Abertay University

Court Report: John Doe Case

Isaac Basque-Rice – 1901124@uad.ac.uk

Ethan Law – 1800219@uad.ac.uk

Lukas Smith – 1902745@uad.ac.uk

Digital Forensics 1 – CMP209

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Note that Information contained in this document is for educational purposes.

Contents

Job Description and Instructions

Police Scotland and the University of Abertay have approached the Ian's Angels team for technical aid in an investigation into one Mr John Doe, an individual who has been accused of the crimes of Ornithological Misconduct, Bird Abuse, Possession of Indecent Bird-Related Imagery, and Possession with Intent to Distribute Indecent Bird-Related Images. This aid comes in the form of a digital forensic examination of the alleged offender's personal computer.

The IA team, comprising of investigators Isaac Basque-Rice, Ethan Law, and Lukas Smith, will primarily be analysing the device for images and videos of bird abuse. However, all bird-adjacent content will be submitted to the record, for example, browser search history, internet messaging relating to the procurement or distribution of bird images, and other documents that may provide evidence relevant to the investigation.

Prior to writing this document, which serves as a report for the court to deliberate over, all necessary information was passed on to the relevant authorities, either to ensure a thorough and well-informed investigation or to make sure any victims receive the help they may need.

Description of Recovered / Examined Items

Due to the Covid-19 pandemic, physical access to the drive was not possible. As such, the recovered items were digitised and provided to the analysts by the recovery team. The johnDoe.dd file itself is 5.7GB in size and separated into 3 partitions. The primary partition, known as vol2, is formatted in the NTFS / exFAT format and is 3.1GB in size.

A secondary partition, known as vol3, was also discovered to contain a multitude of illicit material, mostly bird imagery and other bird-adjacent content.

Additionally, the existence of a removable drive was determined. However, the IA team did not have access to this drive at the time of the assessment.

Analysis Methodology

Disk Imaging

In the process of analysing a drive such as this, it is of the utmost importance that the integrity of the data is kept fully intact for the benefit of the investigation. It is inadvisable for any analysis to be conducted on the original device, in this case, an HDD, because any mistakes or issues may result in critical evidence being lost permanently.

As previously mentioned, due to the COVID-19 pandemic, the investigators were unable to gain physical access to the John Doe drive. As a result of this fact, the team that acquired the drive gave the IA team access to an Ubuntu VM, which was hosted on the Microsoft Azure platform and was accessible through RDP. On this VM was an exact copy, or "image" of the drive's contents, contained within a .dd file that the assessors could examine.

For the sake of validation, an md5 hash was taken of the drive when it was imaged initially. This hash was handed off to the IA team alongside the image and instructions to check that the md5sum of the image received matched the original.

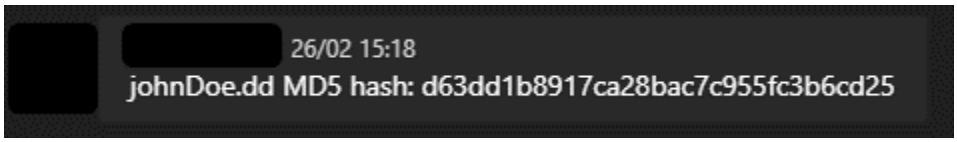


FIGURE 1, MD5 HASH AS SENT TO THE TEAM

```
~/Downloads> md5sum johnDoe.dd
d63dd1b8917ca28bac7c955fc3b6cd25  johnDoe.dd
~/Downloads>
```

FIGURE 2, MD5 HASH AS TESTED BY THE TEAM

This step was performed many times throughout the course of the investigation to ensure that no data had been altered during the analysts' work.

Physical Searching

Physical searching is the process of searching through a drive by treating it as a single binary and not, as may initially occur to most people, a collection of binaries and/or executables. The benefit this process has is that deleted files and file segments, as well as hidden partitions, are revealed to the assessor.

Disk Analysis

In this preliminary stage, the analysts gathered as much information as they could about the drive itself. Information gathered included but was not limited to the size of the drive, the

number of files found, and the number of partitions available on the drive, which has been touched upon previously.

The analysts were able to determine that the Operating System running on the drive was Windows XP SP 2, the maximum size of the drive was 6GB, that there were 17,129 allocated files, 1,764 unallocated files, 10,764 Slack files, and 4,400 directories, and Clamscan was able to confirm that there was no malware present on the drive.

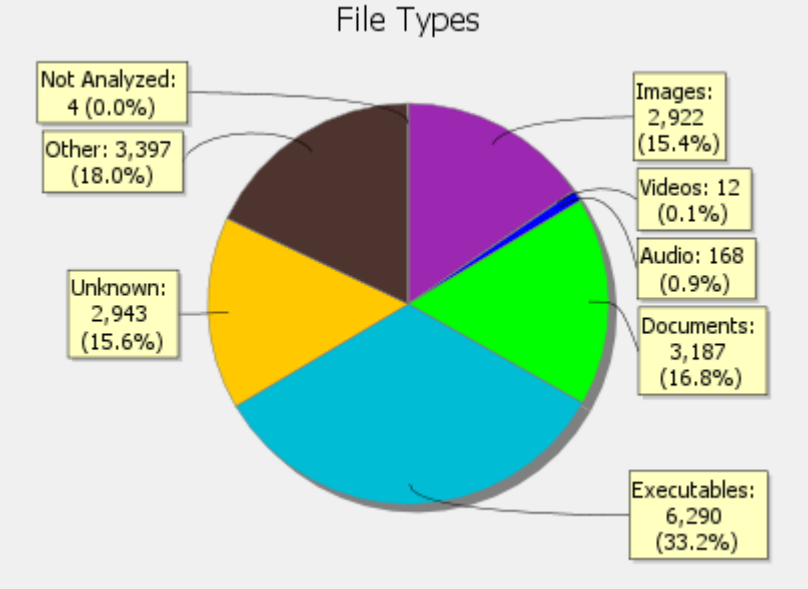


FIGURE 3, A BREAKDOWN OF THE FILES FOUND ON THE DRIVE BY TYPE, PRODUCED BY AUTOPSY

```
~/Downloads> clamscan johnDoe.dd
/home/student/Downloads/johnDoe.dd: OK

----------- SCAN SUMMARY -----------
Known viruses: 3955976
Engine version: 0.102.4
Scanned directories: 0
Scanned files: 1
Infected files: 0
Data scanned: 0.00 MB
Data read: 5495.77 MB (ratio 0.00:1)
Time: 30.441 sec (0 m 30 s)
```

FIGURE 4, A COMPLETED CLAMSCAN SCAN OF THE IMAGE SHOWING THERE IS NO MALWARE PRESENT

Autopsy

Autopsy is an open-source digital forensics platform that serves as a GUI for The Sleuth Kit, a library of digital forensic tools that allows a user to analyse and investigate disk images (Carrier, n.d.). The GUI that Autopsy provides in this instance provides an emulated file

system that allows the analysts to browse the drive with relative ease. It achieves this by hashing all files, unpacking compressed files and other archives, cataloguing common files (including standard email formats), extracting EXIF data, and indexing keywords.

Work in Autopsy has allowed the analysts to collect a significant amount of information relevant to the investigation. Chief amongst these discoveries that the program facilitated were the 42 separate images of birds discovered in various locations in the image **(Appendix AA),** as well as the four emails Doe received of an ornithological nature from an email belonging to an individual named Ben, and one from a mailing list that taught subscribers how to identify birds (all emails found in **Appendix B**).

Autopsy also facilitated the discovery of several bird adjacent documents (birdwatching guides etc.). Two of these documents were copies of one another with identical content, both owned by a one Mr Paul Teddy and authored (according to the document itself) by an individual named Pete Dunne. Another document, authored by a Mr Antony Lynam, describes the process of birdwatching in Thailand, and yet another is the Spring 2001 edition of the UC Berkeley Botanical Garden Newsletter. All miscellaneous documents are available in **Appendix C.**

File Carving

The primary tool used for this stage was Foremost, a command-line-based tool that allows users to "Recover files using their headers, footers, and data structures." From this, the analysts were able to recover a wide range of files, including (upon further inspection) several files hidden away in the separate partition.

A complex one-liner[1] (below) was used to retrieve the files and recursively place them in separate directories depending on file type, as well as outputting all files taken with a PowerShot camera, as determined by Metacam, a program that scans image EXIF data.

```
foremost -T -t all johnDoe.dd && cd output*/jpg && for i in $(metacam *
2>/dev/null | egrep -i PowerShot -B 4 | grep "File" | cut -d " " -f 2);
do cp $i /tmp; done
```

FIGURE 5, THE FOREMOST AND METACAM COMMAND

[1] With thanks to Allan Goodwill for writing it

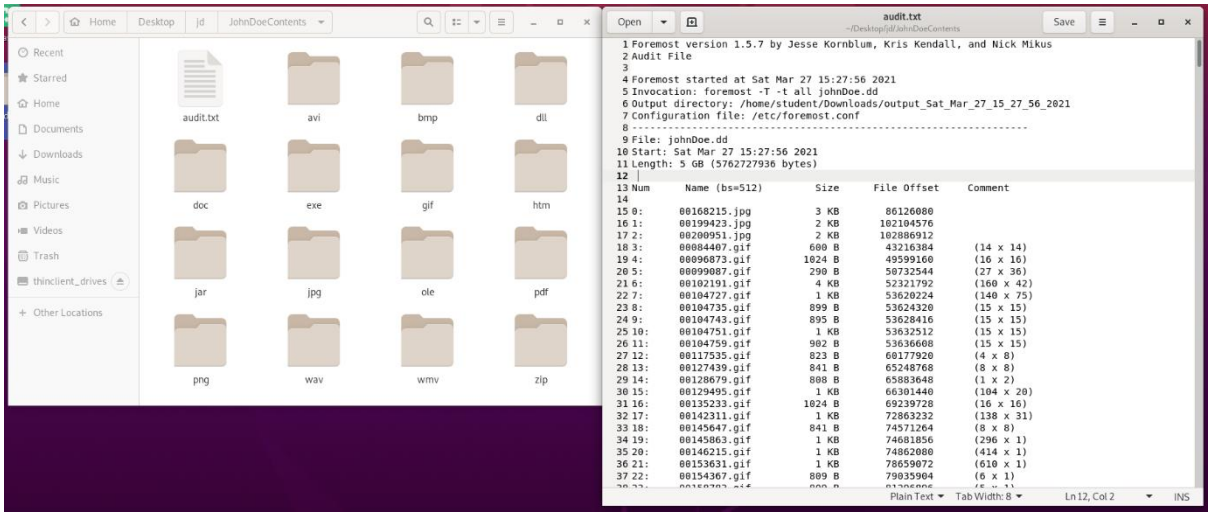


FIGURE 6, THE RESULT OF THE FOREMOST COMMAND, A DIRECTORY OF FILES WITH VARIOUS SUBDIRECTORIES ORGANISED BY FILETYPE, ALONGSIDE THE BEGINNING OF THE AUDIT.TXT FILE THAT SERVES AS A LIST OF RECOVERED FILES.

From this process, the analysts were able to identify a range of materials of an ornithological nature and identify further persons of interest, both of which have been passed on to the relevant authorities.

Images

As Mr Doe is accused of possessing material of an ornithological nature, the primary items the analysts were searching for in their analysis were, of course, images matching this description. These images include images of birds themselves and bird-related imagery, such as photos of bird boxes, bird seed, and imagery relating to birds such as drawings.

126 images with unique filenames were marked “of interest” by an analyst. Of these images, 32 were found to have EXIF data associated with them. 29 of these images were taken with a Canon PowerShot SD100, which was the camera discovered at the crime scene. Of the remaining three, two (identical) images were taken with a different Canon camera, and the remaining one was taken with a Sony Cybershot and was one of the images attached to the emails from the Ben account.

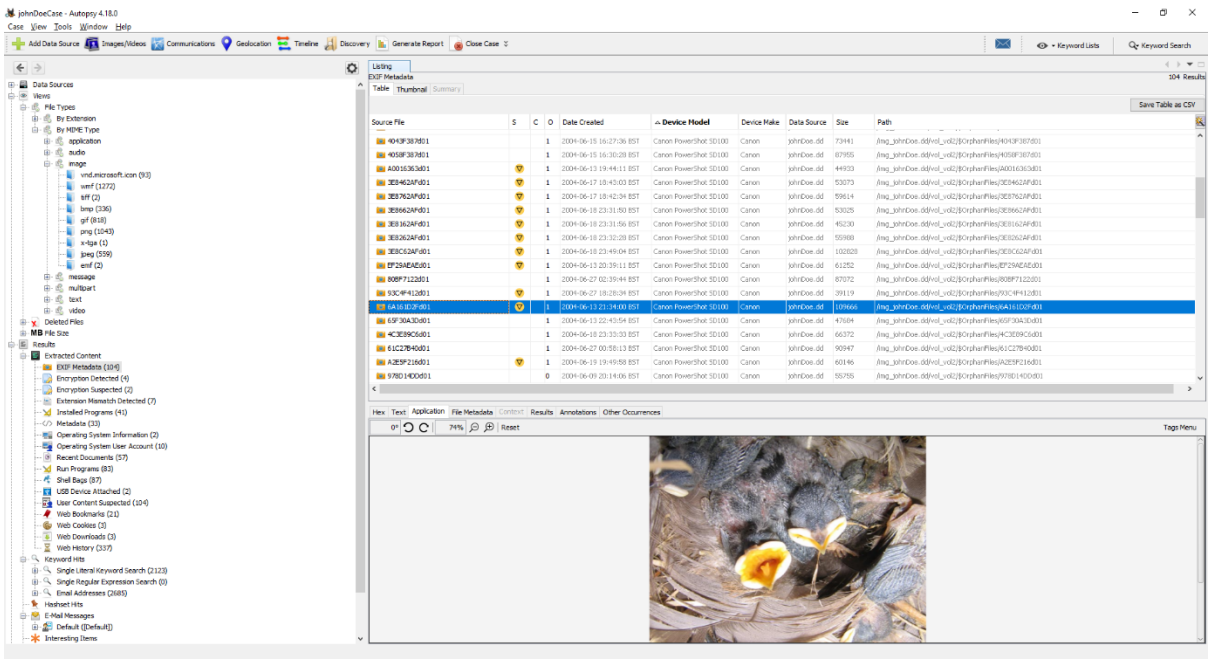


FIGURE 7, THE EXIF TAB IN AUTOPSY

To access these images, the analysts had to make use of a series of tools and techniques. These include but are not necessarily limited to file carving, email forensics, and browser analysis.

Communications

Due to the nature of the alleged crime, it is pertinent to search through any communication with any other individuals or groups that John Doe has engaged in. In this case, Autopsy managed to recover five individual emails, four of which were from ben@example.org, and one of which came from mailinglist@birds.example.org. Within these emails were eight separate media attachments, all images of an ornithological nature.

The contents of the emails in their entirety can be found in **Appendix B**, with the image attachments in **Appendix AA, IDs 35-42**.

Recent Documents

The Recent Documents tab revealed several additional things. For example, an inspection of the tab partially revealed the file structure of the removable USB drive the analysts had no access to (henceforth referred to as "E:/" or "the E drive"). An example of this would be the presence of a folder called "birds" in the root of the drive's file system, and several sub directories including "audio" and "non images".

Prefetch Analysis

When a program is run on a computer for the first time (from a specific directory), a prefetch file is made to speed up subsequent uses in the future. This can therefore be read as a list of programs that have been executed on the machine, including any non-standard

executables that may have been custom made for the viewing or creation of ornithological material. As well as this, stored within these files are timestamps of the first and last times these programs were executed.

Copies were made of the prefetch files available on John Doe's directory and transferred to the analyst's computer. From there, the open-source tool *analyzePF* was utilised to make these files human-readable and to understand the most recent times these programs were executed.

Registry Examination

All Windows computers, such as Mr Doe's, make use of a registry, a database containing items such as user settings, program installations, and recently accessed files, as well as information relating to connected devices such as serial numbers and what drive they were mounted as.

This is where key information can be gathered surrounding external storage. As well as this, things like Most Recently Used (MRU) and recent documents records can provide a clear indication that the suspect has indeed viewed and accessed ornithological material stored on the device.

The main registries examined were NTUser, Software, System, and SAM. The SAM (short for Security Account Manager) registry has information on user logins. The main aim of the investigation, therefore, was to find Mr Doe's password, which could potentially be recovered for reuse on any suspicious files that were password protected. *John the Ripper,* an open-source password recovery tool, was used to extract Mr Doe's password. The system registry contains information relating to hardware on the device, such as removable storage and the last time the computer was turned off. The software registry contains information on the programs installed on the machine and whether any of them run when the computer boots up. Finally, NTUser contains information relating to Mr Doe's account on his PC, such as his most recently viewed documents and executed applications.

The registry also makes use of log files, these detail transactions or changes that are made to the registry. For example, if a program related to viewing ornithological content was uninstalled, a record of this could be found in the software registry's log.

Mr Doe's registries and logs were copied from the disk image onto the analyst's own machine. They were then marked as read-only so that they could not be changed. Registry analysis was then carried out with the tool *Forensic Registry EDitor (FRED),* whilst *glogg* was used to view the log files.

Browser Analysis

It was found that John Doe used both Internet Explorer and Mozilla Firefox. Internet Explorer's usage was restricted to downloading Firefox and viewing other files; therefore, Firefox was analysed in more depth.

Both Internet Explorer and Mozilla Firefox stores information on the user's device, including file downloads, bookmarks, and search history to assist the user navigation. The analysts can view these files, and they have given a significant amount of information regarding the suspect's activities online.

As a user's search history is collected with dates and times, this also allowed the analysts to create an accurate timeline of events whilst building a profile of the suspect and insight into the ornithological related material that was viewed.

E-mail Analysis

John Doe made use of an email client called "Thunderbird", where he accessed his email account "jdoe@example.com". The analysts were able to recover several emails received by this account that have attachments that are explicitly ornithological. It gave the analysts insight into the suspect's network and to see if the suspect participated in the distribution of such ornithological materials.

Encrypted Archive

A file (birdpics.gpg) was found that had been encrypted by GNU Privacy Guard (GPG) and so it would not be accessible for examination without first decrypting it. Decryption of the suspect file would require access to the encryption key, which was stored in GPG's Application Data directory. Access to the key was password-protected, and so *John the Ripper* was again employed to secure the key. With the key available to the analysts, the file was decrypted and was found to be a zip file containing five pictures of an ornithological nature **(Appendix AA, 30-34)**.

Analysis

Physical Searching

Disk Analysis

Using OSFMount, a program that allows users to mount virtual drives, the analyst was able to see a single partition, labelled E:, that had a size of 2.9GB. At this point, however, other analysis that the analyst conducted on the drive had shown them that there was considerably more space being utilised on the drive. The image itself showed up in the Windows Explorer "Properties" tab as being over 5.6GB in size, and analysis using TestDisk that occurred prior to this test had shown that the majority of the space on the drive was being utilised with a wide variety of files present.

Due to this discrepancy, the analysts decided to have a further look at the drive's partition table.

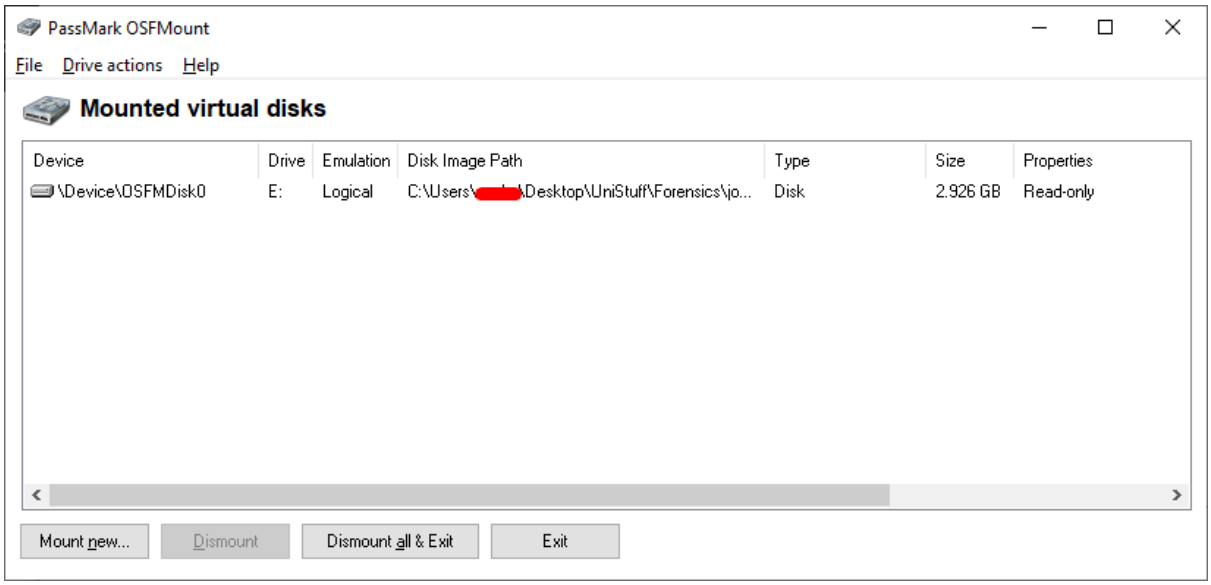


FIGURE 8, OSFMOUNT SHOWING ONLY ONE 2.9GB DISK, WHEN THE ANALYSTS KNOW THIS NOT TO BE THE CASE

Summary of the Partition Table

To confirm the suspicions of the analysts, they made use of a command-line sleuth kit tool called mmls. This tool allows a user to display all of the partitions of a selected "volume" (image in this case), alongside where each partition starts and ends, its "length", and (if the user applies the right flag) the size in bytes. The output of this tool definitively proved the analysts' hypothesis.

```
~/Desktop/jd> mmls -Bi raw johnDoe.dd
DOS Partition Table
Offset Sector: 0
Units are in 512-byte sectors

     Slot      Start        End          Length       Size    Description
000:  Meta      0000000000   0000000000   0000000001   0512B   Primary Table (#0)
001:  -------   0000000000   0000000062   0000000063   0031K   Unallocated
002:  000:000   0000000063   0006136829   0006136767   0002G   NTFS / exFAT (0x07)
003:  -------   0006136830   0011255327   0005118498   0002G   Unallocated
~/Desktop/jd>
```

FIGURE 9, PARTITION TABLE SUMMARY

Alongside this information, the information gathered from TestDisk, and later investigation with Autopsy, it has been determined that there exists a hidden drive partition of approximately 2GB in size. The description the tool gave of this partition (003) calls it "unallocated", which means that programs cannot write to the space. Due to its size as denoted both by the size of the block length number and by the "size" section, it was determined that it's likely that files that may be of interest to the team are located within the partition.

In total, a large amount of ornithological material was recovered from this volume, mostly images **(Appendix AA, Images 65-86)** with several documents included within. In addition, there was one image, Df1.jpg **(Appendix AA, Image 56)**, which was found in the recycling on the desktop. The file structure of this recovered partition can be viewed in the images below.

