are growing too. Helmeted guinea fowl and two-spurred francolin are the two most-conspicuous birds, and at least 275 bird species have been identified on the ranch.

The MET currently is operating the ranch. In the first half of 1990, the ranch earned income from tourism, sport hunting, and a small amount of cropping. The ranch's progress toward becoming a fi-

nancially self-sustaining enterprise, however, has been set back because of the abruptness of the transition. Nevertheless, there is ample reason to be optimistic about the future of the Nazinga Game Ranch. Before AWHDA's departure from the ranch, the results of two harvest seasons (1988 and 1989) were sufficient to strongly suggest that a ranch of mixed uses can be operated as a self-sustaining commercial venture in Burkina Faso.

In May 1990, the MET commenced meeting with AWHDA to work out a plan for the return of AWHDA to the Nazinga Game Ranch. It is likely that by the start of the next cropping and tourist season (December 1990), AWHDA may again be managing the ranch in close cooperation with the MET.

It is hoped that the Nazinga experience will serve as a model (of both what to do and what not to do) for developing other game ranches in Burkina Faso.

Editor's Note: Urbain Belemsobgo^{ASG}, formerly Provincial Director of the MET, wrote in July that he is now the Director of the Nazinga Game Ranch (see ASG News, Changes of Address or Status).

DJIBOUTI

Alain Laurent, a resident of Djibouti (BP 2092, Djibouti - République de Djibouti) submitted a very detailed account in April, 1989 about wildlife conservation in this small country (formerly French Somaliland), which updates and adds a lot of information to the chapter in Part 1, East and Northeast Africa of *Antelopes, Global Survey and Regional Action Plans*. First Rod and then I hoped but have failed to find time to translate the article from French into English. In any case, it is too long to publish in the *Gnusletter* (perhaps it can be printed separately as a supplement to the Survey or to the newsletter). However, I intend to publish Laurent's species accounts in the next *Gnusletter*. Meanwhile, as a token downpayment, here are the subject headings of the paper and the part of the abstract dealing with antelopes.

Status, distribution and conservation of the wild bovids in the Republic of Djibouti: preliminary findings, by Alain Laurent, April 1989.

I. Introduction II. Physical environ-

ment. 1. Topography (2 maps). 2. Climate. III. Principal habitats. IV. Limited habitats. V. Conservation. Table 1. Brief history of nature conservation. VI. Desirable conservation measures. VII. Numbers and status of the species (with distribution maps). VIII. Discussion. IX. Conclusion. X. Acknowledgements. XI. Bibliography.

"Summary. . . The status of the wild bovids. . . is not definitively known up to now. But observations made since 1984 allow a preliminary balance sheet to be made: at least 10 species are (or have been) present in the country. Among these, 3 are considered extinct (lesser kudu, beira, common duiker), 2 as strongly threatened (greater kudu, oryx), 2 others are rare (gerenuk, klipspringer), and 3 species have a satisfactory status (Pelzeln's and Soemmering's gazelles, Salt's dik-dik)."

ETHIOPIA

In the same letter of Chris Hillman's quoted under Antelope News (Mountain Nyala and Tragelaphine Bibliography), Chris writes, "A Captive Breeding Specialist Group Workshop was held recently [June 9-15] in the Bale Mountains National Park, attended by seven overseas participants from CBSG (Ulrie Seal - Chairman), Zoological Society of London (David Jones, Alexandra Dixon, Zoological Society of San Diego (Jim Dolan), Los Angeles Zoo (Warren Thomas, Robert Barnes), and Cincinnati Zoo (Ed Maruska), together with participants from EWCO [Ethiopian Wildlife Conservation Organization], WWF, and myself. Ethiopian species determined as priorities for urgent assistance were the Simien jackal (*Canis simensis*), Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) and mountain nyala (*Tragelaphus buxtoni*). It was [agreed] that detailed analyses of populations and trends in each species would be prepared by September this year, to determine further appropriate action."

Later I received a thick "Briefing Book" from the CBSG, containing a lot of useful background information about Ethiopia and its wildlife, which helped to prepare the participants for the "Workshop to Explore Possible Avenues of Assistance to Wildlife Conservation in

Ethiopia." The following facts are reported in a briefing document (No. 1233J, May 1989), "Ethiopia: conservation of biological diversity and forest ecosystems," prepared by the IUCN Tropical Forest Programme and reprinted in the CBSG briefing book.

