

USER MANUAL

for

Sparks

Single Population Analysis

and

Records Keeping System

Version 1.5

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INTRODUCTION

This is the user manual for Sparks – the Single Population Analysis and Records Keeping System software from ISIS. This software has been created to assist you in assembling, editing, analyzing and producing reports on the status of captive populations held in multiple facilities.

This manual will show you how to install Sparks software on your computer, to load, create and edit studbook data, produce many different kinds of reports, to analyse your data within Sparks and perform further analyses with routines provided by others.

Sparks is intended to give you considerable power to do what is typically necessary, as well as the flexibility to handle unique circumstances. Sparks emphasizes data-quality-control plus ready analysis and comparison of different subsets of your data. The idea of a "VIEW" of the data is particularly important in Sparks. For example, Sparks allows you to look at, list, and demographically analyse the last 5 years' captive population history for the North American SSP population of your taxon, compare this to the entire North American population, then compare it to the same time periods for the European EEP population. Or alternatively, you can readily compare age-specific fecundity for hand-reared versus parent-reared individuals (assuming you have assembled the rearing data), in a particular geographic area and/or managed population and/or time period of your choice.

Sparks has built-in capabilities to export appropriate parts of your dataset to commonly used stand-alone demographic and genetic analysis programs, such as GENES from Dr. Bob Lacy (built on an initial core from Dr. Georgina Mace), Laurie Bingaman Lackey and Dr. Jon Ballou's demographic spreadsheet analyses DEMOG, and pm2000 from Drs. Lacy & Ballou and J.P. Pollak, the most recent program combining the two earlier works.

Sparks is also intended to help you be careful. Many genetic and demographic analyses are quite sensitive to an individual datum; bad data can cause very bad results. Sparks includes both a powerful data validation module and extensive interactive editing of data entered through your keyboard; both perform numerous checks on the biological integrity of your data. We strongly suggest that you run the Data Validation report from time to time on any dataset you are building or maintaining with Sparks.

Furthermore, the various analytical routines in Sparks are designed to carefully process each individual specimen's history - move by move - and decide whether each period in a specimen's lifetime is relevant to the analysis and "view" you have selected - including or excluding each period from reports and calculations on that basis. As genetic and demographic techniques applicable to the conservation-oriented management of small populations further develop, we hope to extend Sparks, as resources permit.

We have tested Sparks on model and real population data, evaluating the results for internal consistency, for consistency with routines written by others, and for small data sets, for consistency with manual calculations. We are committed to deal with problems that are identified. We would welcome suggestions and constructive criticism from anyone at any time. Written remarks supported by examples will receive the highest priority. Suggestions on how to improve this User Manual are also welcome.

Sparks would not have been possible without cooperation and suggestions from the authors of several pioneer programs - notably Jon Ballou PhD & Laurie Bingaman Lackey (National Zoo), Bob Lacy PhD (Brookfield Zoo), Georgina Mace PhD (London Zoo), Frank Princeé (Dutch Federation of Zoos), Randy Rockwell (Jacksonville Zoo), Andy Teare DVM (Jacksonville Zoo), and Andy Odum (Houston Zoo),

Nate Flesness ISIS Executive Director

User Registration

ISIS developed and distributes Sparks under license to its members in good standing in an effort to promote sound and consistent methods of animal population management. With Sparks, we are making a direct commitment to supporting conservation goals. As new and improved methods of analyses come along, we will add them to Sparks as resources permit. Sparks is also available to non-ISIS members for a one-time licensing fee; please contact ISIS at <u>isis@isis.org</u>.

Disclaimer

ISIS will make a good-faith effort to deal with any Sparks problems identified to ISIS in writing. ISIS can accept no consequential liability for Sparks use. Any modifications to Sparks performed by the user, or any direct access to Sparks data files without using Sparks, are at the user's own risk.

World Zoo Association/ISIS Studbook Library CD

We invite you to participate in the annual edition of the ISIS/WAZA Studbook and Husbandry Manual Library CD and be a part of this growing resource. Sharing studbooks contributes to the long-term genetic and demographic management of species. The availability of husbandry manuals can have an immediate impact on the health and welfare of the animals. We would like to stress the importance of documenting and sharing knowledge with other zoo professionals around the world. All studbook keepers and husbandry manual authors, as well as their sponsoring institutions will of course be appropriately acknowledged as the source of this information. The 2003 edition included ~1070 studbooks and 87 husbandry manuals, representing over 98% of published studbooks. A copy is sent to the ISIS representative at each member institution and to all studbook keepers submitting data. Each studbook keeper known to ISIS is contacted each year with details on how and what to submit.

Including your data has several other advantages - for most zoo associations, inclusion qualifies as publishing your data, with no printing or mailing costs to you or your institution. Several studbooks (unfortunately not submitted to the CD) are lost each year as a result of staff retirements, computer crashes, etc. No electronic copies of these were located; they were re-built by hand. A number of studbook keepers' "life's work" has been lost in this fashion - while the basic birth/death data can be re-done, the invaluable notes that most studbooks include are lost forever.

Technical Assistance

Please contact Laurie Bingaman Lackey, ISIS

Office phone in North Carolina, USA: +1 828.693.4336 Email: <u>giraffe3@bellsouth.net</u> or <u>laurie@isis.org</u> or <u>support@isis.org</u>

Faxes may be sent to the Minnesota, USA main office: +1 651.209.9279

Installation

Sparks will run in DOS, Windows 3.1, 95, 98, NT, 2000, XP and ME systems, and on Macintosh systems in a DOS shell. It is a DOS program.

INITIAL INSTALLATION

Sparks is easy to install on your computer, just follow the directions on the CD provided by ISIS. If you choose to install the program on a network, the program and the data folder must be on the same physical hard drive. Check for possible program upgrades at the ISIS website at <u>www.isis.org</u>. If this is a new installation, you will need to know your institution code to activate Sparks, contact ISIS for this information.

After the program has been copied into your computer, you need to check a few things:

FILES=150

In order to run Sparks, you may need to modify your DOS configuration file (CONFIG.SYS or CONFIG.NT). The Sparks installation routine will automatically offer to do this for you. The only change needed is to check for a line that read FILES=150. If you did not choose to let the install routine modify it, you will need to fix it using a file editor like WordPad. If you have more than one copy of this file in your computer, the CONFIG.SYS file that counts is in your C: root directory, not in any other folder. If you do make a change to your CONFIG.SYS, you may need to re-start the computer for it to take effect. Note that if you are using Windows NT, 2000 or XP, you will instead have a file called CONFIG.NT found in the \Windows\System32 or WinNT\system32 folder. Edit the last line to read FILES=150.

Sparks icon

If a Sparks icon was created by the installation process, delete it. Now create a new one: on the desktop, click the right mouse button, select NEW, select SHORTCUT. At the "Command Line" dialog box, click on the Browse button. Browse until you are at the Sparks folder and double-click on it. Choose the file Sparks15 by double-clicking on it or by clicking on it and choosing Open. Click on Next. Select a name for the shortcut – I suggest "Sparks 1.5". Click Next. Choose any icon at random and pick Finish.

An icon will appear on your desktop. Right-click on it and choose Properties. Choose the Program tab. Be sure that the "Close on exit" box is checked. Click on the Change Icon button. Click on the Browse button. Navigate over to the Sparks folder again and chose the file sparks.ico (it has yellow & brown elephant faces next to it). Pick OK.

Choose the Memory tab. <u>All of these must be set to AUTO</u>! Fix any that are not. Choose the Screen tab. Be sure that Window is checked. Windows XP users may pick the Compatibility tab and check Run in Compatibility mode for Windows 98 if you like. However, I have not found this to be necessary in my XP Pro system.

PKZIP.exe & PKUNZIP.exe

Use Windows Explorer to locate two files in the Sparks folder called pkzip.exe & pkunzip.exe. Copy each of these files and paste the copies into the C: folder. These are the files that allow Sparks to backup and restore. By putting a copy of each in the root directory, your computer should be able to find them. If backup/restore still does not work, try putting the copies in either the C:\windows\system32 folder or in the C:\windows\system32 folder (you will have one or the other of these folders).

Running Sparks

You should be ready to run Sparks at this point. Double-click on the icon. If Sparks opens in a small Window, hold down the ALT key and hit Enter to enlarge it. You may hit Alt Enter again to make it smaller. The first time that you run Sparks, you may need to "Hit any key to continue" several times. If a red box appears with a warning message, pick Ignore and continue. It may ask you to confirm the date. It may ask you to enter your institution code, please contact ISIS for this information. If you already have a studbook, and have a disk backup, pick System Utilities > Restore and follow the instructions. If there are already studbook datasets in Sparks, pick Change Studbooks at the main menu and choose one.

POSSIBLE PROBLEMS

A red box appears with a warning message of some kind. Sparks may be temporarily confused. Pick Ignore and the problem will often resolve itself. If it appears consistently, contact ISIS.

<Studbook> already in use...Please try again later. You probably have two copies of Sparks open, both trying to access the same studbook. It is possible to have Sparks open multiple times, but it should be using different studbooks. You may open Sparks with a regional studbook, then open another copy of Sparks, pick Change Studbooks and choose another, perhaps the international studbook for the same species.

You may be running two copies of Sparks or need to change studbooks... You may be trying to open the same studbook twice. You may also be trying to open a studbook that no longer exists. If you delete or rename a Sparks studbook folder that was the current studbook in Sparks, you will get this message when you next open Sparks. Pick Change Studbook and choose another.

Navigation Light Bar

If the light bar does not appear on the various menus (the one that moves up and down with the arrow keys), get out of Sparks. Right click on your desktop, pick Properties and choose the Settings tab. Under Color palette, try choosing 256 Color or 16 bit. Pick OK. You may need to re-start your computer.

Missing Institution List

After installing Sparks on a Windows XP or Windows 2000 computer, you may receive one of the following errors: '\Sparks\ISISISF does not exist' or the error 'Sorry, the institution file is in use...please try again later'.

During the installation of Sparks, three zipped (compressed) files are copied to your computer, and they should be automatically unzipped during the installation. On rare occasions, this unzipping does not happen, but it is a simple process to do this manually:

Go to Start, My Computer, double-click on the C: drive icon, and then locate the Sparks folder. Doubleclick on the Sparks folder. Now locate a file called ISISISF.ZIP. If you have WinZip installed, just doubleclick the file to open it (if you don't have WinZip installed, you can use PKZip for Windows or any other file extraction program). Extract the file inside the zip file to your Sparks folder. You will most likely need to repeat this process for two other zipped files, GENES.ZIP and DEMOG4_2.ZIP. Please unzip the files contained in these zip files to the Sparks folder.

Screen Display Problem: The Sparks program uses only the top half of the window or monitor screen for display. Sparks is written to display on a 25-line screen. The usual default for DOS tasks in Windows is a 50-line screen, so Sparks only uses the top half of the DOS window.

- Right click on the Sparks icon on the desktop and choose the Properties option off the dropdown menu. Select the Screen tab. Select the Window option and click on the OK button at the bottom to save the property settings
- Start the Sparks program. Right click on the bar at the top of the Sparks window and choose the Properties option off the dropdown menu. Select the Layout tab and change the height for both the Screen Buffer Size and the Window Size to 25. Click on the OK button at the bottom to save the property settings. If asked, also choose "Save properties for future windows".
- Quit the Sparks program and then restart Sparks. Sparks should now be displayed correctly in full size window on the monitor.

Screen Display Problem or the cursor is missing in full screen mode: If Sparks still doesn't display well, open it. Right click on the top blue bar and pick Properties. Pick the Font tab, pick Lucida Console, and pick 24. Pick OK. Pick "Save Properties for Future Windows with same title".

Moving Sparks

If you wish to move Sparks from an old computer to a new computer, simply drag and drop the Sparks folder and all files and subfolders from the old computer to the new, either directly through a network or by using a CD or memory stick. You will need to create an icon, check on the status of FILES=150 and place the PKZIP files appropriately, see above for details.

You may wish to update your Sparks institution list periodically. You may NOT use the Institution List found on the ISIS DVD – this list is formatted for the CMS/Arks4 program and will not work in Sparks. Contact Laurie Bingaman Lackey for an up-to-date list if you wish at <u>laurie@isis.org</u>

Sparks and printers

Sparks contains an extensive list of available printers (System Configuration > System Utilities > Set Printing). The list will not include very recent models, but something similar is probably in the list. The Epson LX and FX are good generic choices for a dot-matrix or bubble jet printers, HP LaserJet for laser printers.

Sparks doesn't understand USB ports and is set up to use LPT1 type ports to connect to a printer. There are some alternatives for people using computers connected to USB port printers.

If you use Windows 95/98, you can use the "capture printer" option on the Windows printer properties window to route output directed to the lpt1: port to a network printer. This allows you to print from Sparks when there is no local printer.

After Windows 98, Microsoft removed the capture printer option, but the "net use" command still functions. This can be run manually from the command prompt or added to the autoexec.bat (or any other batch) file so that it is run automatically. The net use command takes the form:

net use lpt1: \\computername\printername

You can determine the appropriate \\computername\printername parameters from the port address in the Windows printer properties window.

A good alternative is to direct any Sparks report that you need to a file. Please see the Reports section in this manual.

Getting Started

Type: Sparks at a DOS prompt or double-click on the Sparks icon. If the Sparks screen is rather small, try holding down the ALT key and hitting RETURN. This should enlarge the screen.

The Sparks main menu will appear giving credits, version number, and the release date. ISIS contact information is provided. The current studbook in use, if any, is displayed at the top. If no studbook is in use, you'll first have to create one. The options available from the main menu are:



To make a choice from any Sparks menu, you may type the number, the highlighted letter, or use the upand down-arrow keys to position the bar on top of your selection and hit <enter>. The <escape> key will usually return to the previous menu.

What is a Studbook?

Consider the taxonomic scope of a planned studbook before you begin. Should you create a single studbook for all subspecies or a separate studbook for each subspecies? In other words, is your studbook built on the sub-species, species, or even genus level? Sparks will let you build them any way you want, but you should think through your needs and the consequences of your choice. Splitting up a completed dataset assembled as one taxon, or combining multiple datasets created as individual studbooks, are not trivial tasks in Sparks or any other software.

One option is to create a single studbook at the species level and set a User Defined Field to identify the sub-species of individual specimens included in your dataset. See the section in this manual on the flexibility of UDFs. This gives you additional options, but means somewhat more complexity in data entry and reports/analysis as you must also be sure to enter the sub-species in each specimen's UDF field.

In our experience, creating a single studbook for a species and utilizing a UDF for subspecies identification is the most reasonable choice, especially if there is any chance that hybridization has occurred.

Beginning a Studbook

There are several possible sources of studbook data for use in Sparks:

- A Sparks backup obtained from a studbook keeper. To read in all of the appropriate files, use System Utilities to Restore from the disk you have been given.
- A studbook dataset obtained from ISIS. Read in the Sparks format studbook as above.
- A studbook dataset you create by entering the data through your keyboard, which necessitates starting a new (empty) studbook. The main menu of Sparks lists an option to Change Studbooks that also includes Creating a new, empty studbook.

Sparks allows you to have any number of studbooks on your computer at once. Each is stored in a separate folder under the \Sparks folder. If you do have several studbooks, choosing Change Studbook will present you with a list of their names. At the bottom of the list is the option to Create a new studbook. Select a named studbook to close the current one and open another one or select Create to start a new one.

Creating a Studbook

If you wish to create a new studbook, choose Change Studbooks and pick Create from the list. You will be asked to fill in your name, the scope of the studbook (i.e. "International" or "European regional"), the currentness of the data, and the scientific names and common name of the studbook taxon. You will be asked for the gestation or incubation period. These entries will be used for the footnotes printed at the bottom of some reports. Footnotes identify who compiled the data and how current and comprehensive it is - also very useful if files are being transferred to others, or for keeping your own files straight.

Changing Studbooks

There are actually two ways to change to another studbook. One is the way mentioned above, by selecting from the Change Studbooks list; the other can be done at startup. Sparks remembers the name of the last studbook that you worked with and opens it by default at startup. If, however, you know you want to work with another, you may name it on the DOS command line. For example, if you have a studbook file named PANDA that you want to use, enter: Sparks15 PANDA at the DOS prompt.

Using Sparks with data from ISIS

Many captive populations do not yet have a formal studbook (as of May 2003, 975 taxa have had a studbook keeper assigned in at least one region – although some are not yet completed). Perhaps you are interested in evaluating a possible acquisition for your collection, or are interested in starting a formal studbook. ARKS4 can export a Sparks dataset for any of the over 8,500 species and subspecies of mammals, birds, reptiles, amphibians & fish registered with ISIS, for any of the regional associations. Please talk with your zoo's registrar.

The quality and comprehensiveness of the data available from ISIS varies enormously with the taxon. Some institutions have entered data on all animals ever kept by their institution, others have only entered their collections starting with the year they joined ISIS. 55 institutions initiated ISIS in 1974; over 600 in 70+ countries were enrolled in late 2003.

Individual specimen histories are often fragmented into one or more pieces because one reporting facility fails to link a specimen when it is sent to another facility. Such datasets will benefit considerably from human scrutiny and detective work. Ordinarily the raw ISIS data will be too fragmented to permit thorough analysis of pedigrees without additional effort to clean up the data. However, demographic calculations should be reliable without extra effort, as Sparks is intended to produce unbiased demographic values even with fragmentary specimen histories.

ISIS datasets in Sparks format have temporary numbers (T----) assigned to specimens in birth date order. Any studbook numbers reported by participants will be included in the Special Data section. An individual specimen may have a number of studbook numbers assigned to it – it may have an international as well as many regional numbers. Some regional studbook keepers use the international numbers, others assign their own.

If you are starting a new studbook, the available ISIS dataset is often a considerable head start. If you are maintaining a studbook, experience has shown that selectively adding in additional data available from ISIS can improve accuracy and comprehensiveness. It also may save time and/or fill in data for institutions which fail to respond to questionnaires. Since participant institutions make their own taxonomic assignments, you may find specimens in ISIS listed in the taxon of interest that might not qualify for a formal studbook, or specimens of interest listed under an alternative taxon.

To use ISIS to update your studbook, we strongly suggest that you treat the ISIS dataset as a separate studbook with a different name. One approach would be to open the ISIS studbook in Sparks and produce separate "studbook" reports for births, deaths, and transfers -perhaps restricted to the last year or two. This will give you neat lists of recent events on ISIS to check against your own data. Periodically, it will be worth checking over earlier data on ISIS as ISIS is sent new historical data each year.

Data Entry

When you choose the first option from the Sparks main menu, you get into the data entry / data editing part of the system. A password is requested. When Sparks is installed, the password is set to blank - i.e. just hit the [Enter] key to go on. You may re-set the password in the System Utilities section if you wish.



Edit Animal Data

Finding a Specimen

If you're about to enter data for a new specimen, just enter the new studbook number. If you're looking for an animal that you've already entered, it is always quickest to edit or retrieve if you know the studbook number of the specimen. However, you may ask the computer to retrieve the data by other identifiers. These include:

	Identifier	Example
٠	specimen's local ID at a chosen location	DETROIT 52
٠	house name	George
٠	tag/band	green 17
٠	tattoo	M506
٠	notch	16
٠	transponder ID	0011*1245*22
٠	regional or international studbook number	1845
•	old studbook number or local ID	52 or T1234

Enter the identifier you know. If the identifier is unique (as will be studbook numbers), the animal's data will appear. If more than one animal has that identifier, a list of matching animals will appear. Use the upand down-arrow keys to choose an animal, hold down the 'Alt' key and press 'W'. That animal's data will appear.

Studbook Numbering and Re-Numbering

Specimen Numbering

The idealized method of numbering your studbook is to start with the first Specimen as "1" and sequentially increment each additional specimen as it is/was born. This would yield a chronologically numbered studbook. This is rarely achieved, because new information frequently comes along for a previously unreported birth or capture and there is no room to insert the Specimen in the correct order. ISIS and all of the various regional zoo organizations actively discourage the idea of "fixing up" the chronological order of the numbers by re-numbering any published studbook. Once a studbook is distributed or published, you have defined the permanent numbers that you wish the world to use in reference to your animals. Usually, other researchers and animal managers rely on the continuity of the numbers -and you will cause them considerable grief and records confusion if the specimens change their assigned studbook numbers.

Historically, studbook keepers have developed a number of ingenious schemes to embed information in a studbook number, including the year born, the subspecies, the sex, the region or zoo, etc. This was in an age when studbooks were kept with pencils and typewriters, and finding an animal in a large studbook could be quite difficult. With the advent of computerized data, finding animals is trivial. Having the animals' studbook numbers be in chronological order is not necessary, as Sparks will easily print a studbook list order by any number of variations, including studbook number, birthdate, deathdate, and current location. Number any newly published studbook starting with 1 and simply use the next available number up as additional animal data appears.

Temporary Numbering

ISIS recommends assigning temporary studbook numbers while studbook data is being compiled. This includes starting from scratch when a species is not a managed taxon and has no existing studbook. You might also use this strategy for a few months when recording new and recent data for births or captures to be added to your studbook. To indicate that a studbook number is temporary, make the first digit a letter. You may use any letter, however the letter "T" is the international standard. You may even wish to code different batches of temporarily numbered data, for example by using "T"s for one year and 'U's for the next.

Re-Numbering

Sparks does allow you to re-number your studbook from temporary to permanent studbook numbers. See the section titled "Re-Numbering" in System Utilities.

The Sparks Data Entry Screen

Sparks data entry/edit routine shows you a screen split into four quadrants - a very powerful look into the various kinds of information stored on each specimen. Each quarter of the screen contains a summary of the data from the four files that store the information. At upper left is the Master record with basic biological specimen information, the upper right lists the Event records - i.e. moves. The lower left box shows any Special Data records (such as additional specimen identification) and the lower right any UDFs (User Defined Fields). In the center is a large blinking yellow square "cursor".

You can move the cursor by using the arrow keys. If the cursor is in any box or quadrant when you hit the <enter> key, that quadrant will expand to fill the screen and allow you to edit the fields within. If the cursor is between quadrants when you hit enter, you close the current specimen and then can select another studbook number for editing or go back to earlier options. You may also print a single specimen report from this screen, as the box at the bottom shows.

Master Record —	SPARKS	Dat	a Edit Eve	nt Records
Studbook №: 75 Sex: Male Birth Date: ~ 1932 Sire: WILD Dam: WILD	Wild birth -> Parent reared		Wild Caught Transfer to Transfer to Death	ARUSHA NONE Nov 1933 SCHULZ CW NONE 1934 CHICAGOBR 18005 13 Jun 1934 CHICAGOBR 9 Aug 1943
Special Data House Name 1 JACK Collection data 1 Captured on north slope of Museum number 29 Field Museum of Natural Hi Print speci	Jan 1932 Nov 1933 Mount M Mar 2000 Story FM	t t	User D Subspecies/Gro TIPPELSKIRCHI	efined Fields up/Level/ tipp 1.00 'ile>?

Entering dates in Sparks

Date information is more complex than it might initially seem. This is because dates can be entered and displayed in many ways. Sparks allows you to estimate the accuracy of a date by recording various certainty levels. All dates can be set to European or American format as well as alpha or numeric months. The international standard of DD-MM-YYYY is the default in Sparks.

In entering dates in Sparks (whether a birth date, transaction date, removal date, or death date) you enter the date into a date field. If your value is an exact date, where the day, month, and year are known, enter the date only and leave the Date Estimate field blank.

For dates that are known with less certainty, decide what span of time is involved and then use the date that falls in the center of the span. For example, if the date value is "sometime during 1947", enter a date at the center of this time period (1 July 1947) and enter a Date Estimate of Y to indicate that this date is estimated sometime within this year. If an animal was born at some point during June 1982, enter 15 June 1982 (the mid-point of June) and a date estimate of M.

If you know an animal hatched in 1995, and also know that the species is a seasonal breeder, with hatchings occurring only during April, May and June, the center of this time span would be 15 May. Enter 15 May 1995 and a date estimate of Y. Entering a date estimate of M would be incorrect, as you do not know that the animal was born in May.

In some cases, you may have several dates to infer. For example, you may know that an animal was born and died during 1972. You may know that it was stillborn, in which case it would be born/died on 1 July 1972, both dates estimated to Y. If not, subdivide the time period into equal intervals. This results in a birth date of 1 May and a death date of 1 September, both with a Date Estimate of Y.

If you cannot estimate a date to a specific year, but have a good idea that it is within a several year time period, then use the range estimate. To specify a range such as plus or minus two years, enter a date at the mid-point of the range of years involved and then enter the age field as R2. For example, if a crane hatched sometime during the 1960s, enter 1 July 1964 (the mid-point date) and a Date Estimate of R5, indicating a hatch between 1 Jan 1960 and 31 Dec 1969. You may use up to +/- 9 years with the range estimate. You may similarly indicate a range of months – again, enter the central date in the possible time span and then a Date Estimate of Mx, where x takes into account the number of months involved.

Finally, if you know fairly closely when something happened, but are not completely certain, you may enter the best-guess date involved, with a Date Estimate of D to indicate that the exact day is uncertain.

As a last resort, you may enter a totally unknown date. You will still need to enter a date of some sort into the date field – use a date that is your best guess at a sensible date, taking into account the biology of the species. DO NOT enter a birth date such as 1 Jan 1900, which is not biologically sensible or reasonable. Sparks will use this underlying date when sorting the data for the studbook report, so try to at least place the animal in a reasonable era. Then enter U into the Date Estimate. Sparks will display this date as "????" rather than showing any date at all. The data involved in the unknown date will be ignored in the various demographic analyses, so only use this option when all attempts to set a reasonable date have been exhausted.

Pressing the <F2> key will bring up a calendar on-screen. This can be useful as a reference while backcalculating birthdates, possible intervals in which an animal was conceived, etc. The Esc key will close the calendar.

Editing the Master Record

At the data entry screen, move the cursor to the upper left quadrant and hit the enter key. If this is a new specimen, with no data yet entered, this will initialize the new record. The box expands to fill the entire screen and the complete master record for the specimen is displayed. The right side of the screen contains various instructions as you enter each field. For further information on items like studbook numbering and date fields see paragraphs above. If you need more help, hit the FI key.

Notes on Studbook Number: Deleting the studbook number will delete the entire animal. If you delete an animal in error, you may recall it from the main menu: Data Quality > Recall Animal if you have not yet run the Cleanup report. You may change the studbook number to another number, as long as that number is not already in use. However, if the studbook number has already been published, DO NOT CHANGE IT. To change an entire studbook from 'T'emporary numbers to Permanent numbers, see the section System Utilities > Renumbering below. ISIS does **NOT** recommend entering WILD, UNK or MULT as a studbook number at any time.

Notes on entering parent IDs: If you know the parent's studbook number, enter it and enter a blank for institution and local ID. If you do not know the studbook number, but do know the institution and local ID, enter them and Sparks will look up the studbook number for the parent <u>IF</u> the institution and local ID are entered into Sparks.

Notes on Rearing: Most of these are self-explanatory. An example of "Peer" rearing would be two orangs being hand-raised together, in order to encourage appropriate behavior. "None" would apply to herps and also to stillborn/premature mammals, where the parents had no chance to attempt rearing. "Supplemental" rearing would amount to a combination of parent rearing, with some additional human intervention (bottle feeding through the fence for example). Sparks will only store one type of rearing. If a baby was initially parent-reared, then hand-read, then fostered or placed with a peer, enter the one most important to the process. Enter all the rest as Special Data notes.

Editing the Event Records

Move the cursor to the upper right. Hit the enter key to expand the event records screen. Each event in the specimen's life is listed in date order. There are three kinds of event sets: management, movement, and social. The up- and down-arrow keys will move from one event to another.

Movement events may be a birth/hatch or capture, transfers from one facility to another, and finally death or release. These entries are required in order to track the specimen.

Management events involve regional management plan status (SSP, EEP, etc.). When did the specimen enter a regional plan? When did it leave or change to another regional plan? When is it declared surplus? These entries are not required.

Social events track groups of animals, usually within a single institution. Who is housed with whom? When were they put together? When were they separated? This can be invaluable in determining possible parentage or exposure to disease. These entries are not required.

There is a menu at the bottom of the screen. The F1 key brings up a Help screen. The escape key will close this screen. To edit an existing event, place the light bar on the record you would like to

vent Types-Mgmt Plan -In Mamt -Surplus Mgmt Plan -Out Birth Wild Caught Transfer Death Release Social -In Social -Out

change and hit the F10 key. A window showing the details for this event will appear, and you can go through each field, changing anything necessary. When you leave the last field, this window will close and the changes will appear in the event records. If you change your mind while entering data, hit escape to abandon your changes.