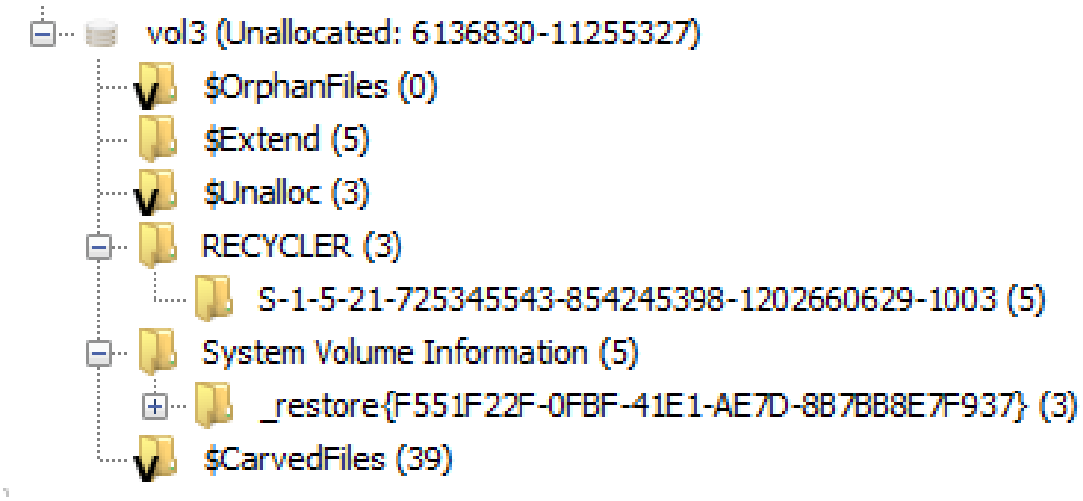


FIGURE 10, FILE STRUCTURE OVERVIEW OF VOLUME 3, AS VIEWED IN AUTOPSY

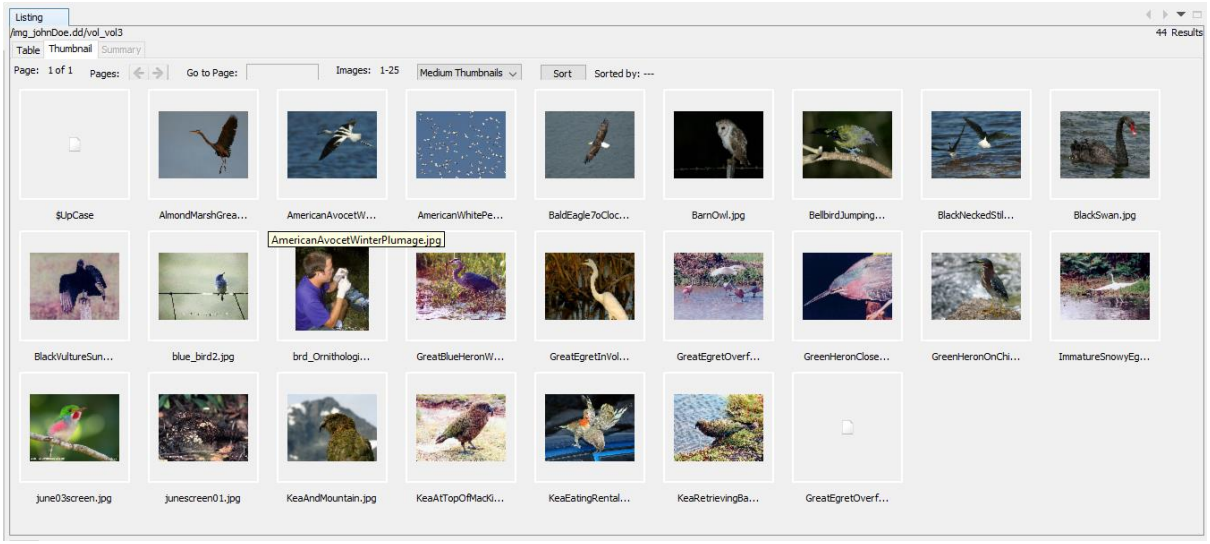


FIGURE 11, THUMBNAIL VIEW OF THE FILES FOUND IN THE HIDDEN PARTITION'S ROOT DIRECTORY

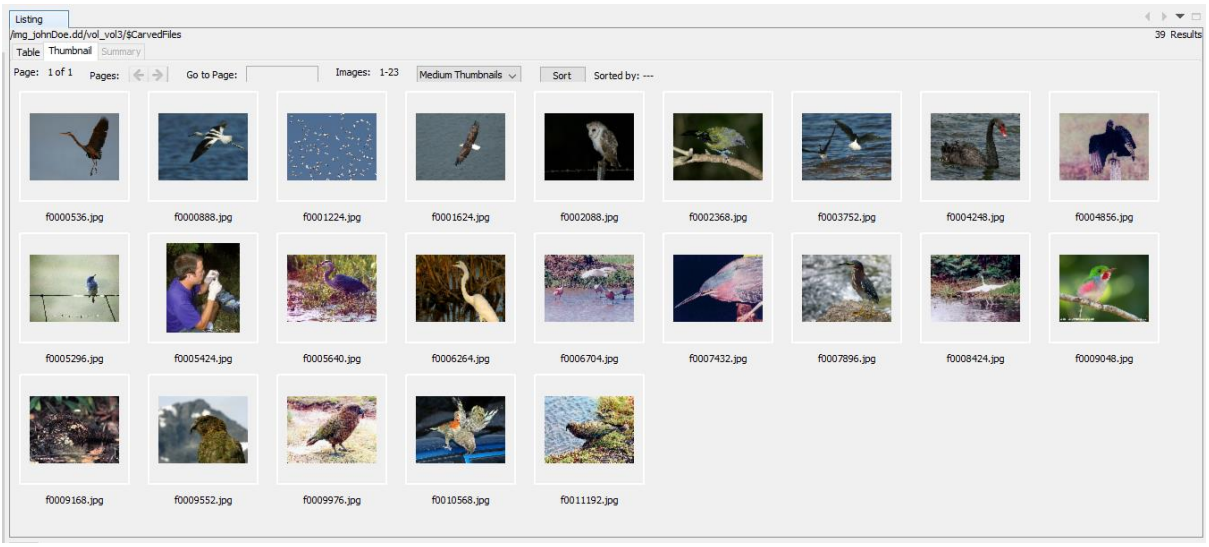


FIGURE 12, SAME AS THE ABOVE FIGURE BUT FOR THE $CARVEDFILES DIRECTORY

Images

The team were able to find 87 images of an ornithological nature, including multiple duplicates over both partitions within the image (found in **Appendix AA**), some of which were photographed in their natural habitat, but most of which were birds in some form of captivity, be they birds that have been captured to be tagged, chicks being fed or sleeping, and other assorted images of them being handled and interfered with by an individual's hands.

With regards to the ornithological images in question, there seems to be three methods of acquisition that has been used in this instance. They are:

- Images taken with the camera recovered from the scene, a Canon Powershot SD100
- Images sent to the email address jdoe@example.com

- Images acquired through other, unproven means

The first method of acquisition can be determined through Autopsy's ability to pull EXIF data from images automatically. In total, 101 images on the recovered drive were taken by the camera in question, of which 29 were determined to be illicit. Of the remaining three images for which there is EXIF metadata available, two were taken with a Canon EOS-1DS camera, and one with a SONY CYBERSHOT. However, these images do fall into the second category of images acquired through being emailed to the suspect.

As can be observed in Appendix B, there were 9 individual media attachments, of which 1 was corrupted to the point it was functionally unreadable. Of the remaining 8, 7 were images of birds themselves, and 1 was an image of what appeared to be a balloon animal version of a penguin, which the analysts do classify as bird related.

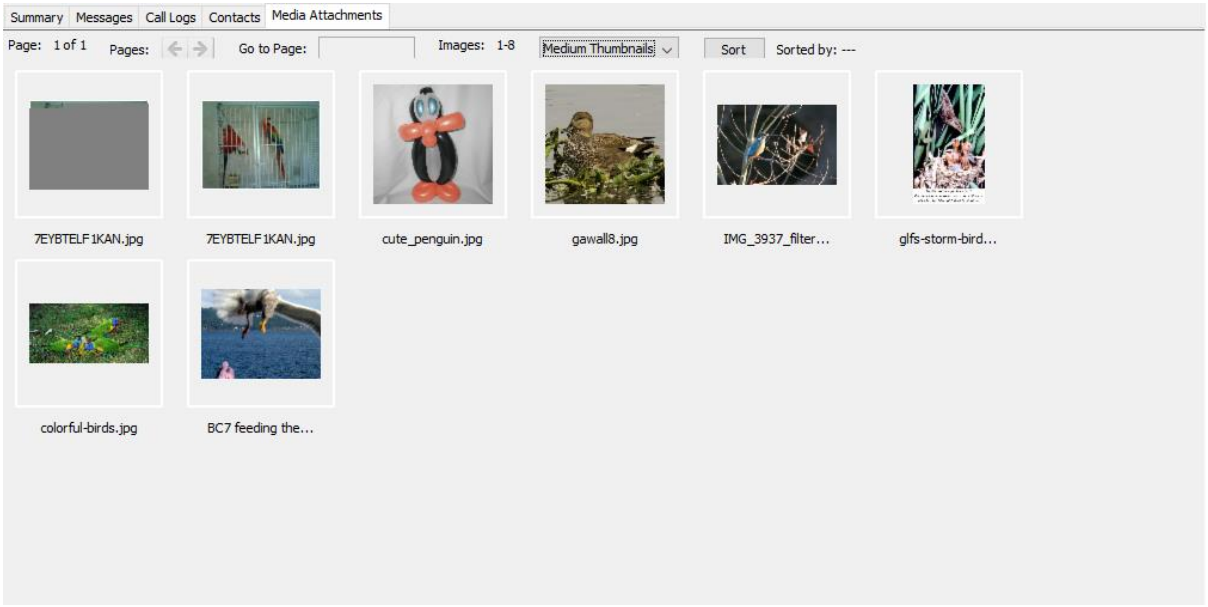


FIGURE 13, SCREENSHOT OF THE "MEDIA ATTACHMENTS" TAB IN THE "COMMUNICATIONS" PANEL IN AUTOPSY

The remaining images recovered, it can be assumed, were acquired by John Doe (or someone with access to this drive) through other means, presumably primarily through downloading from various internet-based sources.

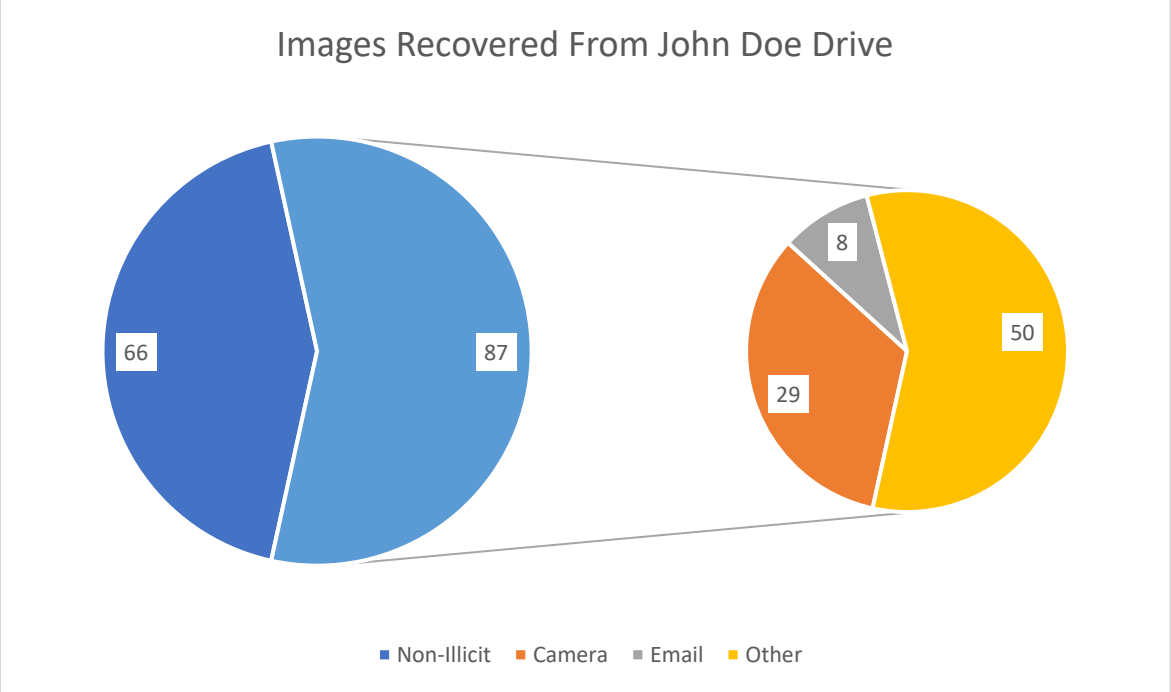


FIGURE 14, A PIE CHART BREAKING DOWN RECOVERED IMAGES BY WHETHER THEY WERE OR WERE NOT ILLICIT, AND THEN FURTHER BY ACQUISITION METHOD

Recovered from the drive also, as can be seen from the chart above, was a not inconsiderable number of "non-illicit" images. Whilst these images do not in and of themselves contain illicit ornithological material. They do seem to portray a group of individuals, presumably John Doe and his associates, based on the fact that the vast majority, if not all of these images, were probably taken with the previously mentioned Canon Powershot SD100, engaging in practices that could be referred to as looking for birds. For example**,** **Appendix AB, Images 16, 18, 24, and 51** clearly show individuals setting up birdhouses in various locations.

All images taken with the camera were taken in the period 2004-06-09 to 2004-06-27. Due to this proximity to one another and the fact that many of the individuals in question appear in multiple images, it is the opinion of the analysts that this was a holiday or extended group outing/series of outings. As such, the analysts have passed these images on to the relevant authorities for the purposes of identifying the people in these images outwith John Doe himself.

Documents

"Documents", in this instance, are classified as any file with metadata or file extensions that assigns them to one of five (but in this instance only four) types. These types are HTML, Office, PDF, Plain Text, and Rich Text (although there are no rich text docs on the image). All acquired files have been handed over to the authorities as evidence in this case.

Firstly, with regards to HTML documents, much of these results pertain more closely to browser history (which will be indexed in subsequent sections). Examples of this include HTML documents that appear to represent search engine results for the terms “bird screensavers”, “birds”, and “bird mating calls”.

Additionally, there are HTML files saved locally that represent other browsing activity, most prominently a file that appears to be the amazon page for a number of bird-related books (Garden birds by Stephen Moss, Birds Without Wings by Louis De Bernieres, and Collins Field Guide: Bird Songs and Calls of Britain and Northern Europe by Geoff Sample).

The totality of the previous files was acquired via file carving within the main partition. There are, however, three other HTML files were present in the “Documents and Settings” directory. These files are called hobbies_birding.htm, hobbies_birding_002.htm, and hobbies_birding_003.htm. The HTML source for these files are in **Appendix C, Documents F, G, and H**, respectively.

Next, we have Office files. There are only three examples of such files that are of note in this context, two of which are duplicates. There is guide.doc (also known as f0005504_An_Insiders_Guide_to_Enjoying_Your_First_Birding_Field_Trip.doc, **Appendix C, Document A**) and “birdwatching.doc” (**Appendix C, Document B**). Both guides on different facets of birdwatching, the former a guide to “enjoying your first birding field trip” and the latter a guide to birdwatching in Thailand.

After Office files come PDFs, outwith the password-protected files (that were inaccessible to the analysts due to the fact they did not have the required passwords), there were three PDFs of note, and these are as follows:

- A single page piece of promotional material for a book called “Birding sites around Perth” by Robin van Delft – **Appendix C, Document D**
- A newsletter from the University of California’s Botanical Garden, whose main theme and headline that edition was “Birds at the UCBG” – **Appendix C, Document C**
- The Porter County Birding Guide, a guide to birds around Porter County in Michigan, USA – **Appendix C, Document I**

Finally, text files. Nestboxtips.txt (**Appendix C, Document J**), f0095992.txt (identical in contents to this email from Ben Forbes), and some miscellaneous web cookies were the only text files of note. The former is a series of tips, written by an anonymous author, on how to prepare best and maintain boxes in which birds are intended to nest. The second is a story, told in the format of a joke, of a young girl who has purchased a bird for her mother, which she subsequently ate, believing it to be exotic foodstuff. And the latter is evidence that John Doe has visited some bird-related websites, which will be touched upon later in the report.

Audio files

The only audio file that was retrieved by the analysts that is of note was "aggressive_song.wav", which was stored locally and found to be an 8-second clip of birds chirping in a particularly high-pitched register.

Logical Searching

Bookmarked Pages

Mozilla Firefox stores a list of the user's bookmarks in 'bookmarks.html' and a backup of this in 'bookmarks.bak' found at 'C:/Documents and Settings/johndoe/Application Data/Mozilla/Firefox/Profiles/w4nf3obl.default/.' Inside these files are three notable links, "Free Bird Wallpaper - Bald Eagle Albatross Owl Falcon 1024x768" **Figure 31**, "Alphabetical Index of Birds" **Figure 32** and "Chickadee Karaoke" **Figure 33**. The file also lists the time they were all added in Epoch time, which aided to the timeline.

Browsing History

The analysts looked at both the Internet Explorer cache and Mozilla Firefox cache stored locally to investigate the suspect's activities online, much of which was of an ornithological nature. These cached history files were stored at:
"C:/Documents and Settings/johndoe/Local Settings/History/History.IE5/index.dat"
"C:/Documents and Settings/johndoe/Application Data/Mozilla/Firefox/Profiles/w4nf3obl.default/history.dat"

The Internet Explorer history file shows the suspect used internet explorer to install Mozilla Firefox and Mozilla Thunderbird an email client.

The Mozilla Firefox history.dat file shows that Thunderbird is again downloaded. A week later, a google search for the phrase "birds" is made, leading to visiting the site "http://www.pbs.org/lifeofbirds/" then heading to "http://www.pbs.org/lifeofbirds/songs/index.html" an area of the website used to download audio files of bird songs. **Figure 34**

The history then indicated a backtrack to the google search, followed by navigation to an Amazon search of the phrase "birds" in the book category. Two books on this site are looked at: Garden Birds (Collins Gem) Paperback – 12 April 2012 and The Secret Lives of Garden Birds Paperback – Illustrated, 30 April 2004. **Figure 35**

Another google search is made this time for the phrase "bird wallpaper", and the suspect navigates to "http://www.naturewallpaper.net/birds_L.html" from there, the suspect views 2 different bird images before clicking on an ad to buy a bald eagle and then views a product called "Bird Watchers Paradise from Choices Direct". **Figure 36**

This time a google search is done with the phrase "bird stories" the user navigated from here to a website called "http://birding.about.com" and accessed 5 different pages relating to the care of birds and the creation of bird enclosures. **Figure 37**

The user then navigates to "http://www.haiths.com/", a site dedicated to bird feeding tips with a bird feed shop. **Figure 38**

It was then found that the user navigated to Alfred Hitchcock's 1963 "The Birds" movie IMDB page and proceeded to look at the trailer for the film. **Figure 39**

The history logs show that the user then returned to the "pbs.org" site to view two more bird audio files. **Figure 40**

It was also found that the user accessed "http://www.gnupg.org/download.html", which is the download page for an encryption software also known as GNU Privacy Guard. As a file on the suspect's device was found to be encrypted with this software, it is relevant to the case. This was followed up with the access of "http://www.winpt.org/", which at the time of accessing was the download page for a taskbar front-end for GNU Privacy Guard. Finally, a user guide for the software was accessed from the University of Hannover; however, this is no longer available. **Figure 41**

Another Google search was made this time for the phrase "bird mating calls," which led the user toward the page "http://whyfiles.org/shorties/104chick_sex/" and to the download of "aggressive_song.wav." From here, a google image search was made with the phrase "young chicks", which led to the downloads of "babyscot_2weeks1.jpg" and "babyscot_vyoung.jpg". **Figure 42**

Several URLs were then accessed and had explicitly ornithological files downloaded from them: "177.jpg" from "http://www.insaneanimals.com/items/177.jpg", "ostbk2b2.htm" from "http://www.cvm.okstate.edu/instruction/kocan/ostrich/ostbk2b2.htm" (which includes ornithological images and information), "chicks2.jpg" from "http://people.cornell.edu/pages/sah67/chicks2.jpg" and "ready2fledge.jpg" from "http://people.cornell.edu/pages/sah67/ready2fledge.jpg". **Figure 43**

The last listed item in the history.dat file is a google search for the phrase "bird screensavers" followed with the access of "http://www.traveltex.com/downloads/screensavers/", and then a zipped file named "birds.zip" is stored locally. **Figure 44**

This web history shows a consistent pattern of ornithological nature, therefore ruling out any possibility of the user being misled or mistaken and indicates that the user was aware of their actions. The dates and times attached to these searches also indicate they were done by the user and not by a malicious attack on the system.

Downloaded Files

Mozilla Firefox saves a history of Downloads in a file named "downloads.rdf", which is stored within a user's personal Firefox profile. This shows any files downloaded, where they were downloaded from and lists the time and date of both the start and the end of the download. This helped find significantly more ornithological material.

On the 2nd of February 2005 at 15:12:09 GMT, “dawn.ram” was downloaded from “http://www.pbs.org/lifeofbirds/songs/dawn.ram” to “C:\Documents and Settings\johndoe\Local Settings\Temp” and was listed as taking up 1KB of storage. This file is still at this location however is listed with a storage size of 35B. This file contains a link to a publically hosted audio file called “dawn.rmd” found at “audio.pbs.org/songs/dawn.rmd”, which is a sound clip of the “dawn bird song” **Figure 45**.

On the 3rd of February 2005 at 12:22:52 GMT, “aggressive_song.wav” was downloaded from "http://whyfiles.org/shorties/104chick_sex/images/" to “E:\birds\audio\aggressive_song.wav” a removable storage disk. This device is not available to the analyst; however, after investigating the link, it is found that the file size is the same, indicating this is the same file. The file was an audio clip of several birds singing. **Figure 46**.

On the 3rd of February 2005 at 15:00:19 GMT “babyscot_vyoung.jpg” was downloaded from “http://freespace.virgin.net/cobber.budgies/images/” to “C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_vyoung.jpg” taking up 38kB. This file remains here and is the same size. The picture depicts three just-hatched birds alongside three unhatched eggs with two yellow arrows pointing toward the newly born. **Figure 47**, **Appendix AA – Bird Images 42**.

On the 3rd of February 2005 at 15:00:27 GMT “babyscot_2weeks1.jpg” was also downloaded from “http://freespace.virgin.net/cobber.budgies/images/” to “C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_2weeks1.jpg” with a listed storage size of 33kB. This file is also still on the device and depicts several birds a couple of weeks after they were born. **Figure 48**, **Appendix AA – Bird Images 43**.

On the 3rd of February 2005 at 15:01:38 GMT, “177.jpg” was downloaded from “http://www.insaneanimals.com/items/177.jpg” to “C:\Documents and Settings\johndoe\My Documents\My Pictures\177.jpg” this file still exists on the device and has the same storage size (9kB) as the download cache. The image consists of a young chick next to an unhatched egg with the caption, “Everyone says you’re too young for me”. **Figure 49**, **Appendix AA – Bird Images 44**.

On the 3rd of February 2005 at 15:02:45 GMT, “ostbk2b2.htm” was downloaded from “http://www.cvm.okstate.edu/instruction/kocan/ostrich/ostbk2b2.htm” to “C:\Documents and Settings\johndoe\My Documents\ostbk2b2.htm” this htm file still exists on the device, and the file sizes are the same, the website discussing the care for chicks as they grow. **Figure 50**, **Document E - ostbk2b2.htm**.

On the 3rd of February 2005 at 15:04:48 GMT, “birdtrans2.jpg” was downloaded from “http://people.cornell.edu/pages/sah67/birdtrans2.jpg” to "C:\Documents and Settings\johndoe\Desktop\birdtrans2.jpg" this image is still on the device, and the file size is

the same. The image shows a man holding a bird and spreading its wings, with a small device appearing to be on the back of the bird. **Figure 51**, **Appendix AA – Bird Images 2**.

On the 3rd of February 2005 at 15:05:03 GMT and at 15:05:44 GMT files “chicks2.jpg” and “newbies2.jpg” were downloaded respectively from “http://people.cornell.edu/pages/sah67/chicks2.jpg” to “C:\Documents and Settings\johndoe\My Documents\My Pictures\chicks2.jpg” and from “http://people.cornell.edu/pages/sah67/newbies2.jpg” to “C:\Documents and Settings\johndoe\My Documents\newbies2.jpg” both files are still stored locally, and both have the same file size as the one listed. “chicks2.jpg” is an image of a finger touching one of several newly hatched chicks, whilst “newbies2.jpg” is an image of several newly hatched chicks resting in what appears to be a nest of feathers. **Figure 52**, **Appendix AA – Bird Images 3 and 4**.

On the 3rd of February 2005 at 15:06:42 GMT “ready2fledge.jpg” a 77kB file was downloaded from “http://people.cornell.edu/pages/sah67/ready2fledge.jpg” to “C:\Documents and Settings\bob\My Documents\My Music\ready2fledge.jpg” although this has been stored in Bob’s user profile, it is known that it was downloaded from Doe’s account as this is referenced in Doe’s “downloads.rdf” file. The file remains on the system and has the same listed file size. The image is of several grown birds inside what appears to be a bird box. **Figure 53**, **Appendix AA – Bird Images 1**.

The last download left in the downloads cache is “birds.zip”, which was downloaded on the 9th of February 2005 at 11:28:00 GMT. The file is listed as being 1028kB and was downloaded from “http://www.traveltex.com/downloads/screensavers/birds.zip” to “C:\Documents and Settings\johndoe\My Documents\birds.zip”. The file is no longer in the listed directory; however, this may be because it was unzipped and then possibly moved. **Figure 54**

The extent of the downloads indicates these downloads were intentional and not a result of being misled or mistaken, and as the dates and times of these downloads are spaced out over the period of a week, it is unlikely that they were due to a malicious attack on the system.

Emails

The recovery of several emails received by John Doe was made possible by the access of the local cache of the mailbox used “Thunderbird”. This cache was found at “C:\Documents and Settings\johndoe\Application Data\Thunderbird\Profiles\8jiqrt8v.default”. In the file “7947277.s”, it was found that the email address used was “jdoe@example.com” with the password stored locally in Base64, “YXJyYW4=”, which decodes to “arran”.

On the 16th of October 2004 at 17:51:39 GMT, the suspect received an email from a "Bird Fanciers" mailing list (mailinglist@birds.example.com) with the subject line "How to identify birds", the paragraph below is an explanation on how to identify birds. **Email B – Subject: How to identify birds**

On the 17th of November 2004 at 18:51:39 GMT, the suspect received an email from Ben Forbes (ben@example.com) with the subject heading "good pics". The email stated that Ben thought John would "like these" when referring to the three attached images. These images (7EYBTELF1KAN.jpg, cute_penguin.jpg and IMG_3937_filtered.jpg) are of, respectively, two parrots in a cage, a penguin made from balloons and a bluebird sitting on a tree. This email also incriminates Ben Forbes, an associate of John Doe, by distributing these ornithological pictures. The email **Email C – Subject: good pics**, Images **Appendix AA – Bird Images 35,36 & 37**

Autopsy recovered a duplicate of this email, with only the 7EYBTELF1KAN.jpg file attached.

On the 17th of November 2004 at 18:51:39 GMT, the suspect also received another email from Ben Forbes (ben@example.org) with the subject line "expensive birds", which tells a story about a bird being eaten. The email **Email A – Subject: Expensive birds.**

On the 8th of February 2005 at 14:35:29 GMT, the suspect received another email from Ben Forbes (ben@example.org), this time with the subject line "some more good ones", in the email, Ben thanks Joe for "the pics you sent me", indicating that Joe has distributed pictures to Ben, in return Ben attaches 5 pictures of birds to his email. "gawall8.jpg" a picture of a bird sitting in some water, "colorful-birds.jpg" 3 brightly coloured birds are sitting on some grass, "glfs-storm-birds.jpg" a bird feeding 3 baby birds, "BC7 feeding the birds.jpg" what looks to be a seagull flying off after taking food from a gloved hand and "IMG_3937_filtered.jpg" the same image that was sent in the first email. The email **Email D – Subject: some more good ones** and Images **Appendix AA – Bird Images 36, 37-41**.

Prefetch Analysis

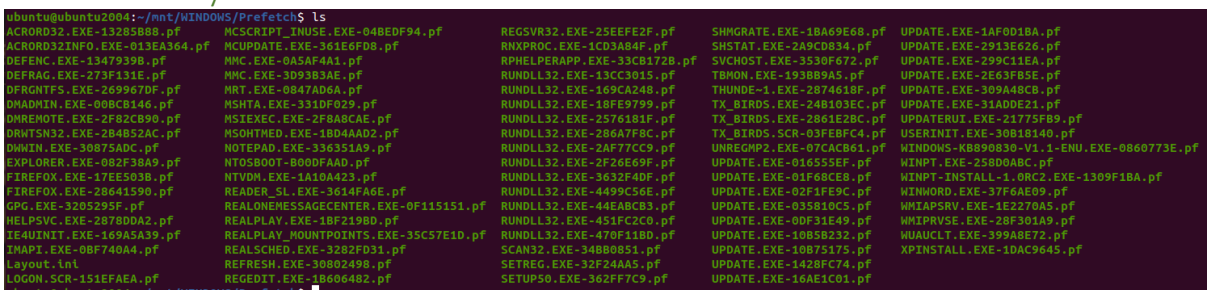


FIGURE 15, THE FULL LIST OF PREFETCH FILES ON JOHN DOE'S MACHINE

Contained within John Doe's prefetch files are several programs that have been utilised either for ornithological content or to try and remove evidence from his device.