"*Fauna.* Ethiopia is very rich in wildlife, with this great variety reflecting the diversity in climate, vegetation, and terrain. The highland regions, although having fewer species than many lowland parts of tropical Africa, have a large number of endemics, particularly birds [19], mammals [20], and amphibians [33]. Eastern low-lying parts of the country have many Somali-Masai species, notably antelopes and reptiles, which otherwise occur only in Somalia and to a lesser extent in Djibouti and northern Kenya. The west and southwest of the country shares its fauna largely with southern Sudan, and is rich in species."

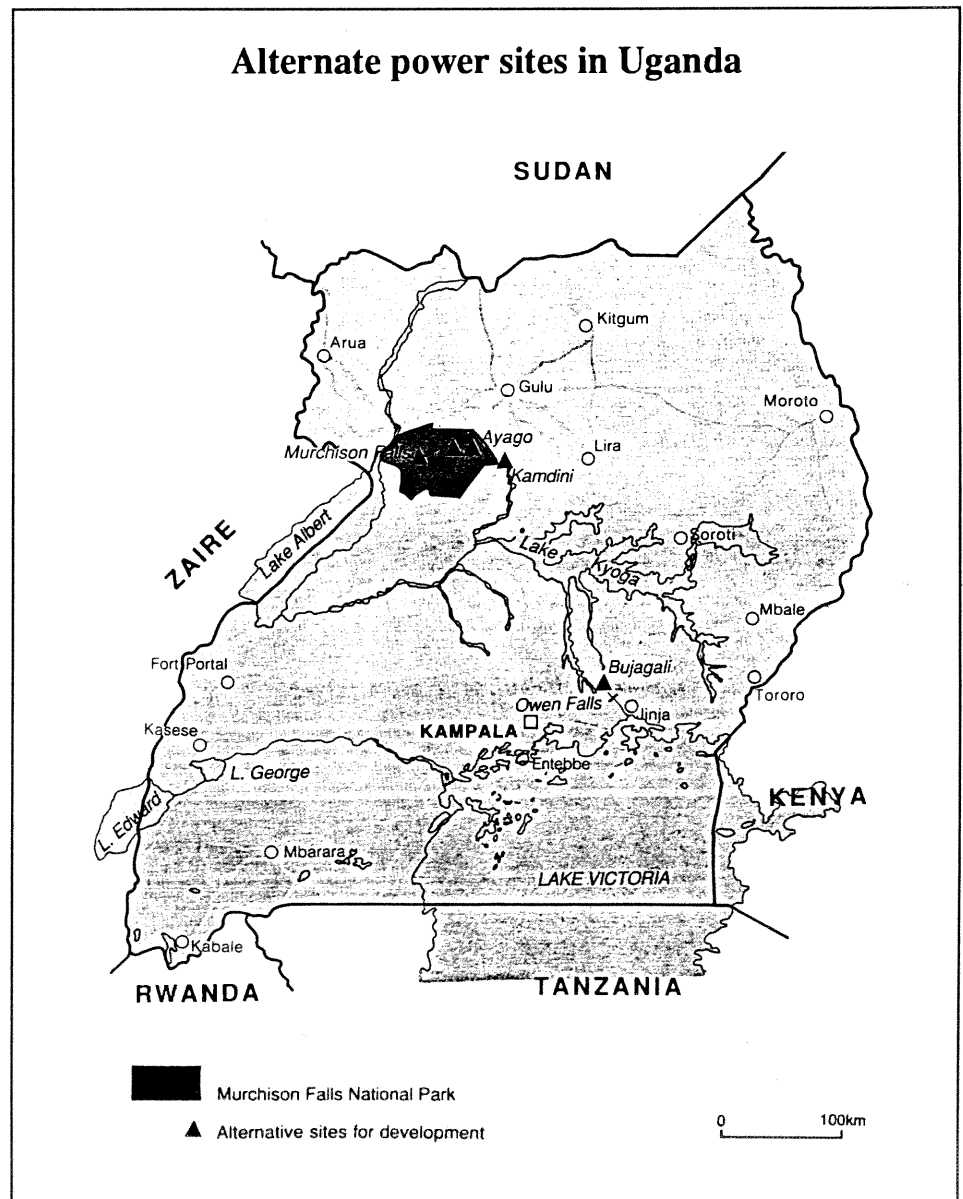
"*Adequacy of protected areas network.* Ethiopia's protected areas . . . consist of National Parks, Wildlife Sanctuaries, Wildlife Reserves, and Controlled Hunting Areas. Of the 13 major protected areas (where some sort of conservation development has occurred), Dahlak Marine NP exists on paper only, Gambella NP has ostensibly ceased to exist as a conservation area, and Yavello Sanctuary has been taken over for a livestock project. The Wildlife Reserves also only exist on paper and so there are only about 22,750 km² of Ethiopia in actively managed wildlife conservation areas; some 1.9% of the country's land area. Of the national parks only two (Awash and Simien Mountains) have been legally gazetted. Action is progressing to gazette the other parks as well as to upgrade and revise, where necessary, management plans for the gazetted parks, and prepare new plans for the remainder." In addition, IUCN is in the process of preparing a National Conservation Strategy for Ethiopia.

