

**JOINT REPORT of**

[REDACTED]

**Abertay's Forensic Taskforce**

**Case against: John Doe**



The student author of this work has been assessed as having Specific Learning Difficulty (SpLD) and this may affect fluent, accurate and concise written expression. Markers are advised to check the student' individual learning plan for specific guidance on issues to take into account when marking. If there are any queries, please contact Advisory Service.

**CMP 209**

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## **1) Introduction / Summary**

### **1.1) Introduction**

Four digital forensics investigators were tasked with recovering and analysing data on the suspect's hard drive, given in the form of a disk image. Each section in this report was written and collated by a different investigator, but the relevant areas of the disk image were analysed by multiple investigators.

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### **1.2) Summary**

The suspect's machine was seized from their house, transported, and stored safely, and a disk image made for the investigators to analyse. The image is identical to the data stored on the suspect's hard drive of their computer.

The investigators found evidence to show the suspect possessed, obtained, and had distributed illegal images of birds while attempting to hide their activities.

Images were directly recovered from the disk image; others were hidden in locations obscured to a computer user without technical ability or deleted. There was also browser evidence to show some illegal images were stored on external storage devices; devices which were not found during the seizure of the suspect's machine.

Illegal images were recovered that had been taken by 3 separate cameras, although no such photo equipment was recovered from the scene.

Browser analysis showed the suspect obtained some illegal images from the internet but also bookmarked their location, and saved others on to their hard drive.

Analysis of the registry keys showed that the suspect's account was the account responsible for viewing the illegal images.

Analysis of email files found that the suspect was in contact with one other person, and the suspect had distributed illegal images to them. One email also confirmed that the suspect had previously received illegal images from the contact.

There was no evidence found to suggest the other users on the machine were also engaged in viewing of the illicit material. Evidence found that the suspect had downloaded illegal files into another user's files, but there was no evidence that the other user accessed or modified the images. Without forensic knowledge, it would outwardly appear that the other user was also storing illegal images; this was not the case.

## **2) Description of Crime**

### **2.1) Functional analysis**

During the investigation, the investigators discovered 3 user accounts on the suspect's machine. The accounts were named "johndoe", "bob" and "jane". The user account "johndoe" appears to have belonged to the suspect, John Doe. From the account's activity it was seen that the suspect engaged in possession and distribution of illicit materials of ornithological nature together with an individual by the name of Ben Forbes, who was found to be an email contact.

The suspect John Doe was in possession of various pictures of birds (Subsection 4.2), some of which he attempted to hide (Subsection 4.2.1). Images were also found of what appears to be a birdwatching trip on his machine, which were also attempted to be hidden (Subsection 4.2.3). Mr. John Doe engaged in downloading of files of illicit nature of the internet and accessing and bookmarking of multiple web pages with illicit content (Subsection 4.4) as well as exchanging pictures of birds with Ben Forbes through emails (Subsection 4.2.2).

Mr. Ben Forbes communicated through email with Mr. John Doe. They shared stories and images of ornithological nature with each other and appear to be friends based on the informality of their emails.

### **2.2) Illicit files recovered from the machine**

#### **2.2.1) Illicit images captured from cameras**

During the physical search (Section 4.2) photos from 3 different camera models were found. All photos can be found within Appendix A, with the Camera labelled along with it.

##### **2.2.1.1) Canon Eos-1ds**

1 illicit image was found originating from a Canon Eos-1ds camera, which was captured on 29.01.2003 at 16:14:10 GMT

##### **2.2.1.2) Canon Powershot Sd100**

19 different illicit images of birds were found originating from a Canon Powershot Sd100 camera. However, from the same camera model there was 34 photos of the suspect taking part in appears to be birdwatching and birdcages. The images were captured between 09.06.2004 at 19:02:28 and 27.06.2004 at 18:28:34 GMT

##### **2.2.1.3) Sony Cybershot**

1 illicit image was found on the Sony Cybershot camera, which was taken on 30.12.2002 at 12:28:49 GMT

## **2.2.2) Illicit files downloaded from the internet**

During browser analysis (Section 4.4) it was found that the suspect visited and downloaded files from various websites containing materials of ornithological nature

### **2.2.2.1) Image files**

12 illicit images were downloaded on from 02.02.2005 to 03.02.2005 with Mozilla Firefox. One of them, called ready2fledge was taken on 20.06.2004 at 18:01:40 GMT and was saved under Bob's user account, but was downloaded from the suspect. Saving it in Bob's account seems like an attempt to hide it.

These images can be found in Appendix B

### **2.2.2.2) Audio file**

An audio file called aggressive.wav, which plays bird sounds was found during browser analysis (Section 4.4). The file was downloaded on 09.02.2005 at 17:00:20 GMT. It can be found in Appendix C.

### **2.2.2.3) Zip File**

A zip file called "birds.zip" was found to be downloaded from one of the sites. The download occurred on 09.02.2005 at 11:28:00 and can be seen in the file called "downloads.rdf" in Appendix E.

### **2.2.2.4) Webpage**

A webpage called "ostbk2b2.htm", which contains bird content was downloaded using Mozilla Firefox. The webpage was downloaded on 03.02.2005.

Another website was found in a file called "aa010703a.htm". It was downloaded using Internet Explorer on 02.02.2005 in John Doe's "My Documents" folder. Its contents are instructions on how to build a bird nest.

The contents of the webpages can be seen in Appendix D.

## **2.2.3) Illicit files received by email**

John Doe (jdoe@example.com) sent and received various emails from Ben Forbes(ben@example.org) which were successfully recovered during the analysis. (Section 4.2.2)

Between 16.10.2004 and 09.02.2005 Mr. Doe received a total of 5 emails. In 4 of those emails, he received materials of ornithological nature from Ben Forbes. Emails can be found in Appendix F.

The other email was from a mailing list which he appears to have been subscribed for (mailinglist@birds.example.com) that send him emails about how to identify birds. Emails can be found in Appendix G

## **2.2.4) Illicit files with edited file extensions**

Files were found with edited file extensions in attempt to hide them (Section 4.2.1). The files were unable to be dated

### **2.2.4.1) Hidden Zip**

A file called "CrouchingKokako.dll" was found to be a ".zip" file with 7 illicit images hidden in it. The contents of the file can be found in Appendix H

#### **2.2.4.2) Hidden images**

An executable file called FantailFrontView.exe was found to be a “.jpg”. There were also 6 files without a file extension, which were found to be “.jpg” files. The images mentioned above can be found in appendix I.

#### **2.2.5) Illicit files in an encrypted archive**

A file called “birdpics.gpg” was found in the “My Documents” folder of the suspect. After successful decryption it was found that it contains 5 images, however 4 of them were corrupted. The one image that was not corrupted was confirmed to be of illicit nature, while the other 4 can be seen having illicit names, but their contents have been corrupted (Section 4.6). The contents of the archive can be found in Appendix J.

