An Operational Information System for Zoo Medicine

by

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Frederic: *A paradox?*

King: *A paradox!*

Ruth: *A most ingenious paradox!*
We've quips and quibbles heard in flocks,
But none to beat this paradox!...

Frederic: *How quaint the ways of paradox!*

Ruth, King: *A paradox, a paradox,*

A most ingenious paradox.

-Gilbert & Sullivan, The Pirates of Penzance, Act I I

Acknowledgements

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I am greatly indebted to my numerous friends for their support, suggestions and criticisms during the development of the system. I would like to single out a few of them. Dr Peter Buss who was my colleague at the National Zoological Gardens for 5 years, made useful suggestions on the functionality and design of the database. He spent many long hours usually after normal work-hours diligently feeding the database with data collected on the field forms. Ms Beverly Hudema (10-515 18 Ave. S.W. Calgary, AB T2S 0C6. Canada. *Personal Communication*), a private consultant and Paradox programmer was a pillar of support in helping me find my feet and learn the ObjectPAL language in order to upgrade the program from Microsoft's DOS operating system to the Windows 95 operating system.

The Borland International's office in Johannesburg donated software, Paradox 5 and Paradox 7 for Windows for this project. Siltek Distribution Dynamics in Midrand, Johannesburg donated a 386MHz desktop computer for the project. International Computers Limited (ICL) in Midrand, Johannesburg donated a 486MHz desktop computer with a 1 GIG hard drive capacity to upgrade the system. Hewlett-Packard (HP) in Midrand, Johannesburg donated a DeskJet printer.

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List of Abbreviations

ISIS	International Species Information Systems
DOS	Disk Operating System
ARKS	Animal Record Keeping System
MedARKS	Medical Animal Record Keeping System
PAL	Paradox Application Language
ObjectPAL	Object Orientated Paradox Application Language

An Operational Information System for Zoo Medicine

Objectives

1. Describe a computer system built and being further developed to facilitate management of data and information relating to Zoo Medicine at the National Zoological Gardens.

2. Contextualise and evaluate this information system in terms of the original objectives, its potential, applied functionality and the manner in which it meets information systems criteria.

3. Make recommendations for further development.

Chapter

1

1 Introduction

1.1 History

In February 1991 when I commenced duties as the veterinarian at the National Zoological Gardens, the medical record keeping system for animals in the collection that were examined or treated in the Zoo was poor, it consisted of basically making entries in a diary. Previous procedures or treatments on animals were difficult and time consuming to find, if they could be found at all. Records which were kept in files on some species and on some diseases were kept in a haphazard fashion and only occasionally updated. Large amounts of daily information regarding the treatment and management of animals were not recorded and therefore lost. Whenever a new clinical problem was faced it was difficult to check past records on what was done before in similar situations. A detailed account of past treatments and procedures together with their success and failures would have great educational advantages to students and veterinarians alike, but were not recorded.

1.2 Motivation

It was imperative that a more structured information system be implemented. The system would be required to be effective in collecting "all" the relevant medical data on each animal examined or treated in the Zoo and provide rapid retrieval of its medical history. This would enable a detailed overview of events such as treatments, immobilization

dosages and causes of death, with the potential value in examining health trends over time.

Report generation and the ease of printing out reports at the push of a few buttons was very appealing at the time, because too much time was spent searching through files for information to include in reports. If all the information was in a computer then report writing would be so much faster, easier and more complete.

It is obligatory for all practising veterinarians to keep accurate records of all the animals he/she examines and treats, a computerised system to perform this function would greatly enhance the accuracy of the recording process.

1.3 Available Computer Programs

The Medical Animal Record Keeping System (MedARKS)[29] is a computer program which was developed by the International Species Information Systems (ISIS) in the late 1980's for the purpose of recording medical treatments of animals kept in zoological collections worldwide. The program was designed to work closely with the Animal Record Keeping System (ARKS) program also developed by ISIS. Institution members of ISIS subscribe to the software and the data collected by each zoo is pooled in the centrally held ISIS database in Minnesota, USA. The use of MedARKS is limited to members of ISIS.

The version of MedARKS in use in 1991 was found to have some major disadvantages. It was:

- too time consuming in collecting, recording and processing data into the computer;
- too rigid in design;
- not capable of recording clinical notes if an animal was not treated;
- not capable of searching data for any criteria, for example animals that had been

treated with a certain drug in the past or keyword searches.

- It was difficult to find the records of an animal without knowing its Accession Number assigned to it by the ARKS program. An animal could not be found by using its specific identifying ring or transponder number only.
- To be able to view an animal's medical history its Accession Number had first to be found in ARKS and then typed into MedARKS. This could only be done with both programs running on the same computer.
- To find an animal by a taxonomic search its scientific name or the taxonomic group for the species had to be known rather than its common name.
- The scientific name of the animal was required in detail down to the level of sub species (in most cases) for a new patient to be first entered into the ARKS program where it was assigned an Accession Number before it could be made a new patient in MedARKS.
- At the National Zoological Gardens ARKS and MedARKS would have operated on different computers in different buildings and because of the lack of a local network, entering new patients onto MedARKS would have been cumbersome;
- only fixed reports generated by MedARKS could be printed;
- the advantages of going to the effort and time of pooling detailed and standardised data were not forthcoming as software was yet to be developed by ISIS in later versions to make use of the advantages of pooling data;
- colleagues that were using the MedARKS program in other zoos were not satisfied with the program but were forced to use it as there was no alternative;
- user appeal of the program appeared to be consistently low.

No other computer programs were commercially available in 1991 for managing Zoo medical information. This is still the situation at present.

It was decided to develop our own "in-house" Computerised Veterinary Information System to be used by veterinarians and others in the Veterinary Hospital at the National Zoological Gardens of South Africa.

1.4 The Information System

The option of recording all medical information of animals treated in the Zoo on forms which are filed in a filing cabinet according to patient or animal group categories was strongly considered. The disadvantages of the paper method over a computerised system are:

- speed of accurate information retrieval is significantly faster with the computerised system both for current and retrospective reports;
- the computerised system can keep all records pertaining to a patient in "one place" as opposed to a paper system where health, medical, immobilization and autopsy records would be kept in different places; and
- there was a growing international trend, driven by ISIS for zoos to computerise their animal collection data.

1.5 The Design of the Information System

The initial design concept of the Information System was to first design **data forms** to capture clinical data and then to design and build a computer database to assimilate and store the collected data in **"tables"**.

Poorly designed tables can result in a very inefficient system, with redundant information taking up unnecessary computer storage space and insufficient or meaningless information stored which could render other information valueless. It was therefore, important from the outset to carefully plan the construction of each data table in terms of the fields to be

included, the field sizes and the relational links between certain fields in other data tables. Five data forms were designed to capture clinical data in a more standardised and structured way. The data forms would be completed for each procedure on a patient and filed after processing was completed. The retained original written hard copy was insurance against computer failure and could be used to check for errors or when disputes occurred in regard to data entered into the computer.

The **Computer Program** would store all the clinical data in a structured and organised way, which would make referencing or searching for past events easy and efficient. Rapid report generation of summary and detailed reports would be one of the main features of the program.

Examples and details of the type of information recorded on the **data forms** are shown in Chapter 2.

Design and development of the **computer program** is described in detail in Chapter 3

Chapter

2

2 Data Forms

The forms were developed where clinical records could be recorded in an efficient, structured and standardised manner. Five data forms were designed and created using Quattro Pro[3] and printed on standard A4 sheets of paper to record data on medical examinations and treatments; hospitalizations; immobilizations; autopsies and specimen referrals. After data is entered into the computer, the data forms are filed in cabinets.

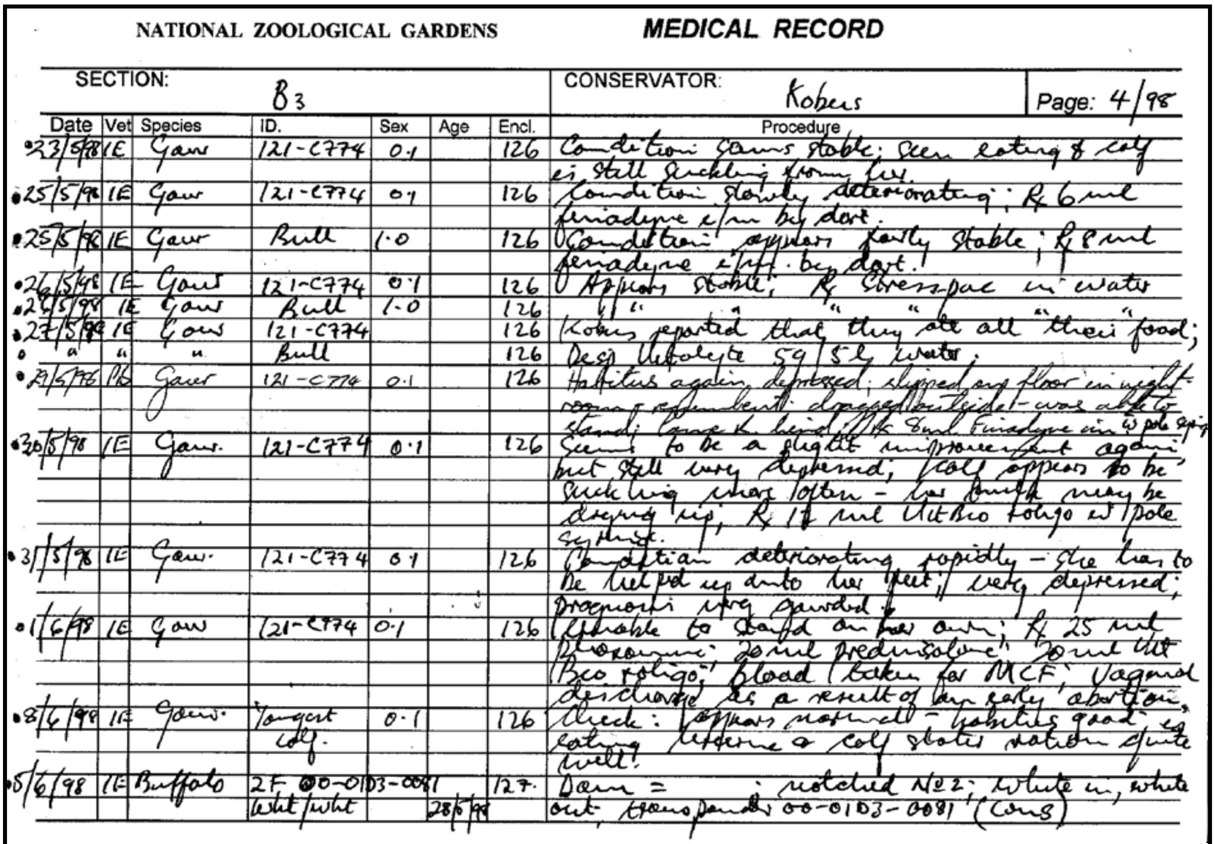
2.1 The Medical Record Form

The Medical Record form in **Figure 1** is the main form which is used to record medical information for the animals in the National Zoological Gardens and its satellite stations.

2.1.1 The Zoo is divided into the following sections:

- A1 and A3 ***hospital and hospital boma***
- B1, B2, B3 ***primates and carnivores***
- C1, C2, C3 ***birds***
- D1, D2, D3 ***ungulates***
- Aquarium/Reptile Park
- Lichtenburg ***breeding farm***
- Potgietersrus ***breeding farm***
- De Wildt Cheetah Breeding Centre (up until the end of 1995)

2.1.2 A written record is kept which includes the following information on the **Medical Record**



NATIONAL ZOOLOGICAL GARDENS **MEDICAL RECORD**

SECTION: B3 CONSERVATOR: Kobers Page: 4/98

Date	Vet	Species	ID.	Sex	Age	Encl.	Procedure
23/5/98	IE	Gaur	121-C774	0.1		126	Condition Gaurs stable; seen eating & calf is still suckling from her.
25/5/98	IE	Gaur	121-C774	0.1		126	Condition slowly deteriorating; Rx 6 ml finadyne i/m by dart.
25/5/98	IE	Gaur	Bull	1.0		126	Condition appears fairly stable; Rx 8 ml finadyne i/m by dart.
26/5/98	IE	Gaur	121-C774	0.1		126	Appears stable; Rx Stresspac in water
26/5/98	IE	Gaur	Bull	1.0		126	" " " " " "
27/5/98	IE	Gaur	121-C774			126	Kobers reported that they ate all their food;
"	"	"	Bull			126	Desi [illegible] 59/5l water.
29/5/98	PB	Gaur	121-C774	0.1		126	Habitus again depressed; slipped on floor in night room & recumbent: dragged outside & was able to stand; [illegible] Finadyne [illegible]
30/5/98	IE	Gaur.	121-C774	0.1		126	Seems to be a slight improvement again but still very depressed; calf appears to be suckling [illegible] often – [illegible] may be drying up; Rx 1[illegible] ml [illegible] Bco forte [illegible] pole syringe.
31/5/98	IE	Gaur.	121-C774	0.1		126	Condition deteriorating rapidly – she has to be helped up onto her feet; very depressed; prognosis very guarded.
1/6/98	IE	Gaur	121-C774	0.1		126	Unable to stand on her own; Rx 25 ml [illegible]; 20 ml prednisolone; 20 ml Vit Bco forte; blood taken for MCF; vaginal discharge as a result of an early abortion.
8/6/98	IE	Gaur.	Youngest calf.	0.1		126	Check: appears normal – habitus good, is eating lucerne & calf starter ration quite well!
5/6/98	IE	Buffalo	2F 00-0103-0081 wht/wht		28/6/98	127.	Dam = ; notched No 2; white in, white out, transponder 00-0103-0081 (Cons)

Figure 1 A scanned image of a typical Medical Record Form showing records entered on Page 4 of 1998 for Section B3. Note the dot to the left of the Date which indicates that the record has been processed and entered into the computer.

form:

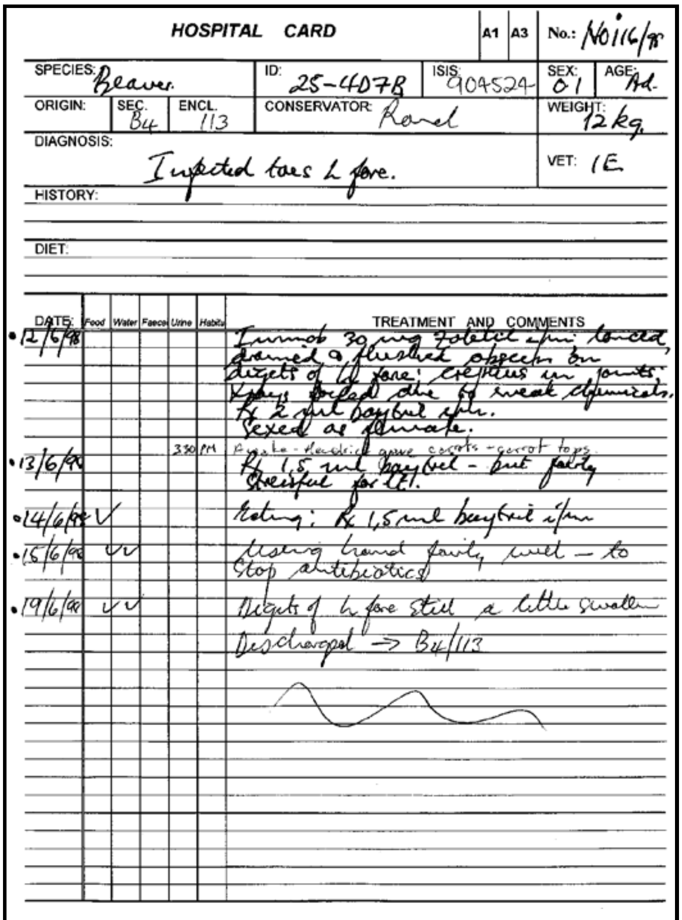
- Section
- Conservator

- Date
- Vet
- Species
- ID
- Age
- Enclosure number
- Procedure

2.1.3 **Figure 1** shows a scanned example of a typical **Medical Record** form. Each form is labelled according to *Section*, person or *Conservator* in charge of the section and a sequential *Page* number (e.g. 1/96, 2/96, etc.). When these forms are completed and all data has been entered into the computer, they are filed according to section and date. Information can be found easily by selecting the correct section and searching according to the date (if known) when checking detail or correcting errors in the computer data. This form provides a systematic record of information of animals that are examined or treated in the Zoo.

2.2 <u>Hospital Records</u>

Each animal brought to the hospital for treatment which will extend over a period of more than one day is given a ***Hospital Card*** illustrated in **Figure 2** with a sequential number e.g. H0116/98 or filing designation. The form records daily treatments and procedures on each patient in the hospital, until the animal is discharged back to its section or sent to a new locality. Details of the animal's food and water intake, excretions and habitus are also recorded on the ***Hospital***



HOSPITAL CARD

A1 A3 No.: N0116/98

SPECIES: Beaver | ID: 25-4D78 | ISIS: 904524 | SEX: 0.1 | AGE: Ad.

ORIGIN: | SEC. B4 | ENCL. 113 | CONSERVATOR: Ronel | WEIGHT: 12 kg

DIAGNOSIS: Infected toes L fore. | VET: IE

HISTORY:

DIET:

DATE | Food | Water | Faeces | Urine | Habitus | TREATMENT AND COMMENTS

Figure 2 A scanned image showing an example of a Hospital Card No. H0116/98.

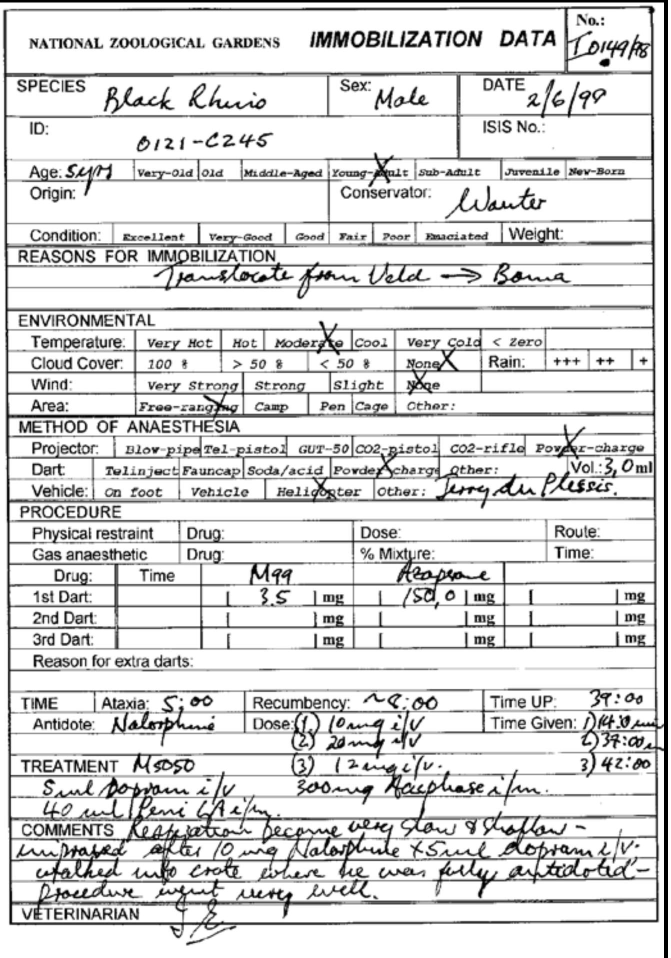
Card.

The advantage to having clinical data for a patient recorded in this manner is that the progress the patient is making together with treatment regimens applied can be seen at a glance and can be studied while the animal is on the examination table for treatment. A similar hard copy can be printed by the computer which can be used at hand when the patient is being examined.

Copies of laboratory reports are attached to this form for easy reference. When the patient has been discharged from hospital and all the data entered into the computer, the completed ***Hospital Card*** is filed according to its sequential number.

2.3 Immobilization Data

Immobilization data is recorded on a separate form for each animal immobilized in the hospital or the Zoo. An example of an ***Immobilization Data*** form is shown in **Figure 3**. Each form is numbered sequentially, e.g. I0149/98. This form records the reason for the immobilization; weather conditions; type of darting equipment; drugs and dosages; treatments and comments on the procedure; and the veterinarian performing the immobilization. An



NATIONAL ZOOLOGICAL GARDENS IMMOBILIZATION DATA No.: I0149/98

SPECIES: Black Rhino Sex: Male DATE: 2/6/98

ID: 0121-C245 ISIS No.:

Age: 5y/M | Very-Old | Old | Middle-Aged | Young-Adult | Sub-Adult | Juvenile | New-Born

Origin: / Conservator: Wauter

Condition: Excellent | Very-Good | Good | Fair | Poor | Emaciated | Weight:

REASONS FOR IMMOBILIZATION: Translocate from Veld → Boma

ENVIRONMENTAL

Temperature: Very Hot | Hot | Moderate | Cool | Very Cold | < Zero

Cloud Cover: 100 % | > 50 % | < 50 % | None | Rain: +++ | ++ | +

Wind: Very Strong | Strong | Slight | None

Area: Free-ranging | Camp | Pen | Cage | Other:

METHOD OF ANAESTHESIA

Projector: Blow-pipe | Tel-pistol | GUT-50 | CO2-pistol | CO2-rifle | Powder-charge

Dart: Telinject | Fauncap | Soda/acid | Powder charge | Other: Vol.: 3,0 ml

Vehicle: On foot | Vehicle | Helicopter | Other: Jerry du Plessis

PROCEDURE

Physical restraint | Drug: | Dose: | Route:

Gas anaesthetic | Drug: | % Mixture: | Time:

Drug:	Time	M99		Azaperone			
1st Dart:		3.5	mg	150,0	mg		mg
2nd Dart:			mg		mg		mg
3rd Dart:			mg		mg		mg

Reason for extra darts:

TIME | Ataxia: 5:00 | Recumbency: ~8:00 | Time UP: 39:00

Antidote: Nalorphine | Dose: (1) 10mg i/V (2) 20mg i/V (3) 12mg i/v. | Time Given: 1) 14:30 min 2) 37:00 3) 42:00

TREATMENT M5050
5ml Dopram i/V 300mg Acuphase i/m.
40 ml Peni LA i/m.

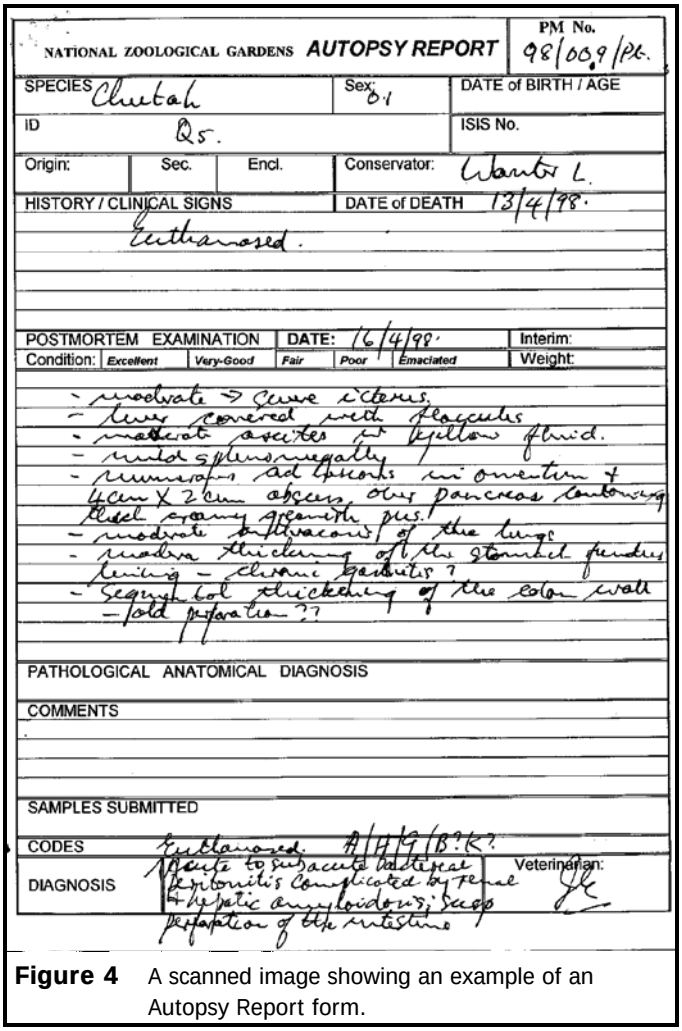
COMMENTS Respiration became very slow & shallow - improved after 10 mg Nalorphine + 5ml dopram i/V: walked into crate where he was fully antidoted - procedure went very well.

VETERINARIAN

Figure 3 A scanned image showing an example of an Immobilization Data Form No. I0149/98.

added advantage of this form is that it records details of the species, date, amount and type of Schedule 7 drugs used.

2.4 Autopsy Report



NATIONAL ZOOLOGICAL GARDENS **AUTOPSY REPORT** PM No. 98/0099/Pt.

SPECIES Cheetah | Sex: ♂ | DATE of BIRTH / AGE

ID Q5. | ISIS No.

Origin: | Sec. | Encl. | Conservator: Wouter L.

HISTORY / CLINICAL SIGNS | DATE of DEATH 13/4/98.

Euthanased.

POSTMORTEM EXAMINATION | DATE: 16/4/98. | Interim:

Condition: Excellent | Very-Good | Fair | Poor | Emaciated | Weight:

- moderate → severe icterus.
- liver covered with plaques
- moderate ascites of yellow fluid.
- mild splenomegaly
- numerous adhesions in omentum + 4cm x 2cm abscess over pancreas containing fluid creamy greenish pus.
- moderate enlargement of the lungs
- moderate thickening of the stomach fundus lining – chronic gastritis?
- segmental thickening of the colon wall – old perforation??

PATHOLOGICAL ANATOMICAL DIAGNOSIS

COMMENTS

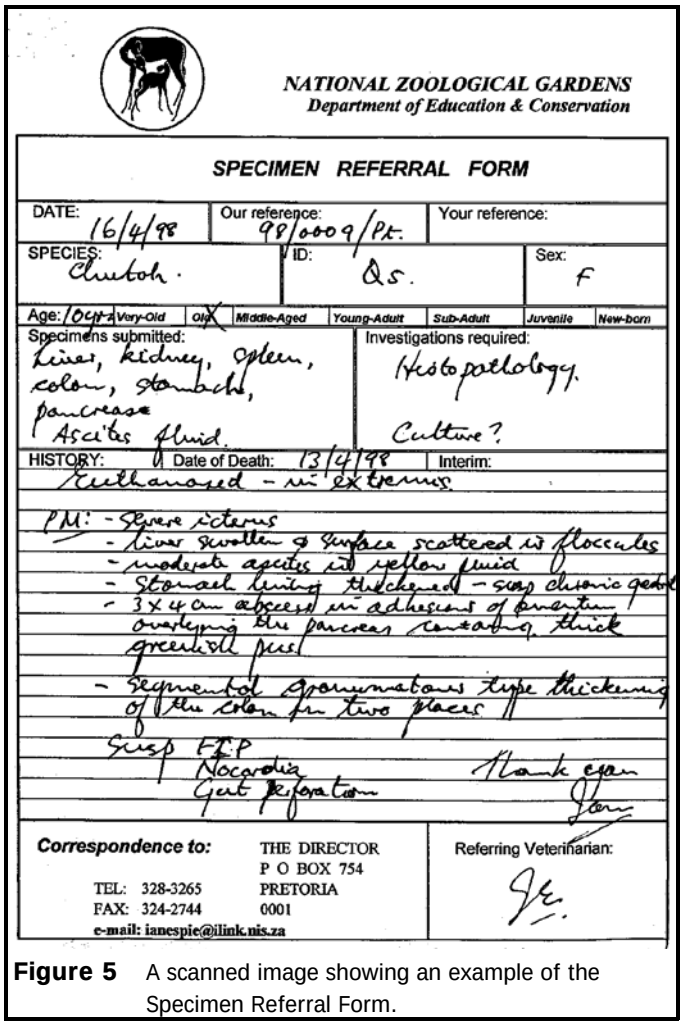
SAMPLES SUBMITTED

CODES Euthanased. A/H/G/B?K?

DIAGNOSIS Acute to subacute diffuse peritonitis complicated by renal & hepatic amyloidosis; Scarp perforation of the intestine

Veterinarian:

Figure 4 A scanned image showing an example of an Autopsy Report form.



NATIONAL ZOOLOGICAL GARDENS
Department of Education & Conservation

SPECIMEN REFERRAL FORM

DATE: 16/4/98 | Our reference: 98/0009/Pt. | Your reference:

SPECIES: Cheetah. | ID: Q5. | Sex: F

Age: Old | Very-Old | Old | Middle-Aged | Young-Adult | Sub-Adult | Juvenile | New-born

Specimens submitted: Liver, kidney, spleen, colon, stomach, pancreas, Ascites fluid.

Investigations required: Histopathology. Culture?

HISTORY: | Date of Death: 13/4/98 | Interim:

Euthanased - ill ex terms.

PM: - Severe icterus
- liver swollen & surface scattered w flocculus
- moderate ascites w yellow fluid
- Stomach lining thickened – susp chronic gastr
- 3 x 4 cm abscess w adhesions of omentum overlying the pancreas containing thick greenish pus
- Segmental granulomatous type thickening of the colon in two places

Susp E.C.P
Nocardia
Gut perforation

Thank you

Correspondence to: THE DIRECTOR, P O BOX 754, PRETORIA, 0001
TEL: 328-3265
FAX: 324-2744
e-mail: ianespie@ilink.nis.za

Referring Veterinarian:

Figure 5 A scanned image showing an example of the Specimen Referral Form.

The **Autopsy Report** form in **Figure 4** is numbered sequentially with a Post Mortem Number that is printed on a tag that is tied to the carcass to identify and correlate the form with the specific animal. The history, date of death, date of autopsy, findings, diagnosis and veterinarian are recorded. Reports obtained from further laboratory investigations are attached to this form for reference.

2.5 Specimen Referral From

The **Specimen Referral** form in **Figure 5** is used to send carcasses or samples to laboratories for further diagnostic investigations. It provides the laboratory with a history of the animal and all other relevant data about the case, including, identity, age and sex of the animal. A copy of this form is attached to the originating form of the specimen e.g. the Hospital Card, Immobilization Card or Autopsy Report for reference. The information is usually not entered into the computer. A hard copy of the result which is either returned by facsimile or sent by post is attached to this form when completed.

Chapter

3

3 The Computerised Information System

To design and develop a comprehensive "tailor made" computer database to serve the requirements of the National Zoological Gardens was the challenge. It was decided to start by capturing the basic medical data in a computer program, which could be built on by adding new features as they were required. The idea of using some pre-developed program which would have limitations of one kind or another was not appealing. A standard 486MHz IBM compatible desktop personal computer was used to run the software for designing the forms as well as the software for developing the database.

3.1 Selection of the Software to build the Database

In 1991 when Microsoft DOS was one of the standard operating systems for desktop computers. Database software packages for DOS were not as bountiful as they are today, the choices were limited. Some of the desktop databases of the day were dBASE III by Ashton Tate, FoxPro and Paradox 3.5 by Borland. Although the first version of MedARKS was written in dBASE, the program was not user friendly at the time. There were expensive packages available for building massive robust corporate databases, but these required computers with greater speed and storage capacity than the available desktop computers. They were best suited to run on mainframe computers.

The Paradox 3.5[4] for DOS program was selected as in 1991 it was:

- a high-end program and suitable for developing sophisticated and robust applications

for desktop computers;

- competitively priced and relatively inexpensive;
- flexible in its capabilities and ease of use for "novice programmers" and advanced developers;
- able to build simple databases within a short time and these could be developed into more sophisticated applications incorporating more programming code from the developer;
- capable of powerful and fast searches using Paradox's unique *Query By Example*[7,9,13,16,27]. In addition the size of the database was limited by disk space and there was an active Paradox user group in Johannesburg which met each month to discuss and share applications. For the beginner these meetings were very helpful for learning useful programming techniques. Paradox was gaining popularity above other software packages among high level application developers. Paradox was produced by Borland who are developers of the popular and successful software like Quattro Pro.

Since Paradox was selected as the software to build the database, it was appropriate to name the program **"ZooDox"** (***Zoo*** Medicine + Para***Dox***).

The historical events of ZooDox are as follows:

- In 1991 Paradox 3.5 for DOS was selected as the software to develop the program and by June 1991 ZooDox was developed to the stage of gathering only the essential information and generating a few basic reports.
- In 1995 Microsoft released Windows 95.
- In 1995 Borland released Paradox 5 for Windows 95.
- In 1996 ZooDox was re-written in Windows using Borland's Paradox 7 for Windows

95 with ObjectPAL[10,11,12,17,29].

- In 1997 Borland sold the rights of Paradox to the Corel Corporation in Canada who included Paradox in its WordPerfect 8 Office Suite released in early 1998. This is a rather unfortunate course of events, because Corel does not have the experience Borland has in database application development software.
- During the last five years or so many other software manufactures have developed similar programming development tools, e.g. Visual dBASE, Visual Basic, Microsoft's Access, Delphi from Borland, and others. Borland in 1991 was a pioneer in the field of producing object based application languages and still is. Borland's new Delphi 4 is the *state-of-the-art* application development tool and probably the most logical development tool to use for future developments and upgrades to ZooDox. However, the process of re-writing a sophisticated program in a new development language takes many man-hours to achieve.

3.2 PAL and ObjectPAL

Paradox Application Language (PAL) for DOS [4,5,15,14,6] was the language used in 1991 to develop the program. Paradox for Windows uses the high level language ObjectPAL[10,11,12,17,29] which is event-driven, object-based, visual programming language, and was used in 1996 to develop the present version of ZooDox. Typically, the user interface is a ***form*** which in itself is an object. Specially designed forms enable the user to interact with and edit the data in the database. Several different kinds of **objects** can be placed on the ***form***, for example, fields linked to a table, buttons, table frames and dialogue boxes to name a few. Programming code attached to an object is executed when an **event** occurs like clicking on a button. By clicking on a button, the code attached to the button's event ***pushButton*** (there are many of them for each type of object) will

execute. Similarly, when the cursor leaves a field, code attached to the field's ***depart*** event will execute. This allows for functionality to be built into the program for certain actions preformed by the user to be standardised and automated, thereby reducing the frequency of errors in data input and neglecting to enter certain essential data. All these actions go on behind the scenes and are not obvious to the user.

A description of the construction of the database will be based on the currently used Windows version of Paradox. Although the user interfaces between the DOS and Windows versions are fundamentally different, the design criteria and concepts for storing the data remain the same.

Applications developed using Paradox could be distributed to other users by using the Runtime[8] distribution package sold under licence. Users do not need to have Paradox installed on their machines to use a Paradox application distributed with Runtime.

3.3 System Structure and Function

The design is centred around the types of reports the system must generate and accordingly appropriate data is captured which will satisfy the requirements of these reports. The ***Daily Report*** (page 57) is the most commonly used report and is submitted to the Animal Data Bank on a daily basis. The various ***Monthly Reports*** are used frequently to extract information used to compile a general monthly report for the Veterinary Hospital. Other useful reports were added to the system as the system was developed and as the need for such reports arose.

The mind map[25] in **Figure 6** shows the basic design concept of the Information System and the flow of information from **data forms** , to the **computer program**, to reports generated by the program and provided to the **users** as hard copies or electronic mail.

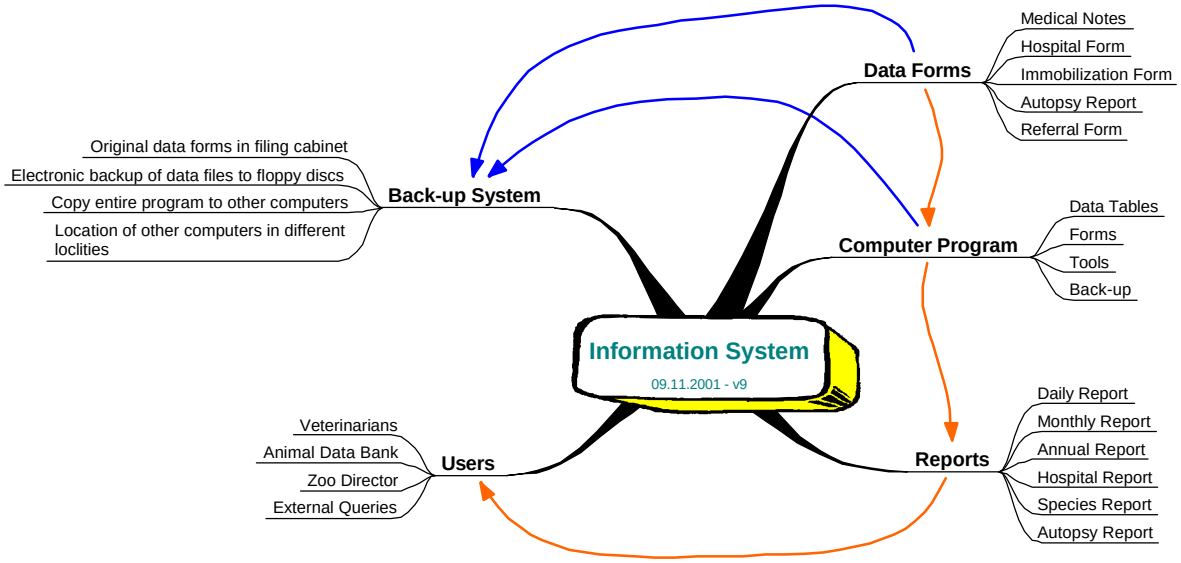


Figure 6 A mind map showing the basic design of the Information System and flow of information.

3.4 Characteristics of the Proposed System

The characteristics needed to ensure the success of the system are:

The **Functionality**[2,23,30] of a system requires that it must work effectively in the environment in which it is used. This means that the system must be designed properly, and be accepted as a useful tool by the people who are using it. To enhance user acceptance of the system it should be easy to use or **"user friendly"** and allow for rapid, accurate and standardised data entry. Sufficient ***Help*** must be provided for the user.

A **Simple structured recording format** is essential for recording information on examinations; treatments; immobilizations; laboratory procedures and results; clinical pathology; parasite control; vaccinations and post mortems; in a simple "telegraphic" style. This must be accurate and have enough detail to be informative and have meaningful value later. Capturing information on data forms allows for standardization using drop-down lists and promotes a more thorough collection of data, to ensure that critical data is

recorded. The data form also serves as a reference to check errors that may have occurred when entering data into the database.

Rapid information retrieval of previous case histories and treatments is the main advantage of having a functional system. Past records must be available quickly and it is possible to set complex queries designed to ask meaningful questions of the stored data.

Versatile searches and queries for information are essential for the system to be appealing and useful to the user. Analysis of the accumulated data can be done which will assist in decision making in the treatment and husbandry of the animals.

Automation and Pre-designed reports stored in the program, and which can be called up using a simple click of a button are essential.

Security is important to prevent data loss. Appropriate backup systems must be designed into the system to prevent this. The main causes of data loss are human error in using the program, hardware malfunctions, electrical surges (e. g. lightning strike), theft of the hardware, and fire. Human error in using the program with the inadvertent loss of records may occur when inexperienced operators use the program. Appropriate checks on operator error should be built into the system to prevent data loss or corruption of data files from occurring.

Inexpensive. Usually software development of this nature and extent by private consultants is expensive.

Adaptable. The system is be designed in such away that additional features and functionality can be added to it as the need arises. It is not rigid and improvements to the program are easy to achieve. As a result it develops and grows in the real world through the process of “evolution”. As new technological features become available, they can be included into the system with little effort.

3.5 Building the Database

In Paradox the data are stored in ***tables*** and the data is viewed and edited by the user using a ***form*** on the screen, called the ***"User Interface"***. Information stored in the tables are printed either to the screen or printer using ***reports***.

3.6 Table Construction

The design and construction of the data tables used to store data recorded by the data forms is fundamentally important for the success of the program and its efficiency of function.

3.6.1 The Data Model

The Data Model of ZooDox in **Figure 7** shows the eight data tables which make up the

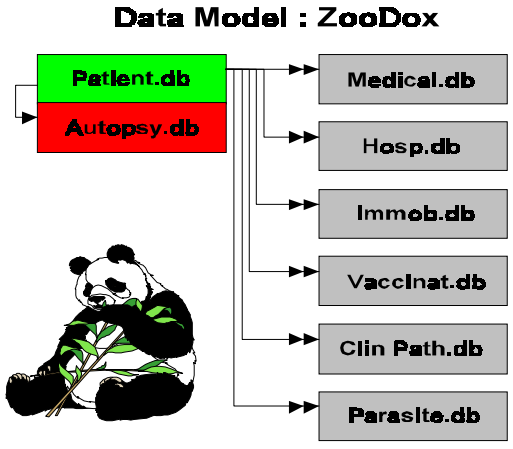


Figure 7 A schematic diagram of the Data Model showing eight databases and how they relate to each other with referential integrity. Note that *Autopsy.db* and a one-to-one (—>) relationship with *Patient.db*, while all the others have a one-to-many (—>>) relationship with *Patient.db*

system and their specific relationships with each other. The single arrow link in the case of *Autopsy.db* is a **one-to-one link** as there can be only one autopsy record for each

animal, while the other six tables show a double arrow link indicating a **one-to-many link**, as there can be more than one of these records per animal.

3.6.2 **Referential Integrity** is the process whereby the seven ***Child Tables*** shown in the data model are relationally linked to the ***Parent Table*** or *Patient Table*:

- Each table is constructed with a number of fields of which the first two or three are ***"keyed"*** fields. A table's key fields establishes the primary index and sort order for the table. A key also requires each value in the field(s) that define it to be unique. For example, each animal in the Zoo is uniquely defined by its ***"Species"*** and ***"ID"***, therefore the *Species* and *ID* fields are keyed fields in the *Patient* table. Each animal in the *Patient* table therefore has one unique record.
- The keyed fields are of the same size and type in the linked tables. This links tables using referential integrity.
- Paradox uses the ***Cascade*** rule for referential integrity, which means that any change made to the value in the key field(s) of the parent table is automatically made in the child table(s). The means of identifying an animal may change during its life in the Zoo. For example, a bald ibis chick with a blue plastic ring on its right leg is given a new identity by replacing the plastic ring with a metal ring with a number.

  Accordingly, the key fields in the *Patient* table will change:

  [Species] = ***"Bald Ibis"***; [ID] = ***"Blue right leg"*** changes to

  [Species] = ***"Bald Ibis"***; [ID] = ***"9-61778 right leg"***.

  The *Medical* table (a child table) is linked to the *Patient* table and because of the referential integrity rules, the key fields in the *Medical* table will automatically change accordingly and thereby preventing all previous medical records for this patient from being lost.

3.6.3 **Normalization**[5,9,13,14,27,30] is a technique that organises data attributes such that they are grouped to form stable, flexible, and adaptive entities [30]. This means rather than having one large table containing all the data relevant to a patient, the table is broken down into smaller tables, e.g. Patient Info, Medical Info, Immobilization Info, etc. The process of normalizing tables allows for more efficient use of computer storage space and does away with all information related to a patient being recorded for each record. The smaller tables record distinct data entities and they can be all linked to the main or **parent table** for speedy data access, as described above.

Table 1: Patient Table *(Patient.db)*			**Table 2: Medical Table** *(Medical.db)*			**Table 3: Hospital Table** *(Hosp.db)*			**Table 4: Immobilization Table** *(Immob.db)*		
	Field Name	**Type**		**Field Name**	**Type**		**Field Name**	**Type**		**Field Name**	**Type**
1	Species	**A(30)***	1	Species	**A(30)***	1	Species	**A(30)***	1	Species	**A(30)***
2	ID	**A(30)***	2	ID	**A(30)***	2	ID	**A(30)***	2	ID	**A(30)***
3	Status	A(13)	3	Date	**D***	3	Date_IN	**D***	3	Date	**D***
4	Types	A(9)	4	Procedure	A(25)	4	Hosp_No.	**A(8)***	4	Immob No.	**A(8)***
5	Sex	A(6)	5	Vet	A(8)	5	Diagnosis	A(30)	5	Reason	A(255)
6	Birth	D	6	Comments	A(255)	6	Comments	A(200)	6	Methods	A(50)
7	Age	A(10)	7	Report	M(50)	7	Date_OUT	D	7	Narcotic	A(10)
8	Section	A(2)	8	Month	D	8	Destination	A(13)	8	Dose (mg)	A(13)
9	Conservator	A(12)	9	Year	A(4)	9	Vet	A(8)	9	TOTAL (mg)	N
10	Log_ON	D	10	Check	A(1)	10	Sec	A(2)	10	No. Darts	A(2)
11	Removed	D				11	Enclosure	A(4)	11	Tranquillizer I	A(12)
12	Locality	A(13)				12	Fromm	A(9)	12	Tranquillizer II	A(12)
13	ISIS	A(6)				13	Month	D	13	Dose I (mg)	A(6)
14	Month	D				14	Year	A(4)	14	Dose II (mg)	A(6)
15	Year	A(4)							15	Ataxia (min)	A(6)
16	Check	A(1)							16	Recumb (min)	A(6)
									17	Antidote	A(12)
									18	Anti Dose (mg)	A(25)
									19	Time UP (min)	A(6)
									20	Comments	A(200)
									21	Vet	A(8)
									22	Month	D
									23	Year	A(4)
									24	Check	A(1)

Table 5: Vaccination Table *(Vaccinat.db)*

	Field Name	Type
1	Species	**A(30)***
2	ID	**A(30)***
3	Date	**D***
4	Vaccine	**A(25)***
5	Manufacturer	A(25)
6	Serial No.	A(12)
7	Dose	A(20)
7	Next Date	D
8	Rem	A(1)

Table 6: Clinical Path Table *(Clin_Path_Data.db)*

	Field Name	Type
1	Species	**A(30)***
2	ID	**A(30)***
3	Date	**D***
4	Rank	**N***
5	Test	**A(30)***
6	Time	**T***
7	Result	N
8	Units	A(13)

Table 7: Parasite Table *(Parasite_Rx.db)*

	Field Name	Type
1	Species	**A(30)***
2	ID	**A(30)***
3	Date	**D***
4	Parasite	A(25)
5	Drug	A(30)
6	Dose	A(50)
7	Notes	A(255)
8	Enclosure	A(6)

Table 8: Autopsy Table *(Autopsy.db)*

	Field Name	Type
1	Species	**A(30)***
2	ID	**A(30)***
3	Date	D
4	PM No.	A(8)
5	Date_of_Death	A(30)
6	Examination	A(200)
7	Diagnosis	D
8	Codes	A(13)
9	Vet	A(8)
10	Report	M(80)
11	Month	D
12	Year	A(4)

Tables 1-8 show the structure of each Paradox Table with ***Field Names*** and ***Type***, where A = alphanumeric, D = Date, N = Numeric, T = Time; the values in parentheses represent the size of the field in number of characters; and * denotes that the field is a ***keyed*** field. **Fromm** in Table 3 is used in place of **"From"** which is a reserved word in ObjectPAL and should not be used for naming fields. **Recumb (min)** in Table 4 means **"Recumbency time"** which is the time in minutes the animal takes to become recumbent after being darted.

3.6.4 **Key fields** are required to make records unique as well as to link tables using referential integrity. The keyed fields in the parent table, Patient.db (Table 1) are ***"Species"*** and ***"ID"*** which link all information to the child tables. These two key fields used together make each patient record unique. Likewise, in Table 6 the keyed fields up to the *Time* field make each record in the clinical pathology table unique. The most efficient method of design would link all the tables with only one key field using an incremental number assigned to each new patient for uniqueness. However, it was decided to retained the *Species* and *ID* fields in the child tables at the expense of duplication (as it is only one additional field in the child tables) so that it would be easy and convenient to follow the flow of data when the tables are opened individually. Querying the child tables is much simpler - rather than obtaining an answer with meaningless numbers which then would

require further linking to make sense of the answer. It is of no concern to the end-user of the system how the tables look or work in the background, but for a developer it was convenient to be able to find data fast and easily by searching on the *ID* field.

3.7 Paradox Form Construction

A **"user friendly"** interface is built for the user of the program to enter new data, view and edit the data in the data tables. Apart from the main *ZooDox* form, a number of other forms which are opened by the main form are required to enhance the functions of the program.

3.7.1 How ObjectPAL handles events is explained in detail in texts on Paradox[11,17] and understanding how it works is fundamentally important for designing efficient and functional applications.

3.7.2 An example of the ***pushButton*** event code attached to the *Daily Report* button in **Figure 8**, **Figure 94**, to generate and print the *Daily Report*, is given in **Appendix I** on page 172. There are many similar event codes attached to objects on forms giving them specific functionality as required by the design of the form. To list all the codes attached to all the forms and objects will merely add unnecessary bulk to this thesis. One example is sufficient to illustrate what happens in the "background" when the user works with the forms.