If you need to add a new event to the list, use the F9 key. The same window will appear, but the fields are blank. Add your data.

Notes for Wild Capture: Generally, a wild-caught animal is NOT caught in a zoo, but caught in Africa, Peru, Tahiti, etc. When adding an animal to your studbook as wild caught, first enters its wild-caught location and best-known date of capture. Then add a transfer event to the zoo that first held the animal on the date that zoo received it. Do NOT enter a Birth/Hatch, then a Wild Caught event. The Birth/Hatch entry is for captive-born/hatched animals only.

Notes for Social In or Out: Some examples of social groups might be BERLINZOO GROUP2 or LONDON RP CAGE14 or LISBON MALES2.

Notes for Removal Dates: Generally, it is not necessary to enter removal dates. In almost all cases, the removal date from one institution is within a few days or less of arrival at the next institution, depending how long a trip the animal makes in a truck or airplane. Enter the date of arrival at the second location as the Transfer date for this location.

To delete one of your event records from the list, position the light bar on the record, hold down the control key (the CTRL key) and type the letter T. [This is usually written as ^T.] A * will display next to the deleted record. If you change your mind, hit ^T again to un-delete the record before leaving this screen. "Deleted" records will be visible and un-deletable until you run Data Quality > Cleanup Files when they will be permanently erased.

Notes for Lost-to-Followup: Quite often, an animal is transferred to a final location where it is never heard from again. It is important to indicate that these are NOT to be included in analyses such as Mx/Qx. To indicate that an animal is no longer in the population, enter the transfer to its last known location on the date it went there, and answer 'Y' to the question Lost-to-Followup. **DO NOT under any circumstances invent a death for** the animal, even if it is impossible that it is still alive. Do not indicate that an animal is lost-to-followup at any intermediate location, only at the last one. This animal was moved to Central Park Zoo on 18 September 1872, where its fate is unknown:

Transaction:	Transfer	to
Location: Local ID:	CENTRALPK NONE	Loan involved? No
Transaction Date:	18/09/1872	Date Estimate: 📕
Removal Date:	///	Date Estimate: 📒
Lost-to-Followup:		

When through with all your changes and additions, hit the enter key or the escape key to return to the quadrant edit screens. A quick logical consistency check of your list is performed. If illogical errors exist, such as a birth occurring after the date of death, you will not be able to leave this section until the problem is corrected.

Sometimes an animal is transferred to a location, and is known to be there for some time because it has reported offspring or the institution contacts you. If you then lose contact, and never know what becomes of the animal, add another transfer to the location as of the last date you knew it to be there. Mark this entry as lost-to-followup.

Transfer	to	COLO SPRG	90A014
		13	Dec 1990
Transfer	to	MONROE	551668
Loss to			Jul 1993
LUdii LU		WHND 30E 91	Nec 1995
Transfer	to	WARD SUE	000 1775
		1tf 29	Sep 2001

Notes for loans: Sparks will allow entering loan information. It will also allow you to include or not include this information in the studbook report. International studbook are required to track loans, regional studbooks are not required, but many do.

To indicate a **loan** from one zoo to the next, pick F9 to start adding a Transfer. Choose Transfer. Enter the location and local ID. When asked "Loan involved?: type 'Y'es. Enter Physical = Yes, Ownership = No. Enter the transaction date. This will appear in reports as "Loan to Zoo as of Date"

To indicate a **change of ownership**, where the animal does not physically move, pick F9 to start adding a Transfer. Choose Transfer. Enter the location which will own the animal and its local ID there. When asked "Loan involved?: type 'Y'es. Enter Physical = No, Ownership = Yes. Enter the transaction date. This will appear in reports as "Ownership to Zoo as of Date"

To enter a **birth on loan** – a baby born/hatched at a zoo, but owned by a second zoo as generally one of its parents is in on a Breeding Loan:

Pick F9 to start adding a Birth/Hatch. Choose Birth/Hatch. Enter the location where the animal was born/hatched. When asked "Loan involved?: type 'Y'es. Enter Physical = Yes, Ownership = No. Enter the hatch/birth date. This will appear in reports as "Born/Hatched at (holding) Zoo as of Date" Then enter the location which will own the animal and its local ID there. When asked "Loan involved?: type 'Y'es. Enter Physical = No, Ownership = Yes. Enter the birth/hatch date. This will appear in reports as "Ownership to (loaning) Zoo as of Date"

Editing the Special Data Records

The left lower quadrant allows you to enter dozens of different Special Data items, including things like house name, tattoo, breeder number, permits, tag/band/ring, notch mark, transponder number, death number, old studbook number, et cetera. If you already have some Special Data records you will see a familiar screen. It is a list screen just like the one mentioned above for the Event records and works the same way. If you do not yet have any Special Data records for this particular specimen, you automatically go to the Add (F9) step.

Special Data Optio	ns‡	
1- House Name 2- Tattoo (or FB) 3- Breeder Nº 4- Permits 5- Tag/Band 6- Color Phase 7- Wgt/Length 8- Litter 9- Natching Mark	11- Sire Taxon 12- Old Studbook Nº 13- Death Nº 14- Growth Stage 15- Transponder ID 16- Carcass Recip. 17- Parent Assumptns 18- Regional/Intl Nº 19- Dam Taxon	N- General notes B- Behavior notes P- Physical condition M- Medical notes R- Reproductive notes
10- Vendor's Taxon X- eXit Specia	20- Old Accession № 1 Data Options	Hit 'V' to View/Add more codes

There is also an extensive list of user-supplied items, called OwnCodes. Enter a V to view them. You may add to the OwnCode list to suit your own needs.

Meaning	Code	_
Note	N	
Age estimate	NE	
Acquisition note	NA	
Donor's name	NN	
Collection data	NC	
Physical/legal arrival	ND	
Birth note	NB	
Possible parents	NP	
Death note	NX	
Disposition note	NO	
Missing/escaped	NM	
Carcass note	NR	
Museum number	NU	
Identification	ID	
Identity description	NI	
Animal management note	Q	

Editing the UDF Records

The UDF records are in the lower right quadrant. By now you probably know what a User Defined Field is. If not, see the next. If none are yet set up, you will not be able to edit any UDFs.

Editing the UDFs is just like the Event Records and Special Data records; a list screen. Make your changes and additions, hit enter or escape to return to the Edit Data quads.

Re-sizing the Sparks Data Entry windows

Many of the windows in Sparks can be re-sized and moved to suit your preference. For example, pick Data Entry > Edit Animal Data > and call up an animal. Move the cursor into the right upper quadrant to edit the Event records. A new window will appear. Click on the small yellow dot in the lower right corner and stretch the window to the right. You will discover that there are two additional columns of data: Physical and Ownership status. If you then click on the yellow heading at the top "Moves Data' and hold your finger down, you may move the entire window. I suggest sizing and positioning this window so that it covers the bottom half of this screen. In this way, you will be able to see the Master and Event Records at the top while adding new data. Do not hide the menu bar at the bottom of the screen. Once you have positioned this window, Sparks will remember and always show this window in this manner for this studbook. Repeat for the Special Data and the UDF window.

Another window to consider re-sizing is the Institution List (System Utilities > Institution List > Edit). While in this window, please notice that a vertical line separates each column of information. If you click on this line and move the line to the left, you can re-size the column and allow more information on the screen. This list includes data on city, state, country, mailcode, phone, fax, and email to the right that you cannot see on the default screen. Using the Enter/Return key will move the screen to the right and allow you to see this information as well.

The Quick View window should be re-sized: additional information for House Name or Tag/Band is available to the right.

Defining User Fields (UDFs)

For any given studbook there are any number of types of data for which Sparks cannot anticipate your needs. There are probably many data items that someday will be useful. You can define extra fields for data collection that are pertinent only to your studbook. User Defined Fields may be established at any time from the data edit section. There are five types of UDFs; date fields, number fields, character fields, logical fields and memo fields.

The scope of UDFs is limited only by your imagination. Examples include defining a character field to contain the subspecies name (or "generic"). You could define a logical field to record hybrid status and a character field to describe the hybrid cross, a numeric field to store important genetic anomalies, date fields to record the dates of events or samples. These UDFs are repeating records. This means that a value may be stored more than once. If an estrogen value is taken periodically, you can store each new value and still maintain the previous ones.

There can be some redundancy between UDFs and Special Data items. Weight/length is a Special Data field, but you could also define a UDF for weight. There is a difference in how the data can be used. The contents of UDF fields may be used as selection retrieval criteria when used for reports and analysis. Special Data items cannot.

Do not use a UDF for a value that will change and must be frequently recalculated, such as MK values.

To set up a User Defined Field, choose Data Entry > Define User Fields and follow the instructions. F9 will allow you to add a new field; F10 will let you edit an already existing one. Holding down the Control key and hitting 'T' will delete the UDF under the light bar. F8 will automatically add a pre-determined set of UDFs that could help you track management decisions such as which animal to move to which institution on which date to breed with which animal.

Data Quality

A number of reports and procedures exist to check the validity of your data.

Data Quality
<mark>1 - Backup</mark> 2 - Clean Up 3 - Data Validation 4 - UDF Validation 5 - Recall animal

Backup

All computers will fail. The trick is in knowing when. Backup your data as often as you would be unwilling to re-enter everything that is lost. Choosing Backup will lead you through copying out all of the studbook's data onto a floppy disk in your A: drive. Sparks uses a DOS-based utility called PKZIP.exe to accomplish this. Be sure that there is a copy of this (and of PKUNZIP.exe, which is used to restore data) in your computer's root directory/C: folder. [In some computers, you may need to put the copies in the C:\Windows\System32 or the C:\WinNT\System32 folder.]

Periodically ensure that you have a valid backup by restoring the data into another copy of Sparks on another computer. A backup is not necessarily a backup if it is in on the same desk or the same room or building. Fires, floods and a collapsing bookshelf have destroyed both computer and backup. Take one home periodically.

Clean Up

From time to time it is advisable to do a "house cleaning" of your studbook data files. Sometimes data records can become damaged, from power failures, re-booting, disk damage or cosmic rays. As part of the cleanup process, records are scrutinized for damaged and repaired or removed. New indexes are also built for each of the files.

Running Clean Up will

- Produce an audit trail of records that have been marked for deletion and permanently remove them from the database
- Show a list of possibly duplicated animals that share an institution's local ID
- Show a list of event locations that have been entered that do not match any in the Institution List. These need to be researched and entered into the list.
- Show a list of duplicated institution codes or mnemonics found in the Institution List. These need to be researched and fixed.
- Replace any animals' locations with an updated location if there is a location synonym in the Institution List
- Show a list of possibly duplicated animals that share a transponder number.
- Copy a text version of your Species Notes into the studbook folder.

Additional note: if you notice files in your Sparks folder that are made up of random numbers (for example, 83629572.idx or 50293845.txt or 30938596.tmp), you may use Windows Explorer to delete these if Sparks is not currently running. These are temporary files that Sparks creates to hold various sets of data during analysis. They are normally erased when Sparks closes, but if Sparks is not closed properly (a power failure for example), then they remain.

Data Validation

The Data Validation report will run numerous internal consistency checks on your data. See the Appendix "Data Validation" for details.

UDF Validation

This report will list any UDFs that have been declared and each unique entry, giving you a list of what's been entered so far. This will also enable you to find cases in which an entry has a typo, for example a UDF called TAXON in which you have entries of smithii, kingii and kngii. The report also indicates animals with blank entries.

Recall animal

If you have deleted an animal (by blanking out its studbook number in the Master quadrant) and realize that you were in error, you may recall the animal here IF YOU HAVE NOT YET RUN the Clean Up report.

Reports

Retrieval Criteria

One powerful approach to population data assembly and analysis is to look at and compare various subsets with each other. Sparks is designed to make this very straightforward, by setting retrieval criteria - or "views" of your data. A view may consist of any number of set criteria, in many combinations. Once you have established a "view" - defined a subset of interest - it remains in effect until you reset it or leave Sparks. At the main Reports menu, hit the left arrow key <- to set a view.

Geographic Area View: During your data entry, Sparks maintained close control over location names and tried to assure consistency with its internal Institution List dictionary. This standardization has its rewards here. You may restrict your view of the data to a list of geographic areas. These may be a single zoo or a dozen zoos. It may also be states, provinces, countries, continents, or any combination. Sparks generally knows the hierarchical geographic relationships from single locations on up to continents, and will recognize many names of political and/or geographic regions. You may enter a maximum of 25 locations. If you have not entered a specimen's location in a way Sparks can recognize, and Sparks can't determine if it should be included within your selected subset, you will be prompted as to whether or not to include this data at report time. If this happens so frequently that it becomes a nuisance, you will want to edit the location names for these specimens to become something Sparks can recognize - or you may need to add them to the Sparks institution list. Run the Cleanup Report under Data Quality for a list of the locations in your data that Sparks does not recognize.

-View Criteria-

Geographic Area End of Date Span Age Sex Event Type Coop. Mgmt. Plan Birth Origin Founder/Mult Breeder Rearing Association Living/Dead/LTF Necropsy info Inbreeding Permanent/Temp # User Defined Flds User Selected Flag

To un-set a Geographic view, blank out the first location entered.

Date View: Viewing your data through a date "window" or "view" is an important tool - you can compare fecundity and mortality during different periods of time, for example. You may set the criteria for starting date and/or ending date to form a date span. For example: you may analyse the last five years and compare it to the five years before. To set a Date Span, enter the beginning and end dates and choose '**D**' for During the time span.

You may also be interested in a view of the studbook as of a certain date, for example, a studbook report of all animals alive in zoos as of 31 Dec 1995. To set this view, enter the date in which you are interested in the space provided for the Stop Date and choose 'E' for End of the time span.

To un-set a Date view, either change the dates to <u>01/01/1700</u> and <u>today</u> or exit and re-enter Sparks.

Age View: You may also specify an age window. All animals currently (hence living) between the starting age and ending age are included in your subset. This is dependent on the Stop Date for the age span, if any. If none is set, then this is as of today.

To un-set an Age view, enter 0 and 999.99.

Sex View: There are nine categories of sex (male, neutered male, contracepted male, female, sterilized female, contracepted female, chromosomally abnormal, hermaphrodite and unknown) that may be used to limit the data reported and/or analysed. You may choose one or more by using the arrow keys and the enter key.

To un-set a Sex view (and many of the others), pick No restriction.

Event Type View: These limit you to such occurrences as births, captures, transfers, loans, deaths, and releases. This is perhaps most useful for printing lists of births, moves, or deaths in studbook format, often for a time span, i.e. all births in 1999 or all deaths in 2003.

Cooperative Management Plan View: If a specimen has been recorded as being in a management plan, either globally or regionally, you may select it for reporting. With this you can compare animals in a management plan with those not in a plan, or compare two plans, presuming you have this data in your studbook dataset.

Birth Origin: There are three choices of birth type: captive born, wild born, and unknown birth. By setting the "view" in turn, you can compare, for example, the fecundity and mortality of wild-caught versus captive-bred specimens.

Founder View: This view checks the sire and dam IDs entered in Sparks. You might wish to select for founders to check your studbook dataset before performing genetic analyses to see just which specimens will be treated as founders. Founders are not just those animals that were obtained directly from the wild. For genetic calculation purposes, they are those animals whose parents are listed as wild ("WILD") or unknown ("UNK"), or one of several possibilities ("MULT"). A founder is a "potential founder" if it has not bred. See below to select on breeders. You may also choose HYPothetical parents you may have created or find any animals with blank parents.

Breeder View: This view includes animals that have bred at some point in time. It does NOT take into account the fact that all of an animal's offspring may no longer be living, or may have all been moved out of the population.

Rearing View: Choose one or more rearing types if you wish to examine the effects of different rearing situations and your data contains this information.

Association View: You may restrict the view to animals held in a particular set of zoos. Sparks includes an Association File (also called a FED file) for most of the regional zoo associations: North American (AZA), Australasian (ARAZPA), British, Canadian (CAZA), Dutch, European (EAZA), Japanese (JAZGA), Southeast Asian (SEAZA), and Swedish. You may build a FED file for any subset of locations that you need: use an editor such as Notepad, create a new file in the Sparks folder called list>.fed (where list> is a word eight characters long or less, no spaces) and enter each location's mnemonic, one entry per line. Mnemonics should be capitalized, i.e. LONDON RP

If you choose ASSOCIATION, which shows the available FED files, the last choice in the list will be 'Create'. Choose this to build a list of every mnemonic mentioned in your studbook. They will be displayed in a new window. Edit this list – deleting and adding mnemonics as you wish – then save by using Control 'W'. It will be saved into the Sparks folder as X<studbook>.fed Note that if you wish to keep this file, you should get out of Sparks at this point and rename the file X<studbook>.fed to another name, as Sparks will overwrite it the next time Create is chosen. You may use Windows Explorer to rename it. File names should not include spaces, should not exceed 8 characters and must end in .fed. For example, giraffe.fed or elephant.fed.

Living/Dead/LTF View: This includes subsetting animals by whether or not they are living, dead or lost-to-followup either during a date span or as of a certain date, depending on how the Date Span parameter is set.

Necropsy info View: You may choose one or more circumstances of death, carcass disposition, topographic & etiological causes of death.

Inbreeding View: You may specify the inbreeding levels of the animals to be included in the report or analysis. The Inbreeding report must have been run recently, or you will not be able to use this view.

Permanent/Temp # View: You may restrict reports and analyses to animals with 'real' studbook numbers (numeric numbers) or to 'temporary' studbook numbers (alphanumeric numbers, i.e. T numbers).

User Defined Fields: UDFs add a lot of power to your studbook if set up thoughtfully. See the section on UDFs above for more information. By using UDFs, you may select only data based on your special requirements, be it hybrid, hernia, or health.

User Selected Flag View: This is the most flexible of all retrieval criteria selections. With this option you may set your "view" to a list of specific studbook numbers. You can create this list any way you choose - including saving some Sparks report as a DOS file and editing it down to a list of specimens. The uses of this option are limited only by your needs, skills, and imagination.

This requires a file of specimen studbook numbers, one per line, to be read by Sparks. You must create this before entering Sparks. Once read in, a flag is set to indicate which animals are in your subset. You may select to use or not use this flagged subset in your retrieval. Reading in another list of numbers sets the flag to the new set.

To create a USF file: Get out of Sparks. Use WordPad, Word or WordPerfect or the like to create a list of the studbook numbers you wish to subset, one number per line, using capital letters for any alphabetical characters. For example,

123 4356 T1001

Save the file into the studbook folder, in text format and include .txt in the file name. The filename should be eight characters or less and not include a space. Examples: group.txt exclude.txt list.txt

Now, get into Sparks and change to your studbook if necessary. Choose Reports. Move to the Retrieval Criteria, and select the last item, User Selected Flag. If you wish to exclude the animals you have listed from your studbook and analyses, select False. If you wish to include only the animals you have listed in your studbook and analyses, select True. Press the left arrow, <- and type the name of the file you had saved previously, LIST.TXT (be sure to include the .TXT). Now press ESC, and then the right arrow, ->, to return to the Reports menu. At this point your studbook should either exclude or consist exclusively of the animals you listed, depending on whether you chose to include or exclude the list of numbers.

Sort Order

The default order of presentation in a studbook report is by studbook number. Because the data is stored in studbook number order in Sparks, this is also quickest. However, you may request any studbook or other listing report in a number or different orders. At the main Reports menu, hit the right arrow key -> to set a sort order.

Studbook Number: The normal and default production order for reports.

Birth Date: Every animal has some birth date in Sparks, even if it is only estimated. Studbook numbers are often assigned in approximate birth date order, but not always. This gives you the option of sorting the report strictly on birth date.

Death Date: Specimens are listed in order of death. Living specimens are listed last, by studbook number, as they have nothing in the death field.

Studbook Number Birth Date Death Date Location (geographic) Location (alphabetic) Owner Sex Birth Type Management Plan Social Group

Location (geographic): Animals are presented in order of current or last location, sorted geographically.

Location (alphabetic): Animals are presented in order of current or last location, sorted alphabetically by location mnemonic. This sort order matches the presentation of current animal data under Species Holdings at the ISIS website.

Owner: A list by current or last owner. This is different from the above location orders only if an animal has involved in a loan. If you wish only living animals (i.e. current owner, not last), add the criteria "living".

Sex: Females, males, and unknown.

Birth Type: Captive born, wild born, and unknown births.

Management Plan: Those in a management plan are listed first.

Social Group: Those in a Social Group are listed first.

Reports

There are several reports available for general data reporting purposes, which may be useful in compiling and evaluating your studbook. In addition, Sparks offers analysis reports that look at specimen relationships and evaluate population demographics and to a limited extent, genetics. More sophisticated genetics analyses are available through export of data to the separate programs GENES or pm2000.



For most reports you may choose to have a) just a screen display, b)

printed on paper immediately, or c) deferred for later printing or saving as a text file. All of the reports may be terminated before completion by hitting the Escape (ESC) key to stop printing.

All the reports can be made much more powerful by use of the retrieval criteria selections and, for some, the sort order options. To set these criteria use the left and right cursor movement keys. Be sure to read the description of these capabilities below.

Sparks can search for words or characters in any report sent to the screen. If you have run a report – for example, a Studbook Report – and sent it to the screen, use Ctrl F (find the first one) and Ctrl G (find the next ones) to find specific animals or dates or locations. This is especially useful if you do not know an animal's studbook number, but may know its location or birth or death date.

Hold down the Control key and type an 'F'. This will open a small window – type in the word or phrase you wish to find and click on Find. The cursor will move down the list and highlight the first match it can find. If this is not what you are searching for, use a Control 'G' to find the next one and again for the next.

To send a report to a file for later editing, run the report, and when Sparks offers the choice of Screen/Printer/File/Cancel, pick File. Pick No Codes if you see this choice. The report will run into memory and will not appear on the screen. Now get out of Sparks. Say "Yes" when you're asked if you want to save the report. You'll be offered a chance to name the report. You may use up to 8 characters, but use no spaces.

i.e. studbook agepyr census

The file will be saved to the Sparks folder (in Sparks 1.4) or the studbook folder (in Sparks 1.5). Now get into Word or other word processor and open up the file - it will have had a .txt added to the end. i.e. studbook.txt agepyr.txt census.txt

Examples of each of the reports are included in Appendix IV

Specimen/Others Reports

There are a number of items available under this choice. These are:

Specimen ReportError! Bookmark not defined.

This is a report showing all the data entered for a specimen. It lists the current status, the history of transaction events, any special data, and any UDFs entered. If you would like this report for every animal in your studbook, enter "ALL" when prompted for the individual studbook number. If you want specimen reports for a group of specimens, define the group by setting the selection criteria to create a view of your data that includes just the ones you wish, and then request "ALL".

Special Data Report

This report will allow retrieval of Special Data comments by searching for word or phrases, or by choosing specific codes. You may enter words or phrases in the first three boxes and/or specific codes in the fourth box. For example, to find all animals with notes on Diet, type QD into the fourth box. For all animals with the word 'alfalfa' mentioned in their Special Data notes, type ALFALFA in one of the top boxes. You may choose to sort the output by studbook number, current location, the codes involved, birthdate or deathdate. If you need help in remembering what the Special Data codes are, hit the F1 key

to see a list of the standard Sparks codes.

Institutional Summary

This report will list institutions included in the studbook, the total number of animals held, the number of living animals as of the end of the report, the years managed at that institution, and the number of births and deaths. All of the regular filtering capability can be applied.

Export Lineage

You may export the studbook data in a format suitable for importing into the Lineage pedigree drawing program. You may include the data in up to 3 User Defined Fields. See http://www.ansci.cornell.edu/lineage/

Export Gedcom

You may export the studbook data in the international pedigree-drawing standard GEDCOM. Most available software packages allow drawing pedigrees based on this format. Try a Google search on 'gedcom' to find explanations and suitable software.

Studbook Report

This report is the global standard for a published studbook. It is also useful when trying to organize and edit a new dataset. Some flexibility is included - when you request this report, additional columns may be added to display event types, birth origins, countries, a separate death column, rearing type, and the other specimen identifiers such as house name, tag/band/ring, and tattoo. UDFs may also be included. Studbook reports, in order to squeeze the most information on a page, use your printer's condensed print mode. For this reason, they do not display on your screen. If you request too many additional choices, the data will "fall off" the right side of the report page. If space becomes a problem, you may wish to export the report to a file, and edit and print it in landscape format by using Word or another word processing program.

A set of customized studbook reports can be run for every institution in an Association file (i.e. EAZA.fed or ARAZPA.fed). First pick a FED file by choosing Association under Retrieval Criteria and choosing one of the FED files. See above for how to create a customized FED file. Then run a Studbook Report, answering 'Yes' to the question "Obtain a separate report for each location?" This method will not produce a report for every location in the studbook, only for those in the FED file. This can be useful if you wish to send a studbook report to each participating institution in a breeding programme, including only those animals that they have held.

Most studbooks track ownership/loan status. If you prefer not to include this information in a printed studbook or in one sent to a file, answer 'N'o at the question "Include Loan Information". Ownership entries will not be included in the report. Instead, "Transfer' will be substituted for 'Loan to' on the report. The actual data will remain unchanged. This will allow accurate tracking of loan information (required for international studbooks and most organized breeding programmes) while not necessarily printing it. There have been concerns expressed by institutions about "their missing animals" on studbook reports, as some studbook keepers have been deleting transactions involving loans. This is no longer necessary.

Fax numbers, Email addresses and data currentness by institution will appear in the Studbook Glossary (see Institution List, below) if data are available. Contact names will appear if requested, the ISIS default contacts are the registrars.

You may specify that the report headers and footers not be included, if sending the report to a file. In this case, Sparks will include one header at the top of the report and one footer at the bottom. This will facilitate re-formatting in Word, WordPerfect, etc – cut and paste the Sparks header into a Word header.

Printing the Studbook Report in Landscape mode

This is only possible with Sparks 1.5, not with Sparks 1.4

Set up the Studbook Report, including any View Criteria (i.e. Geographic Area = EUROPE or Event Type = BIRTHS) and any Sort Order (i.e. Location). Pick Studbook Report and choose any additional data columns (i.e. Tag/Band, House Name). At this point, you will probably choose 'No' for "Obtain a separate report for each location". Choose File. Choose No Codes. Choose 'No' for "Include Page Headers & Footers". Set the additional choices as needed. The report will run, but will not appear on the screen.

Exit from Sparks - you will see a question 'Save output file rather than print?'. Type Y for Yes. Sparks will provide a box in which to enter a file name. The name is subject to the standard DOS limit of up to 8 characters and may not include spaces. Examples of valid file names are

studbook stud2004 draft

Sparks will add .txt to the name you type and will file the report in the studbook folder. You may open the resulting file in Word or WordPerfect or any other word processing program.

Sparks will include one header (the part that includes the name of the studbook and column headers such as Studbook #, Sex, Sire, Dam, etc.) at the top of the report. There will be one footer (the part that includes Compiled by: your name) at the bottom.

To format in landscape mode, using Word: Open the studbook report file.

- Pick File > Page Setup > Paper Size > Landscape.
- Pick File > Page Setup > Margins and change the left & right margins to something smaller.
- You may need to make the report's font size a smaller number by choosing Edit > Select All, then Format > Font > Size.
- Be careful if you decide to change the actual Font. If you choose a proportional font, the columns may not line up properly.
- Save the report into .DOC format. The report was created as a text file, most of the changes described here will not be saved properly if it remains in Text format. At this point, you may rename the report to anything you like – i.e. "2004 EAZA Blue iguana studbook.doc."

To put the proper Header & Footer on each page:

- Block & Copy the Header that is at the top of the report.
- Pick View > Header and Footer and paste the header and footer into these. Edit the header if
 you like changing the scientific name to italics or centering the text, for example. You will need
 to edit the page number if you wish it to appear here. Delete the number that appears and
 replace it with the incrementing number from the Header & Footer toolbar.



- Repeat these steps for the Footer.

If you have included a Location Glossary in this report, you will want to include a different header for this section.