#### **2.2.6) Illicit files found in unallocated space**

In the unallocated space of the disk were found 23 images of illicit content and a guide on a bird watching (Section 4.2.3 and Section 4.5). Based on the fact that the files were found in unallocated disk space, an area conventionally inaccessible, it can be surmised the images of the birdwatching trip were placed there to hide them. The images and the guide can be found in Appendix K

#### **2.2.7) Other illicit files found on the computer**

##### **2.2.7.1) Other illicit documents.**

In John Doe’s “My documents” folder a file called nestboxtips.txt was found. It contains information on how to build a bird box. The file was created on 02.02.2005 at 14:29:30 GMT

A file called “birdwatching.doc” was created on 03.02.2005 at 15:49:19. Its contents describe birdwatching.

Three “pdf” documents with ornithological content were also found. They can’t be dated.

Documents can be found in Appendix M

##### **2.2.7.2) Other illicit images.**

Inside “User Account Pictures” folder of the suspect an image called johndoe.bmp was found. It appears to have been used as a profile picture for the suspect.

The suspect had a Mozilla Firefox wallpaper of ornithological nature. The file was called “Firefox Wallpaper.bmp”

Inside a document called “Doc1.doc” in the suspect’s “My Music” folder was found an illicit image.

There were also 11 images of illicit ornithological nature, 5 “gif” files which have birds in some of the frames, and 5 drawings of birds that were found on the suspect’s computer.

Images can be found in Appendix L.

### **3) Description of Investigation**

#### **3.1) Job Description and Instructions**

This investigation was commissioned by Dr Ian Ferguson to investigate the suspects computer and any other seized equipment for illicit images.

#### **3.2) Description of Recovered / Examined Items**

The investigators arrived at the house of the suspect and seized a desktop computer from the basement. This was transported by the police and placed into storage until required.

#### **3.3) Methodology**

This section will delve into detail on the steps taken by the investigators to find evidence using the seized hardware from the raid on the suspect's home.

##### **3.3.1) Preservation of Data**

The first step the investigators took was to remove the hard drive from the seized computer and to create a forensic image of the disk. The investigators attached a forensic write tool to the drive and computer then powered it on. Using a Linux forensic workstation, the investigators used the command **dmesg** to confirm the drive is working. The next step was to create an actual forensic image using DCFLDD, a program created by the US department of defence which can create a forensic image file. To do this the investigators used the command:

```
sudo dcfldd if=/dev/sdb of=JohnDoe.dd hash=md5 conv=noerror/notrunc,sync
```

“Conv= noerror, notrunc, sync” sets the convert options. “noerror” will indicate that if an error is found just simply continue. “Notrunc” specifies not to shorten or truncate the file should there be an issue. Once the johnDoe.dd image was successfully created the next step was to change the permissions and owner using **chmod** and **chown** linux commands, setting it to read only to ensure the evidence remains untampered and intact. To confirm the forensic image is forensically sound state the investigators used a program called **md5sum** to create a md5 hash of the drive and compare that to the hash of the cloned drive.

##### **3.3.2) Whitelisting**

The investigators then utilized a process called whitelisting to search for illicit content. Whitelisting works by comparing every single file from an image compared to a fresh installation of the operating system in question, in this case windows XP and filtering out any files that aren't there by default.

Using the mounted recovered image, JohnDoe.dd, the investigators ran a virus scan using Clamscan, a free anti-malware toolkit which can be used to scan images for viruses and malware by using the tool option “–recursive”. Once the investigators had ran a virus scan the whitelisting process begun by hashing every file found on the suspects drive, using the command line tool called **md5deep**. The same was then done using a fresh installation of windows XP. A command line utility called **grep** can be used for searching text and comparing text. In this case **grep** was used to compare both hash sets to output the ones that don't match. This command outputs the file of a chosen filetype which have been modified using pipeline “|”. This process was done for some common media file extension types, such as .JPG, .ZIP, .MP4 and .PDF. The command used follows the format as follows:

```
grep -v -f winXP.md5List.txt johnDoe.nameAndMd5List.txt | grep "<.filetype>"
```

### 3.3.3) Physical searching

The investigators then moved onto the physical searching process, which involves searching through the drive using more manual methods. The investigators made use of an industry standard tool called **Autopsy**, an extension to another tool called the **sleuth kit**.

Firstly, with **Autopsy** the investigators used the image gallery utility to carve every single image on the drive. This was then filtered to group images by the camera that they were taken with. This is hidden within the metadata of the images. Autopsy was also used to search for different users on the operating system, search other partitions of the drive, find files with mismatched file extensions and search emails. Secondly, the investigators then used a tool called **foremost** which was used to do a complete count of all common file extensions for example .JPG, .GIF and .EXE. The investigators used the command:

```
sudo foremost -i <input file>
```

### 3.3.4) Browser analysis

The next step was for the investigators to look at the browser data. Such as cookies, browser history, and browser cache. The first action the investigators took was locating the internet explorer cache for “John Doe” user account.

A tool called **pasco** was then used to be read the “index.dat” files contained within the image. The investigators used the Linux **find** command to find all “index.dat” files. The investigators then followed the same process for Mozilla Firefox searching “history.dat”, “downloads.rdf”, “cookies.txt” and “bookmarks.bak”. Providing information such as internet search history, Firefox wallpaper and book-marked websites.

### 3.3.5) Registry

The penultimate step of this investigation is to investigate the windows registry. The investigators started with copying some files from the mounted drive to the local workstation using the Linux command **cp**. These files being the SAM, SECURITY, SYSTEM and NTUSERDAT registries. A tool called **chntpw** was used to dig up user accounts on the SAM registry. Secondly a tool called **fred** was used to investigate the registries further.

### 3.3.6) Encrypted files.

The final step the investigators took was to investigate the password protected files found on the suspects computer. This step made use of previous discoveries such as an encrypted GPG file. A GPG file called was found “birdpics.gpg”.

This file was copied to the desktop alongside the suspects GnuGP files which contained a file called “secring.gpg” which is the key used to encrypt “birdpics.gpg”. A tool called **Gpg2john** was used to convert the “secring.gpg” file to “secring.jtr” which the tool **John the Ripper** could use. The command to do this is:

```
gpg2john secring.gpg > secring.jtr
```

**John** the Ripper was then used to crack “secring.jtr”. Once cracked the investigators attempted to decrypt “birdpics.gpg” using GPG and the cracked password. Once decrypted, the investigators unzipped the file.

During previous steps in the investigation, investigators found several PDF files that were password protected. The investigators once again used **John** the Ripper. A hash list containing a hash for each of PDFs was created. Using a Perl script for john the ripper called **pdf2john.pl**. The command used to run the script:

```
./pdf2john.pl /home/kali/Desktop/passProtected/*.pdf > /home/kali/Desktop/pdf.jtr
```

Once the hash list “pdf.jtr”, was created **John** the Ripper was then used to attempt to crack the hashes which would result in the password being returned. The command used to do this is:

```
john --incremental=digits /home/kali/Desktop/pdf.jtr
```

## **4) Analysis**

This section covers the analysis of any evidence that was discovered within the early stages of the investigation, with each section corresponding to a section within the methodology.