Figure 8

3.7.3 **The ZooDox Form**. Tabs are used in the main ZooDox form to enhance user friendliness and display information pertaining to a certain patient from the different tables at one time. A tab is an object on the form to which code can be attached. This performs a certain function when a specific tab is opened or closed. Data from each of the eight tables is displayed when its tab is activated on the form. Once a patient is selected, its medical or immobilization data can be viewed by clicking on the *Medical Info* or *Immobilization* tabs.

3.7.4 Seventeen tabs were selected for the main ZooDox form as shown in the mind map in **Figure 9**.

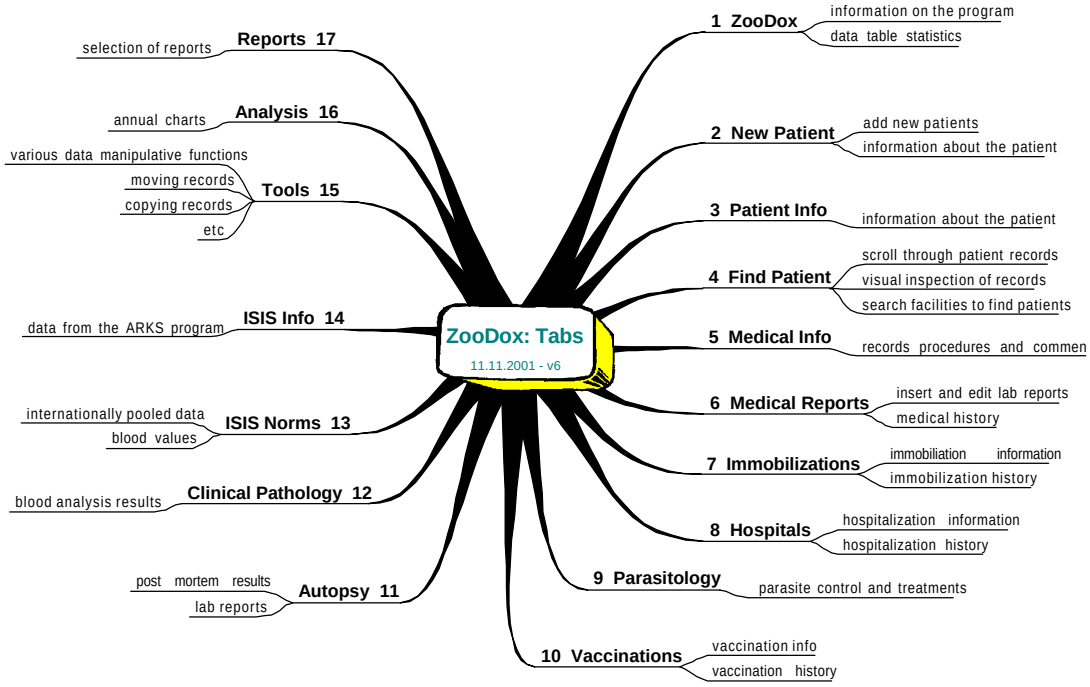


Figure 9 A mind map showing the seventeen tabs used in the ZooDox form.

3.7.5 A detailed account of the forms constructed are given in the Results section in Chapter 4, page 26.

3.8 Report Construction

Data stored in a table can be queried by running Paradox's *Query By Example* (QBE) queries to find specific data. For example in **Figure 10**, all the cheetahs in the database can be found by running a QBE with "Cheetah" as the example element in *Species* field of the query. The results of the query are placed in an *Answer* table. A report of the data is constructed and printed using Paradox's report generator. All these steps are coded and attached to buttons. The ***Daily Report*** button, **Figure 8**, **Figure 94**, has been constructed with code attached to it which will print a daily report either to the screen or to the printer.

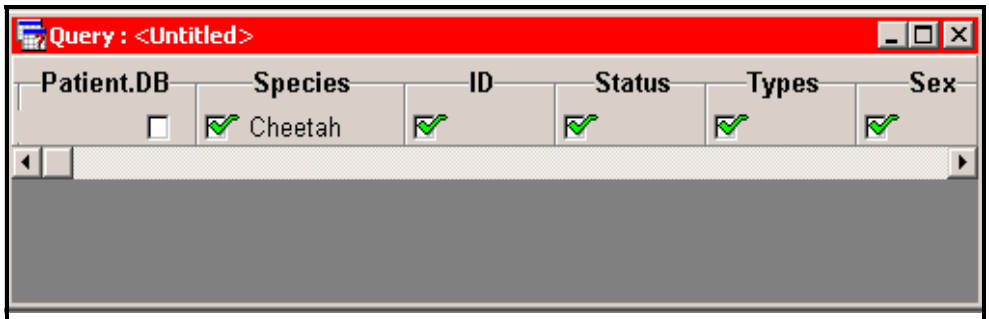


Figure 10 An example of Paradox's *Query By Example* where Cheetah is used in the Species field to find all the Cheetah in the Patient table.

3.8.1 Seventeen reports as shown in the mind map in **Figure 11** were identified to be constructed and included in ZooDox.

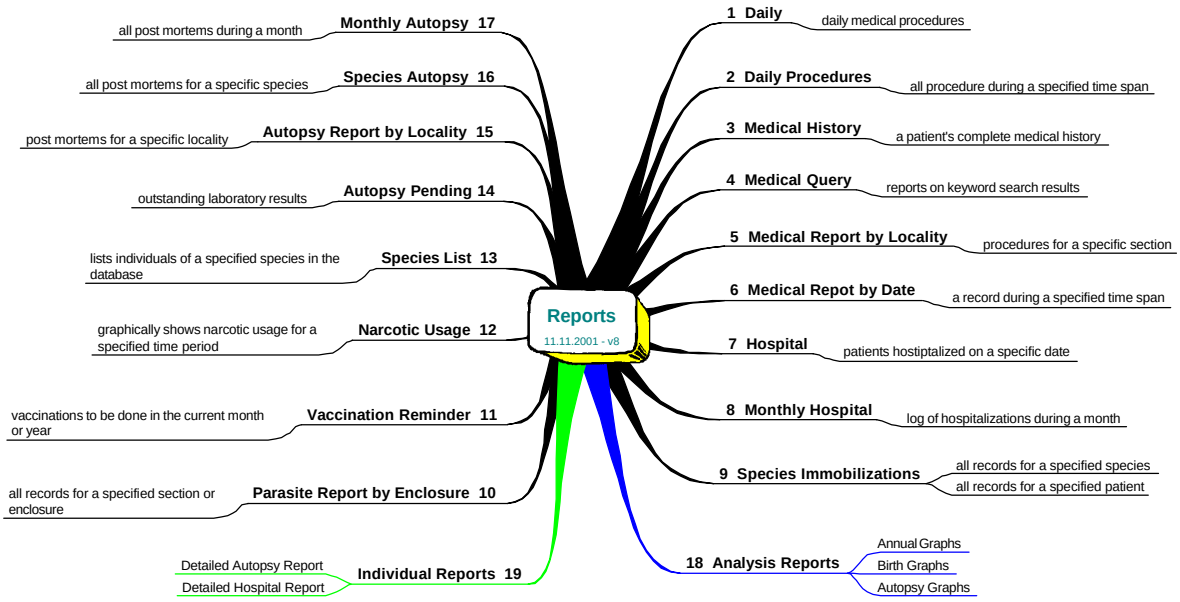


Figure 11 A mind map showing the seventeen reports generated by ZooDox. Two further reports 18 and 19 are shown are generated by other tabs.

3.8.2 A detailed account of the reports are given in the Results section in Chapter 5, page 54.

Chapter

4

4 The User Interface: ZooDox

ZooDox form shown in **Figure 12** is the main form for the database. Placed on the ZooDox form are a series of seventeen tabs from where all actions are conducted and initiated. There are a number of sub-forms which are called by ZooDox to perform other functions.

4.1 ZooDox Tab

4.1.1 **Figure 12** shows the opening tab for the ZooDox form. On the form is a window displaying the number of records in each database.

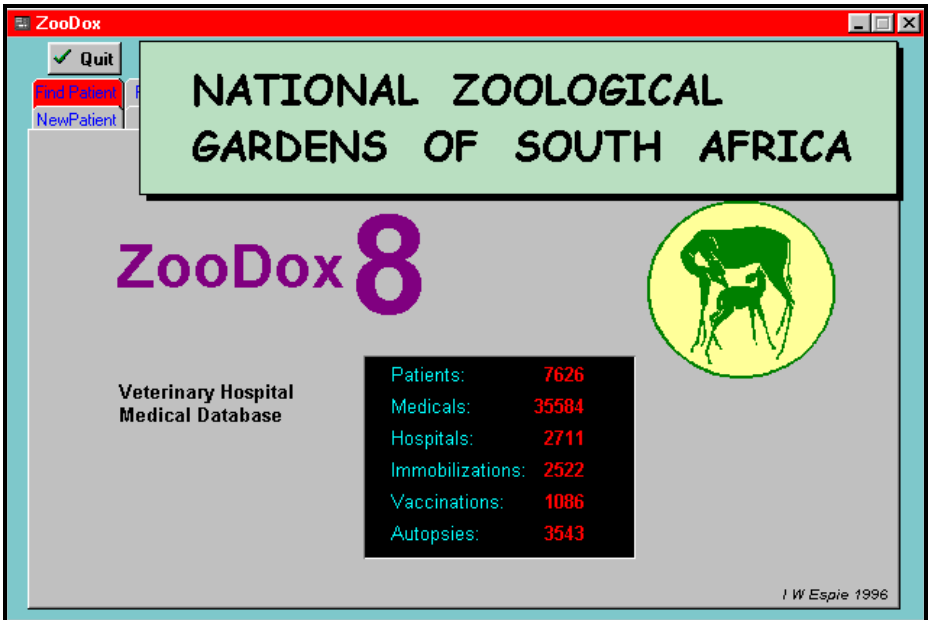


Figure 12 The *ZooDox 8* Form with the opening Tab showing statistics on the number of records in each table. The *Find Patient* and *New Patient* tabs are visible. Behind the banner *National Zoological Gardens of South Africa* are the other tabs.

4.1.2 There are two tabs visible on the form from where the actions begin. The operator can find an existing animal in the database by clicking the *Find Patient* tab or enter a new patient by clicking the *New Patient* tab. Once one of these tabs are opened, the banner ***National Zoological Gardens of South Africa*** disappears and all the other tabs become visible, as shown below. A series of buttons at the top of the form becomes visible, as shown in **Figure 13** where the ***Edit*** buttons are *"Cut"*, *"Copy"*, *"Paste"* and *"Undo"* allow text in fields to be edited in the tabs. The *"Del"* button allows the entire record to be deleted. The *Scroll* buttons in **Figure 14** allow the user to scroll backwards and forwards through lists of records. These buttons provide functionality in any tab which is open.

Figure 13 *Edit*, *Delete* and *Help* buttons.

Figure 14 Scroll buttons.

4.2 Find Patient Tab

4.2.1 **Figure 15** shows the ZooDox form constructed for intuitive and easy use by using a

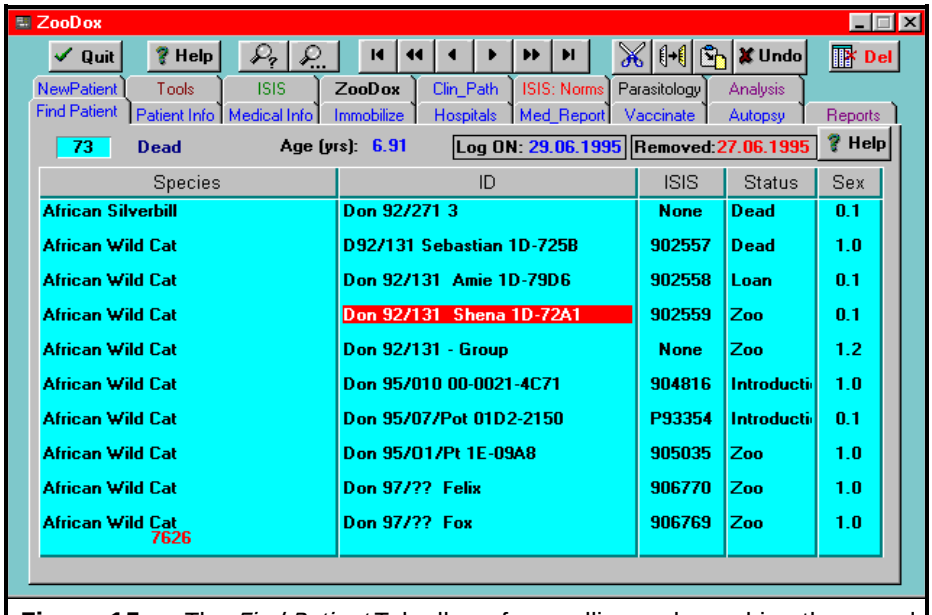


Figure 15 The *Find Patient* Tab allows for scrolling and searching the records in the *Patient* table. Note the buttons at the top of the form which provide functionality for any tab that is open.

tabbed pane consisting of seventeen tabs. An animal is selected in the list by simply placing the cursor on it. Clicking on any one of the tabs will provide data related to that animal this means that the animal only has to be searched for once and all information on it is found in the appropriate tabs.

4.2.2 Above the row of tabs are a number of buttons used for finding and editing records.

4.2.3 To find a patient:-

- use the arrow keys on the keyboard to scroll up or down the list
- use the scroll buttons in **Figure 14** to scroll up or down the list
- if part or the whole identity is known, then use the *locate* or *locate next* buttons in **Figure 16** at the top of the form to find existing patients. Clicking on one of these buttons brings up the form in **Figure 17** , allow the use of wildcards to find partial matches for records. Here ***"..shena.."*** has been entered in the *ID* field. The two sets of periods (..) on either side of the letters are wildcards and allow for finding a match anywhere in *ID* field. This is useful if only part of an identity can be remembered. The result of this search is shown in **Figure 15** where the **African Wildcat** called ***"Shena"*** was found. Note that in this case Shena has three identities: The name ***"Shena"***, a donation number ***"Don 92/131"***, and a transponder number ***"1D-72A1"*** in the *ID* field. This feature of "lumping" the identities together into one field allows for rapid and versatile searching for patients.

Figure 16

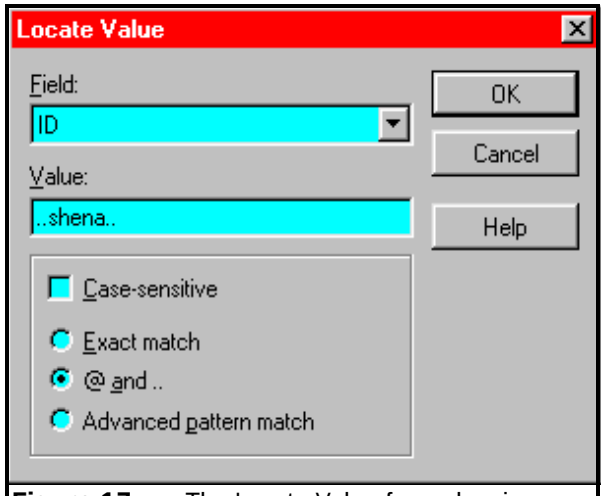


Figure 17 The Locate Value form showing wildcards (..) on either side of "shena".

- if no identity is known, scrolling down from the top of the list of species for likely matches using some of the information visible on the form: *status*, *sex*, *Encl*, *age*, *Log_ON* and *removed* may give clues as to which animal is to be located
- if the animal can not be located then a new entry can be made by clicking on the *New Patient* tab.

4.3 New Patient Tab

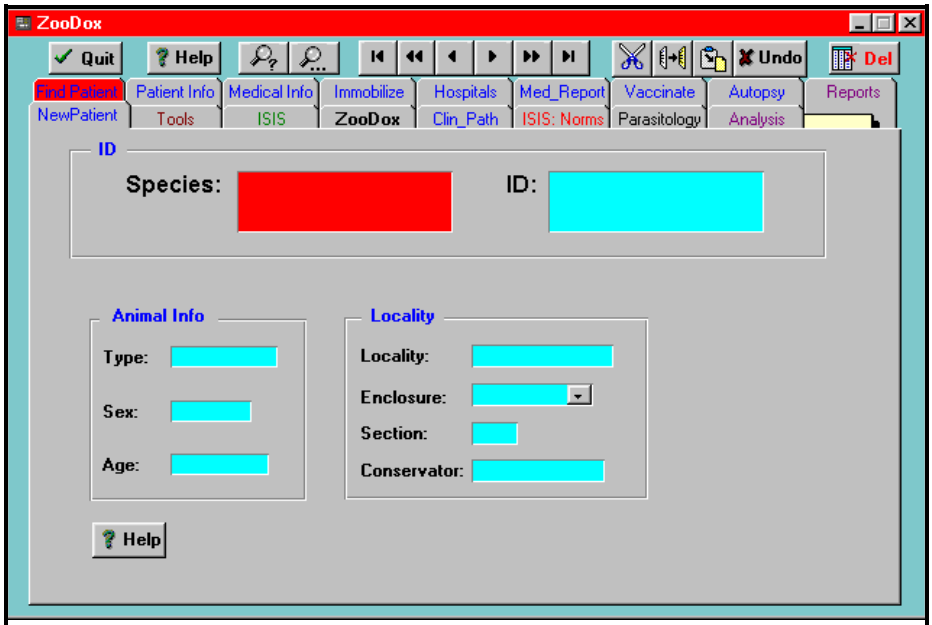


Figure 18 The *New Patient* Tab allows for entry of a new patient.

4.3.1 The *New Patient* tab shown in **Figure 18** allows for a **unique** new patient to be entered into ZooDox. A safety mechanism is in place to safeguard against accidental data loss which could occur if an animal that has already been included in the database is entered as a new patient. Were this to occur records of the patient would be lost when the new record replaces the old. The form, therefore checks if a record of this patient exists before proceeding, if such a record exists, it automatically proceeds to the *Medical Info* tab (**Figure 23**) for further data entry to the existing record and clears the *New Patient* tab.

4.3.2 The *Species* field requires the type of animal to be entered, e.g. ***"Black-backed Jackal"***

could be entered as ***"Black-backed Jackal"*** or ***"Black backed Jackal"***. These synonyms for the common name will be stored differently in the database. It is therefore important to be as uniform as possible in the choice of common name. The field cannot be left blank.

4.3.3 The *ID* field is where the animal's name or any identifying number is entered. If the animal does not have an identifying name or number then a descriptor must be entered because this field cannot be blank. The correct *ID* can be edited later when this information becomes available.

4.3.4 The *Type* field may be Mammal, Bird, Reptile, Amphibian or Fish.

4.3.5 The *Locality* field can be different localities within the National Zoo, for example Zoo, Lichtenburg, Potgietersrus or De Wildt.

4.3.6 The *Enclosure* filed is where the number of the enclosure where the animal is kept can be selected.

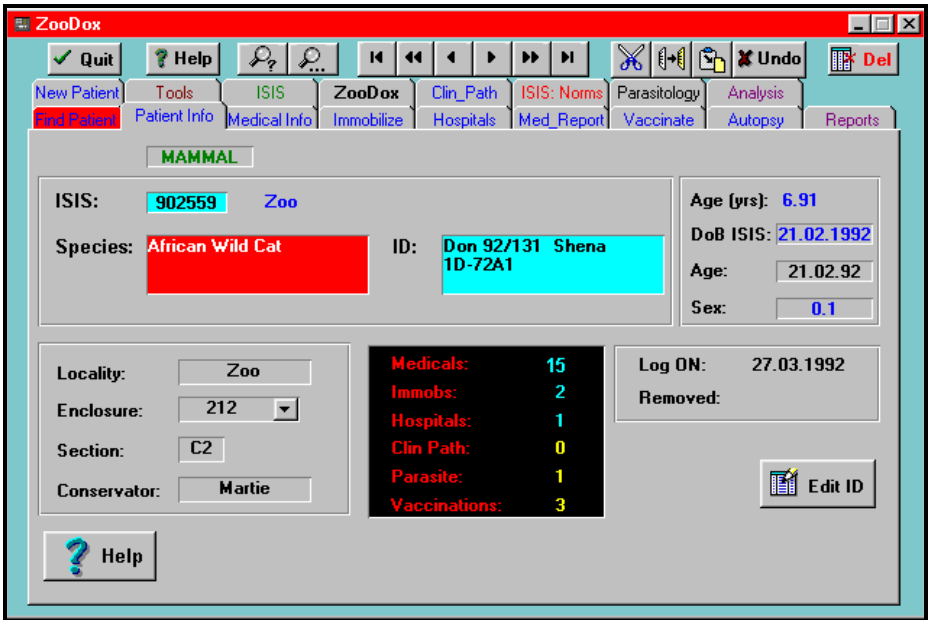


Figure 19 The *Patient Info* Tab showing detailed information on the patient and the number of other records associated with it.

4.4 Patient Info Tab

4.4.1 The Patient Info tab in **Figure 19** presents all the information about the patient concerning the type of animal, where it is kept in the Zoo, the person responsible for it, its age, sex, the date of first entry into the database and when it was removed either by death or translocation to another facility out of the Zoo.

4.4.2 Except for the *Species* and *ID* fields, all the other fields can be edited.

4.4.3 A window shows the type and number of records associated with this patient.

4.4.4 To edit the *Species* and *ID* fields the *Edit ID* button shown in **Figure 20** is clicked to open the *Enter_Initial* form shown in **Figure 21** for the operator to enter his initials as the system records who and when changes are made to the *Species*, *ID* and *ISIS* fields. This process safeguards against accidental changes to these fields which can result in loss of data. The *Enter_Initial* form permits only certain users to proceed. Once the *Enter_Initial* form accepts the operator's initials then the *ID_Editing* form opens shown in **Figure 22**.

Figure 20

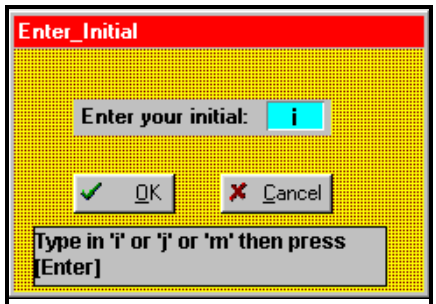


Figure 21 *User Initial* input form.

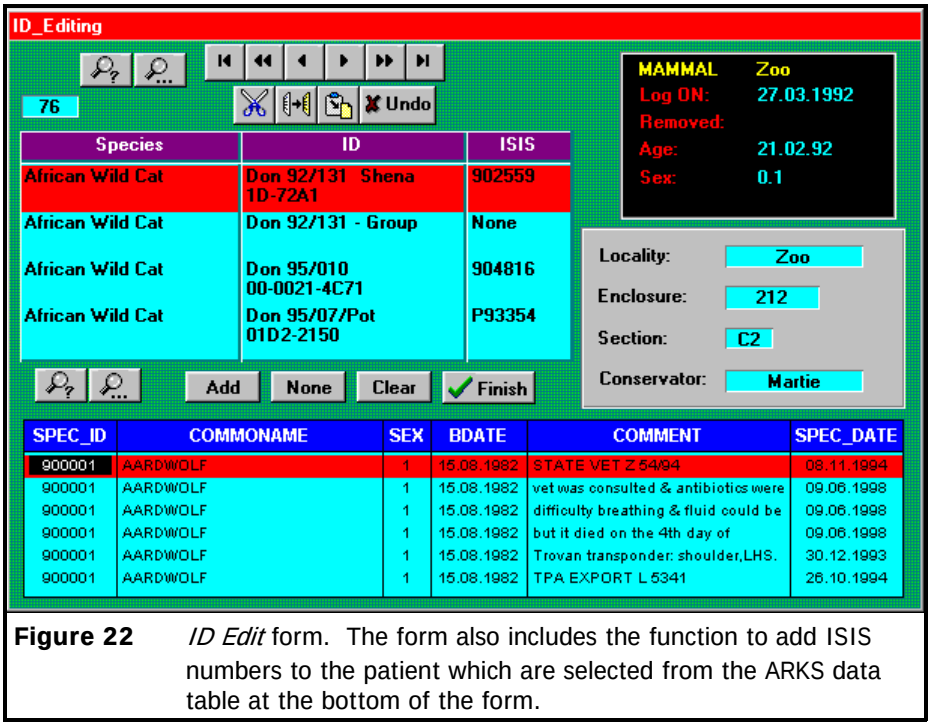


Figure 22 *ID Edit* form. The form also includes the function to add ISIS numbers to the patient which are selected from the ARKS data table at the bottom of the form.

4.4.5 When changes are made to the *Species*, *ID* and *ISIS* fields, these changes together with the date and identification of the editor of these fields are recorded in the medical database.

4.5 Medical Info Tab

4.5.1 The *Medical Info* tab shown in **Figure 23** shows the cursor placed at the bottom of the medical list ready for data input and the last two entries for this patient are shown above

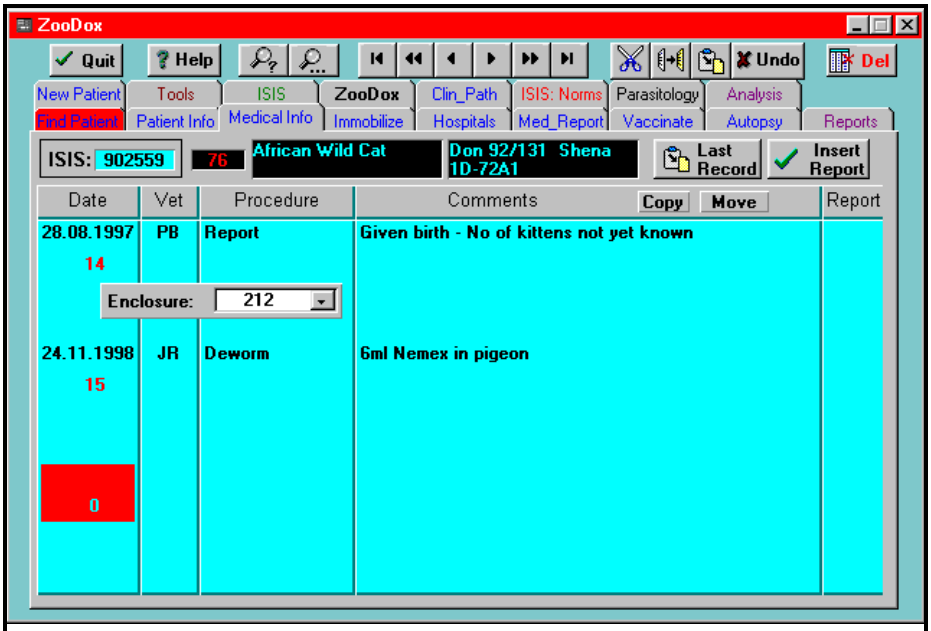


Figure 23 The *Medical Info* Tab where new medical notes, examinations and treatments can be entered. Two procedures are shown, a *Report* that this animal gave birth on the 28.08.1997 and was *Deworm* on 24.11.1998. The cursor shown in red is placed to enter a new record.

it, as is the total number of entries for this patient, 15 in this case. The medical records can be scrolled in the usual way.

4.5.2 There are five fields:

- *Date* on which the procedure was done;
- *Vet*, the veterinarians initials who performed the procedure;

- *Procedure*, this field is important as it tells the program how to proceed once the record has been completed. By pressing **[Ctrl] + [Spacebar]** the *Lookup Help* form shown in **Figure 24** provides help for the operator to complete this field in a standard and consistent manner. The program looks for parts of words like "*autops*", "*immob*" and "*hosp*" in the *Procedure* field and acts accordingly when these are found by automatically proceeding to appropriate forms for further data entry.

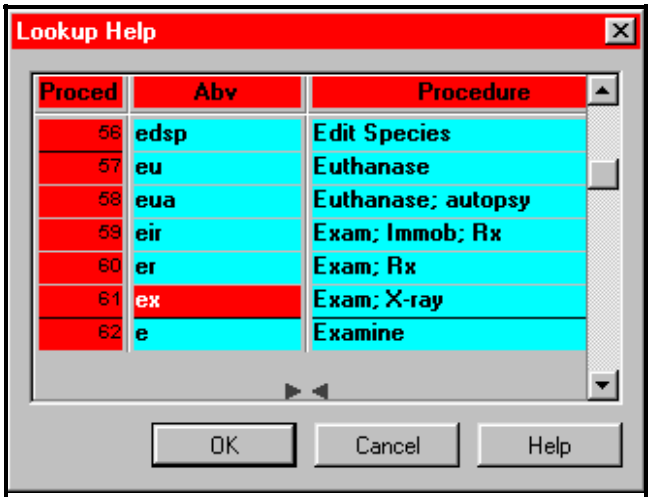


Figure 24 The *Lookup Help* form to assist in completing the *Procedure* field.

- *Comments* field where clinical notes are entered. This field is limited to 255 characters, therefore long comments have to be broken down into different procedures. Note that the system will not allow for the same two procedures on the same day.
- The *Report* field allows for the insertion of a laboratory report which has been converted to an ASCII text file. Clicking on the *Insert Report* button in **Figure 25** on the form opens the *File Select* form shown in **Figure 34**. The procedure for entering reports into the database is described in 4.8 on page 42.

Figure 25

- When the same medical record has to be entered for several patients repeatedly, then the *Last Record* button in **Figure 26** is used to copy the first entered of the previous patient's entry into the next patient's medical

Figure 26

record. This feature saves time having to type the same record many times.

4.6 Immobilize Tab

4.6.1 The *Immobilize* tab shown in **Figure 27** is automatically opened on a new blank record when the *Procedure* field in the *Medical Info* tab contains the string "***immob***"

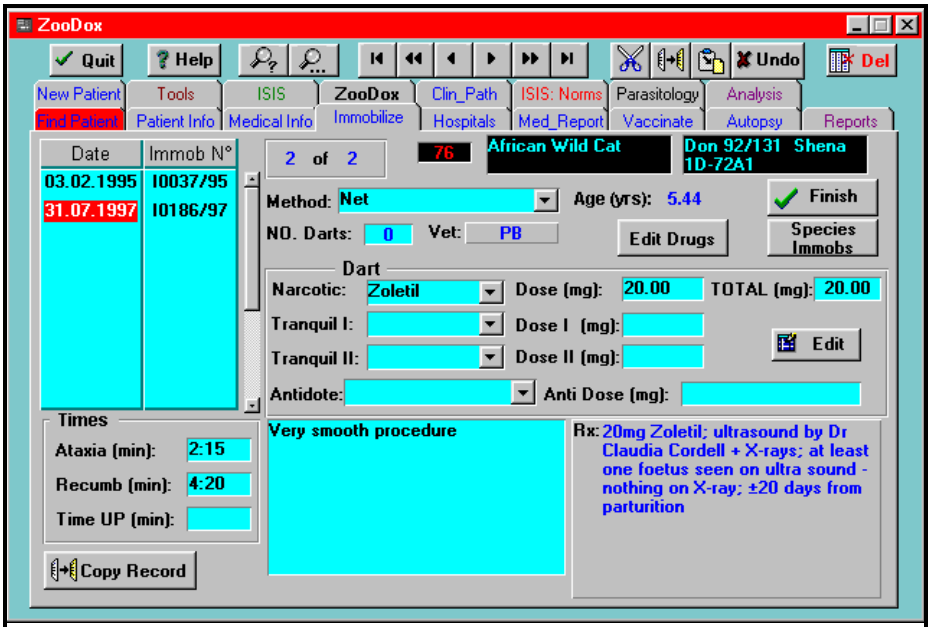


Figure 27 The *Immobilize* Tab where information on each immobilization is recorded.

4.6.2 The form has a scrollable list with *Date* and *Immob No* fields. When the cursor is placed on one of these existing records, all the data relevant to that immobilization is displayed.

4.6.3 Note the *Narcotic*, *Tranquil I* and *Tranquil II* fields are drop-down fields to select the drug used from the list. The ability to select the input data from the list eliminates spelling errors and makes the data for these fields consistent and accurate. If the drug does not exist in the drop-down list then the *Drug List* can be edited or added to by clicking on the *Edit Drugs* button to open the *Edit* form shown in **Figure 28**. This form allows for the editing of a variety of lists, namely, *Enclosure*, *Drugs*, *Vaccines*, *Conservator* and *Parasite/Drugs* tabs are provided to add standardised data used in fields with drop-down

lists.

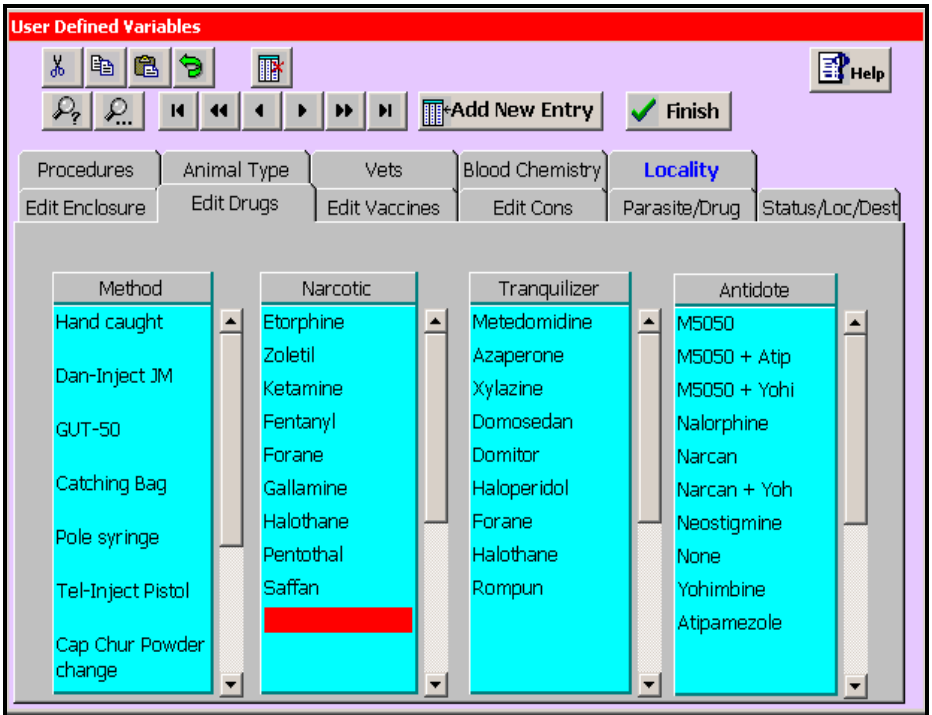


Figure 28 The *Edit* form allows for the editing of standardised data to be used in various drop-down fields in the program.

4.6.4 The *Species Immobs* button in **Figure 29** and found in the *Immobilize* tab opens a form in **Figure 30** which is a useful tool for looking up drug dosages and comments on previous immobilization records in the database. The information can be either viewed on the screen or printed to a printer (see **Printing** of reports on page 54).

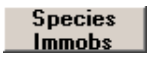


Figure 29

4.6.5 **Figure 30** shows the ***Species Immobilizations Data*** form where

- species can be searched using the search buttons provided
- the *Species* list can be scrolled up and down to select specific records to be marked with an "X" for printing (see example of the ***Immobilization Data*** report printed is shown on page 37)
- *Comments*, *Medical Notes*, *Date*, *Age*, *Immobilizations No.* etc are provided for each immobilization record

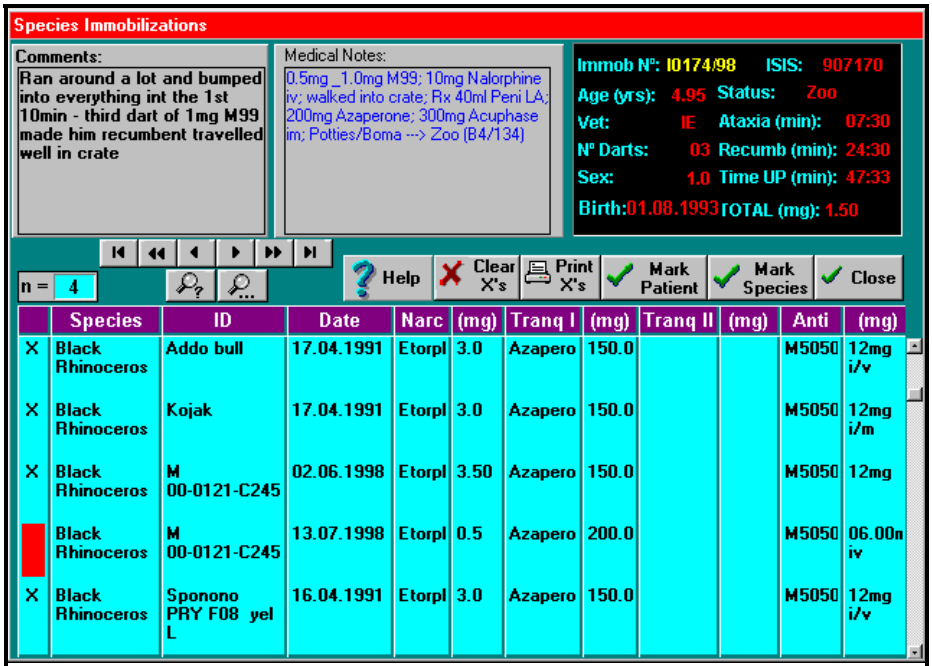


Figure 30 The *Species Immobilization Data* form. Note one of the Black Rhinoceros records has not been selected with an "**X**" for printing.

- drugs used and dosages are provided
- interactive *Help Messages* are provided to guide the operator through the process
- an example of a printed *Species Immobilizations* report on Black Rhinoceros follows page 37.

4.6.6 The *Copy Record* button **Figure 31** allows the immobilization data from the previous patient to be copied if a number of similar records are repeatedly entered for a group of animals. For example four impala are immobilized on the same day and each animal gets a similar does. This helps save time in having to type similar records repeatedly. Where there are minor differences in the data these can easily be edited before completing the record.

Figure 31

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Veterinary Hospital

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

25 March 2002

Immobilization Data

	Species	ID	Date	N°	Narc	(mg)	Tranq I	(mg)	Tranq II	(mg)	Recum (min)	Anti	(mg)	Vet
1	Black Rhinoceros	Addo bull	30.06.2000	I0109/00	Etorphine	4.0	Azaperone	80			0:15:45	M5050	12mg i/v + 6mg i/v	IE

Comments: ***At 37:00 he was walked into the crate; procedure went well - stood quietly in crate***

ISIS: P93212

Medical Notes: Immob: 4mg M99 + 80mg Azaperone; loaded into crate; sold ---> Mkizi Falls Game Reserve: Anton Marais; darted by Dr Richard Burroughs

Birth: 03.05.1983
Age: 17Y : 2M : 2D
Sex: 1.0
Status: Potgietersrus
Removed: 30.06.2000

Time_UP: 0:46:0

	Species	ID	Date	N°	Narc	(mg)	Tranq I	(mg)	Tranq II	(mg)	Recum (min)	Anti	(mg)	Vet
2	Black Rhinoceros	Mbani M 00-0121-C245	13.07.1998	I0174/98	Etorphine	0.5	Azaperone	200.00			0:24:30	M5050	06.00 mg iv	IE

Comments: ***Ran around a lot and bumped into everything int the 1st 10min - third dart of 1mg M99 made him recumbent travelled well in crate***

ISIS: 907170

Medical Notes: 0.5mg _1.0mg M99; 10mg Nalorphine iv; walked into crate; Rx 40ml Peni LA; 200mg Azaperone; 300mg Acuphase im; Potties/Boma ---> Zoo (B4/134)

Birth: 01.08.1993
Age: 4Y : 11M : 12D
Sex: 1.0
Status: Zoo

Time_UP: 0:47:33

	Species	ID	Date	N°	Narc	(mg)	Tranq I	(mg)	Tranq II	(mg)	Recum (min)	Anti	(mg)	Vet
3	Black Rhinoceros	Mbani M 00-0121-C245	02.06.1998	I0149/98	Etorphine	3.50	Azaperone	150.00			0:8:0	M5050	12mg	IE

Comments: ***Respiration become very slow and shallow; improved after 10mg Nalorphine + 5ml dopram iv; procedure went very well***

ISIS: 907170

Medical Notes: 3.5mg M99 & 120mg Azaperone by helicopter (Jerry du Plessis); Rx 40ml Peni LA; 5ml Dopran; 10 + 20mg halorphine; 300mg Ocuphase im Transponder Nº 00-0121-C245 shoulder LHS; loaded into crate; veld rhino boma

Birth: 01.08.1993
Age: 4Y : 10M : 2D
Sex: 1.0
Status: Zoo

Time_UP: 0:42:0

	Species	ID	Date	N°	Narc	(mg)	Tranq I	(mg)	Tranq II	(mg)	Recum (min)	Anti	(mg)	Vet
4	Black Rhinoceros	Addo bull	17.04.1991	I0059/91	Etorphine	3.0	Azaperone	150.0			0:12:30	M5050	12mg i/v	IE

Comments: ***Very large bull in very good condition; blood & tissue sample take; Rx: 35ml compropen; 500mg azaperone i/m while wating in crate before release into boma***

ISIS: P93212

Medical Notes: Captured in reserve & moved into Kojak's camp; tissue samples taken for Prof Harley

Birth: 03.05.1983
Age: 7Y : 11M : 16D
Sex: 1.0
Status: Potgietersrus
Removed: 30.06.2000

Time_UP: 1:20:0

	Species	ID	Date	N°	Narc	(mg)	Tranq I	(mg)	Tranq II	(mg)	Recum (min)	Anti	(mg)	Vet
5	Black Rhinoceros	Kojak	17.04.1991	I0060/91	Etorphine	3.0	Azaperone	150.0			0:8:0	M5050	12mg i/m	IE

Comments: ***20mg nalorphine give i/v in tail vein; walked into crate; went down quickly, but respiration deep & rhythmic; possibly a little deep; took some time to get up - antidote i/m; procedure went well***

ISIS: P93214

Medical Notes: 3.0mg M99 + 150mg azaperone; move out of camp into reserve

Birth: 01.01.1980
Age: 11Y : 3M : 18D
Sex: 1.0
Status: Potgietersrus

Time_UP: 0:48:0

	Species	ID	Date	N°	Narc	(mg)	Tranq I	(mg)	Tranq II	(mg)	Recum (min)	Anti	(mg)	Vet
6	Black Rhinoceros	Sponono PRY F08 yel L	16.04.1991	I0058/91	Etorphine	3.0	Azaperone	150.0			0:17:30	M5050	12mg i/v	IE

Comments: ***Nalorpine 20mg i/v to walk her into the crate; kept in crate for 6hrs; started toshiver/muscle tremour in crate; moved to new boma & released; ate lucerne soon after; procedure went well***

ISIS: P93213

Medical Notes: Move out of camp into reserve; ear tag PRY F08 yellow tag L ear; blood for pregnancy & tissue for Prof Harley

Birth: 01.01.1982
Age: 9Y : 3M : 16D
Sex: 0.1
Status: Potgietersrus

Time_UP: 0:40:0

4.7 Hospitals Tab

4.7.1 The *Hospitals* tab shown in **Figure 32** is automatically opened on a new blank record for data input when the *Procedure* field in the *Medical Info* tab contains the string "***hosp***".

4.7.2 The form has a scrollable list with *Date* and *Hosp No* fields. When the cursor is placed on

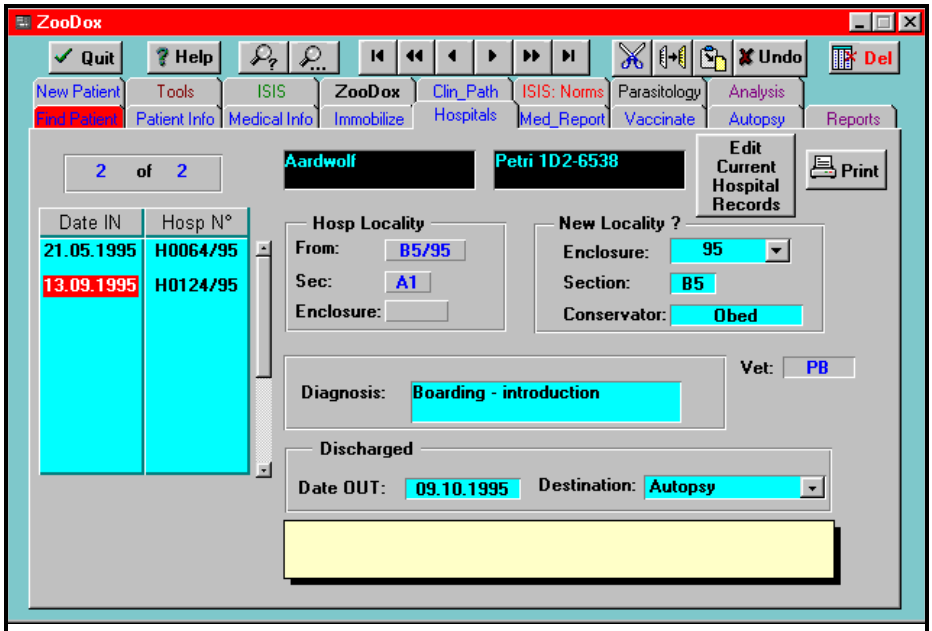

Figure 32 The *Hospitals* Tab showing hospitalization records.

one of these existing records, then all the data relevant to that hospitalization is displayed.

4.7.3 The *Edit Current Hospital Records* button is experimental. When this button is clicked, a list of patients currently in hospital are generated on a form, which can be further selected to add new medical records. In practice this route for entering medical data is seldom used as it is easier to use the route describe above to enter medical data for a patient in or out of hospital.

4.7.4 The *Print* button allows a Hospital report for the selected *Hospital No.* to be printed. The report includes all medical procedures performed on the patient from the date it came into hospital to the date it was discharged from hospital. The example on page 41 shows a *Hospital Card, No. H0178/96* for a cheetah called "Koos" which was examined and

treated for “Weight loss”.

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NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Acinonyx jubatus jubatus

25 March 2002

Hospital Card

Hosp Nº: **H0178/96**

Patient

ISIS: P93295 Status: Dead

Species: **Cheetah** **ID:** **M 126 00-001C-45E8 Koos**

Sex: 1.0 Sec: Pt Log ON: **06.08.1991**

Age (yrs): 12.35 Encl: P-B5 Removed: **18.08.2000**

Birth: 17.04.1988 Cons: Wouter L **01/0046/A1**

Diagnosis: Weight loss

From: / Date IN: 16.10.1996

Dest: Potties Date OUT: 08.01.1997

Vet: IE

Date	Procedure	Comments	Vet
16.10.1996	Admit; hospitalize	Potties ---> A1; in poor condition, to be scoped for gastritis	IE
17.10.1996	Faecal	Faecal flotation 5+ve for Toxascaris	PB
22.10.1996	Deworm	½ teaspoon Nemex H in mince - took it well	IE
11.11.1996	Faecal	Faecal flotation -ve	JR
20.11.1996	Immob; operation	100mg saffan; Wt=29kg; intubated - 2% halothane; 1litre ringers i/v; ===> OP for gastroscopy and biopsy by Dr Andrew Lieshewitz; blood taken for clin path	IE
20.11.1996	Weight	29kg	IE
03.12.1996	Report	Results of gastric biopsy indicate very little inflammatory reaction; some spirilar organisms seen - significance ?; Clin Path results revealed no abnormalities except for a slightly elevated creatinine	IE
09.12.1996	Faecal	Has diarrhoea; faecal flotation ++++ ve Toxacara + Toxascaris (240 eggs)	PB
10.12.1996	Deworm	2.5ml nemex H on food	JR
08.01.1997	Disch; hospital; transloc	A1 -------> Potties, Encl Nº 3	IE

4.8 Med_Report Tab

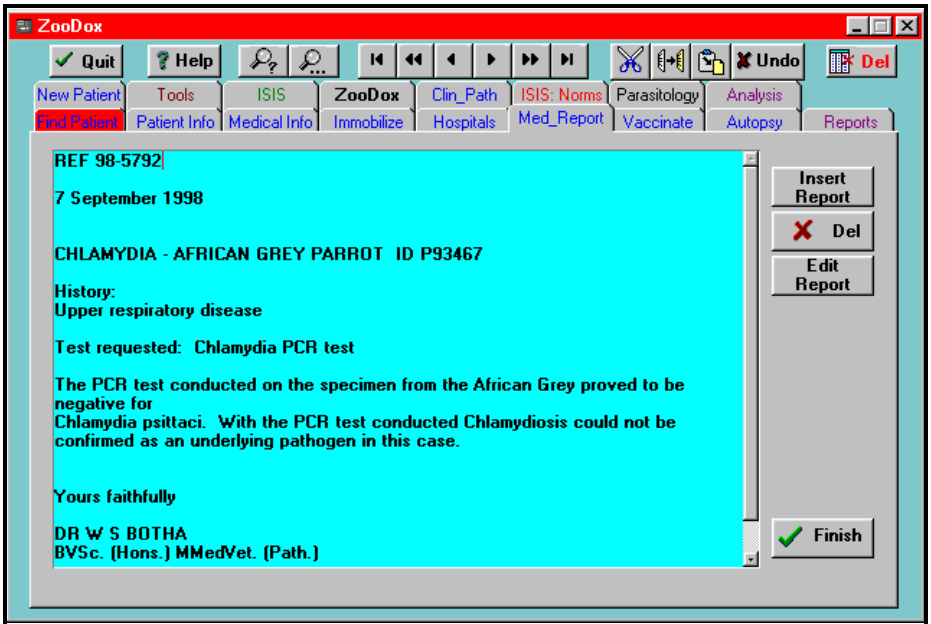

Figure 33 The *Med_Report* Tab where laboratory reports can be inserted into the database.