- Find the bottom of the animal data and the top of the glossary. Pick Insert > Break > Section Break/Next Page. This will tell the document that you want to make different choices for this section.
- It is very important at this point that you turn off the "Same as Previous" option in the small Header & Footer toolbar. If you do not turn this off <u>before</u> you enter a header, the Location Glossary Header will appear as the header for the entire document. The one in the illustration is turned on, click on it to turn it off.
- Cut and paste the Location Glossary header into the Word header box



Questionnaire

The studbook questionnaire looks similar to the studbook report mentioned above. You have a choice of producing, by institution, a listing of all specimens that either are currently at each institution (including animals permanently there because they died there) or have ever passed through each institution. Missing information is indicated. You may request that the zoo's registrar fill in the blanks or provide an ARKS Taxon Report. The institution's mailing address, if known, is printed at the top. This report also uses condensed print mode and is not displayed on the screen.

Species Management Analysis Reports

There are a number of items available under analysis. These are:

Age pyramid: This is a text graphic displaying the current age structure of your studbook population. Males are listed on the left, females on the right. Unknown sex animals are equally split to both sides. A "good" population should have a pyramid shape to the graph, with a wider base of younger animals that can move up and replace older animals in future years. Setting a "view" will produce an Age Pyramid of the population defined by the view. The raw data are exported to an Excel spreadsheet called pyramid.xls, placed in the studbook folder for your own analysis and graphing. It includes # of males, # of females, # of unk sex animals split in halves, by year.

Fecundity and Mortality: Fecundity [Mx] is a measure of reproduction. It shows, by one-year age classes, the proportion of births per individual per age class in your population. Mortality [Qx] tabulates risk of death by age classes. To print the raw data and a description of what goes into the values, type F1 after the charts are produced. These reports also offer a line graph of the two parameters if you computer is capable of displaying them. The 30-day mortality is exported to exch30d.txt along with the births & deaths in the last year for pm2000. See a more detailed description of this report below. The fecundity and mortality data is exported to an Excel spreadsheet called mxqx.xls.

Causes of Death: Summarizes the death codes entered for each dead animal.

Inbreeding Coefficients: This option offers rapid calculation of simple inbreeding coefficients for existing animals and allows you to try possible matings. It is based on the routine FASTINB, written by Dr. A J. Boyce. More sophisticated genetic analysis should be accomplished by export of data to GENES or pm2000.

Inbred animals often have reduced viability. This report shows the amount of inbreeding of individuals based on the known pedigree. Note that any specimens with unknown parentage or multiple possible parents (entered as MULT) will be treated as founders in this analysis, causing underestimation of inbreeding coefficients in their descendants. Hypothetical matings may be entered, when the report is concluded, to assist in possible mating choices. Keep in mind that two animals that are highly inbreed may be crossed to produce offspring that are not inbred. This analysis is very dependent on complete pedigrees.

Inbreeding data is exported to inbreed.xls; it includes studbook #, sex, birth and death date, parent IDs, current location and local ID, identifiers, inbreeding coefficient. You may choose to sort this report by studbook number, current location or inbreeding level. You may choose to include all animals or only living ones.

Census: A list of the number of living animals by year comprises a census. This report takes into account the date entered into System Utilities > Footnotes > Data Currentness, so be sure that this is up-to-date. The census tables presented are broken down by sex. Two line graphs show the last forty years graphically – one subsetted by sex, the other by wild vs captive birth type. The raw data are exported to an Excel spreadsheet called census1.xls and to a dBase file called census1.dbf, placed in the studbook folder for your own analysis and graphing. Copy the last column in the spreadsheet to the last column in the census2.xls spreadsheet below. The exported data includes #s of males, females and unknown sex animals per year and a breakdown of captive-born and wild-caught animals per year

If you are exporting data for use with the pm2000 analysis program, remember to run this report as well so that pm2000 will have access to this data.

Census Details: A list by year of the number of captures, births, stillbirths, releases, deaths, and LTF events that constitute the census. The raw data are exported to an Excel spreadsheet called census2.xls and to a dBase file called census2.dbf, placed in the studbook folder for your own analysis and graphing. The last column in the spreadsheet should be populated with the last column in the census1.xls spreadsheet above. Data exported includes contains year-by-year summaries of captures, births, releases, deaths, stillbirths, LTFs, imports, exports

This report will also calculate the number of imports and exports from a region, if you have specified a view that includes a region in the current view. The region should consist of one entry, i.e. GERMANY or N.AMERICA or ADELAIDE.

Demographics: Crude demographic parameters.

T/Generation: Generation counts within the population. Generation data is exported to an Excel file called generatn.xls. It includes studbook #, sex, parent IDs, T-low, T-avg, T-high values

Export Data Analysis File: The analysis programs GENES, DEMOG and pm2000 require data to be preprocessed in various ways. There are two export options to produce the needed export files: demographic analysis, which includes Mx and Qx and age structure, and genetic analysis, which is a me,pa,ma file.

File names for the exports can be customized to allow exporting multiple views during one Sparks session. [Note that if you are exporting for Genes and Demog, you should accept the default file names. pm2000 will cope with alternate file names, Genes and Demog will not.]

Institutional data (names, addresses, phone #s, etc) is exported to location.txt during the Genetics export for use in the pm2000 reports.

Reproductive Parameters:

- youngest dams/sires at first birth with a warning if the animal was too young to have reproduced;
- oldest dams/sires at first birth;
- oldest dams/sires to have given birth;
- median and mean ages of males/females at first, overall & last reproduction;
- shortest interbirth intervals with intervals <90% of stated gestation/incubation flagged;
- sires/dams with most offspring;
- birth seasonality counts/percentages by month including a graph of this data;
- litter/clutch sizes;
- rearing and viability analysis;
- first vs subsequent birth analysis.

Interbirth interval data is exported to interval.xls. It includes dam ID, interbirth interval since last birth, ID of offspring.

Age:

- median and 25/75th percentiles for ages at death for males, females, unknown sex;
- oldest dozen dead males, females, unknown sex;
- median and 25/75th percentiles for ages of living population;
- oldest dozen living males, females, unknown sex.

Specimen Relationships Reports

There are four reports within the relationships section. These include:

Pedigree Chart: The ancestors of a given animal are printed back four generations, in a simple text graphic form. If the number of generations goes back more than four, you will need to run several pedigrees and piece the chart together. Note that individual specimens may appear more than once on the diagram (indicating inbreeding). If so, they are marked with an asterisk.

Sibling Tables: All full- and half-siblings are displayed. They are grouped by date, which should match up littermates.

Reproductive History: All offspring of a requested animal are listed. These are also grouped by date. The parents' age at which the birth occurred is indicated.

Descendant List: All descendants of an animal and their descendants in turn. This is a potentially massive list of offspring that is the reverse of the pedigree chart. Indentations help in discriminating first and later-generation descendents. Sex, age, death date and/or current location are shown, along with the identity of the other parent.

Master Plan Report

When all the data is in, it is time to sit down and draw up a Masterplan for your animal management. The Master Plan Report is an attempt to bring together in one place many of the "more useful" values that are calculated in other reports. You may also wish to export data for use in pm2000.

The report can be directed to pay attention to an Association view to print a subset of institutional data. See a more detailed description of this report below.

Social Groups

If you have entered data on the social group structure/enclosures for the animals, a report summarizing the data can be produced.

Labels/Cards

You may print mailing labels for the institutions in your studbook. You may also print Studbook Cards for the individual animals, a practice followed by some international studbooks established in previous decades when computers had not yet come to be.

Quick View Report

The Quick View report is available on the main menu. Enter the mnemonic for the zoo you wish to see, all animals currently living at that location will be displayed. There is a column of data to the right containing house names or tag/band information that may not be visible – click on the small yellow dot in the bottom right-hand corner of this window and re-size the window.

Mx/Qx Report - details

This report presents life table information. Age- and sex-specific fecundity and survivorship tables are calculated and presented. Following this are options for generating graphs and/or smoothing the data and producing smoothed tables and/or graphs. Commonly used indicators of population growth are also presented, as is a <u>calculated</u> Ne. Caution is advised because of the small sample sizes typically available. Effective population size is not easy to calculate accurately - be sure to check this value against the loss of heterozygosity over this many generations shown by GENES, which is co- distributed with Sparks, or pm2000. Consult the Glossary for definitions of terms and parameters. Below is an extended discussion of how missing data is handled - an important issue in the analysis of many datasets.

Mx Bias and Missing Data

We calculate the vector Mx for each sex as the ratio of the cells of two vectors - the numerator is the number of births credited to parents at each age class, the denominator is the number of specimens that passed through this age class while in the data set.

Missing data, such as an un-identified parent of a captive born specimen, can cause significant bias in the calculation of Mx. In the case mentioned, no parental age class can be readily credited with the birth, though the unidentified individual is presumably included in the group of individuals "at risk" of birth. Hence, simply throwing out this birth leads to an underestimate of Mx - the parent contributes to the denominator but the birth does not contribute to the numerator. Similarly, a parent of unknown age leads to the same problem as an unidentified parent - we don't know what parental age class to credit with the birth.

For these cases where it is a good presumption that the parent is actually in our data set, but it either has an unknown age or is not identified, Sparks takes the approach of assuming that they have the same age-specific fecundity values as identified or known-age parents. Therefore, Sparks provides the option of adding the births to such parents into the numerator of the Mx vector, distributing the births across parental age classes using the higher-quality data to calculate the weighting factor for each age class. We generally recommend this option, as otherwise many data sets with significantly imperfect Sire and Dam data, will show erroneously low fecundity values, and therefore erroneously low growth rates. It is likely dangerous only when there is something very different about such parents. A good general commonsense procedure is to compare the calculated growth rates with the trend shown by the Census Report. In practice, the Mx calculation utilizing imperfect data requires inference of whether or not the unidentified parent was likely in the dataset as an individual at the time of the birth.

Because Sparks offers extensive ability to subset data for analysis - i.e. to set a "View" of the data to a region, period of time, etc., similar issues arise in determining whether parents were "at risk" of birth in the restricted sense of being in your currently defined view of your data. The rules Sparks uses for Mx calculation are:

In general, Sparks uses estimated dates and accurate dates as "known" dates.

IF the specimen's birth date is unknown, Sparks skips it. It will not be added to the denominator "risk" vector as a potential parent, and this birth to its parents will not be added to the numerator vector.

IF a specimen's last removal (including death) date is unknown, it will only be treated as "at risk" (added to the denominator vector) if there is an earlier known transaction date - and then only for the period between the first known date and this last known date.

IF a parent is identified, then:

IF it is found in the data but it has unknown age, Sparks includes the birth in the pool of births to be distributed across parental age classes according to the weighting function calculated from the high quality subset of the data.

IF it is not found in the dataset, Sparks excludes the birth because the parent is not included in the group "at risk" for birth. "WILD" parents are treated this way.

IF parent is UNK (or MULT), then:

IF the specimen was counted as at risk and contributed toward the denominator, we include any births credited to it in the numerator:

IF the birth event is recorded in the dataset, the missing parent was most likely at the same facility and included in its reporting, so we include the birth as above.

Else if the birth event is not recorded in the dataset, but the birth type is given as captive born, the missing parent is fairly likely to be in the dataset, so we include the birth. This is not a strong inference.

IF the specimen's birth event is not recorded in the dataset and the birth type is given as wild or unknown, the missing parent is unlikely to be in the dataset, so we exclude the birth.

Qx and Missing Data

Qx is calculated using the same general approach as Mx - two vectors are created: the numerator vector consisting of the various possible age classes for deaths with the number recorded in each, the denominator vector consisting of the various age classes at risk to death - with the number recorded in each.

Any known or estimated aged specimen is included.

If a specimen birth date is unknown, it is skipped and does not contribute to either the numerator or denominator.

If a specimen's death date is unknown, it does not contribute to the numerator, but may contribute to the denominator for the years "lived through" to the last known transaction date. This is consistent with the overall approach of assessing what part of a specimen's history is at risk in the dataset and within any view which has been created, and only including birth or death events which also qualify.

Also see the Special Note for Death Events box in the manual section dealing with Entering Studbook Data.

Masterplan Report - details

The Masterplan Report is organized Institution-By-Institution and then Animal-By-Animal to facilitate formulation of recommendations for each individual in the population during development of a masterplan for management and propagation. The report produces separate sheets for each institution. Within the sheet(s) for an institution, it enumerates each living individual. It may be produced for the entire (Global) studbook data set or for a defined geographic region (Restricted), e.g. North America. For each individual in the list, there are 11 columns of potential information that are useful during masterplan formulation. As of the current writing, ISIS strongly recommends using the pm2000 program instead of this report.

The first 2 columns each contain a single entry.

Stud #: The Studbook Number of the Individual. **Sex**: The Sex of the individual.

The next column may contain either or both of 2 dates:

- Birth Date: The birth date, if known or estimated, of the animal will appear on the first line in this column for each individual.
- Arrival: The arrival date of this individual at the indicated institution will appear on the second line in this column for each individual.

The next column indicates the Sire and Dam, if known, of the individual.

Sire: The father of the individual appears on the first line of the column. **Dam:** The mother of the individual appears on the second line of the column.

The next column provides information on the local identification number and the social group of the individual.

- Loc ID: The local identification number of the animal if known appears on the first line of the column.
- Social: The social group, if known, of the animal appears on the second line of this column.

The next column is a single value.

Genome: This is the fraction of the genome of an individual that can be tracked back through the pedigree to known founders, assuming that each individual receives one-half its genome from its mother and the other half from its father.

The next 3 columns present genetic metrics (measures) that can be calculated in two ways:

- (a) [unks -> founders] The first way treats any animals with unknown parents as if they are potential founders (i.e., as if wild caught). These values appear on the first line under each column.
- (b) **[unknowns removed]** The second way is to remove all unknowns from the pedigree before the genetic metrics are calculated. These values appear on the second line under the respective columns.

The 3 genetic metrics are:

- **F** Inbreeding Coefficient
- Values range from 0 (non-inbred) to 1 (completely inbred). For a further explanation of the inbreeding coefficient and its relationship to other genetic metrics the reader is referred to the documentation for the GENES and pm2000 programs.
- **MK** Mean_Kinship. Mean kinship is a measure of the degree of relationship between this individual and all other animals (including itself) in the living, descendent population (i.e.; the non-founder, captive-born population). The values range from 0 (animal has no relatives in the mean descendant population) to 1 (the animal is completely related to every animal in the living descendant population). Mean kinship is considered the best measure of the genetic importance

of individuals in terms of their priority for breeding in the managed population: The lower the mean kinship of an individual is, the more important this animal is for breeding to preserve the genetic diversity of the founders. For further explanation of mean kinship, the reader is referred to the documentation for the GENES and pm2000 programs.

KV Kinship Value. Kinship Value is a weighted mean kinship, where the weightings are the reproductive values (Vx) of the animals in the population. In calculating the KV of an individual, its kinship to every other animal is weighted by the reproductive value of that other animal. KV adds information to the MK of an individual on the demographic status of the animal's relatives. The lowest Vxs will occur for animal in advanced age classes or sometimes for pre-reproductive animals if there is very high mortality before the age of sexual maturity. Hence, given two individuals with the same MK, the one whose relatives have lesser reproductive values (e.g. all relatives are old) will have a lower KV and hence be a higher priority for breeding in terms of both genetics and demography. For further explanation of mean kinship, the reader is referred to the documentation for the GENES and pm2000 programs.

The next column provides another genetic characteristic of the individual:

- **GU** Genome Uniqueness. GU is the proportion of the genes in an individual that are present in no other animal in the population. GU is calculated two ways.
 - (a) **GU AII** which includes all living animals, including any actual and potential founders. This value appears on the first line in this column.
 - (b) **GU CB** which considers only individuals in the living, captive born (i.e., non founder) population.

The next column is a demographic characteristic of the individual:

Vx Reproductive value is a measure of expected future lifetime reproduction and is a combination of the probability of how much longer the animal will live and the likely number of offspring it will produce at each age through which it lives. For a more technical definition of Vx, the reader is referred to the documentation for DEMOG and pm2000.

The next column provides information on the number of siblings and offspring of the individual. The data are presented as either:

- (a) **Global** if no geographic view is invoked and therefore the entire studbook population is being analysed; in this case siblings and offspring anywhere in the captive population are included in the count.
- (b) **Restricted** to a geographic view that may be invoked; in this case only siblings or offspring within the geographic region analysed are included in the count.

Live Sibs: The number of living siblings (male. female. unknown sex) of the individual.

Live Offspr: The number of living offspring of the individual.

Repro Offs: The number of offspring that have reproduced.

The final column is yet another genetic characterization of the individual.

Founder The percentage of the genome of this individual that has been inherited from each of the indicated founders, e.g. 19 = 30% means that 30% of the genes of this individual can be tracked back to founder number 19.

System Utilities

There are a number of Sparks System utilities that you will use periodically. These include:

Institution List

The Sparks Institution List contains over 15,000 entries of zoos and aquariums, dealers and exchanges, museums, individuals, and non-exhibit centers throughout the world. Some entries contain address, phone, fax, and email information. The names of geo-political units, such as cities, states, provinces, countries, regions and continents are also included. Each entry is assigned up to a nine-character abbreviation as a short identifier. For zoos, it is usually the city name, following the international studbook convention. For individuals, it is usually the individual's last name/first initial. Multiple facilities in a single city may merit creativity...



Some examples:

LONDON RP for the Regent's Park Zoo in London. LONDON is the city thereof.

CHICAGOBR and CHICAGOLP for the Brookfield and Lincoln Park Zoos, respectively, in Chicago, Illinois.

AN KING, BORDENTWN, BRISBANE, BYRON CEN, DISNEY AK, VILLIERS, WHITESZOO are all called "Animal Kingdom". They are found in Illinois USA, New Jersey USA, Australia, Michigan USA, Florida USA, South Africa and Nevada USA. Be careful when assuming location identities.

The list is used to assure consistent use of location and facility names. The 9 character mnemonic identifier is stored in the actual event record. However, because of an associated hierarchical institution code in the list, the exact geographic location can be determined. This allows Sparks to determine that Audubon Park is in Louisiana, which is in the USA, which is in North America. A printed copy of the entire list, the ISIS Institution Directory, is available from ISIS.

An example:

The institution code for the Audubon Zoo is 310519004.

'3xxxxxxx' stands for the Western Hemisphere

'x1xxxxxx' stand for the continent of North America

'xx05xxxxx' stands for the country of the United States

'xxxx19xxx' stands for the state of Louisiana (the 19th alphabetically)

'xxxxx004' stands for the Audubon Zoo (the 4th zoo listed by ISIS)

If you have made changes to the Institution List, choose the option to back it up periodically so that these changes are not lost. (This includes a backup of the OwnCode list as well.) There is (deliberately) no option to restore this list into Sparks. If for any reason you should decide to restore this list onto a computer that is not your own, there are possible severe implications. If there is a copy of Sparks on the other computer, that studbook keeper may have customized his list for his species. If you overwrite that list with institutions customized for <u>your</u> species, this will destroy his work. Ask permission, explain the possibilities, and use a program such as WinZip. For further help, please contact ISIS.

If you wish to print a full or partial subset of the Institution List, you may do so by choosing Print.

On occasion you may find it necessary to make changes to the institution list. By selecting the edit option you will be presented with the now familiar edit screen that is used in event records, special data records, and UDF records. F10 is used to make changes to an existing institution's name or other info, F9 will allow you to add an institution, and F8 will allow you to search for one. Hit F1 for Help. Before adding a new entry, please check under alternative synonyms and spellings to be certain that the institution is not already in the list.

When editing the institution code it is important to maintain the hierarchy that is established. If you need a new institution code, check with ISIS. If you enter an incorrect institution code, it will place the entered institution in another part of the world when producing reports by geographic location. The mnemonics provided by ISIS should not be changed – this would make it impossible to find institution names or locations when the old abbreviation is encountered in a record.

Sparks can search for words or characters in the Institution List. This is especially useful in finding Institution List entries when you do not know the mnemonic. Get into the Institution List. On the far right center edge of the window is a small yellow diamond. Use the mouse to move the diamond to the top of the list. Click on any entry near the top – now the cursor is positioned near the top of the institution list. Hold down the Control key and type an 'F'. This will open a small window – type in the word or phrase you wish to find and click on Find. The cursor will move down the list and highlight the first match it can find. If this is not what you are searching for, use a Control 'G' to find the next one. Control F searches from its current position in the list – always remember to go to the top of the list before starting a search.

Using the Sparks Institution List

Pick System Utilities > Institution List > Edit Press any key to continue after reading this screen.

To find an institution:

Press the <F8> key. If you know the ISIS mnemonic, type in all or part of it, for example type KARL and hit the <enter> key. This will take you to the first matching mnemonic. If you use the down-arrow key, you can move down to the KARLSRUHE entry.

To change the sort order from Alphabetic by ISIS mnemonic to Geographic, press the <F7> key. Now the cursor is still on Karlsruhe, but the entry is surrounded by other German zoos. Hitting <F7> again will switch back to Alphabetic. You may switch back and forth between Alphabetic and Geographic whenever you wish.

A useful method to find a zoo when you don't know the ISIS mnemonic is to use <F8> to search for the country, change the sort order to geographic and then read the screen underneath the country. There can be many places under the country, but this is better than reading the entire list.

If you know that a zoo is in a certain state or province or region (for example, Hesse or California or Ontario), try using <F8> to search for that, and then look underneath.

To edit an institution:

Once you have found the institution you wish, you can edit the information by hitting the <F10> key.
Adding an institution to the Institution List is a 2-step process. First you must show Sparks where in the list to add the new mnemonic and then you must tell Sparks the details. So for example, I will give you the details on how to add BOLOGNA to your copy of Sparks, since it is not there.

Get into the institution list. Change the order to Geographic with <F7> Pick <F9> to add a new institution. The Search Value is the place under which Sparks will add the new location. Bologna is in Italy, so to start, type ITALY and hit <enter>. Sparks will take you to the entry for Italy. If you use the arrow keys, you will notice that we have put the regions/states/provinces of Italy into the list an alphabetical order: Abruzzi, Apulia, Brasilicata, Calabria, and so on. Bologna is in the region called Emilia-Romagna. So use the arrow keys until you are on top of Emilia-Romagna (mnemonic E-ROMAGNA). Now Sparks knows where to put the new location. You'll notice that "Continue Add=F9" at the bottom of your screen is either highlighted or blinking as a reminder. To add the details, press <F9> again. Choose to add a New Institution. You will be shown a screen to fill in. The InstCode should not be changed - this number is how we position the locations. The mnemonic should be BOLOGNA. The contact person could be the director or the vet or the curator - whoever you tend to contact. The Instname would be something like Bologna Zoo. The address would be the street address and/or mailing address.

City would be Bologna

State would be Emilia-Romagna

Country would be Italy

Mailcode, phone, fax, email would be...

Hitting return at the last box will store the entry in the list.

Adding a synonym to the Institution List is possible, but usually not necessary. ISIS has added hundreds of synonyms to the list. These function as reminders. Users often type in mnemonics that are not the "real" ISIS mnemonic, the synonyms are guides to the correct ones. For example, users commonly type in BRONX, meaning the Bronx Zoo. BRONX has been added to the ISIS Institution List as a synonym, pointing to NY BRONX, the "real" ISIS mnemonic.

System Configuration

There are several small adjustments that you can make to change the way Sparks looks.

File Locations: This pertains to the default locations for FED files (used in Association Views) and User Selected Flag files (used in User Selected Flag views).

The next three pertain to the way dates are handled. Dates can be day/month/year or month/day/year. Before the millennium change, dates could have two digit years or four digit years, Sparks is now fixed at four. Months can be in numbers or in letters. See the section on date formats under Entering Data. ISIS STRONGLY suggests not altering these choices, as less coherent reports can result.

You may change color scheme and the graphics codes. These should not be changed unless you have a compelling reason to do so. If the colors, for example, are set to something like blue-on-blue, all of the screens will seem to disappear. Color-blind users, please contact ISIS.

There are also a number of printing choices.

- Changing the left margin for binding will shove the report on a printed page to the right as many characters as you specify. This can allow you to three-hole-punch a report without punching through data. However, every character gained on the left will be lost on the right, potentially causing the printing to fall off the page. You may want to consider using a photocopy machine to reduce the page slightly instead.
- Page length if printing a report always gives you 2 pages of print-out for every one that you expected, try making this a smaller number. I suggest 60 in North American paper sizes, 62 in Europe for A4 paper.
- Initial page number If you have several dozen pages already finished for your final studbook (title pages, bibliography, natural history, etc) and you wish the studbook section to be paginated starting at page 32, enter that number here.
- Printer port choose whatever makes sense for your system. Note that Sparks cannot generally recognize USB printer ports, please see the explanation near the beginning of this manual.
- The list of printers is one purchased from a company that is no longer in business. The Epsons are good generic choices for a dot matrix or bubble jet printer, HP LaserJets are good to try for a laser.
- The last feature is the ability to change your password. When Sparks is installed, the password is set to blanks.

Backup

Your data is not secure unless you have a recent backup. You must make regular backups, of each studbook, whenever you make changes to your data. Your hard disk will fail; the only question is when it will fail. Other mass storage devices are also not infallible. Backups should be stored in a different location, buildings have burned down with both computer and backup inside!

Executing this backup utility will copy all the data files for your currently open studbook to the floppy disk drive of your choice. You may back up to the A: floppy drive, to a ZIP drive or to a memory stick in a USB port. It performs the backup by temporarily leaving Sparks to run a DOS batch file. This batch file, named BACK.PRG, executes a file compression utility called PKZIP. Knowledgeable users may modify this file to work with other forms of backup devices.

Don't just run this backup routine and assume that all is well. It is up to you to confirm that it has run correctly. Make sure that the files are indeed being copied to your floppy disk. They should be listed on the screen as they are written out

Re-Numbering

Sparks allows you to easily and automatically re-number any animals in your studbook whose studbook number begins with a letter, typically 'T'. This routine will sort all the individuals beginning with the single letter that you specify into birth date order, and allow you to specify what studbook number to start with. Each successive animal will automatically be assigned the next highest number. Any temporarily numbered animals mentioned as a sire or dam will be automatically updated as well. You may re-number from your original temporary numbers to your first assigned permanent studbook numbers (all numeric). Once you have made a specimen number permanent (numeric), you may no longer use the re-number utility to change its number.

After the initial studbook is numbered, make use of temporary specimen numbers while entering a new batch of data, typically while all new births and imports in a given year are accumulated and entered. Once you are confident that all is up to date for the year, run the Re-Numbering option. Although it is possible to renumber a set of temporarily numbered animals (perhaps) starting with 'T', to another alphanumeric (perhaps starting with 'S') we discourage this practice. Any paperwork you have on which you have written the T numbers will no longer be of any use, several studbook keepers report that having done this was a major mistake.

Before you start the re-numbering process, be sure that you know the next available studbook number. In Sparks 1.5, you may choose System Utilities > Information > Last Ids to find the highest studbook number used to date.

It is possible to change the number of a permanently assigned studbook specimen. There are rare occasions, such as when compiling a new studbook, when conflicts in the data are resolved and corrections are needed. This can only be done on a specimen-by-specimen basis while a specimens' data is brought up for editing. Please be careful about changing a permanent studbook number at any time, as it will affect others using your data.

Species Notes

Species Notes is simply a place to enter free-form notes. These should be notes that concern the entire studbook; any notes specific to an individual animal should be entered into Special Data for that specimen. Be careful to remember that to save any new information typed here, you must hit Ctrl-W to save your work. Hitting Esc as you do on so many of the other Sparks screens will abandon your work.

Examples of the type of notes to include here include:

- Natural history
- Conventions on choosing birth dates for animals with uncertain or unknown birth dates
- Veterinary or husbandry concerns, handrearing protocols, or other precursors to a formal husbandry manual
- Detailed contact information for the studbook keeper or management program
- Acknowledgements
- Data sources
- Detailed explanations of any UDFs
- Ongoing research projects

Footnotes

A number of the reports allow the use of various footnotes to appear at the bottom of the reports. These include the name of the studbook keeper, contact information, the scope of the data (regional or international) and the date to which the data are current. You may also enter taxonomic and common name information and the gestation/incubation period.

Information

You may see information on the last IDs used (highest studbook number, highest temporary number, highest UNKx, MULTx & WILDx numbers, highest HYPothetical number assigned to date), the number of records stored in your data, the contents of the AUTOEXEC and CONFIG.bat files, and the DOS path statement.

DOS

If your computer is capable of bring up a DOS window or Command Prompt window, you may go there from here. To return to Sparks, type EXIT at the prompt. [Note – this functions at least through Windows XP.]