Regedit is a tool used to edit registry keys. From the existence of a prefetch file, the analysts know that this has been run at some point, but it is not clear if or how it has made changes to the registry.

Tx_birds.exe has multiple entries meaning it was run from many separate places on the machine. This was found to be a Windows executable file which, when run with the emulator *wine*, created a screensaver containing 9 pictures of birds **(Appendix AA, 45-53)**.

GPG has been run and was used to encrypt the zip file of birds detailed earlier.

Registry Analysis

Examination of the system registry was carried out first. This showed that the last shutdown time of the machine was 09.02.2005 at 17:10:01 and that John Doe's account was the last user on this machine. This can therefore be considered the end of the timeline of events on this machine. A number of devices were connected to Mr Doe's machine, details of which can be found in Appendix E **(figures 4-6)**

Of particular interest among these devices was a USB drive (serial number 071A190F01DF) that had been attached to the suspect's computer and was mounted as the E: drive, which was the drive that stored the encrypted bird pictures detailed earlier in this report.

Analysis of the software registry revealed the programs that had been installed on the machine. This included the Mozilla Firefox browser used as well as the encryption software utilised to encrypt the zip file of ornithological material. No suspicious programs were found to be run at start-up, only antivirus software, nor were any suspicious programs found to have been run recently.

Finally, within the NTUser registry is a list of files that have been accessed most recently. From examining this list, it was clear John Doe had intentionally accessed various photos, texts, and sound files of an ornithological nature.

Key	Type	Value
MRUList	REG_SZ	bajihgfedc
a	REG_SZ	C:\Documents and Settings\johndoe\My Documents\newbies2.jpg
b	REG_SZ	C:\Documents and Settings\bob\My Documents\My Music\ready2fledge.jpg
c	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\7107298.jpg
d	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\wbpremium_s.jpg
e	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\40m.jpg
f	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_vyoung.jpg
g	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_2weeks1.jpg
h	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\177.jpg
i	REG_SZ	C:\Documents and Settings\johndoe\Desktop\birdtrans2.jpg
j	REG_SZ	C:\Documents and Settings\johndoe\My Documents\My Pictures\chicks2.jpg

FIGURE 16, AN EXAMPLE OF AN MRU LISTING RECENTLY ACCESSED BIRD MATERIAL

Log files were attempted to be examined for any removed programs or to find evidence of any registry changes that were made by *regedit*. The log files, however, were virtually empty, each one only being a mere 1kb in size. To ensure that there was not an error in the copying, an md5 hash was taken of both the original and the copied log files, which contained no discrepancies. The software utilised was able to open log files of the analyst's own machine and so appeared to be working as intended. This, therefore, means that methods of analysing the logs were accurate, the issue lies with the log files themselves. After this, a backup was searched for, but there appeared to be none on Mr Doe's device. There is no current evidence that the log files were tampered with by John Doe.

Timeline Reconstruction

13/06/2004 – 27/06/2004

Over this period, 29 pictures of an ornithological nature are taken with the “Canon PowerShot SD100”.

02/02/2005

14:11:46 – Google search for “birds” is done by John Doe
14:15:42 – Google search for “bird wallpaper” is done by John Doe.
14:22:25 – Google search for “bird stories” is done by John Doe.
14:50:55 – Regedit is utilised
15:12:09 – “dawn.ram” is downloaded
15:57:40 – Google search for “windows gnpupg” and subsequent download of GnuPG
16:25:10 – The photos within the encrypted zip file are saved to the system
16:46:32 – birdpics.gpg is created as an encrypted file
16:54:20 – Adobe Reader is downloaded.

03/02/2005

12:21:40 – Google search for “bird mating call” is done by John Doe.
12:22:52 – “aggressive_song.wav” is downloaded.
15:00:19 – “babyscot_vyoung.jpg” is downloaded.
15:00:27 – “babyscot_2weeks1.jpg” is downloaded.
15:01:38 – “177.jpg” is downloaded.
15:02:45 – “ostbk2b2.htm” is downloaded.
15:04:48 – “birdtrans2.jpg” is downloaded.
15:05:03 – “chicks2.jpg” is downloaded.
15:05:44 – “newbies2.jpg” is downloaded
15:06:42 – “ready2fledge.jpg” is downloaded by John Doe’s profile but saved in Bob's documents folder.

09/02/2005

11:08:08 – John Doe’s emails are synced to the installed email client “Thunderbird”.
11:27:00 – Google search for “bird screensavers”
11:28:00 – “birds.zip” is downloaded from John Doe’s Firefox profile.
15:50:27 – The screensaver “tx_birds” is used.
17:10:01 – The last shutdown of the system before seizure. This concludes the timeline.

Conclusions

In total, 87 images of an ornithological nature have been recovered from John Doe's computer, as well as bird adjacent content such as the pictures of bird costumes and bird watching guides.

There is also a clear record of Mr Doe being in contact and exchanging bird pictures with a Mr Ben Forbes, some of which provided a metadata analysis that showed they were taken on John Doe's own camera. Also contained within these communications, and examination of certain images, is information relating to a birdwatching trip attended by Mr Doe and Mr Forbes, as well as several other unnamed individuals. Doe's images from this excursion were then stored on his computer.

From the analysis of his online browsing, it is concluded that John Doe has intentionally accessed various online sites which provided images of birds and information relating to them. This was carried out with the intention of adding these pictures to his own collection of illegal material.

To cover up some of his illegal possessions and activities, Mr Doe has employed several techniques. He has created a separate partition on his disk drive that was hidden and unviewable if using the computer normally. This, along with the USB drive found from registry examination, was used to store illegal photos of birds away from the eyes of other users on the computer. He also employed the use of the program GNU Privacy Guard to encrypt ornithological content so that it could not be viewed without his decryption key. The analysts also note that a tool to edit the computer's registry has been used, but without reliable logs to examine, it is not clear what changes were carried out.

To conclude, Mr John Doe did indeed possess a sizeable collection of illegal bird pictures. From the evidence gathered in this report, it is the opinion of the analysts that Mr John Doe is in offence of the crime of possession, creation, and distribution of illegal ornithological material.

Contributions

Isaac Basque-Rice

- Disk Imaging
- Analysis Methodology/Physical Search
- Analysis/Physical Search

Ethan Law

- Registry Examination
- Prefetch Analysis
- Cryptography

Lukas Smith

- Browser Analysis
- E-mail Analysis
- Analysis/Logical Searching/Bookmarked Pages
- Analysis/Logical Searching/Browsing History
- Analysis/Logical Searching/Downloaded Files
- Analysis/Logical Searching/Emails
- Timeline Reconstruction

Glossary

- **Binaries** - files that contain compiled code, like an executable, that a user can run
- **Directory** - another word for folder
- **EXIF** - Exchangeable Image File Format, the standard that specifies information in image files (such as camera make and model, and location of where the image was taken)
- **Encryption** - converting readable data into unreadable data. Decryption reverses this process. A key is a random string of characters specifically for converting encrypted data to unencrypted, and vice-versa
- **GB** - Gigabyte, 1 GB is equal to one billion bytes
- **GUI** - Graphical user Interface
- **HDD** - Hard Disk Drive
- **HTML** - HyperText Mark-up Language, the scripting language in which the contents of most websites are written
- **Hash** - a function that converts one set of data (in this case, a hard drive) to another (in this case, a fixed value)
- **IA** - Ian's Angels
- **IMDB** - Internet Movie Database
- **KB** - Kilobytes, 1KB is equal to a thousand bytes
- **MD5** - a specific algorithm that hashes a supplied data set. MD5Sums are the result of this hash
- **Metadata** - data that describes other data
- **NTFS / exFAT** - Microsoft's proprietary file systems (a set of structures and constructs in software, built into an operating system that manages files of all types). NTFS is the newer of the two
- **One-liner** - a command that can be executed on the console or command line in a single line
- **PDF** - Portable Document Format, a standard file format designed to present documents
- **Partition** - A section or division of a hard disk, normally user created, that allows for one physical disk to act as multiple in software
- **RDP** - Remote Desktop Protocol, a method of connecting to and controlling one computer from another over the internet
- **USB** - Universal Serial Bus, a connector that allows the transfer of power and info from one device to another. colloquially, USB tends to refer to a pen drive or USB drive, a method of storing data externally from a computer
- **Ubuntu** - a Linux-Based Operating System

- **VM** - Virtual Machine, a computing concept that allows users to emulate one operating system (the "guest") inside another (the "host")

Equipment Required for Court Proceedings

For the findings of this report to be presented in a court setting, the following equipment is required:

- Hardware:
  - Computer with internet access, capable of running various tools.
  - Display device of adequate size with an HDMI port (i.e., monitor, projector, television)
  - HDMI cable
  - Relevant power cables
  - Image of John Doe drive
  - Keyboard
  - Mouse
- Software:
  - Linux-based operating system (the assessors used Debian-based operating systems such as Ubuntu and Kali Linux for the assessment)
  - Microsoft Windows Operating System
  - Autopsy/SleuthKit
  - Md5 hash command line feature
  - Foremost
  - Metacam
  - Glogg
  - Forensic Registry Editor (FRED)
  - AnalyzePF
  - John The Ripper
  - OSFMount
  - TestDisk

References

Carrier, B., n.d. *The Sleuth Kit (TSK) & Autopsy: Open Source Digital Forensics Tools.* [Online] Available at: http://www.sleuthkit.org/
[Accessed 17 April 2021].

University of California Botanical Garden, 2001. University of California Botanical Garden Newsletter. *University of California Botanical Garden Newsletter,* 26(2), pp. 1-12.

Appendices

Appendix A – Images

Appendix AA – Bird Images

Image ID	Image	Image Name on Disk
1		ready2fledge
2		birdtrans2
3		chicks2

4		newbies2
5		A0016363d01
6		3E8462AFd01

7		3E8762AFd01
8		3E8662AFd01
9		3E8162AFd01

10		3E8262AFd01
11		3E8C62AFd01
12		EF29AEAEd01

13		93C4F412d01
14		6A161D2Fd01
15		A2E5F216d01

16		A3D4DDDDd01
17		BellbirdJumpingOffBranch
18		BC7 feeding the birds

19		f0382464
20		f0415008
21		f0416072

22		f0438640
23		f0439400
24		f0440944

25		f0441536
26		f0443520
27		f0526960

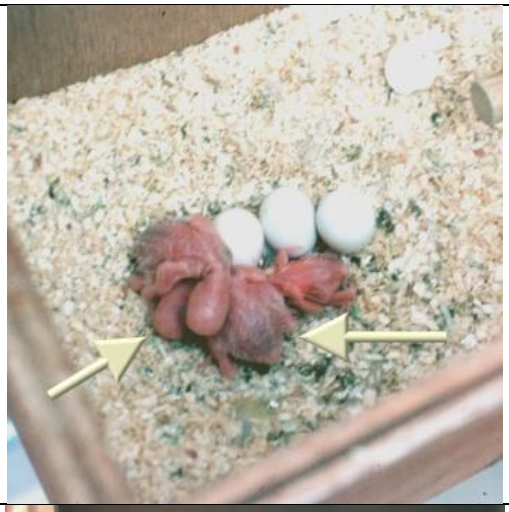
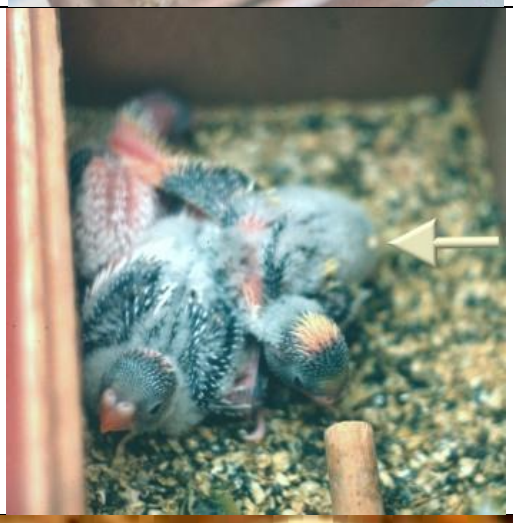
28		f0592136
29		f0002368
30		E:\birds\birdpics\WhiteFaced HeronFlying.jpg

31		E:\birds\birdpics\WhiteFrontedParrot.jpg
32		E:\birds\birdpics\WhiteThroatedSparrowInTree.jpg
33		E:\birds\birdpics\Whooping Cranes.jpg

34		E:\birds\birdpics\yellow-wag-cover-nb.jpg
35		7EYBTELF1KAN.jpg
36		IMG_3937_filtered.jpg

37		cute_penguin.jpg
38	 *Nesting red-winged blackbird/ Carouge à épaulettes en cours de nidification Mike Hopiak / Cornell Lab of Ornithology*	glfs-storm-birds.jpg

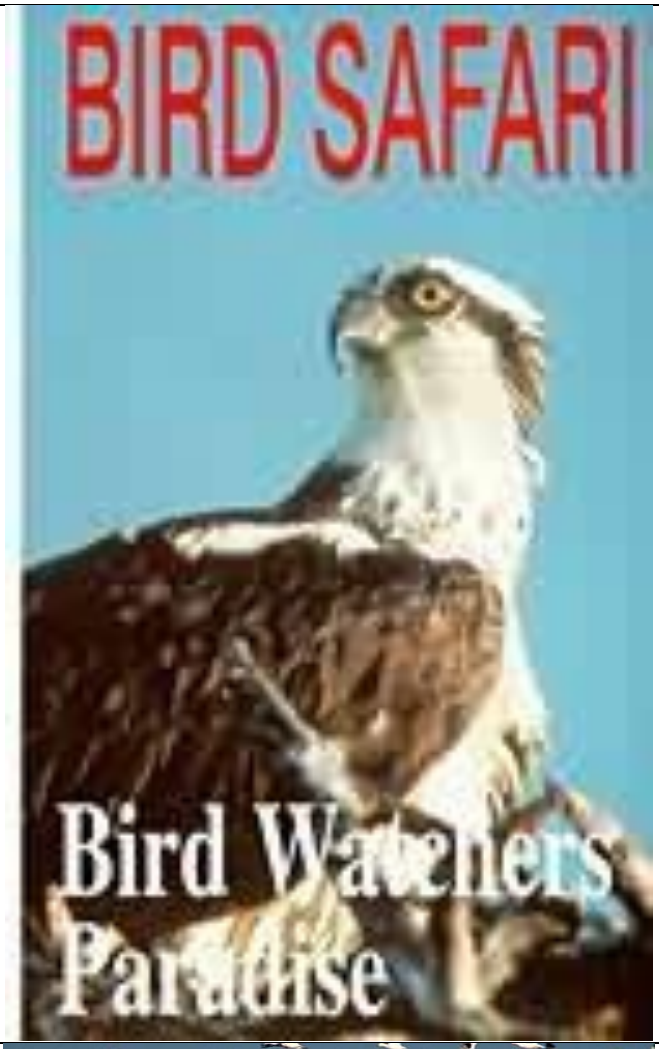
39		colorful-birds.jpg
40		IMG_3937_filtered.jpg
41		gawall8.jpg

42		babyscot_vyoung.jpg
43		babyscot_2weeks1.jpg
44		177.jpg
45		tx_birds.scr

46			tx_birds.scr
47			tx_birds.scr
48			tx_birds.scr
49			tx_birds.scr
50			tx_birds.scr
51			tx_birds.scr

52		tx_birds.scr
53		tx_birds.scr
54		31873-978D14DDd01.jpg
55		f0360392.jpg

56		Df1.jpg
57		40m.jpg

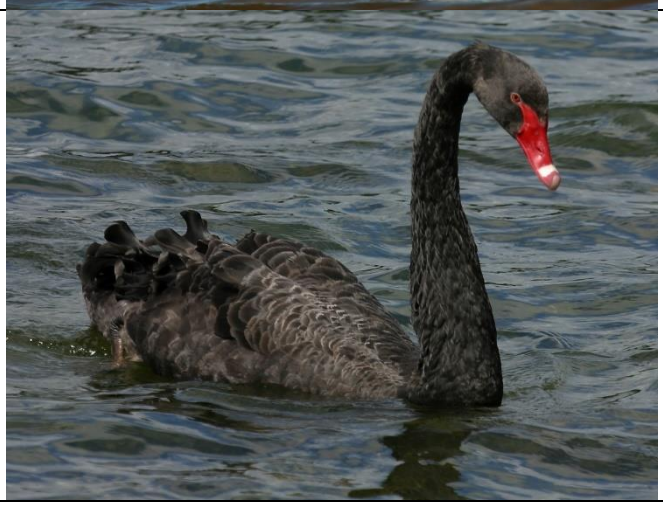
58		7107298.jpg
59		Snow_geese.jpg

60		tn_duck.jpg
61		Wbpremium_s.jpg

62		frankbeecostume_1827_34457581.jpg
63		frankbeecostume_1827_96360352.jpg

64		FantailFrontView.jpg
65		BaldEagle7oClock.jpg
66		GreatEgretOverflyingRoseate Spoonbills.jpg

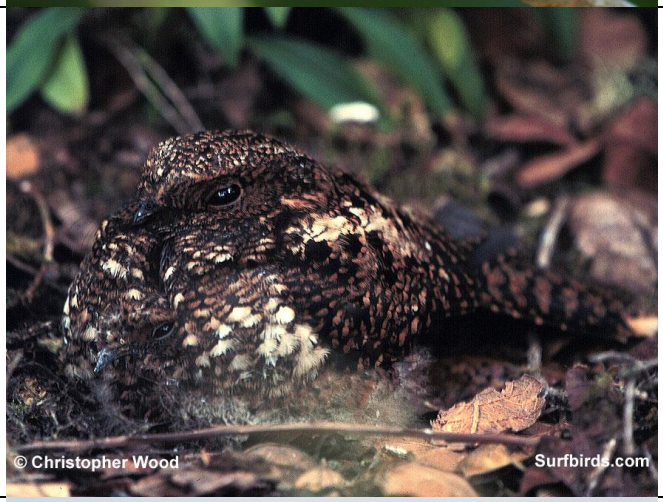
67		AlmondMarshGreatBlueHeronStalling.jpg
68		AmericanAvocetWinterPlumage.jpg
69		AmericanWhitePelicansCircling.jpg

70		BellbirdJumpingOffBranch.jpg
71		BlackNeckedStiltsFromBehind.jpg
72		BlackSwan.jpg

73		BlackVultureSunningOnPost.jpg
74		blue_bird2.jpg
75		brd_Ornithologist_TWG.jpg

76		BarnOwl.jpg
77		GreatBlueHeronWithFish.jpg
78		GreatEgretInVoloBog.jpg

79		GreenHeronCloseup.jpg
80		GreenHeronOnChicagoLakeshore.jpg
81		ImmatureSnowyEgretTakingOff.jpg

82		june03screen.jpg
83		junescreen01.jpg
84		KeaAndMountain.jpg

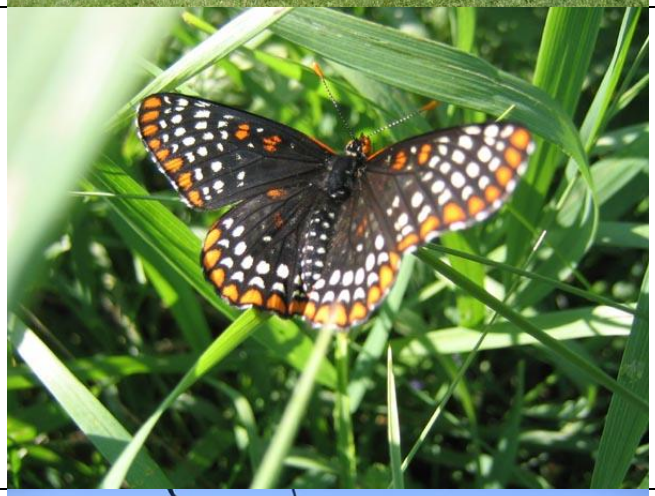
85		KeaAtTopOfMacKinnonPass0930.jpg
86		KeaEatingRentalCar.jpg
87		KeaRetrievingBakedBeanCanFromTarn.jpg

Appendix AB – Non-Bird images

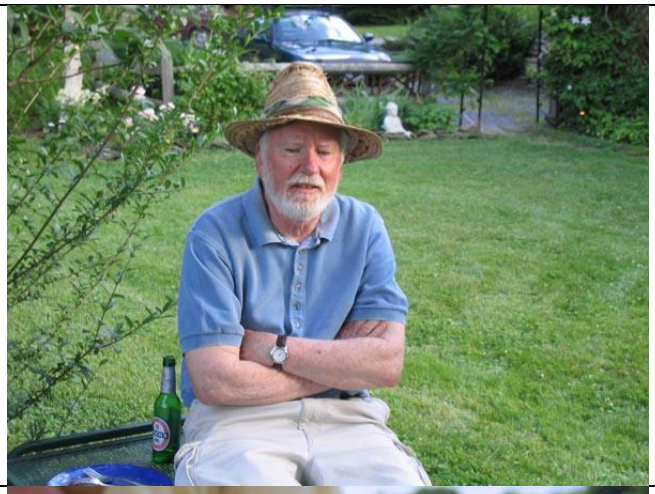
Image ID	Image	Image Name on Disk

1		31813-A9E5105Ad01.jpg
2		31815-7013F58Dd01.jpg
3		31817-6F61F39Dd01.jpg

4		31909-A8331696d01.jpg
5		31911-FC6938FDd01.jpg
6		31913-B76BD0AEd01.jpg

7		31917-D8829E69d01.jpg
8		31921-AA784519d01.jpg
9		31923-D19FCBF6d01.jpg

10		31931-BF5BE9D9d01.jpg
11		31933-BF4BE9D9d01.jpg
12		31935-8F5F3282d01.jpg

13		31865-61C27B40d01.jpg
14		31883-FB4EDA00d01.jpg
15		31885-FB4DEA89d01.jpg

16		31887-7E37FA89d01.jpg
17		31889-D192AAB2d01.jpg
18		31891-B9D470B5d01.jpg

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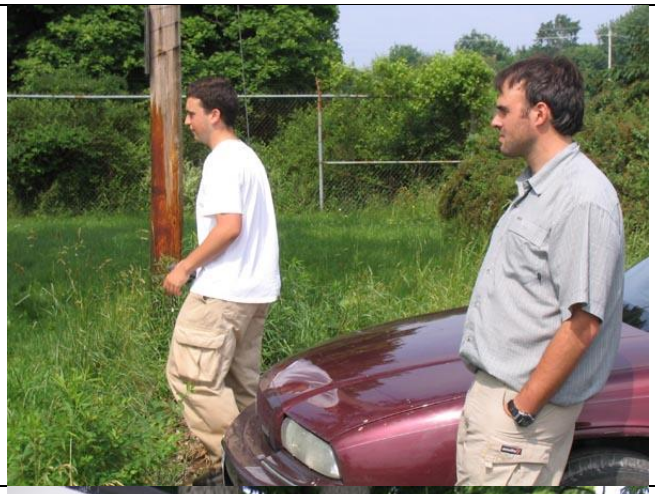
25		31923-D19FCBF6d01.jpg
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27		31933-BF4BE9D9d01.jpg

28		31935-8F5F3282d01.jpg
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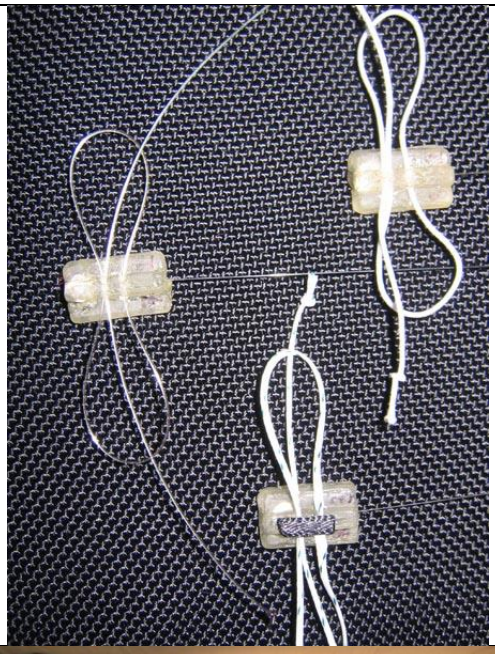
30		31939-5E5570B4d01.jpg

31		31941-848752E7d01.jpg
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37		31953-884B7041d01.jpg
38		37125-f0348056.jpg
39		37153-f0378088.jpg

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47		37255-f0432032.jpg
48		37265-f0438992.jpg

49		37291-f0457096.jpg
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52		37370-f0494144.jpg
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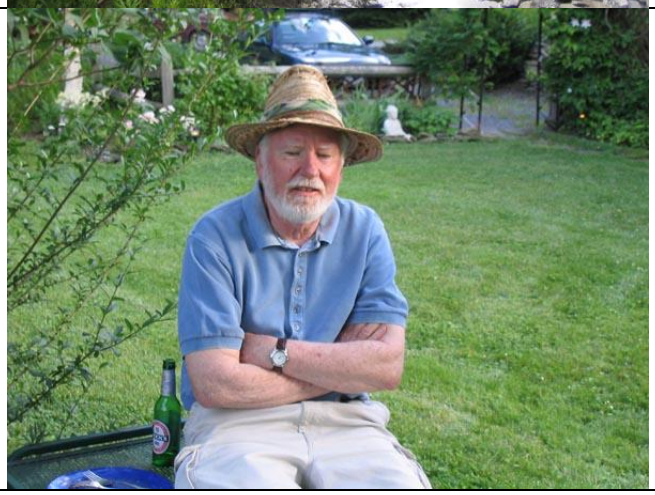
54		37406-f0508024.jpg

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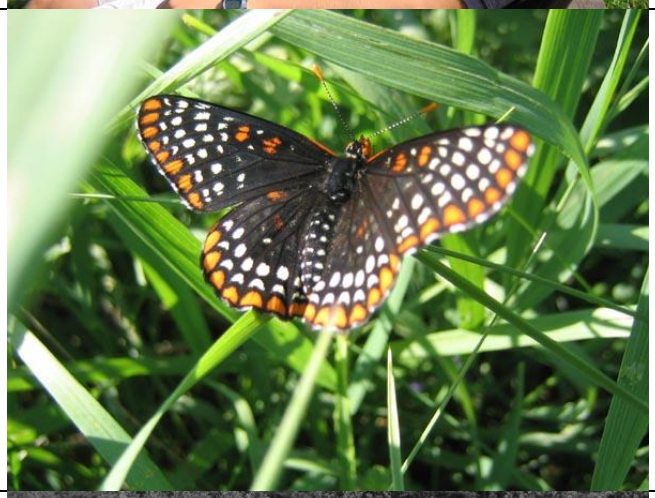
56		37418-f0522304.jpg
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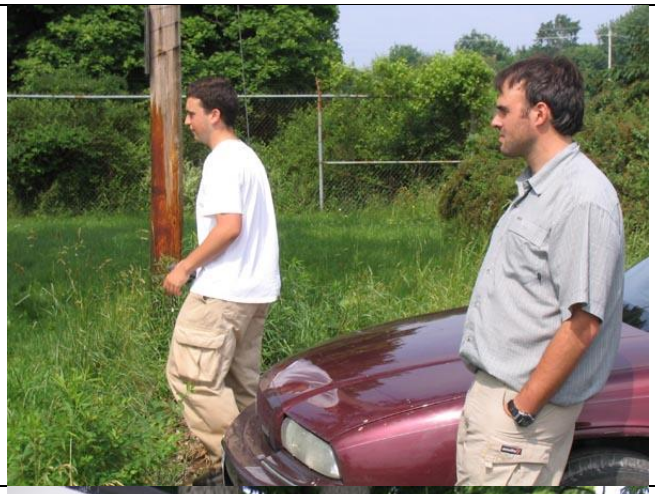
61		37433-f0529544.jpg
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63		37457-f0544152.jpg

64		37461-f0545184.jpg
65		37471-f0552688.jpg
66		37507-f0561264.jpg

Appendix B – Emails

Email A – Subject: Expensive birds

from ben@example.org

A young woman was walking past a pet shop and saw an exotic, white cockatoo for sale. The price was $6000. She entered the store and asked the clerk why the bird was so expensive. The clerk told her that the bird spoke 6 different languages. "Does it speak English?" asked the woman. "Of course it does!" said the clerk.