### **4.1) Preservation of Data**

To establish that the data was not altered throughout the investigation, the team had taken a md5 hash copy from the suspects' original machine and then one from the clone of the machine that had been created for the forensics investigation.

John Doe's machine hash: d63dd1b8917ca28bac7c955fc3b6cd25

Clone of John Doe's machine hash: d63dd1b8917ca28bac7c955fc3b6cd25

Throughout all the stages of the methodology, the investigation team kept checking to see if the hashes were the same. This was done to ensure the integrity of any evidence gathered throughout the investigation and provides proof that the evidence had not been tampered with during the investigation by any external parties.

### **4.2) Physical Search**

Moving onto physical search, the investigation team looked through the cloned disk instead of the suspect's original machine, so none of the evidence found could be removed or tampered with from the original device. From filtering and searching metadata with foremost and metacam, the investigators found photos from different cameras. A Sony Cybershot, which had 1 image on it which was illicit, A Canon Eos-1ds with 1 illicit image and finally a Canon Powershot Sd100 with 19 different illicit images. However, from the same camera there was 34 photos of the suspect taking part in birdwatching and birdcages. All photos can be found within Appendix A, with the Camera labelled along with it.

#### **Autopsy was utilised for manual searching**

Autopsy is software that is specialised in digital forensics and utilises a graphical interface for the set of tools that it uses. This allows blacklists and whitelists to be imported into the software. It also has a search function which allows regex expressions. The entire clone of the suspect's machine was imported into the software for automatic analysis and then displays the results to the user to search through.

##### **4.2.1) Mismatching File Extensions**

Autopsy revealed multiple files had a different file extension compared to their original file extensions. "CrouchingKokako.dll" was a .zip file which was only revealed when an image coming from that pathname was found under the same name. This zip file had 7 illicit images hidden within the folder. An executable file called "FantailFrontView.exe" had data to show it was a jpg of an illicit image. The images from the zip files can be found in appendix H and the image from the executable can be found in appendix I.

3 Files were also found in the directory "Program Files". These files have no file extension so they wouldn't be accessible unless they extension .jpg was added onto the end. A further 3 images were found within "\$ORPHANFILES". All of These are in appendix I.

#### **4.2.2) Email Analysis**

The suspect has been found emailing two different emails, an email to **mailinglist@birds.example.com** and an email chain of four emails with **ben@example.org**. The emails from **ben@example.org** contained 8 illicit images and information on identifying certain types of birds. Emails from the mailing list can be found in appendix G and emails from Ben can be found in appendix F.

#### **4.2.3) Browsing through Autopsy's Analysis.**

From browsing around the suspects cloned drive using autopsy, numerous folders were found to contain illicit images; In the “My Pictures” folder 9 illicit images were found, in the “recycler folder” there was 1 illicit image. The 9 images are found within appendix B, index 59-67. And the image within the “recycler folder” is found within appendix K, index 101.

Inside of a document called “Doc1.doc” in the “My Music” folder was found to have an illicit image. Also, there were 11 illicit images, 5 gifs which have illicit images hidden throughout the frames, and 5 drawings of birds. All the files can be found within appendix L.

Inside of “User Account Pictures” folder, an image called “johndoe.bmp” was found. This appears to be the profile picture used by the suspect. Furthermore, the suspect used a Firefox wallpaper with ornithological content called “Firefox Wallpaper.bmp”.

A text file containing tips about how to make nest boxes for birds was found within “My Documents”. Inside of the drive itself at the very top was a file called “birdwatching.doc” and 3 pdf documents containing content about studying birds was found. All the documents and the text file can be found within appendix M.

Autopsy also confirms the unallocated partition on the suspect’s drive. In this partition, 23 illicit images were found as well as a document containing a guide on enjoying your first birdwatching trip. The document and images can be found in appendix K.

#### **4.3) Whitelisting**

Before the whitelisting had begun, the investigators ran a malware scanner to make sure the drive had no malware on it and couldn’t affect the evidence on the original machine if it was run. From this the investigators found one piece of malware called “Win.Trojan.Tufik--100” which upon further analysis found that the malware had not caused any changes to the evidence found from the disk.

The evidence from whitelisting was the same as the evidence from Physical searching.

#### **4.4) Browser Analysis**

Browser analysis was conducted upon two different browsers, Mozilla Firefox, and Internet Explorer. All downloads from browsers are found within a file called “downloads.rdf” which can be found in appendix E. The investigation team looked through this document and found

7 illicit images, a zip file called “birds.zip”, a downloaded webpage called “ostblk2b2.htm” about group breeding and an audio file called “aggressive.wav”. The file “ready2fledge.jpg” was downloaded to the user account “Bob” however, the picture was then accessed by the suspect. The illicit images can be found in appendix B and the audio file can be found in appendix C. The downloaded webpage can be found in Appendix D.

The investigators moved to search the browsing history of both Mozilla and Internet Explorer. Using **Pasco** to reveal the cache and cookies from within the browser the investigators found the suspect accessing multiple web pages with illicit images and illicit content. A snippet of the browser history can be found in Appendix I and Autopsy was used to create an easier way of exporting the data to a .csv file.

Finally, the investigators looked through “bookmarks.bak”, which contains all of the bookmarks that were made by the suspect. After reading through it multiple webpages that had illicit content were found. The contents of the file can be found in appendix N.

#### **4.5) Registry**

Searching the registry of the computer revealed that there were multiple partitions on the computer, one which was unallocated and the main partition. After looking through both the drives, illicit images were found on both partitions.

#### **4.6) Encrypted Files**

Within the Suspects “My Documents” folder an encrypted file was found by the investigators, inside of the encrypted file was a .zip folder containing 1 illicit image and 4 corrupted images. All the above images can be found in appendix J.

### **5) Production List and Associated Description**

**johnDoe.dd** – This image is a clone of the suspect’s original drive and had been analysed during the investigation to gather evidence for the case regarding John Doe. This was loaded into a Windows virtual machine and a Kali Linux virtual machine to utilise the tools on both virtual machines such as Autopsy.

**Ubuntu Linux** – Used to create a clone of the drive to be analysed using Kali Linux and Windows.

**Kali Linux** – Used to analyse the drive with tools installed, Image was passed directly from online copy provided for investigation.

**Digital Forensics Report** – The report created as evidence against John Doe. Contains information about the evidence and methodologies to gather such evidence.

## **6) Conclusions**

This report shows that the suspect was in possession and actively obtained images of an illegal nature, collecting them on the seized computer. Some of the photos were found to have been taken by 3 different models of camera, but no cameras were recovered in the investigation. There is also evidence to show the suspect had access to external storage devices, some of which had illegal images stored, but no external storage device was found and seized for the investigation. Evidence was also found to show the suspect was involved in distribution of some illegal images with another contact.