Restore

Restore works in the reverse of Backup. A batch file, named RESTORE.PRG, executes to read back into your hard disk from any floppy drive. It un-compresses using the utility PKUNZIP. Unlike backup, which only backs up your currently open studbook files, restore will restore any studbook files, whether or not they previously existed on the computer. If backup fails to run in a Windows 95, 98 or ME system, be sure that copies of the files pkzip.exe and pkunzip.exe are in the C:\ folder. In Windows NT, 2000 and XP computers you will need to put them in the C:\Windows\System or C:\WinNT folders instead.

Be sure that the backup you wish to restore was created by the Sparks program. If it was created independently by someone using another method, Sparks will almost certainly move the data to the wrong place in your computer, usually by putting the data into the Sparks folder instead of a studbook sub-folder. This will not harm the program itself, but you will be unable to find the data. If this occurs, do not attempt to fix the results yourself, please contact ISIS for help. A detailed description of creating a proper Sparks backup with WinZip follows.

If you are restoring a studbook that was not previously in your computer, you DO NOT need to set up a folder for the data before you restore it. Sparks will build whatever folder is needed.

Backup & Restore with WinZip

The following assumes that Sparks is installed on the C: drive, in a folder called Sparks. Adjust this to compensate if needed.

Sparks normally uses pkzip.exe & pkunzip.exe to backup and restore studbook datasets. These files can be found in the Sparks folder. Copy and paste a copy of each into the C: folder so that your computer can find them reliably. In some computers, you may need to put them in the C:\Windows\System or the C:\WinNT folders.

Having done this, if Backup and Restore will not work, you may use WinZip to backup and restore Sparks data. WinZip is available at <u>www.winzip.com</u> and also on the ISIS Specimen Data DVDs.

To Backup Sparks data using WinZip Classic version:

Close Sparks. Put a floppy disk in the A: drive. Get into WinZip. Pick the 'New' icon.

At the top of the window at the 'Create in:' box, click on the small down-facing arrow on the right. Pick the $3\frac{1}{2}$ Floppy (A:).

At the bottom of the window at the 'File name:' box, type the name of your studbook. (Sparks studbook names are 8 characters or less and contain no spaces. When you first get into Sparks, it is shown in green at the top of the screen.) Pick OK.

Pick the 'Add' icon. At the top of the window at the 'Add from:' box, click on the small down-facing arrow on the right. Navigate around until you find your studbook folder. It will be under My Computer, then under C\:, then under Sparks. When the yellow Sparks folder appears in the large white window, double-click on it. Look through the various studbook folders that may be available, double-click on the one you want to use.

- File name: should be *.*
- Compression: should be Normal
- Store filenames in 8.3 format: should NOT be checked
- Include subfolders: should not be checked
- Save extra folder info: SHOULD be checked
- Attributes: leave these as they are

Click on 'Add with wildcards'. WinZip will backup your data.

You may close WinZip. Label the floppy disk and store it in a safe place.

To Restore Sparks data using WinZip Classic version:

Close Sparks. Put the floppy disk containing the Sparks backup in the A: drive. Get into WinZip. Pick the 'Open' icon.

At the top of the window at the 'Look in:' box, click on the small down-facing arrow on the right. Pick the $3\frac{1}{2}$ Floppy (A:).

Double-click on the dataset you wish to restore. WinZip will display a listing of all the files.

If you are restoring data to a studbook that already exists in the computer: Click on the 'Extract' icon. In the larger Folders/drives window, double-click on the C: folder, find and double-click on the Sparks folder. Find and double-click on the studbook folder that you wish to restore to.

If you are restoring data for a studbook that does not yet exist in the computer: In the box 'Extract to:' type C:\Sparks\<studbook> where <studbook> stands for the name of the studbook. Sparks studbook names can be up to 8 characters long and MAY NOT contain spaces. Examples of valid names would be LION COCKATOO KING_COB

For either case, continue by seeing that

- 'All files' is checked
- 'Overwrite existing files' is NOT checked
- 'Skip older files' is NOT checked
- 'Use folder names' is **NOT** !! checked
- If there are any other choices in this short list on the bottom left, uncheck them.

Choose the Extract button on the upper right corner. The files will be extracted. If WinZip warns you that you are overwriting files that already exist, pick 'Yes to all'.

Close WinZip. Get into Sparks. Pick Change Studbook and choose the one you wish to use for that session.

Appendix I: Technical Reference

This documentation is provided for experienced computer users who wish to know how the data is stored in Sparks in order to access the files from your own analysis programs to go beyond the capabilities of Sparks. However, please keep in mind that you also have the power to destroy all your records. Make sure you know what you are doing and that you have a backup of your data.

Please do NOT modify any Sparks data files from outside of the Sparks program. Doing so disables Sparks' powerful edit checking. ISIS cannot assist with files corrupted in this manner.

Sparks is written and compiled in FoxPro 2.6. All the data files, lookup table files and indexes are standard xBase formats that may be read from any xBase program such as dBase4, FoxPro, etc. Please do NOT use Microsoft Access on the data files, as this program changes the file headings; Sparks will no longer recognize the files as xBase and will not be able to open them.

Each studbook kept in Sparks is stored in a separate folder under the \Sparks folder.

Data Files

There are four main .dbf files and associated indexes for each. A complete description of each is stored in a master dictionary called metafile.dbf.

Structure for table: METAFILE.DBF

Field	Туре	Width
FIELD_NAME	Character	10
FIELD_TYPE	Character	1
FIELD_LEN	Numeric	3
FIELD_DEC	Numeric	3
DESCRIPTN	Character	24
FILE_NAME	Character	8

Structure for table: MASTER.DBF

Field	Туре	Width	Description
STUD_ID	Character	6	KEY-Studbook Number
SEX	Numeric	1	Sex
HYBRID	Logical	1	Hybrid flag
DAM_ID	Character	6	Dam's Studbook Number
SIRE ID	Character	6	Sire's Studbook Number
BIRTH_TYPE	Character	1	Birth type
BDATE	Date	8	Birth Date
BIRTH_EST	Character	1	Confidence in Birth Date
REARING	Character	1	How young was raised
MGMT_PLAN	Logical	1	Global Management Plan
SURPLUS	Logical	1	Management Plan Surplus
UPDATE	Date	8	Last update to record
SEND	Logical	1	Data has been changed
RSORT	Character	9	Report Sort Order
SSORT	Character	9	Report Sort Order
SELECT1	Logical	1	Report Select Flag 1
SELECT2	Logical	1	Report Select Flag 2
Some datasets	may contain the	following fields.	
DAM_LOC	Character	9	Dam's location
SIRE_LOC	Character	9	Sire's location
TAXON_PK	Numeric	11	Arks4 taxonomic code
ISIS_KEY	Numeric	11	Unique ISIS key

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For each studbook specimen, there is only one master record. However, in the moves file there is at least one record and often more. The key field, STUD_ID, is common to all four files and is the key that links all the data for a single studbook specimen together.

Structure for table: MOVES.DBF

Field	Туре	Width	Description
STUD_ID	Character	6	KEY-Studbook Number
TRAN_CODE	Character	2	Type of transaction
PHYSICAL	Logical	1	Physical transfer
OWNER	Logical	1	Ownership transfer
LOCATION	Character	9	Physical location
LOCAL ID	Character	6	Institutions local ID
TRAN DATE	Date	8	Date of transaction
TDATE_EST	Character	1	Confidence in Trans Date
REM_DATE	Date	8	Removal Date
RDATE EST	Character	1	Confidence in Removal Date
INSTCODE	Character	9	Institution code

Structure for table: **SPECIALS.DBF**

Field	Туре	Width	Description
STUD ID	Character	6	KEY-Studbook Number
CODE	Character	2	Type of Special Data
COMMENT	Character	65	Text
SPEC DATE	Date	8	Date of Special Data

The UDF file will only contain records if the user has defined UDFs.Again, the key field is always there, followed by any UDF fields.Structure for table:UDF.DBFStud IDTypeSTUD IDCharacter6KEY-Studbook Number

Each .dbf file has an index file (.IDX or .CDX) of the same name to speed retrieval. The STUD_ID field is always part of the index key field.

Master Data File...

Etc...

index on Stud_Id to \&xSparks\&xSTUD\master compact

Moves Data File...

index on stud_id + DTOS(Tran_Date) + tran_code + ; IIF(empty(Rem_Date),'1','0') + DTOS(Rem_Date) ; TAG MOVES of \&xSparks\&xSTUD\Moves.cdx

index on location TAG LOCATION of \&xSparks\&xSTUD\Moves.cdx

Special Data File...

index on stud_id+str(year(spec_date),4)+str(month(spec_date),2)+str(day(spec_date),2); to \&xSparks\&xSTUD\specials compact

User Defined File...

index on stud_id to \&xSparks\&xSTUD\UDF compact

where the variable &xSparks is the folder where Sparks is installed and &xSTUD is the name of the studbook.

Each studbook has an associated contact file that contains fields to enter the name of the person to contact at each institution and the last date through which an individual institution has submitted data.

Structure for table: CONTACT.DBF

Field	Tvpe	Width	Description
INSTCODE	Character	9	Instcode in the ISISISF file to associate with
CONTACTNAM	Character	35	Contact name at an institution
CURRENTNES	Date	8	Date current

This file has one index: index on instcode to \&xSparks\&xSTUD\Contact.idx compact

Institution List

The largest data file by far is the institution lookup table with over 15,000 records. This is the very important list that contains the name of most of the world's zoos and aquariums, museums, dealers and exchanges, many individual collectors, and non-exhibit centers. There is room to store the complete address, although only some are provided. Each entry is assigned a mnemonic code, often a city abbreviation. It is this code that is used by Sparks to record all locations. Without the consistency forced by Sparks to use the same name for a location, it would not be possible to retrieve reports based upon any geographic criteria. This file is located in the main Sparks folder.

Structure for table: ISISISF.DBF

Field	Tvpe	Width	Description
INSTCODE	Character	9	ISIS numeric geographic code
MNEMONIC	Character	9	ISIS alpha geographic code
INST_NAME	Character	40	Full institution name
ADDRESS	Character	35	Institution address
CITY	Character	20	City
STATE	Character	20	State/province
COUNTRY	Character	20	Country
MAILCODE	Character	10	Mail code / ZIP code
PHONE	Character	20	Telephone number
FAX	Character	20	Fax number
EMAIL	Character	40	Email address
ISIS_MEMB	Logical	1	ISIS membership
SYNONYM	Logical	1	Is the entry a synonym to another entry?
NOMODIFY	Logical	1	Does not allow modification of ISIS-assigned mnemonics/codes
ISF_PK	Numeric	6	Occurs in more modern lists linked to ARKS4

This file also has an index file:

index on InstCode TAG InstCode of \&xSparks\ISISISF

index on Mnemonic TAG Mnemonic of \&xSparks\ISISISF

where the variable &xSparks is the folder where Sparks is installed.

There are several small lookup tables containing translations for various codes.

Autopsy Codes

Structure for table: AUTOCODE.DBF					
Field	Tvpe	Width	Decimals	Description	
ACODE	Character	1		Code	
ATYPE	Numeric	19	4	Grouping	
AMEANING	Character	24		Translation	

Help Files

Structure for table: SPHELP.DBF

Field	Tvpe	Width	Description
TOPIC	Character	30	Help Topic
DETAILS	Memo	10	Explanation
CLASS	Character	20	Section of Sparks that it applies to

OwnCode List

OwnCode.dbf is a long list of standardized codes used in the Special Data table to organize comments on Notes, Reproduction, Medical Comments, Physical Condition, Behavior, etc. Structure for table: **OWNCODE.DBF**

Field	Tvpe	Width	Description	
CODE	Character	2	Code	
TEXT	Character	24	Translation	

These three tables have no associated indices.

Appendix II: GENES

Software package for genetic analysis of studbook data

Written by Robert Lacy, Chicago Zoological Society/Brookfield Zoo Available at http://home.netcom.com/~rlacy/genes.html

Assuming that you have exported an appropriate pedigree data set using the Export Report from Sparks, to run GENES, simply type GENES from the operating system, and answer the questions that appear on the screen.

GENES will, if asked politely, do:

Inbreeding calculations:

- Calculate inbreeding coefficients.
- Produce a matrix of inbreeding coefficients for hypothetical offspring that would be produced from every M x F cross of currently living animals.

Founder representation analysis:

 Calculate founder contributions to each living descendant, summed and average founder contributions to the living population, and the number of founder equivalents (see Lacy 1989 in Zoo Biology). The number of founder equivalents is the number of founders of equal contribution that would have yielded the diversity of founder genes that have come through the pedigree. If all founders contribute equally, the founder equivalents is the actual number (hence the name, founder equivalents). If contributions are unequal, the founder equivalents will be less.

Gene drop analysis of founder allele distribution:

• A stochastic simulation of founder-allele transmission through the pedigree. The program was written by Dr. Georgina Mace, British Federation of Zoos, in FORTRAN and then translated into the C programming language and modified by Lacy. As presently dimensioned, analysis is restricted to studbooks with no more than 2000 animals with living descendants, 500 living animals, and 200 founders. Limited computer memory may further restrict these sizes. (The program will warn you if a studbook is unlikely to fit into memory. If it doesn't fit, the program will terminate.) GENES ignores dead animals with no living descendants when running the gene drop simulation, thereby much reducing the computer memory needed and the running time.

In addition to the statistics calculated in the GENEDROP program written by Georgina, the GENES version also calculates:

- Target founder representations --parity representations corrected for the irreversible loss of founder alleles that has already likely occurred in the pedigree: algorithm developed by Jon Ballou. Note that living wild-caught animals have the highest target representations, because none of their genes are yet irreversibly lost.
- Mean allelic retention --the fraction of a founder's genes that are present in at least one copy in the living descendant population.
- Founder genomes surviving --the summed allelic retention; i.e., the number of founder alleles still in the population.

A brief explanatory interlude

Geneticists use "heterozygosity" for several different, though closely related, concepts. Most simply, the heterozygosity of a population is the proportion of the individuals that are heterozygous at the locus or loci of interest. This is often termed the "observed heterozygosity" of a population.

In a randomly mating population (i.e., one in Hardy-Castle-Weinberg equilibrium), the mean heterozygosity is expected to be $H = 1 - sum(p_i^2)$, in which p_i is the frequency of allele i. (The expected frequency of monozygosity for each allele is p_i^2 .) The heterozygosity expected under Hardy-Castle-Weinberg equilibrium is often termed the "expected heterozygosity" of a population.

For many genetic loci (typically 50X to 90X), all individuals of a population are homozygous for a single allele, i.e., the locus is monomorphic. In population management, as in other evolutionary processes, such invariant loci are of relatively little interest. (Evolution requires variation.) Often we are concerned with not the absolute heterozygosity (observed or expected), but rather the heterozygosity of a population relative to the heterozygosity of some starting reference population. This fraction heterozygosity is termed the "gene diversity" of a population is sometimes symbolized P. ($P_i = H_t/H_0$, in which P_t is the gene diversity at time t and H_t and H_0 are the expected heterozygosities at time t and 0).

Inbreeding reduces the probability that an individual is heterozygous at any given locus and the inbreeding coefficient, F, of an individual is defined as the fractional reduction of that individual's heterozygosity (across all loci) relative to the mean expected heterozygosity of the population. [$F_i = (H_e - H_i)/H_e$, in which F_i is the inbreeding coefficient of individual i, H_e is the expected heterozygosity of the population at some reference time point and H_i is the (observed) heterozygosity of the population at some reference time point and H_i is the (observed) heterozygosity of the that the mean inbreeding coefficient (at time t, relative to reference time 0) of a small population that is in Hardy-Weinberg-Castle equilibrium is given by $F_t = (H_0 - H_t)/H_0 = 1 - P_t$.

In the gene drop simulation in GENES (and typically in any founder analysis), the starting (observed) heterozygosity is set at 1.0, because each founder is given two unique alleles. The expected heterozygosity among the founders is $1 - sum\{[1/(2 * N_f)^2, in which N_f \text{ is the numbers of founders, because P_i = 1/(2 * N_f)$. For reasons I won't explain here, this expected heterozygosity of the founders is also equal to the fraction of the (expected) heterozygosity of the wild population that is expected in the founder stock (i.e., the "gene diversity" of the founders relative to the wild population from which they came; P_f = 1 - sum{[1/(2 * N_f)^2]}.

With this clarifying (?!) background on the distinction between observed heterozygosity, expected heterozygosity, gene diversity, and inbreeding coefficients, we now continue with the output from GENES:

Fraction of wild heterozygosity retained --the "gene diversity" of the captive population: the expected heterozygosity in the living population relative to the wild population from which the founders were taken.

Fraction of wild heterozygosity lost = 1 minus the heterozygosity retained. If the population were randomly mating (few populations are), then the fraction of heterozygosity lost would be equal to the mean inbreeding coefficient of the population.

Mean inbreeding coefficient realized -- the mean inbreeding coefficient within the living descendant population. This is also equal to one minus the observed heterozygosity of the descendant population.

Founder genome equivalents -- the number of equally represented founders, with no loss of founder alleles, which would yield the amount of genetic diversity in the living descendant population. Thus, the number of newly wild caught animals that would be needed to obtain the genetic diversity in the present captive population.

Founder equivalents - -the number of equally represented founders, with the observed losses of founder alleles, that would yield the amount of genetic diversity observed in the living descendant population.

Founder equivalents do not correct for the losses of alleles in population bottlenecks, whereas founder genome equivalents do. (See Lacy 1989 paper in Zoo Biology).

Each of the above is calculated on the total pedigree and also on a subset that excludes contributions from animals with unknown parents (which otherwise are treated as founders). Also given are the summary statistics (mean retention, heterozygosity, founder equivalents, etc.) attainable with "perfect" management in the future, i.e., if all target founder representations are met and no further allelic losses occur.

Before running GENES, the directory should contain:

GENES.EXE XXXXXXX.TXT (your Sparks export file from studbook xxxxxxx)

To this, GENES will add data matrices xxxxxx.rf and xxxxxx.des, and output files INBREED.PRN, FOUNDER.PRN, and GD.PRN. The program also creates several temporary files that will be deleted when the program terminates normally.

The inbreeding analysis assumes that UNK and WILD parents are unrelated to all other animals - it cannot do otherwise. Thus, animals with unknown parents will be treated as wild-caught founders. If one parent is known (and captive), but the other parent is WILD or UNK (as would occur if a wild-caught female gave birth to an offspring sired in the wild), GENES will treat the unknown parent as a founder. The "studbook number" of that pseudo-founder is set equal to the negative of the studbook number of the known (captive) parent (This pseudo-founder is not added to the studbook, however, it is simply assumed to exist for the genetic calculations.) If an animal gives birth to several offspring with an UNK or WILD animal for the other parent, the program assumes that the unknown (pseudo-founder) parent is the same for all those offspring. The gene drop program outputs summary statistics for the entire data set (treating unknowns as wild-caught founders) and for only those founders recorded as truly WILD. (A few statistics cannot be calculated on the subset without unknown "founders". Those spots are left blank on the output.)

One unknown parent causes no problem for the inbreeding calculations, beyond the obvious loss of information (and possible under-estimation of F) if the unknown parent is in fact related to other animals in the studbook.

If none of this makes sense, try the program and see what happens.

The number of animals that GENES can handle on any given computer can be calculated by taking the square root of 75% of the available RAM and dividing that number by 2.

E.g., 128 MB RAM: multiply by 75% to get something like 100 MB, take square root to get 10 KB, divide by 2 to get 5 KB. So ... the limit would be in the ballpark of 5,000 animals.

GENES assumes that the studbook data are ASCII format as produced by using the Sparks Export utility. Minimally necessary is a file containing the following fields:

ID/Sire/Dam/Sex/Selected/Dead/NewID/NewSireID/NewDamID

Lacy welcomes comments on GENES, to which he will respond if he has time. No guarantees of any sort are provided with this software: some effort has gone into testing and debugging. Use at your own risk...

DEMOGRAPHICS GLOSSARY

- Age Age class in years.
- **Px** Age-specific survival Probability that an animal of a given age will survive to the next age class.
- **Qx** Age-specific mortality Probability that an animal of a given age will die before reaching the next age class.
- Lx Age-specific survivorship. Probability of a newborn surviving to a given age class.
- **Mx** Age-specific fertility. Average number of offspring (of the same sex as the parent) produced by an animal in the given age class. Can also be interpreted as average percentage of animals that will reproduce.
- **r** Instantaneous rate of change. If r < 0, Population is declining r = 0, Population is stationary r > 0, Population is increasing

IambdaPercent of population change per year. If lambda < 1, Population is declining
lambda = 1, Population is stationary
lambda > 1, Population is increasing

RoNet reproductive rate, the rate of change per generation. If Ro < 1, Population is declining
Ro = 1, Population is stationary
Ro > 1 Population is increasing

- **T** Generation Time Average length of time between the birth of a parent and the birth of its offspring. Equivalently, the average age at which an animal produces its offspring.
- **Ne** Effective Population Size The size of an idealized population that would have the same amount of inbreeding or of random gene frequency drift as the population under consideration. In an idealized population all individuals breed successfully, so only breeding individuals are included in calculating Ne.

GENETICS GLOSSARY

Genome The complete set of genes (alleles) carried by an individual.

Retention Fraction of founder's original set of genes (genome) still present in the population.

Existing Representation The existing percentage representation of founders in the population.

Target Representation The desired or target percentage representation of founders. These target figures are proportional to the fraction of each founder genome that survived. Achieving these target representation values will maximize preservation of genetic diversity.

Difference (Existing Representation) - (Target Representation) = Difference A minus sign (-) designates a founder that is over-represented.

Potential Founder An animal from a source population (e.g., the wild) that establishes a derived population (e.g., a captive or new wild population).

Founder An animal from a source (e.g., wild) population that actually produce offspring and has descendants in the living derived (e.g., captive) population. The minus sign (-) designates the unknown mate of the founder with that number.

Mean Retention Average fraction of each founder genome surviving in the population.

Mean Heterozygosity Average fraction of original heterozygosity remaining in the population.

Bottleneck A generation in the lineage from a founder when only one or a few offspring are produced so that not all of the founder's alleles are transmitted onto the next generation.

Founder Genome Surviving The sum of the allelic retention; i.e., the number of founder genomes still in the population. This metric measures loss of original diversity due to bottlenecks in the pedigree of the population.

Founder Genome Equivalents The number of newly wild caught animals required to obtain the genetic diversity in the present captive population. This metric reflects loss due to both bottlenecks and disparities in founder representation.

Appendix III: USER DOCUMENTATION FOR Sparks DATA VALIDATION MODULE

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Sparks DATA VALIDATION - Frequently Asked Questions

Why should I use Data Validation?

Data Validation checks your Sparks data set for logic errors, possible file damage, and inappropriate, invalid or missing information. Data Validation systematically looks at all the major fields for each specimen record in your studbook. It checks that all required information has been entered correctly, that essential information is not missing, and that there are not logic errors between conflicting pieces of information. Data Validation also counts missing or unknown data, verifies field justification and contents, and looks for inappropriate characters that may be an indication of file damage. Data Validation verifies that your data set is sufficiently clean and reliable to analyse for species management.

How long does Data Validation take?

You should be aware that Data Validation will be slower when validating a larger data set. How long Data Validation takes depends on the speed of the computer, the size of the studbook, the extent to which parents are identified in the studbook, and the average number of transactions per specimen.

Data Validation creates a log file, 'C:\Sparks\VALIDATE.LOG' that lists when validation was run and how long it took. After you have run Data Validation for the first time, this file will give you an approximate benchmark for how long it takes your computer to process a data set and will accumulate more information each time you run data validation.

What is the difference between coarse and fine validation?

Coarse validation looks for evidence of file damage, manipulation of the data in a xBase program outside of Sparks, major logic errors, and significant missing information. Fine validation includes problems with data format and inappropriate field values, minor logic errors, warnings of potential problems, and situations that may or may not be a problem depending on biology and circumstances. It does not add significant time to how long the program takes to run.

GETTING STARTED

Preparing To Run Data Validation

1) Back Up Your Studbook Data

ISIS STRONGLY RECOMMENDS THAT YOU MAKE REGULAR BACKUP COPIES OF YOUR STUDBOOK

2) Run Clean Up Files

Clean Up Files will prepare your data for validation and correct some types of problems.

Running Data Validation

Choose the Data Quality option on the Main Menu. Select Data Validation. Choose Coarse or Fine Validation.

Selecting Output Format

When validation is finished, the total number of errors is shown on the screen. You will have the normal options to see the report on the screen, send the report directly to the printer, save the report in a file with or without printer codes, or cancel the report.

Canceling Data Validation

It is possible to interrupt Data Validation by using the escape key, "Esc". After the program is done processing the current record, a window will appear asking if you wish to cancel. If you select "No", you will be returned to continue Data Validation.

Sparks 1.4 DATA VALIDATION ERROR MESSAGES -MASTER RECORD ERRORS

Master record validation verifies the information in the studbook ID field as well as the sex code, rearing code, hatch/birth type, and master birth date and birth date estimator fields. This stage also verifies that there is at least one record in the moves database with the same studbook ID. The first physical acquisition event, such as a birth, capture, or transfer, is used to validate hatch/birth type and master birth date and birth date and birth date estimator.

ERROR M-01 COARSE

Empty Studbook ID -This record has an empty Studbook ID field. It has been deleted and will be erased next time you Clean Up files. [Data from deleted Master record.]

This error occurs when the studbook ID field in the master record is blank. When a user wants to delete a studbook record in Data Entry mode, they move to the master record quadrant and delete the studbook ID. Clean Up files permanently removes these deleted records. You should never see this error if you always run Clean Up files prior to Data Validation.

ERROR M-02 COARSE

Duplicate Studbook ID - ID: "[Stud ID]" has multiple masters! The following master record has the same ID as the previous record. It has been deleted and will be erased next time you Clean Up files. Verify that this deleted information is in the current record: [Data from deleted Master record.]

This error occurs when the current master record has the same studbook ID as the previous master record. By default the first master record is kept, and any subsequent master records with identical studbook IDs are deleted. The data from the deleted master record(s) is included in the report. Verify that the data from the deleted record(s) is included in the current master record. This situation cannot be created from within Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR M-03 COARSE Illegal ASCII Character in Studbook ID: "[Stud ID]". Character # [#], "[C]", at position [#].

Illegal ASCII characters are low ASCII characters 0 to 31 and high ASCII characters 123 to 255. It is possible to deliberately or inadvertently enter these characters in Sparks. Using these characters in a studbook ID is undesirable because depending on the computer many of these characters do not appear on the screen or will not print correctly. The error message identifies the ASCII character number as well as attempting to produce the character. If the character does not print or appear on your screen, you can still look it up in any table of ASCII characters.

ERROR **M-04** FINE **Inappropriate ASCII Character in Studbook ID**: "[Stud ID]". Character # [#], "[C]", at position [#].

Inappropriate ASCII characters are lowercase letters, "a-z", ASCII characters 97 to 122, and symbols ASCII characters 33 to 47,58 to 64, and 91 to 96. Lowercase letters cannot be entered in Sparks. They are converted to uppercase upon entry. The symbols are a variety of punctuation and other symbols, mostly characters on the keyboard. Studbook recommendations discourage the use of coded studbook ID schemes that use symbols or alphanumeric combinations to represent coded information about the specimen.

ERROR M-05 FINE

Studbook ID Justification Problem. [#] Illegal space(s) on the right-hand side of Studbook ID: "[Stud ID]".

Studbook IDs should be right trimmed or right justified such that there are no blank spaces on the right-hand side of the studbook ID. Trailing spaces will cause a studbook ID to sort improperly. A studbook ID of "2 ", ("2" followed by a space) will not sort correctly between "1" and "3", but rather will sort between "19" and "20". These IDs also will not print correctly on reports. This error cannot be created from within Sparks. This may be found in studbooks that have been transferred from earlier studbook programs.

ERROR M-06 FINE

Improper or Inappropriate Studbook ID: "[Stud ID]". This convention should not be used as a studbook ID.

This error is triggered by studbook IDs of "UNK", "UKN", "MULT", "NONE", and "WILD".

These should not be used as studbook IDs. Each specimen in your studbook should have a unique studbook ID.

ERROR M-07 COARSE

Master Record Orphan - No Associated Moves Records. There are no moves records for this master studbook ID. It has been deleted and will be erased next time you Clean Up files. This record will need to be re-entered if this is a valid specimen. [Data from deleted Master record.]