The woman thought about her mother who was multi-lingual, a bit of a recluse and lived all alone.

She decided to purchase the bird and send it to her mother as a companion. She paid for the bird and made arrangements for it to be delivered. The following day, the woman telephoned her mother. "Mama, did you like the cockatoo that the analystssent you?" "Oh it was delicious!" she replied." "Mama, what do you mean delicious?" "I made soup out of it."

"But mama, that bird spoke six different languages!"

"Oh dear! Why didn't it say something?"

Email B – Subject: How to identify birds

from mailinglist@birds.example.com

How to Identify Birds

Are you amazed at how quickly birders can identify birds? Actually, it's just like getting to know your human neighbors. When you move into a new neighborhood everyone is a stranger, but soon you learn to tell people apart as you unconsciously catalog their characteristics. Their habits, shape, styles of walking, and "habitats" become familiar enough that you can recognize each neighbor immediately, even at a distance.

Paying attention to individual differences can help you identify birds, too. You can recognize many birds simply by noting their shapes, even if seen only in silhouette. Other useful characteristics are a bird's posture, size (easiest to judge if you use familiar birds as a size reference), flight pattern and/or head-on flight profile, and the kind of habitat in which the bird was seen.

Start by learning to identify general groups of birds- warblers, flycatchers, hawks, owls, wrens- whose members all share certain similarities. As your observation skills improve, familiarize yourself with the field marks- colored or patterned areas on the bird's body, head, and wings- that help distinguish species.

Email C – Subject: good pics

from ben@example.org

Hi thought you'd like these

Enjoy

Attachment(s):

/img_johnDoe.dd/vol_vol2//$CarvedFiles/f0005296.mbox/7EYBTELF1KAN.jpg **(Appendix AA, 35)**

Email D – Subject: some more good ones

from ben@example.org

Thanks for the pics you sent me here are some the analystsreally like

Attachment(s):

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/glfs-storm-birds.jpg **(Appendix AA, 38)**

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/gawall8.jpg **(Appendix AA, 41)**

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/BC7 feeding the birds.jpg **(Appendix AA, 18)**

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/colorful-birds.jpg **(Appendix AA, 39)**

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/IMG_3937_filtered.jpg **(Appendix AA, 40)**

Email E – Subject: good pics

from ben@example.org

Hi thought you'd like these

enjoy

Attachment(s):

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/7EYBTELF1KAN.jpg **(Appendix AA, 35)**

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/cute_penguin.jpg **(Appendix AA, 37)**

/img_johnDoe.dd/vol_vol2/Documents and Settings/johndoe/Application Data/Thunderbird/Profiles/8jiqrt8v.default/Mail/Local Folders/Inbox/32643-IMG_3937_filtered.jpg **(Appendix AA, 40)**

Appendix C – Miscellaneous Documents

Document A - f0005504_An_Insiders_Guide_to_Enjoying_Your_First_Birding_Field_Trip.doc & guide.doc (identical content with differing filenames)

An Insider's Guide to Enjoying Your First Birding Field Trip

by Pete Dunne

Field trips are a lot like going to a dance, and there are two schools of thought. You can just waltz onto the dance floor and let the other person lead or you can learn a few basic dance steps beforehand. Here, for those who want to get a jump on etiquette, are some of the basic rules of the birding field trip. Learn them, and you'll spend more time birding and less time tripping over your feet.

- **Rule 1 - Never miss an opportunity to use a restroom.**

Your capacity for birding may be limitless but your bladder is not. Some leaders are generous with their planned rest stops; some are miserly. Whenever the group arrives at a planned rest stop, take full advantage {and mind your coffee consumption between stops).

- **Rule 2 - Familiarize yourself with whatever pre-trip information is sent.**

Most organized field trips come with instructions. In the pre-trip material, you will almost certainly find the answers to your most pressing questions: dress, equipment needs, time commitment, lunch plans. Being prepared is the first step toward having a great time.

Re: Clothing. Rule of thumb: In winter, if in doubt, just bring it. In hot weather, cover up for sun protection-this means hat, long-sleeved cotton shirt, long pants. At any time of year, avoid bright colors, particularly white. In the universal language of wild creatures, white means "Danger! Watch Out! Hide ! It's not the message you want to send.

- **Rule 3 - Don't be late.**

When you join a group, you sacrifice a measure of self-determination. One of the quickest ways to annoy the group leader and everyone else, is to arrive late and delay the group's departure.

- **Rule 4 - Don't wander off.**

The second quickest way to annoy the group leader is to wander off. You don't want to be left behind and you don't want to be the focus of an unnecessary search. If you plan to leave the group, for a short time or for the balance of the day, be certain you inform the leader.

It is in your interest to stay close to the leader and the more experienced members of the group so that you can rely on their knowledge and bird-finding skills.

Staying close applies to car caravanning, too. The rule of thumb is one car length back for every ten miles per hour of velocity. Thirty miles per hour; three car lengths behind the bumper ahead of you. Sixty miles per hour; six lengths. Don't trust yourself to keep the pace? Don't drive. Car-pool with someone else.

- **Rule 5 - Come prepared.**

If the trip involves driving, make sure you have enough fuel to see you through. If the instructions state "bring lunch," don't assume that you'll be able to stop at a convenience store to pick up a sandwich. Do that, and you'll likely be eating alone.

- **Rule 6 - Check out your equipment before the trip.**

The single greatest frustration first-time trip goers face in not inexperience, but rather the lousy or malfunctioning equipment - usually optics.

If your binoculars aren't working, ask whether a loaner is available. It you don't own binoculars, do not rush out to the nearest discount store and buy some for the trip. People who do this usually end up with instruments they soon replace. Borrow binoculars for the trip. Use your field trip experience to see what instruments experienced birders are using in order to make an educated purchase later.

- **Rule 7 - Speak Softly.**

Human voices put wildlife on alert. Talking may also prevent a leader from hearing songs or calls and keep you from hearing instructions. Field trips are social and conversation is part of the field trip experience. If you want to converse, do so in whispers or stand away from the group.

- **Rule 8 - Keep motion to a minimum.**

More than sound, birds react to motion. In close proximity to birds, don't move quickly and above all do not advance until the leader gives the word. Want to draw the ire of a group? Walk toward "the bird of the day" and scare it away.

- **Rule 9 - Don't monopolize the leader.**

Sure you have questions. Sure you want to get to know the leader, and you want them to come to recognize your wonderful qualities, too. One of those qualities should be deference, because everyone in the group shares your ambition. Deference extends to use of the spotting scopes, too.

When the leader trains his scope on an interesting bird, and you were first to get a glimpse last time, defer to others the next several times. No matter what your place in line, first looks through a scope are quick looks. After you get an identifying glimpse, step quickly aside for the next person. If the bird is moving, reposition the scope so the next user won't have to pan back and forth. After everyone has had their glimpse, more leisurely viewing is possible.

- **Rule 10 - Do ask questions.**

Leaders want to share their knowledge, and questions are the catalyst that unlocks it. Don't be intimidated by what you don't know or what you presume that others know. Chances are your question is shared by others in the group. You may not be the leader, but if you trigger the answer to a question that some other member of the group was too shy to utter, you'll be their hero. That's it. All you need to know to get the most out of your first field trip experience. If it seems like too much to remember, just remember Rule #1. At any other time, there will be someone else around to ask for assistance.

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Document B – birdwatching.doc

BIRDWATCHING IN THAILAND
Feathered Magic from Mangroves to Mountaintops by Antony Lynam

One of the great attractions for nature tourists visiting Thailand is the diversity of environments extending across mountain peaks, lowland rainforests, mangroves, coral reefs, farmland and urban jungles. Within a day, or even a few hours travel, one can easily make the transition between these places and witness natural marvels large and small.

For wildlife enthusiasts no group maintains interest and pleasure more than birds. While special efforts are required to see in the wild charismatic species such as elephants and primates, birds are found across the entire spectrum of environments from pristine to severely degraded areas.

Part of the attraction for birds lies in their diversity. Nine hundred and seventy eight bird species have been recorded in Thailand, approximately 10% of the world's total. At the Isthmus of Kra between latitudes 11° and 13°N, a major biogeographic transition between Indochinese and Sundaic forests produces a special diversity of birds with a total of 152 species of birds reaching the northern or southern range limits of their geographic ranges.

Two-thirds of Thai birds are residents, the remainder are seasonal visitors. Locations where migrants congregate, often in large numbers, are highly accessible making Thailand a special destination for birdwatchers.

Many birds are susceptible to human disturbance because they have small geographic ranges, a result of specific habitat requirements. For example, Deignan's babbler - a non-descript forest bird is found on Doi Chiang Dao and nowhere else in the world. Gurney's pitta are only found in lowland rainforests. Fewer than 30 birds remain in the last known population in Thailand at Khao Nor Chuchi, Krabi. Efforts by local and international conservation agencies strive to increase protection efforts and reafforest areas encroached by rubber farmers, though time is running out. With approximately 20% of the birds found in Thailand being globally or regionally endangered species, this makes the country a birdwatching haven for bird enthusiasts.

IDENTIFYING BIRDS

Birds are distinguished first by their size and shape. They range from diminutive flowerpeckers, sunbirds and white-eyes, about the size of your index finger, to lanky storks and egrets that stand almost a metre tall, and Green peafowl with its spectacular

2m tail. The form of the beak offers vital clues about the bird's diet. For example a thin curved tube for sipping nectar or a sharp hook for tearing flesh. The pattern and colour of plumage can tell apart the sexes as in pheasants where males are bright and striking, and females are drab and dowdy. By far the most useful character for identification is a bird's voice. This is especially true in forests where on average 90% of birds are hidden from view. The most experienced birdwatchers in the tropics know their songs and calls.

BEST TIMES TO SEE BIRDS
The nesting season is a good time to be watching birds. During this most active time in a bird's life a variety of vocalizations and behaviours are exhibited. In Thailand, as in other tropical countries, the nesting season coincides with the period when food is in abundant supply. A bird expends much energy in courting, mating, incubating eggs, defending a nest and feeding offspring. Most birds nest during the transition between dry and wet seasons when new leaves and grass shoots sprout. This occurs from February to June. Certain birds depend on the availability of water and nest throughout the rainy season.

Migrants are best observed during their passage into or out of the country, or as they pass through on their way to other places. Most conspicuously, half a million ducks spend their winter in Thailand, feeding and resting in watery roosts from Chiang Saen to Thale Noi. Thousands of garganey and Lesser treeduck flock during January and February.

Shorebirds like sandpipers, stints and plovers migrate long-distances between nesting grounds in Eurasia and tropical Asia and wintering grounds in Australasia. They stop to feed in Thailand's mudflats and mangroves during September to May where they stock up on invertebrates and crustaceans. During October, the southward migration of hawks over peninsular Thailand is an avian spectacle. Chinese goshawks, Japanese sparrowhawks, crested honey buzzards, black bazas, and others are seen coasting on thermals in their thousands daily. Less conspicuous is the blue-winged pitta, a ground dwelling bird that arrives with the rains to nest in deciduous and bamboo forests, and escapes the hot season for the wetter forests of Malaysia and Sumatra.

WHERE TO FIND BIRDS
Given that many birds are denizens of certain times, places, habitats or seasons, the amateur naturalist can remember them by association.

PARKS, TEMPLES AND GARDENS
Some species like barn swallows, magpie robins, mynas and starlings can be found around Bangkok and environs. *Lumphini Park,* a heavily-used green area in the city centre supports a variety of birds with over 90 species having been recorded there. Temples near Bangkok and Ayutthaya preserve pockets of the natural landscape including birds such as black kites, parakeets and woodland birds that are characteristic of the habitats.

RICE PADDIES, MARSHES AND PONDS
Rice paddies, marshes and ponds away from built-up areas support breeding populations of Asian openbill stork and many other waterbirds.
Key sites: *Suphan Buri-Ayutthaya* and *Beung Boraphet.*

PEAT SWAMP FORESTS
Almost the last vestige of Thailand's peat swamp forest at *Phru To Daeng or Chalerm Phrakiat Wildlife Sanctuary* in Narathiwat supports Lesser adjutants, a kind of stork, along with several birds characteristic of Sundaic forests.

LAKES, RIVER SANDBANKS AND REEDBEDS
Lakes, river sandbanks and reedbeds preserve unique assemblages of wintering waterfowl and perching birds.
Key sites: *Chiang Saen, Fang Hot Springs,* and *Thaton.*

AGRICULTURAL LANDSCAPES
Agricultural landscapes across the country support species that tolerate human presence and include kites, rollers, bee-eaters, coucals, weavers and bulbuls.

SANDY BEACHES, MANGROVE AND TIDAL FLATS
Sandy beaches are attractive to tourists but are barren habitats for birds, while little-visited mangroves and tidal flats that are rich in nutrients and microorganisms, are favoured feeding haunts for migrant waders. Some birds like the Brown-winged kingfisher and Mangrove pitta, are entirely restricted to mangroves while Mangrove whistlers and flyeaters rarely leave the area.
Key sites: *Samut Sakhon, Ban Laem in Petchburi,* and *Krabi*.

OFFSHORE ISLANDS
Offshore islands such as *Phi Phi, Libong, Surin* and the *Similans* support fewer species than similar sized mainland habitats but some such as Nicobar and Pied Imperial pigeon are entirely restricted to these refuges.

SEASCAPES
While there are fewer seabirds in the warm Thai waters compared with those in the northern and southern hemispheres, frigate birds, skuas, boobies, and terns are among the rewards for marine birders.

FORESTS
Most resident Thai birds depend upon forests for their survival. Rainforests in the extreme south support the greatest avian diversity, while seasonally dry dipterocarp, mixed deciduous and evergreen forests in the centre and north.
Key sites: *Khao Yai National Park, Kaeng Krachan National Park, Khao Soi Dao, Nam Nao National Park, Khao Nor Chuchi, Ban Nai Chong,* and *Hala Bala Wildlife Sanctuary.*

MOUNTAINS
Sibias, minlas, and laughing thrushes are relatives of species found in the Himalayas and southern China, and can only be found in mountain forests. Following surveys of high mountain peaks in the last decade, at least 20 new species or 2% of the total have been added to the lists for Thailand.
Key sites: *Doi Pha Hom Pok, Doi Chiang Dao, Doi Inthanon, Doi Ang Khang,* and *Doi Suthep.*

By visiting these enchanting destinations, travellers can appreciate the avian wonders that Thailand offers and better understand the importance of the wild and not so wild areas that preserve them.

Contact information:
Bird Conservation Society of Thailand (BCST)*
69/12 Soi Ramindra 24, Joorakaebau, Ladprao, Bangkok 10230, Thailand
Email: bcst@box1.a-net.net.th
Tel: 66-(0)-2943-5965
Web sites:
www.bcst.org/index_ebird.html
www.thai.net/bcst
* The Bird Conservation Society of Thailand (BCST) is a BirdLife Partner

Oriental Bird Club (OBC)
c/o Uthai Treesucon, 723/1 Mu 2 Soi Ram Intra, Joorakhaebua, Bangkok 10230.
E-mail:
utree@loxinfo.co.th
mail@orientalbirdclub.org
Web site: www.orientalbirdclub.org

Wildlife Conservation Society - Thailand Programme
P.O. Box 170, Laksi, Bangkok 10210
Tel: +662-503 4478, +662-503 4479
Fax: +662-503 4096
Email: thailand@wcs.org

Reference information:
Field guide
Robson, C. 2002.
A field guide to the birds of Thailand.
Asia Books, Bangkok. 272pp.

TAT PUBLICATIONS ON NATURE TOURISM
For more information on birdwatching in Thailand, please refer to the following nature tourism guide books in the "National Park" series published by the Tourism Authority of Thailand as part of the Tourism and Employment Creation Plan implemented under the Social Investment Project.

- KHAO YAI: DONG PHAYA YEN FOREST RANGE
  ISBN 974-8252-70-1
- KAENG KRACHAN:
  Amazing Forest of Phetchburi River
  ISBN 974-8252-72-8
- KHAO SOK
  Fascinating Limestone Mountains Amid The Verdant Forest of Surat Thani, Thailand
  ISBN 974-679-099-4
- DOI INTHANON - DOI SUTHEP
  The Himalayan Springs of Thailand
  SBN 974-8252-67-1
- PHU LUANG
  The Kingdom of Plants
  ISBN 974-8252-73-6

BIRDWATCHING TIPS

- Consult field guides, checklists, and maps prior to arriving at the birdwatching destination.
- Dress in colours that blend in with the surroundings.
- Bring appropriate equipment such as telescope, bird guide, and a notebook.
- Plan to arrive at the destination at sunrise when birds are first out in search for food and are most active.
- Walk slowly stopping at intervals to listen for calling birds.
- Look for the birds in thickets, on the branches of trees, and on the ground.
- Avoid talking, smoking, or walking on dry leaves, all of which will scare birds away.

CONSERVING BIRD DIVERSITY
Across the world, humans coexist with birds but human activities often affect the survival prospects for birds. Forty-eight species of birds found in Thailand (5% of the

total) are globally threatened by the loss or disturbance of their habitats, food resources, and breeding areas, and by other human actions, and so require special conservation attention. A further 97 species (10%) are potentially threatened if current trends persist.

In Thailand, 101 species (10% of the total) are hunted as pests, for food or for the pet trade and are directly threatened by humans. The list of hunted species includes waterbirds, birds of prey, pheasants, parakeets, pigeons, hornbills, pittas weavers, bulbuls, and other forest birds. Worldwide the trade in birds includes 2,600 species and several million birds each year. Ten percent of threatened birds worldwide are affected by the bird trade.

There are a number of ways in which the numbers and distribution of threatened birds are being restored. Habitat conservation programmes are an important mechanism. Feeding habitats for seasonal migrants are being preserved by incorporating mangroves and coastal tidal areas in marine protected areas. Lowland forests that support Gurney's pitta and other diversity are being protected and a reafforestation programme planned. Preventing encroachment around the edges of parks maintains the integrity of forest blocks used by the majority of native birds, including migrant raptors and songbirds.

In most cases, preserving and protecting natural habitats can bring back even highly endangered populations of rare birds. These measures are relatively cost effective to implement. As an example, a 3-year Khao Yai Conservation Project preserved over 2,000 sq km of wildlife habitat, discouraged poaching, and provided employment alternatives for local forest resource users, at an annual cost of 7 million baht (US$171,000).

For critically endangered species, whose populations are extremely small, and whose survival in the wild is uncertain due to factors that simply cannot be controlled, other more costly measures such as captive breeding, are being considered. Captive breeding is risky because birds need to be recovered from the wild to establish breeding populations, and injury is possible. Some species do not breed well in captivity because their natural courting and nesting behaviours are no longer possible. Strict controls on who is allowed to breed endangered species, registration of individuals, and enforcement of laws so that commercial sale is not possible, need to be adopted. Without these controls, captive breeding programmes cannot succeed.

HOW YOU CAN HELP IN THE CONSERVATION OF BIRDS

Visitors to Thailand can assist efforts to preserve and maintain the diversity of birds and their habitats simply by visiting national parks and other wilderness areas. Bird enthusiasts can report the species they observe to authorities. Checklists are now available at many popular national parks. Tourists can report evidence of suspicious activity that might lead to the arrest of unscrupulous individuals trapping or hunting birds and can also participate as volunteers in habitat conservation programmes. In these ways, tourists can help reduce the threats to birds, and at the same time enjoy Thailand's birdwatching paradise.

Contact information:

TO REPORT BIRD SPECIES OBSERVED

- **TO REPORT BIRD SPECIES OBSERVED**
  Please contact the Park Visitor Centre of the National Park
  or
  Bird Conservation Society of Thailand (BCST)*
  69/12 Soi Ramindra 24, Joorakaebau, Ladprao, Bangkok 10230, Thailand

Email: bcst@box1.a-net.net.th
Tel: 66-(0)-2943-5965
Web sites:
www.bcst.org/index_ebird.html
www.thai.net/bcst
* The Bird Conservation Society of Thailand (BCST) is a BirdLife Partner

- **TO REPORT EVIDENCE OF SUSPICIOUS ACTIVITY**
  Please contact
  Willdife Protection and Suppression Office
  Department of National Parks, Wildlife, and Plant Conservation
  61 Paholyothin Road, Chatuchak, Bangkok 10900
  Tel: 66-(0)-2579-5266

- **HABITAT CONSERVATION VOLUNTEER PROGRAMMES**
  Please contact
  Wildlife Conservation Society - Thailand Programme
  P.O. Box 170, Laksi, Bangkok 10210
  Tel: +662-503 4478, +662-503 4479
  Fax: +662-503 4096
  Email: thailand@wcs.org

FAMILIES OF BIRDS IN THAILAND UNDER THREAT

The following bird species are under threat because there is a high demand for them and they are hunted for the local, regional and global bird trade. To help preserve the species, please refrain from purchasing any of the following birds as pets, and if you happen to witness any of the following birds being sold or traded, or note any suspicious activities involving them, please contact:
The Willdife Protection and Suppression Office
Department of National Parks, Wildlife, and Plant Conservation
61 Paholyothin Road, Chatuchak, Bangkok 10900
Tel: 66-(0)-2579-5266

1. Phasianidae (wood partridges and pheasants) - 4 species
2. Anatidae (White-winged duck) - 1 species
3. Picidae (woodpeckers and barbets) - 3 species
4. Bucerotidae (hornbills) - 7 species
5. Upupidae (Common hoopoe) - 1 species
6. Cuculidae (Coral-billed ground cuckoo) - 1 species
7. Psittacidae (parrots and parakeets) - 4 species
8. Columbidae (pigeons) - 12 species
9. Accipitridae (birds of prey) - 9 species
10. Threskiornithidae (White-shouldered ibis) - 1 species
11. Ciconiidae (Lesser adjutant) - 1 species
12. Pittidae (pittas) - 3 species
13. Irenidae (Asian fairy bluebird and leafbirds) - 6 species
14. Corvidae (jays, crows, magpies, orioles and minivets) - 14 species
15. Muscicapidae (thrushes, robins, and sharmas) - 3 species
16. Sturnidae (starlings and mynas) - 3 species
17. Paridae (Yellow-cheeked tit) - 1 species
18. Pycnonotidae (bulbuls) - 7 species
19. Zosteropidae (Japanese white-eye) - 1 species
20. Sylvidae (laughing thrushes, mesias, minlas and sibias) - 8 species
21. Nectariniidae (Scarlet-backed flowerpecker) - 1 species
22. Passeridae (weavers and munias) - 7 species

23. Fringillidae (grosbeaks and buntings) - 3 species

About The Author
ANTONY LYNAM
Antony Lynam (Ph.D.), Wildlife Conservation Society (WCS)- Thailand Programme Director and conservation scientist, works with the Thailand Department of National Parks, Wildlife and Plants to develop programmes for the conservation of the country's endangered species, park resources management, and the design and conduct of training curriculum for park rangers.

An Australian citizen, he has authored a number of technical papers and popular articles concerning conservation issues in Australia, North America, and Thailand, and was a contributor to the seminal volume on habitat fragmentation "Tropical Forest Remnants: Ecology, Conservation and Management". He writes frequently on natural history for magazines, journals and newspapers including Wildlife Conservation, The Nation, The Bangkok Post, and The Natural History Bulletin of The Siam Society.