Files were easily recovered from the suspect hard drive in partition 2, but another group of illegal images were recovered from the unallocated disk space in partition 3. Unallocated space is conventionally inaccessible to computer users without a degree of technical knowledge, suggesting the images had been placed there to hide them.

Illegal images were also found in the files of another user's account; however, evidence was obtained to show these files had been downloaded there and accessed by the suspect. Again, without the ability to conduct digital forensics, it would appear as though the other user was also complicit in viewing and obtaining illegal images: the evidence clearly shows this was not the case. This also indicates there was some attempt to disguise the illegal activities of the suspect, by the suspect.

Evidence also suggests illegal images have been stored on external storage devices that have not been recovered when the suspect's computer was seized. The evidence suggests the material was illegal based on established patterns of file naming. Given the storage devices were not present at the scene, they had been hidden or already in the possession of another person(s).

More illegal images may be found on cameras that were not found in the house search. There is evidence to show that some images on the hard drive were taken from 3 separate models of camera. Additionally, some of these images were found to have their file extension removed, which would make them unidentifiable to a person without adequate technological knowledge.

The suspect's browser activity was shown to contain evidence that illicit images were being accessed online and downloaded. The suspect had also stored bookmarks to illegal images on one browser.

Registry keys on the suspect machine gave evidence to show that the suspect had viewed illegal images on the machine, specifically giving the suspect's account as the account viewing the illegal images. No evidence was found in this manner that another user was accessing the illegal material.

Email evidence was found to show that the suspect was in contact with 2 email addresses, sharing illegal images with one. The method of distribution was found to be images attached to the email.

The evidence has shown that the suspect has viewed, obtained, and has access to stored illegal images on the seized machine. The evidence found also shows the suspect attempted to hide illegal files and appropriate suspicion on another innocent user. The evidence also shows that the suspect was involved in the distribution of illegal images.

## Appendices

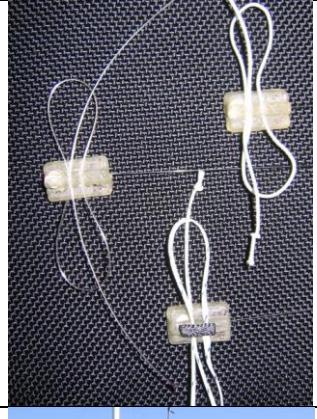
### Appendix A – Photos taken with cameras

Index	File Name	Camera Model	Image
1	BellbirdJumpingOffBranch.jpg	Canon Eos-1ds	
2	chicks2.jpg	Canon Poweshot Sd100	
3	newbies2.jpg	Canon Poweshot Sd100	
4	f0416072.jpg	Canon Poweshot Sd100	
5	f0438992.jpg	Canon Poweshot Sd100	
6	ready2fledge.jpg	Canon Poweshot Sd100	
7	f0443520.jpg	Canon Poweshot Sd100	

8	f0526960.jpg	Canon Poweshot Sd100		
9	f0360392.jpg	Canon Poweshot Sd100		
10	f0439400.jpg	Canon Poweshot Sd100		
11	f0438640.jpg	Canon Poweshot Sd100		
12	f0415008.jpg	Canon Poweshot Sd100		
13	BF5BE9D9d01.jpg	Canon Poweshot Sd100		
14	f0382464.jpg	Canon Poweshot Sd100		

15	birdtrans2.jpg	Canon Poweshot Sd100		
16	f0592136.jpg	Canon Poweshot Sd100		
17	f0441536.jpg	Canon Poweshot Sd100		
18	f0345656.jpg	Canon Poweshot Sd100		
19	978D14DDd01.jpg	Canon Poweshot Sd100		
20	5E5570B4d01.jpg	Canon Poweshot Sd100		
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52	FB4EDA00d01.jpg	Canon Poweshot Sd100		

53	f0525496.jpg	Canon Poweshot Sd100		
54	502FE69Dd01.jpg	Canon Poweshot Sd100		
55	BC7 feeding the birds.jpg	Sony Cybershot		

#### Appendix B – Images downloaded from the internet

Index	File name	Image
56	birdtrans2.jpg	
57	ready2fledge.jpg	
58	newbies2.jpg	
59	chicks2.jpg	

60	177.jpg	 Everyone says you're too young for me.	
61	babyscot_vyoung.jpg		
62	babyscot_2weeks1.jpg		
63	40m.jpg		
64	snow_geese.jpg		
65	tn_duck_3.jpg		

66	wbpremium_s.jpg		
67	7107298.jpg		

#### Appendix C – Audio file downloaded from the internet

Index	File Name	Contents
68	aggressive_song.wav	 aggressive_song.wav

#### Appendix D – Webpages downloaded from the internet

Index	File Name	Contents
69	ostbk2b2.htm	<p><b>FACILITIES</b></p> <p><b>CHICKS</b></p> <p>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.</p> <p>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.</p>

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 surprising, 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 injuries 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

		<p>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.</p> <p>Difficulties with a group breeding situation include the inability to determine exactly the resultant chicks parentage.</p> <p>Ostrich Book</p>
70	aa010703a.htm	<p>You are here:</p> <p>About&gt;Hobbies &amp; Games&gt;Birding / Wild Birds&gt; Equipment &amp; Supplies&gt; Birdhouses &amp; Feeders&gt; Build Birdhouses&gt; Birding and Birdwatching - Build a Bluebird Nest Box for Wild Birds</p> <p>Home Essentials Types of Birds Worldwide Directory of Where to Bird US State and Canadian Province Birds Birdhouses &amp; Feeders Cooking FOR the Birds Recipes Articles &amp; Resources Bird Facts and Information Attracting Birds Photography Bird Problems Other Winged Creatures Conservation - Research Bird Related Activities Bird Computer Items Types of Birds Identifying Birds Where to See Birds Bird Books Find Other Birders Equipment &amp; Supplies Extinct Birds Buyer's Guide Before You Buy Top Picks Great Digital Cameras Best Feeders Bird Stories to Read Product Reviews Articles Forums Help</p> <p>FREE Newsletter</p> <p>Sign Up Now for the Birding / Wild Birds newsletter! See Online Courses</p> <p>Search Birding / Wild Birds Build a Bluebird Nest Box Easy Box to Make This bluebird nesting box is a great way to get started making birdhouses. You do not need to miter any edges and the entire project can be completed using one 6 foot length of of 1" x 6" lumber. Since only simple materials and tools are required, this birdhouse is also a wonderful project for Scouts, youth groups, and beginning woodworking classes.</p> <p>Related Resources</p>

- Wood to Make Houses
- Tools to Make Houses
- Paints for Houses
- Bird House Specs
- Make Birdhouses
- Make Bird Feeders
- What to Feed Birds
- Nesting Materials

[Click here for drawings of the pieces and dimensions you will need. \(A\)](#)

[Click here for a close up of the hole. \(B\)](#)

[Click here for a diagram of the pivot nails. \(C\)](#)

See the box to the right for wood and tool recommendations

Materials needed:

Wood cut to the dimensions shown in A above

Finishing nails

1 eye screw

Wood screws

Directions:

Cut the wood to the dimensions in diagram A. All of the pieces can be cut from one 6' length of 1" x 6" lumber.