This master record does not have any associated transaction records in the moves database. Every specimen must have a master record in the master database file, and at least one transaction record in the moves database file. If this master record was a legitimate specimen, it will need to be reentered along with any Transaction and Special Data.

ERROR M-08 COARSE .

Invalid First Event - No Acquisition Event for Specimen. There are no physical birth, capture, or transfer events for this specimen. It is not possible to validate hatch/birth date or type.

The first transaction event for each specimen in the moves database should be a birth or capture. In the case where origin is completely unknown, this first event may be a transfer. This error indicates that there are no physical birth, capture or transfer events for this specimen. This may indicate that there are no acquisition events for this specimen, or that all the acquisition events

are flagged as non-physical, ownership only. If there are no acquisition events, you will need to enter at least one acquisition event. If there are acquisition events for the specimen, verify that the ownership and physical transaction flags are set correctly. The first physical acquisition event is used to validate other fields such as hatch/birth date and type. If there are no physical acquisition events, it is not possible to validate these fields. M-08 should occur with T -04 in cases where a specimen has a release or death event without a valid origin event.

ERROR M-09 COARSE

Illegal Sex Code: "[Sex Code]" is invalid. Valid codes are 0-7.

Valid sex codes are numerals 0 to 7. Any other characters are invalid. Invalid sex codes cannot be entered from within Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR M-10 COARSE

Illegal Rearing Code: "[Rearing Code]" is an invalid code. Valid codes are H,P,S,F,C,G,N & U only.

Rearing code is invalid. Invalid rearing codes cannot be entered from within Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR M-11 FINE

Incompatible Rearing Code - Conflicts with Hatch/Birth Type. Hatch/Birth Type is Unknown. Code of "[Rearing Type]" is inconsistent.

This error occurs when the first event is a transfer and the hatch/birth type is unknown, while a specific rearing type code has been entered. If nothing is known about the origin of the animal, then rearing should also be unknown.

ERROR M-12 COARSE

A) **Incompatible Hatch/Birth Type** - Hatch/Birth Type / First Event Conflict. Hatch/Birth Type is wild hatched/born but first physical event is a captive hatch/birth.

B) Incompatible Hatch/Birth Type - Hatch/Birth Type / First Event Conflict. Hatch/Birth Type is unknown, but first physical event is a captive hatch/birth.

C) Incompatible Hatch/Birth Type - Hatch/Birth Type / First Event Conflict. Hatch/Birth Type is captive hatched/born, but first physical event is a capture.

D) Incompatible Hatch/Birth Type - Hatch/Birth Type / First Event Conflict. Hatch/Birth Type is unknown, but first physical event is a capture.

The first <u>physical</u> acquisition event is used to validate the hatch/birth type. The hatch/birth type should agree with this first acquisition event. If the first acquisition event is a captive hatch/birth, the hatch/birth type should be captive hatched/born, not A) wild hatched/born, or B) unknown hatch/birth type. If the first acquisition event is a wild capture, the hatch/birth type should be wild hatched/born not C) captive hatched/born or D) unknown hatch/birth type. If there is a M-08 Error condition, hatch/birth type is not validated.

ERROR M-13 COARSE & FINE

A) ERROR M-13C: Empty Hatch/Birth Type - Hatch/Birth Type field is empty. According to first physical event this should be captive hatched/born.

B) ERROR M-13C: Empty Hatch/Birth Type - Hatch/Birth Type field is empty. According to first physical event this should be wild hatched/born.

C) Error M-13f: Empty Hatch/Birth Type - Hatch/Birth Type field is empty. First event is a transfer.

D) Error M-13f: Empty Hatch/Birth Type - Hatch/Birth Type field is empty. No valid first event.

Hatch/birth type should be captive, wild, or unknown. It should never be empty. The first <u>physical</u> acquisition event is used to validate the hatch/birth type. A), If the first event is a hatch/birth, the type should be captive. B), If the first event is a capture, the hatch/birth type should be wild. C), If the first event is a transfer, the hatch/birth type is most likely to be unknown, but it can be captive or wild. D), If there is no valid first event, a M-08 Error message should also be issued.

ERROR M-14 COARSE

A) **Illegal Character in Hatch/Birth Type Field**. "[Birth Type]" is not a valid Hatch/Birth Type Code. According to first physical event this should be captive hatched/born.

B) Illegal Character in Hatch/Birth Type Field. "[Birth Type]" is not a valid Hatch/Birth Type Code. According to first physical event this should be wild hatched/born.

C) Illegal Character in Hatch/Birth Type Field. "[Birth Type]" is not a valid Hatch/Birth Type Code. First event is a transfer.

D) Illegal Character in Hatch/Birth Type Field. "[Birth Type]" is not a valid Hatch/Birth Type Code. No valid first event.

Valid hatch/birth type codes are "1" (captive hatched/born), "2" (wild hatched/born), and "X" or "U" (unknown hatch/birth type). Error M-14 is issued when the hatch/birth type field in the master database contains an illegal character. The error message indicates the first event. Invalid hatch/birth type codes cannot be entered from within Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR M-15 COARSE

Missing Master Hatch/Birth Date - Conflicts with First Event. This conflicts with captive hatch/birth at [Location] on {Date}.

ERROR M-16 COARSE

Unknown Master Hatch/Birth Date - Conflicts with First Event. Unknown conflicts with captive hatch/birth at [Location] on {Date}.

These two error messages are closely related. M-15 is generated when the first event is a captive hatch/birth, the master record hatch/birth date field is empty, and the master record hatch/birth date estimator field is not equal to "U", whereas M-16 is generated under the same conditions when the date estimator field is "U". Sparks now requires that a date be entered into the master record hatch/birth date field. If the first event is a captive hatch/birth, the master record hatch/birth date and date estimator should agree with the date and estimator for the hatch/birth event. M-16 assumes that if a specimen is known to have been captive hatched/born at a location, we should know something about the hatch/birth date.

ERROR M-17 COARSE

Hatch/Birth Date Conflict - Master Hatch/Birth Date, {Date}, conflicts with captive hatch/birth at [Location] on {Date}.

For a captive hatched/born specimen, the master record hatch/birth date must be the same as the hatch/birth event date. This error message is generated when the first physical acquisition event is a captive hatch/birth and the event date is not the same as the master record hatch/birth date.

ERROR M-18 COARSE

Illegal Hatch/Birth Date Estimator - "[Birth Estimate]" is an invalid code.

Valid hatch/birth date estimators are "D" day, "M" month, "Y" year, "U" unknown, and numbers 1-9 for range in years. Invalid hatch/birth date estimators cannot be entered in Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR M-19 FINE

Hatch/Birth Date Estimate Conflict - Accuracy Conflict. Master Birth Date estimate of " " conflicts with Birth Event estimate of "".

For a captive hatched/born specimen, the master record hatch/birth date estimator must be the same as the estimator for the hatch/birth event date. This error message is generated when the first physical acquisition event is a captive hatch/birth and the event date estimator is not the same as the master record hatch/birth date estimator.

ERROR M-20 COARSE

Missing Master Hatch/Birth Date and Date Estimate is not "U".

This error message is generated when the first physical acquisition event is a capture or a transfer, the master record hatch/birth date field is empty, and the hatch/birth date estimator does not equal "U" unknown. If the first event is a capture or transfer, the hatch/birth date is likely to be estimated or unknown. The master hatch/birth date field should only be empty when the date is unknown, and this must be indicated by a "U" in the date estimator field.

ERROR M-21 COARSE

- A) Hatch/Birth Date Conflict Master Hatch/Birth Date, {Date}, conflicts with capture at [Location] on {Date}.
- B) Hatch/Birth Date Conflict Master Hatch/Birth Date, {Date}, conflicts with first physical event at [Location] on {Date}.

If the first event is a capture or transfer, the master record hatch/birth date must be prior to or equal to the A) capture date, or B) transfer date. M-21 is issued when the master hatch/birth date is after the capture or first transfer event date.

ERROR M-22 COARSE

Hatch/Birth Date In Future -Master Hatch/Birth Date, {Date}, is after current date, {Date}.

The master record hatch/birth date is after the current date according to your computer. If your computer date is not correct, set this in DOS using the DATE command, or in windows using the control panel.

ERROR M-23 FINE

Hatch/Birth Date Conflict - Master Hatch/Birth Date, {Date}, is prior to the year 1601. Verify that this date is correct. The master record hatch/birth date is prior to the year 1601. Some studbooks have had problems with corrupted, but still valid, dates. This may be a sign of file damage.

DAM & SIRE VALIDATION - GENERAL DISCUSSION

INTRODUCTION

Data Validation attempts to verify that the Dam was at the specimen hatch/birth location at the time of birth or estimated date of laying, and that the Sire was at the same location on the estimated date of conception. In order for this to work, the reproductive mode must be correctly entered and a value entered for gestation or incubation period. Reproductive mode is set based on the taxonomy entered in the Footnotes section under the System Utilities menu. Depending on the Class and Order entered, reproductive mode is set to either live-bearing or egg-laying. In some cases the user will be prompted to enter the reproductive mode. At the bottom of the taxonomy screen, the user is prompted to enter a gestation time for live-bearers and an incubation time for egg-layers. The reproductive mode and incubation/gestation interval are used to determine low (earliest) and high (latest) dates that are used to verify parent location and status at time of offspring birth/laying conception.

DATE WINDOW

For the error messages listed below, two dates are checked, a low (earliest) and a high (latest) date. If the parent is at an unknown location, or Lost-To-Follow-Up, or in the wild, etc, at the low date, then a later (high) date is checked to make sure that the parent's status has not changed in the interval. The starting date is the master record hatch/birth date. If the master hatch/birth date is empty or unknown, then the date of the first physical acquisition event (hatch/birth, capture, or transfer) is used. A positive or negative adjustment to the starting date is then made based on the master record hatch/birth date estimator. For example, if the estimator is "Y" for a year, 233 days are added and subtracted to the starting date. If the estimator is blank or "U", unknown, then the exact date is used.

DAMS

If the species is live-bearing, the low date is the offspring birth date minus the estimator adjustment if any, minus 1 day. This day is necessary to trap for the situation where the dam dies on the same day as the birth. The high date is the birth date plus the estimator adjustment if any. For egg-layers, the incubation period, if it has been entered, is used to estimate an egg-laying date. For the low date, a further adjustment is made to the live-bearing date of 17/16 times the incubation period. For the high date, 15/16 times the incubation period is subtracted from the live-bearing high date.

SIRES

If gestation/incubation period has been entered in the Footnotes section under System Utilities, an attempt is made to calculate the date of conception in order to more accurately validate the studbook data. The low date is the offspring birth date minus the estimator adjustment if any, minus 17/16 times the gestation/incubation period. The high date is the birth date plus the estimator adjustment if any, minus 15/16 times the incubation period.

PARENT TRANSACTION STREAM ERRORS

The following error messages look at the parent's transaction stream to determine location and status of the parent at the time of birth/laying conception. * Starred errors use a date window. D-07*, D-08*, D-09, D-10, D-11*, D-13, S-07*, S-08*, S-09, S-10, S-11*, S-13

Sparks DATA VALIDATION ERROR MESSAGES - DAM ID ERRORS

The Dam studbook ID is a field in the master record database. It is first validated for improper ASCII characters and justification. The Dam ID cannot be the same as the offspring, and if it is a specific ID, the Dam studbook number must be in the studbook. The Dam ID should not be blank, it must be a specimen of the appropriate sex, and the Dam ID should agree with the first event. Finally, for captive hatched/born animals, the Dam should be at the location of hatching/birth prior to offspring birth date or estimated laying date.

ERROR **D-01** COARSE

Illegal ASCII Character in Dam Stdbk ID: "[Dam ID]". Character # [#], "[C]", at position [#].

Illegal ASCII characters are low ASCII characters 0 to 31 and high ASCII characters 123 to 255. It is possible to deliberately or inadvertently enter these characters in Sparks. Using these characters in a studbook ID is undesirable because depending on the computer many of these characters do not appear on the screen or will not print correctly. The error message identifies the ASCII character number as well as attempting to produce the character. If the character does not print or appear on your screen, you can still look it up in any table of ASCII characters.

ERROR **D-02** FINE

Inappropriate ASCII Character in Dam Stdbk ID: "[Dam ID]". Character # [#], "[C]", at position [#].

Inappropriate ASCII characters are lowercase letters, "a-z", ASCII characters 97 to 122, and symbols ASCII characters 33 to 47,58 to 64, and 91 to 96. Lowercase letters cannot be entered in Sparks. They are converted to uppercase upon entry. The symbols are a variety of punctuation and other symbols, mostly characters on the keyboard. Studbook recommendations discourage the use of coded studbook ID schemes that use symbols or alphanumeric combinations to represent coded information about the specimen.

ERROR D-03 FINE

Dam Stdbk ID Justification Problem. [#] Illegal space(s) on the right-hand side of Dam ID: "[Dam ID]".

Studbook IDs should be right trimmed or right justified such that there are no blank spaces on the right-hand side of the studbook ID. Trailing spaces will cause a studbook ID to sort improperly. A studbook ID of "2 ", ("2" followed by a space) will not sort correctly between "1" and "3", but rather will sort between "19" and "20". These IDs also will not print correctly on reports. This error cannot be created from within Sparks. This will be found in studbooks that have been transferred from earlier studbook programs, notably ZRBook.

ERROR D-04 COARSE

Dam-Offspring Studbook ID Conflict - ID: "[Dam ID]". Dam Studbook ID is the same as this offspring studbook ID.

This error message indicates that the studbook number in the Dam ID field is the same as the studbook number for this specimen. Each animal in your studbook must have a unique identifier. The Dam studbook ID cannot be the same as the offspring studbook ID.

ERROR D-05 COARSE

Dam Sex Error - Dam, "[Dam ID]", is entered as "[Sex]". The Dam, "[Dam ID]", must be sexed as female, contracepted female, or neutered female.

ERROR D-06 COARSE. Dam Stdbk ID: "[Dam ID]" Not Found in Studbook.

All specific Dam studbook IDs are validated against the studbook. Unless the Dam ID is a generic, it must be included in the studbook. Generic studbook IDs are the following abbreviations for unknown, wild, and multiple possibilities:

Unknown - "UNK", "UKN", "UNK"+ (except UNKx), "UKN"+ Wild - "WILD", "WILD"+ (except WILDx) Multiple Possibilities - "MULT", "MULT"+ (except MULTx)

ERROR **D-07** COARSE

A) **Unable to determine Dam location prior to offspring birth**. Dam, "[Dam ID]", at an indeterminate location prior to birth, {Date}.

B) Unable to determine Dam location prior to estimated laying date.

Dam, n [Dam ID]", at an indeterminate location on earliest/latest estimated date of egg-laying, {Date} (, and on latest estimated date, {Date}).

See Dam & Sire Validation - General Discussion.

This error message is generated when it is not possible to determine the Dam's location A) prior to the offspring's date of birth, or B) around the estimated date of laying. This occurs when the Dam is at a location called "UNKNOWN", or when the date checked falls into a transaction gap such as the interval between a removal date and the next acquisition date. For live-bearers, the date window is the birth date minus the estimator adjustment minus one day, and the birth date plus the estimator adjustment. For egg-layers, the date window is the hatch date minus the date estimator adjustment minus 17/16 times the incubation interval, and the hatch date plus the date estimator minus 15/16 times the incubation interval.

ERROR D-08 COARSE

A) Dam Lost-To-Follow-Up prior to offspring birth.

Dam, "[Dam ID]", Lost-To-Follow-Up prior to birth date, {Date}.

B) Dam Lost-To-Follow-Up prior to estimated laying date.

Dam, "[Dam ID]", Lost-To-Follow-Up prior to earliest/latest estimated date of egg-laying, {Date} (, and on latest estimated date, {Date}).

See Dam & Sire Validation - General Discussion.

This error message indicates that the Dam was listed as Lost-To-Follow-Up A) prior to the offspring's date of birth, or B) around the estimated date of laying. For live-bearers, the date window is the birth date minus the estimator adjustment minus one day, and the birth date plus the estimator adjustment. For egg-layers, the date window is the hatch date minus the date estimator adjustment minus 17/16 times the incubation interval, and the hatch date plus the date estimator minus 15/16 times the incubation interval.

ERROR D-09 COARSE

A) Dam Birth Date Conflict - Dam born after offspring birth.

Dam, "[Dam ID]", birth on {Date} conflicts with specimen birth on {Date}. Dam not yet born by date of offspring birth, {Date}.

B) Dam Hatch Date Conflict - Dam hatched after offspring laid.

Dam, "[Dam ID]", hatch on {Date} conflicts with specimen hatch on {Date}. Dam not yet hatched on estimated date of egg-laying, {Date}.

See Dam & Sire Validation - General Discussion.

This error message is generated when the Dam hatch/birth date is after the offspring's hatch/birth date. This validation does not use a date window. The Dam hatch/birth date is validated against the low test date. This could potentially create a false error when the Dam and offspring hatch/birth dates are estimated, the offspring estimate is larger than the estimator for the Dam's hatch/birth date, and the offspring's hatch/birth date is shortly after the Dam's hatch/birth date.

ERROR D-10 COARSE

A) Dam Death Conflict - Dam dead before offspring birth.

Dam, "[Dam ID]", death (on {Date}) is prior to specimen birth on {Date}.

B) Dam Death Conflict - Dam dead before estimated date of laying.

Dam, "[Dam ID]", death (on {Date}) is prior to estimated laying, {Date}.

See Dam & Sire Validation - General Discussion.

This error message is generated when the Dam is dead A) prior to the offspring's birth date, or B) prior to the earliest estimated date of laying. This validation does not use a date window. If the Dam is dead on the low test date, it is assumed that there will not be a resurrection.

ERROR D-11 COARSE

A) Dam In Wild prior to Specimen Birth.

Dam, "[Dam ID]", in wild on {Date}, conflicts with birth at [Location]. (Dam is still in wild on {Date}, conflicts with birth on {Date}.)

B) Dam In Wild prior to Specimen Hatch.

Dam, "[Dam ID] ", in wild on earliest/latest estimated date of laying, {Date}, conflicts with hatch at [Location] on {Date}. (and on latest, {Date}, conflicts with hatch at [Location] on {Date}.)

See Dam & Sire Validation - General Discussion.

This error message is generated when the Dam is in the wild (either prior initial capture or post release) A) prior to the offspring's birth date, or B) on the earliest/latest estimated date of laying. For live-bearers, the date window is the birth date minus the estimator adjustment minus one day, and the birth date plus the estimator adjustment. For egg-layers, the date window is the hatch date minus the date estimator adjustment minus 17/16 times the incubation interval, and the hatch date plus the date estimator minus 15/16 times the incubation interval.

ERROR D-12 FINE

No Parental ID Recorded - Dam is identified as "[Dam ID]". Any parental ID assumptions and further identification possibilities should be indicated in a Special Data Note as a Parental Assumption.

If there are multiple possibilities for the Dam of a captive hatched/born specimen, this can be indicated in the Dam ID field by using the convention of "MULT", or "MULT1 ", "MULT2", etc. If wild hatched/born siblings are captured, their common parentage can be indicated in the Dam ID field by using the convention "WILD1 ", "WILD2", etc. In both of these cases, the assumptions about parentage as well as a list of potential parents should be entered in the Specials database as a Parental Assumption Special Data Note #17 - Parental ID Assumptions.

ERROR D-13 COARSE

Dam Location Conflict - Does Not Agree With Specimen Hatch/Birth. Dam, "[Dam ID] ", not at [Location] prior to specimen hatch/birth on {Date}. Dam at [Location] on earliest/latest estimated date of egg-laying, {Date}.

See Dam & Sire Validation - General Discussion.

This message indicates that the Dam was not at the hatch/birth location A) prior to the offspring's date of birth, or B) around the estimated date of laying. For live-bearers, the date window is the birth date minus the estimator adjustment minus one day, and the birth date plus the estimator adjustment. For egg-layers, the date window is the hatch date minus the date estimator adjustment minus 17/16 times the incubation interval, and the hatch date plus the date estimator minus 15/16 times the incubation interval.

ERROR D-14 FINE

Warning - No ID Recorded For Dam. Dam ID is blank. Verify Dam ID.

The master record Dam studbook ID field is empty. Either a specific or generic Dam ID should be entered for every specimen. See the explanation for Error D-06 for a list of generic studbook IDs.

ERROR D-15 COARSE

A) Dam ID Inconsistent With First Event.

Dam ID is "UNK"/"[Dam ID]", but animal was Wild Caught. Dam ID should be "WILD".

B) Dam ID Inconsistent With First Event. Dam ID is "[Dam ID]", but animal was Captive Hatched/Born. (Was this an egg collected from the wild and hatched in captivity?)

If a Dam is identified by a generic studbook ID (see the explanation for Error D-06), this generic ID should agree with the birth type based on the first event. A) If the first event is a capture and the Dam identity is unknown, the Dam studbook ID should be the generic "WILD", not "UNK", or "UKN", etc.

B) If the first event is a captive hatch/birth, the Dam studbook ID should not be "WILD".

ERROR D-XX PROGRAM ERROR

Unable To Interpret Invalid Dam Transaction Stream.

Dam, "[Dam ID]", status of not yet born on {Date} is incompatible with previous error message of "Lost-To-Follow-Up" on {Date}.

(previous error message of "In The Wild" on {Date}.) (previous error message of "Dam at Wrong Location" on {Date}.) (previous error message of "Dam Status Unknown" on {Date}.)

The Data Validation program is unable to interpret the Dam's transaction stream due to incompatible transactions. If you ever receive this message, please send a copy of the report and a backup of your studbook to ISIS.

Sparks DATA VALIDATION ERROR MESSAGES - SIRE ID ERRORS

The Sire studbook ID is a field in the master record database. It is first validated for improper ASCII characters and justification. The Sire ID cannot be the same as the offspring, and if it is a specific ID, the Sire studbook number must be in the studbook. The Sire ID should not be blank, it must be a specimen of the appropriate sex, and the Sire ID should agree with the first event. Finally, for captive hatched/born animals, the Sire should be at the location of hatching/birth prior to estimated date of conception. See Dam & Sire Validation - General Discussion.

ERROR **S-01** COARSE

Illegal ASCII Character in Sire Stdbk ID: "[Sire ID]". Character # [#], "[C]", at position [#].

Illegal ASCII characters are low ASCII characters 0 to 31 and high ASCII characters 123 to 255. It is possible to deliberately or inadvertently enter these characters in Sparks. Using these characters in a studbook ID is undesirable as depending on the computer, many of these characters do not appear on the screen or will not print correctly. The error message identifies the ASCII character number as well as attempting to produce the character. If the character does not print or appear on your screen, you can still look it up in any table of ASCII characters.

ERROR **S-02** FINE **Inappropriate ASCII Character in Sire Stdbk ID**: "[Sire ID]". Character # [#], "[C]", at position [#].

Inappropriate ASCII characters are lowercase letters, "a-z", ASCII characters 97 to 122, and symbols ASCII characters 33 to 47, 58 to 64, and 91 to 96. Lowercase letters cannot be entered in Sparks. They are converted to uppercase upon entry. The symbols are a variety of punctuation and other symbols, mostly characters on the keyboard. Studbook recommendations discourage the use of coded studbook ID schemes that use symbols or alphanumeric combinations to represent coded information about the specimen.

ERROR S-03 FINE

Sire Stdbk ID Justification Problem. [#] Illegal space(s) on the right-hand side of Sire ID: "[Sire ID]".

Studbook IDs should be right trimmed or right justified such that there are no blank spaces on the right-hand side of the studbook ID. Trailing spaces will cause a studbook ID to sort improperly. A studbook ID of "2 ", ("2" followed by a space) will not sort correctly between "1" and "3", but rather will sort between "19" and "20". These IDs also will not print correctly on reports. This error cannot be created from within Sparks. This may be found in studbooks that have been transferred from earlier studbook programs, notably ZRBook.

ERROR S-04 COARSE

Sire-Offspring Studbook ID Conflict -ID: "[Sire ID]". Sire Studbook ID is the same as this offspring studbook ID.

This error message indicates that the studbook number in the Sire ID field is the same as the studbook number for this specimen. Each animal in your studbook must have a unique identifier. The Sire studbook ID cannot be the same as the offspring studbook ID.

ERROR S-05 COARSE

Sire Sex Error -Sire, "[Sire ID]", is entered as "[Sex]". The Sire, "[Sire ID]", must be sexed as male, contracepted male, or neutered male.

ERROR S-06 COARSE Sire Stdbk ID: "[Sire ID]" Not Found in Studbook.

All specific Sire studbook IDs are validated against the studbook. Unless the Sire ID is a generic, it must be included in the studbook. Generic studbook IDs are the following abbreviations for unknown, wild, and multiple possibilities:

Unknown - "UNK", "UKN", "UNK"+ (except UNKx), "UKN"+ Wild - "WILD", "WILD"+ (except WILDx) Multiple Possibilities - "MULT", "MULT"+ (except MULTx)

ERROR S-07 COARSE

A) Unable to determine Sire location prior to estimated conception.

Sire, "[Sire ID] ", at an indeterminate location on earliest/latest estimated date of conception, {Date} (, and on latest estimated date, {Date}).

B) Unable to determine Sire location prior to estimated laying date.

Sire, "[Sire ID] ", at an indeterminate location on earliest/latest estimated date of egg-laying, {Date}, and on latest estimated date, {Date}).

See Dam & Sire Validation - General Discussion.

This error message is generated when it is not possible to determine the Sire's location prior to the estimated date of conception. This occurs when the Sire is at a location called "UNKNOWN", or when the date checked falls into a transaction gap such as the interval between a removal date and the next acquisition date. For live-bearers, the date window is the birth date minus the estimator adjustment minus 17/16 times the gestation period, and the birth date plus the estimator adjustment minus 15/16 times the gestation period. For egg-layers, the date window is the hatch date minus the estimator adjustment minus 15/16 times the incubation period.

ERROR S-08 COARSE

A) Sire Lost-To-Follow-Up prior to estimated conception.

Sire, "[Sire ID]", Lost-To-Follow-Up prior to earliest/latest estimated date of conception, {Date} (, and on latest estimated date, {Date}).

B) Sire Lost-To-Follow-Up prior to estimated laying date.

Sire, "[Sire ID]", Lost-To-Follow-Up prior to earliest/latest estimated date of egg-laying, {Date} (, and on latest estimated date, {Date}).

See Dam & Sire Validation - General Discussion.

This error message indicates that the Sire was listed as Lost-To-Follow-Up prior to the estimated date of conception. For live-bearers, the date window is the birth date minus the estimator adjustment minus 17/16 times the gestation period, and the birth date plus the estimator adjustment minus 15/16 times the gestation period. For egg-layers, the date window is the hatch date minus the estimator adjustment minus 17/16 times the incubation period, and the birth date plus the hatch date minus the estimator adjustment minus 17/16 times the incubation period, and the hatch date plus the estimator minus 15/16 times the incubation period.

ERROR S-09 COARSE

A) Sire Birth Date Conflict - Sire born after conception.

Sire, "[Sire ID]", birth on {Date} conflicts with specimen birth on {Date}. Sire not yet born on date of conception, {Date}.

B) Sire Hatch Date Conflict - Sire hatched after offspring.

Sire, "[Sire ID]", hatch on {Date} conflicts with specimen hatch / on {Date}. Sire not yet hatched on estimated date of egg-laying.

See Dam & Sire Validation - General Discussion.

This error message is generated when the Sire hatch/birth date is after the offspring's hatch/birth date. This validation does not use a date window. The Sire hatch/birth date is validated against the low test date. This could potentially create a false error when both the Sire and offspring hatch/birth dates are estimated, the offspring estimate is larger than the estimator for the Sire's hatch/birth date, and the offspring's hatch/birth date is shortly after the Sire's hatch/birth date.

ERROR S-10 FINE

A) **Sire Death Conflict - Dead before estimated conception**. Death of Sire, "[Sire ID]", (on {Date}) conflicts with estimated date of conception, {Date}.

B) Sire Death Conflict - Dead before estimated date of laying.

Death of Sire, "[Sire ID]", (on {Date}) conflicts with estimated date of laying, {Date}.

See Dam & Sire Validation - General Discussion.

This error message is generated when the Sire is dead prior to the earliest estimated date of \sim conception. This validation does not use a date window. If the Sire is dead on the low test date, it is assumed that there will not be a resurrection.

ERROR S-11 FINE

A) Sire In wild prior to estimated date of conception. Sire, "[Sire ID]", in wild on {Date}, conflicts with captive birth at [Location] on {Date}. (Sire is still in wild on {Date}.)