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UNIVERSITY of CALIFORNIA
BOTANICAL GARDEN
NEWSLETTER

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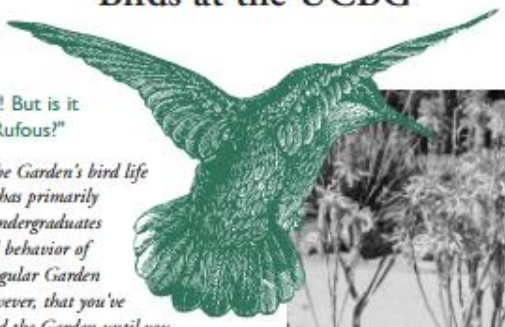
Birds at the UCBG



"It's a hummingbird! But is it Anna's, Allen's or Rufous?"

Academic interest in the Garden's bird life over the last few years has primarily been associated with undergraduates studying the territorial behavior of hummingbirds. Any regular Garden visitor can tell you however, that you've never really experienced the Garden until you have taken the time to sit and just watch the birds, listen to their songs and enjoy the way in which they use the Garden! Encouraged by the vast plant variety and habitat diversity, there are around seventy-six bird species regularly sighted here over the course of an average year. The hope of spotting one of the more rarely sighted birds, such as the Western Kingbird or the White-throated Swift, keeps our endless parade of avid birdwatchers in thrall.

Our resident birds, however, whether it's an audacious jay, a noisy woodpecker or a colorful finch, provide plenty of ongoing interest for the Garden community.

Aloes in the Southern African Area attract hummingbirds and demonstrate how birds at the Garden enjoy the diversity of plants in this collection.

The diverse collections of the Garden support an equally diverse population of birds, as is apparent in the list from the recent Christmas Bird Count. In addition to providing general shelter for both resident and migrant species, our collection provides food and nesting sites for many different taxa. The Garden environment offers a range of habitats that are rather different from the native chaparral of the canyon. Some visitors to the Japanese Pool, such as belted kingfishers and green and blue herons, might not otherwise stop in Strawberry Canyon. Native chaparral species are found in parts of the Garden that more closely approximate their preferred habitat. Wren tits, California thrashers, and spotted towhees are most commonly found in the scrubby areas of the South American and Australasian sections. Similarly, native riparian species are found in the trees along Strawberry Creek, such as Wilson's and orange crowned warblers.

Many birds have identified new food sources among the many non-native plants in our collections. This is particularly obvious when watching hummingbirds feed on both native salvias and penstemons, and also on bird-pollinated plants from other parts of the world. Aloes in the Southern African Area are pollinated by sun birds in their native habitat. These small colorful nectivores perch on the rigid blossom stalks of the aloes. This is a distinct contrast to the hovering feeding habit of the hummingbirds, which as a group are restricted to North and South America. Nonetheless, as a walk through this area at this time of the year demonstrates, hummingbirds utilize aloes extensively and assertively defend their feeding resources against other intruding hummers.

—Chris Carmichael

FIGURE 17, PAGE 1

When not watching birds from the Elizabeth Hammond Interpretive Center, where he is pictured here, noted local ornithologist Dennis Wolff, regularly teaches popular birdwatching classes in the Garden.

From Killing to Counting

Before 1900, Americans engaged in a holiday tradition known as the Christmas "Side Hunt". People would choose sides and go afield with their guns; whoever brought in the biggest pile of feathered quarry won. On Christmas Day 1900, ornithologist Frank Chapman, an early officer in the Audubon Society, called for an end to the slaughter. Rather than shooting birds, he suggested counting them. From Toronto to Pacific Grove, California, the Christmas Bird Count began. In its first year, 27 people participated, counting 18,500 individual birds of ninety species.

On Christmas Day 2000, 52,000 people participated in 1800 counts in the United States and Canada. They sighted 78,636,382 individual birds of 676 species! A century of bird counts has amassed a wealth of data which scientists use to monitor the health of bird species, pinpoint and explain trends, and detect the rise of environmental threats.

Along with three other members of the Audubon Society, I came to the rich and varied habitats of the UC Botanical Garden for this annual count. We found a total of 226 individual birds of 38 species, including such rarities as hermit and black-throated warblers.

—Dennis Wolff

AUDUBON CHRISTMAS COUNT DECEMBER 17, 2000	
American Robin	30
Anna's Hummingbird	25
Steller's Jay	21
Bushtit	16
Golden-Crowned Kinglet	14
Ruby-Crowned Kinglet	12
Yellow-Rumped Warbler	10
Townsend's Warbler	9
Western Scrub-Jay	9
Chestnut-Backed Chickadee	7
Hutton's Vireo	7
Song Sparrow	6
California Towhee	5
Golden-crowned Sparrow	5
Bewick's Wren	4
Fox Sparrow	4
Dark-eyed Junco	4
Turkey Vulture	3
Hermit Thrush	3
Allen/Rufous Hummingbird	3
Common Raven	3
Band-Tailed Pigeon	2
Northern Flicker	2
Black Phoebe	2
Red-breasted Nuthatch	2
Brown Creeper	2
California Thrasher	2
Spotted Towhee	2
White-crowned Sparrow	2
Cooper's Hawk	1
Sharp-shinned Hawk	1
Red-breasted Sapsucker	1
Nuttall's Woodpecker	1
Hairy Woodpecker	1
Wrentit	1
Black-throated Gray Warbler	1
Hermit Warbler	1

Dr. Chris Carmichael, UCBG Manager of Collections and Horticulture, is one of our noteworthy birders, a group which also includes Dr. Jennifer White, Associate Director for Education, and Curator Holly Forbes. Chris' academic background in vertebrate zoology equips him to effortlessly make the connections between the birds here in the Garden and their relationships to the plants.

FIGURE 18, PAGE 2

SIBLEY'S GUIDE TO BIRDS

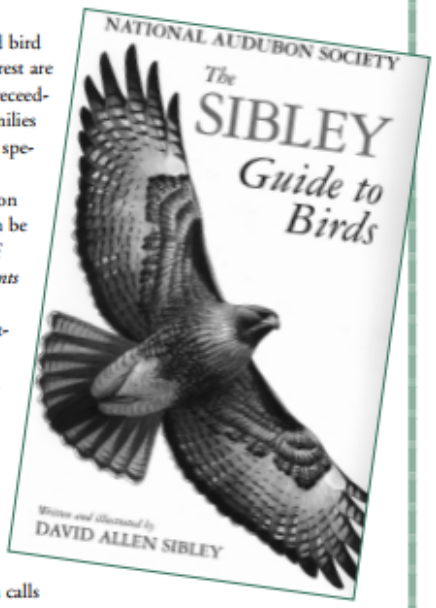
National Audubon Society: The Sibley Guide to Birds, written and illustrated by David Allen Sibley; A Chanticleer Press Edition, Alfred A. Knopf, NY, ©2000; 544pp. Flexible Binding. $35.00.

Most visitors to the Garden come to see and study our special plants, but a surprising number also come to see the animals and birds which feed and take shelter in the hospitable environment. We have newts which breed yearly in our Japanese Pool and monarch butterflies visiting our milkweed plants. Now and again we are surprised to learn that we are on the Audubon Society's Hotline, as we were several years ago when dozens of visitors came to see a rare bird sighted in the southwest corner of the Garden.

In past years, the Roger Tory Peterson *Field Guide to Western Birds*, or the National Geographic Society's *Field Guide to Birds of North America*, were seen tucked under the arms of our 'Garden Birders'. Now there is a new, up-to-date field guide these birders will want to own, although its size and weight make it awkward to carry in the field.

The Sibley Guide to Birds is a great user-friendly guide containing over 6600 wonderfully detailed watercolor paintings of 810 species and 350 populations of North American birds. Descriptions and remarks accompany the illustrations, removing the need to flip back and forth between text and pictures. The birds are shown in similar poses to make comparisons between species easy. All important plumages are depicted and range maps show migration routes, summer, winter, and breeding locations, and bird distribution. Of particular interest are the good introductory pages preceeding each family or group of families showing bird classification and speciation at a glance.

In many ways the publication of *The Sibley Guide to Birds* can be compared to the publication of *The Jepson Manual: Higher Plants of California* a few years ago. Both were preceeded by respected long-used references. It is likely that the *Sibley Guide* will become the current authority for birds, as the *Jepson Manual* has become for plants. But keep your worn, well-loved field guides handy. For this reader, at least, it is hard to think that the beloved California Quail in the Garden calls "put-way-do" rather than the familiar "chi-ca-go" of old, which we teach the touring school children.



The Garden Shop also carries the following books related to the above review:

■ *Birds of Northern California* by David Fix and Andy Bezener; range maps by Don Roberson and David Fix; Lone Pine Pub., Renton, WA,©2000; 384pp. Paper. $19.95.

■ *Birds of San Francisco and the Bay Area*, by Chris C. Fisher and Joseph Morlan; Lone Pine Pub., Renton, WA, ©1996; 159pp. Paper. $9.95.

■ *Common Dragonflies of California, A Beginner's Pocket Guide*, by Kathy Biggs; Azalea Creek Pub., Sebastopol, CA, ©2000. 96pp. Paper. $9.95.

■ *Newts and Salamanders, Everything about Selection, Care, Nutrition, Diseases, Breeding, and Behavior*, by Frank Indiviglio; with photos by Richard D. Bartlett; illus. by Michele Earl-Bridges; Barron's, Hauppauge, NY, ©1997; 128pp. Paper. $6.95.

Brochures:

■ *Birds of the UC Botanical Garden*, UC Botanical Garden Staff. $1.00.

■ *Butterflies of the San Francisco Bay Region, A County Species List*, 5th ed., by John Steiner; San Francisco Bay Wildlife Soc, 1988. $1.00.

—*Elly Bade*

FIGURE 19, PAGE 3

DIRECTOR'S COLUMN

Celebrating the Garden

Spring is here again! The hills are green and spangled with flowers. The wind is whipping across the coastal bluffs, and anyone with even the slightest inclination toward gardening has their hands in the soil. As I watch the seasons march across the landscape and think back to the past year, I'm amazed at the amount of progress we have to celebrate here at the Garden.

The living collection is in superior condition. Over the years, the horticultural staff has done an inspired job of maintaining and building the collection. However, with leadership by Manager of Collections and Horticulture, Chris Carmichael, and better access to materials and supplies, they have added new shine to the Garden. I invite you to push past the construction sites in the entrance to get a better look!

Ah, yes, those construction sites. We were so excited when they started. Now, we look forward eagerly to their completion. The Garden has not been a peaceful place to work or visit this year. Staff and volunteers have been wonderful, carrying out their work over the din of jackhammers, dump trucks, cement mixers, and more. From all this dust, mud, and upset, the Garden is gaining many physical improvements. Some, like the utility upgrades, make our jobs easier but are invisible to visitors. Others, such as renovated bathrooms and FEMA restoration of pathways in the Mexican and Central American area, are essential but not sensational. Many projects, though, are downright sensational!

Master rock garden creator, Phil Johnson, has just completed a spectacular hardscape in the Southern African section, and horticulturist Lawrence Lee will soon begin planting it with material obtained during his collecting trips to South Africa. This garden will feature the natural beauty of bulbs and succulents from the winter rainfall areas of the Karoo and Fynbos semi-arid and desert habitats. It also provides an opportunity to inform visitors about the precarious situation of these habitats in the face of regional development and global climate change.

Our new Arid House is also nearing completion. The name has recently been changed to Arid House from Desert Greenhouse — Arid House being more appropriate for that collection, though we are still making the name transition. This structure will house a substantial number of the most biologically and scientifically valuable plants in our collection, including many living "type" specimens. Type specimens are the exemplar individuals a taxonomist uses to describe a new species. Other specimens belong to species that are now extinct in the wild, and are therefore irreplaceable. The new house provides the public with excellent visual access to the exciting and unusual plant forms in this collection while ensuring their security.

UC researchers are anxiously awaiting opening of the Center for the Study of Plant Conservation (CSPC) at the Garden. Although the lab is not yet finished, scientists associated with this center are already exploring a diversity of questions related to plant conservation. Richard Shefferson, a graduate student at the Center, writes in this issue about his research devoted to discovering the types of fungi that sustain terrestrial orchids. Another graduate student, Jessica Riquetti, recently established a major field experiment to determine whether soil-borne organisms can limit the spread of European beach grass, an invasive species that reduces native plant diversity in sand dunes along the Pacific coast of North America. Work by these students and other scholars will be greatly facilitated by the new Center.

In preparation for our next round of construction, we have just begun design of the Jane Gray Research Greenhouse, which will be an important adjunct of Garden research in plant conservation and ethnobotany. This house will be erected in the place currently occupied by the temporary arid house and will serve researchers from both the CSPC and elsewhere on the Cal campus.

Although construction is the most visible sign of progress that visitors can see, the Garden has many other achievements to celebrate as well. Our educational outreach programs are receiving national recognition. Many partners are joining our Math in the Garden initiative. Beginning this spring staff at the UC Davis Arboretum, Brooklyn Botanic Garden, Missouri Botanical Garden, Morris Arboretum, and Atlanta Botanical Garden become active partners in the development process of the 'Math in the Garden' project as they try out the activities in their own programs. San Francisco Girl Scout Council troops and 4-H programs across California are also partners in this effort. Over the next year their evaluations of the effectiveness of the project's activities will provide crucial information to ensure that the final published materials will fit into different informal settings and programs and work in gardens throughout the country. Collaborations with these, and other partners, provide audiences diverse program opportunities that strengthen this and other aspects of the Garden's Education Programs.

Cactus drawings by UCBG horticulturist, Judith Finn. Above: Gymnocalycium saglione *and at right:* Euphorbia cf. leuconeura.

FIGURE 20, PAGE 4

Our collaboration with East Bay Munipal Utility District, which resulted in our spectacular and innovative contribution to last year's San Francisco Flower and Garden Show, is now producing exciting new Garden interpretation materials. Garden staff and dedicated volunteers worked with EBMUD staff to develop an extensive and well-received tour of Plants for Water-wise Gardening. (See the Education Director's column for more information about this tour.) The tour takes advantage of our diverse and outstanding collection to illustrate landscape uses of water-conserving plants. Most species highlighted in the tour are available in the horticultural trade, but some are not, which puts the tour on the leading edge of horticultural innovation.

Through all of these changes, the Garden continues to expand its primary mission of support for botanical research. New molecular tools are allowing exciting discoveries in evolutionary biology and plant systematics. These tools work best on DNA extracted from live tissues, which makes living collections such as ours ever more important scientifically. Important new studies that have used UC Botanical Garden specimens are finding exciting and sometimes disturbing results. For example, Olmstead, DePamphilis, Young, and colleagues report this spring in the *American Journal of Botany*, (Vol. 88: 348-361, 2001) that the snapdragon family (Scrophulariaceae) is not a natural evolutionary grouping. In their new interpretation, which was based in part on samples from the UC Botanical Garden, the only member of this family in the California flora that will remain in the Scrophulariaceae is the eponymous *Scrophularia californica*. Even the snapdragons *(Antirrhinum)* will no longer be in the "snapdragon" family.

Although living tissue is the *sine qua non* for molecular phylogenetics, it is still essential that every plant used in such research be vouchered. Vouchering, which involves removing a sample of the plant to produce a herbarium specimen, creates a permanent record that persists after death of the plant itself. It is essential that Garden material be vouchered so that future scientists can examine the specimens that today's botanists are using to classify plants and understand their evolutionary relationships. Thus, an important goal of the Garden is to voucher all accessioned plants in our collection. This academic year, our graduate student assistant, Rich Shefferson, has helped to voucher 274 plants in our collection.

With all this happening this year, one might ask whether Garden staff has had time to plan very far into the future. In fact, we have embarked on the early stages of strategic planning and, as the first round of construction nears completion, we will continue to move forward on this very important project.

—Ellen Simms

Garden Visitors

(left to right): Horticulturist Elaine Sedlack accompanied Mark Flanagan, "Keeper of the Gardens" at Windsor Great Park, and William McNamara, director of Quarryhill Botanical Garden in Glen Ellen, CA, during their visit on April 16th. Mr. Flanagan was the April speaker for the California Horticultural Society meeting.

Gardening Tips

■ The larvae of the diamond back moth can be a serious pest for members of the cabbage family, including cabbage, broccoli, collards, kale and others. The insects are becoming resistant to Bt, which has been used widely to control the insect. A researcher in Florida found that the larvae of the moths prefer feeding on highly fertilized collards more than on any other members of the family. Fields of crucifers to be protected are surrounded by a crop of specially treated collards, resulting in a reduction of sprays from 75 to 100%. In addition, a naturally occuring parasitic insect of diamond backs built up in the collards, and this helped control them in the desired crop. *Agricultural Research* 47 (3): 26.

■ The old world fern, (*Lygodium microphyllum*), introduced into Florida in 1950, now covers over 40,000 acres. In the last 6 years, there has been a 100 fold increase. A single leaf can be 100 feet long. Fortunately, it is believed that the plant will not move farther north than central Florida. *American Nurseryman* 191 (3): 10.

■ *Euphorbia esula*, an introduced species in the northern midwestern states, has colonized vast areas of marginal and non-agricultural land, displacing many beneficial plant species. In addition, it is toxic to sheep, cattle and horses. Recently, a gall midge was released which produced galls on the stem tips resulting in their destruction, thus preventing flowering and seed production. The insect may produce 3 or 4 generations in a season though the first generation produces the largest number of adults. It is these that can be harvested and used for new releases. *Biological Control* 16(2): 128-132.

—Robert D. Raabe

FIGURE 21, PAGE 5

The Overlooked Equation

When I was an undergraduate living in Chicago, I volunteered at local county nature preserves to help restore Illinois' endangered prairies, savannas, and wetlands. Very often, my work involved monitoring the endangered plants that grew in the area, especially the imperiled populations of native, wild lady's slippers.

The lady's slippers we all know and love *(Paphiopedilum spp.)* are tropical, and have been propagated and hybridized for many years. Should you ever see a lady's slipper of the genus *Cypripedium* on display at a nursery, be warned – it was most likely stolen from the wild. Cypripedioid lady's slippers grow on the wild lands of North and Central America, Europe, and Asia, and have not been propagated successfully at all. Yet, as we have seen in other endangered plants, propagation is very often integral to successful restoration.

Why has propagation been so unsuccessful? The biology of orchids, especially the rare terrestrial orchids that evolved in the temperate regions of the world, is very complex. In fruiting structures known as pods, they produce thousands to millions of seeds no longer than a single millimeter, and half that in width. These seeds very rarely survive to produce a mature plant, and this seems to be why they have evolved to produce so many seeds all at once. The seeds scatter in the wind and find a new place to settle in the soil. Once the winter snows and rains are over, they imbibe water, and then they just sit. Why? Because they cannot progress any further

This Cypripedium californicum *in the Garden was collected by Garden horticulturist, Roger Raiche.*

in their development without the aid of a soil-inhabiting fungus. The orchid family is one of the few plant families that depends completely on soil fungi for germination. This kind of interaction is called "mycorrhizal," and requires some more explanation.

A mycorrhiza is an interface of two organisms – a plant and a fungus. The fungus, which can be one of many different species, grows through the soil as a mass of tiny filaments known individually as hyphae, forming a hyphal network called a mycelium. The fungus grows outward, looking

GARDEN NOTES

SUDDEN OAK DEATH…Horticulturists **Judith Finn** and **Jerry Parsons** attended an all day symposium, "Combating the Sudden Oak Death *Phytopthora*: a new disease", in Marin County, hosted by UC Cooperative Extension on March 9th.

CHANNEL ISLAND VISIT…Horticulturist **Nathan Smith** accompanied **Steven Junak**, of the Santa Barbara Botanic Garden, on a three-day visit to San Nicolas Island in late March. This island is part of the southern group of Channel Islands off the coast of southern California. They were conducting plant surveys and removing exotic plants. Nathan was able to collect several plants for the Garden's Californian Area.

GARDEN SHARING…Curator **Holly Forbes**, distributed duplicates of the Garden's epiphytic cactus collection to the Huntington Botanical Gardens in San Marino and to Ganna Walska Lotusland in Santa Barbara. It is common practice among gardens to share duplicates of collections, providing some protection against loss in any one location. **John Trager**, Curator of Desert Collections at the Huntington, donated several collections of South African material for the Garden's African Area.

RESEARCH GRANT…We are pleased to report that the Genetic Resources Conservation Program at UC Davis funded a grant proposal by **Dr. Jason Koontz** and Holly Forbes to study the genetic variability of Baker's Larkspur, *Delphinium bakeri*. The research will seek to determine the genetic diversity of this species to obtain base-line data for future research and conservation efforts. The grant money will pay for the cost of DNA analyses to be performed by Dr. Koontz. Baker's

FIGURE 22, PAGE 6

for new patches of resources to digest and absorb. Part of the mycelium grows into the root system of a plant, penetrating the root tissue itself, and "colonizes" it. Other parts of the same mycelium grow far beyond the range of the plant's root system, and collect nutrients such as phosphorus and calcium. Amazingly, the mycelium then gives the plant vast quantities of these nutrients, which are very often limiting to the plant's growth. But the fungus does not do this out of the goodness of its fungal heart! It gets a very valuable commodity from the plant: carbon. The plant produces sugar in its photosynthetic leaves, and it now appears that, on average, at least 20% of all the sugar produced by the plant goes to the fungus. This makes sense: the plant is limited much more by phosphorus, calcium, and other nutrients than carbon. Hence, the fungus and the plant seem to exist in a mutually beneficial system.

The importance of mycorrhizae is evident in the fossil record, which shows that the first land plants (now thought to be *Rhynia* species), growing roughly 500 million years ago, actually had mycorrhizal structures in their roots. Indeed, current estimates suggest that 90% of plants are mycorrhizal – a situation that clearly displays the importance of this unusual interaction.

Which brings us back to the orchid. Orchids are unlike any other plants. We are discovering that this is true in their biology as well as in their aesthetics. Orchids break all the rules. With most plants, germination and growth are possible without fungi, although the plant will generally be stunted throughout its life. But orchids do not appear to grow without these organisms. Although some orchids can be cultivatable in the lab under very specific conditions, these orchids generally grow poorly relative to their wild-grown kin. More and more we find that most orchids cannot even germinate without a fungus.

Why should this concern us? The kind of interaction that orchids exhibit with mycorrhizal fungi is very different from what we are used to, and this has important ramifications for propagation, and ultimately restoration. First of all, we have as yet not seen any evidence that orchids donate carbon to the fungus. Second, we have found that as seedlings, and in the case of the non-photosynthetic "ghost" and "phantom" orchids, orchids even extract sugar from the fungus! Third, orchids are very particular about which fungi they will associate with, and it appears that they choose fungi that are mycorrhizal, or sometimes even pathogenic, on local trees and other plants. So, these unusual plants indirectly acquire their sugar from other plants in the ecosystem. Fourth, orchids native to the northern temperate latitudes generally stay within the soil as seedlings for many years without developing any leaves, relying on mycorrhizae for complete nourishment. Finally, even mature, photosynthetic orchids choose not to break the surface and sprout leaves in some growing seasons. This happens particularly often in lady's slipper populations. In my Midwestern study sites, I have found that lady's slippers can stay belowground like this for many years without interruption, while still growing more root and rhizome tissue. Other researchers have found very solid evidence that this "dormant" condition can last for 25 years or more. Considering that lady's slippers have very low sugar reserves, this is an amazing feat.

The key, then, to understanding what can be done to restore native orchid populations, which are in decline all over the world, is to explore this overlooked equation: orchid + appropriate fungus + appropriate conditions = successful growth.

It is an exciting topic. We are now beginning to understand the nature of this puzzling interaction, and modern scientific methods and tools, including molecular techniques, genetic sequencing, carbon-isotopes, and mathematical and statistical theory, are helping us in tackling major environmental questions. My research is an example of the conservation issues which will be investigated by Cal scientists and graduate students at the Garden's new Center for the Study of Plant Conservation.

—Richard P. Shefferson

larkspur is one of several endangered and rare California native plants the Garden is committed to helping conserve through its participation in the Center for Plant Conservation. Dr. Koontz studied the genus *Delphinium* for his dissertation project. He is now at the Center for Biodiversity of the Illinois Natural History Survey.

NEW STAFF MEMBER…

We extend a warm welcome to Ms. Leslie Wozniak who has joined the staff at the Garden in the capacity of Visitor Services Specialist. Leslie is a long time fan of the Garden and brings a wealth of work skills to the new position.

Water-Wise Gardening Tour

EDUCATION AT THE GARDEN

The shining silver leaves of Leucadendron argenteum *make it an interesting choice for water conservative landscaping in the Bay Area. Threatened in its native habitat in South Africa it can be seen in the Garden in the Southern African Area, where it is just one of the 125 exciting plants in the new Water-Wise Gardening Tour.*

One goal of the Education Program is to encourage visitors to discover the Garden's magnificent collection and to look at plants from new perspectives. While our seasonal self-guided tours showcase different plants in their peak flowering or display seasons, other brochures focus on ethnobotanical (Chinese medicinal herbs) or special collections (serpentine plants). Building on the interest generated through our successful collaboration at last year's San Francisco Flower and Garden Show, the Botanical Garden and the East Bay Municipal Utility District (EBMUD) have teamed up again, this time to develop a self-guided tour in the Garden. This interpretive tour of the collection focuses on plants that grow successfully in the Bay Area, but use little water.

Most people have no idea how much water their garden needs. The typical Bay Area residential landscape is irrigated enough each year to flood it six feet deep. This is at least twice as much as plants need for healthy growth. Using water-efficient plants and creative design, local gardeners can create a garden that thrives on little more than natural rainfall. Properly designed, a water-efficient garden is easier to maintain than one that is over-watered. It requires less weeding, pruning, mowing, fertilizing, and pest control. It is better adapted to fluctuations in rainfall and seasonal changes. There is no one way to create a water-efficient garden. The Botanical Garden is filled with a plethora of exciting possibilities from around the world.

This walking tour of the Garden introduces you to some of these beautiful plants that thrive in the Bay Area. California's chaparral is our local community of drought tolerant plants. The climate and plant communities in Chile's mattoral, South Africa's fynbos, and the Mediterranean maquis, with their winter rains and summer drought, are but a few of the parts of the world that have water-conserving plants similar to California's chaparral. Most of the plants on this tour have been in our collection for many years. They will give you a good idea of what that seedling in the local nursery will look like once it gets established in your garden.