4.8.1 The *Med_Report* tab provides an enlarged window of the *Report* field for the current record in the *Medical Info* tab.

4.8.2 **Figure 33** shows an example of a laboratory result which had been inserted into the *Report field.* Reports are obtained from the laboratories as, documents sent by post, facsimile, email or facsimile directly to the computer using WinFax Pro. The report is scanned into a wordprocessor using a scanner or directly from the facsimile in WinFax Pro, converted to an ASCII text file and saved to a file with the ***Report No.*** on the document as the name of the file. All the ASCII report files are stored in the Reports subdirectory in the database directory.

4.8.3 The *Insert Report* button opens the *Select File* form shown in **Figure 34**, which lists all the **.txt* files in the *Reports* subdirectory from where the desired file can be selected for insertion into the field. Multiple reports can be inserted into this field, the second behind the first and so on. The *Reports* field is a "Memo" field which allows for unlimited text

storage.

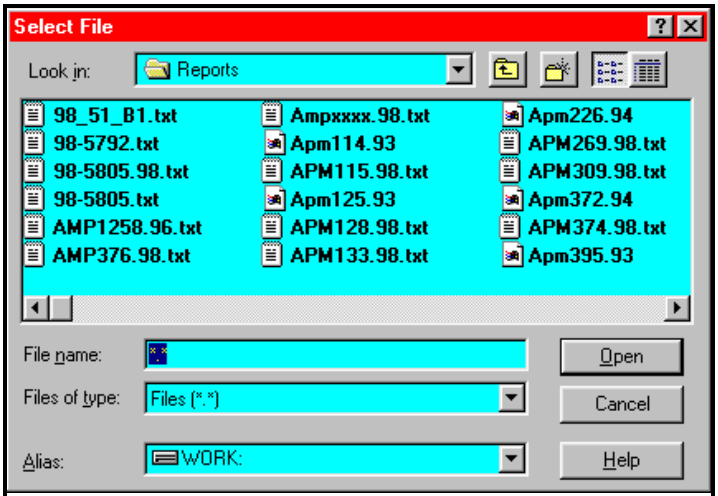

Figure 34 The *File Selection* form. Showing a list of text files. The name of the file is the number on the report.

4.8.4 The *Del* button clears the field.

4.8.5 The *Edit Report* button allows editing of the text of the report.

4.9 Vaccine Tab

4.9.1 The *Vaccinate* tab shown in **Figure 35** gives a visual display of all the vaccinations this animal has had. A similar form is opened automatically when the *Procedure* field in the *Medical Info* tab contains the string "***vacc***". The cursor is positioned at the bottom of the list for data input. The fields in this form have drop-down lists to select standardised data and these lists can be edited by opening the *Edit* form with the button supplied on the form as described in paragraph 4.6.3 above.

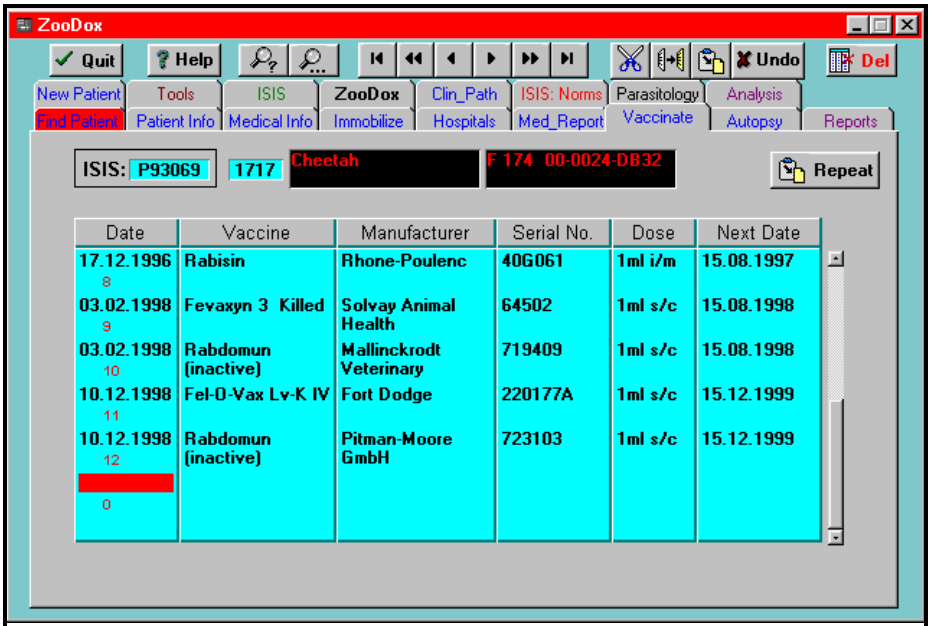

Figure 35 The *Vaccinate* Tab providing details on vaccination records.

4.9.2 The *Repeat* button in **Figure 36** can be used to copy one or multiple records from the previous patient in the case of group treatments, when clicked all the fields are automatically filled in. Any changes can still be made to these fields. This feature saves unnecessary typing time.

Figure 36

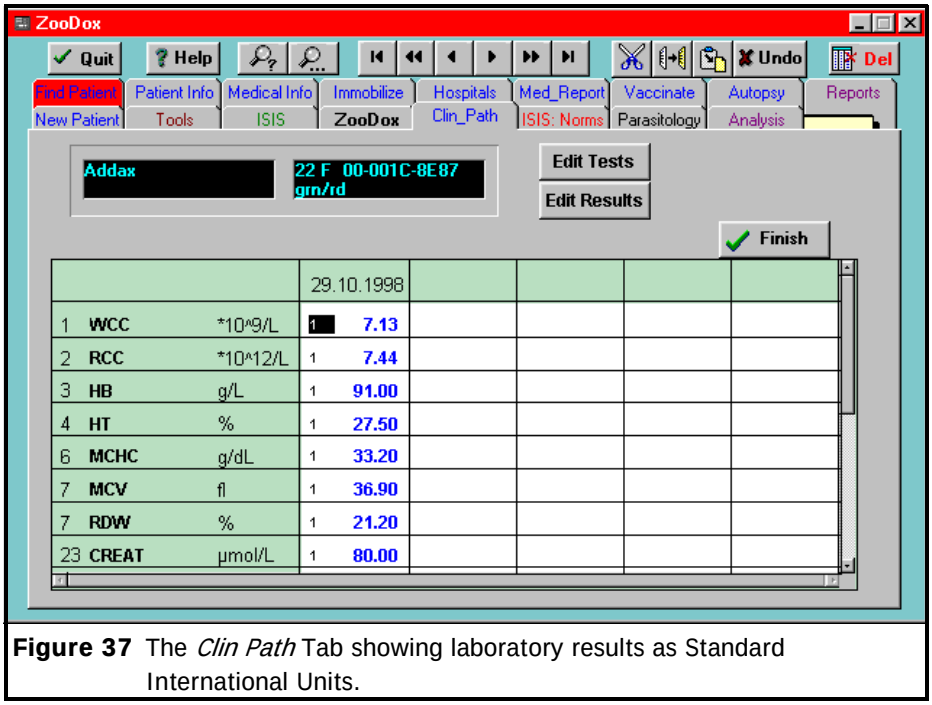

Figure 37 The *Clin Path* Tab showing laboratory results as Standard International Units.

4.10 Clin Path Tab

4.10.1 The *Clin Path* tab provides a view of all clinical pathology tests and results.

4.10.2 **Figure 37** shows the data is presented in the from of a cross tab with the tests down the left and dates when the blood was taken along the top.

4.10.3 The values for each test are displayed as mean values for this animal, and the smaller number to the left of each value indicates the number of values (***n***).

4.10.4 The test results and the tests can be edited by clicking the buttons provided on the form.

4.10.5 The *Add Clin Path Values* form in **Figure 38** is automatically opened on a new blank

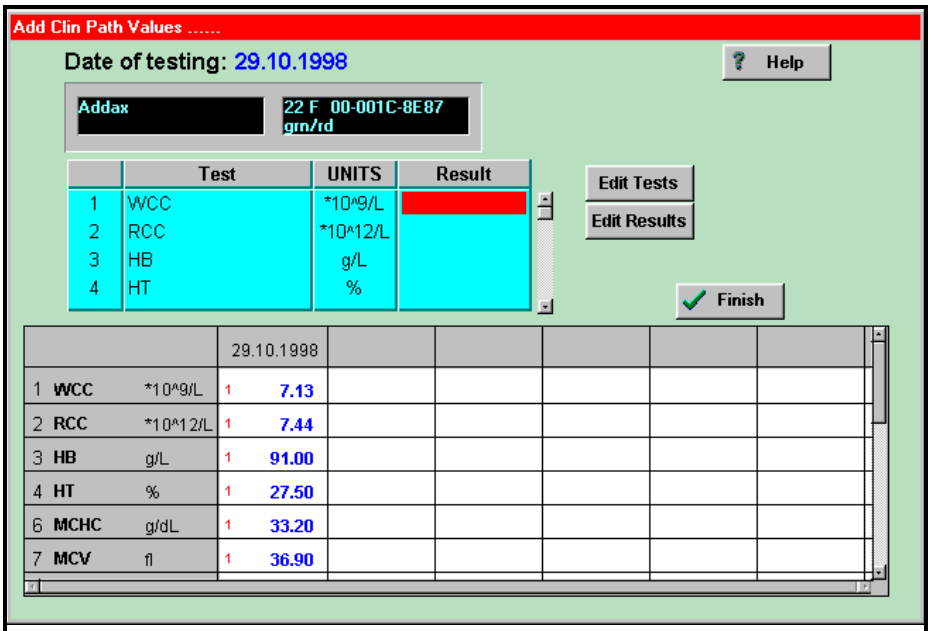

Figure 38 The *Add Clin Path Values* form where results are entered. A new value would be entered for WCC at the position of the cursor.

record for data input when the *Procedure* field in the *Medical Info* tab contains the string "***Clin path***"

- shown in this form, a scrollable list of the tests is provided and the values for each test are typed into the *Results* field adjacent to the test.
- if a test is not in the list then click on the *Edit Tests* button opens an edit form where the new test can be added to the list.

- suppose you want the new test to appear between HT (rank = 4) and MCHC (rank = 6) then make the rank of the new test equal 5 or 4.1 will give the same effect.

4.11 ISIS: Norms Tab

4.11.1 The *ISIS: Norms* tab in **Figure 39** provides a searchable database of physiological normal blood values obtained from the MedARKS database from ISIS in the USA.

4.11.2 The *Species* provided can be searched in the usual way using the *Locate* buttons at the top of the form.

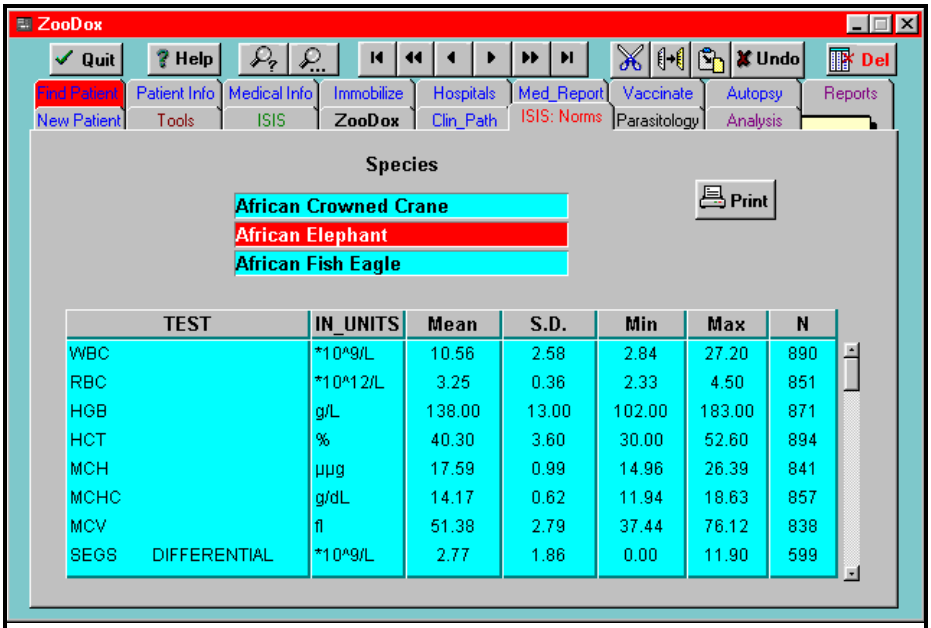

Figure 39 The *ISIS:Norm* tab showing normal blood values for the African elephant.

4.11.3 The *Print* button prints the values to the printer as shown in the printed report below on page 47.

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Veterinary Hospital

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

ISIS Clinical Pathology Values

LOXODONTA AFRICANA

African Elephant

TEST		Int_UNITS	Mean	SD	Min	Max	N
HEMOGLOBIN	HGB	GM/L	137.0	16.0	70.0	261.0	1522
RED BLOOD CELL COUNT	RBC	*10^12/L	3.2	.4	2.1	4.8	1480
HEMATOCRIT	HCT	%	39.5	4.6	27.0	56.0	1984
MCV	MCV	fL	125.8	8.1	91.1	190.0	1466
MCH	MCH	pg/cell	43.6	3.0	34.8	66.8	1454
MCHC	MCHC	g/L	347.0	20.0	184.0	579.0	1501
WHITE BLOOD CELL COUNT	WBC	*10^9/L	10.5	2.6	4.5	22.1	1544
SEGMENTED NEUTROPHILS	SEGS DIFF	*10^9/L	3.1	1.7	.0	11.8	1224
NEUTROPHILIC BANDS	BANDS DIF	*10^9/L	.8	.8	.0	6.5	605
LYMPHOCYTES	LYMPHOCYTES	*10^9/L	4.9	2.5	.0	17.4	1236
MONOCYTES	MONOCYTES	*10^9/L	1.5	1.7	.0	9.5	1175
EOSINOPHILS	EOSINOPHILS I	*10^9/L	.2	.3	.0	2.9	885
BASOPHILS	BASOPHILS D	*10^9/L	.0	.1	.0	.5	464
TOTAL PROTEIN (COLORIMETR	T.PROT. (C)	GM/L	77.0	6.0	58.0	105.0	1261
ASPARTATE AMINOTRANSFERA	AST (SGOT)	U/L	24.0	10.0	6.0	93.0	1398
ALANINE AMINOTRANSFERASE	ALT (SGPT)	U/L	7.0	6.0	.0	40.0	547
GAMMA GLUTAMYLTRANSFERA	GGT	U/L	12.0	5.0	.0	37.0	389
ALKALINE PHOSPHATASE	ALK.PHOS.	U/L	128.0	61.0	32.0	441.0	1404
AMYLASE	AMYLASE	U/L	3075.0	1552.0	.0	7918.0	241
SODIUM	NA	MMOL/L	129.0	4.0	107.0	182.0	1353
CHLORIDE	CL	MMOL/L	88.0	4.0	67.0	129.0	1323
GLOBULIN (COLORIMETRY)	GLOBULIN (C)	GM/L	41.0	5.0	26.0	64.0	1135
POTASSIUM	K	MMOL/L	4.8	.5	3.3	7.6	1368
CALCIUM	CA	MMOL/L	2.7	.2	2.0	3.8	1434
ALBUMIN (COLORIMETRY)	ALBUMIN (C)	GM/L	36.0	4.0	24.0	52.0	1145
BLOOD UREA NITROGEN	BUN	MMOL/L	3.6	1.1	.0	7.9	1458
CREATINE PHOSPHOKINASE	CPK	U/L	256.0	196.0	18.0	1884.0	247
URIC ACID	URIC ACID	MMOL/L	.0	.0	.0	.3	466
PROGESTERONE	PROGESTERON	NMOL/L	4.6	6.9	.0	32.2	266
GLUCOSE	GLUCOSE	MMOL/L	4.6	.8	2.1	9.6	1437
ALBUMIN (ELECTROPHORESIS)	ALBUMIN (E)	GM/L	44.0	3.0	41.0	49.0	7

LOXODONTA AFRICANA

African Elephant

TEST		Int_UNITS	Mean	SD	Min	Max	N
ALPHA GLOBULIN (ELECTROPH	ALPHA GLOB.	GM/L	.0	.0	.0	.0	1
ALPHA-1 GLOBULIN (ELECTROF	ALPHA-1 GLOB	GM/L	.0	.0	.0	.0	8
ALPHA-2 GLOBULIN (ELECTROF	ALPHA-2 GLOB	GM/L	.0	.0	.0	.0	8
BETA GLOBULIN (ELECTROPHC	BETA GLOB.	GM/L	.0	.0	.0	.0	2
BICARBONATE	HCO3	MMOL/L	25.1	3.6	13.0	31.0	44
CARBON DIOXIDE	CO2	MMOL/L	27.0	3.1	12.0	61.4	840
CHOLESTEROL	CHOL	MMOL/L	1.8	.4	.0	6.1	1290
CREATININE	CREAT.	UMOL/L	132.6	44.2	.0	972.4	1405
DIRECT BILIRUBIN	D. BILI	UMOL/L	1.7	1.7	.0	5.1	154
ERYTHROCYTE SEDIMENTATIC	ESR						1
FIBRINOGEN	FIBRINOGEN	G/L	2.4	1.4	.0	6.0	70
GAMMA GLOBULIN (ELECTROP	GAMMA GLOB	GM/L	16.0	4.0	7.0	19.0	7
INDIRECT BILIRUBIN	I. BILI.	UMOL/L	1.7	1.7	.0	15.4	152
IRON	IRON	UMOL/L	14.1	7.5	1.4	31.1	54
LACTATE DEHYDROGENASE	LDH	U/L	988.0	568.0	157.0	4306.0	1099
LIPASE	LIPASE	U/L					66
MAGNESIUM	MG	MMOL/L	.8	.3	.3	1.7	98
NUCLEATED RED BLOOD CELL	NRBC	/100 WBC	.0	1.0	.0	3.0	92
OSMOLARITY	OSMOLARITY	OSMOL/L	259.0	4.0	246.0	272.0	689
PHOSPHORUS	PHOS	MMOL/L	1.6	.3	.9	2.6	1291
PLATELET COUNT	PLATE. CNT.	*10^12/L	.4	.2	.1	1.4	215
RETICULOCYTES	RETICS	%	.0	.0	.0	.0	7
TESTOSTERONE	TESTOSTERON	NMOL/L					2
TOTAL BILIRUBIN	T. BILI.	UMOL/L	3.4	1.7	.0	17.1	1187
TOTAL PROTEIN (REFRACTOMI	T.PROT. (R)	GM/L	80.0	4.0	74.0	86.0	8
TOTAL THYROXINE (RIA)	TOTAL T4	NMOL/L	105.8	16.8	89.0	122.6	3
TOTAL TRIIODOTHYRONINE (RI	T3 (RIA)						1
TRIGLYCERIDE	TRIG	MMOL/L	.7	.3	.0	2.0	1124

4.12 Parasite Tab

4.12.1 The *Parasite* tab is shown in **Figure 40** and includes three fields with drop-down lists for consistency and accurate input of data.

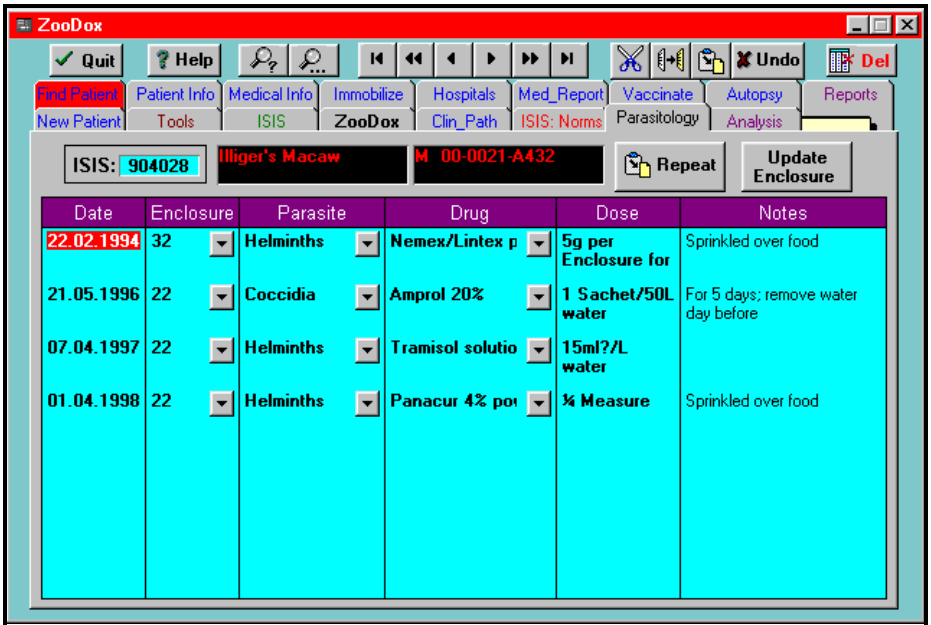


Figure 40 The *Parasite* Tab showing details of parasite control treatments.

4.12.2 A similar form to that of the tab is automatically opened with the cursor at the bottom of the list for data input when the *Procedure* field in the *Medical Info* tab contains the string "***de-worm***" or "***parasite***".

4.12.3 The *Repeat* button allows for copying of the last record for repeated input to the next patient which has the same treatment.

4.12.4 The *Update Enclosure* button opens the *ISIS Enclosure Query* shown in from **Figure 41**. This is a powerful and useful tool for finding all animals in an enclosure on a specific date and applying the same medical record to all the animals in the enclosure without having to repeatedly type the records for each animal.

4.12.5 How it works:-

- the program generates a list of animals in a specified enclosure on a specified date from the ARKS database which is kept up to date on a daily basis

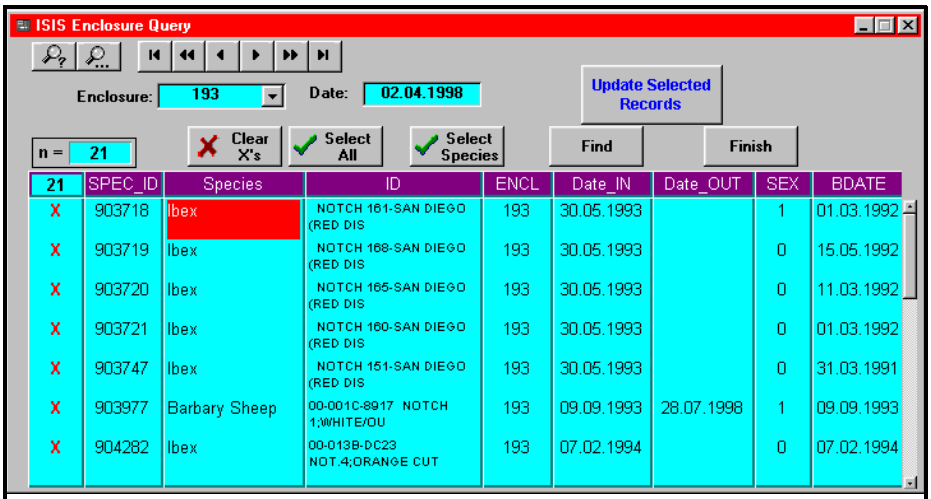


Figure 41 The *ISIS Enclosure Query* form showing multiple selections for batch processing.

- the program then checks to see if all the animals in the list are in the ZooDox database, if not they are added as new patients automatically when the records are updated
- an enclosure may have mixed species, so the form allows all the same species in the enclosure to be selected, or all the animals can be selected for the same update, i.e. if all animals in the enclosure receive the same de-worming in the form of antelope cube or mixed in the food
- the *Update Selected Records* button will add the same data to each animal's record in ZooDox in a few seconds, as well as add the animal if it does not exist in ZooDox

4.13 Autopsy Tab

4.13.1 The *Autopsy* tab shown in **Figure 42** is automatically opened on a blank record for data input when the *Procedure* field in the *Medical Info* tab contains the string "***autopsy***"

4.13.2 The *Insert Record* button functions as described above for the *Med_Report* tab.

4.13.3 The *Find Autopsy* button opens a form which allows the patient to be found by searching

on the PM No. which in many cases is the only reference on the laboratory report to the patient.

Figure 42 The *Autopsy* Tab giving data and inserted autopsy report.

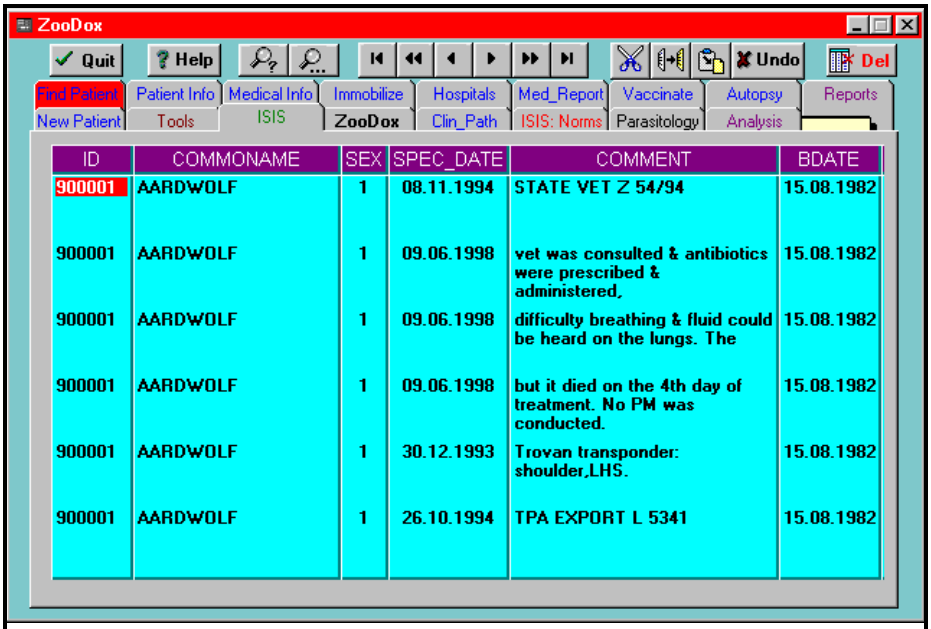


Figure 43 The *ISIS* Tab showing information stored in the ARKS files.

4.14 ISIS Tab

4.14.1 The ISIS tab shown in **Figure 43** provides a direct look at the ARKS database (which has

been copied from the ARKS computer to the computer running ZooDox) for looking up information such as identity details, sex, and birth date of a patient.

4.15 Reports Tab

4.15.1 See Chapter 5 on page 54

4.16 Analysis Tab

4.16.1 See Chapter 6 on page 119

4.17 Tools Tab

4.17.1 See Chapter 7 on page 137

4.18 Interactive Help

4.18.1 The user can obtain interactive help in two ways while using the program.

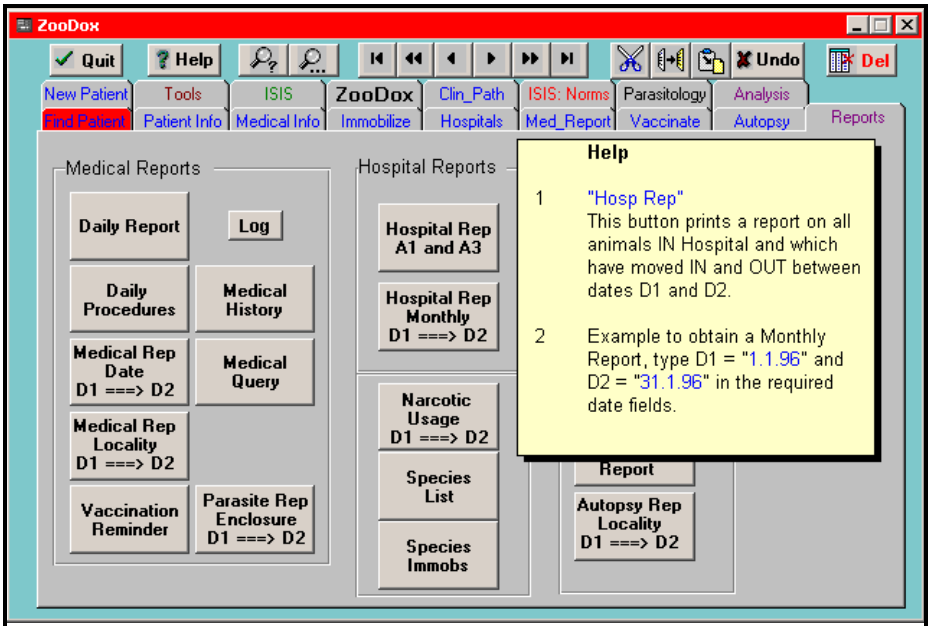


Figure 44 An example of an interactive pop-up help message.

4.18.2 When the mouse pointer moves over a specific object on the form which has been programmed to provide user help or more information, a pop-up message appears on top

of the form and disappears when the pointer moves off the object in **Figure 44**.

4.18.3 Clicking on the **Help** button in **Figure 45** takes the user to the typical Windows style help system which was created using the program dotHLP[1]. The user has the option of finding help by using the comprehensive index provided in form **Figure 46**, or by using the interactive *Contents Tab* in form **Figure 47**, in the typical Windows style.

Figure 45

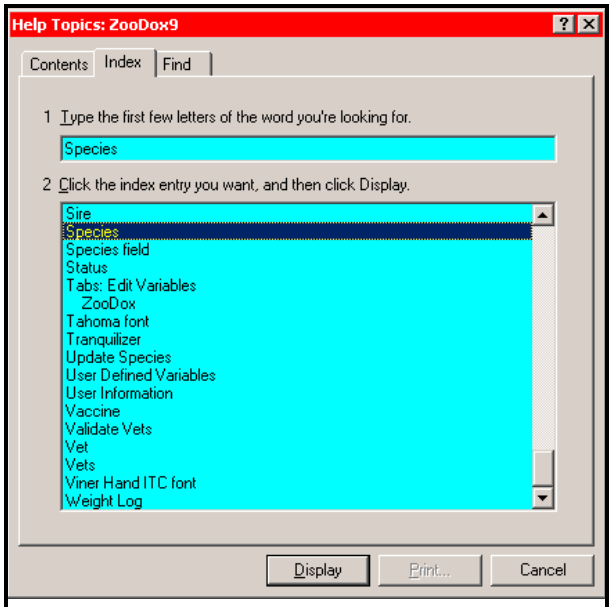


Figure 46 *Index Tab* of the Help file.

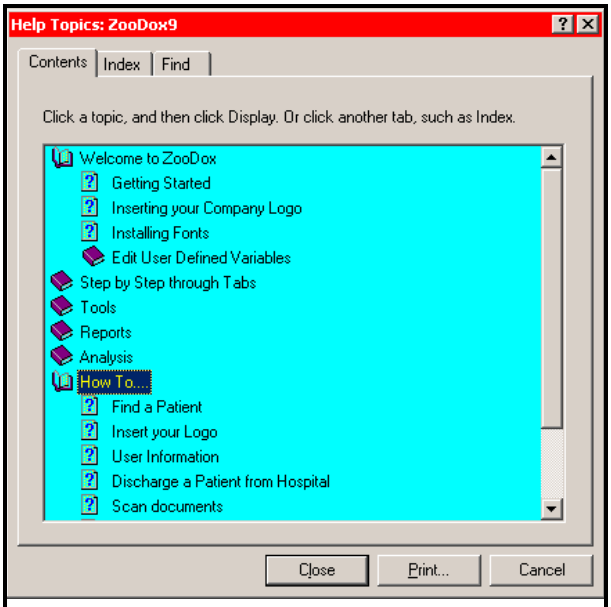


Figure 47 *Help Contents Tab* showing some of the help options.

Chapter

5

5 Reports

The *Reports* tab in **Figure 48** provides a number of buttons to generate a variety of pre-defined reports. Complex reports as show on this tab and in the mind map in **Figure 11** on page 25, are attached to a button which is clicked to generate the report. The transfer of reports generated by Paradox 7 [7,13,16,17] to other programs such as word processors is not possible. Paradox reports can be viewed on the screen from within the program or

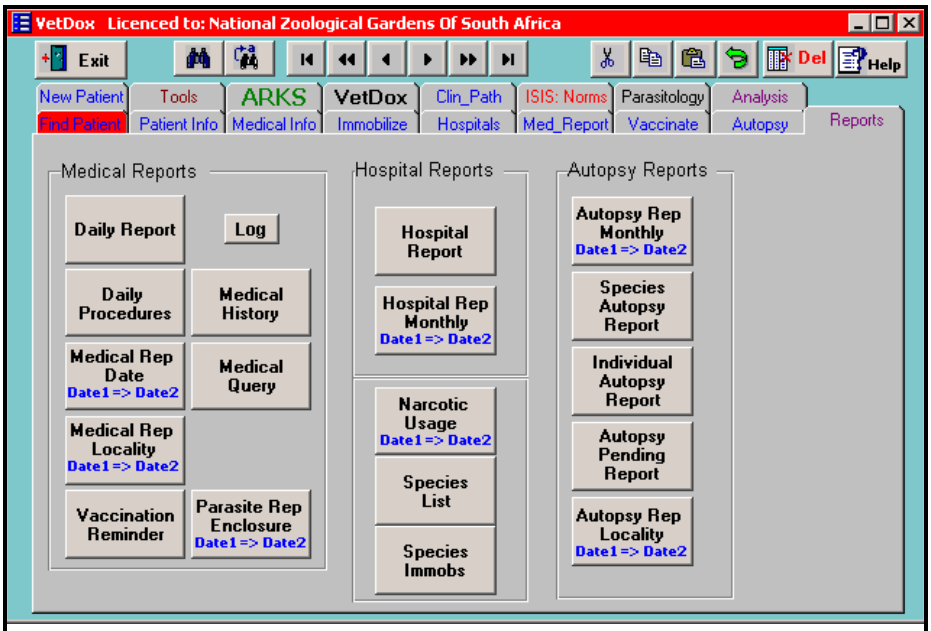


Figure 48 The *Reports* Tab showing the buttons available for printing reports.

printed to a printer, from where it can be distributed by several means.

5.1 Printing

5.1.1 The user has the choice of viewing the report on the screen or sending the report directly

to the printer. The following printing options are available in ZooDox for printing reports:-

- the default printer (or any other printer loaded onto the system or network)
- a text file
- WinFax Pro
- eFax

5.1.2 Paradox does not have the facility to generate reports suitable to send using e-mail. To solve this problem eFax Messenger Plus[18] can be used and set up as one of the printers. The report is printed to eFax and can be sent as an attachment via e-mail to a person who does not possess Paradox. The eFax "reader" needed to view the file is automatically transmitted with the eFax file.

5.1.3 Similarly reports produced by ZooDox can be faxed by printing them to WinFax Pro[28].

5.1.4 The feature of printing reports from Paradox to Text Files is not used, because the layout of report is significantly distorted during the process of converting from the Paradox report format to the text file. The distortion of the field make it difficult to read the report.

5.2 Daily Report

5.2.1 The *Daily Report* is printed each day and submitted to the Animal Data Bank at the Zoo where relevant new information on identities, translocations, births and deaths are extracted to update the inventory records and the ARKS database program. The report provides information on:

- the medical procedures and treatments,
- all the animals in hospital on the specified date,
- all animals moving in and out of hospital on the specified day and

- all postmortems and findings done for the day

5.2.2 Clicking on the ***Daily Report*** button in **Figure 49** opens the form in **Figure 50**. This form allows for the entry of a single date or a date span to print

Figure 49

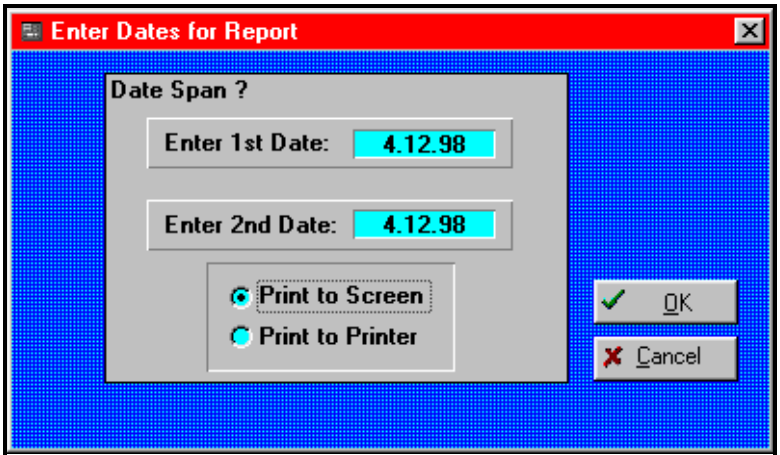


Figure 50 The date input form used for the Daily Report. Note that a date span can be entered to print multiple reports. A single report can be printed to the screen for previewing before printing.

multiple *Daily Reports* between and including the two dates. Only single reports can be printed to the screen for previewing before printing to the printer.

5.2.3 An example of a *Daily Report* is given on the following page 57.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Fri, 04 December 1998

Daily Report

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
906846	African Wild Cat	M 00-0121-C719 Bar-one	1.0	1Y : 0M : 15D	C1	200	Zoo	Discharge; hospital	A1 -------> C2/202	IE
907400	African Wild Cat	Newborn 1 '98	1.0	0Y : 0M : 21D	B1	108	Dead	Autopsy	Carcass sent to OVI for PM	IE
907401	African Wild Cat	Newborn 2 '98	1.0	0Y : 0M : 21D	B1	108	Dead	Autopsy	Carcass sent to OVI for PM	IE
906859	Blue And Gold Macaw	Chick 2 '97 00-0121-C24F	0.0.1	1Y : 1M : 19D	C1	28	Dead	Autopsy	Most of RHS of carcass and organs eaten by rats	IE
906969	Bongo	F 00-01F6-EBE9 blu/blu	0.1	1Y : 5M : 16D	D3	165	Zoo	Examine	Check - looking good; chin a little swollen drain seems to be out; Frank reported that she has been eating grass	IE
900172	Gorilla	Hobbit 00-001A-D856	1.0	19Y : 9M : 3D	D1	160	Zoo	Exam; Rx	Habitus much the same; did not eat much; drinking water; small amount of hard faeces in night room; Rx: 4 Disprin before giving antibiotics	IE
907246	Lanner Falcon	Ex Ltx 00-01F7-EB6D	0.1	1Y : 2M : 29D	L		Sold	Edit ID	[Ex Ltx] ===> [00-01F7-EB6D]	ML
907418	Spotted Dikkop	Don 98/128	0.0.1	0Y : 0M : 10D	A1		Dead	Disch; hospital; PM	A1 -------> Autopsy	IE

Animals in Hospital on: **04.12.1998**

ISIS	Species	ID	Sex	Age	Date IN	Hosp No.	Diagnosis	From
905407	Harlequin Quail	4-84127	0.0.1	2Y : 8M : 9D	26.03.1996	H0043/96	Quarantine	Intro
None	Leopard Tortoise	Don 96/069	0.1	Unknown	05.11.1996	H0180/96	R hind amputated; miasis	Intro
901345	Patas Monkey	Pete 00-0063-747E	1.0	11Y : 7M : 1D	15.07.1997	H0120/97	Fractured L femur	B2/60
None	Leopard Tortoise	Don 97/102	0.1	Unknown	30.09.1997	H0176/97	Boarding	Intro
None	Leopard Tortoise	Don 97/112	1.0	Unknown	15.10.1997	H0183/97	Injured carapace	Intro
900617	Scimitar Horned Oryx	8 F 00-001F-D234	0.1	8Y : 8M : 8D	18.12.1997	H0225/97	Chronic deep pyoderma	D2/39
None	Leopard Tortoise	Don 98/018	0.1	Unknown	25.01.1998	H0021/98	Boarding	Intro

ISIS	Species	ID	Sex	Age	Date IN	Hosp No.	Diagnosis	From
906980	Scimitar Horned Oryx	9 F 00-0121-BEF8 yel/grn	0.1	0Y : 9M : 24D	09.02.1998	H0036/98	Boarding	Intro
906990	Lord Derby Eland	00-0133-35DD	0.1	3Y : 3M : 23D	07.03.1998	H0056/98	Quarantine	Intro
906991	Lord Derby Eland	White Oak - Bull	1.0	2Y : 5M : 1D	07.03.1998	H0055/98	Quarantine	Intro
None	Leopard Tortoise	Don 98/036	0.1	Unknown	13.03.1998	H0058/98	Boarding	Intro
None	Leopard Tortoise	Don 98/057	1.0	Unknown	05.05.1998	H0097/98	Attacked by dog	
905988	Cape Parrot	Suaheli 00-01F7-9CB9	1.0	3Y : 1M : 9D	11.06.1998	H0115/98	Feather plucking	Intro
P93503	Giant Eagle Owl	Don 98/007/P J-12843 01F7-E523	0.1	2Y : 4M : 18D	16.07.1998	H0133/98	Compound # R wing	Intro
907213	Cape Eagle Owl	Don 98/082 9-77080 yel R 00-0144-4120	0.1	0Y : 4M : 22D	17.08.1998	H0151/98	Quarantine	Intro
907246	Lanner Falcon	Ex Ltx 00-01F7-EB6D	0.1	1Y : 2M : 29D	04.09.1998	H0164/98	Quarantine	Intro
907227	Whitefaced Owl	Don 98/088	0.1	0Y : 2M : 28D	07.09.1998	H0165/98	Injured R eye	Intro
None	Hedgehog	Don 98/090	0.0.1	Unknown	12.09.1998	H0167/98	Boarding	Intro
None	Hedgehog	Don 98/092	0.0.1	Unknown	20.09.1998	H0172/98	Boarding	Intro
None	Leopard Tortoise	D3/163/1	1.0	Unknown	09.10.1998	H0186/98	Respiratory Tract Disease	D3/163
None	Hedgehog	Don 98/100	0.0.1	Unknown	10.10.1998	H0187/98	Observation	A1/
907288	Sichuan Takin	0097-2D2D	1.0	2Y : 5M : 14D	11.10.1998	H0188/98	Quarantine	Intro
907289	Sichuan Takin	F	0.1	1Y : 9M : 22D	11.10.1998	H0189/98	Quarantine	Intro
907287	Central Chinese Goral	F 00-016A-9435	0.1	1Y : 6M : 14D	11.10.1998	H0191/98	Quarantine	Intro
907286	Central Chinese Goral	M 00-016A-8A5B	1.0	3Y : 5M : 17D	11.10.1998	H0190/98	Quarantine	Intro
907326	Hadeda Ibis	Don 98/112	0.0.1	0Y : 1M : 7D	27.10.1998	H0202/98	Fractured R humerus	Intro
None	Rock Leguaan	Unknown 1 '98	1.0	Unknown	27.10.1998	H0201/98	Prolapsed L hemipenis	Rp/R
907331	Spotted Eagle Owl	Don 98/114	0.0.1	0Y : 1M : 26D	29.10.1998	H0203/98	Handraising	Intro
907332	Lesser Bushbaby	Don 98/117	1.0	0Y : 0M : 29D	05.11.1998	H0204/98	Boarding	Intro
None	Hedgehog	Don 98/120	0.0.1	Unknown	09.11.1998	H0206/98	Boarding	Intro
907407	Crested Barbet	Don 98/?? R. 4A03629	0.0.1	0Y : 0M : 25D	09.11.1998	H0205/98	Fractured R radius/ulna	Intro

ISIS	Species	ID	Sex	Age	Date IN	Hosp No.	Diagnosis	From
907409	African Wild Cat	Don 98/007/Pt 00-01F6-E87C	1.0	0Y : 7M : 22D	12.11.1998	H0213/98	Boarding	A1/
907412	Ovambo Sparrowhawk	Don 98/123	0.0.1	0Y : 1M : 18D	16.11.1998	H0211/98	Can't stand properly	A1/
907417	Cape Eagle Owl	Don 97/?/Pt 9-77079 Red L 00-0144-8101	1.0	0Y : 0M : 17D	17.11.1998	H0212/98	Scoping	Pt/P-A3
906846	African Wild Cat	M 00-0121-C719 Bar-one	1.0	1Y : 0M : 15D	19.11.1998	H0217/98	Coccidiosis	C2/202
900582	Grass Owl	7-80000	0.1	9Y : 9M : 22D	23.11.1998	H0220/98	Tumour	C2/5
907418	Spotted Dikkop	Don 98/128	0.0.1	0Y : 0M : 10D	24.11.1998	H0222/98	Both primary feathers cut	Intro
907428	Cape Vulture	Don 98/?/LTX G-11626 01F6-19B4	0.1	0Y : 0M : 10D	24.11.1998	H0221/98	Poisoning	Intro
907432	Kodiak Bear	Manna 00-0124-9E78	0.1	12Y : 1M : 3D	25.11.1998	H0223/98	Quarantine	Intro
907431	Kodiak Bear	Woetie 00-0123-2D55	0.1	13Y : 0M : 3D	25.11.1998	H0224/98	Quarantine	Intro

Hosptial Admittances: No records to report on

Hospital Discharges:

ISIS	Species	ID	Sex	Age	Date	Hosp No.	Diagnosis	Encl	Dest	Vet
906846	African Wild Cat	M 00-0121-C719 Bar-one	1.0	1Y : 0M : 15D	04.12.1998	H0217/98	Coccidiosis		C2/202	IE
907418	Spotted Dikkop	Don 98/128	0.0.1	0Y : 0M : 10D	04.12.1998	H0222/98	Both primary feathers cut		Autopsy	IE

Postmortem Report

ISIS	Species	ID	Sex	P.M. No.	Death	Diagnosis	Codes
907400	African Wild Cat	Newborn 1 '98	1.0	98/0253/B1	04.12.1998	Suspect Herpes virus infection possibly from feral cats	F/C/D/I?
907401	African Wild Cat	Newborn 2 '98	1.0	98/0253/B1	04.12.1998	Suspect Herpes virus infection possibly from feral cats	F/C/D/I?
906859	Blue And Gold Macaw	Chick 2 '97 00-0121-C24F	0.0.1	98/0255/C1	04.12.1998	Cause of death not determined; carcass extensively eaten by rats	N/H/N/X

5.3 Daily Procedures Report

5.3.1 The *Daily Procedures Report* is used to generate a monthly report on all the medical procedures performed during the specified period.

5.3.2 Clicking on the ***Daily Procedures*** button in **Figure 51** brings up the *Date span input form for repots* in **Figure 52** for date span entry for the report. The user has the option to view the report on the screen or print it to a printer.

Figure 51

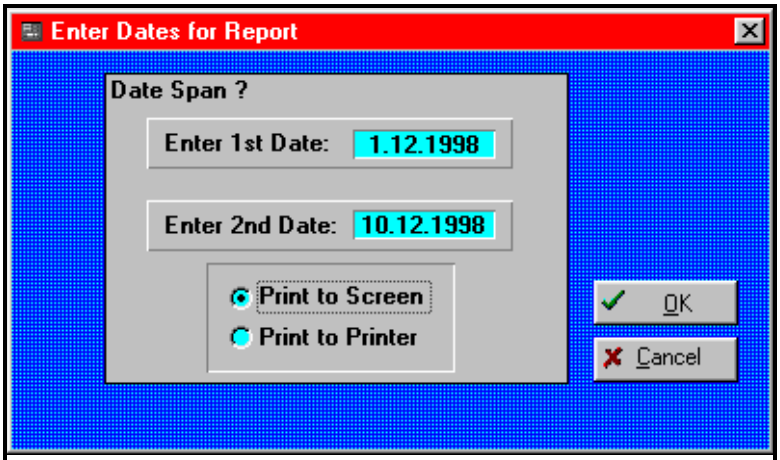


Figure 52 Date span input form for reports.