B) Sire In wild prior to estimated date of egg-laying.
Sire, "[Sire ID]", in wild on earliest/latest estimated date of laying, {Date}, conflicts with hatch at [Location] on {Date}.
(Sire is still in wild on {Date}.)

See Dam & Sire Validation - General Discussion.

This error message is generated when the Sire is in the wild (either prior initial capture or post release) prior to the offspring's estimated date of conception. For live-bearers, the date window is the birth date minus the estimator adjustment minus 17/16 times the gestation period, and the birth date plus the estimator adjustment minus 15/16 times the gestation period. For egg-layers, the date window is the hatch date minus the estimator adjustment minus 15/16 times the incubation period, and the hatch date plus the estimator adjustment minus 15/16 times the incubation period.

ERROR S-12 FINE

No Parental ID Recorded -Sire is identified as "[Sire ID]". Any parental ID assumptions and further identification possibilities should be indicated in a Special Data Note as a Parental Assumption.

If there are multiple possibilities for the Sire of a captive hatched/born specimen, this can be indicated in the Sire ill field by using the convention of "MULT", or "MULT1 ", "MULT2", etc. If wild hatched/born siblings are captured, their common parentage can be indicated in the Sire ID field by using the convention "WILD1 ", "WILD2", etc. In both of these case, the assumptions about parentage as well as a list of potential parents should be entered in the specials database as a Parental Assumption Special Data Note #17 -Parental ID Assumptions.

ERROR S-13 FINE

Sire Location Conflict - Does Not Agree With Specimen Hatch/Birth. Sire, "[Sire ID]", not at [Location] prior to hatch/birth on {Date}. Sire at [Location] on estimated date of egg-laying/conception, {Date}.

See Dam & Sire Validation - General Discussion.

This message indicates that the Sire was not at the hatch/birth location prior to the offspring's earliest/latest estimated date of conception. For live-bearers, the date window is the birth date minus the estimator adjustment minus 17/16 times the gestation period, and the birth date plus the estimator adjustment minus 15/16 times the gestation period. For egg-layers, the date window is the hatch date minus the estimator adjustment minus 17/16 times the incubation period, and the birth date window is the hatch date minus the estimator adjustment minus 17/16 times the incubation period, and the hatch date plus the estimator minus 15/16 times the incubation period.

ERROR S-14 FINE

Warning - No ID Recorded For Sire. Sire ID is blank. Verify Sire ID.

The master record Sire studbook ID field is empty. Either a specific or generic Sire ID should be entered for every specimen. See the discussion for Error S-06 for a list of generic studbook IDs.

ERROR S-15 COARSE

A) **Sire ID Inconsistent With First Event**. Sire ID is "UNK"/" [Sire ID]", but animal was Wild Caught. Sire ID should be "WILD".

B) Sire ID Inconsistent With First Event.' Sire ID is "[Sire ID]", but animal was Captive Hatched/Born. (Was this specimen conceived in the wild and hatched/born in captivity?)

If a Sire is identified by a generic studbook ID, this generic ID should agree with the birth type based on the first event. A) If the first event is a capture and the Sire identity is unknown, the Sire studbook ID should be the generic "WILD", not "UNK", or "UKN", etc. B) If the first event is a captive hatch/birth, the Sire studbook ID should not be "WILD".

ERROR S-XX PROGRAM ERROR

Unable To Interpret Invalid Sire Transaction Stream.

Sire, "[Sire ID]", status of not yet born on {Date} is incompatible with previous error message of "Lost-To-Follow-Up" on {Date}.

(previous error message of "In The Wild" on {Date}.) (previous error message of "Sire at Wrong Location" on {Date}.) (previous error message of "Sire Status Unknown" on {Date}.)

The Data Validation program is unable to interpret the Sire's transaction stream due to incompatible transactions. If you ever receive this message, please send a copy of the report and a backup of your studbook to ISIS.

Sparks DATA VALIDATION ERROR MESSAGES - TRANSACTION ERRORS

Transaction stream validation examines each specimen record in the moves database. Events are evaluated for internal consistency and examined in the context of all the events for that specimen. Transaction stream errors identify the event number to make it easier to locate the problem event. In the events editing window (upper right quadrant) events are counted down from one.

ERROR T-01 COARSE

A) ERROR T-01 at event # [#]: **Multiple Origin Events**. This specimen has multiple hatch/birth events.

B) ERROR T-01 at event # [#]: Multiple Origin Events. This specimen has a hatch/birth event after a wild capture event.

C) ERROR T-01 at event # [#]: Multiple Origin Events. This specimen has (a) transfer event(s) prior to this hatch/birth event.

D) ERROR T-01 at event # [#]: Multiple Origin Events. This specimen has a captive hatch/birth event prior to this wild capture.

E) ERROR T-01 at event # [#]: Multiple Origin Events. This specimen has multiple wild capture events without releases.

F) ERROR T-01 at event # [#]: Multiple Origin Events. This specimen has (a) transfer event(s) prior to this capture event.

G) ERROR T-01 at event # [#]: Multiple Origin Events. INTERNAL PROGRAM ERROR!!! (Contact ISIS)

Origin event logic: The first event in the event stream should be a hatch/birth, capture, or transfer, and it should be a physical event. A hatch/birth should always be first in the event stream. A capture event can only follow a previous origin event if there is a release event before the capture event.

Errors are issued when a subsequent event conflicts with the origin event.

A) Indicates that this hatch/birth is preceded by an earlier hatch/birth.

B) Indicates that this hatch/birth event is preceded by a capture from the wild.

C) Indicates that this hatch/birth event is preceded by at least one transfer event.

D) Indicates that this capture event was preceded by an earlier hatch/birth without an intervening release event.

E) Indicates that this capture event was preceded by an earlier capture event without an intervening release event.

F) Indicates that this capture event was preceded by at least one transfer event without an intervening release event.

G) The Data Validation program is unable to interpret the transaction stream due to internal logic errors in the program. If you ever receive this message, please send a copy of the report and a backup of your studbook to ISIS.

WARNING T-02 FINE

Warning T-02 at event # [#]: First Event not a Birth or Capture. First Event is a transfer to [Location].

Ideally, all specimen histories should start with a hatch/birth or capture, even if at an unknown location on an unknown date. In practice, there may be some specimens where it is not possible to determine whether they were wild caught or captive hatched/born and this entry may not be possible.

ERROR T-03 COARSE

A) ERROR T-03 at event # [#]: **Event After Specimen Death**. Hatch/Birth conflicts with specimen death on {Date}.

B) ERROR T-03 at event # [#]: Event After Specimen Death. Capture conflicts with specimen death on {Date}.

C) ERROR T-03 at event # [#]: Event After Specimen Death. Transfer conflicts with specimen death on {Date}.

D) ERROR T-03 at event # [#]: Event After Specimen Death. Release conflicts with specimen death on {Date}.

There should not be any transactions after the date of death. This error message is issued when there is a A) hatch/birth, B) capture, C) transfer, or D) release with a transaction date after the death date. Multiple death events is a fine error, T-05.

ERROR T-04 COARSE

A) ERROR T-04 at event # [#]: **Invalid First Event - No Acquisition Event.** Event stream error - no transaction events prior to this death.

B) ERROR T-04 at event # [#]: Invalid First Event -No Acquisition Event. Event stream error - no transaction events prior to this release.

This error message is issued when a A) death or B) release event is reached without a previous origin event such as a hatch/birth, capture, or transfer. T -04 will usually be accompanied by error message M-08.

ERROR T-05 FINE

Error T-05 at event # [#]: **Multiple Death Events** - This Event Is Unnecessary. Specimen already dead on {Date}.

This death event is preceded by an earlier death event.

ERROR T-06 COARSE

ERROR T-06 at event # [#]: **Transfer to [Location] after release**. Transfers are not allowed for animals in the wild.

This transfer event follows a release event without an intervening capture event. If an animal has been released to the wild, it cannot be transferred without having been re-captured.

ERROR T-07 COARSE

ERROR T-07 at event # [#]: Duplicate Release Event. No capture event since prior release on {Date}.

This release event follows a release event without an intervening capture event. If an animal has been released to the wild, it cannot be re-released without having been re-captured.

ERROR **T-08** COARSE

ERROR T-08 at event # [#]: **Embedded Lost-To-Follow-Up.** There are events after this "Lost-To-Follow-Up" event.

Embedded Lost-To-Follow-Up occurs when an animal is marked as lost-to-follow-up by means of a date estimator of "U" in the removal date field of a transaction event, and that event is then followed by another transaction event. This situation presents a problem for many of the Sparks, GENES, DEMOG and pm2000 analytical routines – all further data will be ignored.

WARNING T-09 FINE

Warning T-09 at event # [#]: Lost-To-Follow-Up. There are no events after this "Lost-To-Follow-Up" event.

This is not an error. An animal is marked as lost-to-follow-up by entering a date estimator of "u" in the removal date field of the last transaction.

ERROR T-10 COARSE

ERROR T-10 at event # [#]: Empty Transaction Date. A Transaction Date is required for event sorting.

The transaction date field for this event is blank. This situation cannot be created in Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR T-11 COARSE & FINE

A) ERROR T-11C at event # [#]: **Event Date Before Hatch/Birth**. Event date of {Date} is prior to hatch/birth date of {Date}.

B) Error T-11f at event # [#]: Event Date Before Hatch/Birth. Event date of {Date} is prior to hatch/birth date of {Date}.

The transaction date for this event is prior to the animal's hatch/birth date. This is a A) coarse error for transactions such as hatch/birth, capture, transfer, release, and death, and a B) fine error for management and social grouping events.

ERROR T-12 COARSE & FINE

A) ERROR T-12C at event # [#]: **Event Date in the Future**. Event date of {Date} is after today's date {Date}.

B) Error T-12f at event # [#]: Event Date in the Future. Event date of {Date} is after today's date {Date}.

The transaction date for this event is after the current date according to your computer. This is a A) coarse error for transactions such as hatch/birth, capture, transfer, release, and death, and a B) fine error for management and social grouping events. If your computer date is not correct, set this in DOS using the DATE command, or in windows using the control panel.

ERROR T-13 COARSE

ERROR T-13 at event # [#]: Invalid Transaction Date Estimator. "[Date Estimator]" is not a valid date estimator.

Valid date estimators are "D" day, "M" month, "Y" year, "U" unknown, letters "ABCEFGHIJ" for range in months and numbers 1-9 for range in years. Invalid transaction date estimators cannot be entered in Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR T-14 COARSE & FINE

A) ERROR T-14C at event # [#]: **Removal Date Before Birth.** Removal date of {Date} is prior to birth date of {Date}.

B) Error T-14f at event # [#]: Removal Date Before Birth. Removal date of {Date} is prior to birth date of {Date}.

The removal date for this event is prior to the animal's hatch/birth date. This is a A) coarse error for transactions such as hatch/birth, capture, transfer, release, and death, and a B) fme error for management and social grouping events.

ERROR T-15 COARSE & FINE

A) ERROR T-1SC at event # [#]: **Removal Date in the Future**. Removal date of {Date} is after today's date {Date}.

B) Error T-1Sf at event # [#]: Removal Date in the Future. Removal date of {Date} is after today's date {Date}.

The removal date for this event is after the current date according to your computer. This is A) coarse error for transactions such as hatch/birth, capture, transfer, release, and death, and B) fine error for management and social grouping events. If your computer date is not correct, set this in DOS using the DATE command, or in windows using the control panel.

ERROR T-16 COARSE

ERROR T-16 at event # [#]: Invalid Removal Date Estimator. "[Date Estimator]" is not a valid date estimator.

Valid date estimators are "D" day, "M" month, "Y" year, "U" unknown, letters "ABCEFGHIJ" for range in months and numbers 1-9 for range in years. Invalid removal date estimators cannot be entered in Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR T-17 COARSE

ERROR T-17 at event # [#]: **Illegal Transaction Code**. "[Transaction Code]" is not a valid transaction code.

Valid transaction codes are "AA" hatch/birth "AB" capture "AS" transfer "BA" death and "BI" release. Valid management codes are "21" plan in, "20" plan out, and "2S" surplus to plan. Valid social group codes are "DI" social in, and "DO" social out. Invalid transaction codes may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR T-18 COARSE

ERROR T-18 at event # [#]: **Transaction Dates Not Sorted**. Prior event has a transaction date after this event date. Transaction stream has not been properly sorted by date.

This may indicate that the index file for the moves database has become corrupted. Running Clean Up Files should correct this problem.

ERROR T-19 COARSE

ERROR T-19 at event # [#]: **Removal-Transaction Date Overlap**. Removal date conflicts with the next transaction date. This removal date is after the transaction date for event # [#].

The removal date for the first event is after the transaction date of the subsequent event. Even if both dates are estimated, there should never be an overlap between removal date and subsequent transaction (acquisition) date.

ERROR T-20 COARSE & FINE

A) ERROR T-20C at event # [#]: **Removal-Transaction Date Gap**.

There is a gap of greater than six months between this removal date and the transaction date for event # [#]. Where was the specimen during this time period?

B) Error T-20f at event # [#]: Removal-Transaction Date Gap. There is a gap of greater than 31 days and less than 6 months between this removal date and the transaction date for event # [#].

Where was the specimen during this time period?

This error message indicates that there is a gap in the animal's record with an unexplained interval between the removal date of the first event and the transaction date of the second event. This is a A) coarse error for gaps greater than 180 days, and a B) fine error for gaps greater than 31 days and less than or equal to 180 days.

ERROR T-21 COARSE

ERROR T-21 at event # [#]: **Removal Before Transaction**. Removal date of {Date} is prior to the transaction date of {Date} !!!' The removal date must be after or equal to the transaction date.

The removal date for this event is prior to the transaction (acquisition) event for the same transaction. This situation cannot be created in Sparks. This may suggest file damage or manipulation outside Sparks using an xBase program.

ERROR T-22 COARSE

ERROR T-22 at event # [#]: **Non-Physical Hatch/Birth**. A non-physical hatch/birth is a meaningless transaction! This hatch/birth event has not been used to validate hatch/birth date, hatch/birth type, or rearing.

If this is a hatch/birth on loan, follow the directions in Sparks to correctly enter a hatch/birth followed by an ownership transfer. Hatch/Birth events should always be physical events. They may or may not also be ownership events. Sparks is unable to interpret a non-physical hatch/birth event.

ERROR T-XX PROGRAM ERROR

ERROR T-XX at event # [#]: Internal Program Error in Interpreting Event Stream.

This message indicates that the Data Validation program is unable to interpret the transaction stream due to internal logic errors in the program. If you ever receive this message, please send a copy of the report and a backup of your studbook to ISIS.
Sparks DATA VALIDATION ERROR MESSAGES - FILE ORPHAN ERRORS

File orphans are records in one of the three dependent (child) databases which do not have a record in the master database. Every specimen must have a master record in the master database file, and at least one transaction record in the moves database file. Every moves, specials, and UDF record must have a record in the master database. The data from orphan records is output on the Data Validation report, and the records are marked for deletion. When Clean Up Files is next run, they will be permanently expunged. The presence of file orphans suggests file damage or manipulation outside Sparks using an xBase program.

ERROR F-01 COARSE

ERROR F-01: Event Record is an Orphan without a Master Record. There is no Master Record for the following Event Record for Studbook ID: "[Stud ID]". [Data from deleted Moves record.]

ERROR F-02 COARSE

ERROR F-02: Special Record is an Orphan without a Master Record.

There is no Master Record for the following Specials.dbf Record for Studbook ID: "[Stud ID]". [Data from deleted Specials record.]

ERROR F-03 COARSE

ERROR F-03: UDF Record is an Orphan without a Master Record.

There is no Master Record for the following UDF.dbf Record for Studbook ID: "[Stud ID]". [Data from deleted UDF record.]

Sparks DATA VALIDATION - ERROR LISTING BY ERROR LEVEL

COARSE Errors

Master Errors - Coarse

ERROR M-01: Empty Studbook ID ERROR M-02: Duplicate Studbook ID ERROR M-03: Illegal ASCII Character in Studbook ID ERROR M-07: Master Record Orphan ERROR M-08: Invalid First Event ERROR M-09: Illegal Sex Code ERROR M-10: Illegal Rearing Code ERROR M-12: Incompatible Hatch / Birth Type ERROR M-13C: COARSE Empty Hatch / Birth Type ERROR M-14: Illegal Hatch / Birth Type Code ERROR M-15: Missing Master Hatch / Birth Date for a Captive Hatch / Birth ERROR M-16: Missing Master Hatch / Birth Date for a Captive Hatch / Birth ERROR M-17: Hatch / Birth Date Conflict ERROR M-18: Illegal Hatch / Birth Date Estimate Character ERROR M-20: Empty Master Hatch / Birth Date w/o Estimate = 'U' for a Wild Capture ERROR M-21: Hatch / Birth Date After Capture or First Event ERROR M-22: Hatch / Birth Date In Future

Dam Error Conditions - Coarse

ERROR D-01: Illegal ASCII Character in Dam Studbook ID ERROR D-04: Dam-Offspring Studbook ID Conflict ERROR D-05: Dam Sex Error ERROR D-06: Dam ID Not Found In Studbook ERROR D-07: Unable to determine Dam location prior to Specimen hatch / birth ERROR D-08: Dam Lost-To-Follow-Up prior to Specimen hatch / birth ERROR D-09: Dam Hatch/Birth Date Conflict - Hatched / Born after offspring. ERROR D-10: Dam Death Conflict - Dam dead before offspring hatch / birth ERROR D-11: Dam in Wild at time of Specimen hatch / birth ERROR D-13: Dam Location Conflict - Does Not Agree With Specimen Hatch / Birth ERROR D-15: Dam ID inconsistent with specimen first event / origin

Sire Error Conditions - Coarse

ERROR S-01: Illegal ASCII Character in Sire Studbook ID ERROR S-04: Sire -Offspring Studbook ID Conflict ERROR S-05: Sire Sex Error ERROR S-06: Sire ID Not Found In Studbook ERROR S-07: Unable to determine Sire location prior to Specimen hatch / birth ERROR S-08: Sire Lost-To-Follow-Up prior to Specimen hatch / birth ERROR S-09: Sire Hatch/Birth Date Conflict - Hatched / Born after offspring. ERROR S-15: Sire ID inconsistent with specimen first event

Transaction Stream Errors - Coarse

ERROR T-01: Multiple Origin Events ERROR T-03: Events After Death ERROR T-04: No Acquisition Event ERROR T-06: Transfer After Release ERROR T-07: Multiple Conflicting Release Events ERROR T-08: Embedded Lost-To-Follow-Up ERROR T-10: Empty Transaction Date ERROR T-11C: COARSE Transaction Date Prior To Hatch / Birth Date ERROR T-12C: COARSE Transaction Date in the Future ERROR T-13: Invalid Transaction Date Estimator ERROR T-14C: COARSE Removal Date Prior To Hatch / Birth Date ERROR T-15C: COARSE Removal Date in the Future ERROR T-16: Invalid Removal Date Estimator ERROR T-17: Invalid Transaction Code ERROR T-18: Missorted Transactions ERROR T-19: Removal-Transaction Date Overlap (between records) ERROR T-20C: COARSE Removal-Transaction Date Large Gap ERROR T-21: Removal-Transaction Date Conflict (same record) ERROR T-22: Non-Physical Hatch / Birth ERROR T-XX: Internal Program Error in Interpreting Events Stream

File Orphan Errors - Coarse

ERROR F-01: Moves.dbf Record Orphan ERROR F-02: Specials.dbf Record Orphan ERROR F-03: UDF .dbf Record Orphan

FINE Errors

Master Errors - Fine

Error M-04: Inappropriate ASCII Character in Studbook ID Error M-05: Illegal Justification of Studbook ID Error M-06: Improper or Inappropriate Studbook ID Error M-11: Incompatible Rearing Code Error M-13f: FINE Empty Hatch / Birth Type Error M-9: Hatch / Birth Date Estimate Conflict Error M-23: Hatch / Birth prior to the year 1601

Dam Error Conditions - Fine

Error D-02: Inappropriate ASCII Character in Dam Studbook ID Error D-03: Illegal Justification of Dam Studbook ID Error D-12: No Parental ID Assumptions Recorded Error D-14: Blank Dam ID

Sire Error Conditions - Fine

Error S-02: Inappropriate ASCII Character in Sire Studbook ID Error S-03: Illegal Justification of Sire Studbook ID Error S-10: Sire Death Conflict -Sire Dead Before Offspring Hatch / Birth Error S-11: Sire in Wild at time of Specimen hatch / birth Error S-12: No Parental ID Assumptions Recorded Error S-13: Sire Location Conflict -Does Not Agree With Specimen Hatch / Birth Error S-14: Blank Sire ID

Transaction Stream Errors - Fine

Error T-02: First Event = Transfer Error T-05: Multiple Death Events Error T-09: Lost- To-Follow-Up Error T-11f: FINE Transaction Date Prior To Hatch / Birth Date Error T-12f: FINE Transaction Date in the Future Error T-14f: FINE Removal Date Prior To Hatch / Birth Date Error T-15f: FINE Removal Date in the Future Error T-20f: FINE Removal-Transaction Date Small Gap

Appendix IV: Sample Reports

Speci WELSH	. men Report DRAGON Studbook	Page 1
Taxon Name: DRACONIS CYMRU	Stı	udbook Number: 1902
Current Status >>>		
Vital Statistics >>> Sex: Female Age: 12Y,3M,5D at	death	
Origin >>> Birth Type: Captive born Birth Location: MINNESOTA Birth Date: 16 Jun 1985	Identifiers >: House Name Tag/Band	>> e: GRANDMA d: 10 WHITE (RIGHT EAR)
Dam Id: 1655 Rearing:	Transponder ID	. 00-0021-5F3B
Transaction History >>>		
# Event	Local ID Date In ->	Date Out
 Birth MINNESOTA Minnesota Zoological Garden Transfer to COLUMBUS Columbus Zoo and Aquarium Po Death at age: 12Y, 3M by: Euthanasia • Unknown 	4476 16 Jun 1985 Apple Valley Mn 852066 27 Jun 1985 well Oh 1,5D 17 Sep 1997 1 • Unknown (after Autop	psy)
Special Data & Comments >>>		
# Code/Text		Date
1 Tag/Band While	at MINNESOTA	16 Jun 1985
2 Dam/Sire Id's elsewhere 1952:MINNESOTA\ 1955:MINNE	SOTA	19 Nov 1986
3 Tag/Band While BLUE 137 LEFT EAR	at COLUMBUS	19 Nov 1986
4 Transponder ID While 00-0021-5F3B	at COLUMBUS	14 Nov 1991
5 Tag/Band While 10 WHITE RIGHT EAR	at COLUMBUS	14 Nov 1991
6 House Name While GRANDMA	at COLUMBUS	8 Apr 1997
		SPARKS v1.5 21 Jun 2003

Special Data Report
GIRAFFE Studbook Page 1
Taxon Name: GIRAFFA CAMELOPARDALIS
Searching for comments including "BLADDER"
Stud ID Sex Status
223 Female Died at St Louis Necropsy results: Ruptured ureter, bladder stones? 3 Aug 1966 at age ~12Y
525 Male Died at Cleveland Necropsy results: Ruptured bladder, hemorrhagic cystitis, urethral obst, stones 3 Nov 1987 at age ~20Y
536 Male Died at Littleroc Necropsy results: Cystic calculi (stones), ruptured bladder, peritonitis 30 Mar 1980 at age 12Y,10M,1D
549 Male Died at Hogle Necropsy results: Ruptured bladder? 15 Mar 1985 at age ~17Y
679 Female Died at Toronto Necropsy results: Ruptured bladder? 11 Oct 1990 at age 20Y,6M,4D
1203 Male Died at Philadelp Necropsy results: Kidney/bladder stones, blockage of urethra, ruptured bladder 5 Jul 2001 at age 20Y,9M,18D
1220 Male Died at Jackson Necropsy results: Blocked urinary tract, burst bladder 22 Oct 2002 at age 21Y,9M,12D
1378 Male Died at Natbridge Necropsy results: Complications of a blockage caused by bladder stones 15 Jan 1999 at age 15Y,6M,14D
1533 Male Died at Asheboro Necropsy results: Ruptured bladder 19 Mar 1998 at age 12Y,0M,12D
1664 Male Died at Yulee Necropsy results: Ruptured bladder due to urethral blockage by stones 7 Jan 2000 at age 11Y,7M,10D
2141 Male Died at Milwaukee Necropsy results: Urinary tract blockage, stones & gravel in both kidneys/bladder 13 Aug 2002 at age 8Y,0M,7D
Results: 11 entries for 11 animals
Compiled by: Laurie Bingaman thru International Species Information System Data current thru: 31 Dec 2002 North American Regional/Global Printed on 1 Jun 2003 using Sparks v1.53

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	Insti	itutiona	al Summa	ary R	eport	
Restricted to	ST	UHLMANN'S	BLUE MONKE	Y Stud	book	Page 1
ASSOCIATION:	Sparks (AZA.					
	Total	Living	Years			
Location	Animals	Animals	Managed		Births	Deaths
BATONROUG	11 10 3	1 1 0	1969-04	36	763	431
CALDWELL	3 2 0	1.1.0	1997 - 04	8	1 0 0	1 1 0
CHICAGOLP	4 1 0		1967-78	12	3 0 0	0 1 0
FERNDALE	7.8.0	0.0.0	1965-93	29	0.0.0	2.1.0
FRESNO	1.1.0	0.0.0	1976-80	5	0.0.0	0.1.0
HOUSTON	3.3.0	0.0.0	1966-93	2.8	2.2.0	1.1.0
JACKSON	5.6.0	0.0.0	1972-82	11	3.4.0	0.1.0
KNOXVILLE	1.1.0	1.1.0	2003-04	2	0.0.0	0.0.0
LUFKIN	4.3.1	0.0.0	1973-97	25	0.0.0	2.2.1
MANHATTAN	2.3.0	0.0.0	1998 - 02	5	1.2.0	2.2.0
ОМАНА	12.13.2	1.4.1	1965-04	40	5.7.2	7.8.1
SAN FRAN	0.1.0	0.0.0	1978	1	0.1.0	0.0.0
WACO	1.1.0	0.0.0	1987	1	0.0.0	0.0.0
Note that lea	rs Mallageu IIIa	y include	Solle years	- 111 WI		is were herd.
Compiled by: Data current Printed on 21	Terry Webb th thru: 1 Mar Apr 2004 usi	ru Miami M 2004 North ng Sparks	Metrozoo American v1.55	region	al	

Sparks 1.5 manual appendix – Data Validation

STUDBOOK REPORT

				(DR.	ACONIS CYMR	2U) ====				
tud #	Sex	Birth Date	Sire I	0am	Location	Dat	.e	Local II) Event	Name
1020	М	\$555	WILD	WILD	N.AMERICA NY BRONX	10 3	???? Dec 1900 Apr 1902	NONE 001659	Capture Transfer Death	
			[Deat	h by:	Unknown mea	ins]				
1021	F	?????	WILD	WILD	N.AMERICA NY BRONX	14 25	???? Dec 1900 Oct 1902	NONE 001656	Capture Transfer Death	
			[Deat	h by:	Unknown mea	ns]				
1022	F	????	WILD	WILD	N.AMERICA NY BRONX	24 24	???? Dec 1900 Dec 1900	NONE 001650	Capture Transfer Death	
			[Deat	h by:	Unknown mea	ns]				
1023	F	????	WILD	WILD	N.AMERICA NY BRONX	24 3	???? Dec 1900 Sep 1903	NONE 001658	Capture Transfer Death	
			[Deat	h by:	Unknown mea	ns]				
2741	М	9 Jun 2000	UNK	UNK	ROSS PK OMAHA	9 3	Jun 2000 Nov 2000	990047 11889	Birth Transfer	
2742	М	9 Jun 2000	UNK	UNK	IDAHO ST ROSS PK OMAHA	9 23 3	Jun 2000 Aug 2000 Nov 2000	990056 11892	Birth Transfer Transfer	
2743	М	11 Jun 2000	2333	2592	OR WILDLF	11 11	Jun 2000 Jun 2000	200648	Birth Death	_ ,
		l	Death by:	Injury	from Exhib	oit M	late • Unk	nown • (Jeneralized •	• Trauma]
2744	М	11 Jun 2000	2333	2592	OR WILDLF	11 11	Jun 2000 Jun 2000	200649	Birth Death	
		[Death by:	Stillb	irth • Unkn	lown	• General	lized • (Genetic and H	Prenatal]
2745	М	11 Jun 2000	2333	2530	OR WILDLF	11 11	Jun 2000 Jun 2000	200650	Birth Death	
		[Death by:	Stillb	irth • Unkn	nown	• General	lized • 0	Genetic and H	Prenatal]