This new publication is the collaboration of the Garden's horticultural, educational and communications staff working with three knowledgeable and dedicated docents — Barbara Lyss, Kathryn Welch and Alison Mills. After hours of walking through the Garden and conversations with horticulturists, Barbara, Kathy and Alison wove fascinating plant histories, horticultural information, name derivations and ethnobotanical information into stories for more than 100 plants. A lot of give and take occurred as the Garden staff vetted the information from different perspectives. Weeding out some plants that we all loved but which did not fit all the criteria was one of our biggest problems. Plants included on the tour use little water, are available (or could be available) in the horticulture trade, and are not weedy or endangered.

Ten thousand preview versions of the tour are available this Spring: in the Garden, at this year's San Francisco Flower and Garden Show and at Earth Day events. Over the next several months, Education staff will be collecting evaluations from visitors. This information will be used to improve the final version of the brochure. I invite you to come to the Garden, go on the tour, and give us your feedback.

We are grateful for EBMUD's participation and support of the process and production of this new exciting self-guided tour of the Garden.

—Jennifer Meux White

FIGURE 24, PAGE 8

Research at the Garden

The Garden recently provided research materials to these individuals:

Ms. **Eden Abram**, dissertation student with Prof. **Donald Kaplan**, UCB Dept. of Plant Biology launched her study of comparative morphology of succulent, drought-tolerant plants. She will be using the desert collections for illustration purposes.

Prof. **David D. Ackerly**, Stanford University, again visited to collect many species in the Rhamnaceae (buckthorn family). He is looking at the evolution of the "evergreen sclerophyll" strategy in California chaparral. The project is to examine each of the major taxa in comparison with their close relatives from non-chaparral habitats, employing a phylogenetic approach where possible.

Dr. **Stephen Burgess**, post-doc, UCB Dept. of Environmental Science, Policy, and Management, used the Mather Grove for an investigation of the basic physiological ecology of redwoods with the aim of relating climatic and hydrological factors with the growth and distribution of *Sequoia sempervirens* (Coast Redwood). They are particularly interested in quantifying direct foliar absorption of fog water by redwoods and determining its role in mitigating drought and allowing redwoods to grow to extreme heights. This study will principally involve the use of sensitive xylem sap flow meters to gauge patterns and amounts of water transport in branches and stems of redwoods.

Prof. **Todd Dawson's** class, Physiological Plant Ecology, used several Garden plants for measurements of photosynthesis under sun and shade conditions during the Spring Semester.

Prof. **James Eckenwalder**, University of Toronto, received leaf bases of *Zamia integrifolia*. These were plants used by Dr. Robert Ornduff for a study published in 1996: Gender performance in a cultivated cohort of the cycad *Zamia integrifolia* (Zamiaceae). *Amer. J. Bot.* 83: 1006-1015.

Mr. **Taylor Field**, dissertation student at Harvard, visited to take cuttings of primitive angiosperms for his project *(Chloranthus, Illicium mexicanum, Illicium simonsii, Schisandra henryi).*

Ms. **Ruth Kirkpatrick**, dissertation student with Prof. **Brent Mishler**, UCB Dept. of Integrative Biology, received fronds of several xerophytic ferns for a course project on dessication tolerance.

Ms. **Nancy Kiang**, dissertation student with Prof. **Dennis Baldocchi**, UCB Dept. of Environmental Science, Policy, and Management, tested a sap flow sensor on a Garden oak for several weeks prior to using it in the field.

Ms. **Jessica Messmer McAbee**, graduate student at UC Davis with Prof. **Charles Gasser**, visited to obtain cuttings of *Impatiens hookeriana* and *Impatiens balsaminifera* for her graduate studies in ovule diversification in the angiosperms.

Dr. **Susana Magallon**, UC Davis, post-doc with Profs. **Michael Sanderson** and **James Doyle**, received a wide range of species for their study of seed plant phylogeny, the age of angiosperms, and the evolution of pentamery among basal eudicots.

Ms. **Jodi McGraw**, dissertation student with Prof. **Wayne Sousa**, in Integrative Biology completed her soil seed bank study in the Garden's research greenhouse.

Prof. **Rei Rasmussen**, Oregon Graduate Institute in Beaverton, Oregon, visited the Garden to collect emissions from several oak species for his study on terpene release by oaks.

Mr. **Andrew Salywon**, dissertation student at Arizona State University, is working on the molecular systematics of the Myrtaceae family. He received cuttings of *Eugenia capuli, Austromyrtus dulicis, Myrceugenia chrysocarpa, Syzygium jambos,* and *Ugni molinae.*

Ms. **Caroline Stromberg**, dissertation student at UC Berkeley, Department of Integrative Biology, received dozens of specimens and associated herbarium vouchers for development of a phytolith reference collection.

Dr. **Nori Yoshikawa**, a post-doc at the University of Washington in Seattle, visited to collect *Hibbertia scandens, Dillenia,* and *Aextoxicon punctatum.* His main object is to find where in the phylogeny of angiosperms particular genes (the RPB2) are duplicated.

—Holly Forbes

FIGURE 25, PAGE 9

Recognition

Contributions received from 2/01/2001 up to and including 4/15/2001.

New Members

The Garden wishes to thank our new Individual and Family Members:

Ms. Shellie Albright & Mr. Scott Emmett
Mrs. Monica Baldzikowski
Ms. Marge W. Barry
Mrs. Wendy S. Bergman & Mr. Robert G. Bergman
Ms. Barbara Boster
Ms. Suzanne M. Briley
Ms. Michaela Brockstedt
Dr. and Mrs. Daniel Callahan
Ms. Dwyn Daniels Robbie
Mr. and Mrs. Randy Davis
Mrs. Lois De Domenico
Mr. Bob Deloria
Ms. Carmel Drudy
Ms. Anna Eastwood
Ms. J. M. B. Edwards
Dr. and Mrs. Ray Ergas
Mr. Raymond Ford
Mr. Sam Foushee
Ms. Gloria Galindo
Ms. Judith E. Garvens
Mr. Kent N. Garvens
Mr. Patrick Gavin Duffy
Ms. Penelope E. Gordon
Ms. Anna Greenwood
Ms. Alix Greenwood
Ms. Jeane Hamilton-Lecky
Mr. and Mrs. Alan Hoben
Ms. Lynne Hosley
Mr. and Mrs. David Huang
Ms. Laura J. Kainik
Ms. Gretchen Kell
Ms. Sydney Kustu
Ms. Marie C. Laganle
Ms. A. Lim & Mr. K. Henderson
Ms. Kiamara Ludwig
Ms. Caren Maghreblian
Ms.Pradeep & Mr. Karek Mathew
Ms. Helen McKinley
Mrs. Laura Miller & Mr. Dave Miller
Mr. Charles L. Moreau
Ms. Alexandra Moss
Ms. Phyllis Peacock
Ms. Phyllis Potter & Ms. Nora Underwood
Ms. Delaine Renard & Mr. Bruce Bedortha
Ms. Janet A. Rudolph
Ms. Jeanine Sidran
Mr. Steve Sivier
Ms. Jean Smith
Ms. Laura Sueoka
Ms. Anita L. Thomas
Mr. Dan Vierra
Ms. Virginia C. von Colditz
Mr. Whitney Vosburgh
Ms. Herta Weinstein
Ms. Karen Wesson
Ms. Charlotte Woody

Grateful Thanks

The Garden thanks these new members for their substantial gifts over and above membership:

Ms. Patti Barker
Mr. and Mrs. David Benning
Ms. Beth Burnside
Mr. and Mrs. Ronald Clendenen
Mr. and Mrs. Fred Dengler
Mr. and Mrs. Jack Dolhinow
Dr. and Mrs. A. Carl Helmholz
Ms. Fonda Karelitz
Mr. and Mrs. Ron Lai
Mr. Jim Lovekin & Prof. Iris Tommelein
Mr. and Mrs. Geoff Machin
Mr. and Mrs. Stuart McDonald
Mr. Bill McJohn
Mr. Ron Morrison
Ms. Sally O'Connell
Ms. Ann Reynolds
Mr. and Mrs. Weldon Rucker
Mr. Bernard Taper & Ms. Gwen Head
Ms. Carol Thompson & Mr. Roderic Duncan
Mr. and Mrs. William D. Watkins
Mr. Stewart Winchester
Mr. Thomas (Rex) Wolf

In Appreciation

The Garden offers appreciation and thanks to these donors for their generous contributions:

Mr. and Mrs. Earl Hamlin
Dr. and Mrs. A. Carl Helmholz
Mr. Bernard Taper & Ms. Gwen Head
Mr. Stewart Winchester
(Orndorff Fund for Garden Interpretation & Docent Activities)

In Memory

The Garden offers appreciation and thanks for gifts from these donors in memory of:

Shih Ning Cheen from:
Mr. & Mrs. Kenneth Palladino
(Chinese Medicinal Herb Garden)
Jean & Earl Hyde from:
Mr. and Mrs. Harry Heckman
(Myrtle Wolf Library)
Josephine Tonge Larson from:
Mr. and Mrs. Bill Bade
(Myrtle Wolf Library)
Ms. Ellen Felker
Ms. Elenor Mulkey
Ms. Mildred J. O'Connor
Ms. Jean Portello
Ms. Jacqueline Woodfill & Mr. John Woodfill
(Myrtle Wolf Library)
James Harrold Van Sickden from:
Mr. and Mrs. Richard Amundsen
Mr. and Mrs. Bill Bade
(Entrance Improvement)
Mr. Michael Gilmore & Family
Mr. Bruce Hayes
Mr. & Mrs. R. Sheldon Milligan, Jr.
Mr. John P. Stock

Gifts In Kind

The Garden offers appreciation and thanks for gifts in kind:

Ms. B. Sonja Ahlena
Ms. Mary Lynn Cox
Ms. Louise Dutton
Mrs. Myrtle Wolf

WISHLIST

The Garden particularly thanks Dr. and Mrs. David Reiffel for their contributions of a sofa and a projector for the new Center for the Study of Plant Conservation.

This issue we are asking our readers if they could support us by donating:

- A "point and shoot" camera
- Card tables

If you can donate, please call (510) 643-2937—we would appreciate the help.

FIGURE 26, PAGE 10

Pictured after receiving their awards from the Director at the recent ceremony are: (Back, left to right) John Domzalski, Judith Finn, Jerry Parsons, Peter Klement, Gerald Ford. (Front, left to right) Elaine Sedlack, Nancy Swearengen, Holly Forbes and Dr. Ellen Simms, Garden Director.

Staff Members Honored

Various members of the Garden staff were recently recognized and applauded for their many years of service. Director Ellen Simms commented that the Garden is the envy of many campus units for the longevity of its staff! University service award pins were given to **Holly Forbes, Gerald Ford, Jerry Parsons** and **Nancy Swearengen** for 10+ years of service; to **Elaine Sedlack** for 15+ years; to **Peter Klement** and **Roger Raiche** for 20+; and to **John Domzalski** for 25. **Judith Finn** had already received her 25-year pin! Congratulations to all you long-timers!

Noteworthy Donations…

The Garden Library received several donations of books and journals. **Mrs. Mary Lynn Cox** donated over 130 books on garden design, horticulture, and botanical subjects. **Mrs. Myrtle Wolf**, donated a complete run of *Pacific Horticulture Magazine*, many issues of the *Journal of the California Horticultural Society*, several volumes of the *Bulletin* of the American Rock Garden Society, the early issues of *The Four Seasons* (journal of the Regional Parks Botanic Garden), and *Fremontia* (journal of the California Native Plant Society), among others. Additional donations of books for the library were made by **Mrs. Sonja Altena** and **Ms. Louise Dutton**. Thank you very much indeed!

GARDEN STAFF

Dr. Ellen Simms, *Garden Director*

ADMINISTRATION

Afsoon Navid, *Administrative Assistant*
Margaret Richardson, *Tour & Rentals Coordinator*
Michael Rimar, *Administrative Assistant*
Candice Schott, *Business Operations Supervisor*
Nancy Swearengen, *Volunteer Services Coordinator*
Janet Williams, *Marketing & Development Officer*
Leslie Wozniak, *Visitor Services Specialist*

COLLECTIONS & HORTICULTURE

Dr. Christopher Carmichael, *Manager of Collections and Horticulture*
Holly Forbes, *Curator*
Barbara Keller, *Curatorial Assistant*
Anthony Garza, *Supervisor of Horticulture and Grounds*
John Domzalski, *Propagator*
Judith Finn, *Horticulturist*
Peter Klement, *Horticulturist*
Lawrence Lee, *Horticulturist*
Jerry Parsons, *Horticulturist*
Dr. Robert Raabe, *Garden Pathologist*
Roger Raiche, *Horticulturist*
Eric Schulz, *Horticulturist*
Elaine Sedlack, *Horticulturist*
Nathan Smith, *Horticulturist*
Gerald Ford, *Building and Grounds Maintenance*

EDUCATION

Dr. Jennifer White, *Associate Director for Education*
Christine Manoux, *Program Assistant*

FACULTY ADVISORY COMMITTEE

Dr. Nan Crystal Arens, *Integrative Biology*
Dr. Lewis Feldman, *Plant Biology*
Dr. Joe McBride, *Environmental Science, Policy, & Management*
Dr. Brent Mishler, *Integrative Biology*
Dr. Vincent Resh, *Environmental Science, Policy, & Management*
Dr. Alan Smith, *Herbarium*

NEWSLETTER

Janet Williams, *Editor*

Administration 642-0849
Development 643-2937
Director's Office 643-8999
Education 495-2805
Entrance Kiosk 643-2755
The Garden Shop 642-3343
Plant Collections 643-8040
Tours/Rentals 642-3352
Volunteers 643-1924

Fax 642-5045
E-mail: garden@uclink4.berkeley.edu
Web Site: http://www.mip.berkeley.edu/garden/

The Newsletter is published by the University of California Botanical Garden with support from memberships.

FIGURE 27, PAGE 11

CALENDAR OF EVENTS

TREES AND SHRUBS OF CALIFORNIA
We are pleased to help launch a new book from University of California Press, Trees and Shrubs of California by two distinguished faculty members from Humboldt State University, John Stuart, Professor of Forestry and John Stewart, Professor of Botany. Both authors will be with us, to share highlights of their research, and to sign copies of their book. Also on hand will be their illustrator, Andrea Pickart, exhibiting samples of her work.
Wednesday, June 13, 7:30 pm
Free
Registration requested

TWILIGHT TOURS
Celebrate the long evenings of summer with us in the Garden. Members of our horticulture staff will share their favorite spots and special insights about the Garden on Wednesday evenings at 5:30 pm. Each walk will be different, so plan to come every week during July, beginning July 11, and every week during August.
Free with Garden admission.

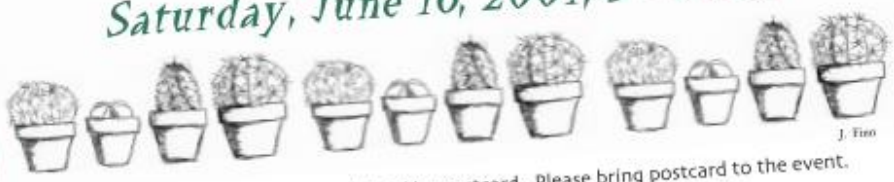
University of California Botanical Garden

Second Annual Garden Party

Please Join Us!

Enjoy fabulous food, wine and music,
stroll around the Garden at the peak of its glory,
and tour the newly renovated South African Desert Habitat.
At 4 PM we'll celebrate the opening of
the new Desert Greenhouse!

Saturday, June 16, 2001, 3 - 6 PM



Your reservation will be acknowledged by postcard. Please bring postcard to the event.

To register for any program or event*, call 510-643-2755.

University of California Botanical Garden
200 Centennial Drive, #5045
Berkeley, California 94720-5045

Address Service Requested

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U.S. Postage
PAID
University of California

Plants are for sale at *The Garden Shop* all year. Call 510-642-3343

FIGURE 28, PAGE 12

Document D – f0180344.pdf

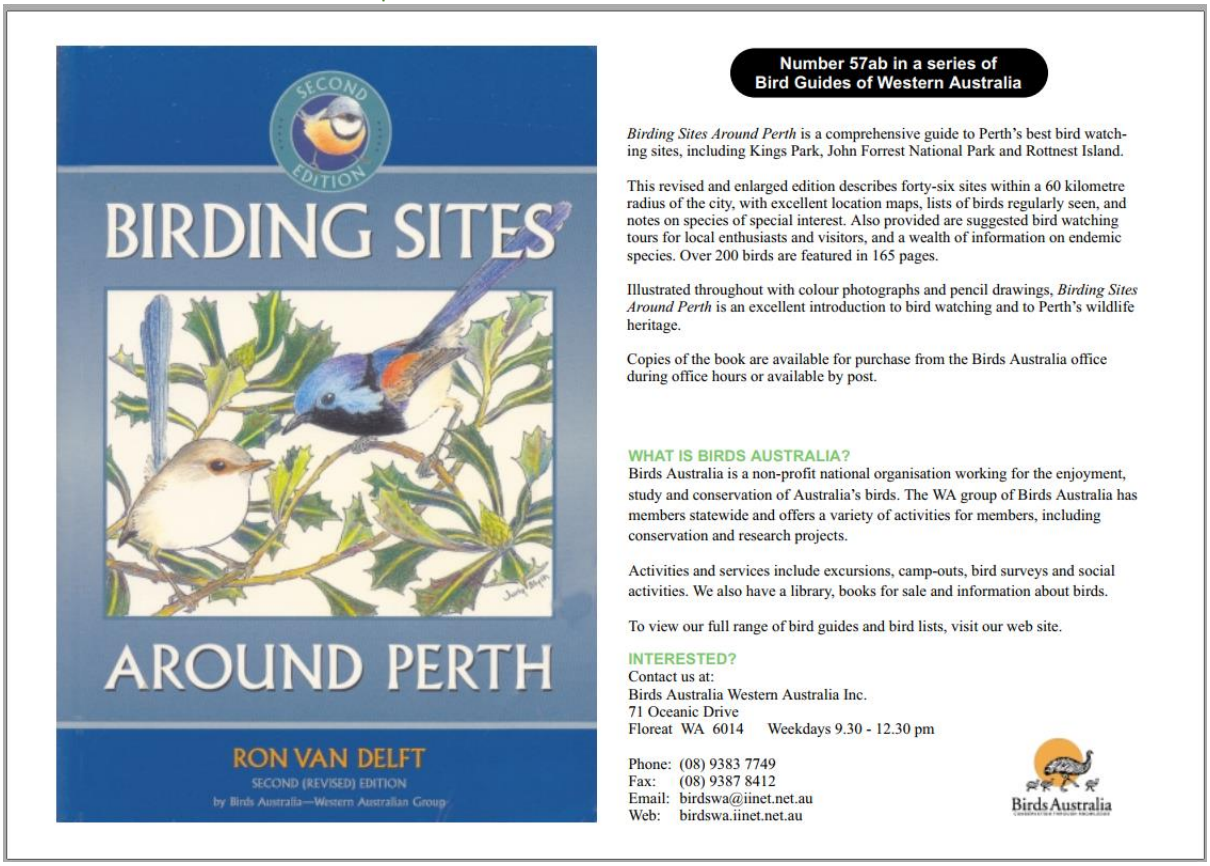

FIGURE 29, LEAFLET FOR A BOOK ENTITLED "BIRDING SITES AROUND PERTH"

Document E - ostbk2b2.htm

FACILITIES

CHICKS

Young chicks can be maintained in a variety of suitable facilities. A small portable pen, 12 feet long, 4 feet wide and 2 foot high can be adequate for a number of chicks. The pen is placed on short cut grass and moved daily. Chicks are brought out to the pen after the temperature reaches above 60 F and the sun is shining. Birds can be maintained in this type of facility until the temperature drops or until weather is prohibitive. Include some type of shade and wind break as young birds are sensitive to extreme sun and wind.

Young birds should be brought indoors in the evening and maintained in a heated environment until at least 2 to 3 months of age. Temperature in indoor shelters should be maintained at least 65 F and enough room to allow the birds to exercise should be provided. In areas where weather is more severe, this period may need to be extended.

Do not provide feed at night but available water is acceptable. Feed the young birds as outlined in CARE OF YOUNG BIRDS section, prior to turning them out in the morning.

JUVENILES

Juvenile birds between 3 and 10 months of age can be maintained in a similar, but larger facility as young birds. For convenience, access to the indoor facility should be available directly from the outdoor pens. However, shelter is not needed except in extremely cold areas. The amount of space per bird, for both indoor and outdoor facilities should be increased for this age bird as compared to that available for younger chicks. Outdoor pens can be of any type of substrate but ground cover such as grass, clover, or alfalfa is ideal. Grass should be kept at a closely mowed level, especially when grass begins to dry out or turn to seed, as impactions are more common at this time. Daily mowing may be necessary during some periods of the year.

ADULTS

Pens and facilities for adults vary considerably. Most ranchers maintain adult pairs or trios in facilities that range from five thousand square feet to an acre or more. In general, the more room that can be provided, the better the situation. Common fences and line of sight access to neighboring pairs is often desirable but may not be practicable with overly aggressive males.

Housing or shade is usually provided although not always utilized. If birds are accustomed to being fed and watered in a shed they will be more easily confined when necessary and may build the nest and lay indoors. Alley-ways for movement of birds from pen to pen, access for haling, and provisions for confinement for veterinary care should be considered at the time of construction. Although suprising, most ratites do not require indoor shelter once over 6 months of age and often refuse to use such structures, independent of weather.

Fencing is dependent on personal preference and economics. Chain link is good but may result in problems related to leg and foot injures and is not easily climbed if escape from the pen by egg gatherers is necessary. Tubular "cattle" type fence is suitable and offer some benefits and others types of woven wire fencing are routinely used.

Many ranchers are now utilizing group pens consisting of several males and numerous females in larger acreage. This appears to provide some benefits and is more nearly similar to a natural situation. Early results indicate that increased fertility, more egg numbers, and extended laying periods can be expected in this type of set up. Several acres of enclosed pasture are needed for this type of operation.

Difficulties with a group breeding situation include the inability to determine exactly the resultant chicks parentage.

Ostrich Book

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944697103"></map>

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Document I - f0327896.pdf

FIGURE 30, THE FRONT COVER OF THE 23 PAGE DOCUMENT, THE FULL DOC HAS BEEN HANDED OVER TO THE RELEVANT AUTHORITIES

Document J – nestboxtips.txt

Tips for Nest Boxes this spring/summer

If you have old boxes in your garden, clean out any of last years nesting material or any old bits of food that may have been stored in there.

If you are putting up new nest boxes make sure that they are out of the reach of cats and Squirrels.

Check that the box isn't in full sun otherwise young birds may literally bake in the heat.

Experiment with different kinds of bird boxes – the open-fronted "Robin" boxes may even attract Spotted Flycatchers.

Make sure any boxes are at least 15mm in thickness.

Face boxes away from prevailing winds.

Don't put nest boxes to close together in a small area as this will only lead to territorial fights.

Always make sure that there is enough food and fresh water made available close by.

Do not but bird boxes with perches attached – the birds do not need them and it may only invite predators.

Never buy a bird table with a nest box built in, as nesting birds will only come into conflict with feeding ones.