Cut the front entrance hole as in diagram B. This is an oval shaped hole that is 1 3/8" wide and 2 1/4" long. To begin cutting this hole, mark the dimensions on the front. Then drill one 1 3/8" circle at the top. Repeat at the bottom of the hole, overlapping the drilled holes.

Drill two small holes near the top of each side for ventilation.

Drill four small holes on the bottom for drainage.

Using finishing nails or wood screws, secure one of the sides to the bottom. Then secure the front and back to the same side.

Slip the 2nd side into place. Secure using two nails, one near the top on each side. These nails will be pivots so make sure they are across from each other. Reach inside the box and push the bottom of the 2nd side outwards, making sure it can pivot outwards. If it is too tight, remove the nails and sand the edges so it is a bit smaller. Repeat until the 2nd side will pivot outwards. See diagram C for

Screw the eye screw near the bottom of the 2nd side. This screw is to make it easier for you to open the box occasionally to monitor it as well as to clean it out at the end of the season.

Drill a small hole through the front near the bottom into the 2nd side. Push a bent nail (I have a few by this point!) into the hole to keep the 2nd side closed. If you wish, use a small wood screw instead of the nail.

Nail or screw the roof to the nest box.

Mount the bluebird nest box to a pole, fence post, or tree. Be sure to use some type of predator guard to keep squirrels, snakes, raccoons, and other creatures from harming the nestlings. See the Birdhouse Spec page for the correct mounting height.

May you always hear the whisper of wings...

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Your Own Wildlife Channel A Bird Nesting Box with a built in TV Camera. Just £59. [www.feathervision.co.uk](http://www.feathervision.co.uk)

Bird & Parrot Breeding Birds, cages, nest boxes, vitamins, incubators, brooders, accessories. [www.parrotsupplies.co.uk](http://www.parrotsupplies.co.uk)

Smart bird box cameras Wireless nest box camera colour images to PC or TV [www.enjoybirdsmore.co.uk](http://www.enjoybirdsmore.co.uk)

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Wiggly Nest Boxes Nest Boxes for all sorts of birds FSC Timber, Order Online [www.wigglywrigglers.co.uk](http://www.wigglywrigglers.co.uk)

Nesting box camera As featured in The Mail on Sunday View bird nest activity on our T.V. [www.cambox.co.uk](http://www.cambox.co.uk)

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		Zuma Deluxe Super Mah Jong Solitaire Crosswords Jigsaw Puzzles Flipwords Slot Words
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### Appendix E – Contents of “downloads.rdf”

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## Appendix F – Emails from Ben Forbes(ben@example.org)

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			 cute_penguin.jpg
75	<p>From: ben@example.org            To: jdoe@example.org            CC:            Subject: some more good ones</p> <p>-----HEADERS-----</p> <p>Content-Type: text/plain;            charset="utf-8"            Content-Transfer-Encoding: 7bit            Content-Disposition: inline</p> <p>---END HEADERS--</p>	<p>Thanks for the pics you sent me            here are some I really like</p>	 BC7 feeding the birds.jpg

			  
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## Appendix G – Emails from mailing list ([mailinglist@birds.example.com](mailto:mailinglist@birds.example.com))

Index	Email Header	Email Contents
76	From: <a href="mailto:mailinglist@birds.example.com">mailinglist@birds.example.com</a> To: <a href="mailto:jdoe@example.com">jdoe@example.com</a> CC: Subject: How to Identify Birds  -----HEADERS-----  X-Account-Key: account2 X-UIDL: vmyLTMZm6jBNjghPvFqQ X-Mozilla-Status: 0001 X-Mozilla-Status2: 00000000	<p>How to Identify Birds</p> <p>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.</p> <p>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</p>

<p>Message-Id: &lt;WnifxIwj4fCUPH80kr3g@fakepop.invalid&gt;</p> <p>Date: Wed, 09 Feb 2005 11:08:01 +0000</p> <p>X-UIDL: vmyLTMZm6jBNjghPvFqQ</p> <p>X-fakepop-version: 7</p> <p>X-fakepop-build: Dec 4 2004 17:08:02</p> <p>X-fakepop-url: <a href="http://vztech.com.br/software/fakepop/">http://vztech.com.br/software/fakepop/</a></p> <p>X-Message-Flag: message delivered by fakepop - <a href="http://vztech.com.br/software/fakepop/">http://vztech.com.br/software/fakepop/</a></p> <p>Envelope-to: jdoe@example.com</p> <p>Delivery-date: Sat, 16 Oct 2004 18:51:39 +0100</p> <p>Received: from outgoing.birds.com ([192.168.231.26]) helo=outgoing2.birds.example.com ) by mail.example.com with esmtp (Exim 4.34) id 1CIWEs-0005v3-7o for jdoe@example.com; Sat, 16 Oct 2004 18:51:39 +0100</p> <p>Received: (qmail 23682 invoked from network); 16 Oct 2004 07:08:32 -0000</p> <p>Date: Sat, 16 Oct 2004 15:20:15 +0200</p> <p>From: Bird Fanciers &lt;mailinglist@birds.example.com&gt;</p> <p>To: jdoe@example.com</p> <p>Subject: How to Identify Birds</p> <p>---END HEADERS--</p>	<p>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.</p> <p>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.</p>
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#### Appendix H – Contents of “CrouchingKokako.dll”

Index	File name	Image
77	brd_WoodDuck.jpg	

78	Brolga.jpg		
79	BrushTurkeyPerching.jpg		
80	CanadaGoose.jpg		
81	CanadaGooseWashing.jpg		
82	ChestnutMandibledToucan.jpg		

83	CrouchingKokako.jpg		
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#### Appendix I – Images with mismatching file extensions

Index	File name	Image	
84	frankbeecostume_1827_84985892		
85	frankbeecostume_1827_96360352		
86	frankbeecostume_1827_34457581		

87	FantailFrontView.exe		
88	67BAEB46d01		
89	6A161D2Fd01		
90	EF29AEAE01		

#### Appendix J – Contents of “birdpics.gpg”

Index	File name	Image
91	WhiteThroatedSparrowInTree.jpg	

#### Appendix K – Files found in unallocated space

Index	File name	Contents
92	f0000536.jpg	

93	f0000888.jpg		
94	f0001224.jpg		
95	BaldEagle7oClock.jpg		
96	BarnOwl.jpg		
97	BellbirdJumpingOffBranch.jpg		
98	BlackNeckedStiltsFromBehind.jpg		

99	BlackSwan.jpg		
100	BlackVultureSunningOnPost.jpg		
101	f0005296.jpg		
102	Brd_Ornithologist_TWG.jpg		
103	GreatBlueHeronWithFish.jpg		

104	GreatEgretInVoloBog.jpg		
105	GreatEgretOverflyingRoseateSpoonbills.jpg		
106	GreatHeronCloseup.jpg		
107	GreatHeronOnChicagoLakeshore.jpg		
108	ImmatureSnowyEgretTakingOff.jpg		
109	june03screen.jpg	 <small>Cuban Tody © Pete Morris/Birdquest Surfbirds.com</small>	

110	junescreen01.jpg		
111	KeaAndMountain.jpg		
112	KeaAtTopOfMacKinnonPass0930.jpg		
113	KeaEatingRentalCar.jpg		
114	KeaRetrievingBakedBeanCanFromTarn.jpg		
115	f0005504_An_Insiders_Guide_to_Enjoying_Your_First_Birding_Field_Trip.doc	<p><b>An Insider's Guide to Enjoying Your First Birding Field Trip by Pete Dunne</b></p> <p>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</p>	

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 is not inexperience, but rather the lousy or malfunctioning equipment - usually optics.