5.3.3 The report is sorted by date.

5.3.4 The following report on page 61 includes the first three days of December 1998.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

1 December 1998 to
3 December 1998

Daily Procedures

Tue, 01 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
907417	Cape Eagle Owl	Don 97/?/Pt 9-77079 Red L 00-0144-8101	1.0	0Y : 0M : 14D	C3	72	Zoo	Observation	Intro to female (juvenile) in Hospital	JR
907213	Cape Eagle Owl	Don 98/082 9-77080 yel R 00-0144-4120	0.1	0Y : 4M : 19D			Loan	Observation	Intro to male from Potties	JR
905988	Cape Parrot	Suaheli 00-01F7-9CB9	1.0	3Y : 1M : 6D	C2	28	Zoo	Examine	Bird to go out to Sarah	JR
907428	Cape Vulture	Don 98/?/LTX G-11626 01F6-19B4	0.1	0Y : 0M : 7D	A1		Sold	Examine	For possible release at Dr Espie's request	JR
900172	Gorilla	Hobbit 00-001A-D856	1.0	19Y : 9M : 0D	D1	160	Zoo	Exam; Rx	Much the same; did not eat much; small amount of ferm faeces in nightroom; to try another 4 Disprins today.	IE
907326	Hadeda Ibis	Don 98/112	0.0.1	0Y : 1M : 4D	A1		Dead	Examine	Spoke to Eugene - he will look into whether there is demand for these birds overseas; explained bird is not ready to go yet; filled out surplus form	JR
None	Hedgehog	Don 98/090	0.0.1	Unknown	A1		Released	Examine	Release form 6/98	JR
None	Hedgehog	Don 98/092	0.0.1	Unknown	A1		Released	Examine	Release form 6/98	JR
None	Hedgehog	Don 98/100	0.0.1	Unknown	A1		Released	Examine	Release form 6/98	JR
None	Hedgehog	Don 98/120	0.0.1	Unknown	A1		Released	Examine	Release form 6/98	JR
None	Hedgehog	Don 98/134	0.0.2	Unknown	B2	Home02	Dead	Intro; translocate	2 x Babies - eyes not open yet; -------> B2/Home for handraising by Carin	IE
907332	Lesser Bushbaby	Don 98/117	1.0	0Y : 0M : 26D	A1		Sold	Examine	Surplus form: to go to Mike Bester (sale)	JR
None	Mice	Don 98/135	0.7	Unknown	A1		Dead	Examine	Slaughtered and used as food	IE
None	Mice	Don 98/135	0.7	Unknown	A1		Dead	Intro; euthanase	Slaughtered and used as food	IE
906980	Scimitar Horned Oryx	9 F 00-0121-BEF8 yel/grn	0.1	0Y : 9M : 21D	A3		Sold	Examine	Put on surplus form to be sold: spoke to Eugene	JR

Tue, 01 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
907418	Spotted Dikkop	Don 98/128	0.0.1	0Y : 0M : 7D	A1		Dead	Examine	To be taken out by Sarah	JR
907227	Whitefaced Owl	Don 98/088	0.1	0Y : 2M : 25D	A1		Dead	Examine	Possibly to go to Chris Olwagen	JR

Wed, 02 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
907409	African Wild Cat	Don 98/007/Pt 00-01F6-E87C	1.0	0Y : 7M : 19D	C1	199	Sold	Deworm	Drontal for cats in mince	JR
907409	African Wild Cat	Don 98/007/Pt 00-01F6-E87C	1.0	0Y : 7M : 19D	C1	199	Sold	Edit ISIS	[] ===> [907409]	IE
906846	African Wild Cat	M 00-0121-C719 Bar-one	1.0	1Y : 0M : 12D	C1	200	Zoo	Deworm	Drontal for cats in mince	JR
906744	Arabian Oryx	00-0125-E062	1.0	1Y : 2M : 1D	D1	184	Sold	Edit ISIS	[] ===> [906744]	IE
906863	Arabian Oryx	0143-99A6	1.0	1Y : 0M : 3D	D1	184	Sold	Edit ISIS	[] ===> [906863]	IE
907353	Bald Ibis	Egg 154 '98	0.0.1	0Y : 0M : 22D	C1	Brood1	Dead	Edit ISIS	[] ===> [907353]	IE
907356	Bali Mynah	Newborn 1' 98	0.0.1	0Y : 0M : 21D	C2	227	Dead	Edit ISIS	[] ===> [907356]	IE
907355	Bali Mynah	Newborn 2' 98	0.0.1	0Y : 0M : 21D	C2	227	Dead	Edit ISIS	[] ===> [907355]	IE
907329	Barbary Sheep	Newborn 4 '98	0.1	0Y : 1M : 2D	D3	192	Dead	Edit ISIS	[] ===> [907329]	IE
907413	Blackeyed Bulbul	Don 98/124	0.0.1	0Y : 1M : 4D	A1		Dead	Edit ISIS	[] ===> [907413]	IE
None	Cape Sparrow	Don 98/115	0.0.1	Unknown	A1		Dead	Edit ISIS	[] ===> [None]	IE
907428	Cape Vulture	Don 98/?/LTX G-11626 01F6-19B4	0.1	0Y : 0M : 7D	A1		Sold	Edit ISIS	[] ===> [907428]	IE
907411	Cattle Egret	Don 98/122	1.0	0Y : 0M : 18D	A1		Dead	Edit ISIS	[] ===> [907411]	IE
None	Egyptian Goose	Freeflying 1 '98	1.0	Unknown	A1		Dead	Edit ISIS	[] ===> [None]	IE
907330	Eland	Newborn 1' 98	0.0.1	0Y : 1M : 1D	D1	196	Dead	Edit ISIS	[] ===> [907330]	IE
907419	Geoffroy's Cat	Newborn 1 '98 Jude 0-0144-7322	1.0	0Y : 0M : 5D	B4		Zoo	Edit ISIS	[] ===> [907419]	IE
907420	Geoffroy's Cat	Newborn 2 '98 Juno	0.1	0Y : 0M : 5D	B1	105	Dead	Edit ISIS	[] ===> [907420]	IE
907421	Geoffroy's Cat	Newborn 3 '98	0.1	0Y : 0M : 5D	B1	105	Dead	Edit ISIS	[] ===> [907421]	IE
900172	Gorilla	Hobbit 00-001A-D856	1.0	19Y : 9M : 0D	D1	160	Zoo	Examine	Frank reported that Hobbit was much the same; no faeces in nightroom; did not eat much; running nose and caughing; to Rx: 4 Disprin again	IE
907415	Grey Duiker	Unknown 1' 98	0.1	1Y : 0M : 29D	D1	195	Dead	Edit ISIS	[] ===> [907415]	IE
907425	Gymnogene	Green 133-W 00-01D3-7B97	1.0	0Y : 0M : 4D	C1	208	Sold	Edit ISIS	[] ===> [907425]	IE
907414	Hadeda Ibis	Don 98/125	0.1	0Y : 3M : 14D	A1		Dead	Edit ISIS	[] ===> [907414]	IE

Wed, 02 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
None	Hamster	Don 98/107 Bikkie	0.1	Unknown	B2	Nurse	Dead	Edit ISIS	[] ===> [None]	IE
None	Hedgehog	Don 98/134	0.0.2	Unknown	B2	Home02	Dead	Edit ISIS	[] ===> [None]	IE
907408	Hoopoe	Don 98/121	0.1	0Y : 1M : 21D	A1		Dead	Edit ISIS	[] ===> [907408]	IE
907394	Indian Black Buck	Newborn 7' 98	0.1	0Y : 0M : 24D	D5	161	Dead	Edit ISIS	[] ===> [907394]	IE
907432	Kodiak Bear	Manna 00-0124-9E78	0.1	12Y : 0M : 30D	D3	186	Zoo	Edit ISIS	[] ===> [907432]	IE
907431	Kodiak Bear	Woetie 00-0123-2D55	0.1	12Y : 11M : 30D	D3	186	Zoo	Edit ISIS	[] ===> [907431]	IE
907332	Lesser Bushbaby	Don 98/117	1.0	0Y : 0M : 26D	A1		Sold	Edit ISIS	[] ===> [907332]	IE
907283	LittleCorella	Newborn 2' 98	0.0.1	0Y : 1M : 22D	C1	Brood1	Dead	Edit ISIS	[] ===> [907283]	IE
None	Little Swift	Don 98/126	0.0.1	Unknown	A1		Dead	Edit ISIS	[] ===> [None]	IE
907399	Mandarin Duck	00-01F7-7CF1 Green 88-97TWT	0.1	0Y : 11M : 10D	C4	10	Zoo	Edit ISIS	[] ===> [907399]	IE
907398	Mandarin Duck	00-01F7-E46F 6-35753 R	1.0	1Y : 0M : 18D	C4	10	Dead	Edit ISIS	[] ===> [907398]	IE
907412	Ovambo Sparrowhawk	Don 98/123	0.0.1	0Y : 1M : 15D	A1		Released	Edit ISIS	[] ===> [907412]	IE
None	Rabbit	Don 98/129	0.1	Unknown	B2	Nurse	Zoo	Edit ISIS	[] ===> [None]	IE
None	Rabbit	Don 98/130 Black	1.0	Unknown	B2	Nurse	Zoo	Anaesthetic	4% Halothane by mask - castration	IE
None	Rabbit	Don 98/130 Grey	1.0	Unknown	B2	Nurse	Zoo	Anaesthetic	4% Halothane by mask - castration	IE
None	Rabbit	Don 98/130 Grey	1.0	Unknown	B2	Nurse	Zoo	Edit ISIS	[] ===> [None]	IE
None	Rabbit	Don 98/??	0.1	Unknown	B2	Nurse	Zoo	Anaesthetic	4% Halothene by mask - castration	IE
907333	Redcrested Pochard	Chick 1 '98	0.0.1	0Y : 0M : 23D	C1	Brood1	Dead	Edit ISIS	[] ===> [907333]	IE
907334	Redcrested Pochard	Chick 2' 98	0.0.1	0Y : 0M : 23D	C1	Brood1	Dead	Edit ISIS	[] ===> [907334]	IE
907335	Redcrested Pochard	Chick 3' 98	0.0.1	0Y : 0M : 23D	C1	Brood1	Dead	Edit ISIS	[] ===> [907335]	IE
907430	Redfaced Mousebird	Don 98/132	0.0.1	0Y : 1M : 2D	B2	Home02	Zoo	Edit ISIS	[] ===> [907430]	IE
None	Scarlet Ibis	Group	6.6.0	Unknown	C1	21	Zoo	Edit ISIS	[] ===> [None]	IE

Thu, 03 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
906032	Blue Duiker	NZ 18 00-0143-E4D8	0.1	1Y : 9M : 29D	D3	166	Zoo	Exam; Rx	Large abscess draining thick creamy pus; drained - cleaned ; Rx: 2ml Peni LA	IE

Thu, 03 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
906969	Bongo	F 00-01F6-EBE9 blu/blu	0.1	1Y : 5M : 13D	D3	165	Zoo	Immobilize	2.5mg M99; 30mg Azaperone; fractured off nostral portion of mandible containing 3 R incisors. Remove bone fragment + teeth; surface soft tissue back into position; put in penrose drain; Rx: 20ml Peni LA i/m; 100mg Trilofan i/m	PB
900172	Gorilla	Hobbit 00-001A-D856	1.0	19Y : 9M : 0D	D1	160	Zoo	Exam; Rx	No improvement; Rx: 2500mg Synulox (10) for 3 days	IE

5.4 Medical Report by Date

5.4.1 This report is similar to the one above, but can give much more detail and information.

5.4.2 Clicking on the ***Medical Rep Date*** button (**Figure 53**, **Figure 55**) opens the form in **Figure 54**.

Figure 53

5.4.3 There are six categories to choose from to include or exclude in the report

5.4.4 If one is only interested in the vaccinations done for that period, then it can be selected

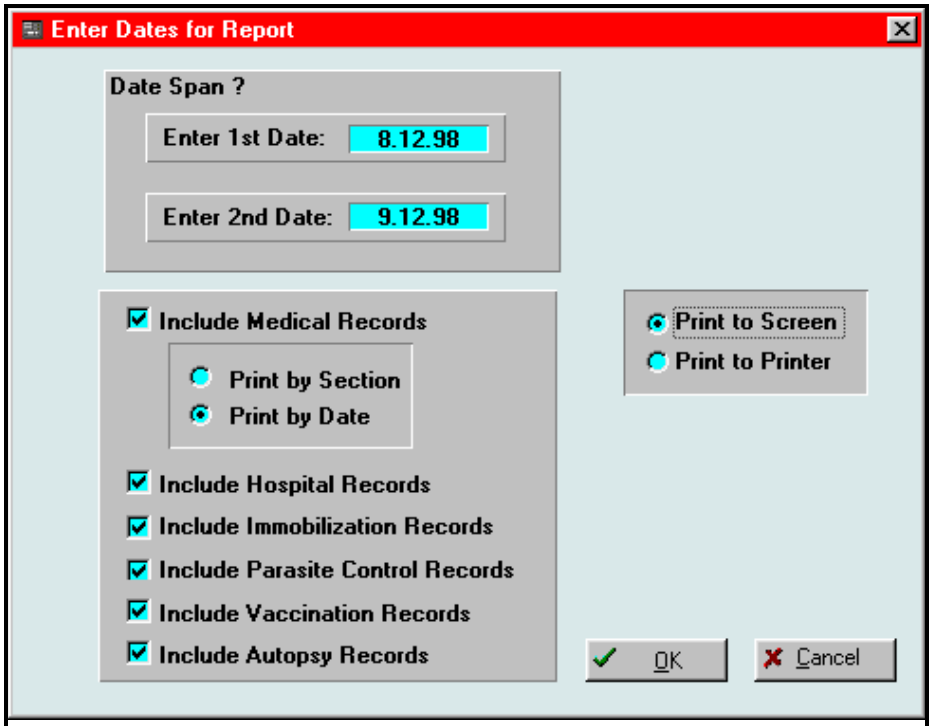


Figure 54 The form for the Medical Report. There are six categories in the report to select for inclusion in the report. Note that this report has been selected to be printed by **Date** to the screen.

without having to print many pages of unwanted information.

5.4.5 An example of a *Medical Report* sorted by ***Date*** is given on page 66.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

8 December 1998 to
9 December 1998

Medical Report

Tue, 08 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
906969	Bongo	F 00-01F6-EBE9 blu/blu	0.1	4Y : 3M : 9D	D3	165	Zoo	Examine	Check - very calm licked my hand; wound looks good; eating; prognoses good	IE
901876	Forest Buffalo	1 M 00-001B-CEE9 red/red	1.0	10Y : 6M : 15D	Lt	L	Sold	Immobilize	4mg + 1mg M99 + 60mg Azaperone; EDTA blood for Blue Tongue ------> USDA	IE
907420	Geoffroy's Cat	Newborn 2 '98 Juno	0.1	26.11.1998	B1	105	Dead	Exam; Rx	Carin concerned that cat is not drinking much and has diarrhoea; seems hungry; dose 3ml fingers Lactate + 5mg Clamoxyl RTV by stomach tube	IE
900582	Grass Owl	7-80000	0.1	11Y : 9M : 12D	C1	230	Zoo	Exam; Rx	GA: Forane 4-2%; excised pendulons leipoma; Rx: Cicutrein + 10mg Baytril i/m.	IE
906882	Small Spotted Cat	Don 97/143 00-012F-B713	0.1	~07.12.1997	C2	217	Dead	Exam; Rx	Martie concerned that cat is not well; check - appears depressed - reduced appetite & habitus respiration appears fast; to Rx: 40mg Clamoxyl tabs bid in chicks; faecal flotation - ve (poor sample ; PM: Martie reported that medication was taken	IE
906882	Small Spotted Cat	Don 97/143 00-012F-B713	0.1	~07.12.1997	C2	217	Dead	Rx	Disp Animalax to put into chicks	IE

Wed, 09 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
907537	Cheetah	K 16 00-0020-2B86	1.0	10Y : 8M : 23D	B4	101	Zoo	Immob; vaccinate	5 + 10ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 40kg	IE
907537	Cheetah	K 16 00-0020-2B86	1.0	10Y : 8M : 23D	B4	101	Zoo	Parasite control	Frontline top Spot 20-40 kg for ticks and fleas	IE

Wed, 09 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
907537	Cheetah	K 16 00-0020-2B86	1.0	10Y : 8M : 23D	B4	101	Zoo	Weight	40kg	IE
P93255	Cheetah	M 105 00-0025-D120	1.0	13Y : 4M : 14D	Pt	P-B2	Dead	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV, FeL; Wt = 31kg	IE
P93255	Cheetah	M 105 00-0025-D120	1.0	13Y : 4M : 14D	Pt	P-B2	Dead	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93255	Cheetah	M 105 00-0025-D120	1.0	13Y : 4M : 14D	Pt	P-B2	Dead	Weight	31kg	IE
P93295	Cheetah	M 126 00-001C-45E8 Koos	1.0	12Y : 4M : 4D	Pt	P-B5	Dead	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 33kg	IE
P93295	Cheetah	M 126 00-001C-45E8 Koos	1.0	12Y : 4M : 4D	Pt	P-B5	Dead	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93295	Cheetah	M 126 00-001C-45E8 Koos	1.0	12Y : 4M : 4D	Pt	P-B5	Dead	Weight	33kg	IE
P93065	Cheetah	M 159 00-0020-3AEE	1.0	10Y : 2M : 13D	Pt	P-B7	Dead	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 40kg	IE
P93065	Cheetah	M 159 00-0020-3AEE	1.0	10Y : 2M : 13D	Pt	P-B7	Dead	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93065	Cheetah	M 159 00-0020-3AEE	1.0	10Y : 2M : 13D	Pt	P-B7	Dead	Weight	40kg	IE
P93073	Cheetah	M 182 00-0021-36BB	1.0	10Y : 6M : 9D	Pt	P-B3	Loan	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 40kg	IE
P93073	Cheetah	M 182 00-0021-36BB	1.0	10Y : 6M : 9D	Pt	P-B3	Loan	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93073	Cheetah	M 182 00-0021-36BB	1.0	10Y : 6M : 9D	Pt	P-B3	Loan	Weight	40kg	IE
P93075	Cheetah	M 184 00-0024-C9C3	1.0	9Y : 1M : 27D	Pt	P-B8	Loan	Immob; vaccinate	5 +3 +2ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 43kg	IE

Wed, 09 December 1998

ISIS	Species	ID	Sex	Age	Sec	Encl	Status	Procedure	Comments	Vet
P93075	Cheetah	M 184 00-0024-C9C3	1.0	9Y : 1M : 27D	Pt	P-B8	Loan	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93075	Cheetah	M 184 00-0024-C9C3	1.0	9Y : 1M : 27D	Pt	P-B8	Loan	Weight	43kg	IE
P93082	Cheetah	M 193 00-0021-3258	1.0	9Y : 5M : 17D	Pt	P-B6	Loan	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Rx Wt = 41kg	IE
P93082	Cheetah	M 193 00-0021-3258	1.0	9Y : 5M : 17D	Pt	P-B6	Loan	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93082	Cheetah	M 193 00-0021-3258	1.0	9Y : 5M : 17D	Pt	P-B6	Loan	Weight	41kg	IE
P93084	Cheetah	M 199 00-001B-F007	1.0	8Y : 5M : 16D	Pt	P-B9	Loan	Immob; vaccinate	5 +5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 55kg	IE
P93084	Cheetah	M 199 00-001B-F007	1.0	8Y : 5M : 16D	Pt	P-B9	Loan	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
P93084	Cheetah	M 199 00-001B-F007	1.0	8Y : 5M : 16D	Pt	P-B9	Loan	Weight	55kg	IE
907442	Impala	Newborn 1' 98	0.1	09.12.1998	B4		Dead	Exam; Rx	Has diarrhoea; rejected by mother; cleaned cabed tail & perineum; Rx: 1ml Baytril; 1ml Peni LA; 1ml Vit Bco + oligo; stomach tubed 50ml Lectade; prenuine on slain; D1/196 --------> B4 - for handraising by Ronel	IE
907441	Suricate	Don 98/137	1.0	09.12.1997	A1		Dead	Admit; hospitalize	Animal came in after hours & Martie put it in the Backyard; tame?	IE
907441	Suricate	Don 98/137	1.0	09.12.1997	A1		Dead	Intro; exam	Found by public in Soutpansberg Road - appears very tame; no other history. Animal came in after hours & Martie put it in the Backyard; tame?	IE

0 **Hospital Admittances:** No records to report on

0 **Hospital Discharges:** No records to report on

9 **Immobilizations:**

ISIS	Species	ID	Date	Immob No.	Narcotic	TOTAL (mg)	Vet
907537	Cheetah	K 16 00-0020-2B86	09.12.1998	I0255/98	Saffan	15.00	IE
P93255	Cheetah	M 105 00-0025-D120	09.12.1998	I0254/98	Saffan	5.00	IE
P93295	Cheetah	M 126 00-001C-45E8 Koos	09.12.1998	I0261/98	Saffan	5.00	IE
P93065	Cheetah	M 159 00-0020-3AEE	09.12.1998	I0256/98	Saffan	5.00	IE
P93073	Cheetah	M 182 00-0021-36BB	09.12.1998	I0257/98	Saffan	5.00	IE
P93075	Cheetah	M 184 00-0024-C9C3	09.12.1998	I0259/98	Saffan	10.00	IE
P93082	Cheetah	M 193 00-0021-3258	09.12.1998	I0260/98	Saffan	5.00	IE
P93084	Cheetah	M 199 00-001B-F007	09.12.1998	I0258/98	Saffan	10.00	IE
901876	Forest Buffalo	1 M 00-001B-CEE9 red/red	08.12.1998	I0271/98	Etorphine	5.00	IE

7 Parasite Records:

Encl	Species	ID	Date	Parasite	Drug	Dose	Notes
P-B7	External Parasites	M 159 00-0020-3AEE	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas
P-B3	External Parasites	M 182 00-0021-36BB	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas
P-B8	External Parasites	M 184 00-0024-C9C3	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas
6	External Parasites	M 193 00-0021-3258	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas
P-B9	External Parasites	M 199 00-001B-F007	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas
P-B2	External Parasites	M 105 00-0025-D120	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas
P-B3	External Parasites	M 126 00-001C-45E8 Koos	09.12.1998	External Parasites	Frontline (20 - 40kg)	1 Tube	For ticks and fleas

14 Vaccinations:

ISIS	Species	ID	Sex	Age	Date	Vaccine	Serial No.	Next Date
P93255	Cheetah	M 105 00-0025-D120	1.0	13Y : 4M : 14D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93255	Cheetah	M 105 00-0025-D120	1.0	13Y : 4M : 14D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999
P93295	Cheetah	M 126 00-001C-45E8 Koos	1.0	12Y : 4M : 4D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93295	Cheetah	M 126 00-001C-45E8 Koos	1.0	12Y : 4M : 4D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999
P93065	Cheetah	M 159 00-0020-3AEE	1.0	10Y : 2M : 13D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93065	Cheetah	M 159 00-0020-3AEE	1.0	10Y : 2M : 13D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999

ISIS	Species	ID	Sex	Age	Date	Vaccine	Serial No.	Next Date
P93073	Cheetah	M 182 00-0021-36BB	1.0	10Y : 6M : 9D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93073	Cheetah	M 182 00-0021-36BB	1.0	10Y : 6M : 9D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999
P93075	Cheetah	M 184 00-0024-C9C3	1.0	9Y : 1M : 27D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93075	Cheetah	M 184 00-0024-C9C3	1.0	9Y : 1M : 27D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999
P93082	Cheetah	M 193 00-0021-3258	1.0	9Y : 5M : 17D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93082	Cheetah	M 193 00-0021-3258	1.0	9Y : 5M : 17D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999
P93084	Cheetah	M 199 00-001B-F007	1.0	8Y : 5M : 16D	09.12.1998	Fel-O-Vax Lv-K IV	220177A	15.12.1999
P93084	Cheetah	M 199 00-001B-F007	1.0	8Y : 5M : 16D	09.12.1998	Rabdomun (inactive)	723103	15.12.1999

1 Postmortems:

ISIS	Species	ID	Sex	Age	Sec	Date	P.M. No.	Death	Diagnosis	Vet
907420	Geoffroy's Cat	Newborn 2 '98 Juno	0.1	0Y : 0M : 12D	B1	08.12.1998	98/0259/B2	08.12.1998	Severe acute peritonitis & enteritis - suspect secondary umbilical infection	IE

5.5 Medical Report by Section

5.5.1 This report is similar to the one above, but the data is sorted in the report according to the different sections in the Zoo.

5.5.2 Clicking on the ***Medical Rep Section*** button (**Figure 53**, **Figure 55**) opens the form in **Figure 56**.

Figure 55

5.5.3 There are six categories to choose from to include or exclude in the report

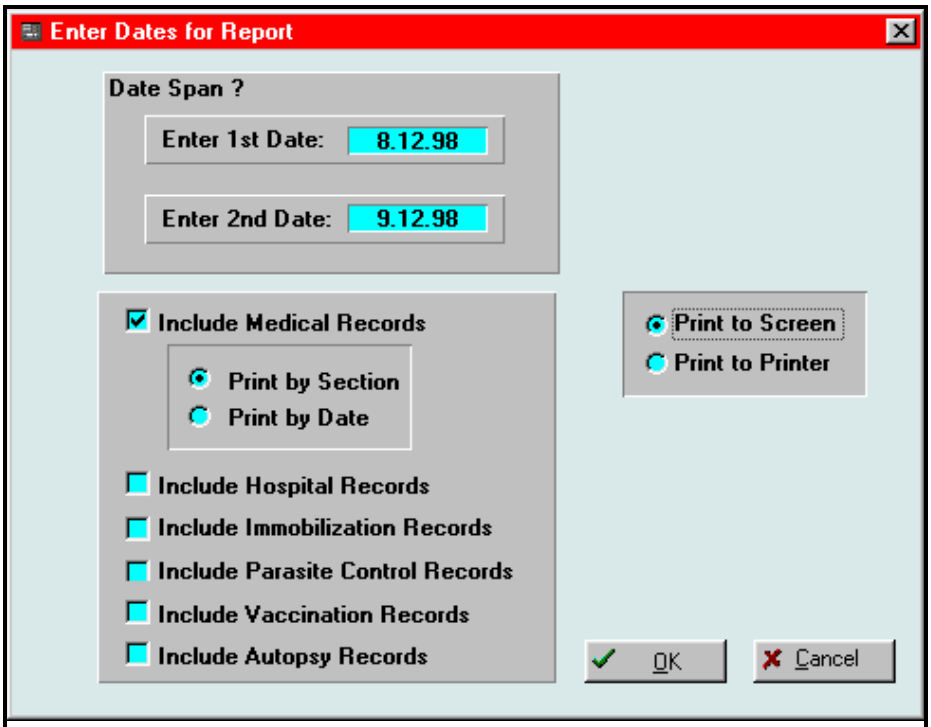


Figure 56 Medical History specification form. In this example only the Medical Records are selected for the report to be printed to the screen and sorted by Section.

5.5.4 If the user is only interested in the vaccinations done for that period, then it can be selected without having to print many pages of unwanted information.

5.5.5 An example of a *Medical Report by Section* report is given on page 72

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

9 December 1998 to
9 December 1998

Medical Report

A1

Date	Species	ID	ISIS	Sex	Birth	Encl	Procedure	Comments	Vet
09.12.1998	Suricate	Don 98/137	907441	1.0	09.12.1997		Admit; hospitalize	Animal came in after hours & Martie put it in the Backyard; tame?	IE
09.12.1998	Suricate	Don 98/137	907441	1.0	09.12.1997		Intro; exam	Found by public in Soutpansberg Road - appears very tame; no other history. Animal came in after hours & Martie put it in the Backyard; tame?	IE

B4 Angie

Date	Species	ID	ISIS	Sex	Birth	Encl	Procedure	Comments	Vet
09.12.1998	Cheetah	K 16 00-0020-2B86	907537	1.0	18.04.1991	101	Immob; vaccinate	5 + 10ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 40kg	IE
09.12.1998	Cheetah	K 16 00-0020-2B86	907537	1.0	18.04.1991	101	Parasite control	Frontline top Spot 20-40 kg for ticks and fleas	IE
09.12.1998	Cheetah	K 16 00-0020-2B86	907537	1.0	18.04.1991	101	Weight	40kg	IE
09.12.1998	Impala	Newborn 1' 98	907442	0.1	09.12.1998		Exam; Rx	Has diarrhoea; rejected by mother; cleaned cabed tail & perineum; Rx: 1ml Baytril; 1ml Peni LA; 1ml Vit Bco + oligo; stomach tubed 50ml Lectade; prenuine on slain; D1/196 -------> B4 - for handraising by Ronel	IE

Pt Wouter L

Date	Species	ID	ISIS	Sex	Birth	Encl	Procedure	Comments	Vet
09.12.1998	Cheetah	M 105 00-0025-D120	P93255	1.0	09.05.1987	P-B2	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV, FeL; Wt = 31kg	IE
09.12.1998	Cheetah	M 105 00-0025-D120	P93255	1.0	09.05.1987	P-B2	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
09.12.1998	Cheetah	M 105 00-0025-D120	P93255	1.0	09.05.1987	P-B2	Weight	31kg	IE

Pt Wouter L

Date	Species	ID	ISIS	Sex	Birth	Encl	Procedure	Comments	Vet
09.12.1998	Cheetah	M 126 00-001C-45E8 Koos	P93295	1.0	17.04.1988	P-B5	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 33kg	IE
09.12.1998	Cheetah	M 126 00-001C-45E8 Koos	P93295	1.0	17.04.1988	P-B5	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
09.12.1998	Cheetah	M 126 00-001C-45E8 Koos	P93295	1.0	17.04.1988	P-B5	Weight	33kg	IE
09.12.1998	Cheetah	M 159 00-0020-3AEE	P93065	1.0	21.04.1990	P-B7	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 40kg	IE
09.12.1998	Cheetah	M 159 00-0020-3AEE	P93065	1.0	21.04.1990	P-B7	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
09.12.1998	Cheetah	M 159 00-0020-3AEE	P93065	1.0	21.04.1990	P-B7	Weight	40kg	IE
09.12.1998	Cheetah	M 182 00-0021-36BB	P93073	1.0	01.07.1991	P-B3	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 40kg	IE
09.12.1998	Cheetah	M 182 00-0021-36BB	P93073	1.0	01.07.1991	P-B3	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
09.12.1998	Cheetah	M 182 00-0021-36BB	P93073	1.0	01.07.1991	P-B3	Weight	40kg	IE
09.12.1998	Cheetah	M 184 00-0024-C9C3	P93075	1.0	01.07.1991	P-B8	Immob; vaccinate	5 +3 +2ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 43kg	IE
09.12.1998	Cheetah	M 184 00-0024-C9C3	P93075	1.0	01.07.1991	P-B8	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
09.12.1998	Cheetah	M 184 00-0024-C9C3	P93075	1.0	01.07.1991	P-B8	Weight	43kg	IE
09.12.1998	Cheetah	M 193 00-0021-3258	P93082	1.0	29.03.1991	P-B6	Immob; vaccinate	5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Rx Wt = 41kg	IE
09.12.1998	Cheetah	M 193 00-0021-3258	P93082	1.0	29.03.1991	P-B6	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE
09.12.1998	Cheetah	M 193 00-0021-3258	P93082	1.0	29.03.1991	P-B6	Weight	41kg	IE
09.12.1998	Cheetah	M 199 00-001B-F007	P93084	1.0	12.03.1992	P-B9	Immob; vaccinate	5 +5ml Saffan i/v gastroscope + biopsy by Prof Lobetti; vaccinate Fel-O-Vax Ser Nº 220177A + Rabdomum Ser Nº 723103 s/c; blood taken for FIP, FIV; FeL; Wt = 55kg	IE
09.12.1998	Cheetah	M 199 00-001B-F007	P93084	1.0	12.03.1992	P-B9	Parasite control	Frontline Top Spot 20-40kg for ticks & fleas	IE

Pt **Wouter L**

Date	Species	ID	ISIS	Sex	Birth	Encl	Procedure	Comments	Vet
09.12.1998	Cheetah	M 199 00-001B-F007	P93084	1.0	12.03.1992	P-B9	Weight	55kg	IE

0 **Hospital Admittances:** Not selected

0 **Hospital Discharges:** Not selected

0 **Immobilizations:** Not selected

0 **Parasite Records:** Not selected

0 **Vaccinations:** Not selected

0 **Postmortems:** Not selected

5.6 Medical Report by Locality

Figure 57

5.6.1 This report is useful for providing a monthly report on the activities at a specific locality(s) which are provided for accurate entry by the drop-down list.

5.6.2 The report can be further narrowed down specific Sections in the Zoo.

5.6.3 Clicking on the ***Medical Rep Locality*** button in **Figure 57** opens the form in **Figure 54**.

5.6.4 The report can be narrowed down to include records on one or more Localities or a specific section in the Zoo.

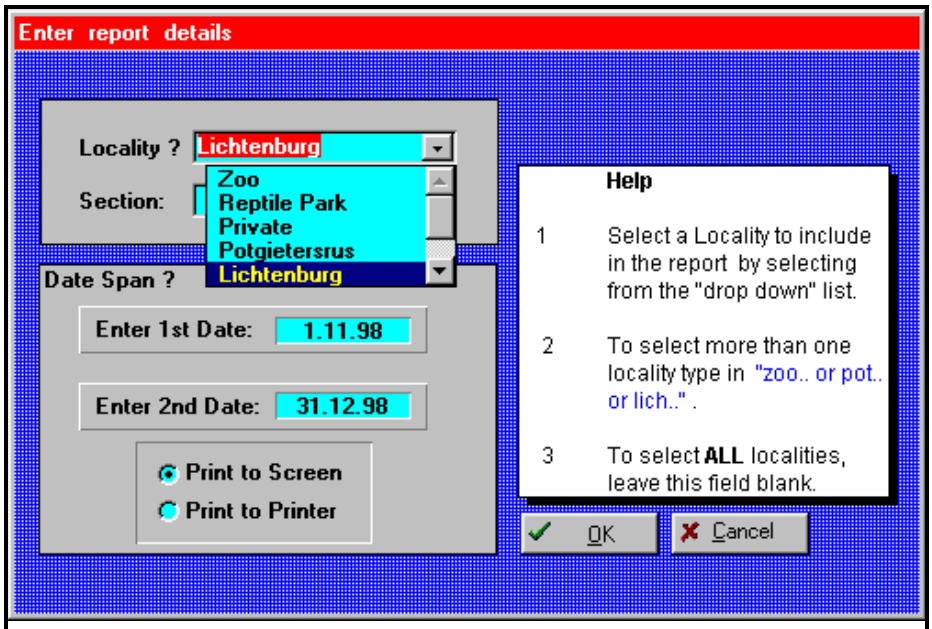


Figure 58 *Medical Report* Form. Both the Locality and Section fields can be entered by selecting the values in the drop-down fields. An interactive **Help** dialogue is provided for assistance. It is possible to include more than one Locality for the report.

5.6.5 Leaving the *Locality* and *Section* field blank will result in all records for the specified period being printed which could result in quit a lengthy report.

5.6.6 In the example given on page 76, the locality was selected as “Lichtenburg” for the period 1 November 1998 to 31 December 1998.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:
1 November 1998 to 31 December 1998

Procedure Report

Date	ISIS	Species	ID	Sex	Age	Sec	Encl	Proced	Comments	Vet
Lichtenburg										
Lt	**Andre M**									
23.11.1998	L92422	Forest Buffalo	00-01F6-1A56 LHS wht/grn R ear	1.0	Y : 11M : 21	Lt	L	Immob; mark; translocate	3mg M99; 50mg Azaperone + 5mg; Rx: 20ml Peni LA; 20ml Drastic Deadline; 100mg Trilafon i/m; 00-01F6-1A56 Shoulder LHS; Disc White in, green out; D1/183 -----> Ltx	IE
23.11.1998	L92421	Forest Buffalo	012A-681E grn/grn	0.1	01.04.1996	Lt	L	Immob; mark; translocate	3mg M99; 80mg Atoperone; 5mg Xylazine; Rx: 20ml Peni LA; 150mg Trilafon i/m; 20ml Drastic Deadline; Loaded into truck D1/183 -----> Ltx	IE
23.11.1998	L92421	Forest Buffalo	012A-681E grn/grn	0.1	01.04.1996	Lt	L	Immob; translocate	3mg M99; 80mg Atoperone; 5mg Xylazine; Rx: 20ml Peni LA; 150mg Trilafon i/m; 20ml Drastic Deadline; Loaded into truck D1/183 -----> Ltx	IE
03.11.1998	901876	Forest Buffalo	1 M 00-001B-CEE9 red/red	1.0	)Y : 6M : 15	Lt	L	Immobilize	3.5 + 1.0mg M99 + 80mg Azaperone ; Rx: 20mg Peni LA i/m; 10ml Ivomec; tagged red in, red out L ear; blood taken for USA.	CONS
08.12.1998	901876	Forest Buffalo	1 M 00-001B-CEE9 red/red	1.0	)Y : 6M : 15	Lt	L	Immobilize	4mg + 1mg M99 + 60mg Azaperone; EDTA blood for Blue Tongue ----> USDA	IE

Date	ISIS	Species	ID	Sex	Age	Sec	Encl	Proced	Comments	Vet
Lichtenburg										
Lt Andre M										
30.11.1998	L92424	Grevy's Zebra	1 F 00-0125-18EB	0.1	7Y : 7M : 5I	Lt	L	Immob; mark; translocate	Immob 5mg M99 + 10mg Demosedan; Rx: 100mg Azaperone i/m + 25ml Peni LA; transponder on LHS; loaded into game truck; D3/157 -------->Ltx	IE
30.11.1998	L92423	Grevy's Zebra	1 M 00-0143-D6E4	1.0	?Y : 5M : 25	Lt	L	Immob; mark; translocate	Immob 5mg M99 + 10mg Demosedan; Rx: 100mg Azaperone i/m ; transponder on LHS; loaded into game truck; D3/157 -------->Ltx	IE

5.7 Medical History

Figure 59

5.7.1 The *Medical History* generates a report on all the procedures and laboratory reports performed on a patient The report can be flexible in terms of what can be included. If certain information is required only, then that section which is required can

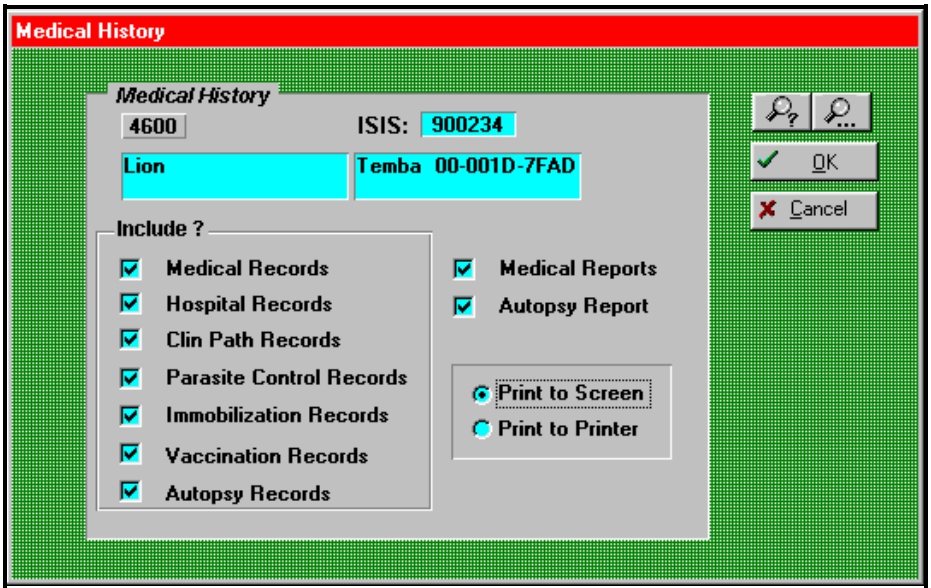


Figure 60 The *Medical History* form. The form allows for a patient to be searched with the two button above the ***OK*** button. All the options have been selected for inclusion in the report.

be selected and printed, failing this many unnecessary pages of unwanted information will be printed which will be a waste of paper.

5.7.2 Clicking on the ***Medical History*** button in **Figure 59** opens the form in **Figure 60**. The form in **Figure 60** shows a list of subheadings which can be selected for inclusion in the report. In the example on page 79 a full *Medical History* report is produced including all laboratory reports.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

25 March 2002

Medical History

Patient

ISIS: 900234 Status: Dead Sex: 1.0 Sec: D2 Log ON: 05.06.1991

Species: Lion **ID:** Temba 00-001D-7FAD Birth: 12.08.1975 Encl: 191 Removed: 26.02.1994

Age: 18Y : 6M : 16D Cons: Paul

Date	Procedure	Comments	Vet
05.06.1991 15Y : 9M : 23D	Immob; vaccinate	blood for FIV	IE/SQ
17.06.1991 15Y : 10M : 5D	Examine	Western blotting; FIV +ve	IE
02.07.1991 15Y : 10M : 20D	Examine	Did not eat last night; vomited in cage; will check again when he comes into cage tomorrow	GM
10.04.1992 16Y : 7M : 29D	Faecal	+ve; hookworm ??; low infestation	JR
06.07.1992 16Y : 10M : 24D	Immobilize	Blood for FIV; transponder 00-001D-7FAD shoulder LHS; 500mg zoletil; 4ml atropine; 5ml ivomec s/c	IE
17.09.1992 17Y : 1M : 6D	Examine	Vomit with pieces of meat in the nightroom; severe limp L fore with blood on upper aspect of paw; bite wound ??; observe	IE
01.10.1992 17Y : 1M : 20D	Vaccinate	Felocell CVR 31483310 by dart; still limping on L fore; ingrowing nail ??	JR
23.03.1993 17Y : 7M : 11D	Examine	Paul suggests there is a change to the stride of the hindlegs; examine NAD; possibly early arthritis	PB
07.05.1993 17Y : 8M : 25D	Examine	Nails growing into pads, front paws; to be immobilized and nails trimmed	PB
10.05.1993 17Y : 8M : 28D	Exam; Immob; Rx	300mg zoletil + 100mg rompun; + 200mg zoletil; cut ingrowing nails IV L&R fore; also cut other nails; Rx: 30ml peni LA; clean wound in pads w iod/pren	IE/PB
16.10.1993 18Y : 2M : 5D	Examine	Not eaten past two days - ate today; observe	PB
27.10.1993 18Y : 2M : 15D	Examine	Has not eaten for the past four days; reluctant to come into the nightroom today - i.e. change in behaviour	PB
28.10.1993 18Y : 2M : 16D	Immob; Rx	Immobilize 500mg zoletil + 100mg xylazine; examine - pale mucous membranes, refill <2sec; temp 37.5; teeth OK; lungs N.A.D; Heart N.A.D; abdomen (fat), small mass 5*4cm palpable mid-abdomen - spleen?; claws - little regrowth; blood ---> O.P. clinpath.	PB
29.10.1993 18Y : 2M : 17D	Examine	Recovered from immobilization; eating	PB
31.10.1993 18Y : 2M : 19D	Examine	Did not eat last night	PB
02.11.1993 18Y : 2M : 21D	Report	Clin path: haemoglobinaemia; low RBC count; low PCV and an increase in MCV ie anaemia; high urea; low reticulocytes; all meaning a non-regenerative macrocytic normochromic anaemia most probably due to renal failure	PB
05.11.1993 18Y : 2M : 24D	Rx	100mg anabolin by dart; to feed chickens rather than red meat	PB
03.12.1993 18Y : 3M : 22D	Examine	Paul feels there has been a deterioration in habitus and appetite; should have a repeat of anabolin	PB
04.01.1994 18Y : 4M : 23D	Rx	4ml anabolin by dart; appears to be losing weight; wasting of muscles in hind legs; kidneys are possibly starting to fail	PB
17.01.1994 18Y : 5M : 6D	Examine	Vomiting watery blood tinged fluid; may be uraemic ----> haemoptesis; prognosis guarded; to feed low protein diet - chicken mielie pap ?	IE/PB

Date	Procedure	Comments	Vet
21.01.1994 18Y : 5M : 10D	Examine	Paul reports that his food intake has dropped and he seems more listless; to try with some fat free mince	IE
22.01.1994 18Y : 5M : 11D	Examine	Dean concerned that he did not touch his food; Paul could not get him in last night, but he came in later as there were faeces in the nightroom; to try giving him any meat to eat; to do a faecal	IE
23.01.1994 18Y : 5M : 12D	Examine	In nightroom; ate meat on bone last night; no evidence of faeces or urine in nightroom; not sure if he is drinking water; to do faecal	IE
24.01.1994 18Y : 5M : 13D	Faecal	Flotation +++ve Toxascaris leonina & ++ve Coccidia ?? Toxoplasmosis ?? oocysts (difficult to see)	IE
26.01.1994 18Y : 5M : 15D	Deworm	4000mg (20mg/kg*200kg) pyrantel base in food	PB
29.01.1994 18Y : 5M : 18D	Examine	Not coming into nightroom during the day and therefore cannot be locked in to collect faecal sample	PB
03.02.1994 18Y : 5M : 23D	Faecal	Flotation -ve for Toxascaris; 4 +ve Coccidia ??	PB
10.02.1994 18Y : 5M : 30D	Examine	General condition appears to be deteriorating; Wt loss; anorexia today; increased resp. rate although in a cool nightroom	PB
12.02.1994 18Y : 6M : 2D	Examine	Appears to have recovered from immobilization - still to eat today	PB
14.02.1994 18Y : 6M : 4D	Faecal	Faecal -ve for coccidia	IE
14.02.1994 18Y : 6M : 4D	Immob; Rx	Immobilize 250mg zoletil + 300mg xylazine im; examine - very pale mucous memb., refill OK; Chest - moist rales esp. ventrally; pitting on chest from stethascope; dehydrated - skin remained folded; Temp 37.8; blood ---> clinpath & Prof Howell	PB
14.02.1994 18Y : 6M : 4D	Rx	Rx 1.5l plasmolyte B iv; 200mg anabolin forte im; 10ml Vit Bco; 10ml Peni LA; 4ml ivomectin; started waking up +-60min post darting; 4ml yohimbine im plus 4ml iv - not all went iv - moderate response	PB
16.02.1994 18Y : 6M : 6D	Faecal	Faecal flotation -ve	PB
16.02.1994 18Y : 6M : 6D	Report	Report re:- clinpath; non-regenerative anaemia probably due to chronic renal failure; animal dehydrated; moderate neutrophilia with left shift - inflammation, stress or infection (Dr T. Dippenaar)	PB
21.02.1994 18Y : 6M : 11D	Faecal	Faecal -ve	PB
25.02.1994 18Y : 6M : 15D	Examine	Has not eaten for the past two days; going out of nightroom but no further than the bottom of the moat - been there since yesterday; recommend euthanasia	PB
26.02.1994 18Y : 6M : 16D	Autopsy	Carcase ---> O.P.; skin and salt hide for Transvaal museum; P.M. by Dr J. Jardine; samples taken for Prof Howell re:- HIV	PB
26.02.1994 18Y : 6M : 16D	Immob; euthanase	Condition deteriorating - still has not moved from moat or eaten; appears reluctant/unable to lift head; immobilize 500mg zoletil im; 50ml euthanase iv; carcase ---> O.P.	PB

Hospitalizations No records to report on

Immobilizations

Date	Immob No.	Narcotic	Dose (mg)	Tranq I	Dose I (mg)	Tranq II	Dose II (mg)	Recumb (h:m:s)	Antidote	Anti Dose (mg)	Time UP (h:m:s)	Comments	Vet
05.06.1991	I0119/91	Zoletil	875.0					0:30:0				1st dart near stifle joint -- slow absorption ??	IE/SQ
06.07.1992	I0139/92	Zoletil	500.0					0:7:30				Had profuse salivation & and also very rigid; Rx: 2mg=4ml atropine; salivation stopped; 5ml ivomec s/c; went well apart from unusual reactions	IE
10.05.1993	I0167/93	Zoletil	300.0	Rompun	100.0			0:23:0	Yohimb	5ml		1st dart not sufficient to knock him out; 2nd given at 16:20min; very smooth anaesthesia; after yohimb tried to get up & developed muscle tremours/rigidity; paddling; licking; suggest 500mg z +100mg r	PB

Date	Immob No.	Narcotic	Dose (mg)	Tranq I	Dose I (mg)	Tranq II	Dose II (mg)	Recumb (h:m:s)	Antidote	Anti Dose (mg)	Time UP (h:m:s)	Comments	Vet
28.10.1993	I0351/93	Zoletil	500	Xylazine	100			0:14:0	Yohimbine	5ml	1:4:0	Very smooth procedure; yohimbine given after 1 hour => animal recovered such that it could lift its head; refer immobilization sheet re:- recommendations for future immobilizations	PB
14.02.1994	I0019/94	Zoletil	250	Xylazine	300			0:5:30	Yohimbine	4ml im + iv		Rapid induction (sick lion with anaemia and chronic kidney failure); +-60min started lifting head; yohimbine im and attempted iv dose - only moderate response	PB
26.02.1994	I0030/94	Zoletil	500					0:9:0				50ml ethanase iv; very smooth procedure	PB

Parasite Control No records to report on

Vaccinations

Date	Vaccine	Manufacturer	Serial No.	Dose
05.06.1991	Felocell CVR	SmithKline Beecham		
01.10.1992	Felocell CVR	SmithKline Beecham	31483310	

CLinical Pathology No records to report on

ISIS

Mean SD Min Max N

Postmortem

Date	P.M. No.	Date of Death	Diagnosis	Vet
26.02.1994	94/0065/D2	26.02.1994	Euthanased; Systemic haemangiosarcoma	PB

Report

Ref.:WPM257.94

7 March 1994

PATHOLOGY REPORT
Your reference: Our reference: PM257.94 S505.94
Date submitted: 26 February 1994

Species: Panthera leo Lion Breed: White Lion Sex:
Age: 19 years Colour: pale biscuit-white Name/ID:
Specimen(s): Carcase

RESULT: The necropsy revealed severe multifocal haemangiosarcoma in the lungs, myocardium, kidneys, GIT, striated muscles, and brain. The metastatic foci were accompanied by very severe haemorrhage and thrombosis and the cardiac lesions were particularly severe in this regard. The neoplasms consist of cells with very plump oval to round nuclei and eosinophilic poorly delineated cytoplasm. The cells are arranged in very haphazard vascular channels which contain red blood cells. The cells show a high degree of mitotic activity and appear rather anaplastic. There is considerable necrosis and thrombosis associated with the tumours. Special immunohistochemical stains were utilised to elucidate the cellular type of the neoplasm. Staining with desmin and vimentin point towards a cell of mesenchymal origin with contractile ability. Most significantly, the staining against factor 8 related antigen was strongly positive. factor 8 is only found in endothelial cells where it is one of the clotting factors. These findings indicate fairly conclusively that the neoplasm is an haemangiosarcoma.