Appendix D – Browser Analysis

Bookmarked pages

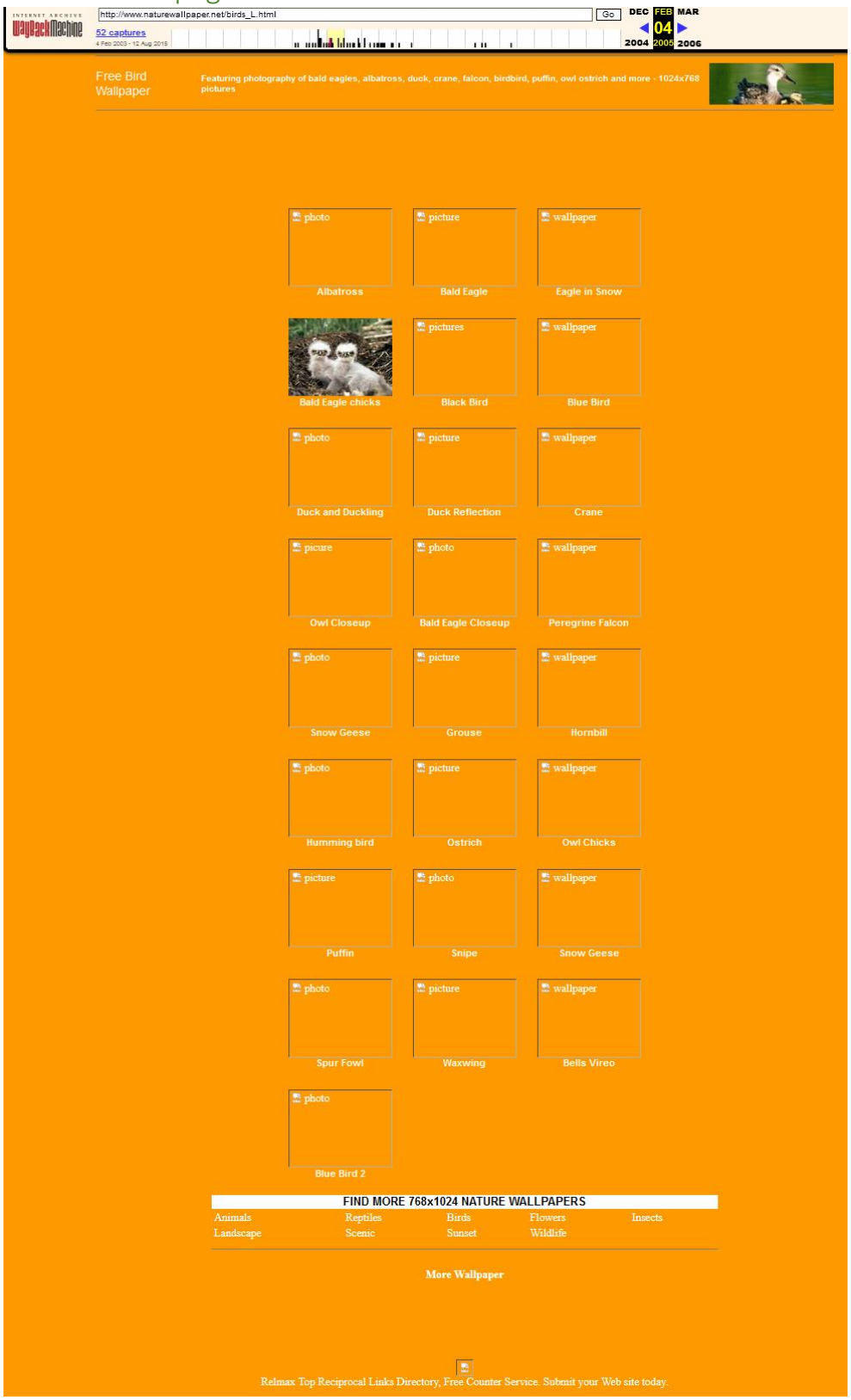

FIGURE 31, BOOKMARKED PAGE "HTTP://WWW.NATUREWALLPAPER.NET/BIRDS_L.HTML"

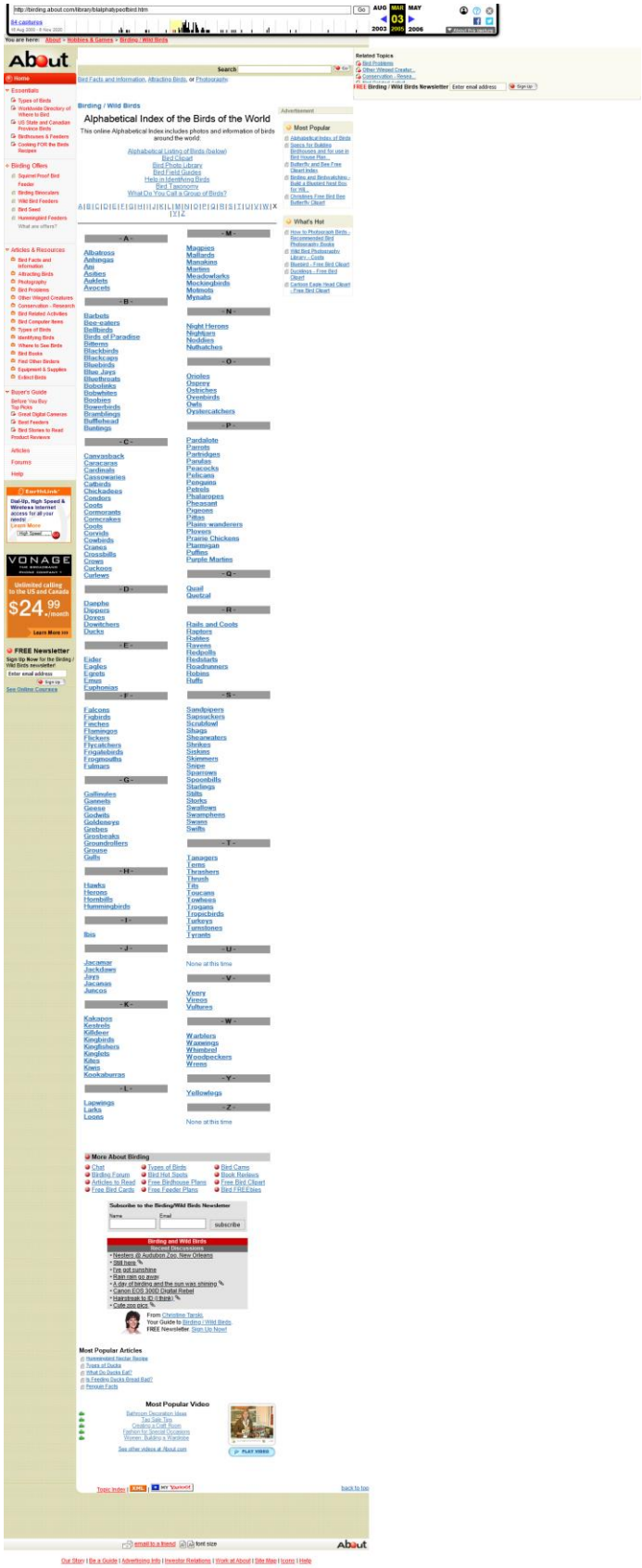

FIGURE 32, BOOKMARKED PAGE "HTTP://BIRDING.ABOUT.COM/LIBRARY/BLALPHATYPEOFBIRD.HTM"

POSTED 2 MAY 2002

RELATED WHY FILES:
More bird mating

Evolution

Bird migration

Snail sex

Science of love

Sleepy birds learn better

The best songs, it would seem, are about love. Whether it's a blues singer lamenting a lost love, or the sirens luring Odysseus to the shoals, a good song is a great way to attract the opposite sex.

This is not news to songbirds, who started mixing crooning and wooing long before Frank Sinatra lamented that he "didn't stand a ghost of a chance with you."

The mating song of the black-capped chickadee helps females decide who's sexy, and who isn't. Courtesy National Park Service.

Songbirds perform their vocal gymnastics to mark territory and get noticed by eligible females. Many scientists think the quality of the song tells her about his health -- since only a healthy guy bird could belt out the avian equivalent of "Lover Man."

Now we hear that female black-capped chickadees do more than listen closely. When their fellas lose out in a song competition, the ladies respond.

But not with a soothing, "Honey, maybe you can't hit high C-sharp, but you're still number-one. Come kiss my chicken lips."

No. The takeaway message for the ladies is: "I married a loser!"

Sounds courtesy Daniel Mennill.

And then they step outside the nest for some quick action with another guy! In evolutionary terms, that would guarantee that at least some of her young get top-notch genes.

The day I lost my baby

This, in short, is the message of a new study by Daniel Mennill and colleagues at Queen's University, Kingston, Ontario. Mennill, a graduate student, is interested in how animals make decisions, and especially how birds communicate during mating. Instead of looking just at two parties, however, he's checking the network thing -- how, say, a third party interprets communication between two others.

He calls it eavesdropping, since the females overhear the "conversations" of others.

Mennill studied wild-living black-capped chickadees at the Queen's University biological station and identified high- and low-status males. As with people, upper-crust chickadees skim off the cream, so to speak. "At a food source... everybody makes way for the highest ranking bird," he says.

Sing me softly of the blues

Male songs during mating season can be submissive or aggressive, Mennill says. Aggressive songs copy the pitch of the other guy's song.

In contrast, a submissive song uses a different pitch, giving the first songster some breathing room..

During mating season, Mennill hung out in the woods with a laptop and a speaker. He gathered the birds by playing the familiar chickadee call.

Bird Blues

When the guys began their mating songs, Mennill used software to identify the frequency, and then issued either an aggressive or a submissive song from his laptop. Weeks later, after the young were born, he took blood samples and used genetic techniques to determine each kid's biological dad.

The genetics told the sordid tale, Mennill says. "After a high-ranking guy lost a competition because I matched and overlapped his song, his female engaged in extrapair copulations." To Mennill, this proves that the females are eavesdropping on the guy-to-guy discussion.

Although songbirds were once considered monogamous -- they hang out in couples, and all of the young in the nest of a dominant male are normally his -- their behavior actually has elements of Beach Blanket Bingo. Many females do a certain amount of stepping out on their mates.

So when the lady heard her guy humiliated by the computerized song, about half of her future young wound up having a different dad, Mennill reports. "She's accustomed to hearing him win every song contest, but after hearing him lose, she changes her reproductive strategy."

It's a lot stranger in the night

Indeed, it took only six minutes a day, on two successive days, for the songs to change the female's mind, says Mennill. Apparently "the kind of information available through eavesdropping has a lot of importance relative to reproductive strategies."

The overlapping and matching songs may have other uses, says Mennill. "Most animals, including chickadees, live in groups, where many males are singing at the same time. You have to have capacity to address one individual if you want to say 'Hey you, I want you out of my territory.'"

Moral of the story: Guys, if you want to impress the ladies, tune up those vocal cords,.

Karaoke, anyone?

-- David Tenenbaum

BIBLIOGRAPHY

Female Eavesdropping on Male song Contests in Songbirds, Daniel Mennill et al, Science, 3 May 2002.

Credits | Feedback | Search

FIGURE 33, BOOKMARKED PAGE "HTTP://WHYFILES.ORG/SHORTIES/104CHICK_SEX/"

Browsing History

http://www.google.co.uk/search?client=firefox-a&rls=org.mozilla%3Aen-GB%3Aofficial_s&hl=en&q=birds&meta=&btnG=Google+Search	02/02/2005 14:11:46	0	google.co.uk	Google Search: birds
http://www.pbs.org/lifeofbirds/	02/02/2005 14:11:54	2	pbs.org	The Life of Birds
http://www.pbs.org/lifeofbirds/songs/index.html	02/02/2005 14:12:05	2	pbs.org	The Life of Birds | Songs

FIGURE 34, SEGMENT OF BROWSER HISTORY SHOWING SEARCH FOR "BIRDS" AND NAVIGATION TO "HTTP://WWW.PBS.ORG/LIFEOFBIRDS/SONGS/INDEX.HTML"

http://www.amazon.co.uk/exec/obidos/external-search/026-5665785-2744400?tag=roscosolutions&keyword=birds&mode=books-uk	02/02/2005 14:14:49	0	amazon.co.uk	Amazon.co.uk: Search Results Books: birds
http://www.amazon.co.uk/exec/obidos/external-search?tag=roscosolutions&keyword=birds&mode=books-uk	02/02/2005 14:14:49	0	amazon.co.uk	
http://www.google.co.uk/pagead/iclk?adurl=http://www.amazon.co.uk/exec/obidos/external-search%3Ftag%3Droscosolutions%26keywor...	02/02/2005 14:14:49	0	google.co.uk	
http://www.googleadservices.com/pagead/adclick?adurl=http://www.amazon.co.uk/exec/obidos/external-search%3Ftag%3Droscosolution...	02/02/2005 14:14:49	0	googleadservices.com	
http://www.amazon.co.uk/exec/obidos/ASIN/0007176147/qid=1107353690/sr=2-1/ref=sr_2_11_1/026-5665785-2744400	02/02/2005 14:14:59	0	amazon.co.uk	Amazon.co.uk: Books: Garden Birds Collins Gem S.
http://www.amazon.co.uk/exec/obidos/ASIN/0713666161/qid=1107353690/sr=2-3/ref=sr_2_11_3/026-5665785-2744400	02/02/2005 14:15:29	0	amazon.co.uk	Amazon.co.uk: Books: The Secret Lives of Garden Birds

FIGURE 35, SEGMENT OF BROWSER HISTORY SHOWING NAVIGATION TO AMAZON, AND THE ACCESS OF TWO BIRD RELATED BOOKS

http://www.google.co.uk/search?q=bird+wallpaper&sourceid=mozilla-search&start=0&start=0&ie=utf-8&oe=utf-8&client=firefox-a&rls=org.mozilla:en-GB:official	02/02/2005 14:15:42	0	google.co.uk	Google Search: bird wallpaper
http://www.naturewallpaper.net/birds_L.html	02/02/2005 14:15:51	0	naturewallpaper.net	Free Bird Wallpaper - Bald Eagle Albatross Owl Falcon 1024x768
http://as.casalemedia.com/s?s=53524&u=http%3A//www.naturewallpaper.net/birds_L.html&f=2&id=5780266264.517584	02/02/2005 14:15:51	0	as.casalemedia.com	
http://pagead2.googlesyndication.com/pagead/ads?client=ca-pub-0241683974610684&dt=1107353756202&lmt=1107353751&format=468x60_as&output=html&url=h...	02/02/2005 14:15:56	0	pagead2.googlesyndica...	
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http://www.naturewallpaper.net/birdsLpages/image4.html	02/02/2005 14:16:21	0	naturewallpaper.net	bald_eagle3.jpg
http://media.fastclick.net/w/get.media?t=n&sid=11194&m=1&f=b&v=1.4&c=1495&r=http%3A//www.naturewallpaper.net/birds_L.html&d=f	02/02/2005 14:16:21	0	media.fastclick.net	Winner !!!!
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http://www.naturewallpaper.net/birdsLpages/image21.html	02/02/2005 14:18:45	0	naturewallpaper.net	snow_geese.jpg
http://media.fastclick.net/w/get.media?t=n&sid=11194&m=1&f=b&v=1.4&c=7262&r=http%3A//www.naturewallpaper.net/birds_L.html&d=f	02/02/2005 14:18:45	0	media.fastclick.net	Winner !!!!
http://pagead2.googlesyndication.com/pagead/ads?client=ca-pub-0241683974610684&dt=1107353925746&lmt=1107353925&format=468x60_as&output=html&url=h...	02/02/2005 14:18:45	0	pagead2.googlesyndica...	
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http://uk.shop.com/amos/cc/main/ccn_search_catsa/st/bald+eagle/sy/products/ccsyn/518/SourceID/30	02/02/2005 14:19:56	0	uk.shop.com	SHOP.COM - Search results for bald eagle
http://amos.shop.com/amos/cc/main/catalog/pcd/7107298/prd/10187717/ccsyn/518/_x_/Choices-Direct---Movies-Bird-Safari---Bird-Watcher's-Paradise-VIDEO\	02/02/2005 14:20:19	0	amos.shop.com	SHOP.COM - Bird Safari - Bird Watcher's Paradise from Choices Direct - Movies is available in Documentary

FIGURE 36, VIEWING BIRD WALLPAPERS THEN NAVIGATING TO A SHOP VIA AN ADVERTISEMENT.

URL	First Visit Date	V..	Host Name	Title
http://www.google.co.uk/search?hl=en&client=firefox-a&rls=org.mozilla%3Aen-GB%3Aofficial&q=bird+stories&btnG=Search&meta=	02/02/2005 14:22:25	0	google.co.uk	Google Search: bird stories
http://birding.about.com/od/storie1/	02/02/2005 14:22:38	0	birding.about.com	Bird Stories and Tales
http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=14;pc=1;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=1;r=0;dcopt=i...	02/02/2005 14:22:38	0	n479ad.doubleclick.net	Click Here!
http://z.about.com/5/ad/go.htm?gs=birding	02/02/2005 14:22:38	8	z.about.com	Google Offers
http://z.about.com/0/ip/417/5.htm?CDN=hobbies	02/02/2005 14:22:38	8	z.about.com	
http://z.about.com/0/ip/496/0.htm	02/02/2005 14:22:38	8	z.about.com	Untitled Document
http://z.about.com/0/ip/512/6.htm	02/02/2005 14:22:38	8	z.about.com	
http://z.about.com/0/ip/512/12.htm	02/02/2005 14:22:38	8	z.about.com	
http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=14;pc=1;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=4;r=0;sz=728x...	02/02/2005 14:22:45	0	n479ad.doubleclick.net	Click Here!
http://z.about.com/6/o/b.htm?gs=birding	02/02/2005 14:22:45	7	z.about.com	Current Headlines
http://z.about.com/5/ad/am.htm?pid=about	02/02/2005 14:22:45	8	z.about.com	Audience Match Data Agent
http://birding.about.com/library/weekly/aa102598.htm	02/02/2005 14:23:04	0	birding.about.com	Wings of Terror - avian humor article for people interesting in birdwatching and others interested in birds
http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=0;pc=2;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=1;r=0;dcopt=is...	02/02/2005 14:23:04	0	n479ad.doubleclick.net	Click Here!
http://z.about.com/7/o/cw.htm?gs=birding	02/02/2005 14:23:04	6	z.about.com	
http://z.about.com/5/o/c.htm?gs=birding	02/02/2005 14:23:04	6	z.about.com	Related Articles
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http://birding.about.com/library/blalphatypeofbird.htm	02/02/2005 14:23:56	0	birding.about.com	Alphabetical Index of Birds
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http://birding.about.com/library/blhousespecs.htm	02/02/2005 14:24:18	0	birding.about.com	Specs for Building Birdhouses and for use in Bird House Plans
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http://birding.about.com/od/buildhouses/	02/02/2005 14:24:32	0	birding.about.com	How to Build Bird Houses and Nest Boxes
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http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=14;pc=5;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=4;r=0;u=0mfh...	02/02/2005 14:24:32	0	n479ad.doubleclick.net	Click Here!
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http://view.atdmt.com/VON/iview/btcmxvon026000001Svon/direct/01?click=http://n479ad.doubleclick.net/click%3Bh=v4|3213|3|0|%2aJq%3B12023409%3B0-0%3B0%3...	02/02/2005 14:24:42	0	view.atdmt.com	vonage_vpart_gothrubiz_336
http://birding.about.com/library/weekly/aa010703a.htm	02/02/2005 14:24:55	0	birding.about.com	Birding and Birdwatching - Build a Bluebird Nest Box for Wild Birds
http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=0;pc=7;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=1;r=0;u=0mfh7...	02/02/2005 14:24:55	0	n479ad.doubleclick.net	Click Here!
http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=0;pc=7;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=2;r=0;u=0mfh7...	02/02/2005 14:24:55	0	n479ad.doubleclick.net	Click Here!
http://n479ad.doubleclick.net/adi/abt.hobbies/hobbies_birding;svc=;site=birding;t=0;pc=7;fd=0;fs=0;a=;sbj=pid512;kw=;chan=hobbies;syn=about;tile=4;r=0;u=0mfh7...	02/02/2005 14:24:55	0	n479ad.doubleclick.net	Click Here!
http://clk.about.com/?zi=18/yW&sdn=hobbies_birding&tm=107&f=00&su=p512.6.140.ip_p512.12.140.ip_&tt=08&zu=http%3A//birding.about.com/library/blhousefeed...	02/02/2005 14:26:43	0	clk.about.com	
http://birding.about.com/library/blhousefeederpaint.htm	02/02/2005 14:26:43	0	birding.about.com	Birding and Birdwatching - Painting or Staining Bird Houses and Feeders

FIGURE 37, NAVIGATING "BIRDING.ABOUT.COM" AND ACCESSING SEVERAL ARTICLES WITHIN THE SITE

http://www.haiths.com/	02/02/2005 14:27:07	0	haiths.com

FIGURE 38, VISITING "HAITHS.COM"

http://www.imdb.com/title/tt0056869/	02/02/2005 14:40:24	0	imdb.com	The Birds 1963
http://www.imdb.com/google/box?num=3;k=power100-withsc;placement=midbucket;rnd=45504;sid=7845;referer=%2Ftitle%2Ftt0056869%2F;slot=GOOGLE	02/02/2005 14:40:30	0	imdb.com	
http://www.imdb.com/rg/title-tease/trailers/title/tt0056869/trailers	02/02/2005 14:40:46	0	imdb.com	
http://www.imdb.com/title/tt0056869/trailers	02/02/2005 14:40:46	0	imdb.com	Trailers for The Birds 1963
http://rcm.amazon.com/e/cm?f=ifr&t=imdb-rec-banner-20&l=st1&search=widescreen&mode=dvd&p=13&o=1	02/02/2005 14:40:46	0	rcm.amazon.com	
http://www.imdb.com/google/box?num=3;k=power100-withsc;placement=midbucket;rnd=83932;sid=8055;referer=%2Ftitle%2Ftt0056869%2Ftrailers;slot=BOTTOM_CE...	02/02/2005 14:40:46	0	imdb.com	
http://www.imdb.com/google/box?num=5;k=maxww-sky;placement=2;rnd=87222585498205930O;sid=-123;referer=maxww;slot=TOP_RHS	02/02/2005 14:40:49	0	imdb.com	
http://www.imdb.com/rg/TITLETRA_VIDDET//http://videodetective.com/home.asp?PublishedID=1843	02/02/2005 14:41:00	0	imdb.com	

FIGURE 39, VISITING THE IMDB PAGE FOR "THE BIRDS" 1963

http://www.pbs.org/lifeofbirds/songs/kakapo.ram	02/02/2005 15:11:41	0	pbs.org
http://www.pbs.org/lifeofbirds/songs/dawn.ram	02/02/2005 15:12:06	0	pbs.org

FIGURE 40, RETURNING TO "PBS.ORG"

http://www.google.co.uk/search?q=windows+gnupg&sourceid=mozilla-search&start=0&start=0&ie=utf-8&oe=utf-8&client=firefox-a&rls=org.mozilla:en-GB:official	02/02/2005 15:57:40	0	google.co.uk	Google Search: windows gnupg
http://www.gnupg.org/download.html	02/02/2005 15:57:51	0	gnupg.org	
http://www.gnupg.org/download/	02/02/2005 15:57:51	0	gnupg.org	Download - GnuPG.org
http://www.winpt.org/	02/02/2005 15:58:23	0	winpt.org	WinPT
http://www.stud.uni-hannover.de/~twoaday/winpt.html	02/02/2005 15:58:23	0	stud.uni-hannover.de	

FIGURE 41, SEARCH AND ACCESSING OF GNUPG AND WINPT

http://www.google.co.uk/search?client=firefox-a&rls=org.mozilla%3Aen-GB%3Aofficial_s&hl=en&q=bird+mating+calls&meta=&btnG=Google+Search	03/02/2005 12:21:40	0		Google Search: bird mating calls
http://whyfiles.org/shorties/104chick_sex/	03/02/2005 12:21:56	0	whyfiles.org	Chickadee Karaoke
http://www.google.co.uk/imghp?hl=en&tab=wi&client=firefox-a&rls=org.mozilla:en-GB:official_s&q=	03/02/2005 14:59:29	0		Google Image Search
http://images.google.co.uk/images?client=firefox-a&rls=org.mozilla%3Aen-GB%3Aofficial_s&q=young+chicks&hl=en&btnG=Google+Search	03/02/2005 14:59:40	0	images.google.co.uk	Google Search: young chicks
http://images.google.co.uk/imgres?imgurl=http://freespace.virgin.net/cobber.budgies/images/babyscot_vyoung.jpg&imgrefurl=http://freespace.virgin.net/cobber.bu...	03/02/2005 14:59:56	0		Google Image Result for http://freespace.virgin.net/cobber.budgies/images/babyscot_vyoung.jpg
http://images.google.co.uk/imgres?imgurl=http://freespace.virgin.net/cobber.budgies/images/babyscot_vyoung.jpg&imgrefurl=http://freespace.virgin.net/cobber.bu...	03/02/2005 14:59:56	0		

FIGURE 42, GOOGLE IMAGE SEARCH FOR "YOUNG CHICKS" AND GOOGLE SEARCH FOR "BIRD MATING CALLS"

http://images.google.co.uk/imgres?imgurl=http://www.insaneanimals.com/items/177.jpg&imgrefurl=http://www.insaneanimals.com/funny-animals/177.html%3Fsor...	03/02/2005 15:01:02	0		Google Image Result for http://www.insaneanimals.com/items/177.jpg
http://images.google.co.uk/imgres?imgurl=http://www.insaneanimals.com/items/177.jpg&imgrefurl=http://www.insaneanimals.com/funny-animals/177.html%3Fsor...	03/02/2005 15:01:02	0		
http://www.insaneanimals.com/funny-animals/177.html?sort=date	03/02/2005 15:01:08	0	insaneanimals.com	Young Chicks - Funny Animals, Pets, Cats and Dogs Pictures - Insane Animals
http://media.fastclick.net/w/get.media?t=n&sid=13470&m=3&f=b&v=1.4&c=7098&r=http%3A//images.google.co.uk/imgres%3Fimgurl%3Dhttp%3A//www.insanea...	03/02/2005 15:01:17	0		
http://pagead2.googlesyndication.com/pagead/ads?client=ca-pub-2066660325911329&dt=1107442877733&format=120x600_as&output=html&url=http%3A%2F%2Fi...	03/02/2005 15:01:17	0		
http://images.google.co.uk/images?q=young+chicks&hl=en&lr=&client=firefox-a&rls=org.mozilla:en-GB:official_s&start=20&sa=N	03/02/2005 15:01:53	0		
http://images.google.co.uk/imgres?imgurl=http://www.cvm.okstate.edu/instruction/kocan/disk2/images/img0056.jpg&imgrefurl=http://www.cvm.okstate.edu/instru...	03/02/2005 15:02:14	0		Google Image Result for http://www.cvm.okstate.edu/instruction/kocan/disk2/images/img0056.jpg
http://images.google.co.uk/imgres?imgurl=http://www.cvm.okstate.edu/instruction/kocan/disk2/images/img0056.jpg&imgrefurl=http://www.cvm.okstate.edu/instru...	03/02/2005 15:02:14	0		
http://www.cvm.okstate.edu/instruction/kocan/ostrich/ostbk2b2.htm	03/02/2005 15:02:14	0	cvm.okstate.edu	
http://images.google.co.uk/images?q=young+chicks&hl=en&lr=&client=firefox-a&rls=org.mozilla:en-GB:official_s&start=40&sa=N	03/02/2005 15:03:32	0		
http://images.google.co.uk/imgres?imgurl=http://people.cornell.edu/pages/sah67/chicks2.jpg&imgrefurl=http://people.cornell.edu/pages/sah67/summer.html&h=4...	03/02/2005 15:03:54	0		Google Image Result for http://people.cornell.edu/pages/sah67/chicks2.jpg
http://images.google.co.uk/imgres?imgurl=http://people.cornell.edu/pages/sah67/chicks2.jpg&imgrefurl=http://people.cornell.edu/pages/sah67/summer.html&h=4...	03/02/2005 15:03:54	0		
http://people.cornell.edu/pages/sah67/summer.html	03/02/2005 15:03:54	0	people.cornell.edu	Eco Gallery '04

FIGURE 43, SEVERAL ORNITHOLOGICAL FILES ACCESSED AND DOWNLOADED

http://www.google.co.uk/search?client=firefox-a&rls=org.mozilla%3Aen-GB%3Aofficial_s&hl=en&q=bird+screensavers&meta=&btnG=Google+Search	09/02/2005 11:27:00	0		Google Search: bird screensavers
http://www.traveltex.com/screen.asp?SN=62453008&LS=0&SS=1	09/02/2005 11:27:12	0	traveltex.com	Screensavers
http://www.traveltex.com/downloads/screensavers/birds.zip	09/02/2005 11:27:48	0		

FIGURE 44, DOWNLOAD OF "BIRDS.ZIP"