If your binoculars aren't working, ask whether a loaner is available. If 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.

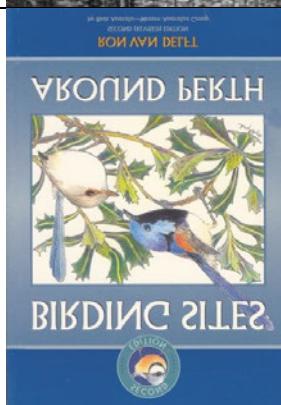
**• Rule 10 - Do ask questions.**

		<p>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.</p> <p>This guide has been reproduced with the permission of Pete Dunne. Minor editing by Ron Bourque.</p>
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## Appendix L – Other Illicit images

Index	Filename	Image
116	Firefox Wallaper.bmp	 A photograph showing two fluffy, downy bird chicks with dark eyes and beaks, nestled together in a nest made of twigs and dried grass. They are looking directly at the camera.
117	J0178932.jpg	 A photograph of two small, yellow ducklings standing side-by-side on a dark wooden surface, possibly a dock or railing. In the background, there is a vibrant garden filled with various colorful flowers like red poppies and yellow daisies.

118	junescreen01.jpg		
119	f0033912.jpg		
120	f0033928.jpg		
121	f0056920.jpg		
122	f0056936.jpg		
123	f0056944.jpg		

124	f0056952.jpg		
125	image4.jpg		
126	image0.jpg		
127	Found inside 3328DD4Ed01.gif		
128	Found inside 83E8FA9Dd01.gif and 8558EA93d01.gif		
129	Found inside 83E8FA9Dd01.gif		

130	Found inside B2906B79d01.gif		
131	Found inside B2906B79d01.gif and B6E0588Dd01.gif		
132	Found inside B2906B79d01.gif and B6E0588Dd01.gif		
133	Found Inside B6E0588Dd01.gif		
134	Found Inside B6E0588Dd01.gif		
135	Found Inside B6E0588Dd01.gif		

136	Found Inside B6E0588Dd01.gif		
137	Found Inside B6E0588Dd01.gif		
138	Found Inside B6E0588Dd01.gif		
139	Found Inside B6E0588Dd01.gif		
140	J0099150.JPG		
141	J0099145.JPG		
142	J0099147.JPG		

143	J0099148.JPG	
144	J0099152.JPG	

### Appendix M – Other Illicit documents

Index	Filename	Contents
145	nestboxtips.txt	<p>Tips for Nest Boxes this spring/summer</p> <p>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.</p> <p>If you are putting up new nest boxes make sure that they are out of the reach of cats and Squirrels.</p> <p>Check that the box isn't in full sun otherwise young birds may literally bake in the heat.</p> <p>Experiment with different kinds of bird boxes – the open-fronted “Robin” boxes may even attract Spotted Flycatchers.</p> <p>Make sure any boxes are at least 15mm in thickness.</p> <p>Face boxes away from prevailing winds.</p> <p>Don't put nest boxes too close together in a small area as this will only lead to territorial fights.</p> <p>Always make sure that there is enough food and fresh water made available close by.</p> <p>Do not buy bird boxes with perches attached – the birds do not need them and it may only invite predators.</p> <p>Never buy a bird table with a nest box built in, as nesting birds will only come into conflict with feeding ones.</p> <p>-----METADATA-----</p>
146	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](http://www.bcst.org/index_ebird.html)

[www.thai.net/bcst](http://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](mailto:utree@loxinfo.co.th)

[mail@orientalbirdclub.org](mailto:mail@orientalbirdclub.org)

Web site: [www.orientalbirdclub.org](http://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](mailto: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 INTHONON - 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](mailto:bcst@box1.a-net.net.th)

Tel: 66-(0)-2943-5965

Web sites:

[www.bcst.org/index\\_ebird.html](http://www.bcst.org/index_ebird.html)

[www.thai.net/bcst](http://www.thai.net/bcst)

\* The Bird Conservation Society of Thailand (BCST) is a BirdLife Partner

###### · TO REPORT EVIDENCE OF SUSPICIOUS ACTIVITY

Please contact

Wildlife 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 Wildlife 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.

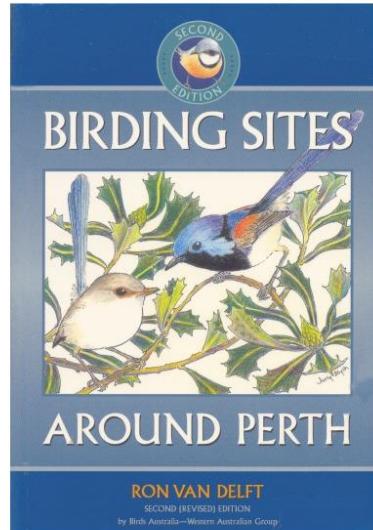
An Australian citizen, he has authored a number of technical papers and popular articles concerning conservation issues in Australia, North America, and Thailand, and was a contributor to the seminal volume on habitat fragmentation "Tropical Forest Remnants: Ecology, Conservation and Management". He 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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Number 57ab in a series of  
Bird Guides of Western Australia

*Birding Sites Around Perth* is a comprehensive guide to Perth's best bird watching sites, including Kings Park, John Forrest National Park and Rottnest Island.

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Illustrated throughout with colour photographs and pencil drawings, *Birding Sites Around Perth* is an excellent introduction to bird watching and to Perth's wildlife heritage.

Copies of the book are available for purchase from the Birds Australia office during office hours or available by post.

#### WHAT IS BIRDS AUSTRALIA?

Birds Australia is a non-profit national organisation working for the enjoyment, study and conservation of Australia's birds. The WA group of Birds Australia has members statewide and offers a variety of activities for members, including conservation and research projects.