The liver showed large multi-locular cystic structure, many of which were fluid-filled and some containing clotted blood. Histologically these structures are lined with proliferative biliary epithelium and can be classified as benign hepatic cystadenomas.

The lungs macroscopically showed dense yellow-brown areas in the dorsal aspects of the caudal and muddle lobes. Histologically these consist of large areas of inflammation characterised by severe macrophage accumulation as well as alveolar wall fibrosis and epithelialisation. The macrophages have a very foamy cytoplasm and there are large vacuoles in the alveoli suggestive of a lipid-like substance. These findings are strongly suggestive of exogenous lipid pneumonia due to the aspiration of a lipid-rich fluid. No sign of pneumocystosis was detected.

The bone marrow, spleen, and lymph nodes show very marked haemopoiesis. Extra-medullary haemopoiesis (EMH) is also visible in the liver, lungs and adrenal cortex. The lymphoid tissues are depleted and in some nodes there is practically complete absence of the cortex and paracortex with tremendous medullary cord hyperplasia, due to plasmacytosis and EMH.

The GIT shows very mild eosinophilic infiltrates in the mucosa indicative of recent parasite infestation. No other significant lesions were noted apart from metastatic neoplasms and accompanying thrombosis and haemorrhage. The kidneys also show insignificantly mild focal interstitial nephritis.
The adrenal gland shows interesting changes with focal hyperplasia in the cortex. These cells have also managed to break through the capsule and invade the surrounding tissues. The cells show little in the way of advanced neoplastic change, this invasive behaviour is not enough to classify this as neoplastic and merely represent advanced hyperplasia.

DIAGNOSIS: Euthanasia while suffering from systemic haemangiosarcoma.

COMMENT: The primary site of this neoplasm is interesting. Cats are reported to have haemangiosarcomas arising primarily in the spleen, sub-cutaneous tissues and GIT. Dogs show the same neoplasms arising in spleen, right atrium and liver. To the best of my knowledge this lion showed no sign of primary neoplasia in the spleen. The most likely primary sites are then in the GIT or the liver. The lesion in the distal ileum was very large, but more of a haematoma than neoplasm. In my opinion this lesion most probably arose first in the liver with spread to the lungs and myocardium and final dissemination to skeletal muscle, brain, kidney and gut.

I shall attempt to follow up the histological examination with electron microscopy of the neoplasm to further confirm its nature. Factor 8 containing granules, Weibel-Palade bodies, should be distinguished in the cells. I will let you have the results of this investigation as soon as they come to hand.

Yours sincerely

Dr J E Jardine BVSc MRCVS
Senior Lecturer: Department of Pathology
8 March 1994

Medical Reports No records to report on

5.8 Hospital Report

Figure 61

5.8.1 The *Hospital Report* on page 84 generates a list on all the animals in the Hospital on any specified day. It is a very useful report for checking to see exactly which animals are in Hospital.

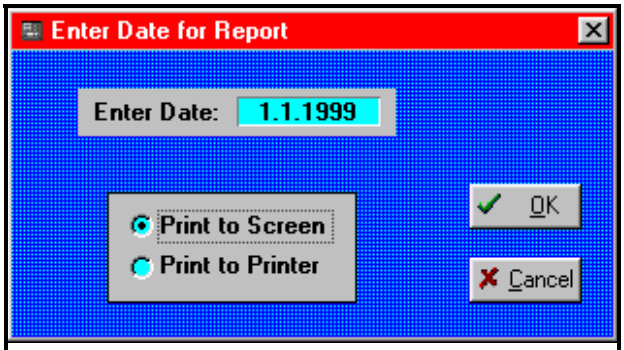


Figure 62 Form for Date entry for Hospital Report.

5.8.2 The Hospital has two sections; A1 for small animals and A3 "*Bomas*" for antelope.

5.8.3 Clicking on the ***Hospital Rep A1 and A3*** button in **Figure 61** opens the form in **Figure 62** where only a single date is required to be entered for the report.

[redacted]

Veterinary Hospital

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Hospital Report

Animals in Hospital on: **Fri, 1 January 1999.**

Hospital

ISIS	Species	ID	Sex	Age	Date IN	Hosp No.	Diagnosis	From
907409	African Wild Cat	Don 98/007/Pt 00-01F6-E87C	1.0	0Y : 8M : 19D	12.11.1998	H0213/98	Boarding	A1/
None	Angora Goat	Newborn 4 '98	0.1	Unknown	22.12.1998	H0234/98	Verminosis - severe anaemia	B3/Farm
907474	Burchell's Coucal	Don 98/145 6-20337	0.0.1	0Y : 0M : 2D	30.12.1998	H0237/98	Mauled by dogs	Intro
907428	Cape Vulture	Don 98/? /LTX G-11626 01F6-19B4	0.1	0Y : 1M : 7D	24.11.1998	H0221/98	Poisoning	Intro
907470	Common Marmoset	Don 98/? 00-01F7-1A12	1.0	7Y : 0M : 3D	27.12.1998	H0236/98	Quarantine	Intro
P93503	Giant Eagle Owl	Don 98/007/P J-12843 01F7-E523	0.1	2Y : 5M : 16D	16.07.1998	H0133/98	Compound # R wing	Intro
900582	Grass Owl	7-80000	0.1	9Y : 10M : 20D	23.11.1998	H0220/98	Tumour	C2/5
905407	Harlequin Quail	4-84127	0.0.1	2Y : 9M : 6D	26.03.1996	H0043/96	Quarantine	Intro
907432	Kodiak Bear	Manna 00-0124-9E78	0.1	12Y : 2M : 0D	25.11.1998	H0223/98	Quarantine	Intro
907431	Kodiak Bear	Woetie 00-0123-2D55	0.1	13Y : 1M : 0D	25.11.1998	H0224/98	Quarantine	Intro
907246	Lanner Falcon	Ex Ltx 00-01F7-EB6D	0.1	1Y : 3M : 27D	04.09.1998	H0164/98	Quarantine	Intro
None	Leopard Tortoise	Don 96/069	0.1	Unknown	05.11.1996	H0180/96	R hind amputated; miasis	Intro
None	Leopard Tortoise	Don 97/102	0.1	Unknown	30.09.1997	H0176/97	Boarding	Intro
None	Leopard Tortoise	Don 97/112	1.0	Unknown	15.10.1997	H0183/97	Injured carapace	Intro
None	Leopard Tortoise	Don 98/018	0.1	Unknown	25.01.1998	H0021/98	Boarding	Intro
None	Leopard Tortoise	Don 98/036	0.1	Unknown	13.03.1998	H0058/98	Boarding	Intro

Animals in Hospital on: **Fri, 1 January 1999.**

Hospital

ISIS	Species	ID	Sex	Age	Date IN	Hosp No.	Diagnosis	From
None	Leopard Tortoise	Don 98/057	1.0	Unknown	05.05.1998	H0097/98	Attacked by dog	
None	Leopard Tortoise	Don 98/?	1.0	Unknown	05.12.1998	H0226/98	Wound in shell RHS	Intro
None	Leopard Tortoise	Don 98/? /Rep	0.0.1	Unknown	21.12.1998	H0231/98	Bite wounds in carapace	Intro
907332	Lesser Bushbaby	Don 98/117	1.0	0Y : 1M : 26D	05.11.1998	H0204/98	Boarding	Intro
907412	Ovambo Sparrowhawk	Don 98/123	0.0.1	0Y : 2M : 16D	16.11.1998	H0211/98	Can't stand properly	A1/
901345	Patas Monkey	Pete 00-0063-747E	1.0	11Y : 7M : 29D	15.07.1997	H0120/97	Fractured L femur	B2/60
901765	Redwinged Starling	D-19379 R/L	1.0	10Y : 9M : 9D	30.12.1998	H0239/98	Listless	C3/12
907331	Spotted Eagle Owl	Don 98/114	0.0.1	0Y : 2M : 24D	29.10.1998	H0203/98	Handraising	Intro
906766	Suricate	906766	0.1	1Y : 3M : 0D	24.12.1998	H0235/98	Boarding	C2/206
907070	Suricate	907070	0.1	0Y : 11M : 4D	24.12.1998	H0235/98	Boarding	C2/206
907071	Suricate	907071	0.1	0Y : 11M : 4D	24.12.1998	H0235/98	Boarding	C2/206
907227	Whitefaced Owl	Don 98/088	0.1	0Y : 3M : 25D	07.09.1998	H0165/98	Injured R eye	Intro

Animals in Hospital on: **Fri, 1 January 1999.**

Hospital-Boma

ISIS	Species	ID	Sex	Age	Date IN	Hosp No.	Diagnosis	From
907287	Central Chinese Goral	F 00-016A-9435	0.1	1Y : 7M : 12D	11.10.1998	H0191/98	Quarantine	Intro
907286	Central Chinese Goral	M 00-016A-8A5B	1.0	3Y : 6M : 14D	11.10.1998	H0190/98	Quarantine	Intro
906990	Lord Derby Eland	00-0133-35DD	0.1	3Y : 4M : 20D	07.03.1998	H0056/98	Quarantine	Intro
906991	Lord Derby Eland	White Oak - Bull	1.0	2Y : 5M : 29D	07.03.1998	H0055/98	Quarantine	Intro
900617	Scimitar Horned Oryx	8 F 00-001F-D234	0.1	8Y : 9M : 6D	18.12.1997	H0225/97	Chronic deep pyoderma	D2/39
906980	Scimitar Horned Oryx	9 F 00-0121-BEF8 yel/grn	0.1	0Y : 10M : 21D	09.02.1998	H0036/98	Boarding	Intro
907288	Sichuan Takin	0097-2D2D	1.0	2Y : 6M : 12D	11.10.1998	H0188/98	Quarantine	Intro
907289	Sichuan Takin	F	0.1	1Y : 10M : 20D	11.10.1998	H0189/98	Quarantine	Intro

Note: Age is calculated from the 1 January 1999

5.9 Hospital Monthly Report

Figure 63

5.9.1 The *Hospital Monthly Report* is printed at the end of each month in order for the Animal Data Bank to update the monthly census and to know which animals

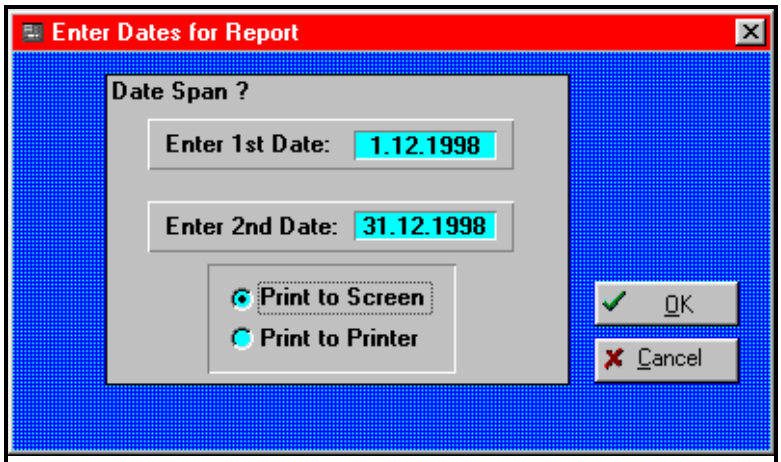


Figure 64 Date span input from for reports.

were in the Hospital during the month and at the end of the month.

5.9.2 Clicking the ***Hospital Rep Monthly D1 —> D2*** button in **Figure 63** opens the *Date span input* form shown in **Figure 64** , where the required date interval can be entered.

5.9.3 An example of the *Hospital Monthly Report* is give on page 87.

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

1 December 1998 to
31 December 1998

Hospital Monthly Report

Animals in Hospital on: **Thu, 31 December 1998.** N = **37**

ISIS	Species	ID	Sex	Age	Date_IN	Hosp_No	Diagnosis	From	Vet
905407	Harlequin Quail	4-84127	0.0.1	2Y : 9M : 5D	26.03.1996	H0043/96	Quarantine	Intro	PB
None	Leopard Tortoise	Don 96/069	0.1	Unknown	05.11.1996	H0180/96	R hind amputated; miasis	Intro	PB
901345	Patas Monkey	Pete 00-0063-747E	1.0	11Y : 7M : 28D	15.07.1997	H0120/97	Fractured L femur	B2/60	PB
None	Leopard Tortoise	Don 97/102	0.1	Unknown	30.09.1997	H0176/97	Boarding	Intro	IE
None	Leopard Tortoise	Don 97/112	1.0	Unknown	15.10.1997	H0183/97	Injured carapace	Intro	IE
900617	Scimitar Horned Oryx	8 F 00-001F-D234	0.1	8Y : 9M : 5D	18.12.1997	H0225/97	Chronic deep pyoderma	D2/39	PB
None	Leopard Tortoise	Don 98/018	0.1	Unknown	25.01.1998	H0021/98	Boarding	Intro	IE
906980	Scimitar Horned Oryx	9 F 00-0121-BEF8 yel/grn	0.1	0Y : 10M : 20D	09.02.1998	H0036/98	Boarding	Intro	PB
906991	Lord Derby Eland	White Oak - Bull	1.0	2Y : 5M : 28D	07.03.1998	H0055/98	Quarantine	Intro	IE
906990	Lord Derby Eland	00-0133-35DD	0.1	3Y : 4M : 19D	07.03.1998	H0056/98	Quarantine	Intro	IE
None	Leopard Tortoise	Don 98/036	0.1	Unknown	13.03.1998	H0058/98	Boarding	Intro	PB
None	Leopard Tortoise	Don 98/057	1.0	Unknown	05.05.1998	H0097/98	Attacked by dog		PB
P93503	Giant Eagle Owl	Don 98/007/P J-12843 01F7-E523	0.1	2Y : 5M : 15D	16.07.1998	H0133/98	Compound # R wing	Intro	IE
907246	Lanner Falcon	Ex Ltx 00-01F7-EB6D	0.1	1Y : 3M : 26D	04.09.1998	H0164/98	Quarantine	Intro	IE
907227	Whitefaced Owl	Don 98/088	0.1	0Y : 3M : 24D	07.09.1998	H0165/98	Injured R eye	Intro	IE

ISIS	Species	ID	Sex	Age	Date_IN	Hosp_No	Diagnosis	From	Vet
907289	Sichuan Takin	F	0.1	1Y : 10M : 19D	11.10.1998	H0189/98	Quarantine	Intro	IE
907288	Sichuan Takin	0097-2D2D	1.0	2Y : 6M : 11D	11.10.1998	H0188/98	Quarantine	Intro	IE
907286	Central Chinese Goral	M 00-016A-8A5B	1.0	3Y : 6M : 13D	11.10.1998	H0190/98	Quarantine	Intro	IE
907287	Central Chinese Goral	F 00-016A-9435	0.1	1Y : 7M : 11D	11.10.1998	H0191/98	Quarantine	Intro	IE
907331	Spotted Eagle Owl	Don 98/114	0.0.1	0Y : 2M : 23D	29.10.1998	H0203/98	Handraising	Intro	JR
907332	Lesser Bushbaby	Don 98/117	1.0	0Y : 1M : 25D	05.11.1998	H0204/98	Boarding	Intro	IE
907409	African Wild Cat	Don 98/007/Pt 00-01F6-E87C	1.0	0Y : 8M : 18D	12.11.1998	H0213/98	Boarding	A1/	IE
907412	Ovambo Sparrowhawk	Don 98/123	0.0.1	0Y : 2M : 15D	16.11.1998	H0211/98	Can't stand properly	A1/	IE
900582	Grass Owl	7-80000	0.1	9Y : 10M : 19D	23.11.1998	H0220/98	Tumour	C2/5	IE
907428	Cape Vulture	Don 98/?/LTX G-11626 01F6-19B4	0.1	0Y : 1M : 6D	24.11.1998	H0221/98	Poisoning	Intro	JR
907432	Kodiak Bear	Manna 00-0124-9E78	0.1	12Y : 1M : 29D	25.11.1998	H0223/98	Quarantine	Intro	IE
907431	Kodiak Bear	Woetie 00-0123-2D55	0.1	13Y : 0M : 29D	25.11.1998	H0224/98	Quarantine	Intro	IE
None	Leopard Tortoise	Don 98/?	1.0	Unknown	05.12.1998	H0226/98	Wound in shell RHS	Intro	IE
None	Leopard Tortoise	Don 98/?/Rep	0.0.1	Unknown	21.12.1998	H0231/98	Bite wounds in carapace	Intro	IE
None	Angora Goat	Newborn 4 '98	0.1	Unknown	22.12.1998	H0234/98	Verminosis - severe anaemia	B3/Farm	JR
906766	Suricate	906766	0.1	1Y : 2M : 29D	24.12.1998	H0235/98	Boarding	C2/206	IE
907070	Suricate	907070	0.1	0Y : 11M : 3D	24.12.1998	H0235/98	Boarding	C2/206	IE
907071	Suricate	907071	0.1	0Y : 11M : 3D	24.12.1998	H0235/98	Boarding	C2/206	IE
907470	Common Marmoset	Don 98/? 00-01F7-1A12	1.0	7Y : 0M : 2D	27.12.1998	H0236/98	Quarantine	Intro	IE
901765	Redwinged Starling	D-19379 R/L	1.0	10Y : 9M : 8D	30.12.1998	H0239/98	Listless	C3/12	IE
907309	Ruffed Lemur	Newborn 1 '98	0.1	0Y : 2M : 14D	30.12.1998	H0238/98	Malnutrition?	B2/69	IE

ISIS	Species	ID	Sex	Age	Date_IN	Hosp_No	Diagnosis	From	Vet
907474	Burchell's Coucal	Don 98/145 6-20337	0.0.1	0Y : 0M : 1D	30.12.1998	H0237/98	Mauled by dogs	Intro	IE

Hospital Admittances for: **December 1998** N = **16**

ISIS	Species	ID	Sex	Age	Date_IN	Hosp_No	Diagnosis	From	Vet
None	Leopard Tortoise	Don 98/?	1.0	Unknown	05.12.1998	H0226/98	Wound in shell RHS	Intro	IE
None	Angora Goat	Unknown 3 '98	0.1	Unknown	10.12.1998	H0227/98	Found flat; covered in lice	B3/Farm	JR
907441	Suricate	Don 98/137	1.0	1Y : 0M : 2D	11.12.1998	H0228/98	Quarantine	Intro	IE
906638	White Pelican	PM 025 George	1.0	1Y : 11M : 3D	13.12.1998	H0229/98	Bleeding blood feather	A1/	IE
907450	Crowned Plover	Don 98/139	0.0.1	0Y : 0M : 0D	15.12.1998	H0230/98	Amputated L carpus	Intro	IE
None	Leopard Tortoise	Don 98/?/Rep	0.0.1	Unknown	21.12.1998	H0231/98	Bite wounds in carapace	Intro	IE
906584	Darter	Don 97/055 01F6-DBCF 9-77071	0.1	2Y : 0M : 3D	22.12.1998	H0233/98	Vomiting	C3/12	IE
907462	Rufouscheeked Nightjar	Don 98/141	0.0.1	0Y : 3M : 1D	22.12.1998	H0232/98	Boarding	Intro	IE
None	Angora Goat	Newborn 4 '98	0.1	Unknown	22.12.1998	H0234/98	Verminosis - severe anaemia	B3/Farm	JR
906766	Suricate	906766	0.1	1Y : 2M : 23D	24.12.1998	H0235/98	Boarding	C2/206	IE
907070	Suricate	907070	0.1	0Y : 10M : 26D	24.12.1998	H0235/98	Boarding	C2/206	IE
907071	Suricate	907071	0.1	0Y : 10M : 26D	24.12.1998	H0235/98	Boarding	C2/206	IE
907470	Common Marmoset	Don 98/? 00-01F7-1A12	1.0	6Y : 11M : 28D	27.12.1998	H0236/98	Quarantine	Intro	IE
901765	Redwinged Starling	D-19379 R/L	1.0	10Y : 9M : 7D	30.12.1998	H0239/98	Listless	C3/12	IE
907309	Ruffed Lemur	Newborn 1 '98	0.1	0Y : 2M : 13D	30.12.1998	H0238/98	Malnutrition?	B2/69	IE
907474	Burchell's Coucal	Don 98/145 6-20337	0.0.1	0Y : 0M : 0D	30.12.1998	H0237/98	Mauled by dogs	Intro	IE

Hospital Discharges for: **December 1998** N = **20**

ISIS	Species	ID	Sex	Age	Hosp_No	Diagnosis	Date_OUT	Destination	Vet
906846	African Wild Cat	M 00-0121-C719 Bar-one	1.0	1Y : 0M : 15D	H0217/98	Coccidiosis	04.12.1998	C2/202	IE
None	Angora Goat	Unknown 3 '98	0.1	Unknown	H0227/98	Found flat; covered in lice	11.12.1998	Autopsy	JR
907417	Cape Eagle Owl	Don 97/?/Pt 9-77079 Red L 00-0144-8101	1.0	0Y : 0M : 28D	H0212/98	Scoping	15.12.1998	C5/72	IE
907213	Cape Eagle Owl	Don 98/082 9-77080 yel R 00-0144-4120	0.1	0Y : 5M : 3D	H0151/98	Quarantine	15.12.1998	C5/72	IE
905988	Cape Parrot	Suaheli 00-01F7-9CB9	1.0	3Y : 1M : 12D	H0115/98	Feather plucking	07.12.1998	223	IE
907407	Crested Barbet	Don 98/?? R. 4A03629	0.0.1	0Y : 0M : 28D	H0205/98	Fractured R radius/ulna	07.12.1998	C3/12	IE
907450	Crowned Plover	Don 98/139	0.0.1	0Y : 0M : 3D	H0230/98	Amputated L carpus	18.12.1998	Released	IE

ISIS	Species	ID	Sex	Age	Hosp_No	Diagnosis	Date_OUT	Destination	Vet
906584	Darter	Don 97/055 01F6-DBCF 9-77071	0.1	2Y : 0M : 5D	H0233/98	Vomiting	24.12.1998	Autopsy	IE
907326	Hadeda Ibis	Don 98/112	0.0.1	0Y : 1M : 18D	H0202/98	Fractured R humerus	15.12.1998	Autopsy	JR
None	Hedgehog	Don 98/090	0.0.1	Unknown	H0167/98	Boarding	28.12.1998	Released	IE
None	Hedgehog	Don 98/092	0.0.1	Unknown	H0172/98	Boarding	28.12.1998	Released	IE
None	Hedgehog	Don 98/100	0.0.1	Unknown	H0187/98	Observation	28.12.1998	Released	IE
None	Hedgehog	Don 98/120	0.0.1	Unknown	H0206/98	Boarding	28.12.1998	Released	IE
None	Leopard Tortoise	D3/163/1	1.0	Unknown	H0186/98	Respiratory Tract Disease	17.12.1998	Autopsy	IE
None	Rock Leguaan	Unknown 1 '98	1.0	Unknown	H0201/98	Prolapsed L hemipenis	17.12.1998	Reptile Park	JR
907309	Ruffed Lemur	Newborn 1 '98	0.1	0Y : 2M : 14D	H0238/98	Malnutrition?	31.12.1998	Autopsy	IE
907462	Rufouscheeked Nightjar	Don 98/141	0.0.1	0Y : 3M : 3D	H0232/98	Boarding	24.12.1998	Released	IE
907418	Spotted Dikkop	Don 98/128	0.0.1	0Y : 0M : 10D	H0222/98	Both primary feathers cut	04.12.1998	Autopsy	IE
907441	Suricate	Don 98/137	1.0	1Y : 0M : 5D	H0228/98	Quarantine	14.12.1998	Autopsy	IE
906638	White Pelican	PM 025 George	1.0	1Y : 11M : 4D	H0229/98	Bleeding blood feather	14.12.1998	C4/11	IE

Note: Age is calculated from the 31 December 1998

5.10 Species List

Figure 65

5.10.1 The *Species List Report* provides a full list patients of any selected species on the system.

5.10.2 Clicking on the ***Species List*** button in **Figure 65** opens the form in **Figure 66**, which shows a drop-down list to select the species and a second drop-down list on the form can be used to select the status of the species e.g. "Zoo" for all patients currently in the Zoo. If the *Status* field is left blank then all animals for that species will be listed regardless whether they are dead or sold. The use of drop-down lists here helps to eliminate spelling errors or the typing in of a synonym for a species.

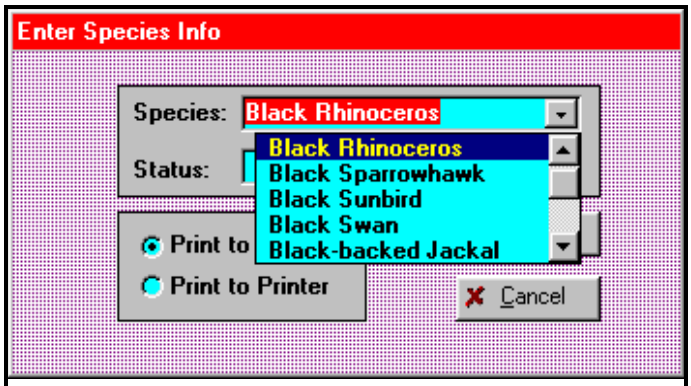


Figure 66 Data entry form for the Species List.

5.10.3 A *Species List Report* for Black Rhinoceros is on page 92.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Tue, 26 March 2002.

Species List

N = 7

B4 Ronel B

	ISIS	Species	ID	Sex	Birth	Encl	Log_ON	Removed	Status
1	907170	Black Rhinoceros	Mbani M 00-0121-C245	1.0	01.08.1993 **8Y : 7M : 24D**	133	02.06.1998		Zoo

Pt Marius P

	ISIS	Species	ID	Sex	Birth	Encl	Log_ON	Removed	Status
2	P93212	Black Rhinoceros	Addo bull	1.0	03.05.1983 **18Y : 10M : 23D**	P	17.04.1991	30.06.2000	Potgietersru
3	P93214	Black Rhinoceros	Kojak	1.0	01.01.1980 **22Y : 2M : 23D**	P	17.04.1991		Potgietersru
4	P93366	Black Rhinoceros	M '95	1.0	17.06.1995 **1Y : 4M : 9D**	PC2	19.06.1995	25.10.1996	Dead
5	P93559	Black Rhinoceros	Newborn 1 '97	0.0.1	01.12.1997 **4Y : 3M : 23D**	P-D	19.02.2000		Potgietersru
6	P93521	Black Rhinoceros	Newborn 1 '99	0.0.1	20.10.1999 **2Y : 5M : 5D**	P-D	23.10.1999		Potgietersru
7	P93213	Black Rhinoceros	Sponono PRY F08 yel L	0.1	01.01.1982 **20Y : 2M : 23D**	P	16.04.1991		Potgietersru

5.11 Vaccination Reminder

Figure 67

5.11.1 The *Vaccination Reminder* is a useful tool for planning a vaccination work schedule and for ordering the vaccines well in advance.

5.11.2 Clicking on the ***Vaccination Reminder*** button in **Figure 67** opens the form in **Figure 52** where a date interval can be entered to generate the *Vaccination Reminder*. The default

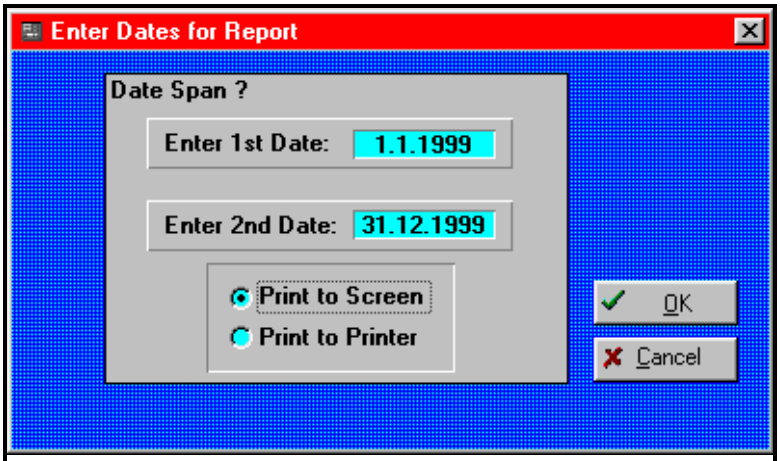


Figure 68 The date span input from for reports.

blank entry for the ***1st Date:*** is ***1.1.1990*** and the default blank entry for the ***2nd Date:*** is ***"Today's Date"***. These default values are only functional if the fields are left blank.

5.11.3 In this example the date fields are filled in to produce a *Vaccination Reminder* report for the year 1999 show on page 94.

[redacted]

Veterinary Hospital

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Vaccination Reminder

ISIS	Species	ID	Date	Vaccine	Next Date
March 2001					
906028	African Wild Cat	M 00-0141-2366 '97 Kit-kat	01.03.2000	Fel-O-Vax Lv-K IV	15.03.2001
906598	African Wild Cat	F 00-01BB-5DB1 Flake	01.03.2000	Fel-O-Vax Lv-K IV	15.03.2001
E00020	Lion	Bandit 00-05FE-1217	01.02.2001	Fel-O-Vax IV	16.03.2001
April 2001					
E00018	Lion	00-01FD-F8B5 Hunter Newborn 5 '00	30.10.2000	Fel-O-Vax Lv-K IV	30.04.2001
May 2001					
907667	Tiger	Newborn 2 '99 00-01D2-FB0E	31.05.2001	Fel-O-Vax IV	31.05.2001
907667	Tiger	Newborn 2 '99 00-01D2-FB0E	31.05.2001	Rabisin	31.05.2001
June 2001					
903754	Maned Wolf	Tokian 00-013A-F35C	23.06.2000	Rabisin	23.06.2001
905525	Maned Wolf	1 F Toya 00-0012C-6570	23.06.2000	Rabisin	23.06.2001
907537	Cheetah	K 16 00-0020-2B86	28.06.2000	Rabisin	28.06.2001
August 2001					
906845	African Wild Cat	Tempo F 00-012F-C5BD	12.12.2000	Fel-O-Vax IV	15.08.2001
906845	African Wild Cat	Tempo F 00-012F-C5BD	12.12.2000	Rabisin	15.08.2001
906027	African Wild Cat	M 00-0141-8C54 '97 Nuts	12.12.2000	Fel-O-Vax IV	15.08.2001
908201	African Wild Cat	00-01D1-041E Caesar	12.12.2000	Fel-O-Vax IV	15.08.2001

26.03.2002

ISIS	Species	ID	Date	Vaccine	Next Date
August 2001					
908201	African Wild Cat	00-01D1-041E Caesar	12.12.2000	Rabisin	15.08.2001
908259	African Wild Cat	Diana 00-01BF-12CC	12.12.2000	Fel-O-Vax IV	15.08.2001
908259	African Wild Cat	Diana 00-01BF-12CC	12.12.2000	Rabisin	15.08.2001
902559	African Wild Cat	Don 92/131 Shena 1D-72A1	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
904816	African Wild Cat	Don 95/010 00-0021-4C71 Dameon	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
905709	Small Spotted Cat	Don 96/061 6 M 00-0140-EEF7	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
905711	Small Spotted Cat	Don 96/061 1 F 00-0141-086A	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
906028	African Wild Cat	M 00-0141-2366 '97 Kit-kat	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
906598	African Wild Cat	F 00-01BB-5DB1 Flake	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
906729	African Wild Cat	M 00-0143-9A15 Rambo	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
906846	African Wild Cat	M 00-0121-C719 Bar-one	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
907924	African Wild Cat	00-01F7-F0D6 Milo	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
908201	African Wild Cat	00-01D1-041E Caesar	30.08.2000	Fel-O-Vax Lv-K IV	30.08.2001
September 2001					
908259	African Wild Cat	Diana 00-01BF-12CC	04.09.2000	Fel-O-Vax Lv-K IV	04.09.2001
905308	African Wild Cat	M 00-0019-9C2D Tex	28.03.2001	Fel-O-Vax IV	28.09.2001
905308	African Wild Cat	M 00-0019-9C2D Tex	28.03.2001	Rabisin	28.09.2001
October 2001					
904475	Lion	F 00-0020-42B3 Moon	27.10.2000	Rabisin	15.10.2001
906756	Lion	Newborn 2 '97 Emma 0-0143-65CB	27.10.2000	Rabisin	15.10.2001
908054	Lion	00-01F5-CCB2 Cayla	30.10.2000	Rabisin	15.10.2001
908055	Lion	00-0125-0B82 Amber	30.10.2000	Rabisin	15.10.2001

5.12 Parasite Control Report

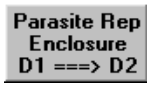


Figure 69

5.12.1 The *Parasite Control Report* generates a list of all parasite treatments performed on animals in an Enclosure. This provides useful information on specific enclosures which have multiple species. All the animals in an enclosure are treated for worms by medicating all the food supplied to the enclosure.

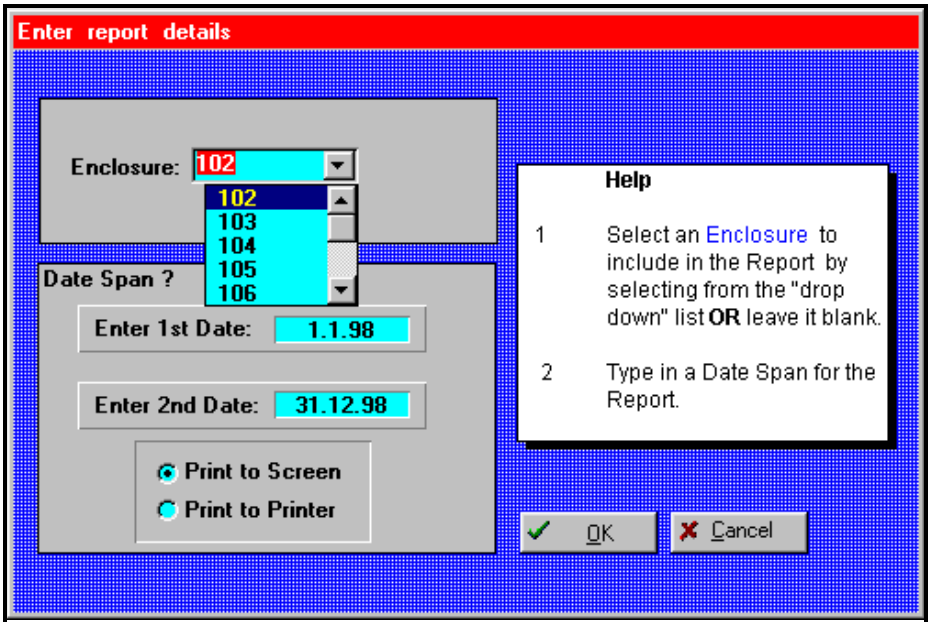


Figure 70 Data entry form for the *Parasite Control Report*. Note the drop-down list of enclosures for the *Enclosure* field and the pop-up help when the cursor is on the *Enclosure* field. The pop-up help disappears when the cursor leaves the field.

5.12.2 Clicking on the ***Parasite Rep Enclosure D1 ----> D2*** button in **Figure 69** opens the form in **Figure 70** where the *Enclosure No.* and date interval can be entered to generate the report shown on page 97. The drop-down list in the *Enclosure* field has a list of enclosure numbers present in the Parasite_Rx Table.

[redacted]

Veterinary Hospital

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Report covers period:

1 January 1998 to
31 December 1998

Parasite Control Report

ISIS	Species	ID	Date	Parasite	Drug	Dose	Notes
Enclosure: 192							
902134	Barbary Sheep	00-001C-38D1 TRO NOTCH 22;BLU	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
903244	Barbary Sheep	00-001D-104B TRO NOTCH 75;YEL	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
906619	Barbary Sheep	00-0143-7AF0 NOT. 13;GREEN/OUT	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
904556	Barbary Sheep	10 F 00-004E-70E1 yel/gr	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
907202	Barbary Sheep	14 M yellow/white	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
901799	Barbary Sheep	35 M 00-0021-6324	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
901882	Barbary Sheep	45 F 00-0021-69B6	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
902135	Barbary Sheep	52 F 00-001C-B7A8	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
902126	Barbary Sheep	64 M 00-0021-6264	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
902128	Barbary Sheep	66 F 0021-56DF orng/yell	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
902131	Barbary Sheep	69 F 00-0021-39FF blu/gr	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
902133	Barbary Sheep	71 F 00-0021-3589	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
903641	Barbary Sheep	84 F 00-001C-8FB9 blue L	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
907201	Barbary Sheep	907201	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
907328	Barbary Sheep	907328	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
None	Barbary Sheep	Group	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days
905014	Barbary Sheep	NOT. 8;GREEN CUTTAGS LT/EAR	17.12.1998	Helminths	Panacur Cubes	500g/100kg	For 5 days

5.13 Species Immobilizations

Clicking on the ***Species Immobs*** button in **Figure 71** - see page 35 for details.

Figure 71

5.14 Narcotic Usage

5.14.1 It is important to note that the use of the term “narcotics” here, is not strictly

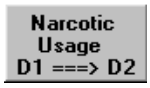


Figure 72

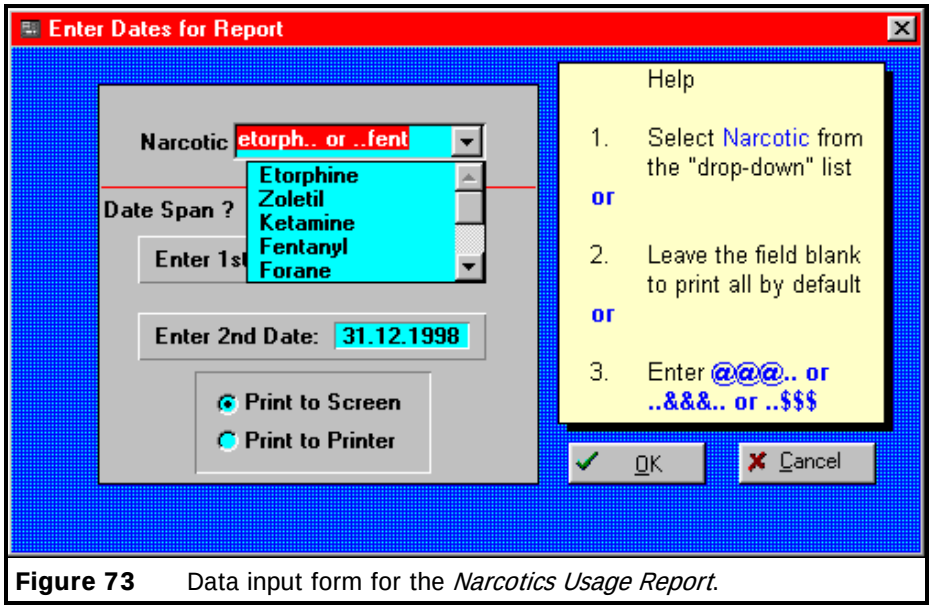


Figure 73 Data input form for the *Narcotics Usage Report*.

correct, as it includes drugs such as zoletil, ketamine, forane, halothane, saffan, gallamine and pentothal which are the main “knock-down” drugs used in the immobilization.

5.14.2 Clicking on the ***Narcotic Usage D1 ----> D2*** button (**Figure 72**) opens the form in **Figure 73** for data entry for the *Narcotics Usage* report where etorphine and fentanyl have been selected from a drop-down list to be printed in the report.

5.14.3 If the *Narcotic* field is left blank then all drugs used during the specified period will be included in the report.

5.14.4 A date span is provided and in this example it is set at ***1.1.1996*** to ***31.12.1998*** - covering the last 3 years.

5.14.5 An interactive *Help Message* guides the operator through the process.

5.14.6 An example of the *Narcotic Usage Report* is on page 100.

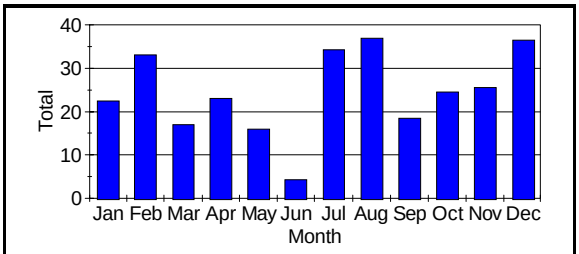
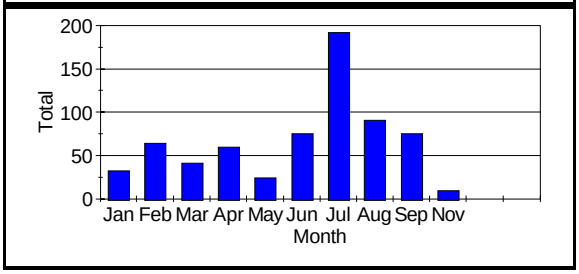
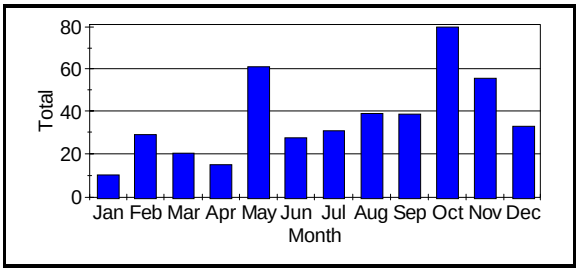
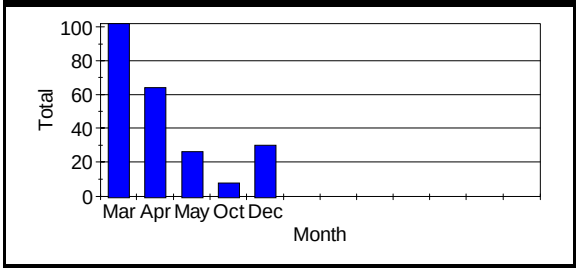
[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

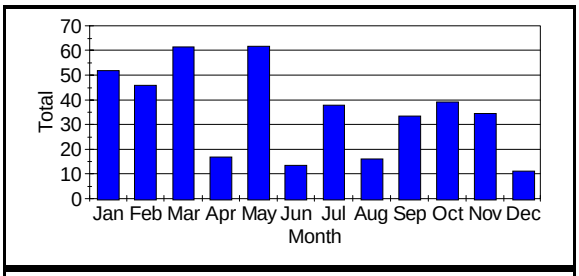
Report covers period:
1 January 1996 to
31 December 1998

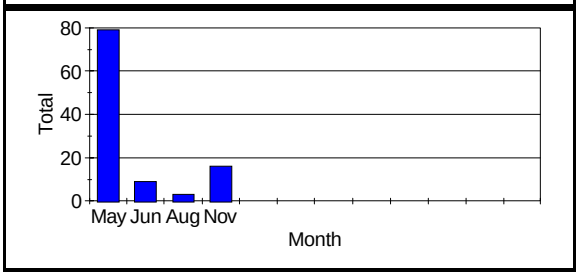
Drug Usage Report

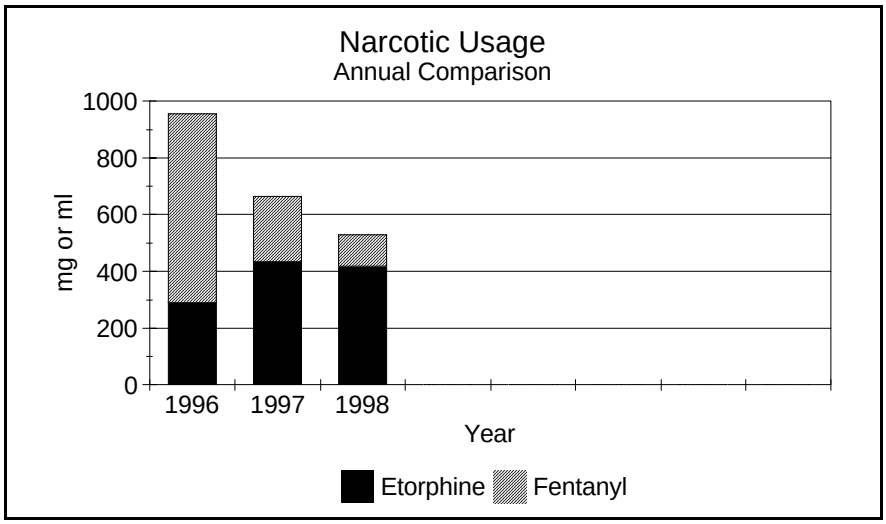
	Narcotic	Total: (mg or ml)	Nº of Cases	
1996				
	Etorphine	292.00	113	
	Fentanyl	664.00	41	
1997				
	Etorphine	437.65	151	
	Fentanyl	227.00	16	
1998				

26.03.2002

	Narcotic	Total: (mg or ml)	Nº of Cases
1998			
	Etorphine	422.65	130
	Fentanyl	107.00	11







5.15 Autopsy Monthly Report

5.15.1 The *Autopsy Monthly Report* generates a list of all autopsies done during the

Figure 74

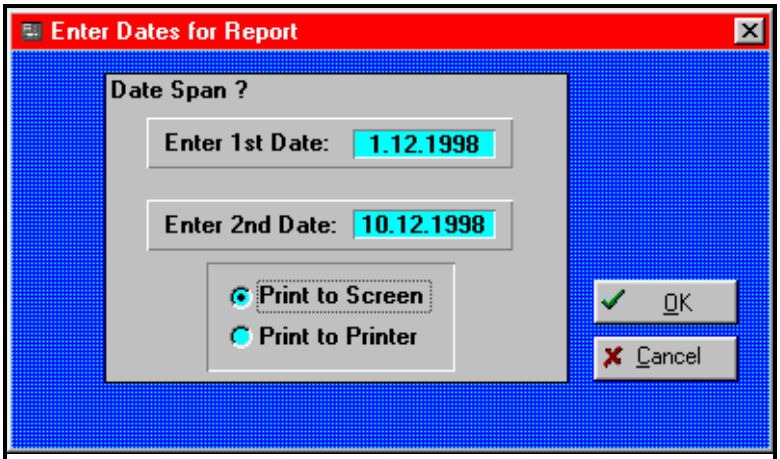


Figure 75 Date span input form for reports.

specified period. It can be used to generate an annual or monthly report on autopsies for the specified year.

5.15.2 Clicking on the ***Autopsy Rep Monthly D1 ----> D2*** button in **Figure 74** opens the form in **Figure 75** which shows the data input used to used to generate the report In this example only the first 10 days of December 1998 have been selected for the report.