"*Human encroachment into protected areas.* Given that the country's protected areas are well sited to protect what remains of Ethiopia's natural resources, it is very disheartening to see the extent to which many of them suffer from human encroachment. Examples of areas suffering from this are Abijatta-Shalla

Lakes NP and Awash NP. The former is probably one of the most heavily settled protected areas on the continent, with the entire area having been overrun by people and permanent settlements established. Although being one of only two gazetted wildlife areas in Ethiopia, Awash NP is also being severely degraded as a result of the illegal presence of people. The northern part is overrun by nomadic pastoralists and parts are already badly overgrazed, with few large wild animals to be seen. Such problems are not confined to these two parks and, indeed, Nechisar NP is perhaps unique in Ethiopia in being the only conservation area that is virtually free from human encroachment."

UGANDA

In the last *Gnusletter*, the revival of a plan to build a hydroelectric dam at Murchison Falls was reported. Fortunately opponents of the plan, proposed by the Uganda Ministry of Natural Resources and backed by the Government, have rallied and have mounted a campaign to defeat it. A brochure with a beautiful picture of Murchison Falls on the cover, jointly published by the Uganda Ministry of Environment, the Trustees of the Uganda National Parks, the Makerere University Institute of Environment and Natural Resources, and IUCN, shows very clearly that an alternative site for the dam at Kamdini (see map) offers a



solution to Uganda's need for electric power that is in the best interests of the Ugandan people and of the rest of the world, for whom Murchison Falls deserves to be a world-heritage site. The arguments in favor of this solution are summed up at the end of the brochure:

Conclusions

- The potential environmental impacts of five alternative hydro-electric power schemes on the Nile have already been studied in considerable detail in a comparative Environmental Impact Assessment [carried out in 1984-85 by Britain's Overseas Development Administration].
- The numerous adverse effects on Murchison Falls and its surrounding environment could not be totally eliminated by amendments to the project design.
- Development of such a major project within Murchison Falls National Park would be contrary to the national and international understanding of National Park status.
- The national and international potential for tourism would suffer as a result.

There is an alternative site at Kamdini (Karuma). This:

- Is in the north of the country.
- Is outside the National Park.
- Would not have the environmental problems of the Murchison site.
- Can satisfy all Uganda's additional home and export power requirements for the foreseeable future. (Beyond that, another environmentally benign site, Bugajali, could be developed).

— **The irreparable damage of Uganda's greatest natural heritage is therefore simply not necessary.**

On an earlier page of this impressive brochure, "The importance of Murchison Falls and Murchison Falls National Park" is explained:

"Do the impacts referred to really matter? Is Murchison Falls really that important anymore?" The answer is most emphatically 'yes'.

"The Falls are Uganda's most spectacular feature, ranking with the Ruwenzori mountains as being known throughout the world. The Murchison Falls are to Uganda as the Victoria Falls are to Zimbabwe. The tourism potential of Murchison Falls was clearly demonstrated in the pre-Amin years: nearly

60,000 visitors in 1970 made Murchison Falls the premier tourist destination in the whole of East Africa. Without the Amin era, that figure might by now have reached a quarter of a million, a figure which would not now be an unreasonable target for the year 2000.