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UNIVERSITY OF CALIFORNIA  
**BOTANICAL GARDEN**  
NEWSLETTER

Volume 26, Number 2 Published by the UNIVERSITY OF CALIFORNIA BOTANICAL GARDEN at Berkeley, California Spring 2001

## 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, keep 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.*

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

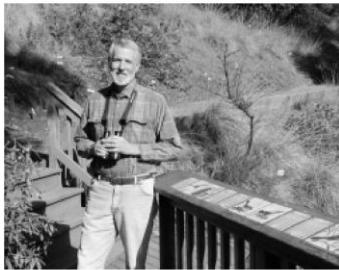


*Aloes in the Southern African Area attract hummingbirds and demonstrate how birds at the Garden enjoy the diversity of plants in this collection.*

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



*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.*

#### 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

### 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

*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.*



## 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 news 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, win-

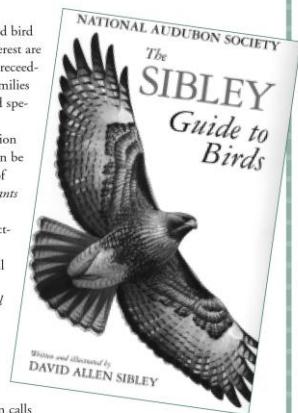
ter, and breeding locations, and bird distribution. Of particular interest are the good introductory pages preceding each family or group of families showing bird classification and speciation at a glance.

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 preceded 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.

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



Written and illustrated by  
DAVID ALLEN SIBLEY

### 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, 1998. \$1.00.

—Elly Bade

## 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 areas, 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 irreplace-

able. 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 saglionii and at right: Euphorbia cf. leuconeura.*

Our collaboration with East Bay Municipal 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 Sedlacek accompanied Mark Flanagan, "Keeper of the Garden" 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 moth 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 occurring 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, (*Lycopodium 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

## 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 *Phytophthora*: 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 Kootz 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. Kootz. Baker's

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 mycorrhize 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.





## EDUCATION AT THE GARDEN

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 matorral, South Africa's fynbos, and the



*The shining silver leaves of Leucadendron argenteum make it an interesting choice for water-conservative landscaping in the Bay Area. Threatened in its native habitats 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.*

Photo by Barbara Mills  
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

## 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 photosynthesisis 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 desiccation 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 balsaminaefera* 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 dulcis*, *Myrcenoxylon chrysocarpa*, *Syzygium jambos*, and *Ugni moliniae*.

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

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

—Holly Forbes

## 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 Bester  
 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. Alison Greenwood  
 Ms. Jeanne Hamilton-Lecky  
 Mr. and Mrs. Alan Hoben  
 Ms. Lynne Hosley  
 Mr. and Mrs. David Huang  
 Ms. Laura J. Kainik  
 Ms. Gretchen Kell  
 Ms. Sydney Kusu  
 Ms. Marie C. Lagarde  
 Ms. A. Lim & Mr. K. Henderson  
 Ms. Kianara Ludwig  
 Ms. Caren Maghebian  
 Ms. Pradeep & Mr. Karel Mathew  
 Ms. Helen McKinley  
 Mrs. Laura Miller & Mr. Dave Miller  
 Mr. Charles L. Moreau  
 Ms. Alessandra Moss  
 Ms. Phyllis Peacock  
 Ms. Phyllis Potter & Ms. Nora Underwood  
 Ms. Odaline 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 Viera  
 Ms. Virginia C. von Colditz

Mr. Whitney Vorburgh  
 Ms. Herta Weinstein  
 Ms. Karen Wesson  
 Ms. Charlotte Woody

Ms. Elenor Mulkey  
 Ms. Mildred J. O'Connor  
 Ms. Jean Portello  
 Ms. Jacqueline Woodfill & Mr. John Woodfill  
*(Myrtle Wolf Library)*

**James Harold Van Sicklen** 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

### 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 Clendence  
 Mr. and Mrs. Fred Dengler  
 Mr. and Mrs. Jack Dollinow  
 Dr. and Mrs. A. Carl Helmholz  
 Ms. Fonda Karchiti  
 Mr. and Mrs. Ron Lai  
 Mr. Jim Lovkin & Prof. Iris Tommlein  
 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

**Gifts In Kind**  
*The Garden offers appreciation and thanks for gifts in kind:*

Ms. Sonja Altena  
 Ms. Mary Lynn Cox  
 Ms. Louise Dutton  
 Mrs. Myrtle Wolf

### In Appreciation

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

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

### In Memory

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

Shih Ning Chern 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

### 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.



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 Swarengen, 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 Swarengen** 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 Wolff, 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

Afrooz Navid, *Administrative Assistant*  
Margaret Richardson, *Tour & Rentals Coordinator*  
Michael Rimar, *Administrative Assistant*  
Candice Schott, *Business Operations Supervisor*  
Nancy Swarengen, *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*  
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 Manous, *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  
  
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Web Site: <http://www.mip.berkeley.edu/garden/>

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## 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**



J. Finn

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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University of California

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

# The Porter County Birding Guide

INDIANA DUNES  
*The Casual Coast*



Welcome to the Casual Coast, along the southern shore of Lake Michigan. Home to the Indiana Dunes National Lakeshore, the Indiana Dunes State Park and the most diversified flora and fauna in the Midwest, the dunes are complemented by several nearby inland nature preserves. Together, they provide a unique haven for birds and birders that will make your stay on the Casual Coast both enjoyable and memorable.



*Rose-breasted Grosbeak*



*Baltimore Oriole*



*Morning Doves*

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*Photography provided by David Oberst*



## BIRD MIGRATION TO THE DUNES

*"Without doubt the presence of Lake Michigan affects the movement and distribution of birdlife in the Dunes more than any other single factor. The shores of this enormous lake provide leading lines that control flight paths of numerous migrants, and the vast open waters draw legions of transitory and wintering birds. During autumn the elongate north-south boundaries of the lake become airways along which thousands of migrants navigate toward wintering areas. Southbound birds following the shores are ultimately guided into the Dunes Area, at the toe of the lake. This avian convergence at the bottom of Lake Michigan is termed the funneling effect." The funneling effect explains the unusually high diversity of autumn birds in northwest Indiana.*



*"Lake Michigan also provides two important avian habitats that are otherwise quite rare in the Midwest: the deep lake and the beach. Waters of the lake attract large numbers of bay and sea ducks, many of which are virtually unrecorded at inland sites in the Midwest. Additionally, the lake attracts a number of rare periodic transients, including the Purple Sandpiper, Red Phalarope, Pomarine Jaeger, Parasitic Jaeger, Great Black-backed Gull, Glaucous Gull, Iceland Gull, Thayer's Gull, Sabine's Gull, Little Gull, Black-legged Kittiwake. Extensive beaches provide resting and feeding areas for shorebirds, especially those species preferring sand rather than mudflats, e.g., Sanderling, Red Knot, and Baird's Sandpiper.*

*"The deep waters of Lake Michigan also constitute a significant obstacle to migrants. During nocturnal flights many north-bound passerines overfly land's end and daybreak finds them over the lake. When landfall is visible, they often fly directly to the shore, where they immediately land for rest and feeding.*

*This effect generates an anomalously high concentration of passersines in parks and woodlands immediately adjacent to the lake" (Brock 5).*



## WEATHER EFFECTS OF BIRDING

**T**hat most migrants fly during fair weather when trailing winds are available is well documented in ornithology textbooks. Along the shores of southern Lake Michigan this principle is most clearly evident during the fall. Bennett (1952) discovered that the number of fall passerine migrants along the Chicago lakefront tripled (compared to numbers on the day immediately prior to frontal passage) on the days immediately following passage of cold fronts.