5.15.3 An example of the *Autopsy Monthly Report* is on page 103.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

1 December 1998 to
10 December 1998

Autopsy Report

ISIS	Species	ID	Sex	Age	Loc	Date	P.M. No.	Death	Diagnosis	Vet
Section: **B1** Conservator: **Paul**										
907400	African Wild Cat	Newborn 1 '98	1.0	0Y : 0M : 21D	Zoo	04.12.1998	98/0253/B1	04.12.1998	Suspect Herpes virus infection possibly from feral cats	IE
907401	African Wild Cat	Newborn 2 '98	1.0	0Y : 0M : 21D	Zoo	04.12.1998	98/0253/B1	04.12.1998	Suspect Herpes virus infection possibly from feral cats	IE
907420	Geoffroy's Cat	Newborn 2 '98 Juno	0.1	0Y : 0M : 12D	Zoo	08.12.1998	98/0259/B2	08.12.1998	Severe acute peritonitis & enteritis - suspect secondary umbilical infection	IE
Section: **B4** Conservator: **Ronel B**										
907442	Impala	Newborn 1' 98	0.1	0Y : 0M : 1D	Zoo	10.12.1998	98/0261/B4	10.12.1998	Acute pneumonia and septicaemia	IE
Section: **C1** Conservator: **Charlotte**										
906859	Blue And Gold Macaw	Chick 2 '97 00-0121-C24F	0.0.1	1Y : 1M : 19D	Zoo	04.12.1998	98/0255/C1	04.12.1998	Cause of death not determined; carcass extensively eaten by rats	IE
Section: **D5** Conservator: **Frans**										
907426	Indian Black Buck	907426	1.0	0Y : 0M : 2D	Zoo	05.12.1998	98/0251/D5	28.11.1998	Mismothering	IE

5.16 Species Autopsy Report

Figure 76

5.16.1 The *Species Autopsy Report* if very useful for providing a list of deaths and causes of death for a species in the database over a specified time period or

5.16.2 Clicking on the ***Species Autopsy Report*** button in **Figure 76** opens the form in **Figure 77**

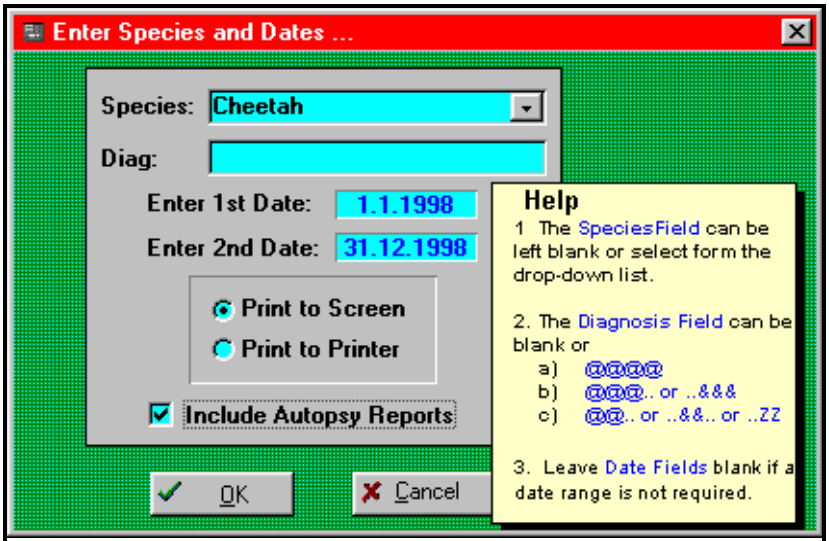


Figure 77 Data input form for the *Species Autopsy Report*.

which shows the data input used for the report where:-

- the *Species* can be selected from the drop-down list or left blank;
- a *Diagnosis* can be searched using keywords and a report generated listing all the animals that have the specific keywords in the diagnosis field;
- *Include Autopsy Reports* has been selected to include all scanned postmortem reports into the report;
- note the pop-up Help instructing the user how to use search strings for finding data.

5.16.3 As an example, to find all animals that died of malignant catarrhal fever in the Zoo since 1990:-

- leave the *Species* field blank;

- in *Diag* enter ***mcf.. or ..bmc.. or ..snot.. or ..catarrh*** to find all possible occurrences of the disease in the database;
- in the *Date* fields enter ***1.1.1990 to "today's date"***, leaving these fields blank is also an option;

5.16.4 An example of the *Species Autopsy Report* is on page 106, where Cheetah deaths between 1 January 1998 and 1 October 1998 were selected.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

1 January 1998 to
1 October 1998

Search Criteria:

Nº of Records Found = 4

Species Autopsy Report

1 ***Patient***

ISIS: P93047 **Species:** Cheetah **ID:** Q 14 T 00-

Sex: 0.1 Sec: Pt Log ON: **12.09.1991**
Age: **6Y : 9M : 6D** Encl: P-G9 Removed: **18.03.1998**
Birth: 11.06.1991 Cons: Wouter L

Date	P.M. No.	Date of Death	Diagnosis	Vet
18.03.1998	98/0005/PT	18.03.1998	Euthanased; fractured both tibia after jumping up a fence while being herded	IE

2 ***Patient***

ISIS: P93086 **Species:** Cheetah **ID:** F 202 00-0023-

Sex: 0.1 Sec: Pt Log ON: **11.08.1992**
Age: **6Y : 0M : 17D** Encl: P-G3 Removed: **30.03.1998**
Birth: 12.03.1992 Cons: Wouter L

Date	P.M. No.	Date of Death	Diagnosis	Vet
30.03.1998	98/0006/PT	30.03.1998	Cause of death not determined; carcass too autolysed	IE

Report:

Ref: 9-12/1/1/1-3/2

DEPARTEMENT VAN LANDBOU DEPARTMENT OF AGRICULTURE
VETERINêRE LABORATORIUM VETERINARY LABORATORY

Datum: 1998-04-16 Tel: 0154-491 4128/9

LABORATORIUMONDERSOEK: MONSTER NR.: 98/148 U VERW NR:
LABORATORY EXAMINATION: SPECIMEN NO: YOUR REF:

Datum ontvang: 1998-03-30 Diersoort: Jagluiperd
Toets verlang: Nadoodse ondersoek

UITSLAG/RESULT:

Die karkas was erg ontbind wat die beoordeling van letsels onmoontlik gemaak het.
Die maaginhoud is vir plaagdoders en strignien getoets - met negatiewe resultate
(Sien die aangehegde verslag van die OVI.)

VEEARTS IN BEHEER * VETERINARIAN IN CHARGE

OP94091

U verw: 98/148

Aandag: DR STROEBEL

TOKSIKOLOGIE

Eienaar : NATIONALE DIERETUIN

Spesie	Game		
Itern	Monster	PD	Str
1	Maaginhnud	Negatief	Negatief

PD: Plaaqdoders
Str: Strignien

Kornmentaar: Die rnaaginhoud van die jagluiperd het negatief getoets vir plaagdoders en strignien.

Die uwe,

DR J.P.J JOUBERT

---

3 ***Patient***

ISIS: P93040 Sex: 0.1 Sec: Pt Log ON: **06.08.1991**

Species: **Cheetah** **ID:** **Q 5 00-001C-** Age: **9Y : 11M : 26D** Encl: P-G2 Removed: **13.04.1998**

Birth: 17.04.1988 Cons: Wouter L

Date	P.M. No.	Date of Death	Diagnosis	Vet
16.04.1998	98/0009/PT	13.04.1998	Euthanased; acute to subacute bacterial peritonitis complicated by renal and hepatic amyloidosis; susp perforation of the intestin e	IE

Report:

OP94615
20.04.98

Your Ref: 98/0009/PT

Bacteriology

Cheetah Q5.

Specific Isolations : None.

Serotype

Non-specific Isolations : Proteus sp. Klebsiella sp. Contaminants.
Type of Test : Aerobic culturing

Klebsiella was isolated from all the samples. We do not think that it is highly significant, but it is the only potential pathogen isolated and we can type it if you would like us to.

Thank you for referring the samples to us. If you have any further queries, please contact me.

Sincerely,

For: Director, Onderstepoort Veterinary Institute

20 April 1998

HISTOPATHOLOGY REPORT

Your reference: 98/0009/Pt; Our reference: W81000.98; Date received: 17 April 1998

Owner: National Zoological Gardens; Address: P0 Box 754 Pretoria

Species: Cheetah; Sex: Female; Age; 10 yrs; ID/Name: Q5

Specimen(s): Organs in formalin for histological evaluation The animal was euthanased in extremis and necropsy lesions included: icterus, ascites, thickened stomach mucosa, focal abscess in the mentum, segmental thickening or the colonic wall in two locations. DD's include: FIP, Nocardiosis, and perforation of the gut.

RESULTS: Sections of pancreas, spleen, stomach and intestine confirm segmental to diffuse acute to subacute peritonitis with areas of necrosis and bacterial colonies present in the exudate. The bacteria have a small rod-shaped morphology. In one area of intestine, apparent mucosal ulceration is accompanied by extensive subacute to chronic inflammation of the submucosa and muscular layers (adjacent to area of perforation?) Other lesions in the stomach are characterized by focal calcification in the mucosa and lymphoplasmacytic infiltrates in the tunica muscularis. In the kidneys, the following lesions are evident: membranous glomerulonephritis and glomerulosclerosis, proteinuria, acute tubular necrosis, multifocal mild plasmalymphocytic interstitial nephritis, and medullary amyloidosis. There is marked atrophy of hepatocytes associated with amyloidosis and atrophy of red pulp in the spleen. The lungs are mildly congested.

DIAGNOSIS: Acute to subacute bacterial peritonitis complicated by renal and hepatic amyloidosis.

COMMENT: The peritonitis is bacterial in origin and most likely caused by perforation of the intestine: in one area of the intestinal tract lesions were subacute to chronic in nature and may indicate an area of chronic inflammation associated with perforation. The type of kidney lesions have been previously reported in cheetahs. In a recent publication (submitted for publication), Munson and Bolton speculated on stress as being the cause of glomerulonephritis and amyloidoses in captive cheetah or chronic Helicobacter gastritis; the later condition was not confirmed in sections stained with HE.

Yours sincerely

JJ van der Lugt MMedVet(Path)

4 ***Patient***

ISIS: P93066

Species: Cheetah **ID:** F 175 00-0021-

Sex: 0.1 Sec: Pt Log ON: **07.06.1991**

Age: **12Y : 5M : 29D** Encl: P-G17 Removed: **02.07.1998**

Birth: 01.01.1986 Cons: Wouter L

Date	P.M. No.	Date of Death	Diagnosis	Vet
02.07.1998	98/0013/PT	02.07.1998	Pneumonia; glomerulonephritis & medullary amyloidosis	IE

Report:

Ref: WS1682.98
7 July 1998

HISTOPATHOLOGY REPORT

Your reference: 98/0013/Pt
Our reference: W51682.98

Date received: 6 July1998

Species: Cheetah; Sex: Female; Age.. 12,5 yrs; Colour: Typical; ID/Name: F175
Specimen(s): Organs in formalin

RESULTS:
Spleen; Macroscopically the spleen was contracted, with several, well demarcated, white nodules, visible in the pulp on incision. Histopathologically well demarcated accumulations of mature adipocytes were scattered throughout the pulp. The lymphoid tissue was atrophied, with mild hemosiderosis and extra medullary haematopoiesis.
Lung: Well demarcated, firm, grey-white nodules were present on, presumable the pleural surface.
Histopathological examination failed to reveal the' nature of these nodules, additional sections will be cut.
Other changes in the lung consisted of severe, alveolar emphysema, with collapse of the bronchi. Most of the larger bronchi contained foreign material, bacteria as well as a minimal neutrophil response. The Alveolar walls exhibited marked leukostasis.
Kidney: The subcapsular surface was monled yellow and red, with a thin cortex. Histopathological examination showed multfocal to oonfluent necropurulent inflammation of the cortex and upper half of the medulla, with marked destruction of glomeruli, interstiflum and tubules. Large numbers of Gram - cocci to coccobacilli was visible in the inflammatory foci. The tubules contained proteinaceous. cellular, neutrophilic and bacterial casts. The glomeruli exhibited marked membranous glomerulonephrib's, with periglomerular fibrosis. The medulla contained an amorphous, eosinophilic material in the interstflum, which in some areas compressed the tubules. The pelvis contained small number of lymphocytes and plasma cells.
Liver: Putrefactive changes hampered the histopathological examination. Mild neutrophilic leukostasis was present.
Stomach: Sectioning was obliquel, additional sections will be cut.

DIAGNOSIS:
Spleen: Myelolipoma complicated by
Kidney: Severe, multifocal to confluent, embolic, bacterial nephritis, glomerulonephritis and possible medullary amyloidosis
Lung: Severe alveolar emphysema, acute foreign body broncho-pneumonia

COMMENT: Myelolipomas are common occurrences in cheetahs, and may be proliferative rather than neoplasic (as the name suggests). The embolic lesion in the kidney probably originated from a lesion on the heart valves. Endocardiosis does not occur, as far as we know, in felidae. Is it possible that the lesions on the valves were vegetative endocarditis? The results of the lung and stomach sections will follow.

Dr J Pearson BVSc
Lecturer: Dept of Pathology

End

5.17 Individual Autopsy Report

5.17.1 The *Individual Autopsy Report* generates a report on a specific patient on page 111. This report is frequently used to provide relevant members of staff with final post mortem reports on individual animals.

5.17.2 Clicking on the ***Individual Autopsy Report*** button in **Figure 78** opens the form in **Figure 79** which shows details of the requested patient. Note that the block for "*Autopsy Report*" in the *Include ?* block has a tick which will include the laboratory

Figure 78

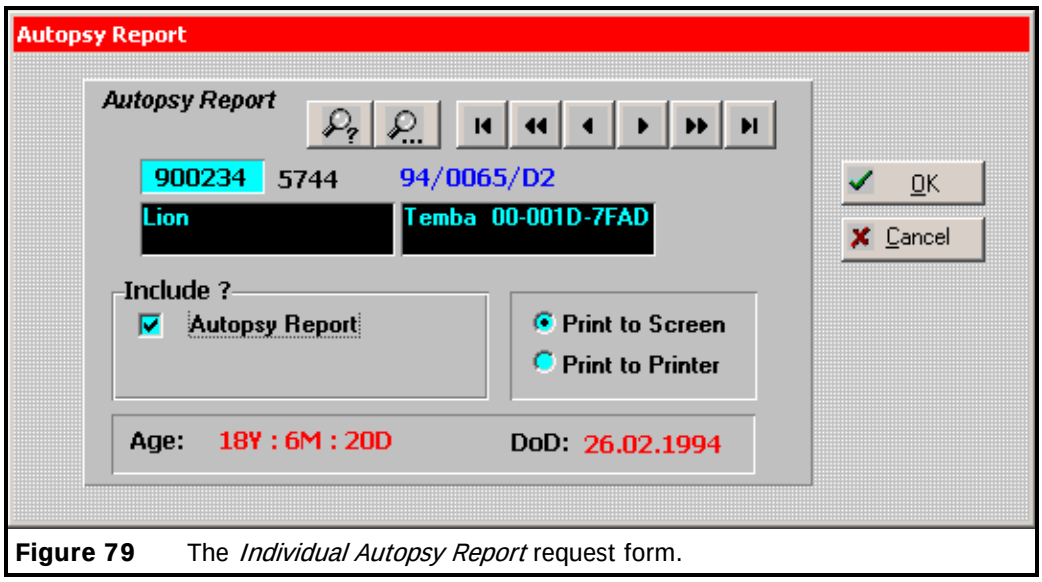


Figure 79 The *Individual Autopsy Report* request form.

report from the pathologist. If this block is left un-ticked then a much shorter report will be printed.

5.17.3 The form includes additional information about the patient, namely, ***"Age:"*** = age of the patient at the time of death, ***"DoD:"*** = date of death, and the Post Mortem No. ***"94/0065/D2"*** found on the original *Autopsy Report Data Sheet* with all attached laboratory reports.

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

26 March 2002

Autopsy Report

Panthera leo

Patient

ISIS:	900234	Status: Dead	Sex:	1.0	Sec:	D2	Log ON: **05.06.1991**
Species:	**Lion**	**ID:** **Temba 00-**	Birth:	12.08.1975	Encl:	191	Removed: **26.02.1994**
			Age:	**18Y : 6M : 16D**	Cons:	Paul	

Postmortem

Date	P.M. No.	Date of Death	Diagnosis	Vet
26.02.1994	94/0065/D2	26.02.1994	Euthanased; Systemic haemangiosarcoma	PB

Report

Ref.:WPM257.94

7 March 1994

PATHOLOGY REPORT
Your reference: Our reference: PM257.94 S505.94
Date submitted: 26 February 1994

Species: Panthera leo Lion Breed: White Lion Sex:
Age: 19 years Colour: pale biscuit-white Name/ID:
Specimen(s): Carcase

RESULT: The necropsy revealed severe multifocal haemangiosarcoma in the lungs, myocardium, kidneys, GIT, striated muscles, and brain. The metastatic foci were accompanied by very severe haemorrhage and thrombosis and the cardiac lesions were particularly severe in this regard. The neoplasms consist of cells with very plump oval to round nuclei and eosinophilic poorly delineated cytoplasm. The cells are arranged in very haphazard vascular channels which contain red blood cells. The cells show a high degree of mitotic activity and appear rather anaplastic. There is considerable necrosis and thrombosis associated with the tumours. Special immunohistochemical stains were utilised to elucidate the cellular type of the neoplasm. Staining with desmin and vimentin point towards a cell of mesenchymal origin with contractile ability. Most significantly, the staining against factor 8 related antigen was strongly positive. factor 8 is only found in endothelial cells where it is one of the clotting factors. These findings indicate fairly conclusively that the neoplasm is an haemangiosarcoma.

The liver showed large multi-locular cystic structure, many of which were fluid-filled and some containing clotted blood. Histologically these structures are lined with proliferative biliary epithelium and can be classified as benign hepatic cystadenomas.

The lungs macroscopically showed dense yellow-brown areas in the dorsal aspects of the caudal and muddle lobes. Histologically these consist of large areas of inflammation characterised by severe macrophage accumulation as well as alveolar wall fibrosis and epithelialisation. The macrophages have a very foamy cytoplasm and there are large vacuoles in the alveoli suggestive of a lipid-like substance. These findings are strongly suggestive of exogenous lipid pneumonia due to the aspiration of a lipid-rich fluid. No sign of pneumocystosis was detected.

The bone marrow, spleen, and lymph nodes show very marked haemopoiesis. Extra-medullary haemopoiesis (EMH) is also visible in the liver, lungs and adrenal cortex. The lymphoid tissues are depleted and in some nodes there is practically complete absence of the cortex and paracortex with tremendous medullary cord hyperplasia, due to plasmacytosis and EMH.

The GIT shows very mild eosinophilic infiltrates in the mucosa indicative of recent parasite infestation. No other significant lesions were noted apart from metastatic neoplasms and accompanying thrombosis and haemorrhage. The kidneys also show insignificantly mild focal interstitial nephritis.
The adrenal gland shows interesting changes with focal hyperplasia in the cortex. These cells have also managed to break through the capsule and invade the surrounding tissues. The cells show little in the way of advanced neoplastic change, this invasive behaviour is not enough to classify this as neoplastic and merely represent advanced hyperplasia.

DIAGNOSIS: Euthanasia while suffering from systemic haemangiosarcoma.

COMMENT: The primary site of this neoplasm is interesting. Cats are reported to have haemangiosarcomas arising primarily in the spleen, sub-cutaneous tissues and GIT. Dogs show the same neoplasms arising in spleen, right atrium and liver. To the best of my knowledge this lion showed no sign of primary neoplasia in the spleen. The most likely primary sites are then in the GIT or the liver. The lesion in the distal ileum was very large, but more of a haematoma than neoplasm. In my opinion this lesion most probably arose first in the liver with spread to the lungs and myocardium and final dissemination to skeletal muscle, brain, kidney and gut.

I shall attempt to follow up the histological examination with electron microscopy of the neoplasm to further confirm its nature. Factor 8 containing granules, Weibel-Palade bodies, should be distinguished in the cells. I will let you have the results of this investigation as soon as they come to hand.

Yours sincerely

Dr J E Jardine BVSc MRCVS
Senior Lecturer: Department of Pathology
8 March 1994

End

5.18 Autopsy Pending Report

Figure 80

5.18.1 Clicking on the ***Autopsy Pending Report*** button in **Figure 80** generates the *Autopsy Pending Report* on page 114. This report used frequently used to submit updated autopsy information to the Animal Data Bank, such as the diagnosis which was not available at the time the original autopsy report was submitted. It usually takes a few days for the final autopsy information to be updated in the database.

5.18.2 How it works....

- when post mortem samples are sent to the laboratory, "***Pending***" is typed into the *Diagnosis* and *Codes* fields in the autopsy tab;
- this information is submitted to the Animal Data Bank in the *Daily Report*;
- the word "*Pending*" is typed into the appropriate field in the record for the specific animal in the ARKS database;
- when the button in **Figure 80** is clicked ZooDox searches through the ARKS files to find all the references to "*Pending"*;
- the results of this search are correlated with "*Pending*" autopsy records in ZooDox and the report is generated.

5.18.3 When the final diagnosis is completed. The ARKS database requires certain ***"codes"*** to be given to describe the diagnosis. The word ***"pending"*** is substituted for these codes as shown in the report.

[redacted]

Veterinary Hospital

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

26 March 2002

Autopsy Pending Report

ISIS	Species	ID	Sex	Date	PM_No	Death	Diagnosis	Codes
904849	Nyala	904849	0.1	11.05.2000	00/0149/D1	27.04.2000	Suspect heart failure due to old age	N/A/E/L?
L92335	Cheetah	M 172 T 00-0021-35D8	1.0	08.01.2001	01/0001/LT	08.01.2001	Kidney failure - amyloidosis ?? - no histopath done!!	F/C/H/L
908276	King Vulture	Egg 113 Chick 1 '00 00-01D8-183E	1.0	14.05.2001	01/0131/A1	11.05.2001	Lead poisoning	PENDING
907543	Rock Hyrax	00-01F6-E32D	1.0	18.05.2001	01/0136/A1	18.05.2001	Pending	PENDING
901077	Rock Pigeon	6-18877 F	0.1	27.06.2001	01/0170/C4	21.06.2001	Caseous nodular hepatitis; Avian TB?	PENDING
908737	Barn Owl	Don 01/105	1.0	28.09.2001	01/0246/A1	10.09.2001	Euthanased; damaged wing feathers - can't fly; can't release	A/H/C/K
908809	Eurasian Eagle Owl	Egg 13 '01	0.0.1	27.09.2001	01/0277/C1	24.09.2001	Pseudomanas infection secondary to hatching complication	H/C/A/B
908812	Eurasian Eagle Owl	Egg 18 '01	0.0.1	27.09.2001	01/0281/C1	27.09.2001	Death as a result of hatching complications	H/C/A/L
908826	Eurasian Eagle Owl	Egg 20 '01	0.0.1	03.10.2001	01/0290/C1	02.10.2001	Pseudomonas aeruginosa cultured from the lungs	PENDING
908777	Little Corella	Green 44-V	0.0.1	03.10.2001	01/0289/C1	02.10.2001	Fibrinonecrotic bacterial splenitis	F/C/F/B
907098	Common Marmoset	907098	0.1	08.10.2001	01/0300/A1	08.10.2001	Bacterial enteritis; klepsiella sppisolated	F/C/G/B
908832	Eurasian Eagle Owl	Chick 4 '01/ Parent reared	0.0.1	08.10.2001	01/0302/C3	08.10.2001	Rickets - inadequate diet being fed to the adults	F/C/C/P
908856	Little Corella	Egg 30 '01	0.0.1	12.10.2001	01/0309/C1	11.10.2001	No significant bacterial culture; suspect incubation problem	H/H/A/X
903718	Ibex	81 M = US161	1.0	15.10.2001	01/0316/D2	15.10.2001	Euthanased; Pasteurella bronchopneumonia and reticulo-omasal mucosal benign proliferative and cystic acanthomatous epithelioma	A/C/G/R

ISIS	Species	ID	Sex	Date	PM_No	Death	Diagnosis	Codes
902222	Indian Black Buck	50 F 00-001C-B2AA green/red	0.1	18.10.2001	01/0318/A3	18.10.2001	Euthanased; fractured ribs 7 & 8 in micro haemorrhages in the grey matter	A/C/C/K
904986	Lady Amherst's Pheasant	6-20297 R.	1.0	23.10.2001	01/0321/A1	20.10.2001	Muco purulent pneumonia	F/H/D/C?
908172	Scarlet Ibis	123148171A DI 4264	0.1	02.11.2001	01/0337/C2	02.11.2001	Haemorrhage hepatitis with rupture; acute septicaemic; no pattogenic bacteria isolated	F/C/G/B?
907641	Ibex	30 F blue/orange	0.1	14.11.2001	01/0346/D2	09.11.2001	Chronic bacterial hepatitis	F/H/G/B
908804	Indian Black Buck	WHITE CUTTAGS	1.0	12.11.2001	01/0347/D2	10.11.2001	E.coli septicaemia	A/C/A/B
904524	Beaver	00-0025-4D7B	1.0	14.11.2001	01/0350/B5	12.11.2001	Suspect acute Clostridial enterotoxaemia	F/C/G/B
909010	Andean Condor	Egg 35 '01	1.0	14.11.2001	01/0354/C1	14.11.2001	Suspect complications of the incubator - high humidity resulting in poor hatching and a weak chick	H/C/A/X
907694	Cheetah	Don 97/011/Pt F 204 00-01F7-F0B9	0.1	13.12.2001	01/0402/B4	13.12.2001	Cause of death not conclusive	F?/C/A/X
900192	Spotted Hyena	Cubface	0.1	19.12.2001	01/0415/B4	19.12.2001	Haemorrhagic anaemia due to E. coli endometritis	F/C/A/B
908123	Blue Poison Arrow Frog	F 2	0.1	28.12.2001	01/0423/AQ	28.12.2001	No diagnosis was possible	N/C/X/X
908829	African Wild Cat	908829	0.1	31.12.2001	01/0431/C1	31.12.2001	Bacterial pneumonia	F/C/D/B
909083	Small Spotted Cat	909083	0.0.1	15.01.2002	02/0025/C1	15.01.2002	Pending	PENDING
909084	Small Spotted Cat	909084	0.0.1	15.01.2002	02/0026/C1	15.01.2002	PM not possible - carcass mostly eaten	N/C/X/X
905993	Blue Crane	Don 97/005 0141-00F6 9-77060	0.1	20.02.2002	02/0053/B3	20.02.2002	Death as a result of inability to feed due to broken leg	B/A/A/K

5.19 Autopsy Report by Locality

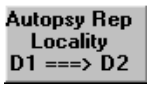


Figure 81

5.19.1 The *Autopsy Report by Locality* is used to generate monthly or annual reports on autopsies for a specific locality for a specific period as shown on page 117 where Potgietersrus has been selected.

5.19.2 Clicking on the ***Autopsy Rep Locality D1 —> D2*** button in **Figure 81** opens the form in

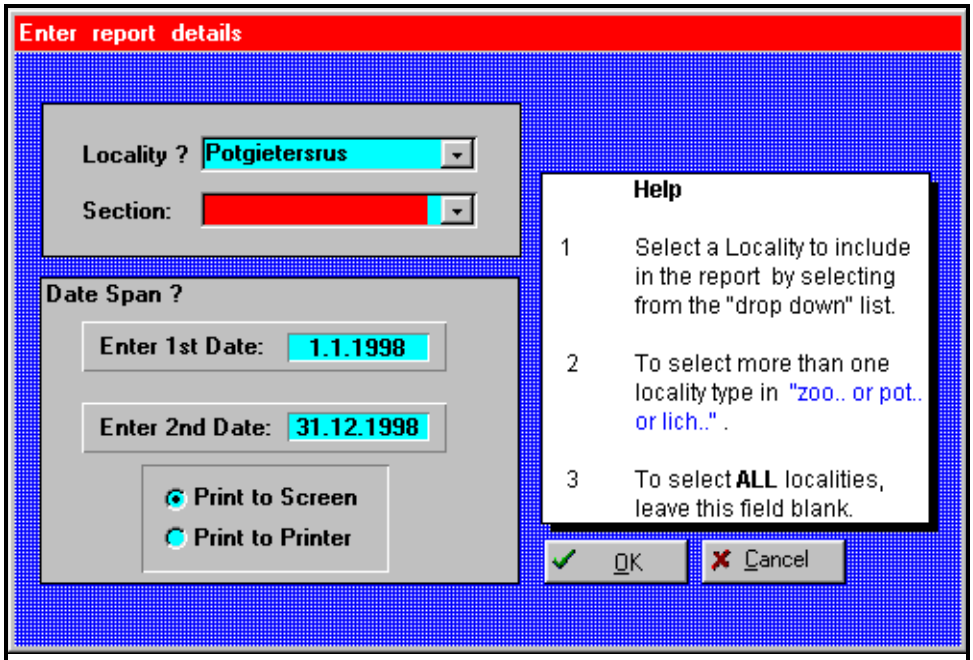


Figure 82 Data input form for the Autopsy Report by Locality.

Figure 82 which shows the data input used for the report, where

- *Locality* and *Section* can be filled in from values in the drop-down list or they may be left blank to select **all** records at all localities and all sections, and
- the *Date* fields are completed as usual, or can be left blank to include all records from ***1990*** to ***"Today's Date"***.

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NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:
1 January 1998 to
31 December 1998

Autopsy Report

ISIS	Species	ID	Sex	Age	Date	P.M. No.	Death	Diagnosis	Codes	Vet

Potgietersrus

A1

Feb 1998

None	Yellowbilled Kite	Don 98/??/Pt	1.0	Unknown	17.02.1998	98/0042/A1	17.02.1998	Euthanased; severe compound fracture of L distal humerus; focal disseminated bacterial hepatitis	AF/H/C/B	IE

Pt

Feb 1998

Wouter L

P93302	Buffalo	Newborn 1 '94	1.0	3Y : 8M : 3D	25.02.1998	98/0003/PT	24.02.1998	Carcass in advanced state of decomposition; cause of death not yet determined; suspect animal was shot??	D?	IE

ISIS	Species	ID	Sex	Age	Date	P.M. No.	Death	Diagnosis	Codes	Vet

Potgietersrus

Pt

Mar 1998

Wouter L

P93047	Cheetah	Q 14 T 00-0021-305B col	0.1	6Y : 9M : 6D	18.03.1998	98/0005/PT	18.03.1998	Euthanased; fractured both tibia after jumping up a fence while being herded	A/C/C/K	IE
P93247	Suni	F P53 00-0142-CEC2	0.1	4Y : 8M : 23D	20.03.1998	98/0004/PT	20.03.1998	Collar was found in Sandgate - date of death not known	N/H/N/X	IE
P93086	Cheetah	F 202 00-0023-BFA0	0.1	6Y : 0M : 17D	30.03.1998	98/0006/PT	30.03.1998	Cause of death not determined; carcass too autolysed	N/C/N/X	IE

Apr 1998

Wouter L

P93040	Cheetah	Q 5 00-001C-42F3	0.1	9Y : 11M : 26D	16.04.1998	98/0009/PT	13.04.1998	Euthanased; acute to subacute bacterial peritonitis complicated by renal and hepatic amyloidosis; susp perforation of the intestin e	A/H/G/B?K?	IE

Jul 1998

Wouter L

P93066	Cheetah	F 175 00-0021-228E col	0.1	12Y : 5M : 29D	02.07.1998	98/0013/PT	02.07.1998	Pneumonia; glomerulonephritis & medullary amyloidosis	F/H/DH/B	IE

Chapter

6

6 Analysis

The *Analysis* tab shown in **Figure 83** shows buttons which generate graphic reports illustrating various statistics over specified periods. The group of three buttons on the

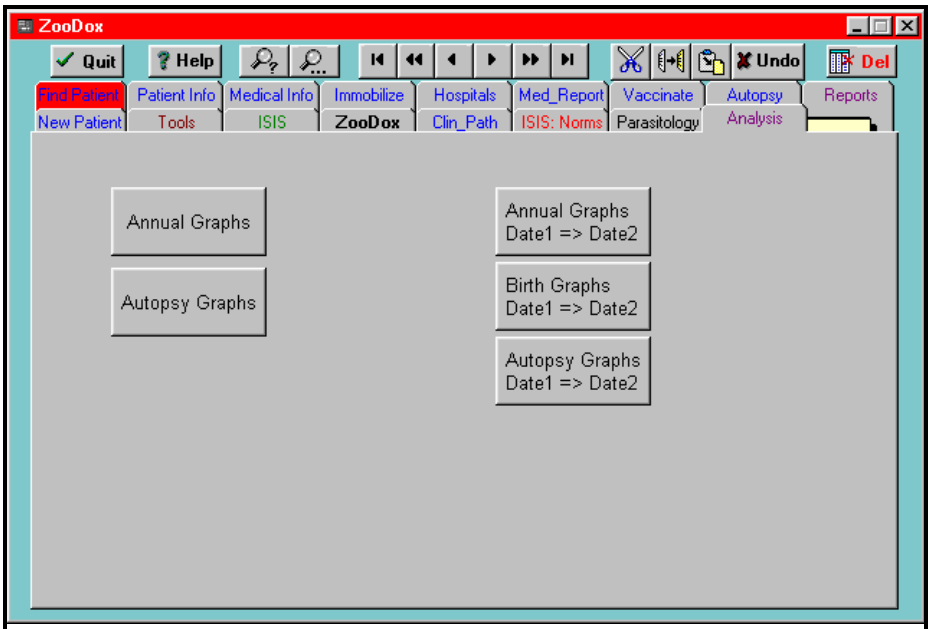


Figure 83 The *Analysis* Tab with the three graphs buttons grouped together on the right.

right will be discussed, as the two buttons on the left are basically duplicates and experimental.

6.1 Annual Graphs (Date1 ==> Date2) (**Figure 84**). This button generates a series of annual graphs in the categories of *Medical Cases*, *Donations*, *Hospital Cases*,

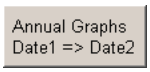


Figure 84

Immobilizations, *Narcotics*, *Births* and *Deaths.* The Date range is used to select the years to be included in the graphs, e.g. ***Date1 = 1.1.1991*** to ***Date2 = 31.12.1998*** will include all the data during the past eight years as shown in the report on page 121.

[redacted]

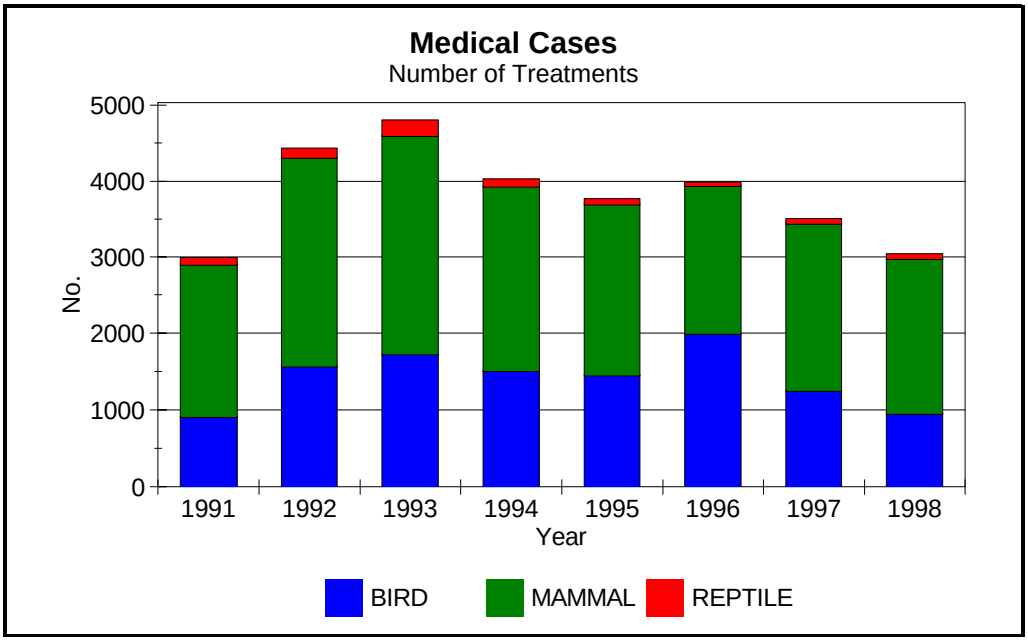
NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

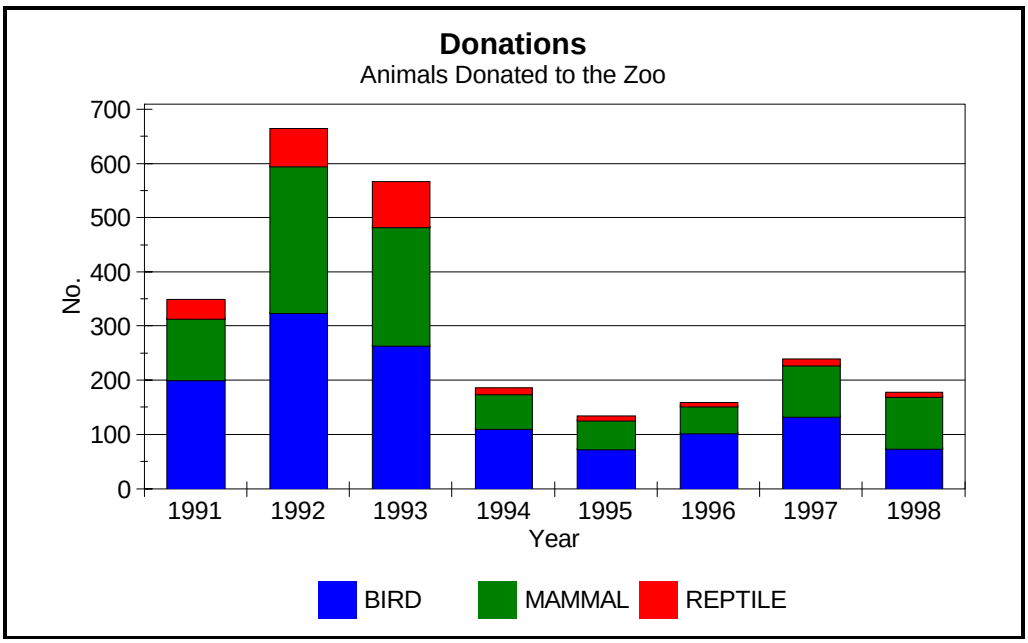
Report covers period:

1 January 1991 to
31 December 1998

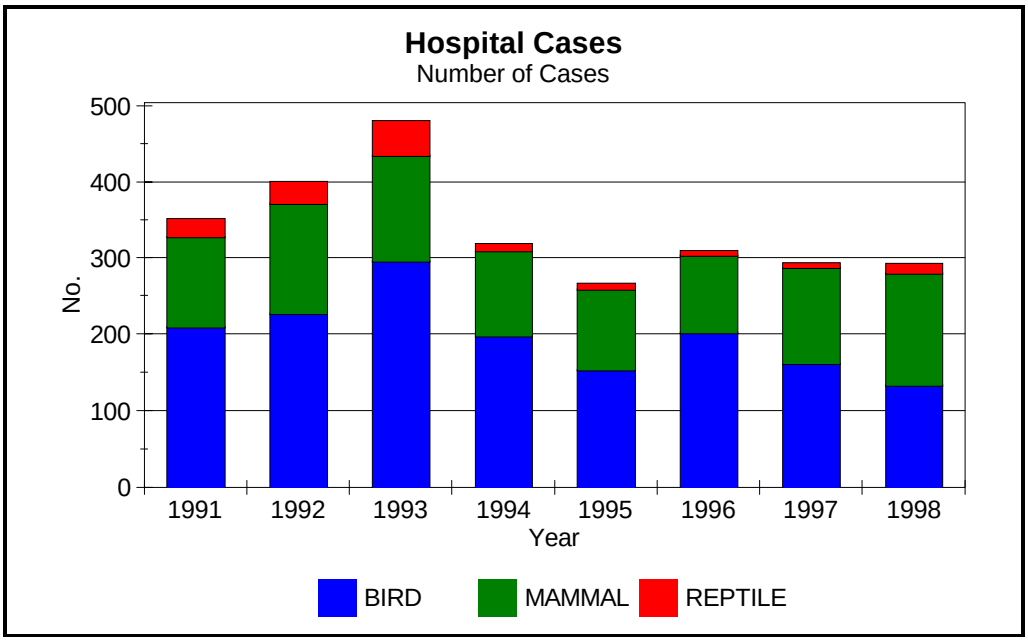
Annual Analysis Report



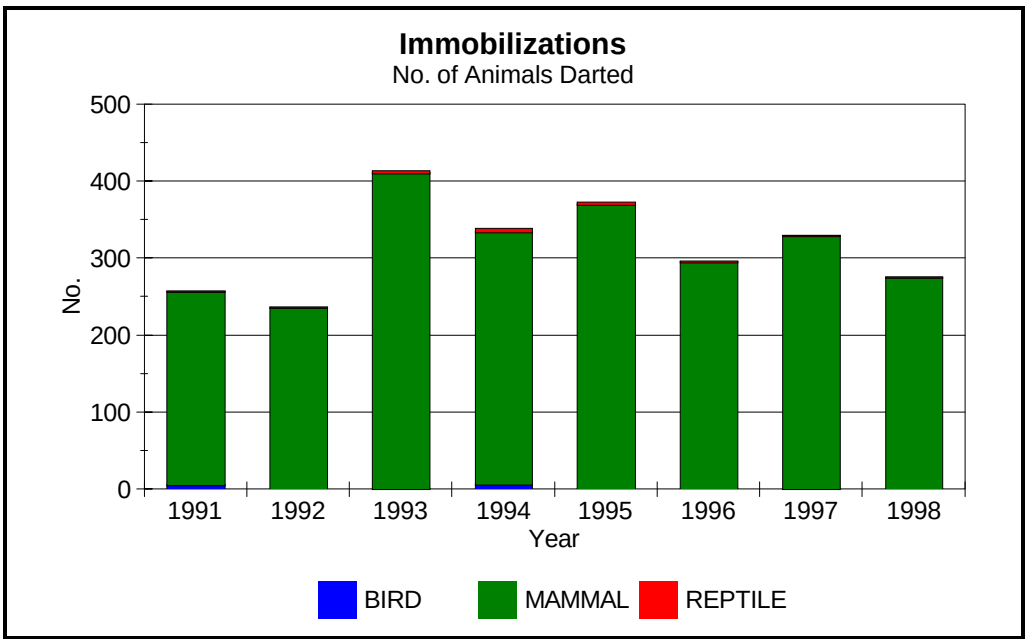
	1991	1992	1993	1994	1995	1996	1997	1998	
BIRD	915	1569	1730	1515	1459	1993	1256	966	
MAMMAL	1981	2718	2836	2398	2215	1924	2181	2005	
REPTILE	88	115	206	90	76	52	50	68	



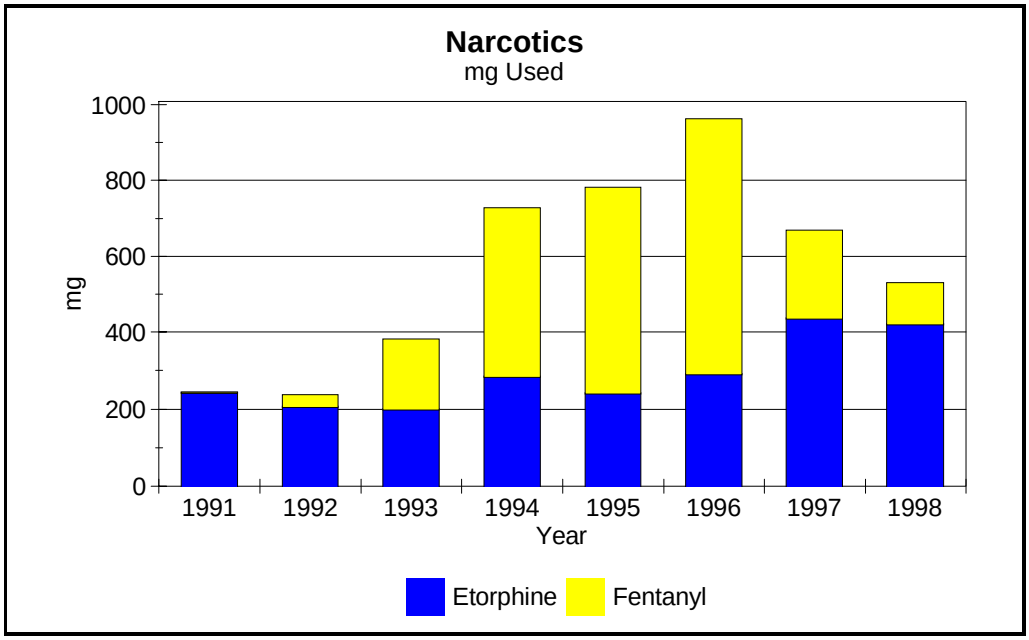
	1991	1992	1993	1994	1995	1996	1997	1998	
BIRD	199	322	261	111	73	103	132	74	
MAMMAL	112	265	216	63	53	48	94	94	
REPTILE	34	68	82	10	6	6	10	8	



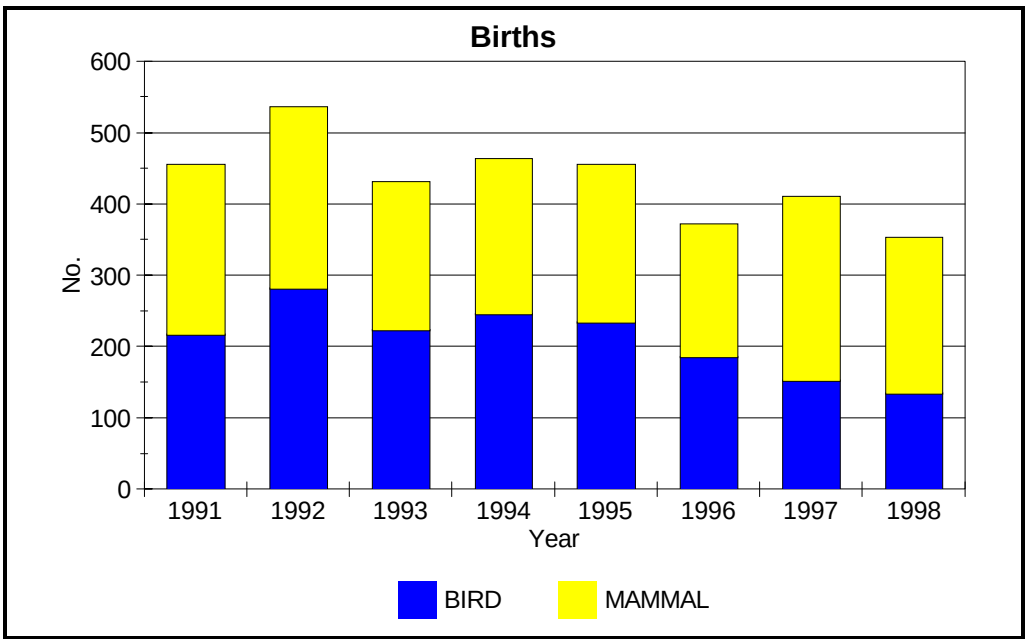
	1991	1992	1993	1994	1995	1996	1997	1998	
BIRD	209	227	295	197	153	202	161	133	
MAMMAL	117	142	137	111	105	100	125	146	
REPTILE	24	29	45	9	8	6	7	12	



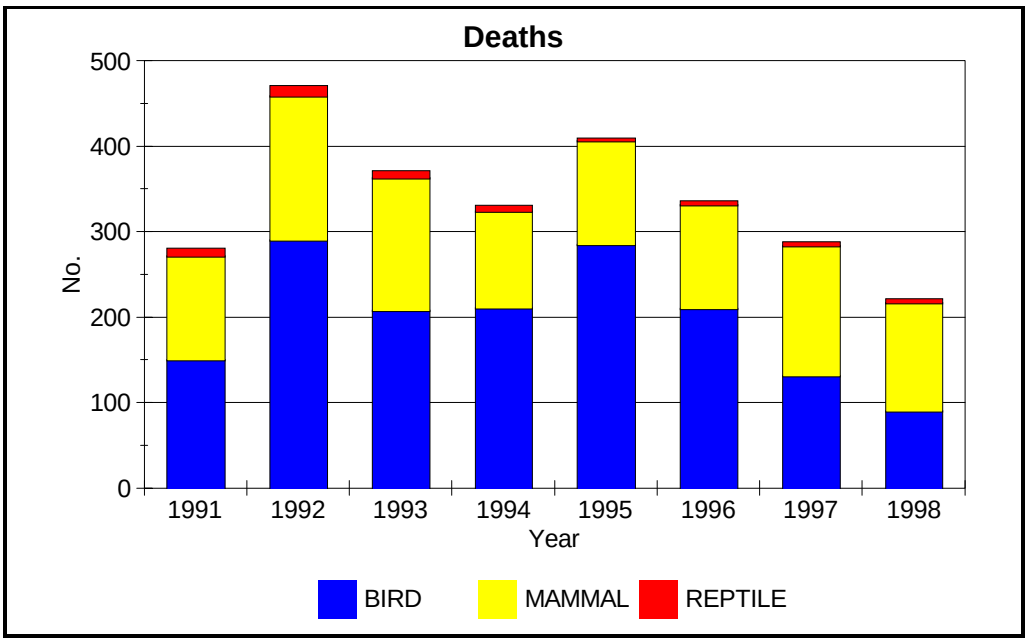
	1991	1992	1993	1994	1995	1996	1997	1998	
BIRD	6		1	7			1		
MAMMAL	251	236	410	327	370	295	328	275	
REPTILE			2	4	3	1			



	1991	1992	1993	1994	1995	1996	1997	1998	
Etorphine	244	208	203	286	243	292	438	423	
Fentanyl		31	181	438	535	664	227	107	



	1991	1992	1993	1994	1995	1996	1997	1998
BIRD	218	282	224	246	235	186	153	135
MAMMAL	238	254	207	217	221	186	257	218



	1991	1992	1993	1994	1995	1996	1997	1998	
BIRD	150	290	208	211	285	210	132	90	
MAMMAL	122	169	155	113	121	122	152	127	
REPTILE	9	12	8	7	3	4	4	4	

6.2 Birth Graphs (Date1 ==> Date2) (**Figure 85**). This button generates a series of graphs shown on page 126 of the monthly births and next to it a graph of the deaths of these births. It is possible that the death count can exceed the birth count for a specific month, if all the births for that month died during the same month and are counted together with the animals born prior to that month which die. For example if all the animals born in February die before the end of the month and are counted together with animals born earlier e.g. January and die in February.