"Such an increase in tourism would provide foreign exchange and support many jobs. It would also help to put Uganda back onto an international footing. *Will tourists come?* The present signs are certainly favorable: roads and other facilities are improving rapidly, and the prospects for stability in the north are increasing. In Queen Elizabeth National Park, there were 85% more foreign tourists in 1988 than in 1987.

"The National Parks exist primarily for the benefit of Ugandans. Already parties of Ugandan Wildlife Clubs members, University students and individuals enjoy park visits. As the economy continues to improve, it will become every Ugandan's ambition to visit Murchison Falls."

In the next paragraphs, Uganda's international responsibilities to safeguard its natural heritage are stressed, concluding with this statement:

"In addition, since 1988 Uganda has been a signatory to the World Heritage Convention. Whilst no World Heritage Sites have yet been inscribed for Uganda, the one site that has been identified for future inclusion is Murchison Falls. This adds further weight to the presumption against development in the National Park, and indeed future inscription would be highly unlikely after such a development."

SOUTH AFRICA

A proposal to link Kruger NP with conservation areas in Zimbabwe and Mozambique

Darryl Mason^{ASG}, Senior Research Officer in Kruger NP, whose perceptive observations on Etosha NP were reported in the January 1990 *Gnusletter*, here again demonstrates the ability to go beyond accepted limitations in proposing to remove the barriers that divide the wildlife populations of Kruger NP and the surrounding countryside. The proposal is made in one of his regular reports on the monitoring of ungulate population

structure in the Kruger NP, released in May 1990, "Report on a survey during August, September and October 1989. He makes the proposal in the section about the nyala population (p. 10):

"In sampling region R where 58.8% of the 1989 population sample was recorded, it was again evident that social cohesion in nyala groups encountered along the Limpopo River is adversely affected by the game fence that follows the southern fringe of the riverbed through prime riparian habitat. Group members may become separated when some succeed in crossing the fence, while others run along the other side searching for breaks or gaps. Moreover, the fence hinders access of nyala and other game to water in the riverbed and is a cause of injury or even mortality when animals try to jump through or over but rake or catch on the wires.

"The international boundary with Zimbabwe follows the undemarcated centre-line of the Limpopo riverbed, which animals can walk across except when subject to flooding in the wet season. In view of land use concepts discussed by Martin & Taylor (1983) who advocate the amelioration of extreme transitions ('hard edges') between wildlife areas and settled rural areas, the merits of removing the game fence flanking the Limpopo River on the Kruger Park side should be seriously considered. Game dispersing across the Limpopo from Kruger Park into Zimbabwe could be subject to safari hunting and harvesting in a buffer zone, allowing direct benefits to accrue to the local rural community."

"In conjunction with the proposed trans-Limpopo wildlife buffer zone, it is further recommended that the Zimbabwean authorities be approached to give urgent consideration to the establishment of a corridor of wildlife habitat connecting the Pafuri region of KNP with Malapati Game Reserve only 38 km to the north-northeast.

"Too many African conservation areas constitute islands scattered widely but sparsely without proper regard for the inclusion of centers of endemism, migration routes of game in accord with foraging and water needs and habitat phenology, or a representative spectrum

of habitats of sufficient area to support ecologically and genetically viable populations of flora and fauna in the long term. Where two or more parks can be connected by corridors, this helps to eliminate or ameliorate problems that arise within and outside the boundaries of isolated wildlife sanctuaries (the so-called 'island dilemma' from which even the relatively large KNP is not immune). Part of the recommended Pafuri-Malapati corridor could be routed along the Zimbabwe-Mozambique boundary at least as far as the Mwenezi (=Nuanetsi) River, a distance of 19 km from Crooks Corner at the junction of the Limpopo and Levubu Rivers. Malapati itself could be linked with Gona re Zhou NP to the northeast via a wildlife dispersal corridor of some 47 km crossing the Rutenga-Maputo railway line on the Tswiza axis. Options would thus be open for the Mozambican government to contribute wildlife estate on their side towards a future constellation of international (trans-border) wildlife parks and buffer zones – potentially one of the greatest in Africa."

Natal

Michael Keep^{ASG}, who retired from Natal Parks last year but still keeps track of the research program, has provided (in lit. no date, Jun? 90) a list of the antelope research presently being undertaken in Natal, with comments upon progress and management implications.