Downloaded Files

```
<RDF:Description RDF:about="C:\DOCUME~1\JOHNDOE\LOCALS~1\TEMP\dawn.ram"
                 NC:Name="dawn.ram"
                 NC:Transferred="1kB of  1kB">
  <NC:URL RDF:resource="http://www.pbs.org/lifeofbirds/songs/dawn.ram"/>
  <NC:File RDF:resource="C:\DOCUME~1\JOHNDOE\LOCALS~1\TEMP\dawn.ram"/>
  <NC:DateStarted NC:parseType="Date">Wed Feb 02 15:12:09 GMT Standard Time 2005 +573635</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Wed Feb 02 15:12:09 GMT Standard Time 2005 +593664</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 45, DOWNLOAD OF "DAWN.RAM"

```
<RDF:Description RDF:about="E:\birds\audio\aggressive_song.wav"
                 NC:Name="aggressive_song.wav"
                 NC:Transferred="716kB of 716kB">
  <NC:URL RDF:resource="http://whyfiles.org/shorties/104chick_sex/images/aggressive_song.wav"/>
  <NC:File RDF:resource="E:\birds\audio\aggressive_song.wav"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 12:22:52 GMT Standard Time 2005 +164782</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 12:23:00 GMT Standard Time 2005 +466720</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 46, DOWNLOAD OF "AGGRESSIVE_SONG.WAV"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_vyoung.jpg"
                 NC:Name="babyscot_vyoung.jpg"
                 NC:Transferred="38kB of 38kB">
  <NC:URL RDF:resource="http://freespace.virgin.net/cobber.budgies/images/babyscot_vyoung.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_vyoung.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:00:19 GMT Standard Time 2005 +779785</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:00:19 GMT Standard Time 2005 +819843</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 47, DOWNLOAD OF "BABYSCOT_VYOUNG.JPG"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_2weeks1.jpg"
                 NC:Name="babyscot_2weeks1.jpg"
                 NC:Transferred="33kB of 33kB">
  <NC:URL RDF:resource="http://freespace.virgin.net/cobber.budgies/images/babyscot_2weeks1.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\My Pictures\babyscot_2weeks1.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:00:27 GMT Standard Time 2005 +761262</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:00:27 GMT Standard Time 2005 +811334</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 48, DOWNLOAD OF "BABYSCOT_2WEEKS1.JPG"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\My Pictures\177.jpg"
                 NC:Name="177.jpg"
                 NC:Transferred="9kB of  9kB">
  <NC:URL RDF:resource="http://www.insaneanimals.com/items/177.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\My Pictures\177.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:01:38 GMT Standard Time 2005 +983675</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:01:39 GMT Standard Time 2005 +033747</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 49, DOWNLOAD OF "177.JPG"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\ostbk2b2.htm"
                 NC:Name="ostbk2b2.htm"
                 NC:Transferred="4kB of  4kB">
  <NC:URL RDF:resource="http://www.cvm.okstate.edu/instruction/kocan/ostrich/ostbk2b2.htm"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\ostbk2b2.htm"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:02:45 GMT Standard Time 2005 +499320</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:02:45 GMT Standard Time 2005 +579435</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 50, DOWNLOAD OF "OSTBK2B2.HTM"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\Desktop\birdtrans2.jpg"
                 NC:Name="birdtrans2.jpg"
                 NC:Transferred="58kB of 58kB">
  <NC:URL RDF:resource="http://people.cornell.edu/pages/sah67/birdtrans2.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\Desktop\birdtrans2.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:04:48 GMT Standard Time 2005 +235806</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:04:48 GMT Standard Time 2005 +285878</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 51, DOWNLOAD OF "BIRDTRANS2.JPG"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\newbies2.jpg"
                 NC:Name="newbies2.jpg"
                 NC:Transferred="54kB of 54kB">
  <NC:URL RDF:resource="http://people.cornell.edu/pages/sah67/newbies2.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\newbies2.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:05:44 GMT Standard Time 2005 +376532</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:05:44 GMT Standard Time 2005 +456648</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\My Pictures\chicks2.jpg"
                 NC:Name="chicks2.jpg"
                 NC:Transferred="38kB of 38kB">
  <NC:URL RDF:resource="http://people.cornell.edu/pages/sah67/chicks2.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\My Pictures\chicks2.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:05:03 GMT Standard Time 2005 +698040</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:05:03 GMT Standard Time 2005 +748112</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 52, DOWNLOAD OF "NEWBIES2.JPG" AND "CHICKS2.JPG"

```
<RDF:Description RDF:about="C:\Documents and Settings\bob\My Documents\My Music\ready2fledge.jpg"
                 NC:Name="ready2fledge.jpg"
                 NC:Transferred="77kB of 77kB">
  <NC:URL RDF:resource="http://people.cornell.edu/pages/sah67/ready2fledge.jpg"/>
  <NC:File RDF:resource="C:\Documents and Settings\bob\My Documents\My Music\ready2fledge.jpg"/>
  <NC:DateStarted NC:parseType="Date">Thu Feb 03 15:06:42 GMT Standard Time 2005 +379937</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Thu Feb 03 15:06:42 GMT Standard Time 2005 +440024</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 53, DOWNLOAD OF "READY2FLEDGE.JPG"

```
<RDF:Description RDF:about="C:\Documents and Settings\johndoe\My Documents\birds.zip"
                 NC:Name="birds.zip"
                 NC:Transferred="1028kB of 1028kB">
  <NC:URL RDF:resource="http://www.traveltex.com/downloads/screensavers/birds.zip"/>
  <NC:File RDF:resource="C:\Documents and Settings\johndoe\My Documents\birds.zip"/>
  <NC:DateStarted NC:parseType="Date">Wed Feb 09 11:28:00 GMT Standard Time 2005 +345172</NC:DateStarted>
  <NC:DateEnded NC:parseType="Date">Wed Feb 09 11:28:00 GMT Standard Time 2005 +415273</NC:DateEnded>
  <NC:DownloadState NC:parseType="Integer">1</NC:DownloadState>
  <NC:ProgressPercent NC:parseType="Integer">100</NC:ProgressPercent>
</RDF:Description>
```

FIGURE 54, DOWNLOAD OF "BIRDS.ZIP"

Appendix E – Registry Examination

Key	Type	Value
BuildLab	REG_SZ	2600.xpsp_sp2_rtm.040803-2158
CSDVersion	REG_SZ	Service Pack 2
CurrentBuild	REG_SZ	1.511.1 () (Obsolete data - do not use)
CurrentBuildNumber	REG_SZ	2600
CurrentType	REG_SZ	Uniprocessor Free
CurrentVersion	REG_SZ	5.1
DigitalProductId	REG_BINARY	a4 00 00 00 03 00 00 00 37 36 34 38 37 2d 30 31 35 2d 34 30 32 37 39 33 33 2d 32 32 30 38 37 00 2c 00 00 00 41 32 32 2d 30 30
InstallDate	REG_DWORD	0x41f51995
LicenseInfo	REG_BINARY	33 b7 21 85 38 a9 f7 32 0e c1 08 ab 4f f4 a5 9d 1b fd 9b 5f e0 c8 20 15 62 2a f6 3a 64 a4 eb e4 e9 ee 73 8e 83 8c 35 c3 67 68 a0 8
PathName	REG_SZ	C:\WINDOWS
ProductId	REG_SZ	76487-015-4027933-22087
ProductName	REG_SZ	Microsoft Windows XP
RegDone	REG_SZ	
RegisteredOrganization	REG_SZ	
RegisteredOwner	REG_SZ	John Doe
SoftwareType	REG_SZ	SYSTEM
SourcePath	REG_SZ	D:\I386
SubVersionNumber	REG_SZ	
SystemRoot	REG_SZ	C:\WINDOWS

Hex viewer

0000	95 19 f5 41	...A

int8:	-107
uint8:	149
int16:	6549
uint16:	6549
int32:	1106581909
uint32:	1106581909
unixtime:	2005/01/24 15:51:49

Byte offset: 0x0000 (0) — Little endian — Big endian

FIGURE 55, SYSTEM INFORMATION ABOUT DOE'S COMPUTER, INSTALL DATE HIGHLIGHTED

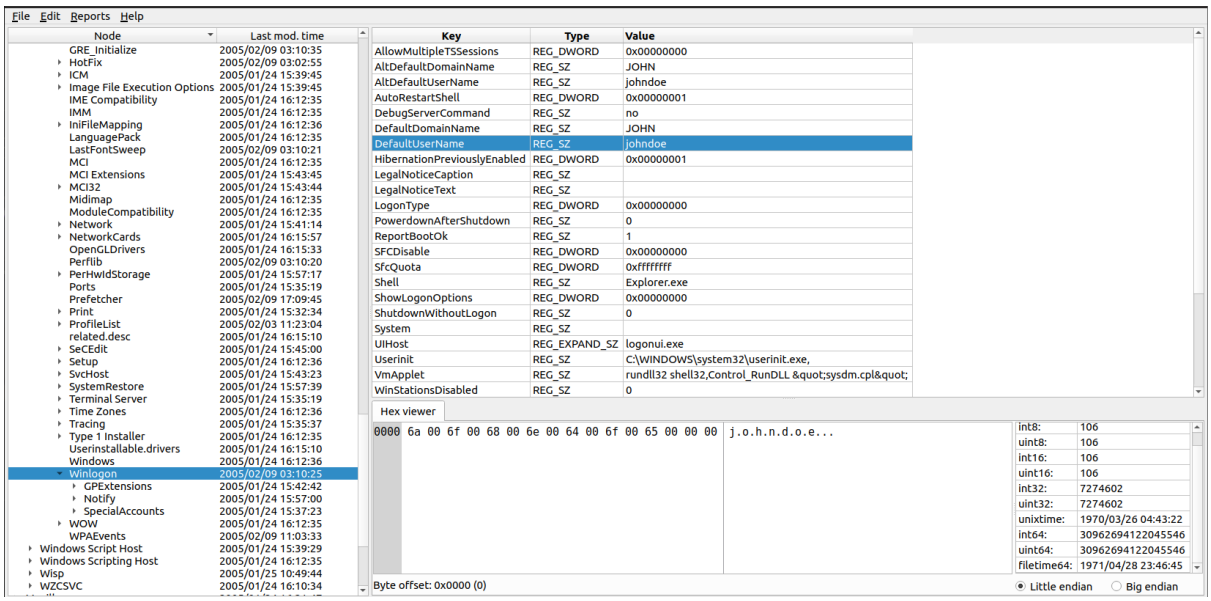


FIGURE 56, THE SOFTWARE REGISTRY'S EVIDENCE THAT JOHN WAS THE LAST USER ON THE MACHINE

Key	Type	Value
CSDReleaseType	REG_DWORD	0x00000000
CSDVersion	REG_DWORD	0x00000200
Directory	REG_EXPAND_SZ	%SystemRoot%
ErrorMode	REG_DWORD	0x00000000
NoInteractiveServices	REG_DWORD	0x00000000
ShellErrorMode	REG_DWORD	0x00000001
ShutdownTime	REG_BINARY	c4 5d a9 30 ca 0e c5 01
SystemDirectory	REG_EXPAND_SZ	%SystemRoot%\system32

Hex viewer

```
0000 c4 5d a9 30 ca 0e c5 01    .].0....
```

uint8:	196
int16:	24004
uint16:	24004
int32:	816405956
uint32:	816405956
unixtime:	1995/11/15 03:25:56
int64:	127524426012515780
uint64:	127524426012515780
filetime64:	2005/02/09 17:10:01

FIGURE 57, THE SYSTEM REGISTRY SHOWING THE LAST SHUTDOWN TIME OF 17.10.01 ON 9TH OF FEBRUARY 2005

Mounted Devices

Key	Type	Value
\??\Volume{30bf5ac0-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00 4
\??\Volume{30bf5ac1-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 5
\??\Volume{30bf5ac3-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	b8 dd b8 dd 00 7e 00 00 00 00 00 00
\??\Volume{44d36d3b-7525-11d9-ab5a-0048545652e0}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 53 00 54 00 4f 00 52 00 41 00 47 00 45 00 23 00 52 00 65 00 6d 00 6f 00 7
\??\Volume{44d36d43-7525-11d9-ab5a-0048545652e0}	REG_BINARY	b8 dd b8 dd 00 fc 47 bb 00 00 00 00
\DosDevices\A:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00 4
\DosDevices\C:	REG_BINARY	b8 dd b8 dd 00 7e 00 00 00 00 00 00
\DosDevices\D:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 5
\DosDevices\E:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 53 00 54 00 4f 00 52 00 41 00 47 00 45 00 23 00 52 00 65 00 6d 00 6f 00 7
\DosDevices\F:	REG_BINARY	b8 dd b8 dd 00 fc 47 bb 00 00 00 00

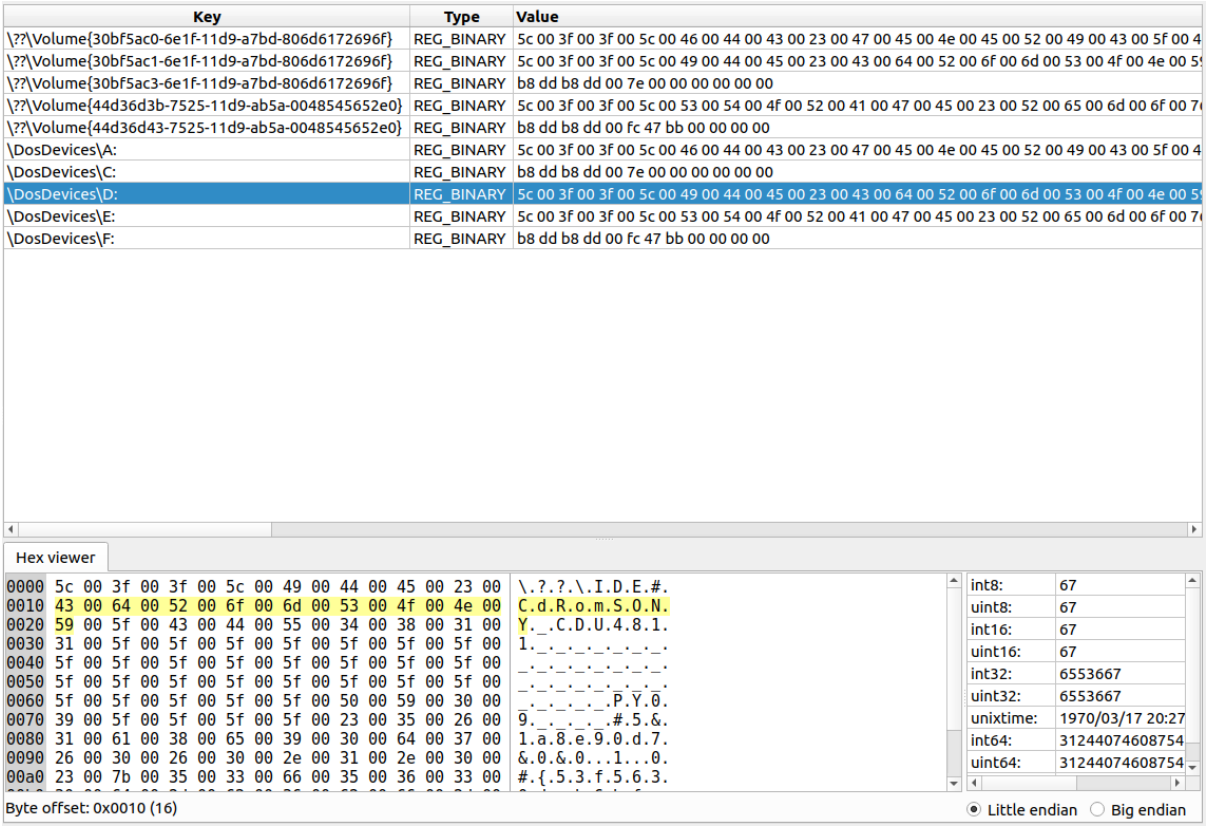
Hex viewer

```
0000 5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00   \.?.?.\.F.D.C.#.
0010 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00   G.E.N.E.R.I.C._.
0020 46 00 4c 00 4f 00 50 00 50 00 59 00 5f 00 44 00   F.L.O.P.P.Y._.D.
0030 52 00 49 00 56 00 45 00 23 00 34 00 26 00 33 00   R.I.V.E.#.4.&.3.
0040 33 00 62 00 63 00 31 00 38 00 66 00 61 00 26 00   3.b.c.1.8.f.a.&.
0050 30 00 26 00 30 00 23 00 7b 00 35 00 33 00 66 00   0.&.0.#.{.5.3.f.
0060 35 00 36 00 33 00 30 00 64 00 2d 00 62 00 36 00   5.6.3.0.d.-.b.6.
0070 62 00 66 00 2d 00 31 00 31 00 64 00 30 00 2d 00   b.f.-.1.1.d.0.-.
0080 39 00 34 00 66 00 32 00 2d 00 30 00 30 00 61 00   9.4.f.2.-.0.0.a.
0090 30 00 63 00 39 00 31 00 65 00 66 00 62 00 38 00   0.c.9.1.e.f.b.8.
00a0 62 00 7d 00                                       b.}.
```

int8:	71
uint8:	71
int16:	71
uint16:	71
int32:	4522055
uint32:	4522055
unixtime:	1970/02/22 08:07
int64:	19422108405006
uint64:	19422108405006

Byte offset: 0x0010 (16) Little endian Big endian

FIGURE 58, A FLOPPY DISK DRIVE WAS MOUNTED AS THE A: DRIVE



Key	Type	Value
\??\Volume{30bf5ac0-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00 4
\??\Volume{30bf5ac1-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 5
\??\Volume{30bf5ac3-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	b8 dd b8 dd 00 7e 00 00 00 00 00 00
\??\Volume{44d36d3b-7525-11d9-ab5a-0048545652e0}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 53 00 54 00 4f 00 52 00 41 00 47 00 45 00 23 00 52 00 65 00 6d 00 6f 00 7
\??\Volume{44d36d43-7525-11d9-ab5a-0048545652e0}	REG_BINARY	b8 dd b8 dd 00 fc 47 bb 00 00 00 00
\DosDevices\A:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00 4
\DosDevices\C:	REG_BINARY	b8 dd b8 dd 00 7e 00 00 00 00 00 00
\DosDevices\D:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 5
\DosDevices\E:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 53 00 54 00 4f 00 52 00 41 00 47 00 45 00 23 00 52 00 65 00 6d 00 6f 00 7
\DosDevices\F:	REG_BINARY	b8 dd b8 dd 00 fc 47 bb 00 00 00 00

Hex viewer

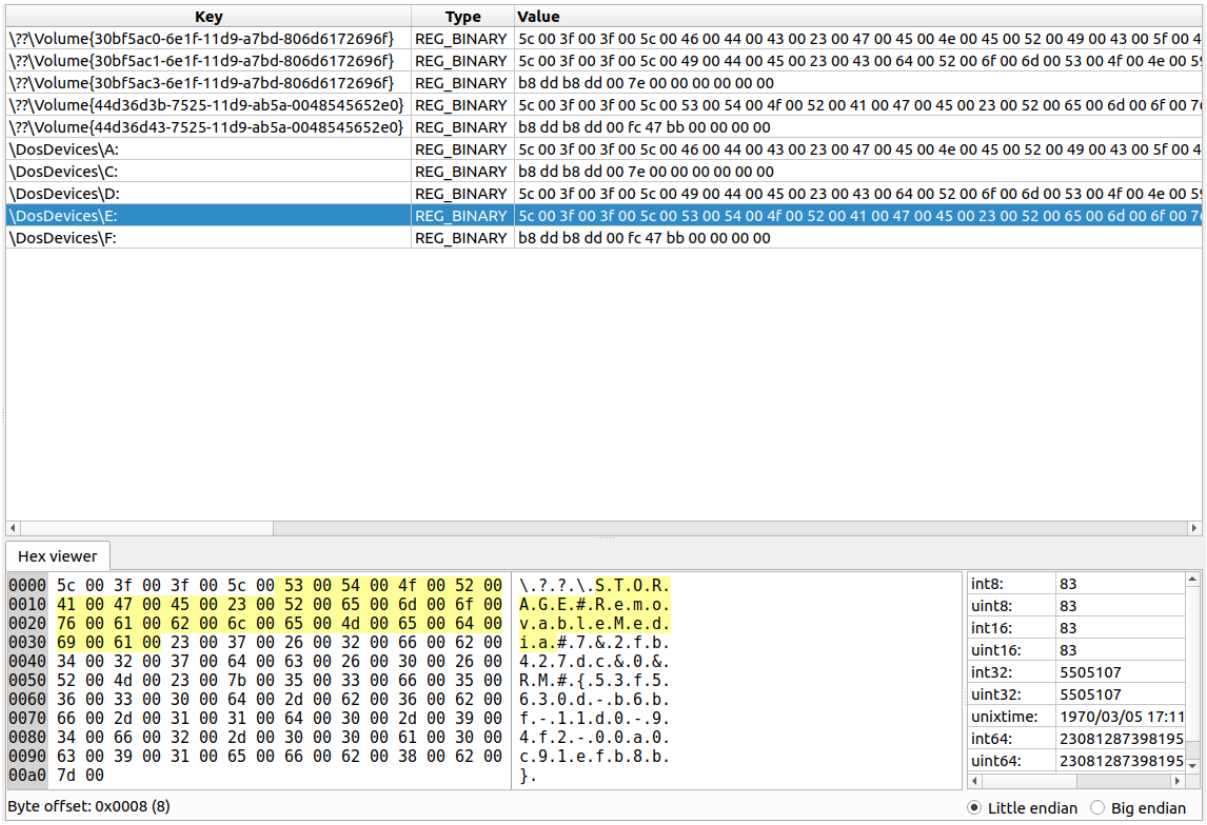
```
0000 5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 \.?.?.\.I.D.E.#.
0010 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 C.d.R.o.m.S.O.N.
0020 59 00 5f 00 43 00 44 00 55 00 34 00 38 00 31 00 Y._.C.D.U.4.8.1.
0030 31 00 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 1._._._._._._._.
0040 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 _._._._._._._._.
0050 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 5f 00 _._._._._._._._.
0060 5f 00 5f 00 5f 00 5f 00 5f 00 50 00 59 00 30 00 _._._._._.P.Y.0.
0070 39 00 5f 00 5f 00 5f 00 5f 00 23 00 35 00 26 00 9._._._._.#.5.&.
0080 31 00 61 00 38 00 65 00 39 00 30 00 64 00 37 00 1.a.8.e.9.0.d.7.
0090 26 00 30 00 26 00 30 00 2e 00 31 00 2e 00 30 00 &.0.&.0...1...0.
00a0 23 00 7b 00 35 00 33 00 66 00 35 00 36 00 33 00 #.{.5.3.f.5.6.3.
```

int8:	67
uint8:	67
int16:	67
uint16:	67
int32:	6553667
uint32:	6553667
unixtime:	1970/03/17 20:27
int64:	31244074608754
uint64:	31244074608754

Byte offset: 0x0010 (16)

Little endian Big endian

FIGURE 59, A SONY CD DRIVE WAS MOUNTED AS THE D: DRIVE



Key	Type	Value
\??\Volume{30bf5ac0-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00 4
\??\Volume{30bf5ac1-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 5
\??\Volume{30bf5ac3-6e1f-11d9-a7bd-806d6172696f}	REG_BINARY	b8 dd b8 dd 00 7e 00 00 00 00 00 00
\??\Volume{44d36d3b-7525-11d9-ab5a-0048545652e0}	REG_BINARY	5c 00 3f 00 3f 00 5c 00 53 00 54 00 4f 00 52 00 41 00 47 00 45 00 23 00 52 00 65 00 6d 00 6f 00 7
\??\Volume{44d36d43-7525-11d9-ab5a-0048545652e0}	REG_BINARY	b8 dd b8 dd 00 fc 47 bb 00 00 00 00
\DosDevices\A:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 46 00 44 00 43 00 23 00 47 00 45 00 4e 00 45 00 52 00 49 00 43 00 5f 00 4
\DosDevices\C:	REG_BINARY	b8 dd b8 dd 00 7e 00 00 00 00 00 00
\DosDevices\D:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 49 00 44 00 45 00 23 00 43 00 64 00 52 00 6f 00 6d 00 53 00 4f 00 4e 00 5
\DosDevices\E:	REG_BINARY	5c 00 3f 00 3f 00 5c 00 53 00 54 00 4f 00 52 00 41 00 47 00 45 00 23 00 52 00 65 00 6d 00 6f 00 7
\DosDevices\F:	REG_BINARY	b8 dd b8 dd 00 fc 47 bb 00 00 00 00

Hex viewer

0000	5c	00	3f	00	3f	00	5c	00	53	00	54	00	4f	00	52	00	\.?.?.\.S.T.O.R.
0010	41	00	47	00	45	00	23	00	52	00	65	00	6d	00	6f	00	A.G.E.#.R.e.m.o.
0020	76	00	61	00	62	00	6c	00	65	00	4d	00	65	00	64	00	v.a.b.l.e.M.e.d.
0030	69	00	61	00	23	00	37	00	26	00	32	00	66	00	62	00	i.a.#.7.&.2.f.b.
0040	34	00	32	00	37	00	64	00	63	00	26	00	30	00	26	00	4.2.7.d.c.&.0.&.
0050	52	00	4d	00	23	00	7b	00	35	00	33	00	66	00	35	00	R.M.#.{.5.3.f.5.
0060	36	00	33	00	30	00	64	00	2d	00	62	00	36	00	62	00	6.3.0.d.-.b.6.b.
0070	66	00	2d	00	31	00	31	00	64	00	30	00	2d	00	39	00	f.-.1.1.d.0.-.9.
0080	34	00	66	00	32	00	2d	00	30	00	30	00	61	00	30	00	4.f.2.-.0.0.a.0.
0090	63	00	39	00	31	00	65	00	66	00	62	00	38	00	62	00	c.9.1.e.f.b.8.b.
00a0	7d	00															}.

int8:	83
uint8:	83
int16:	83
uint16:	83
int32:	5505107
uint32:	5505107
unixtime:	1970/03/05 17:11
int64:	23081287398195
uint64:	23081287398195

Byte offset: 0x0008 (8)

Little endian Big endian

FIGURE 60, A REMOVABLE USB DRIVE WAS MOUNTED AS THE E: DRIVE