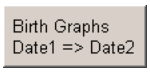


Figure 85

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

Report covers period:

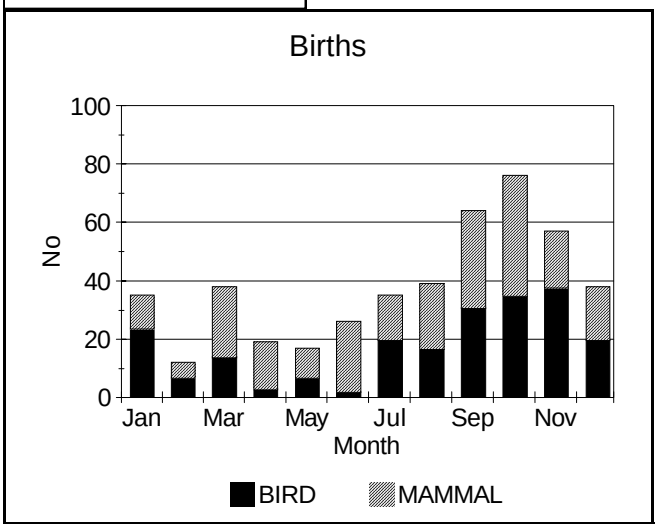
1 January 1991 to
31 December 1998

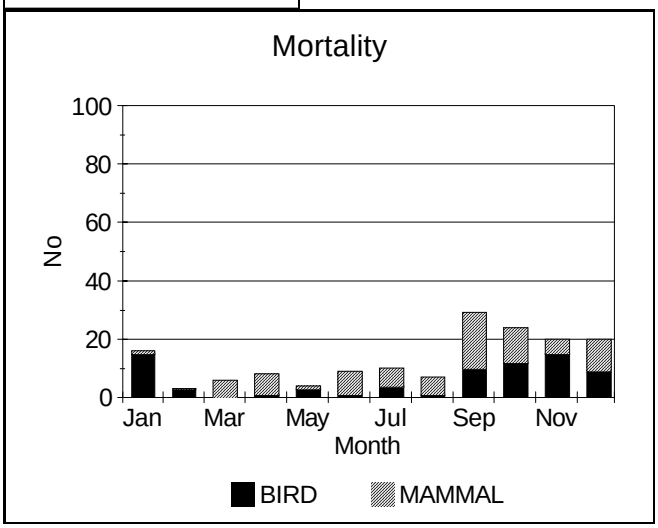
Births Analysis Report

1991

456	1991
BIRD	218
MAMMAL	238

156	1991
BIRD	74
MAMMAL	82

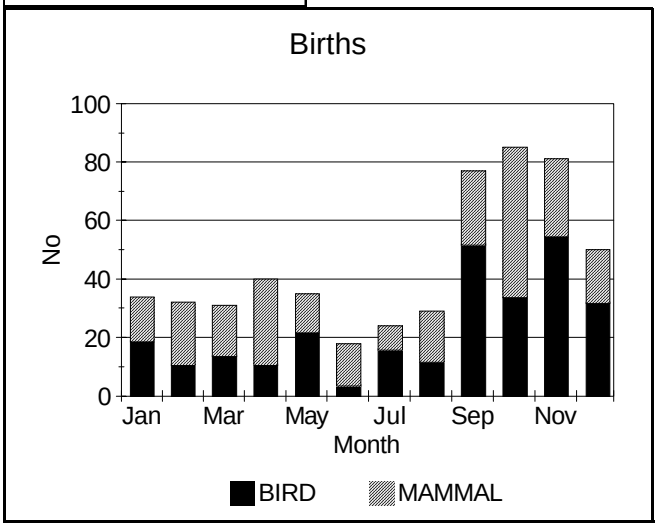




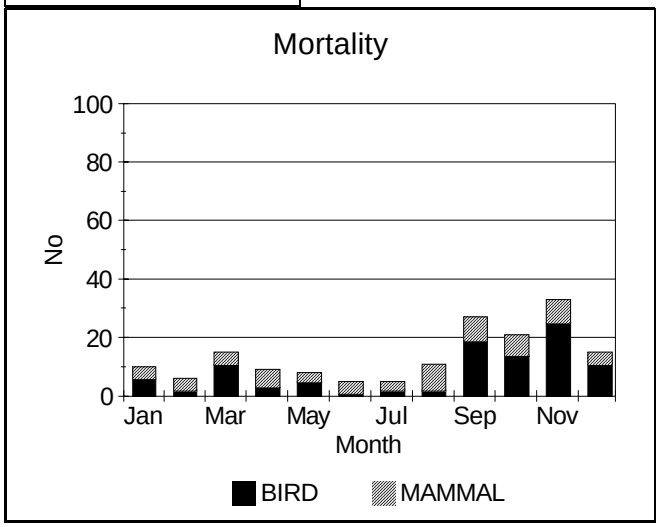
1992

1992

536	1992
BIRD	282
MAMMAL	254

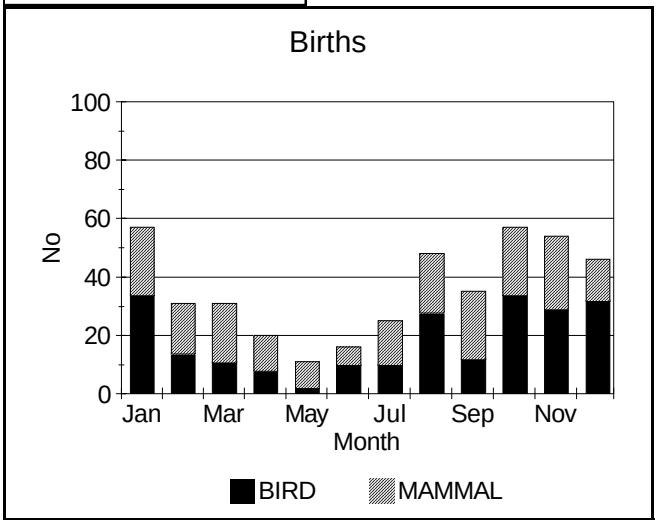


165	1992
BIRD	101
MAMMAL	64

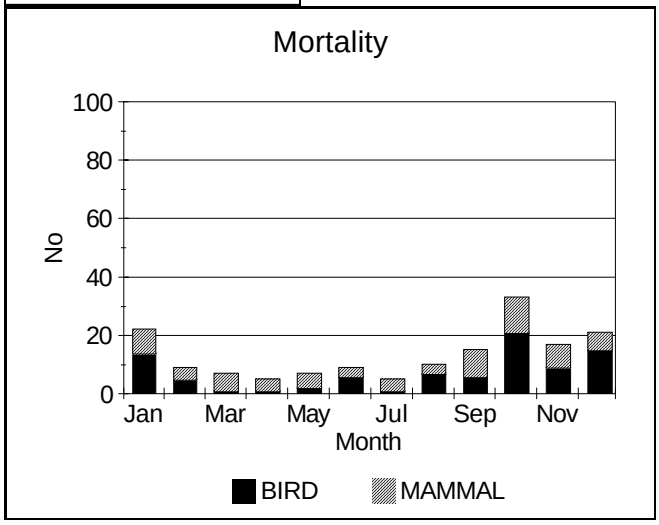


1993

431	1993
BIRD	224
MAMMAL	207

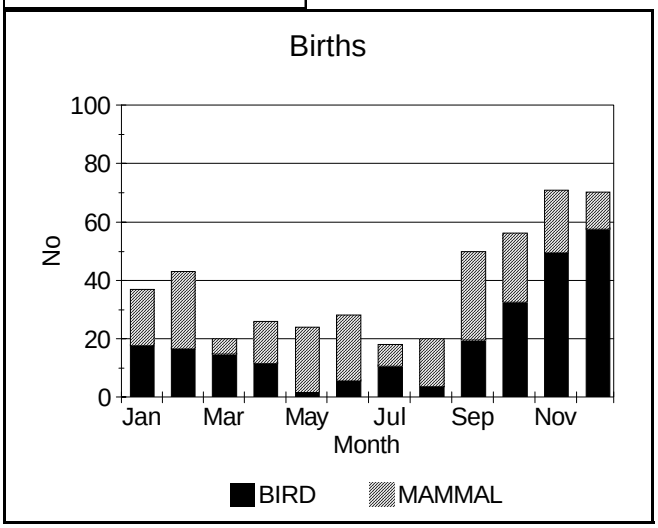


160	1993
BIRD	88
MAMMAL	72

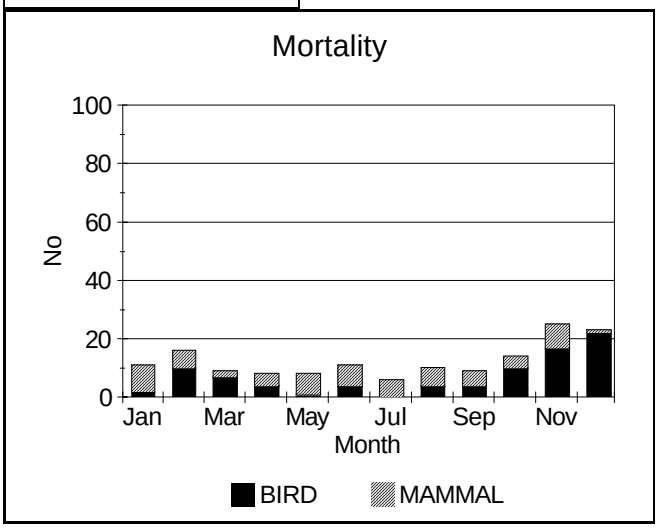


1994

463	1994
BIRD	246
MAMMAL	217

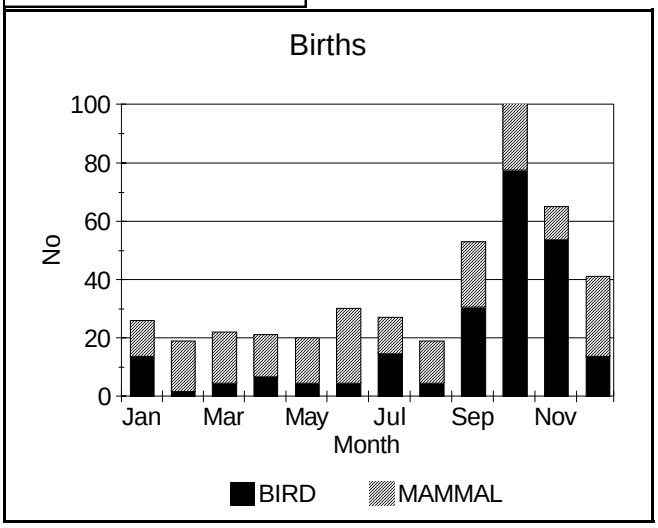


150	1994
BIRD	86
MAMMAL	65

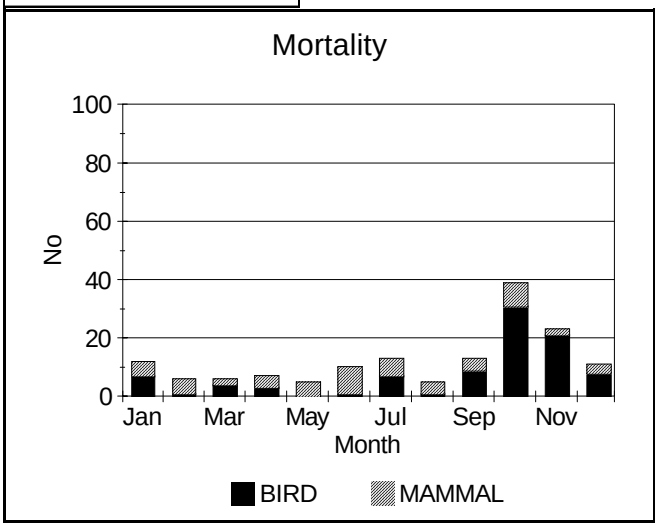


1995

456	1995
BIRD	235
MAMMAL	221

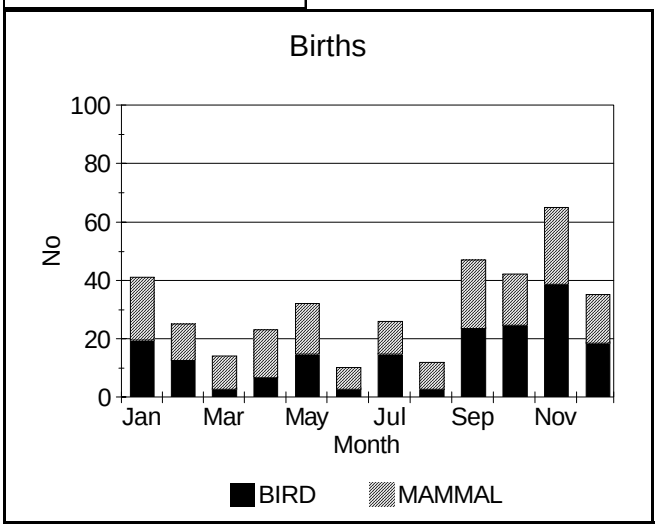


150	1995
BIRD	93
MAMMAL	57

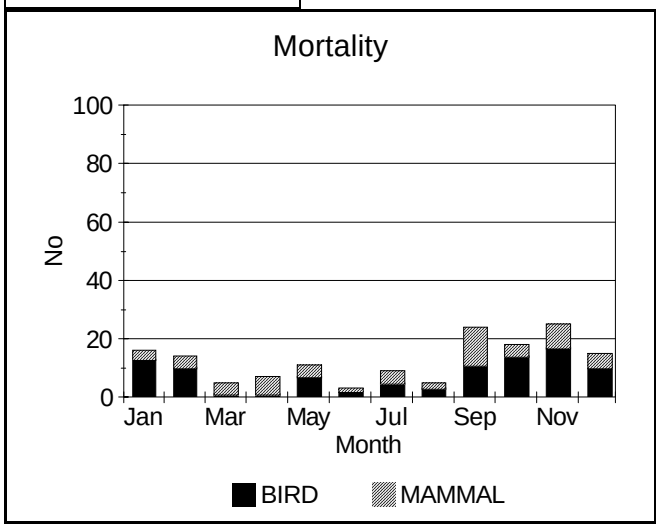


1996

372	1996
BIRD	186
MAMMAL	186

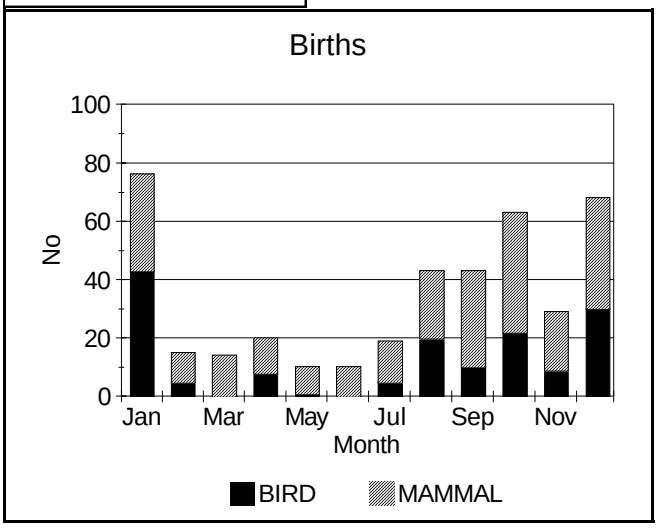


152	1996
BIRD	94
MAMMAL	58

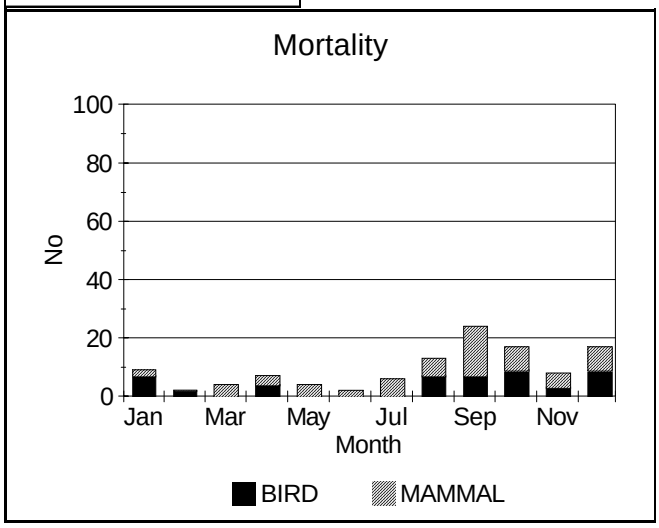


1997

410	1997
BIRD	153
MAMMAL	257

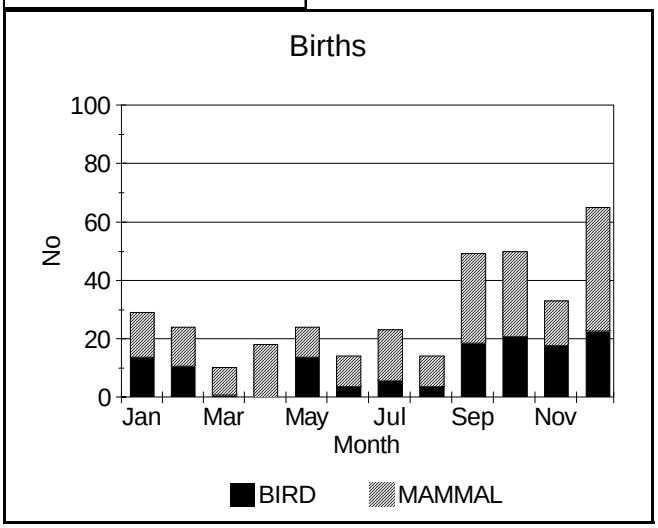


113	1997
BIRD	48
MAMMAL	65

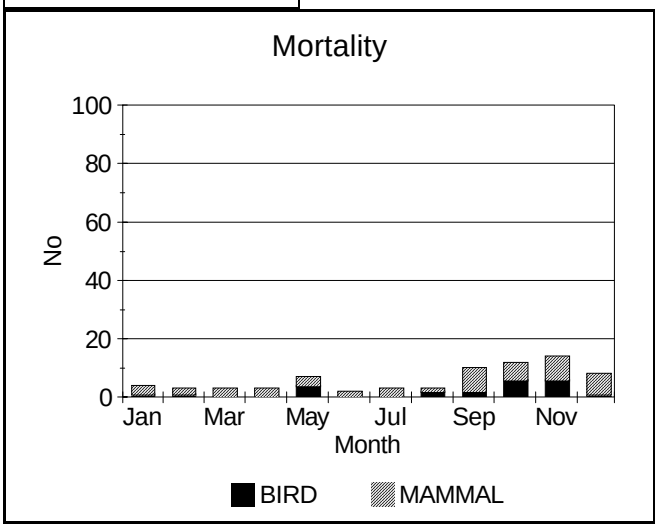


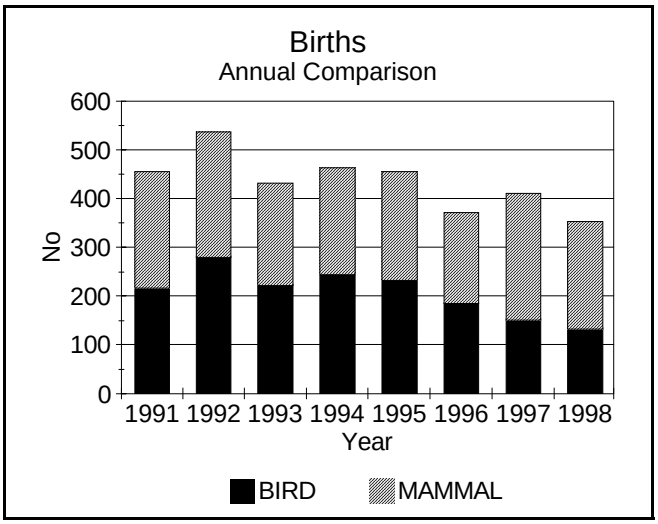
1998

353	1998
BIRD	135
MAMMAL	218

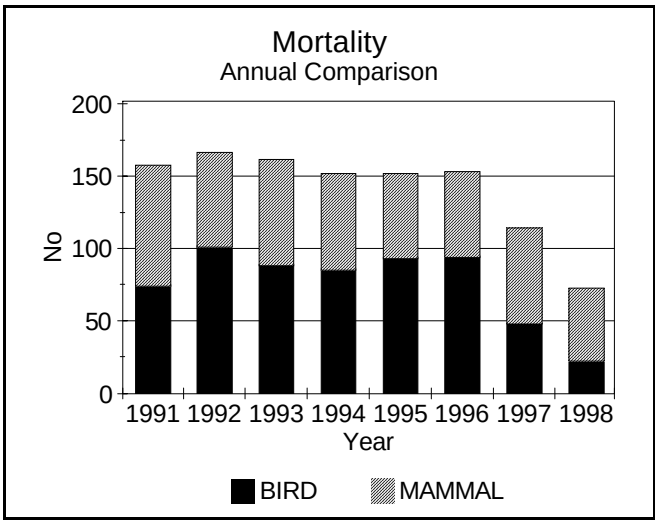


72	1998
BIRD	23
MAMMAL	49





	1991	1992	1993	1994	1995	1996	1997	1998
BIRD	218	282	224	246	235	186	153	135
MAMI	238	254	207	217	221	186	257	218



	1991	1992	1993	1994	1995	1996	1997	1998
BIRD	74	101	88	86	93	94	48	23
MAM	82	64	72	65	57	58	65	49

6.3 **Autopsy Graphs (Date1 ==> Date2)** (**Figure 86**). This button generates a series of graphs shown on page 132 by year of the number of deaths each month within each group of animals showing the trends of deaths for each month.

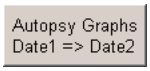


Figure 86

[redacted]

NATIONAL ZOOLOGICAL GARDENS OF SOUTH AFRICA
1899-1999

Veterinary Hospital

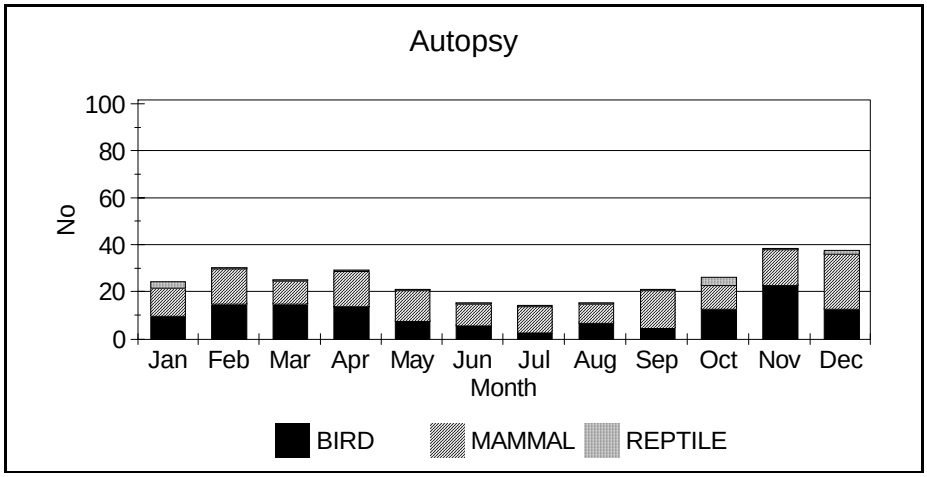
Report covers period:

1 January 1991 to
31 December 1998

Autopsy Analysis Report

1998

295	1998
BIRD	132
MAMMAL	157
REPTILE	6

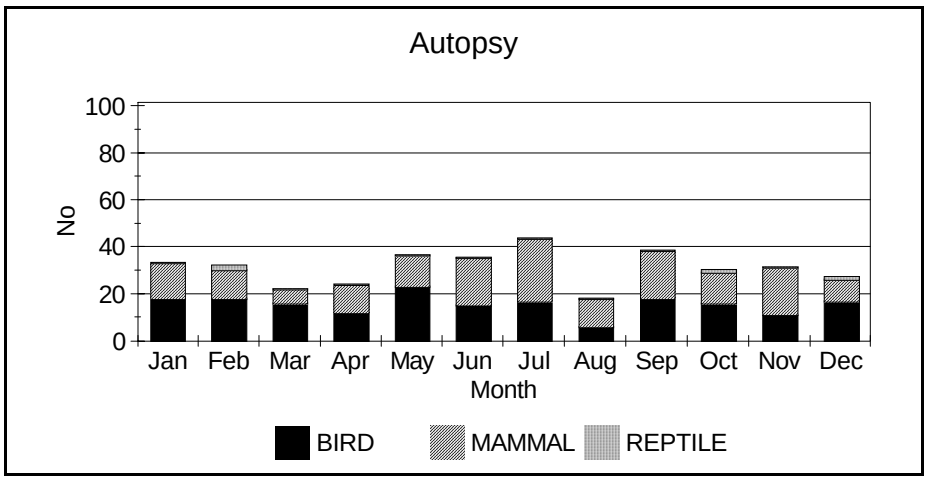


295	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	10	15	15	14	8	6	3	7	5	13	23	13
MAMMAL	12	15	10	15	13	9	11	8	16	10	15	23
REPTILE	2									3		1

1997

1997

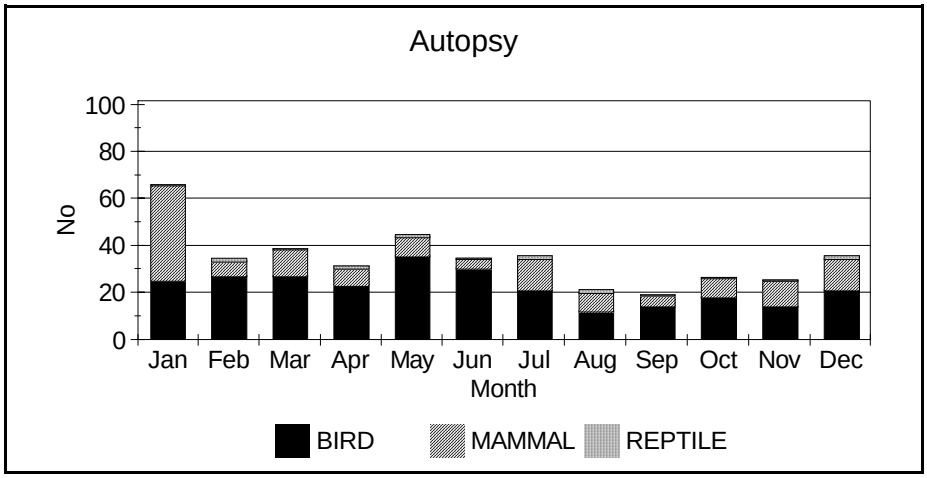
369	1997
BIRD	187
MAMMAL	178
REPTILE	4



369	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	18	18	16	12	23	15	17	6	18	16	11	17
MAMMAL	15	12	6	12	13	20	26	12	20	13	20	9
REPTILE		2								1		1

1996

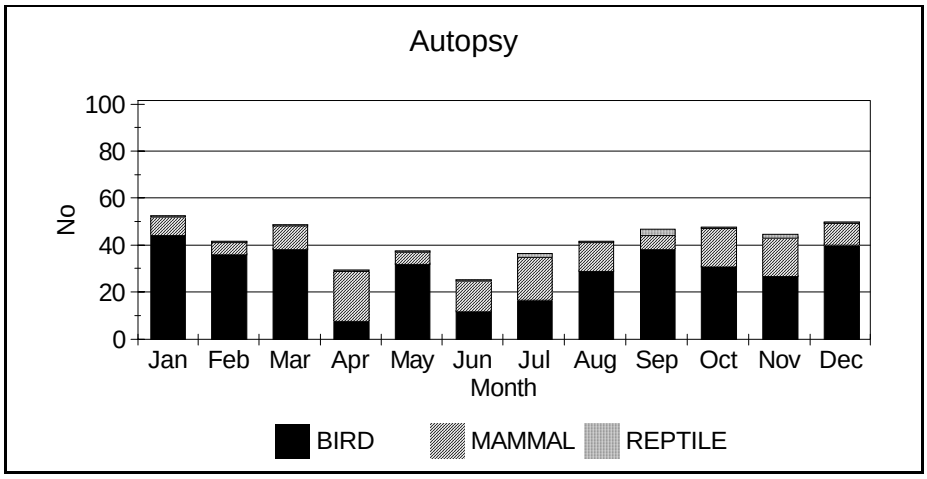
407	1996
BIRD	267
MAMMAL	134
REPTILE	6



407	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	25	27	27	23	35	30	21	12	14	18	14	21
MAMMAL	40	6	11	7	8	4	13	8	5	8	11	13
REPTILE		1		1	1		1	1				1

1995

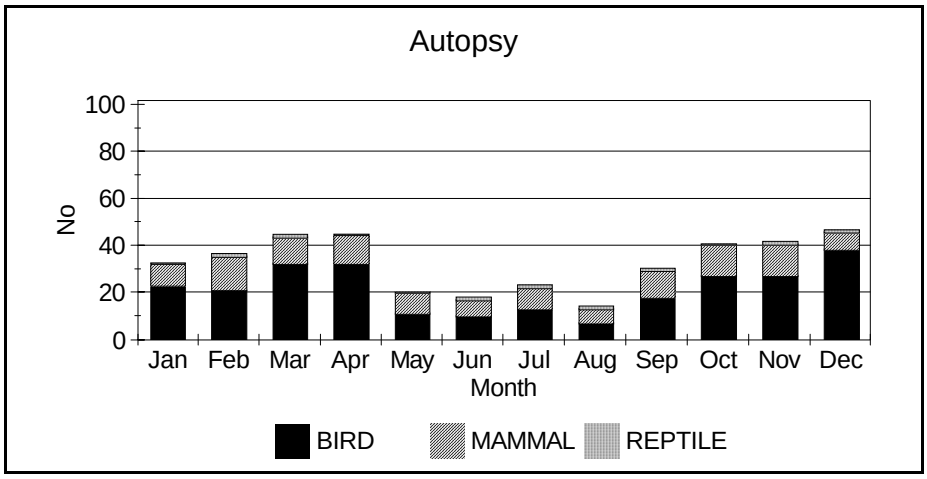
495	1995
BIRD	352
MAMMAL	139
REPTILE	4



495	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	44	36	38	8	32	12	17	29	38	31	27	40
MAMMAL	8	5	10	21	5	13	18	12	6	16	16	9
REPTILE							1		2		1	

1994

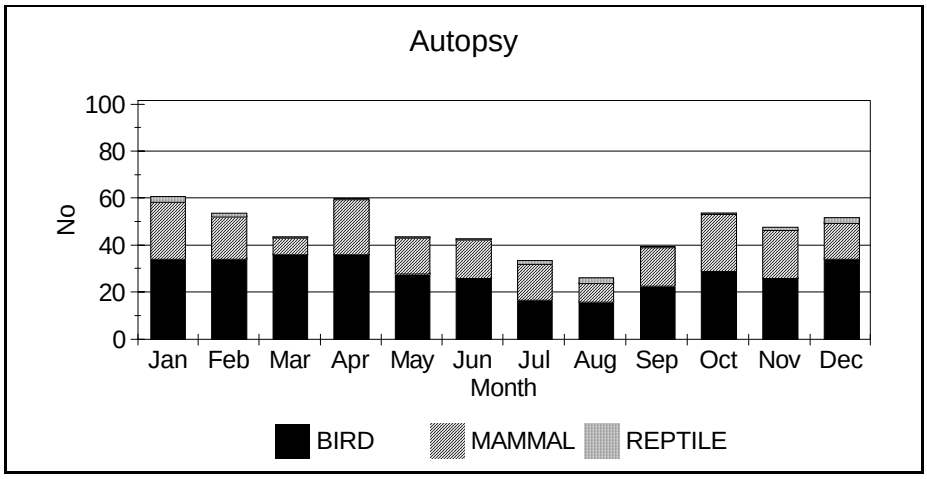
388	1994
BIRD	259
MAMMAL	121
REPTILE	8



388	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	23	21	32	32	11	10	13	7	18	27	27	38
MAMMAL	9	14	11	12	9	7	9	6	11	13	13	7
REPTILE		1	1			1	1	1	1		1	1

1993

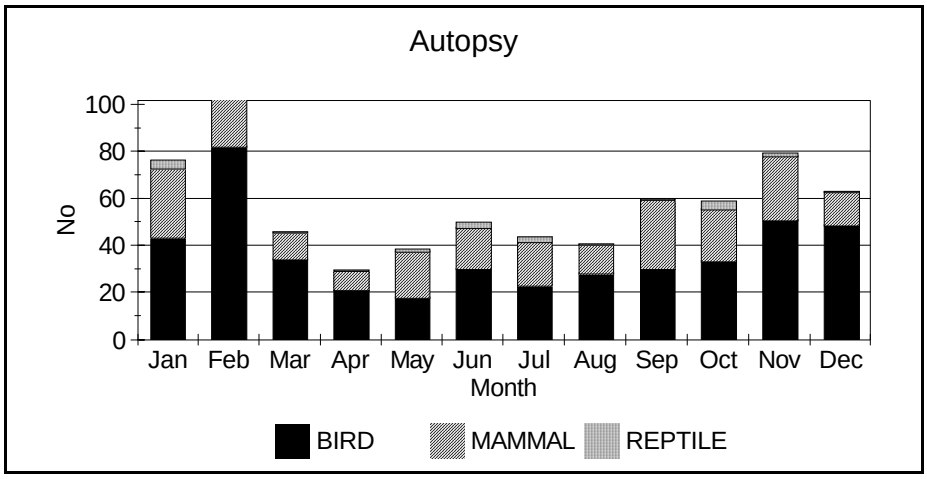
549	1993
BIRD	339
MAMMAL	201
REPTILE	9



549	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	34	34	36	36	28	26	17	16	23	29	26	34
MAMMAL	24	18	7	23	15	16	15	8	16	24	20	15
REPTILE	2	1					1	2			1	2

1992

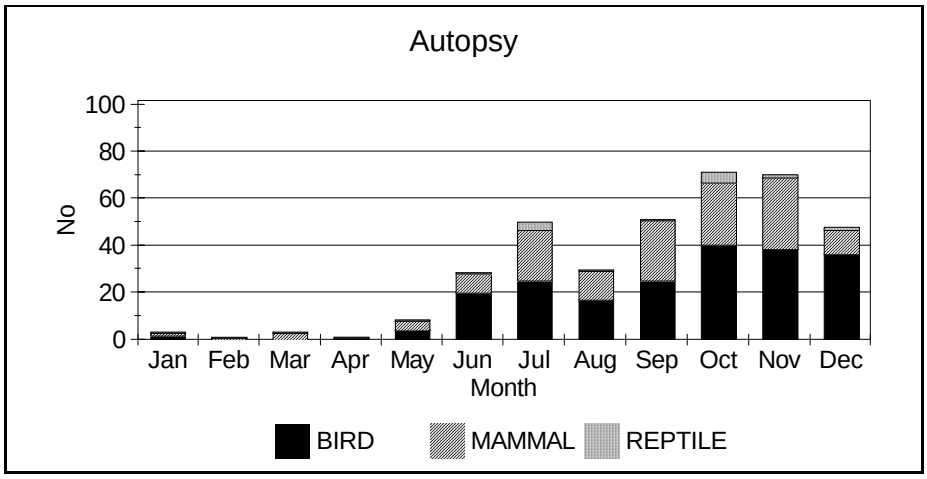
678	1992
BIRD	439
MAMMAL	226
REPTILE	13



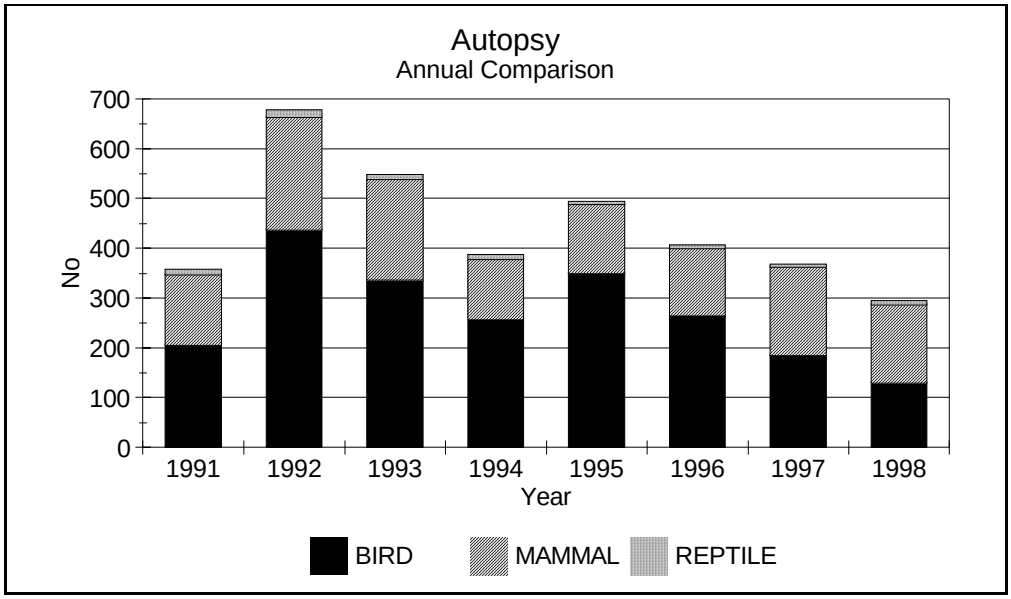
678	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	43	81	34	21	18	30	23	28	30	33	50	48
MAMMAL	29	20	11	8	19	17	18	12	29	22	27	14
REPTILE	3	1			1	2	2			3	1	

1991

358	1991
BIRD	208
MAMMAL	141
REPTILE	9



358	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BIRD	2			1	4	20	25	17	25	40	38	36
MAMMAL	1	1	3		4	8	21	12	25	26	30	10
REPTILE							3			4	1	1



	1991	1992	1993	1994	1995	1996	1997	1998						
BIRD	208	439	339	259	352	267	187	132						
MAMMAL	141	226	201	121	139	134	178	157						
REPTILE	9	13	9	8	4	6	4	6						

7 Tools

The *Tools* tab shown in **Figure 87** provides a variety of buttons for performing certain miscellaneous tasks, which will be discussed individually.

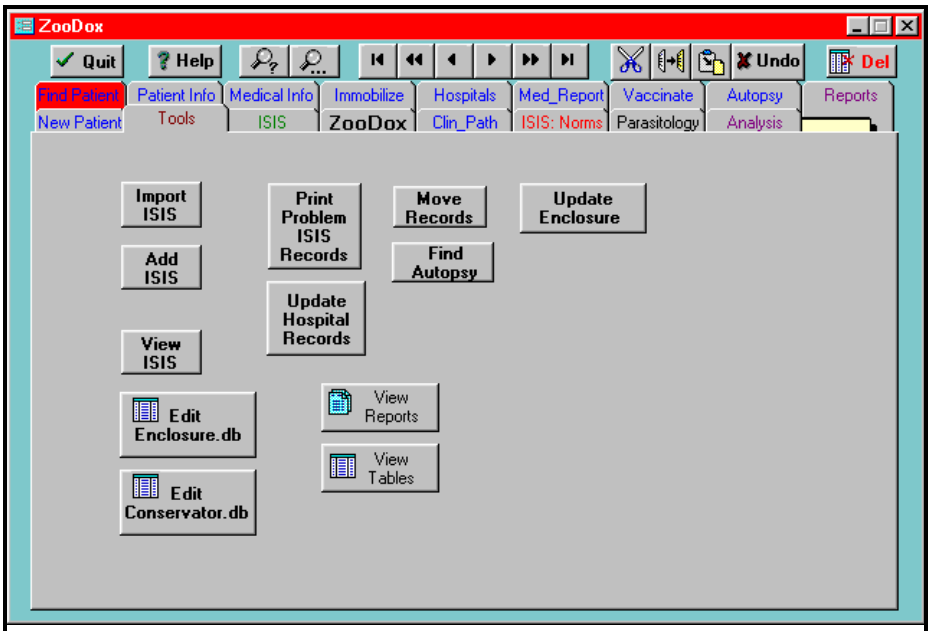


Figure 87 The *Tools* Tab showing the buttons available.

7.1 **Import ISIS**. This button opens the ARKS 3 dBaseIII files and imports all the relevant information into ZooDox which can be viewed by the *View ISIS* button and the *ISIS* tab on page 51. The ARKS data files are backed up from the Animal Databank computer on a regular basis and restored on the ZooDox computer. This process is done manually using stiffy discs. Once the data has been imported it can be used as a reliable reference for finding information on animals in the Zoo, such as birth date, sex, identity, etc.

7.2 **Add ISIS**. This button systematically searches through the Patient database of ZooDox for patients that have not been allocated an ISIS number. When such a patient is found a form as shown in **Figure 88** opens. This allows for the appropriate animal to be matched in the ISIS records by searching for it in the ISIS table in the bottom half of the form. Once a successful match has been made the *ISIS* and *Date of Birth* fields in ZooDox are automatically updated by clicking ***Add*** .

7.2.1 In **Figure 88** a Common Marmoset, a recent donation to the Zoo was found with no ISIS No. Note that the *ISIS* field is blank and the *Age* field has "ad" in it denoting "Adult".

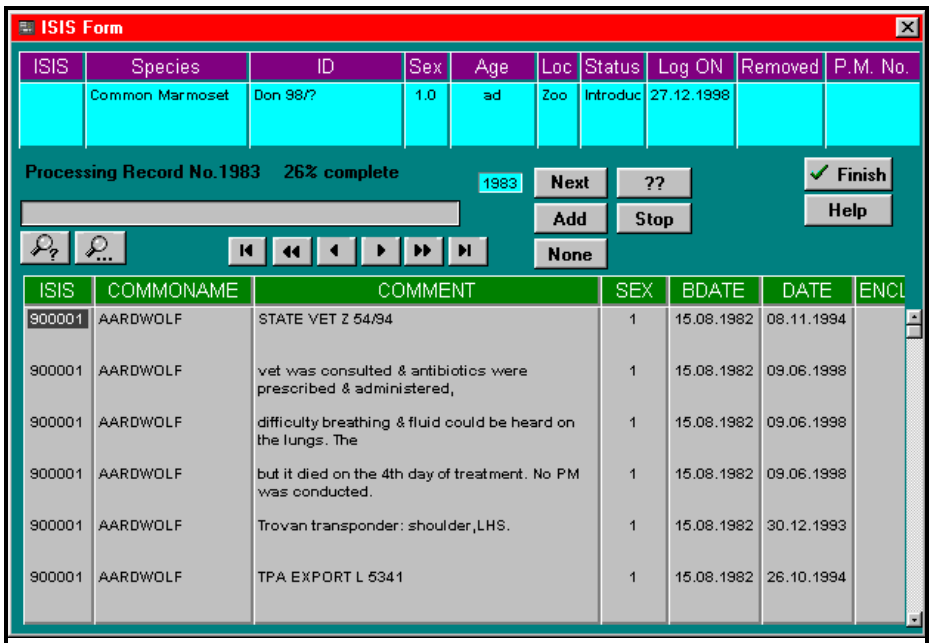


Figure 88 The *ISIS* form showing the ZooDox data in the upper table and the ARKS data for correlating the ISIS number in the table below.

These fields are automatically updated when the ***Add*** button is clicked. At the same time this change is recorded in the Medical data for this patient as an *Edit ISIS* procedure

7.2.2 The ***Next*** button finds the next patient without an ISIS No.

7.2.3 The ***None*** button puts the word "None" in the *ISIS* field when the patient does not

possess an ISIS No.

7.2.4 The ***??*** button puts "??" in the *ISIS* field when there should be an ISIS No., but there may be confusion with other animals as to which ISIS No. should be added. These cases can be rectified and updated at a later stage.

7.3 **View ISIS**. This button when clicked, enables the ISIS data to be.

7.4 **Print Problem ISIS Records**. This button generates a report of all the problem ISIS No's in ZooDox. It provides a useful tool for finding patients that may have erroneously been entered into ZooDox more than once.

7.4.1 It selects all patients which have the same ISIS No., finds all patients which have ISIS marked with "??" and finds all patients which have moved from one facility to another, such as from the Zoo to one of the Game Breeding Centres and where the ISIS No. has not been updated accordingly.

7.5 **Update Hospital Records**. This is an experimental button which opens a form in **Figure 89** and selects all the patients currently in Hospital to allow their medical records to be updated. The form shows a button which will "Discharge" the patient form hospital.

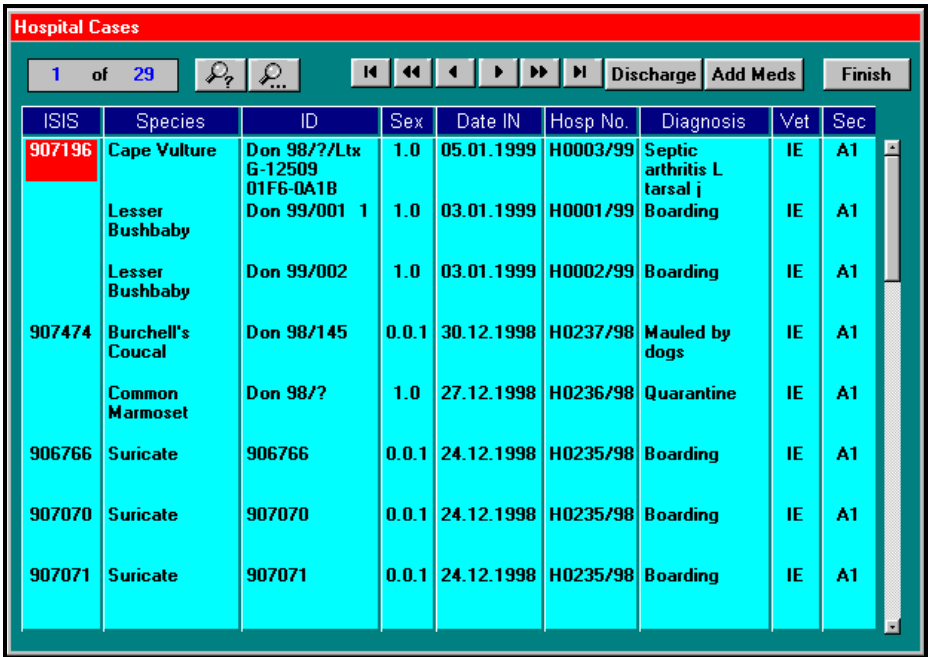


Figure 89 The *Hospital Cases* form listing current patients in hospital.

7.6 **<u>Move Records</u>**. This button enables all records associated with one patient to be moved and added to another patient. This is specifically designed to deal with any duplicate ISIS records found.

7.6.1 In **Figure 90** the patient to be moved is first located and the ***Move From*** button is clicked. The patient which must receive these records is located and the ***Move To*** button is clicked to complete the operation. The first patient is deleted from the database once all its records have been transferred to the recipient.

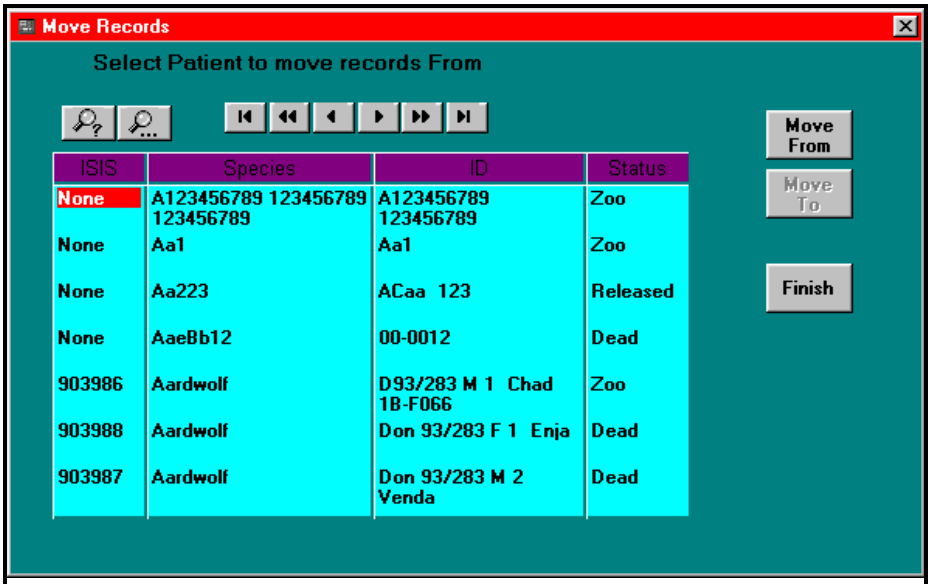


Figure 90 The *Move Records* form used for selecting Patients to move from one to another.