1. Re-assessment of waterbuck ecology in Umfolozi Game Reserve, D. A. Melton. A publication on the findings is being prepared but staff are already acting upon Dr. Melton's findings and recommendations. The population seems to be stable now after being reduced by an increasing lion population and destruction of preferred habitat by cyclonic flooding.

2. Movement of impala in relation to management in Mkuzi Game Reserve, P. S Goodman. This study is in the process of being written up.

3. Movement of eland in the Natal Drakensberg, D. A. Melton. The study is now closed and recommendations acted upon. Eland move out of conservation areas onto private farmland, particularly during winter months, causing crop damage and competition with domestic

species. Control is by permits issued by the Natal Parks Board after investigation.

4. The ecology, conservation, and status of the red and blue duikers in Natal, A. E. Bowland. Field work has been completed and the resultant thesis nearly finished. This has been a very thorough study and the recommendations should be very significant, and must be acted upon. Once again, conservation of habitat is the most important factor controlling the future of both species.

5. Segregation of diet between social groups, and body condition, of two ungulate species in Natal, impala, and nyala in Mkuzi Game Reserve, A. F. van Rooyen. Fieldwork is completed and the project is being written up as a M.Sc. thesis. The results will guide staff upon the numbers of the two species which should be allowed to remain in the reserve. Both have, in the past, become greatly overpopulated with resultant degradation of habitat.

6. The influences upon oribi of land management practices in Natal, P. Everett. This is the most endangered antelope species in Natal, with the numbers diminishing due to the mismanagement of grassland habitat and poaching. They are easily caught by dogs in fenced areas. When preserved in properly conserved areas (e. g. Nature Reserves), numbers increase dramatically very quickly. The results of this study will provide definite advice to private land owners upon the conservation of the species.

7. Reproduction of common reedbuck on eastern shores of Lake St. Lucia, J. D. Skinner. This area carries one of the largest populations of reedbuck in Southern Africa. Large numbers are captured live every year for relocation to suitable areas, by the Natal Parks Board, and it is important to know how many can be safely removed without fear of damage to the remaining population.

8. The common reedbuck on the western shores of Lake St. Lucia, their relationship with the grasslands. D. Tomlinson started this study but unfortunately died just before completion. However it has been completed now, and is being written up.

NAMIBIA

The economic importance of antelopes and other large mammals to Namibia was brought out in a paper presented by Hu Berry, Chief Researcher in the Directorate of Nature Conservation, at the Wildlife Research for Sustainable Development Conference held in Nairobi (reported under ASG News). The main points and selected quotes of his paper, are presented below.

Large-scale commercial wildlife utilization: hunting, tourism and animal production in Namibia

Almost 1/2 of Namibia's 824,000 km² area is fenced off in 6000 private farms, of which 359 (6%), with a total area of 46,000 km², are registered as private conservation areas for the purpose of commercial wildlife utilization. "Privately owned land can be proclaimed as a private nature reserve if it is not less than 1000 ha in extent and is enclosed by a game-proof fence measuring 2.2 m in height."

Trophy hunting

Trophy hunting is the greatest source of income for farmers who utilize wildlife commercially. In 1989, 1488 clients from 24 countries were issued permits to shoot 2589 animals of 30 species. The State received only US\$15,934 for the permits (bargain rates compared to most countries), whereas the farmers received \$1,141,854 for the trophy animals and another \$1,210,694 for providing accommodation, at rates of up to \$388/day. Trophy hunters have to be accompanied by a licensed professional hunter or a registered hunting guide. The property owners gained a further dividend of \$56,500 by selling the meat of the trophy animals.

Hunting

Gemsbok (*Oryx gazella*), kudu, springbok, buffalo, warthog, and bushpig are classified as Hunttable Game, with open seasons of ca. two months a year. Property owners earned \$241,672 from hunters who bought 3322 permits to shoot 7674 springboks, 2094 gemsboks, 1416 kudus, and 43 warthogs. These hunters are required to be accompanied by registered hunters or guides.

Culling

Culling for marketing "venison" is another profitable operation, mostly car-

ried out at night by registered specialists who are tested for marksmanship. Hygienic control of the game meat is supervised by the Directorate of Veterinary Services. In 1989 culling of 12,099 springboks and 271 gemsboks brought farmers \$443,326.