LOCATION GLOSSARY AS PART OF THE STUDBOOK REPORT

	Location Glossary - WELSH DRAGON Studbook Page 11
=========	
ANTWERP	<pre>Royal Zool. Society of Antwerp Zoo of Antwerp, 2018 Antwerp, Belgium 32 3202 4551 fax:32 3202 4547 roland.vanbocxstaele@zooantwerpen.be Contact: Roland Van Bocxstaele</pre>
ATLANTA	Zoo Atlanta 800 Cherokee Ave. SE, Atlanta, Georgia, USA, 30315-1440 (404)624-5926 fax:(404)627-7514 tkurkowski@zooatlanta.org Contact: Mary Noell
AUDUBON	<pre>Audubon Nature Institute PO Box 4327, New Orleans, Louisiana, USA, 70178-4327 (504)212-5368 fax:(504)212-5471 lrobledo@auduboninstitute.org Contact: Linda Robledo</pre>
BATONROUG	BREC's Baton Rouge Zoo P.O. Box 60, Baker, Louisiana, USA, 70704-0060 (225)775-3877 fax:(225)775-3931 hollytech@excite.com
BAYRAMOGL	Bosphorus Zoo Bogazici Hayvanat Bahcesi, Bayramoglu, Darica / Izmit, Turkey, 41870 90 262 653 1374 fax:90 262 653 4664 dkuscenneti@turk.net
BORNEO IN	BORNEO
BROWNSVIL	Gladys Porter Zoo 500 Ringgold St., Brownsville, Texas, USA, 78520 (956)546-0044 fax:(956)546-5703 registar@gpz.org Contact: Diana Lucio
CHASE B	Charles (Bill) P. Chase Co. Inc. 7330 NW 66th St. Miami Florida USA 33166
CHICAGOBR	Chicago Zoological Park 3300 Golf Rd., Brookfield, Illinois, USA, 60513 (708)485-0263x460 fax:(708)485-3140 dejohnso@brookfieldzoo.org
CINCINNAT	Cincinnati Zoo & Botanical Garden 3400 Vine St., Cincinnati, Ohio, USA, 45220-1399 (513)569-8225 fax:(513)569-8213 mary.noell@cincinnatizoo.org Contact: Robert Lotshaw
DALLAS	Dallas Zoo 650 South R.L. Thornton Freeway, Dallas, Texas, USA, 75203-3013 (214)670-6833 fax:(214)670-6717 npiwonk@mail.ci.dallas.tx.us Contact: Norman Piwonka
DENVER	Denver Zoological Gardens City Park, Denver, Colorado, USA, 80205-4899 (303)376-4917 fax:(303)376-4901 nbragin@denverzoo.org Contact: Nanette Bragin
Compiled by: Data current Printed on 21	Studbook keeper's name thru Sponsoring institution's name thru: 30 Jun 2001 North American Regional Jun 2002 using Sparks v1.5

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Institutional Questionnaire

					G (B	AUR S os fr	tudbo ontal	ok is)			Pag	ge 1
	То:	Animal Toront 361A O Scarbo Canada	Records 5 Zoo ld Finch rough, O	Keep Ave. ntari	er o	M1B	5K7					
Quest: Locat	ionn tion	naire Re ns: N.AM	port Res ERICA/	trict	ed T	0:						
Studbo the fo by ret source and to	ook ollc turn es, rans	records owing sp ning ARK or by is fers.	indicat ecimens. S Taxon ndicatin	e tha Ple and/o g any	==== t yo ase r Sp cha	===== ur in corre ecime nges	===== stitu ct or n Rep below	tion ha confir orts, d , inclu	s held m this ata fro ding bi	====== informa m other rths, d	tion records eaths	3
The stand up of mes	tudb tudb ssag ionn	ook kee four l je/notes aire re	per may ines to the port.									
Stud # =======	Sex	Name	Breeder #	Hatch I	Date	Sire	Dam	Location	Date	Local ID	Event	Rearing
57	F	DAISY	BE 21	14 Mar	1973	1	6	BERLINZOO GELSNKRKN TORONTO TORONTO	14 Mar 197 4 Sep 197 23 Nov 197 7 Feb 197	3 730024 3 3 2027	Birth Transfer Transfer Death	Parent
60	М		BE 23	10 Dec	1972	1	2	BERLINZOO GELSNKRKN TORONTO TORONTO	10 Dec 197 4 Sep 197 23 Nov 197 15 Nov 198	2 720025 3 3 2026 9	Birth Transfer Transfer Death	Parent
132	М		TOR 1	21 Jul	1977	60	57	TORONTO TORONTO	21 Jul 197 22 Jul 197	7 9104 7	Birth Death	Parent
146	М		NY 2	30 Sep	1978	64	106	NY BRONX TORONTO TORONTO	30 Sep 19' 18 Dec 198 11 Apr 199	78 781272 1 14926 6	Birth Transfer Death	Parent
226	М		TOR 3	28 May	1982	87	164	TORONTO TORONTO	28 May 198 30 May 198	2 15691 2	Birth Death	Parent
257	F		TOR 4	16 Sep	1983	60	164	TORONTO T ORONTO	16 Sep 198 7 Jun 200	3 17952)1	Birth Death	Parent
342	М		NY 30	26 May	1986	60	164	TORONTO	26 May 198	6 20842	Birth	Parent
477	F		·	24 May	1989	146	341	TORONTO TORONTO	24 May 198 29 May 198	9 24547 9	Birth Death	Parent
478	F			27 May	1989	146	257	TORONTO	27 May 198	9 24566	Birth	Parent
Compi Data o Printo	led curr ed c	by: Dan ent thr on 1 Ju	iel Morr u: 1 Se n 2003 u	is th p 200 sing	ru O 2 No Spar	maha rth A ks v1	Zoo meric .53	an regi	onal			

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Age Pyramid Report WELSH DRAGON Studbook Restricted to: 1 Page Status: Living on 21 Jun 2002 _____ Taxon Name: DRACONIS CYMRU ______ Aqe Males Females N = 56.0_____ N = 68.0_ _ _ 19-XX 18-XX 17-16-15-XX 14-X 13-X 12-XXX X 11-XXX 10-XX XXX 9-XXXX X X 8 -X XXXXXXX 7-XXXX XXXXXX 6-XXX XXXXXXXX XXXXX XXXXXXXXXX 5 -4 – 3-2-1-0-32 28 24 20 16 12 8 4 4 8 12 16 20 24 28 32 Number of Animals X >>> Specimens of known sex... ? >>> Specimens of unknown sex... Compiled by: Studbook keeper's name thru Sponsoring institution's name Data current thru: 30 Jun 2001 North American Regional Printed on 21 Jun 2002 using Sparks v1.5

Age Pyramid Report Restricted to: WELSH DRAGON Studbook 3 Page Status: Living on 21 Jun 2002 ______ Taxon Name: DRACONIS CYMRU _____ Age Studbook Numbers >>> Male _ _ _ _____ 1771 1806 19| 18 17 16 15 14 13 12 2196 11 10 2305 2333 2365 2372 2373 2394 9 8 2460 7 2467 2505 2513 2514 2523 2524 2526 6 2580 2582 2596 2631 2635 2640 2570 2608 5 4 2620 2642 2645 2648 2649 2656 2670 2671 2677 2678 2679 2684 2692 2695 2699 3 2714 2718 2719 2721 2723 2724 2726 2728 2729 2733 2 2737 2740 2741 2742 2747 2748 2846 2847 2479 2893 3001 3003 1 3005 3010 3011 3012 3013 3056 3057 3059 0 - - -- - -Total= 56 [Note that this report is repeated for each sex...] Compiled by: Studbook keeper's name thru Sponsoring institution's name Data current thru: 30 Jun 2001 North American Regional Printed on 21 Jun 2002 using Sparks v1.5

Fegundity and Mortality Peport								
Restricted	to:	WELSH DRAGON	Studbook	Page 1				
Dates: Bef	ore 20/06/2002							
Taxon Name:	DRACONIS CYMR	.U						
	Fecundi	ty [Mx]	Mortality	[Qx]				
Age Class	Male N	Female N	Male N I	Female N				
0- 1	0.01 368.1	0.00 411.1	0.50 634.4	0.50 707.9				
1- 2	0.10 265.7	0.11 329.9	0.22 304.6	0.12 352.9				
2-3	0.60 197.3	0.46 286.6	0.20 223.9	0.18 322.1				
3-4	0.62 154.3	0.52 238.6	0.17 171.8	0.17 262.1				
4-5	0.97 117.0	0.52 185.8	0.17 129.1	0.19 209.7				
5-6	0.81 84.1	0.51 145.5	0.24 96.3	0.18 163.2				
6-7	0.97 56.5	0.52 104.2	0.22 64.1	0.18 115.9				
.7- 8	1.18 43.6	0.45 80.2	0.15 46.0	0.17 88.0				
8-9	1.09 34.8	0.51 56.8	0.11 37.0	0.23 65.8				
9-10	0.69 23.5	0.43 42.3	$0.22 \ 27.7$	0.19 47.4				
10-11	0.68 16.7	0.27 29.8	0.21 18.7	0.20 34.2				
11-12	0.63 12.3	0.30 22.6	0.14 14.0	0.12 24.2				
12 - 13	0.08 8.4	0.14 19.2	0.22 9.2	0.10 20.0				
14 15	0.92 6.1	0.00 13.3	0.29 7.0					
14-15	1.03 4.1	0.00 8.2		0.11 9.1				
15-16	0.00 3.6	0.00 4.8	0.25 4.0	0.18 5.6				
17 10	0.00 3.0	0.00 4.0	0.00 3.0	0.00 4.0				
10 10	0.00 3.0		0.00 3.0	0.00 4.0				
10-19			0.00 5.0					
20-21	0.00 1.0	0.00 2.0	0.00 1.0	0.00 2.0				
	Gestation Pe	riod: 252 days						
	T = 5.407	T = 4.581	30 day mortali	ty: 28%				
	Ro = 1.272	Ro = 0.876	(372 deaths ou	t of 1307 arriving				
	lambda=1.05	lambda=0.97	within 30 day	ys of birth date)				
	r = 0.044	r = -0.029						
898 birt (Average p 2	h events to kn of 919 births lus 3 births to si	own age parents to female parent	tabulated for Mx. s and 878 births	 to male parents.)				
22	4 hirthe to IN	K or MILT girog	90					
23 2	1 birtha to da	me of unknown ac	••					
28	7 births to UN	K or MULT dams	·					
1189	death events	with known age t	abulated for Qx					
WARNING: V	alues with sma	ll sample sizes	(~N<30) warrant l	ess confidence				
Compiled by Data curren Printed on	: Studbook kee t thru: 30 Jun 21 Jun 2002 us	per's name thru 2001 North Amer ing Sparks v1.5	Sponsoring instit ican Regional	ution's name				

Causes	s of	Death	Report		
Restricted to: CUVIER	'S GA	ZELLE Stu	udbook	Page	1
Locations: N.AMERICA/				-	
	=====	=========		 ========	===
Taxon Name: GAZELLA CUVIERI					
	=====	========		 =======	===
metal number of deaths reserved.		202			
TOTAL HUMBER OF GEALINS LECOLGEG.		203			
Circumstance of death					
Euthanasia	22	8%			
Self Inflicted Injuries	1	0%			
Injury from Exhibit Mate	10	4%			
Malicious Destruction	0	0%			
Old Age	0	0%			
Infection Associated	6	2%			
Injury from Predator	1	0%			
Env. or Beh. Conditions	6	2%			
Stillbirth	16	6%			
Premature Birth	4	1%			
Anesth./Restraint Assoc.	1	0%			
Died in Transit	0	0%			
Stranded/Beached	0	0%			
Other/Unknown	216	76%			
Carcage Disposition:					
Incinerated	17	6%			
Buried	13	5%			
Given to an Institution	0	0%			
Sold to an Institution	0	08			
Mounted or Preserved	6	28			
Unknown	247	87%			
Rendered	0	0%			
Namonan Gada manamanhia					
Concralized	1 7	6%			
Generalized Intogumentary	T /	06			
Musculoskeletal	1	0% 08			
Respiratory	⊥ 4	08 12			
Cardiovascular	- 0	1 % 0 %			
Hemic and Lymph	0	0%			
Digestive	6	28			
Urinary	0	0%			
Endocrine	0	08			
Nervous	0	0%			
Reproductive	1	0%			
Sense Organs	0	0%			
No Necropsy Planned	208	73%			
Necropsy Planned Later	0	0%			
Unknown (after Necropsy)	46	16%			
Compiled by Mender Truicht them I		Degest			
Data gurrent thru: 21 Dag 2001 Na	urtying) Desert	cogional		
Data current thru; 31 Dec 2001 NC	orun A	E /	regronar		
Princed on I Jun 2003 using Spar	KS VI				

Causes of Death Report CUVIER'S GAZELLE Studbook Restricted to: Page 2 Locations: N.AMERICA/ Taxon Name: GAZELLA CUVIERI _____ Necropsy Code-Etiological Genetic and Prenatal 0 0% Bacterial 5 28 0 Fungal 0% Metazoan 0 0% PPLO 0 0% 0% Protothecal 0 0 0% Protozoan Rickettsial 0 0% 0 Viral 0% Toxicity 4 1% Trauma 4 1% Circulatory, secondary 0 0% Enervation, secondary 0 08 Mechanical Abnormality 5 2% 1% Metabolism 2 Nutrition 2 18 New Growths 0 0% Unknown (after necropsy) 261 92% Combined Topographic/Etiological Codes 4 Generalized / Bacterial 3 Generalized / Trauma 3 Generalized / Mechanical Abnormality 2 Generalized / Metabolism 2 Generalized / Nutrition Generalized / Unknown (after necropsy) 3 Musculoskeletal / Mechanical Abnormality 1 Respiratory / Bacterial 1 Respiratory / Unknown (after necropsy) 3 Digestive / Toxicity 4 Digestive / Unknown (after necropsy) 2 Reproductive / Mechanical Abnormality 1 208 No Necropsy Planned / Unknown (after necropsy) Unknown (after Autopsy) / Trauma 1 45 Unknown (after Autopsy) / Unknown (after necropsy) Compiled by: Wendy S. Enright thru Living Desert Data current thru: 31 Dec 2001 North American regional Printed on 1 Jun 2003 using Sparks v1.54

	Inbreeding Coefficient Report BLUE DUIKER Studbook Page 1									
======= Taxon Na	ame: CEPHA	ALOPHUS MONT	ICOLA BI	ICOLOR	==========					
======= Stud #	Sex	Age	Sire	Dam	Location	Death Date	Inbreeding			
Stud # 501 502 503 179 183 199 257 260 282 302 310 318 352 361 365 375 385 381 392 390 382 390 382 390 382 390 382 398 409 421 411 430 433 475 488 484 489 495 510 497 511 498	Sex Male Male Female Male Female Female Female Female Female Female Female Female Female Male Male Male Male Male Female Female Male Male Female Male Male Female Male Female Male Female Female Male Female Female Male Female Male Female Male Female Male Female Male Male Female Male Female Male Male Female Male Male Female Male Male Male Male Female Male Male Male Male Male Male Male Male Male Male Male Male Male Male Male Female Male Female Male Male Female Male Male Male Male Male Male Male Male Male Male Male Male Female Male Male Female Male Female Male Male Female Male Female Male Male Female Female Female Male Female Male Male Female Female Female Male Male Female Male Male Male Male Male Female	Age Unk Birth Unk Birth Unk Birth 15Y,2M,13D Lost Lost 13Y,4M,5D 12Y,10M,13D 11Y,9M,10D 11Y,6M,30D Lost Lost 9Y,5M,12D Lost 8Y,8M,29D Lost 8Y,8M,29D Lost 8Y,4M,18D Lost 8Y,1M,29D 7Y,11M,24D 7Y,0M,12D 6Y,1M,18D Lost 5Y,11M,22D 5Y,0M,9D 1Y,11M,7D 1Y,10M,9D 1Y,10M,9D 1Y,1M,25D 10M,2D 9M,13D 9M,10D 6M,1D	Sire WILD WILD WILD 138 106 115 131 151 179 167 255 151 150 306 166 305 UNK 310 354 305 166 305 166 305 166 305 166 305 166 306 283 310 344 294 306 347 179 260 UNK 417 502 485 501 477	Dam WILD WILD WILD 42 126 134 134 56 170 194 231 170 127 282 195 334 UNK 308 302 334 UNK 308 302 334 195 282 349 308 309 298 282 435 381 452 381 452 381 402 503 472 505 471	Location DENVER SD-WAP SD-WAP OKLAHOMA NCS RAL PSU CARMACK PITTSBURG KANSASCTY COWAN B PHILADELP SCHMIDT R CARMACK CHICAGOBR SCHMIDT R WASH ST U CARMACK OKLAHOMA K.HARRY WASH ST U KANSASCTY PROVIDNCE SAN ANTON UNKNOWN COWAN B HOUSTON KANSASCTY BATONROUG OKLAHOMA PITTSBURG OKLAHOMA COWAN B SD-WAP MONTGOMRY SD-WAP SAFARI W	Death Date possibly possibly 15 Mar 2002 01 Apr 2001 possibly possibly possibly possibly 21 Dec 1999 possibly	Inbreeding 0 0 0 0 0 0 0 0 0 0 0 0 0			
Specimer 29 Unkno Parent I	ns listed own parent IDs shown	in birth dat ts treated as as ?'s are 1	te order s founde unknown	ers. and the	erefore tro	eated as found	ers.			
Compiled Data cu Printed	l by: Jose rrent thru on 1 Jur	eph Roman thu u: 31 Dec 200 n 2003 using	ru Norfo)2 North Sparks	olk Zoo 1 Americ v1.54	can region	al				

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Year			Observed Lambda			
as of 31 Dec	Specimen	Counts	Annual	Geometric Mean		
2002	185.117.200	(502)	0.99			
2001	182.120.204	(506)	0.96	0.98 (last 2 yrs)		
2000	187.120.218	(525)	0.98	0.98 (last 3 yrs)		
1999	192.124.219	(535)	0.98	0.98 (last 4 yrs)		
1998	198.124.223	(545)	1.00	0.98 (last 5 yrs)		
1997	199.127.219	(545)	0.95	0.98 (last 6 yrs)		
1996	211.132.228	(571)	0.99	0.98 (last 7 yrs)		
1995	201.136.242	(579)	0.99	0.98 (last 8 yrs)		
1994	201.133.253	(587)	1.00	0.98 (last 9 yrs)		
1993	196.127.262	(585)	0.97	0.98 (last 10 yrs)		
1992	196.133.277	(606)	1.03	0.99 (last 11 vrs)		
1991	192.123.273	(588)	1.11	1.00 (last 12 vrs)		
1990	162.97.271	(530)	0.99	1.00 (last 13 vrs)		
1989	160.93.281	(534)	0.96	0.99 (last 14 yrs)		
1988	172.100.286	(558)	1.29	1.01 (last 15 yrs)		
1987	141.94.196	(431)	1.22	1.02 (last 16 vrs)		
1986	102.76.175	(353)	1.29	1.04 (last 17 yrs)		
1985	86.70.118	(274)	1.67	1.06 (last 18 vrs)		
1984	37.36.91	(164)	1.56	1.09 (last 19 vrs)		
1983	24.7.74	(105)	1.44	1.10 (last 20 yrs)		
1982	23.10.40	(73)	1.55	1.12 (last 21 yrs)		
1981	21.5.21	(47)	1.02	1.11 (last 22 vrs)		
1980	21.4.21	(46)	1.39	1.13 (last 23 yrs)		
1979	21.4.8	(33)	1.10	1.12 (last 24 vrs)		
1978	21.1.0	(30)	0 77	1 11 (last 25 vrs)		
1977	8 4 27	(39)	1 50	1 12 (last 26 yrs)		
1976	6317	(26)	1 37	1 13 (last 27 yrs)		
1975	6 4 9	(19)	0.95	1.12 (last 28 yrs)		
1974	6 5 9	(20)	1 11	1.12 (last 20 yrs) 1 12 (last 29 yrs)		
1973	648	(18)	0 95	1.12 (last 30 vrs)		
±275		(10)	5.25	1.12 (1000 50 /15/		
1963	7.4.1	(12)	1.09	1.10 (last 40 yrs)		
1962	5.4.2	(11)	1.00	1.10 (last 41 yrs)		
1961	5.4.2	(11)	0.79	1.09 (last 42 yrs)		
1960	5.4.5	(14)	3.50	1.12 (last 43 vrs)		
1959	1.1.2	(4)	2.00	1.13 (last 44 vrs)		
1958	0.0.2	(2)	0.17	1.09 (last 45 vrs)		
te: Lambda values in	clude Imports	and Export	ts			

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Census Details Report

INTERNATIONAL GORILLA Studbook

Page 1

Restricted to: Locations: EUROPE / Dates: As of 31/12/2002

During Captures Births Stillbirths Releases Deaths LTFs Imports Exports

2002	0.0.0	14.4.0	1.1.0	0.0.0	3.5.0	0.0.0	1.0.0	4.0.0		
2001	0.0.0	12.9.0	0.0.0	0.0.0	8.5.0	0.0.0	2.3.0	0.0.0		
2000	0.0.0	9.12.0	1.1.0	0.0.0	5.5.0	0.0.0	0.0.0	0.0.0		
1999	0.0.0	14.10.1	0.1.1	0.0.0	5.8.1	0.0.0	0.0.0	3.0.0		
1998	0.0.0	9.9.0	1.1.0	0.0.0	3.3.0	0.0.0	0.0.0	2.1.0		
1997	0.0.0	10,11,1	0.1.1	0.0.0	5.7.1	0.0.0	1.1.0	2.3.0		
1996	0.0.0	8 13 1	1 3 1	0.0.0	3 6 1	0 0 0	1 0 0	4 7 0		
1995	0.0.0	5 12 0	0 2 0	0.0.0	5 7 0	0.0.0	0 1 0	6 1 0		
1994	0.0.0	6 9 0	0.2.0	0.0.0	670	0.0.0	2 1 0	1 0 0		
1993	0.0.0	0.9.0 771	0.1.0	0.0.0	3 6 1	0.0.0	2.1.0	1 0 0		
1002	0.0.0	11 8 2	2 1 2	0.0.0	632	0.0.0	1 0 0	7 1 0		
1001	0.0.0	6 10 2	0 2 2	0.0.0	1 6 2	0.0.0	1 1 0	1 0 0		
1000	0.0.0	0.10.2	1 1 0	0.0.0	4.0.2	0.0.0	1.1.0	110.0		
1000	0.0.0	9.9.0 12 7 2	1 1 2	0.0.0	5.0.0	0.0.0	0.1.0	1 0 0		
1969	0.0.0	13.7.3	1.1.3	0.0.0	0.3.3	0.0.0	0.0.0	1.0.0		
1988	0.0.0	7.9.1	0.0.1	0.0.0	/.4.1	0.0.0	0.0.0	4.1.0		
1987	0.0.0	6.9.0	3.1.0	0.0.0	4.3.0	0.0.0	1.2.0	1.2.0		
1986	0.0.0	9.10.0	1.0.0	0.0.0	10.6.0	0.0.0	0.1.0	0.1.0		
1985	0.0.0	6.10.1	0.0.1	0.0.0	4.5.1	0.0.0	0.0.0	2.1.0		
1984	0.0.0	6.8.1	1.3.1	0.0.0	5.9.1	0.0.0	3.5.0	9.1.0		
1983	0.0.0	10.4.1	0.1.1	0.0.0	1.6.1	0.0.0	1.1.0	6.0.0		
1982	0.0.0	6.8.1	0.0.1	0.0.0	5.5.1	0.0.0	1.3.0	3.0.0		
1981	0.0.0	5.10.0	0.0.0	0.0.0	5.5.0	0.0.0	2.0.0	0.0.0		
1980	0.0.0	13.4.0	1.0.0	0.0.0	7.1.0	0.0.0	2.5.0	5.0.0		
1979	0.0.0	6.5.2	1.0.2	0.0.0	5.2.2	0.0.0	1.1.0	0.0.0		
1978	0.0.0	3.7.1	0.1.1	0.0.0	3.4.1	0.0.0	1.0.0	2.0.0		
1977	0.0.0	5.5.0	1.1.0	0.0.0	6.7.0	0.0.0	2.2.0	2.1.0		
1976	0.0.0	4.2.0	0.0.0	0.0.0	3.3.0	0.0.0	3.4.0	0.1.0		
1975	0.0.0	5.6.0	0.0.0	0.0.0	4.3.0	0.0.0	5.12.0	0.1.0		
1974	0.0.0	2.3.0	0.0.0	0.0.0	2.3.0	0.0.0	14.19.0	0.0.0		
1973	0.0.0	4.1.1	0.0.1	0.0.0	2.3.1	0.0.0	6.8.0	1.2.0		
1972	0.0.0	1.3.1	0.0.1	0.0.0	2.3.1	0.0.0	12.9.0	3.1.0		
1971	0.0.0	3.1.0	0.0.0	0.0.0	2.3.0	0.0.0	3.2.0	0.1.0		
1970	0.0.0	0.1.0	0.0.0	0.0.0	3.2.0	1.0.0	62.0	1.0.0		
1969	0.0.0	0.1.0	0.0.0	0.0.0	3.3.0	0.0.0	4.3.0	0.0.0		
1968	0.0.0	0.2.0	0.0.0	0.0.0	2.0.0	0.0.0	4.6.0	0.0.0		
1967	0.0.0	0.2.0	0.0.0	0.0.0	1.2.0	0.0.0	7.5.0	1.0.0		
1966	0.0.0	1.0.0	1.0.0	0.0.0	1.3.0	0.0.0	8.11.0	1.0.0		
1965	0.0.0	1.0.0	0.0.0	0.0.0	2.2.0	0.0.0	5.7.0	1.1.0		
1964	0.0.0	1.0.0	0.0.0	0.0.0	1.0.0	0.0.0	6.9.0	0.0.0		
1963	0.0.0	0.0.0	0.0.0	0.0.0	0.0.0	0.0.0	6.6.0	1.0.0		
1962	0.0.0	0.0.0	0.0.0	0.0.0	1.0.0	0.0.0	3.4.0	0.0.0		
1961	0.0.0	1.0.0	0.0.0	0.0.0	0.1.0	2.0.0	7.9.0	0.0.0		
1960	0.0.0	0.0.0	0.0.0	0.0.0	0.0.0	0.0.0	4.3.0	0.0.0		
Stillbi	irths are	included	in both t	he Birth a	and Death	columns.				
Compile Data cu Printec	Compiled by: Dr. Sabine Hilsberg thru Frankfurt Zoo Data current thru: 31 Dec 2002 International Printed on 1 Jun 2003 using Sparks v1 54									

	Generation Report GUAM RAIL Studbook Page 1										
======================================	e: RALLUS	OWSTONI		=======================================	====:	=======	======	=======	===		
Stud ID	Sire ID	======= Dam ID	Sex	Birth Type	====: Low T	========= Average T	======= High T	======	===		
1 2 17 23 27 29 31 58 61 81 82 110 111 112 416 417 741 742 859 860 1096 1097 1098 1099 1189 1190 1269 1270 1311 1312	WILD WILD 1 5 12 11 WILD7 1 5 1 1 1 9 19 19 19 19 79 79 79 336 481 636 636 593 287 287 568 526 526 526 593 287 852 586	WILD WILD 2 4 14 15 WILD8 29 29 6 6 6 6 229 229 359 521 390 390 605 322 322 557 736 736 801 467 588 606	Male Female Unknown Female Female Female Female Female Unknown Unknown Female Male Female Male Female Male Female Male Female Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown Unknown	Wild born Wild born Captive born	0 0 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1	0.000 0.000 1.000 1.000 1.000 1.000 1.000 1.500 1	0 0 1 1 1 0 2 2 2 2 2 2 2 2 2 2 2 4 4 5 7 6 6 7 3 6 7 8 6 7 6 7 8 6 7 6 7 8 6 7 6 7 8 6 7 7 8 6 7 7 8 6 7 7 8 6 7 7 8 7 8 7 7 8 8 7 7 8 8 7 8 8 7 7 8 8 7 7 8 8 7 7 8 8 7 7 8 8 7 7 8 8 7 7 8 8 7 7 8 8 6 7 7 8 8 7 7 8 8 7 7 8 8 7 7 8 8 8 7 7 8 8 8 7 7 8 8 8 7 7 8 8 8 7 8 8 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8				
Averages:	T-Lc T-Averag T-Hig	w value e value h value	=	2.44 3.3530 4.80							
Compiled J Data curre Printed of	oy: David ent thru: n 1 Jun	Orndorf 3 Apr 2003 usi	f thru Sar 2002 Inter ng Sparks	n Diego Zoo mational v1.53							