7.7 **<u>Find Autopsy</u>**. This button opens the form shown in **Figure 91**. Which allows a patient to be found by using the PM No. Once the patient has been found and the ***OK*** button is

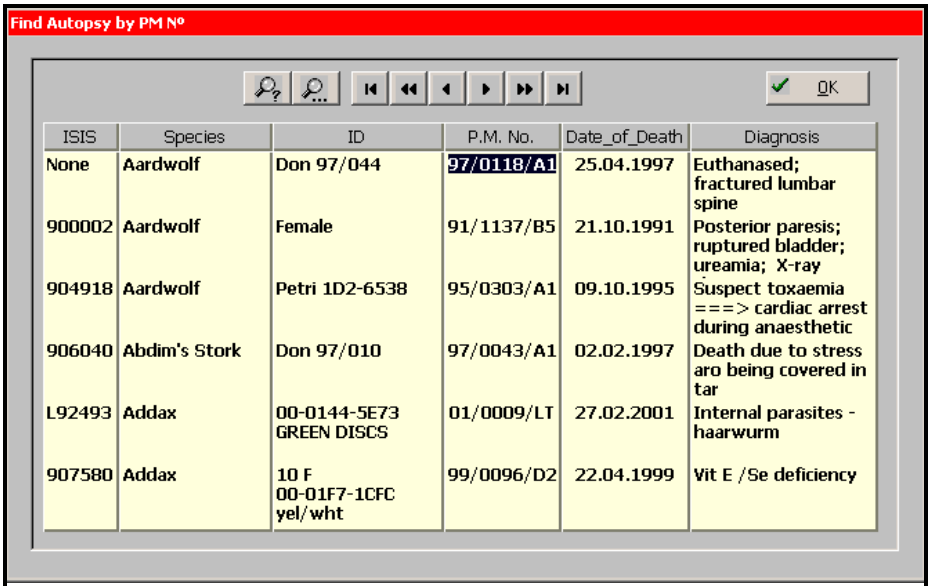


Figure 91 The *Find Autopsy* form showing the cursor in the PM No. field for locating the autopsy record by its number.

clicked, the *Autopsy* tab is opened on the selected patient for further editing and entering of the results. The PM No. is the reference number appended to tissue samples or a carcass and is included in the autopsy report. Without this facility it is at times difficult to correlate the laboratory report with the patient.

7.8 **Update Enclosure.** The action of this button is discussed in detail on page 35.

7.9 **Edit Enclosure.db**. This button opens the form shown in Figure **Figure 28**, page 35 at the appropriate tab for editing of the data.

7.10 **Edit Conservator.db**. This button opens the form shown in Figure **Figure 28**, page 35 at the appropriate tab for editing of the data.

7.11 **Edit Conservator.db**. This button opens the form shown in Figure **Figure 28**, page 35 at the appropriate tab for editing of the data.

The Information System

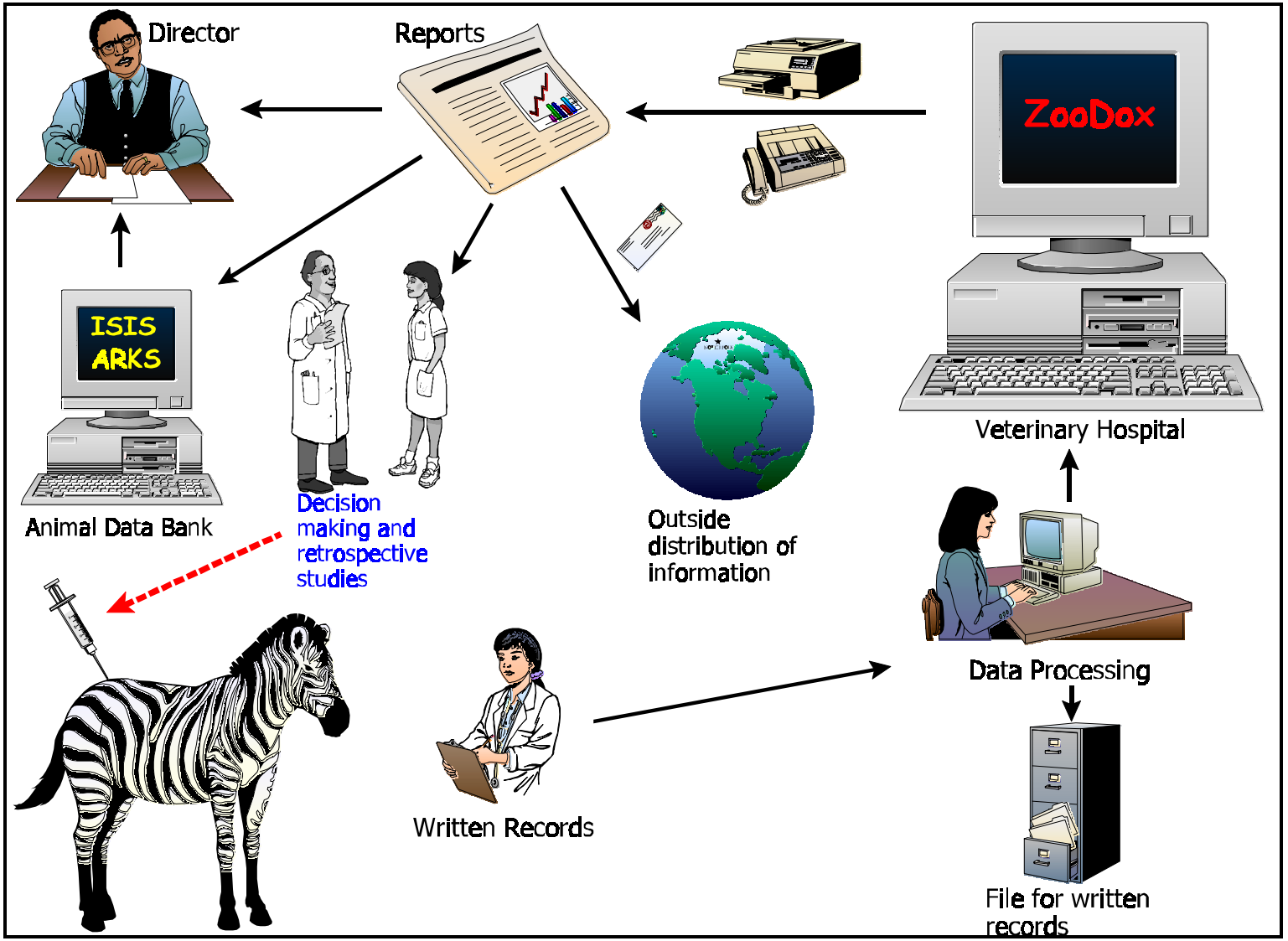


Figure 92 Schematic diagram of the Information System summarising the flow of data when capturing, processing, reporting and utilising the computer database ZooDox.

Chapter

8

Discussion

8 Evaluation of the Information System

The schematic diagram in **Figure 92** summarises the flow of data within the Information System form the animal to end-user. This chapter will critically examine and evaluate this process and attempt to highlight short comings in the system so that future systems that will be developed can benefit.

Computer technology is dynamic and advances in software and hardware development is rapid with a growing trend for internet based programs. However, the experience gained in developing this Information System and the computer program ZooDox is invaluable , providing insight for the development of new and more challenging international systems.

8.1 Disadvantages to an "in-house" developed computerized Information System

8.1.1 **System Development and Maintenance.** Developing and maintaining the in-house system without outside help from professional developers is time consuming. It takes place on an *ad hoc* basis when time is available for example when not occupied with daily routine activities.

8.1.2 **Programming experience and database development** was acquired during all stages of the **"in house"** development of the system. Initial database design was not as efficient as one developed by a professional developer. Formal training in the use of Paradox and Paradox Application Language (PAL) would have been beneficial. However, as the database grew and more experience was gained, this became less of a problem. The database evolved during the seven years it has been in use through a process of meeting the **"needs"**. Newer and more elegant programming techniques have been applied and the latest Paradox software available was used.

8.1.3 **Data processing** which involves accurate collection and entering into the computer can be very labourious and time consuming. For data to be meaningful it must be consistent and standardised. This often gives the impression that irrelevant data which adds to the time spent processing a record for the particular case is being entered.

8.1.4 **Duplication of work** is one of the main disadvantages of the present information system. In effect, information processing is being duplicated in that it is written on paper (in some cases in two or three places) and again entered into the computer, rather than being processed only once by the clinician and further processed by a clerk or entered directly into the computer by the clinician as the work is done. Upgrading the system to a local network would solve part of this problem.

8.1.5 Due to **administrative and financial restraints** it was decided to maintain a system in which clinical data is recorded on forms and stored in filing cabinets. After each case, the forms are up-dated and only at a later stage is the information entered into the computer either by the clinician or a clerk. Form design and database field design allowed for more relevant information to be fed into the system, but it took much more time to enter extra information that was recorded on the forms to be entered into the computer. The line had

to be drawn between too much information and skilled or professional time consumed in processing the extra data. Initially, and until secretarial help was acquired for this task, only essential information was collected and entered into the database to save time. As the system developed and with additional staff helping, the more detailed records could be entered into the computer which made referencing back to the original data forms less frequent. A full-time computer operator and part-time secretary in the Veterinary Hospital with the task of maintaining the information system (including a network) solved this problem.

8.2 Advantages of the "in-house" system

8.2.1 The system is designed according to the needs of the veterinarians and managers of the National Zoological Gardens. As further requirements of the system arose, these were added, thus fostering the growth and functionality of the system. The system is not rigid in its design as may have been the case if a database designed by another institution was used. An example of this is ISIS's MedARKS program which suffers from a rigidity of design.

8.3 What the system was expected to do originally when the project was started.

8.3.1 **The new developing Veterinary Information System facilitated the**:

- collection of standardised data from the data forms
- accuracy of the data by the design of the forms. This did not eliminate errors in writing down and recording the information e.g. bird ring numbers or transponder numbers. The advantage of using the field data forms was that they could be consulted if any disputes occurred with entering the data into the computer. The

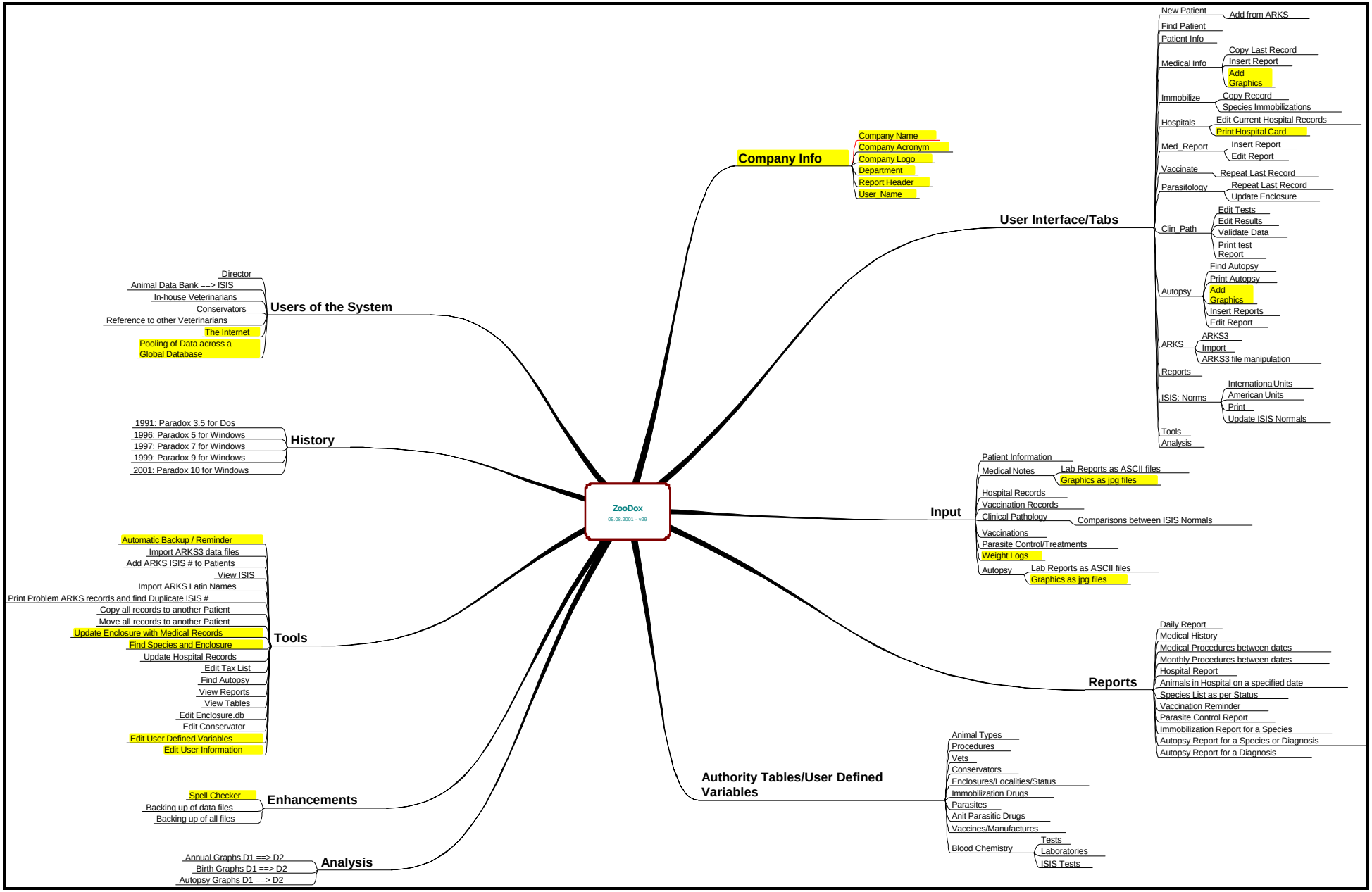


Figure 93 A Mind Map showing the features and functionality of ZooDox. The yellow text are future improvements to the system.

collection of more complete data after each procedure; the paper work **MUST** be completed which required a certain degree of discipline, but entering the data into the computer was more problematic in that it was done by the veterinarians themselves which meant duplication of the information being processed by first recording it on the forms and later typing it into the computer. This issue was partially solved with the acquisition of new staff to enter and maintain data in the database. As a result Daily and Monthly reports are produced in time.

8.4 Current view of what the system does.

- **Sophisticated searches and reports** which can be generated easily with the predesigned queries and reports attached to the buttons in the ***Reports Tab*** (page 54). This allows for automation of ***Daily Reports*** (page 23, 172), ***Monthly Reports*** (pages 66, 84, 103) and ***Post Mortem Reports*** (page 102).
- **Rapid retrieval of specific and relevant information** by the click of a button and typing in a date range or parts of keywords with wildcards in the appropriate fields provided to the user.
- **Rapid and improved** data entry of repeated information where groups of animals receive the same treatments or procedure. Before this feature was added to the system, a single record was made for the group as it was too time consuming to enter the same information over and over again. De-worming and other parasite control records were not entered in a efficient and meaningful way. The program finds all the animals in a specific enclosure on a certain date and automatically updates each animal's medical history with that record. The information on the animal's location in a specific enclosure is obtained from the ARKS enclosure log.

- **Graphic representation** of work done in different categories shows trends and such data can easily be assimilated by managers.
- **Vaccination reminders** are generated whenever required, for example on a three monthly basis, to allow for the ordering and delivery of the required amount of vaccine well in advance of the time for the vaccination.
- **Reports in detail or as summaries can be produced.** The latter to prevent volumes of paper wastage. The user has the option to select reports between a date span and should these reports have detailed laboratory reports attached to them, the user has the option of including these in the printed report. This choice can save reams of paper being printed if such detail in the report is not required.
- **Laboratory reports are faxed directly** to the computer and **Optical Character Recognition** (OCR) is used to convert the data to an ASCII text file which is inserted into the appropriate memo field. These fields can be incorporated into complex queries based on chosen key worlds. Reports received through the post are canned in OCR and converted to an ASCII file. Email is cut and pasted into a wordprocessor and saved as an ASCII file.

8.4.1 **The system is used extensively and well accepted by veterinary and management staff**, who use the system in their daily activities. The system is frequently used to:

- **Aid in decision making** and drug dosage selection for immobilizing animals in the zoo by referring to accumulated records of similar cases of the same species or extrapolating information from similar species.
- Provide **Medical histories** which can be referenced to aid in applying the most appropriate and effect treatment protocol for a specific condition in a species.

- Produce **Grouped species reports** on the causes of deaths relating to a species help ultimately in the decision making at management level and husbandry and disease prevention in that species. Recurring problems can be quickly identified and appropriate action taken.
- Give **Detailed information on groups of animals or individuals** can be rapidly gathered together for review or scrutiny and can be made available for publication and research purposes.

8.5 Criteria for a successful information system

Biggs[2,21] has described some criteria as discussed below for assessing how successful an information system is. The following criteria are discussed:

8.5.1 **Collection of data** should be standardised as much as possible and the use of the forms described in Chapter 2 illustrate this point and its importance. It does mean however, that data is processed twice in this system. The advantages of retaining and filing the original written record are that they are constantly referred to when the accuracy of entered information is questioned. Retaining the original written record in a safe place is a crude backup system should there be a crash and data loss in the database.

8.5.2 **Storage of data** can be accomplished as above with the safe filing of the original written record. It is then transferred to the computer where it is stored electronically. This can be done in various ways:

- The capacity of **hard drives** for PC's have grown and is continuing to grow and a drive can easily accommodate rapidly growing small to medium sized databases without fear of overloading the system.

- **Portable hard drives** can greatly enhance the storage capacity and have the added advantage of backing up vital data to be stored in a safe and remote place from the normal working area.
- **Zip drives** can be used to hold small databases and are recommended to be used in backing up the database.
- **CD writers** which are becoming popular and cheaper, can also be used in a backup system.
- **Networking and copying the database** onto several hard drives within the network is recommended in case the main server should fail. The last three points are concerned with safe guarding against data loss rather than data storage *per se*.

8.5.3 **Distribution for use** in the present system is achieved only by the generation of reports. The system is not on a network and querying the database is confined to the veterinary staff who perform such a function on behalf of other staff or people from outside the organisation who require information from the database.

8.5.4 **The completeness and detail of the data and information** depends directly on the time available to collect such information and how much time is available to feed the collected data into the computer, especially if there is no help provided by the institution in the form of a data typist. A happy medium should be met where valuable time could be wasted processing data which is of little value or never used - and the time required to process relevant and essential data.

8.5.5 **The accuracy of the data** will largely depend on the skills of the recorder and his or her understanding of the need to record quality data which will have meaning in the future. Detailed telegraph and phrase recording is all that is required to make sense and provide valuable information in the future.

8.5.6 **Timely information and reports** can only be achieved when data is fed into the system on a regular and sustained basis such as that the beginning or end of each day. This can place major burdens on the operators of the system especially when they feel that there are issues at hand which should receive attention. It is therefore, not uncommon to find a backlog of collected data that still requires processing and this can become a daunting task.

8.5.7 **The relevance of the data** is of utmost importance, without this it could be a waste of time and effort collecting and processing data. Some of the forms have made provision for extra detail to be recorded. The ***Immobilization Form*** (page 10) has information on the weather at the time of darting, the approach used during the procedure e. g. “on foot” or “in a boma” or “from a vehicle” - this detail is actually of very little relevance compared to the type or cocktail of drugs used, or “time taken to recumbency” or “age”, “weight” and “comments of the procedure”. Nevertheless the other details add completeness and may be of value in the future.

8.5.8 **Accessibility to the data** is possible through automated report outputs and *ad hoc* interactive queries. This is discussed in detail with examples in Chapter 5. An advantage in the system is that long reports need not be printed if the operator requires only a small fragment of information. All reports can first be previewed on the screen and output of the report substantially shortened by making certain selections in the report request form. Screens which enable data to be inspected visually are provided at all levels. Certain data inspections can be done on the screen for groups of animals e.g. immobilization dosages can be scrolled on the screen and specific ones of interest can be selected for printing. When the need arises to automate a specific type of report, this can be added to the system by the developer.

8.5.9 Is the data and information **meaningfully processible**? The type of data that the system is designed to record is the date when an event takes place and clinical notes on the procedures conducted during that event. There is very little quantitative data collected by the system. Therefore, the data can only be processed further in terms of counts of similar events that took place over a specified period of time e.g. number of animals that died during the month, or a comparative of the number of animals treated during the last few years. The use of narcotic drugs is recorded quantitatively and accurate reports can be printed out for inspection purposes if required by the Medical Control Council. This report is also useful in estimating future annual requirement of these drugs for budgetary purposes.

8.6 **Critical success factors**. Biggs[2,21] has described factors listed below to evaluate the success of a system. The critical success factors pertain to any system functioning in the "real world" and how the system relates to that world in which it is used.

8.6.1 **Participation, buy-in and ownership**. ZooDox has proved over the years to be an invaluable tool in the Veterinary Department and Animal Data Bank at the National Zoological Gardens. Its importance in decision making, keeping track of medical events, retrospective studies as similar problems occur, and report generation cannot be overemphasised. Other individuals outside the organisation, and other organisations have expressed a great interest in obtaining and using ZooDox. In 1998 a tailor made modification to the program was made and sold to the Veterinary Department in the Copenhagen Zoo, Denmark where it was equally well accepted and still in use. Ownership of the database and all the records will remain the National Zoological Gardens, while the source code of the program is the property of

the Author (IWE).

8.6.2 **Clarity of objectives**. The objectives of capturing raw field data and entering it into a computer in a structured and systematic way for rapid retrieval and processing at a later stage has been the main objective. It is clear that this objective has been met. However, the system has not reached its final conclusion and will evolve with advancing technology in both hardware and software.

8.6.3 **Faith in delivery**. The system is not widely used by other organisations and therefore expectations of delivery by users of the system are not an issue here.

8.6.4 **Good underlying data design**. The underlying data design has been fundamentally good from the outset of the project and minor changes have been made here and there as inadequacies of the system have been identified.

8.6.5 **Continuing feedback**. Feedback is ongoing in the use of the program. Bugs or deficiencies encountered of the system are rectified, as they become apparent.

8.6.6 **Scientific and traditional credibility**. The scientific community has shown a great deal of interest in the system. ISIS has had a critical look at the program in the hope that it would be a "quick fix" to solving the problem of converting MedARKS to a Windows platform which so many users of MedARKS desperately require. Unfortunately due to major differences in data structures between ZooDox and MedARKS a "quick fix" to the problem is not easily accomplished. At the same time the Borland Database Engine may not be robust enough to handle vast amounts of International pooled data, although it is designed to function adequately on a stand alone PC.

8.6.7 **Intellectual Property Rights (IPR) protection** This important issue must be considered in terms of the National Zoological Gardens' policy (if it exists ?) on IPR.

If any full-time employee of the Zoo develops systems and software during official working hours and uses the equipment of the organisation for this purpose, the software will be the property of the organisation. However, grey areas exist when employees develop software in their own time at home, using their own equipment and at no cost what so ever to the organisation. Perhaps the problem can be dealt with by agreeing that the IPR of the software is the property of its author and the IPR of the data collected and stored in the system belong to the organisation. The author could then sell the software at his own discretion.

8.6.8 **Responsibility and accountability**. The author of the program is responsible and accountable for its day to day function and maintaining it in a "bug-free" state.

8.6.9 **Regular reporting**. Regular reporting is done by generating reports to paper and these are distributed in various was as described above. The ability of the system to generate meaningful and accurate reports on a regular basis makes it an indispensable tool.

8.6.10 **Search facilities**. The built in search facilities allow for the rapid retrieval of information. Complex searches can be performed in a short period of time which are pertinent to decision making at various levels.

8.6.11 **Reports triggered by "external" requirements**. Reports are frequently submitted to other institutions, such as a detailed ***Medical History*** report (page 78) is submitted when ever an animal is transferred to another zoo.

8.6.12 **Educational facilities**. A positive aspect of the system which must not be overlooked is its educational value. New veterinarians joining the Zoo find the "experience" accumulated by the system over the years valuable in terms of decision making. Careful examination of past experiences assists veterinarians in their

education.

8.7 The ideal system

8.7.1 **Database Design.** What makes a data model "good" ?[30]

- ***A good data model is simple***. As a general rule, the data attributes that describe an entity should describe only that entity.
- ***A good data model is essentially nonredundant***. This means that each data attribute, other than foreign keys, describes at most one entity.
- ***A good data model should be flexible and adaptable for future needs***. When new requirements become known it may be difficult to change the database by rewriting many or all of the programs. Data models should be as application-independent as possible to encourage database structures that can be extended or modified without impact to current programs.
- Ideally the data model should be ***analysed*** so that it is implemented as a simple, nonredundant, flexible and adaptable database by the process of normalization. The relational database should be normalized and preferably in the ***Third Normal Form*** with tables linked with key fields and maintaining referential integrity.
- As the ZooDox system has been tailor-made for use by veterinarians at the National Zoo and is still in the process of evolving as new software becomes available and new programming techniques and ideas are implemented and added to the system, it is difficult to visualize how the system could be designed to function in a better way than it is at the present moment. But some suggestions for improvement may be:
- **Flexibility and adaptability**. Because the information system is an in-house

tailor-made system it may be difficult to install it at other zoos without making major design changes. A more flexible design to the system should be implemented to make it adaptable for use in other institutions where animals are kept in captivity and where they could be treated by veterinarians, according to that institution's specific needs and requirements. More self-editing lookup tables linked to specific data fields should be provided where the user adds his own information which will be used throughout the application of the system. This will assist in standardization and ease of data input. These look-up tables can be edited and added to when the need arises. For example, the ***"Procedure Field"*** or ***"Drug Field"*** would have a drop down list linked to a **Procedure Table** where commonly used procedures are listed according to the requirements of veterinarians in that institution.

- If the system was designed for use in other zoos, its design would be greatly influenced by what it is expected to achieve, its users' requirements, the different types of output and reports required, requirements in influencing decision-making at all levels of management and treatment of animals. User survey and questionnaires would also influence the design of the database. The usual issue of trade-offs between quality, accuracy of data, relevance and detail of data against time and effort in processing this information should be considered in designing a good database. An approach of ***"simple is best"*** is advisable. Careful balances between these issues would have to be incorporated into the design of the database.
- **ARKS**. The medical database should interface with the currently developed ARKS program developed by ISIS which is being used in zoos worldwide.

ARKS maintains detailed inventory information on each animal in a zoo. Some of this information is useful to ZooDox, such as, identity information, birth date, enclosure log, weight of the animal etc. However, for practical reasons the veterinary computer and the ARKS computer are usually separated and very often great distances apart making networking difficult or the cost too high. Efficient, frequent and reliable data transfer between the two computers should be developed and implemented. The Internet could serve as a useful means of dealing with this issue in enabling the transferring an updating files in a centralized database which is accessible to other members in the organisation.

- **Flexibility of expression**. Instead of making all fields rigid requiring a specific data entity in a specific format e.g. the following two fields ***"Transponder No."*** = ***"00-001A-3CE5"*** and ***"Ring No."*** = ***"G-707749"*** could be combined into one larger field ***"ID"*** = ***"00-001A-3CE5 G-707749"*** This has the advantage of being flexible - the animal's name can also be included in this field. Only one field needs to be searched to locate the correct record instead of two or more fields. This would bring about a great improvement in efficiency and search speed. The ***"Clinical Notes"*** field could record telegraphic style notes on every procedure that is performed on a patient. This field has the maximum size of 255 characters and in most situations the size of the field is adequate for recording all of the details. If the field is found to be too small the notes can be broken up into more discreet procedures.

8.7.2 **User interface technology** should take into consideration and enhance **"user-appeal"**. The user of the system who must not feel daunted and overwhelmed with the process of learning a new and "complicated looking" system. The interface and

forms have to be intuitive, "user-friendly", menu-driven, and with help dialogues at every step of the way. Menus should be constructed which are simple, easy and speedy to navigate to areas of information within the database. Information in the database should be accessed from various directions in easy steps - in other words the operator should be able to jump to other parts of the database without having to go all the way back to the beginning of the menu. Because of its current market dominance there should be a "Microsoft look" about the forms to enhance familiarity for the user.

- **Input and Output**. This is the component of the information system where most time is spent. The veterinarian records his clinical notes and observations etc. on incident based forms designed to provide the database with standardised and accurate information. A data typist (or in many cases the veterinarian himself) enters the information into the computer. Work is duplicated and there is greater chance of errors being made recording the data to paper then from there into the computer. This step could be removed partially with some forms like the Hospital Form being retained. However, the forms have the advantage of being **"at hand"** in the field or at the animal's side all the time with a quick visual assessment of what has been done to a patient in hospital over the last few days is needed. If this step were to be removed a complete (or partial) record of that animal's previous treatments would have to be printed each time the animal is examined. This could result in a significant increase in paper usage. Though not impossible to implement, it would also not be practical and cost effective to have networked computer workstations in each examination room where animals are treated. Information on the animal in hospital could be obtained.

- Hand held devices which records information in a standard form could be considered making it possible to download data into the computer, later.
- A "Scribbling Pad" where the operator writes notes in the appropriate fields and when the program converts to ASCII text could be incorporated into the system.
- Optical Character Recognition (OCR) is used in the present system where laboratory reports are either faxed or scanned into the system.
- Voice Recognition (VR) has great potential as VR software is being developed and becoming more sophisticated. An ideal situation where this interface would work is in the post mortem room where a microphone could hang from the ceiling with a monitor placed strategically to check the progress of data input into the database. As the organs are systematically examined, the relevant data and comments are spoken in the computer. The operator could be reminded by the computer of fields and information that is missing. At the end of the post mortem, a final report could be printed for checking, editing or further distribution. The system would have to be "trained" to receive commands from the user and this may be problematic in a multi-user system.
- **Report generation**. The most important aspect of the system is its ability to produce good, professional and meaningful reports at the click of a button. It is essential that enhanced reporting capabilities be incorporated into the system, since most database packages lack, to some degree, the ability to produce editable documents which can be processed further. At present ZooDox relies on the report generation capabilities of Paradox and

this is limited. Manipulating and editing the report in a wordprocessor and compiling complex reports from multiple report outputs from ZooDox is not effective. When the report is transferred into a wordprocessor the distribution is much more versatile. This also has the advantage that the recipient does not have to have Paradox installed on his computer in order to read a Paradox report. Reports can be e-mailed with ease which is not possible at the present time.

- Various software developers have produced third party software to enhance the reporting capabilities of databases. These programs can be incorporated into an application for further distribution to end users. An example of such software is Crystal Reports produced by Seagate. At this stage however, the difficulties of report transfer in the present system have not been resolved.

- **Paperless system** As already discussed, ideally the system should strive to be totally paperless and reduce duplication of work with regards to data input. However, this may not be very practical. Continuous reference to progress and previous treatments of a patient must be made, this is best done by holding the current form of a hospitalized patient in one's hand at the side of the patient and with a quick glance through the records, pertinent information is obtained. An electronic hand held device to substitute this action could be considered, but linking it cheaply to the central database may be impractical.
- **Technology, enhancement and transfer**. Accessing the database on the Internet would be the logical route to take for data input, searches, reporting, performing *ad hoc* queries and sharing of information between member institutions.

However, not all institutions have continuous access and connectivity to the Internet.

- **On-line help and support** is important for any system to function successfully. Personnel must be trained in its use, fully understand the capabilities and limitations of the system and the program. Help should be easily obtained when operators experience problems from local help files or from more specialised help obtained **"on-line"**.
- **Bug reporting and feedback**. A bug reporting and report-back facility must go hand-in-hand with on-line support. This will enable requests for enhancements and improvements to be submitted to the development team. Improvements and development of the system should be an ongoing and continual progress together with support.
- System improvements and enhancements, updates and bug fixes should be readily available and downloaded from the Internet.
- Different levels of access to the information in the central database can be designed into the system where only certain members of an institution can access data from their institution.
- Safeguards against data loss and system crashes are discussed under Security on page 163.

8.7.3 **Distribution and Dissipation of Information** would best be accomplished by making the system totally functional on the Internet in terms of data input and output as discussed above.

8.7.4 **Security** can be divided into the following:

- Regular **backups** of all the files the in case of system crashes and data loss. This

aspect has been discussed in great detail earlier.

- **Accessing the database on the Internet** would be limited to members possessing a **"User ID"** and **"Password"**. The password could be changed form time to time, and firewalls would prevent unwanted access by hackers. Password protection for different levels of information in the database will give certain people full rights to all data in the database and other people limited rights and access to only certain data. Full rights would allow changes or data to be deleted for critical key fields.

9 Conclusion

ZooDox has gone a step further in achieving its original goals in being a mere medical data collection tool for the National Zoological Gardens, it has received wide international interest and is being used in the Copenhagen Zoo.

Planning, developing and writing ZooDox was an excellent, challenging and exciting, and sometime frustrating learning experience. Knowledge on database design and usage was gained which I hope will be used to design and build better, faster and smarter Animal Databases for Veterinary Records in the future, and to be used by a wider Zoo community.

9.1 Future of ZooDox

9.1.1 ZooDox was designed to meet the needs of an Operational Information System for the National Zoological Gardens and its initial design criteria were never intended it to be used as a networking type database or for global pooling of data. It was not designed for flexibility to be used by other institutions. Changes to its design are needed if it is to be installed at other institutions. However, ZooDox still has potential for implementing many changes and enhancements in its fundamental design for it to grow into a flexible program capable of being used in many institutions. Much has been learned in terms of software development during the process of developing this Information System which can form a sound basis for developing

more sophisticated and demanding Information Systems in the future. It is likely that ZooDox will not reach completion and will continue to evolve and incorporate new technologies.

9.2 Other users of ZooDox

9.2.1 **Copenhagen Zoo**. Installing ZooDox in the Copenhagen Zoo (24th April to 16th May 1998) required some major changes to be made to the program for it to function desirably for their needs. A decision was made to use both English and Danish in certain parts of the program, as Danish required the use of certain extended characters in the alphabet such as **"å", "æ", "ø"** and **"œ"**. Other workers have experienced similar problems with the Russian language[24]. The root of this problem appeared to lie with the Borland Database Engine, which was not able to perform functions like searches when the extended characters of the foreign language were used in keyed fields. These problems illustrated the need to design a system which is flexible enough to be used in any animal collection type of institution in the world.

9.2.2 There has been a great deal of interest in ZooDox form local "animal collections", private zoos and game farms. But until ZooDox can be built for use by anyone without having to build and maintain several different versions of the program at once, this will grow into an impossible and huge time consuming task.

9.2.3 In addition selling several different forms of ZooDox will also go against the International philosophy of ISIS [20,19] for global pooling of data.

9.3 ZooDox and ISIS.

9.3.1 In October 1999, at the Conservation Breeding Specialist Group (CBSG) meeting

held in Warmbaths, the ISIS Director Mr Nate Flesness showed a keen interest in ZooDox as a Windows based Medical Record Keeping System which ISIS could adopt as an upgrade to the existing DOS MedARKS. In February 2000, I was invited to attend and participate in a workshop held in Amsterdam, Holland to make recommendations on the future of ISIS.

9.3.2 A report by Nate Flesness called "ISIS: Futures Search Meeting 14-16 February 2000[20] " was produced at the meeting, outlining the goals and possible future path for ISIS and the software programs it should produce for its member users in the years to come. The report was distributed to all members of ISIS for comment.

9.3.3 The new ISIS Scientific and Technology Advisory Committee (STAC)[20,19] was spawned at this meeting. The functions of this committee are to look into designing new software and advise ISIS on how best to do this.

9.4 Visit to ISIS, USA.

9.4.1 The Chairman of ISIS, Mr Jerry Borin (Director of Columbus Zoo, Florida, USA) offered to sponsor an air ticket for me to attend a small 3-day workshop in April 2000 on the future software development for MedARKS. The meeting was held at the Jacksonville Zoo, Florida. ZooDox was examined and considered for a possible intermediate step in the development of a new Windows based MedARKS program. The meeting was successful in terms of achieving its goals in evaluating ZooDox and comparing it with the antiquated DOS operated MedARKS, but the use of ZooDox without major changes to its design was clearly difficult.

9.4.2 A further problem was that of migrating about 5 million existing MedARKS data records into a new system, or in this case ZooDox, without any data being lost. A painless transformation from the old system to the new one had greater and far

reaching implications than original imagined. Severe resistance to a new system would be met if existing MedARKS data would be lost in a transition process. It is by no means an easy task.

9.5 ISIS Scientific (and Technology) Advisory Committee (STAC).

9.5.1 In a meeting in April 2000 at the ISIS headquarters in Minneapolis, Minnesota, USA I was asked and I am honoured to serve on the newly formed ISIS Scientific and Technology Advisory Committee.

9.5.2 **PAAZAB** (Pan African Association of Zoos and Botanical Gardens) nominated myself and Mr Dave Morgan to serve on STAC.

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Appendix I

An example of the ***pushButton*** code attached to the *Daily Report* button in **Figure 8**, **Figure 94**, to generate and print the *Daily Report*, is given below. The code consists of ten tasks sequentially executed to print the report.

Figure 94

```
method pushButton(var eventInfo Event)
        (1) Variable definition ----------------------------------------------------
        var
          tbl1   Table
          tbl2   String
          dates          Date
          logo           Graphic
          t              TCursor
          repInfo                ReportPrintInfo
        endVar


        tbl2 = "Med_back"

        (2) Date Input from user ---------------------------------------------------

        if frm1.open("Dates") then
          formVal = frm1.wait()
            if formVal = "Cancel" then
              return
            endIf

            if    formVal = "OK" then
              if frm1.date1.isAssigned() then
                if frm1.date1.isBlank() or
                          frm1.date2.isBlank() then
                          return
                 endIf
                date1 = frm1.date1.value
                 date2 = frm1.date2.value
                endIf
                frm1.hide()
        ;       frm.close()
            endif

        (3) Processing of date span ------------------------------------------------

        for Dates from date1 to date2
          tc.open("Rep_Msg")
```

```
  tc.edit()
  tc.empty()
  tc.insertRecord()
  tc.Start_Date = dates
  tc.endEdit()
  tc.close()
frm.open("progbar")
message("Processing Daily Medicals for ", dates)
frm.mssg.value = "Processing Daily Medicals for " + string(dates)
```

(4) Running the query for Medical records on a specific date ----------

```
q = Query

Medical.db | Species      | ID          | Date1        | Procedure | Vet    |
          | Check _join1 | Check _join2 | Check ~dates | Check     | Check  |

Medical.db | Comments | Reports |
          | Check    | Check   |

Patient.db | Species | ID     | Age    |
          | _join1  | _join2 | Check  |

EndQuery


          q.executeQBE(":work:Daily.db")
   sleep(100)
          tbl1.attach(":work:Daily.db")
   frm.mssg.value = "Adding to Backup"
   tbl1.add(tbl2)                    ; add records to Medical Backup
   sleep(100)
tc.open("Daily")
tc.edit()
tc1.open("Patient")
tc2.open("Autopsy")
dDate = dates
```

(5) Calculating the ages of patients on the date of the report ----------

```
scan tc:
          message("Processing Ages")
          frm.mssg.value = ("Processing Ages")
          sleep(100)
          spp1 = tc.Species
   ids = tc.ID

          tc1.locate("Species", spp1, "ID", ids)
```

```
        tc2.locate("Species", spp1, "ID", ids)
  if not tc1.ISIS.isBlank() then
        if tc1.Birth = "" then
                tc.Age = "Unknown"
        else
                yrs = floor(number(dDate-tc1.Birth)/365)
                mths = floor(fraction(number(dDate-tc1.Birth)/365)*12)
                dys1 = 30*fraction(fraction(number(dDate-tc1.Birth)/365)*12)
                  age1 = strVal(int(yrs))+"Y : "+strVal(int(mths))+"M :
"+strVal(int(dys1.round(0)))+"D"
       tc.Age = age1
        endIf
  endIf
endScan

tc.endEdit()
tc.close()
tc1.close()
tc2.close()

message("Processing Hospital A1 Records for ", dates)
frm.mssg.value = "Processing Hospital A1 Records for " + string(dates)

(6) Running the query for patients in Hospital on a specific date ----------

q = Query

Patient.DB | Species      | ID          | Sex    | Age    | ISIS   |
        | Check _join7 | Check _join9 | Check  | Check  | Check  |

Hosp.DB | Species | ID     | Date_IN        | Hosp_No | Diagnosis |
       | _join7  | _join9 | Check <=~dates | Check    | Check     |

Hosp.DB | Date_OUT          | Enclosure | Fromm  |
                  | blank or >=~dates | Check     | Check  |

EndQuery
        q.executeQBE(":work:Hosp_Dly.db")
  sleep(100)
        tbl.attach(":work:Hosp_Dly.db")

  sort tbl
        on "Date_IN", "ID"
                to (":work:Hosp_Dly.db")
  endSort

tc.open("Hosp_Dly")
tc.edit()
```

```
tc1.open("Patient")
tc2.open("Autopsy")
dDate = dates

scan tc:
        message("Processing Ages")
        frm.mssg.value = ("Processing Ages")
        sleep(100)
        spp1 = tc.Species
  ids = tc.ID

        tc1.locate("Species", spp1, "ID", ids)
        tc2.locate("Species", spp1, "ID", ids)
  if not tc1.ISIS.isBlank() then
        if tc1.Birth = "" then
                tc.Age = "Unknown"
        else
                yrs = floor(number(dDate-tc1.Birth)/365)
                mths = floor(fraction(number(dDate-tc1.Birth)/365)*12)
                dys1 = 30*fraction(fraction(number(dDate-tc1.Birth)/365)*12)
                  age1 = strVal(int(yrs))+"Y : "+strVal(int(mths))+"M :
"+strVal(int(dys1.round(0)))+"D"
       tc.Age = age1
        endIf
  endIf
endScan

tc.endEdit()
tc.close()
tc1.close()
tc2.close()
message("Processing Hospital Admittances for ", dates)
frm.mssg.value = "Processing Hospital Admittances for " + string(dates)
```

(7) Running the query for patients admitted to Hospital on a specific date ----------

```
q = Query

Patient.DB | Species      | ID          | Sex    | Age    | ISIS   |
        | Check _join1 | Check _join2 | Check  | Check  | Check  |

Hosp.DB | Species | ID     | Date_IN      | Hosp_No | Diagnosis | Vet    |
       | _join1  | _join2 | Check ~dates | Check    | Check     | Check  |

Hosp.DB | Enclosure | Fromm  |
                  | Check     | Check  |

EndQuery
```

```
        q.executeQBE(":work:Hosp_Admt.db")
        sleep(100)
tc.open("Hosp_Admt")
tc.edit()
tc1.open("Patient")
tc2.open("Autopsy")
dDate = dates

scan tc:
        message("Processing Ages")
        frm.mssg.value = ("Processing Ages")
        sleep(100)
        spp1 = tc.Species
  ids = tc.ID

        tc1.locate("Species", spp1, "ID", ids)
        tc2.locate("Species", spp1, "ID", ids)
  if not tc1.ISIS.isBlank() then
        if tc1.Birth = "" then
                tc.Age = "Unknown"
        else
                yrs = floor(number(dDate-tc1.Birth)/365)
                mths = floor(fraction(number(dDate-tc1.Birth)/365)*12)
                dys1 = 30*fraction(fraction(number(dDate-tc1.Birth)/365)*12)
                  age1 = strVal(int(yrs))+"Y : "+strVal(int(mths))+"M :
"+strVal(int(dys1.round(0)))+"D"
       tc.Age = age1
        endIf
  endIf
endScan

tc.endEdit()
tc.close()
tc1.close()
tc2.close()


message("Processing Hospital Discharges for ", dates)
frm.mssg.value = "Processing Hospital Discharges for " + string(dates)
```

(8) Running the query for patients discharged from Hospital on a specific date ------

```
q = Query

Patient.DB | Species      | ID          | Sex    | Age    | ISIS   |
        | Check _join1 | Check _join2 | Check  | Check  | Check  |

Hosp.DB | Species | ID     | Hosp_No | Diagnosis | Date_OUT     |
```

```
                    | _join1  | _join2 | Check    | Check     | Check ~dates |

Hosp.DB | Destination | Vet    | Enclosure |
                    | Check      | Check  | Check     |

EndQuery

        q.executeQBE(":work:Hosp_Disch.db")
        sleep(100)

tc.open("Hosp_Disch")
tc.edit()
tc1.open("Patient")
tc2.open("Autopsy")
dDate = dates

scan tc:
        message("Processing Ages")
        frm.mssg.value = ("Processing Ages")
        sleep(100)
        spp1 = tc.Species
  ids = tc.ID

        tc1.locate("Species", spp1, "ID", ids)
        tc2.locate("Species", spp1, "ID", ids)
  if not tc1.ISIS.isBlank() then
        if tc1.Birth = "" then
                tc.Age = "Unknown"
        else
                yrs = floor(number(dDate-tc1.Birth)/365)
                mths = floor(fraction(number(dDate-tc1.Birth)/365)*12)
                dys1 = 30*fraction(fraction(number(dDate-tc1.Birth)/365)*12)
                  age1 = strVal(int(yrs))+"Y : "+strVal(int(mths))+"M :
"+strVal(int(dys1.round(0)))+"D"
       tc.Age = age1
        endIf
  endIf
endScan

tc.endEdit()
tc.close()
tc1.close()
tc2.close()
message("Processing Autopsy Records for ", dates)
frm.mssg.value = "Processing Autopsy Records for " + string(dates)
```

(9) Running the query for Autopsies performed on a specific date ----------

```
q = Query

Patient.DB | Species      | ID          | Sex    | Age    | ISIS   |
          | Check _join1 | Check _join2 | Check  | Check  | Check  |

Autopsy.DB | Species | ID     | Date1    | PM_No | Date_of_Death | Diagnosis |
                                | _join1   | _join2 | ~dates | Check     | Check          | Check      |

Autopsy.DB | Codes  | Vet |
                                | Check  | Check |

EndQuery
                    q.executeQBE(":work:Autopsy_Dly.db")
          sleep(100)
tc.open("Autopsy_Dly")
tc.edit()
tc1.open("Patient")
tc2.open("Autopsy")
dDate = dates

scan tc:
          message("Processing Ages")
          frm.mssg.value = ("Processing Ages")
          sleep(100)
          spp1 = tc.Species
  ids = tc.ID

          tc1.locate("Species", spp1, "ID", ids)
          tc2.locate("Species", spp1, "ID", ids)
  if not tc1.ISIS.isBlank() then
          if tc1.Birth = "" then
                    tc.Age = "Unknown"
          else
                    yrs = floor(number(dDate-tc1.Birth)/365)
                    mths = floor(fraction(number(dDate-tc1.Birth)/365)*12)
                    dys1 = 30*fraction(fraction(number(dDate-tc1.Birth)/365)*12)
                      age1 = strVal(int(yrs))+"Y : "+strVal(int(mths))+"M :
"+strVal(int(dys1.round(0)))+"D"
        tc.Age = age1
          endIf
  endIf
endScan

tc.endEdit()
tc.close()
tc1.close()
tc2.close()
                    frm.close()
```

```
                tbl.attach(":work:Hosp_Dly.db")
                if isEmpty(":work:Hosp_Dly.db") then
                        tc.open(":work:Hosp_Dly.db")
                        tc.edit()
                        tc.insertRecord()
                        tc.Species = "No records to report on"
                        tc.endEdit()
                        tc.close()
                endif

        tc.open("Dly_log.db")
        tc.edit()
        tc.insertRecord()
        tc.date = today()
        tc.report = dates
        tc.endEdit()
        tc.close()

        rep.open("Daily")
                rep.save()
```

(10) Sending the report to either the screen or printer ----------

```
ps = frm1.prtSelect

        switch
                case ps = "Print to Screen"     :       ;; code for screen
                rep.maximize()
                        minimize()

                case ps = "Print to Printer"    :       ;; code for printer
                        rep.print(repInfo)
                        rep.close()
        endSwitch

 endfor
                frm1.close()


        Notebook.Reports.moveto()

        else
                return
        endIf
        Notebook.Reports.moveto()

endMethod
-------------------------------------------------------------------------------------------
```

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