Capture for sale

But capture for sale of live animals is presently the most profitable form of commercial wildlife utilization in Namibia, as it is in Zimbabwe and South Africa (see May 1986, and January, 1988 *Gnusletter*). In 1989, registered game dealers caught 4,906 animals of 13 species, which they sold for \$3,376,246. Of this total, the dealers exported 104 animals of 12 species overseas (\$264,188) and shipped 406 animals of 19 species to South Africa. (\$907,912). Probably nearly all but the ones sent overseas were bought by landowners intent on stocking their own farms with wildlife. Namibian farmers also catered to this market by capturing and selling 1168 animals of 16 species, for \$334,928, the majority at game auctions. The highest bid made at a game auction was \$9686 for a roan antelope.

State versus private income from wildlife utilization

"If all monies derived directly from the utilization of wildlife are combined," says Berry, "the Directorate of Nature Conservation received \$ 25,697, compared to \$ 7,234,930 received by the private sector. The State's share was consequently only 0.4% which is in keeping with the declared policy that wildlife on privately owned farms is an asset of the farmer."

Animals shot on unfenced land in communal areas

But this wildlife bonanza is apparently not shared by the great majority of Africans who live on the land in tribal areas. According to Berry, "Chiefs and Headmen have the traditional right to shoot game which occurs on land which they control. Ten permits were issued for 21 animals of 10 species ranging from giraffe and elephant to hippopotamus. Their income from the products was 3022 US\$."

The Development of Game Farming in Namibia

Berry's account of the way this industry developed and its economic importance for Namibia suggests that different versions of this system could be developed in other African countries as a sustainable and highly profitable form of land use.

"... game farming in Namibia has grown within the last 10 years from virtually nil to a thriving industry, which in itself is an indication of the profitable nature of this form of wildlife utilization. Of interest is the fact that this growth coincided with the onset of the worst drought of the century, which either forced farmers off their land or to find an alternative to cattle ranching. Moreover, the weakening South African Rand which later was classified as the 'Financial Rand', in an effort to attract foreign investment into the country, resulted in massive purchases of land in Namibia by foreign investors, notably West Germans and Swiss. Bought with the Financial Rand, prime game farming land was acquired at as little as US\$44 a hectare. These massive land deals have resulted in huge (10,000 to 40,000 ha) game farms where wildlife utilization is the sole activity.

Current and Future Markets

"Because of historical links, West Germany, Austria and Switzerland have brought in the major portion of revenue from especially trophy hunters. Indications are that the USA, Australia, France and Spain will increase their clientele following Independence, while enquiries from prospective hunters have been received from the Eastern Bloc and Soviet countries. It appears as if an Independent Namibia can expect an unprecedented influx of tourists from all over the world following on the international publicity given the Independence process. (The United Nations Transitional Assistance Group (UNTAG) in itself brought over 7000 people from 37 countries to Namibia and they may well be a unique form of publicity for the country).

Comparative Ecological Advantage of Wildlife Utilization

"Namibia is a classic case where farming with domestic stock in an arid region has shown the pitfalls of over-exploitation for short-term financial gain. Rainfall records since the turn of the century show a 9- to 12-year cycle of wet and dry spells, although rainfall is sporadic and unpredictable. The decade of the 1970s was a wet cycle with good grass production and farmers stocked their veld heavily, in some cases running two to three times the number of head. . . recommended by agriculturists (1 large stock unit per 20 ha). When the drought of the century followed in the 1980s, the denuded pastures were unable to recover and at present eight million hectares of farmland is regarded as bush-encroached to the extent that it is no longer able to support grazing domestic stock commercially (stocking rates have been reduced to as little as 1 large stock unit per 100 ha). The Department of Agriculture in Namibia estimates that 2000 of the 6000 fenced farms are no longer viable units for domestic stock. The majority of these lie in the pro-Namib Desert which has a rainfall less than 200 mm per annum, while some are in areas of higher rainfall but are useless for domestic stock because of bush-encroachment. It is in these areas that farmers initially turned to game farming and their success was such that farmers elsewhere began setting aside a portion of their farms exclusively for wildlife utilization. It is obvious that game, especially gemsbok, kudu, springbok, Hartmann's zebra and ostrich retain condition and have a higher production capability without supplementary feeding than domestic stock, especially during prolonged dry cycles.