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Generation Report GUAM RAIL Studbook Page 31 _____ Taxon Name: RALLUS OWSTONI _____ Sire Dam Birth |Low|Average|High| | T | T | T | Stud ID | ID | ID | Sex | Type T-Low, T-Avg, and T-High are different captive born generation numbers. An T-Low of two would indicate a full second-generation captive born specimen; meaning both of the specimens's parents were captive born, and at least one of the specimen's grandparents was not captive born. T-Low is the most conservative of the captive born generation numbers. T-low for a wild born or unknown birth type specimen is zero. T-Low for a captive born specimen is the lower of the parent's T values, plus one. T-Avg takes into account all of the captive births in a specimen's pedigree. T-Avg will be greater than or equal to T-Low and less than or equal to T-High for a specimen. T-Avg for a wild born or unknown birth type specimen is zero. T-Avg for a captive born specimen is the average of the parents' T-Avg values, plus one. T-High is a measure of the longest arm of a specimen's pedigree. An T_High of three would indicate at least one grandparent was captive born. T-High for a wild born or unknown birth type specimen is zero. T-High for a captive born specimen is the greater of the parents' T-High values, plus one. Compiled by: David Orndorff thru San Diego Zoo Data current thru: 3 Apr 2002 International Printed on 1 Jun 2003 using Sparks v1.53

	Repro	ductive STRIPEI	Parameters	s Report	Page	1
======================================	======================================				========	==
============	=======================================	============			==========	==
	Gestation peri	od set to	90 days, ~3.0 r	months.		
DAM DATA:	21 reported da (not including	ums, with 6 74 offspr	53.66.18 (147) of unknown	offspring dams)		
Youngest 10127 a 10090 a 10059 a 10204 a 10091 a	dams at first t age ~1M,3M: t age 1Y,10M,1 t age 2Y,1M,3I t age 2Y,6M,24 t age 2Y,7M,24	birth: gestation 9D D D	exceeds dam'			
Oldest d 10131 a 10200 a 10103 a 10002 a 10159 a	ams at first k t age 12Y,3M,1 t age 8Y,9M,7I t age 5Y,11M,1 t age 5Y,7M,18 t age 5Y,7M,10	oirth: 6D 4D D D				
Oldest d 10131 a 10131 a 10204 a 10131 a	ams to have gi t age 14Y,1M,2 t age 13Y,4M,1 t age 13Y,1M,1 t age 12Y,3M,1	ven birth: 6D 7D 2D 6D	:			
Age at fir During a Age at la	FEMALES st reproductio ll reproductio st reproductio	on: - on: - on:	Median ~5Y,3M,16D ~6Y,7M,10D ~8Y	Average 5Y,3M,4D 6Y,5M,1D 8Y,6M,3D		
Short 10007 1 10022 1 10091 1 10012 1 10007 1 10159 1 10019 1	est interbirth 13 days betwee 19 days betwee 26 days betwee 34 days betwee 36 days betwee 57 days betwee 62 days betwee	intervals n 10089 & n 10050 & n 10187 & n 10029 & n 10094 & n 10160 & n 10043 &	5 10090 10051 10188 10022 T10174 10076 10046			
Dams with 10019 10007 10103 10204 10095	most offspring 28 15 13 12 10	;: 				
Data current Printed on	brs kaymond v thru: 6 Jun 1 Jun 2003 usi	an der Mee 2001 Europ .ng Sparks	pean regional v1.53	ark Amersioort		

	R	eprodu	ctive	Para	meters	Repo	rt		
		-	STRIPED	HYENA	Studbook	-		Page	2
=======================================			=======		=======	=======		=======	===
Taxon Name: HYA	ENA H	YAENA							
=======================================	=====	======	=======	======	=======	======		=======	===
Birth sea	sonal	ity (litte	ers)						
January:	TO	148							
February:	6 10	86							
March.	0 10	110 110							
Aprii:	0 7	110 09							
May:	10	14º							
July:	10	0% 178							
August:	, 5	28 7≩							
September:	2	7%							
October:	1	1%							
November:	6	8%							
December:	2	3%							
[Litters with a	a bir	thdate est	timated	as 'Y'	are not	include	ed here.]		
	Via	bility:							
	L	ived	Died		Died				
	>	1 year	< 1 ye	ear	< 30 d	ays			
Rearing:									
Parent	24	57%	3	7%	15	36%			
(42)	2.1		-	2.0	2				
Hand	31	89%	1	3%	3	9%			
(35)	4 7		0	2.0	07	200			
Unknown (70)	41	598	2	38	27	398			
(70)									
	96	65%	6	4%	45	31%			
	20	000	C C	20	10	010			
First births to	dams	at an ave	erage ag	ge of ~	4Y,2M,12	D			
63.9% lived >1	year	8.3% d:	ied <1 y	year	27.8% d	ied <30	days		
N = 23		N	= 3		N	= 10			
Subsequent birt	hs to	dams at a	an avera	age age	of ~6Y,	7M,20D	_		
65.8% lived >1	year	2.7% d	ied <1 y	year	31.5% d	ied <30	days		
N = 73		N	= 3		N	= 35			
Litter s	 ize		 V						
1			28	38%					
2			25	34%					
3			16	22%					
4			4	5%					
5			1	1%					
74 total li	tters	, mean si	ze is 2	.0					
		-	_	_			-		
Compiled by: Dr	s Rayı	mond van o	der Meei	r thru	Dierenpa	rk Amer	sfoort		
Data current th	ru:	ь Jun 2003	L Europe	ean reg	lona⊥				
Printea on I Ju	un 20	using S	sparks v	7⊥.53					

R	eproductive STRIPED	Parameters HYENA Studbook	Report	Page	3
Taxon Name: HYAENA H	======================================	:=================			:=
SIRE DATA: 17 repo Youngest sires a (male's age when 10205 at age 1Y 10013 at age 1Y 10199 at age 2Y 10009 at age 2Y 10008 at age 4Y	rted sires, with t first reproduct dam conceived) ,7M,13D ,11M,10D ,6M,8D ,11M,14D ,4M,21D	62.67.18 (147) ion:	offspring		
Oldest sires at 10132 at age 12 10113 at age 10 10094 at age 6Y 10001 at age 5Y 10114 at age 4Y 10092 at age 2Y	first reproductio Y,0M,17D Y,10M,17D ,7M,2D ,4M,19D ,10M,25D ,11M,16D	νn:			
Oldest sires to 1 10132 at age 18 10132 at age 16 10008 at age 14 10132 at age 13 10008 at age 12 10008 at age 11	have reproduced: Y,0M,20D Y,10M,27D Y,8M,4D Y,10M,27D Y,2M,19D Y,7M,8D				
MAL: Age at first reprod During all reprod Age at last reprod (all ages are	ES duction: duction: duction: 8 at dam conceptic	Median ~5Y ~6Y 3Y,10M,5D pn)	Average 5Y,5M,5D 6Y,9M,14D 8Y,6M,8D		
Sires with most of: 10013 26 10008 23 10089 20 10132 15 10205 12 10102 12	fspring:				
Compiled by: Drs Rayn Data current thru: Printed on 1 Jun 20	mond van der Meer 6 Jun 2001 Europe 03 using Sparks v	thru Dierenpar an regional 71.53	k Amersfoort		

Age Report EASTERN BLACK & WHITE COLOBUS Studbook 1 Page _____ Taxon Name: COLOBUS GUEREZA ______ Ages at death for animals surviving to at least 30 days 25th %tile Median 75th %tile Maximum N males: 1Y,4M,17D 4Y,3M,17D 11Y,3M,6D ~30Y 253 3Y,5M,2D 6Y,2M,3D 11Y,5M,12D 2M.21D 4M 20D ~28Y 417 females: unknown sex: 2M,21D 4M,20D 11M,6D 3Y,1M,8D 23 Oldest dozen males: 230 Wild born Died at SANDIEGOZ at age of ~30Y 146Captive bornDied at SANTA ANA at age of 28Y,5M,11D104Wild bornDied at COLO SPRG at age of ~27Y3Wild bornDied at SANDIEGOZ at age of ~26Y 50 Captive born Died at TOLEDO at age of 25Y,11M,11D 16Wild bornDied at COLO SPRG at age of ~25Y18Wild bornDied at ST LOUIS at age of ~24Y103Wild bornDied at PORTLAND at age of ~23Y130Wild bornDied at FRANKLINP at age of ~23Y154Wild bornDied at MILWAUKEE at age of ~21Y Oldest dozen females: 121 Wild born Died at AUDUBON at age of ~28Y 121Wild bornDied at AUDUBON at age of ~28Y137Captive bornDied at COLO SPRG at age of 28Y,0M,1D63Wild bornDied at COLUMBUS at age of ~27Y109Wild bornDied at COLUMBUS at age of ~26Y5Wild bornDied at SANDIEGOZ at age of ~26Y30Wild bornDied at DICKERSON at age of ~25Y291Captive bornDied at GLEN OAK at age of ~24Y,11M,3D264Wild bornDied at MEMPHIS at age of ~23Y216Wild bornDied at MEMPHIS at age of ~23Y26Wild bornDied at MEMPHIS at age of ~22Y244Captive bornDied at HOGLE at age of 22Y,7M,25D Oldest dozen unknown sex: 259 Captive born Died at KANSASCTY at age of 3Y,1M,8D 740Captive bornDied at SAN FRAN at age of 1Y,8M,25D976Captive bornDied at TOPEKA at age of 1Y,3M,17D303Captive bornDied at KANSASCTY at age of 1Y,2M,27D338Captive bornDied at CHICAGOLP at age of 1Y,0M,15D 537 Died at KANSASCTY at age of ~11M 252 Captive born Died at CHICAGOLP at age of 11M,4D 298 Captive born Died at CHICAGOLP at age of 9M,18D 1150Captive bornDied at CINCINNAT at age of 9M,15D1027Captive bornDied at OMAHA at age of 6M,13D Compiled by: Audra Gibson thru Columbus Zoo Data current thru: 1 Feb 2004 North American regional Printed on 29 Mar 2004 using Sparks v1.55

Age Report EASTERN BLACK & WHITE COLOBUS Studbook 2 Page ______ Taxon Name: COLOBUS GUEREZA _____ Ages for animals surviving to present Maximum 25th %tile Median 75th %tile Ν ~37Y males: 6Y,10M,20D 10Y,4M,21D 14Y,6M,9D 119 6Y,5M,20D 10Y,8M,12D 14Y,10M,6D 25Y,0M,8D females: 148 unknown sex: 1M,5D 1 Oldest dozen living males: 72Wild bornAt NZP-WASH at age of ~37Y241Wild bornAt GLEN OAK at age of ~29Y237Wild bornAt ST LOUIS at age of ~29Y 388Captive bornAt NZP-WASH at age of 24Y,8M,16D453Wild bornAt ASHEBORO at age of ~23Y 500Captive bornAt SAN FRAN at age of 22Y,6M,30D506Captive bornAt SANTA ANA at age of 22Y,5M,1D512Captive bornAt SIOUX FAL at age of 22Y,2M,29D 515 Captive born At FRESNO at age of 22Y,2M,3D 522 Captive born At MANHATTAN at age of 22Y, 0M, 24D 525 Captive born At HOUSTON at age of 22Y,0M,1D 533 Captive born At PHILADELP at age of 21Y,9M,27D Oldest dozen living females: 378 Captive born At MILWAUKEE at age of 25Y, 0M, 8D 432 Captive born At MILWAUKEE at age of 23Y,11M,18D 406 At IAE OH at age of ~23Y,10M 447 Captive born At MONTGOMRY at age of 23Y, 3M, 6D 467 Wild born At DALLAS at age of ~23Y 456 At SAN FRAN at age of ~23Y 501 Captive born At CALGARY at age of 22Y,6M,18D 508 Captive born At TOPEKA at age of 22Y,4M,4D 550 Captive born At FT WAYNE at age of 21Y,5M,11D 553 Captive born At ST LOUIS at age of 21Y,4M,4D 593 Captive born At CENTRALPK at age of 20Y, 2M, 28D 638 Captive born At CALDWELL at age of 19Y,5M,19D Oldest dozen living unknown sex: 1462 Captive born At DULUTH at age of 1M,5D Compiled by: Audra Gibson thru Columbus Zoo Data current thru: 1 Feb 2004 North American regional Printed on 29 Mar 2004 using Sparks v1.55



Sibling Report

Sibling Report										
========		=======	=====	шам =====	====	=========	===========			======
Taxon Nam	e: DRAC	ONIS CY	MRU				:	Studbook	Number:	902
======== Full sibl	ings gr	ouped by	===== y dat	===== :e >>	==== >				=======	
Stud.Id	Sire	Dam 	Birt 	:h Da	te 	Sex	Location	Name		
- 1841 1843	1661 1661	1655 1655	21 J 21 J	Jun 1 Jun 1	984 984	Female Female	died <30 died			
1901 * 1902	1661 1661	1655 1655	16 J	Jun 1 Jun 1	985 985	Female Female	died died	GRANDMA		
1914 1915	1661 1661	1655 1655	20 M 20 M	May 1 May 1	986 986	Unknown Unknown	premature premature			
2068 2069	1661 1661	1655 1655	19 J 19 J	Jun 1 Jun 1	988 988	Female Male	stillborn died			
* Requ Total Half sibl	* Requested specimen Total of 1.5.2 full siblings Half siblings grouped by date >>>									
Stud.Id	Sire	Dam	Birt	ch Da	te	Sex	Location	Name		
 - 1768 1769 1805 1806	1662 1662 1647 1647	1655 1655 1655 1655	27 c 27 c 26 c 26 c	Jun 1 Jun 1 Jun 1 Jun 1 Jun 1	982 982 983 983	Male Female Unknown Male	died <30 died stillborn LINCOLN M			
1837 1838 1842	1661 1661 1661	1663 1663 1672	13 3 13 3 21 3	Jun 1 Jun 1 Jun 1	984 984 984	Male Female Female	died died died	SHEKOPE MIRIAH		
1894 1897 1903 1907 1908	1661 1661 1661 1661 1661	1663 1663 1672 1671 1671	14 J 14 J 16 J 24 J 24 J	Jun 1 Jun 1 Jun 1 Jun 1 Jun 1	985 985 985 985 985	Female Male Male Female Female	died stillborn died died [WATERTN]			
Total of	19.14.1	half s	iblir	ngs						
Compiled Data curr Printed o	Compiled by: Studbook keeper's name thru Sponsoring institution's name Data current thru: 30 Jun 2001 North American Regional Printed on 21 Jun 2002 using Sparks v1.5									

Reproductive History Table										
WELSH DRAGON Studbook Page 1										
Taxon Name: DRACONIS CYMRU Studbook Number: 1902										
Sex: Female Died at COLUMBUS on 17 Sep 1997 Tag/Band: BLUE 137 LEFT Tag/Band: BLUE 137 LEFT EAR Tag/Band: 10 WHITE RIGHT EAR Name: GRANDMA										
Offspring grouped by date >>> Parent's Offspring's										
Stud.Id	Sire	Dam	Birth	n Date	Sex	Age	Location	Name		
 1999	1887	1902	4 Ji	ın 1987	Male	1Y,11M,18D	died <30			
2036 2037	1887 1887	1902 1902	22 Ma 22 Ma	iy 1988 Ny 1988	Male Female	2Y,11M,6D 2Y,11M,6D	died <30 died <30			
2100 2101	1887 1887	1902 1902	25 Ma 25 Ma	iy 1989 Ny 1989	Male Female	3Y,11M,9D 3Y,11M,9D	died died	APACHE		
2209 2210	1887 1887	1902 1902	8 Jı 8 Jı	in 1990 in 1990	Female Female	4Y,11M,23D 4Y,11M,23D	[LAMKIN] [LAMKIN]			
2249 2250	1887 1887	1902 1902	25 Ma 25 Ma	ay 1991 ay 1991	Male Female	5Y,11M,9D 5Y,11M,9D	[FOUTS J] [FOUTS J]			
2337 2338	2139 2139	1902 1902	9 Jı 9 Jı	ın 1992 ın 1992	Female Female	6Y,11M,25D 6Y,11M,25D	[FOUTS J] [FOUTS J]			
4.7 offspring, none living										
Compiled Data curre Printed of	Compiled by: Studbook keeper's name thru Sponsoring institution's name Data current thru: 30 Jun 2001 North American Regional Printed on 21 Jun 2002 using Sparks v1.5									

	Desce	ndant	- Tist	_		
	BRAZILIAN	N TAPIR	Studbo	ok	Page 1	
Taxon Name: TAPIRUS TERRES	STRIS			Studbook N	umber: 018	===
Sex: Female At TOBE ZOC Name: MOMO) as of 1 Ma	ar 1988				:==
Studbook ID	Sex	Age	Sire	Death Date	Location	
<pre>>018</pre>	 F 14Y,7M F 12Y,2M F 11Y,10 M 4Y,8M M 1Y,9M F 10Y,6M F 8Y,10 F 1Y,5 more than or eneration 1 eneration 2 eneration 3 C descendant	UNK 4,15D 4,16D 0M,9D 4,16D 4,22D 4,18D 0M,6D 5M,9D nce	017 017 011 025 025 017 017 040	27 May 2003	TOBE ZOO SAYAMA HIMEHI SH ZOORASIA ITO SHI TOKYOUENO ITO SHI HIRAKAWA NAGOYA NAGOYA NAGOYA	
Compiled by: Katsuhiro Kur Data current thru: 31 Dec Printed on 21 Apr 2004 usi	ribayashi th 2003 Japane ing Sparks v	nru Zoc ese reg /1.55	orasia ional			

Masterplan Report GIRAFFE Studbook 2 Paqe (Giraffa camelopardalis) _____ Living Population at: The Living Desert PALM DES Palm Desert, CA USA 92260 (760)346-5694x275 (760)346-9070 afletcherjones@livingdesert.org [Amy Roberts / Anne Fletcher-Jones] Stud Sex Birth Date Sire Loc ID Genome F MK КV GU-All Live Sibs Founder Dam Social | Known GU-CB Live Offspr Arrival [unks = founders] Representation # Vx [unknowns removed] Repro Offspr 2702 m 22 Sep 2000 1712 402017 1.000 0.03 0.215 0.322 2.55 5. 3. 0 235=18.8% 485=12.5% 484=12.5% 2 Nov 2002 1621 207=6.3% 230=6.3% 306=6.3% . . 174=6.3% 208=6.3% . _____ 2739 F 8 Feb 2001 2185 402019 0.750 0 0.122 0.123 3. 2. 0 480=37.5% 487=12.5% 560=12.5% 1 Nov 2002 1722 2.65 299=9.4% 632=6.3% 631=6.3% . . 172=4.7% 206=3.1% 205=3.1% 207=3.1% 171=1.6% _____ 2750 M 30 Mar 2001 1712 402018 1.000 0.01 0.002 0.135 5. 3. 0 235=18.8% 266=12.5% 485=12.5% 2 Nov 2002 1636 5.85 484=12.5% 207=6.3% 289=6.3% . . 267=6.3% 230=6.3% 306=6.3% 174=6.3% 208=6.3% _____ Totals: 1.1 animals plus 1.0 contracepted/sterile animals Compiled by: Laurie Bingaman thru International Species Information System Data current thru: 31 Dec 2002 North American Regional/Global Printed on 1 Jun 2003 using Sparks v1.53

Masterplan Report Definitions GIRAFFE Studbook (Giraffa camelopardalis) Stud # -- Studbook ID number -- 'sm' or 'sf' indicates it is sterilized Sex -- 'cm' or 'cf' indicates it is contracepted Sex Birth/Hatch Date Arrival -- Arrival date at the current institution Sire/Dam -- Sire/Dam IDs -- Current institution ID number Loc ID Social -- Current social group at the current institution Genome Known: Proportion of animal's genome known F -- Inbreeding Coefficient First value assumes animals of unknown origin are founders. Second value omits animals of unknown origin. MK -- mean kinship First value is mean kinship. Second value is mean kinship if animals of unknown origin are omitted. кV -- kinship value A weighted mean kinship where the weights are the other animals' reproductive values. Second value omits animals of unknown origin. GU-All -- Genome Uniqueness Proportion of genes in an animal that are not found in the rest of the population. GU-CB -- Genome Uniqueness of Captive-Born Animals Proportion of genes in an animal that are not found in the rest of the captive-born population. -- Expected future lifetime reproduction by an animal of age x. Vx G L O B A L vs. Restricted -- Following values may be calculated using all animals in the studbook or using the population specified by the view set for the report. -- Half siblings are counted as complete siblings. Live sibs Live offspr -- Living offspring Repro offspr -- Reproducing offspring Founder representation -- Percent of this animal's genes that descended from each founder. Compiled by: Laurie Bingaman thru International Species Information System Data current thru: 31 Dec 2002 North American Regional/Global Printed on 1 Jun 2003 using Sparks v1.53

Social Group Report

GOLDEN LION TAMARIN Studbook 1 Page _____ Taxon Name: LEONTOPITHECUS ROSALIA _____ Stud # | Sex | Birth Date | Sire | Dam | Date in | Rearing | House Name _____ >> Social Group: AALBORG / 805B 2764M8 Apr 19962390174913 Dec 2001Parent3162F31 Mar 20002509253013 Dec 2001Parent Steven Gissmo Totals: 1.1.0 (2) _____ >> Social Group: WATERTNSD / 810B 2338 M 9 Aug 1991 2055 2052 15 May 2002 Parent Raposo 3068 F 22 May 1999 2022 1857 15 May 2002 Hand Megan Totals: 1.1.0 (2) _____ >> Social Group: WELLINGTN / 786B 2019F20 Oct 19881038109426 Jun 2001ParentAide2503M19 Jan 19931493154326 Jun 2001ParentKrefeld Totals: 1.1.0 (2) _____ >> Social Group: WILMINGTN / 392P 1869F18Jul 198765811606Mar 2002ParentApril2150M28Aug 198915918196Mar 2002ParentCry Baby Totals: 1.1.0 (2) _____ >> Social Group: WORCESTER / 796P 1630F31Jan198646878915Jan2002ParentFlo2971M7Aug19981997264515Jan2002ParentSidney2972M7Aug19981997264515Jan2002ParentShadow Totals: 2.1.0 (3) _____ >> Social Group: ZURICH / 540N 3146 M 30 Aug 2000 2358 1735 30 Aug 2000 Parent F 4 Apr 2001 2358 1735 4 Apr 2001 Parent 3218 Totals: 1.1.0 (2) _____ >> Social Group: ZURICH / 782S 3000 M 27 Sep 1998 2358 1735 1 Jan 2001 Parent 3052 M 17 Apr 1999 2358 1735 1 Jan 2001 Parent Totals: 2.0.0 (2) _____ _____ _____ TOTALS: 276.212.14 (502) 269 Social Groups Compiled by: Dr. Jonathan D. Ballou thru Smithsonian National Zoo Data current thru: 31 Dec 2001 International Printed on 1 Jun 2003 using Sparks v1.53

Mailing Labels

Retrieval Criteria set to Geographic Area = AUSTRALAS, Living as of Yesterday

Records Keeper Taronga Zoo PO Box 20 Mosman, NSW 2088 AUSTRALIA

Records Keeper Adelaide Zoological Gardens Frome Road Adelaide, SA 5000 AUSTRALIA

Records Keeper Melbourne Zoo PO Box 74 Parkville, VIC 3052 AUSTRALIA

Records Keeper Perth Zoological Gardens PO Box 489 South Perth, WA 6151 AUSTRALIA

Records Keeper Hamilton Zoo c/o Hamilton City Council Hamilton, Auckland NEW ZEALAND

Records Keeper Orana Wildlife Park McLeans Island Road Christchurch, Canterbury NEW ZEALAND Records Keeper Western Plains Zoo PO Box 831 Dubbo, NSW 2830 AUSTRALIA

Records Keeper Monarto Zoological Park Princes Highway Monarto South, SA 5254 AUSTRALIA

Records Keeper Victoria's Open Range Zoo at Werrib PO Box 460 Werribee, Victoria 3030 AUSTRALIA

Records Keeper Auckland Zoological Park Private Bag, Grey Lynn Auckland, Auckland 1002 NEW ZEALAND

Records Keeper Wellington Zool. Gardens Newtown Park Wellington 2, NEW ZEALAND

Cards

Set to 5x 7 format Retrieval criteria set to Geographic Location = PERTH, Living as of yesterday

----- GIRAFFA CAMELOPARDALIS -----StudBook Number:215Rearing: ParentBirthDate:31 Jul 1990Name: MISHA Sex: Female Sire: 166 Dam: 167 ----- Transaction history ------
 ORANA
 664
 31 Jul 1990
 Birth

 PERTH
 910152
 6 Nov 1991
 Transfer to
 ----- GIRAFFA CAMELOPARDALIS -----StudBook Number: 232 Rearing: Unknown BirthDate: 19 Dec 1991 Name: MARAMA Sex: Female Sire: 166 Dam: 188 ----- Transaction history ------ORANA 91118 19 Dec 1991 Birth MELBOURNE 931828 19 Aug 1993 Transfer to PERTH 930296 20 Oct 1993 Transfer to ----- GIRAFFA CAMELOPARDALIS ------StudBook Number: 258 Rearing: Parent BirthDate: 21 May 1997 Name: SHARNA Sex: Female Sire: 231 Dam: 215 ----- Transaction history ------PERTH 970471 21 May 1997 Birth

Significant Bug Fixes since version 1.42

- Species notes were being duped from the active studbook into a newly created studbook
- Locations were being incorrectly included in datasets restricted to an Association (fed) file. For example, if INDIANAPL was in the view, animals at the location INDIA were also included (thanks to Jon Ballou)
- The Census graph x-axis included a Y2K bug (thanks to Bob Lacy)
- Founder representation data (affecting the Masterplan report and Founder Representation graph) was being rounded off and lost if pedigrees exceeded 8 generations (thanks to Waltraut Zimmerman, Koln and 15 generations of Przewalski's horses)
- Data could be overwritten while editing Special Data
- Choosing an unrecognized mnemonic caused a crash while setting a Geographic filter (thanks to Simone van Velzen, Otterpark)
- Setting a view to animals dead by a certain date actually included all animals that died after that date, instead of before it.
- Age was being reported incorrectly on Specimen report if the animal was lost-to-followup (thanks to Cathleen Cox, Los Angeles)
- Studbook number changes were being incorrectly retained if the change was aborted.
- MxQx and the Demog export would crash in specific datasets due to a 'divide-by-0' problem
- While using the Re-numbering Utility, if a new studbook number was entered for a temporary number, but the new studbook number was already in use elsewhere, Sparks would prompt for another new number. This number was substituted in the wrong animal's records (thanks to Steph Porter)
- During data editing of the Master Record, hitting <esc> at the question "Do you wish to accept this record" caused the animal to be deleted.
- Descendant report would go into an infinite loop for some pedigrees (thanks to Beatrice Steck, Basel)
- Pedigree report would crash on extremely deep pedigrees (thanks again to Waltraut Zimmerman and 15th generation P horse 3150)

Thanks to the following for reporting observations leading to Sparks improvements:

Jon Ballou, National Zoo Cathleen Cox, Los Angeles Aude Desmoulins, Lille Zoo Bob Lacy, Brookfield Martha Fischer, St Louis Ian Fraser, Auckland Hannelore Mercado, Berlin Steph Porter Beatrice Steck, Basel Simone van Velzen, Otterpark Olivia Walter, London Jonathan Wilcken, ARAZPA Waltraut Zimmerman, Köln

Thanks to Bob Lacy, Brookfield Zoo, Jonathan Wilcken, ARAZPA, and Meghan Yurenka, Lincoln Park Zoo for beta testing assistance. Special thanks to all the Studbook and Population Management classes at the AZA Conservation Academy at Wheeling, for saying "I wish Sparks could ..." and then writing it down for me.

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