Diversification

"The strength of Namibia's game industry lies in its diversification. Already substantial overseas markets exist for venison and by-products such as skins are in demand. Sport hunting and trophy hunting are gaining in popularity, with wealthy visitors reserving accommodation on game farms as much as a year in advance. General tourism for game-viewing and photographic 'safaris' exceeds the capacity of both State-con-



trolled Game Reserves and privately-owned farmland. The present statistics place income from hunting, tourism, and wildlife products as second only to the mining and fishing industries. Indeed, with an estimated 150,000 tourists visiting the country during the past year (one tourist for every 10 inhabitants), Namibia has reached the stage where serious consideration must be given to limiting tourist numbers in order to retain a high-quality, exclusive experience for the visitor, rather than mass tourism which has already ruined so many of the world's scenic places. Namibia is a semi-desert to desert country whose harsh beauty belies its fragile environment. Uncurbed, mass tourism may produce high financial gain in the short term, but will undoubtedly reduce the aesthetic appeal which lures visitors to Namibia's magnificent scenery and wildlife, which are set in one of the most sparsely populated regions in Africa."

SAUDI ARABIA

The following progress report on research at the King Khalid Wildlife Research Center, by Doug Williamson, is dated 7 August 1990, very shortly before Iraq's invasion of Kuwait, followed by the deployment of over 100,000 foreign troops (mostly American) in Saudi Arabia. Even assuming that war will somehow be averted, the presence of thousands of armed men with nothing much to do in their spare time is bound to have an impact on the country's sparse wildlife resources. If Jane and Doug Williamson are in a position to report on the changed situation, their update will appear in the next *Gnusletter*. Anyway, this is the way it was a couple of months ago.

"I promised Jane that I would give you

an update on the situation at Thumamah. It is satisfying to be able to report that there has been substantial progress over the past year.

"Undoubtedly the most important advance is that we have established a large measure of control of the tuberculosis problem which caused a lot of very negative predictions about the future of Thumamah. Working with Frank Griffin, Director of the Deer Research Laboratory in Dunedin, New Zealand, we have developed a protocol for Tb-testing that enables us to produce gazelles with a clean bill of health. This has enabled us to begin the implementation of two gazelle reintroduction projects, which is obviously a big step forward. We have already sent 30 rheem (*G. subgutturosa*) to Mahazat As Said, a large, fenced protected area near Taif, and are preparing to move the same number of idmi (*G. gazella*) to the Special Ibex Reserve, a protected area about 150 km southwest of Riyadh. In both areas further transfers of gazelles are planned and the final numbers moved could well run into the hundreds.

"Other gazelle reintroduction projects are under consideration and we are supplying gazelles to private landholders, so it looks as if we will be able to find constructive uses for the gazelle collection at Thumamah.

"Although establishing control over tuberculosis has been a major preoccupation, a fair range of other work is being done. I will summarize briefly:

- In addition to doing diagnostic testing, our well-equipped laboratory is collecting baseline data on gazelle hematology and biochemistry and doing exploratory determinations of reproductive hormone levels, using the ELISA system;

- We have gained a lot of experience in gazelle capture and developed an efficient capture system for small paddocks which obviates the need for chemical immobilization—essentially it is a corridor into which the animals are slowly driven.

- We have made a beginning to systematic research into gazelle ecophysiology and reproductive physiology and are also becoming increasingly involved in research on gazelle genetics.

- We have a program of field research on the distribution, abundance and ecology of the remaining free-ranging gazelle populations.

"Important developments which have recently begun are the breeding of the Saudi 'dorcas' and a brief to become involved in protected-area management. The *Gazella saudiya* were a gift to the Kingdom from Al Areen in Bahrain and we currently have two breeding pairs. We hope to get more.

"Although it is too early to give details, it looks as though their karyotype is very different to that of the Sudanese dorcas. We recently sent blood samples to the Zoological Society of London's new genetics lab for karyotyping and have been told there is a large difference in chromosome number. Details will doubtless be published by the folks at ZSL when the analysis is complete.

"Our involvement in protected-area management is in the Special Ibex Reserve, mentioned earlier with regard to idmi reintroduction. We have been given scientific and technical responsibility for the area and are busy setting up research and management initiatives.

"As far as the future is within our hands, I am confident that we will be able to steadily expand the scope of our work at Thumamah and also improve its quality."