Photo by David Oberst



Common Loon

“Similarly, the most exciting autumn birding in the Dunes occurs during or immediately following the passage of cold fronts. In addition to the passerine waves that follow the fronts, northerly winds stimulate a general longshore movement of water birds.

“On such occasions, an endless stream of loons, ducks, gulls, and terns often flows along the lakefront.” (Brock 6).

## RAPTOR FLIGHTS

**S**pring hawk flights along the High Dunes must be attributed to the presence of Lake Michigan. Northbound hawks, especially buteos, enjoy a leisurely spring migration, wafting effortlessly over the Midwest on balmy southerly winds. These soaring raptors, however, display a marked aversion to flying over large bodies of water. Consequently, upon encountering Lake Michigan the northward movement is abruptly truncated and the birds turn to a course paralleling the shoreline. Thus, the migrating hawks are concentrated in a belt immediately adjacent to the lake. In effect, therefore, the High Dunes rest directly below a narrow flight corridor that extends along the lake’s southern margin.” (Brock 8).

Photo by David Oberst



Cooper's Hawk

During March and April, the major flight months, good daily flights can consist of 100 to 300 birds. Fall flights are limited; the most notable species observed is the Peregrine Falcon, with flight peaks in early October.



## BIRDING SITES

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### BEVERLY SHORES A

*Whether you drive or walk, Beverly Shores will produce a number of species, seen or heard, that will delight the birder. This "island" in the National Lakeshore supports habitats such as an interdunal marsh, lake, beach and wooded dune. The interdunal marsh offers excellent habitat for passerines as well as nesting species. Beverly Drive produces many opportunities to see and hear several species of birds. Best observation time is all year.*

*Types of migration birds seen are loons, waterfowl and gulls. Birds seen and heard in late spring and summer are Willow Flycatcher and warblers.*

### COFFEE CREEK WATERSHED PRESERVE B

*The preserve is a 167-acre home to over 500 native plants, trees, sedges and forbs as well as over 4 miles of trails. Wetlands can be found throughout the landscape including swamps, marshes, wet prairies and fens. Birds commonly seen at Coffee Creek include several species of woodpeckers such as the Red-bellied woodpecker, Downy and Hairy Woodpeckers. Herons, hawks, and wood ducks, as well as the state endangered marsh wren can be seen in their respective habitats throughout the preserve. Bridge 5, near the southern end of the corridor is a great place to see Cardinals, Indigo Bunting and the Tufted Titmouse. From the Water Plaza, at the northern area of the preserve, Belted Kingfishers can be seen fluttering near the wetlands. Don't miss the Killdeer who often nests near Phillips Pond.*



Photo by J.F. New & Associates



Photo by Robert Stokke

### COWLES BOG C

*Wooded edges, savannah, marshes and wooded swamp provide ideal habitats for Common Yellowthroat, Sora, Virginia Rail, American Woodcock, Swamp Sparrow, warblers, and wren. Named after the Father of Plant Succession, Professor Henry Cowles, this area is perfect for the nature lover in general. For more information call 219/926-7561 ext. 225.*



## BIRDING SITES

### PORTER BEACH HAWK WATCH D

*Formerly known as the Johnson Beach hawk watch, this stabilized dune allows prime viewing of several hawk flights, especially in the spring.*

### WEST BEACH & LONG LAKE E

*Following the West Beach trails which take you by the beach, an interdunal pond, and wooded dune, one may discover a Hairy Woodpecker or two and perhaps a Common Yellowthroat. Long Lake may grace one with the presence of Least Bitterns, warblers and scores of waterfowl. A parking fee is required in the summer.*

### INDIANA DUNES STATE PARK F

*Indiana Dunes State Park encompasses a variety of habitats: climax forest, savannah, marram grass covered dunes, blowouts, beaches and marshes. Several trails run through these areas, providing opportunities to view and hear field sparrows, flycatchers, thrushes, warblers, hawks, owls and more. Optimal observation areas would include the forest and the marsh-wood boundary along with trails 2 and 10. Trail 9 allows for eye level bird watching because of its higher elevation. Wilson Shelter also attracts several birds during spring migration. Entrance fee.*



Photo by: Wendy Smith

### PORT OF INDIANA G

*During winter one can best observe the Horned Larks, Lapland Longspurs, Snow Buntings, Common Mergansers and bay ducks from the public access area of the Port of Indiana. On windy days, birds fly almost directly over the public access area.*

### SUNSET HILL FARM COUNTY PARK H

*Porter County's ongoing commitment to ecological restoration, this former 235-acre dairy farm is filled with woods, meadows, and three ponds. Part-time naturalists are available during three seasons of the year to offer a wide range of opportunities including: natural science projects on ponds, trees, birds, wildflowers or fields. With over ten miles of trails, bird watchers, nature photographers, or woods walk observers can enjoy endless outdoor opportunities. Birds commonly seen at Sunset Hill Farm include: field sparrows, flycatchers, thrushes, warblers, hawks, owls, ducks, geese and more.*



Photo by: Wayne Wodridge



## BIRDING SITES

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### TALTREE ARBORETUM & GARDENS I

*Taltree Arboretum & Gardens offers the birder a wide variety of habitats to explore. Prairie, Savanna, Woods, Wooded Edges, Swamp, Pond and open Wetland can all be easily observed at this 300+ acre site. With over 4 miles of trail, Taltree is a special place to bird. For more information on special birding opportunities visit them at [www.taltree.org](http://www.taltree.org). Entrance fee. (Closed Mondays)*



Photo by: David Oberst

### ROGERS LAKWOOD PARK J

*A 122-acre facility of the Valparaiso Park Department, it is home to hiking trails, a beach, fishing, boating, and swimming. Birds commonly seen at Rogers-Lakewood Park include: native waterfowl such as Canada geese and mallard ducks, herons, hawks, and common songbirds. Daily entry fees are collected from Memorial Day through Labor Day and are charged by the carload.*

### JASPER-PULASKI FISH AND WILDLIFE AREA K

*The Jasper-Pulaski Fish and Wildlife Area has long been the sight of the annual migration of Sandhill Cranes. View this awesome spectacle during the fall to see thousands of these birds as they rest from their journey and feed. Springtime also brings the cranes, but in a lesser amount. Don't forget the binoculars or a scope! During the spring and summer, the area boasts ducks, geese, and egrets that are viewable from the observation trail. Jasper-Pulaski Fish and Wildlife Area is also a public hunting area. Please check in at the headquarters to obtain information about the affected areas before setting out.*



Photo by: National Lakeshore

### HERON ROOKERY L

*Observe the Great Blue Heron in the spring and summer at this mature woodland located along the Little Calumet River. Migrant warblers are present in the spring along the channel among other species.*



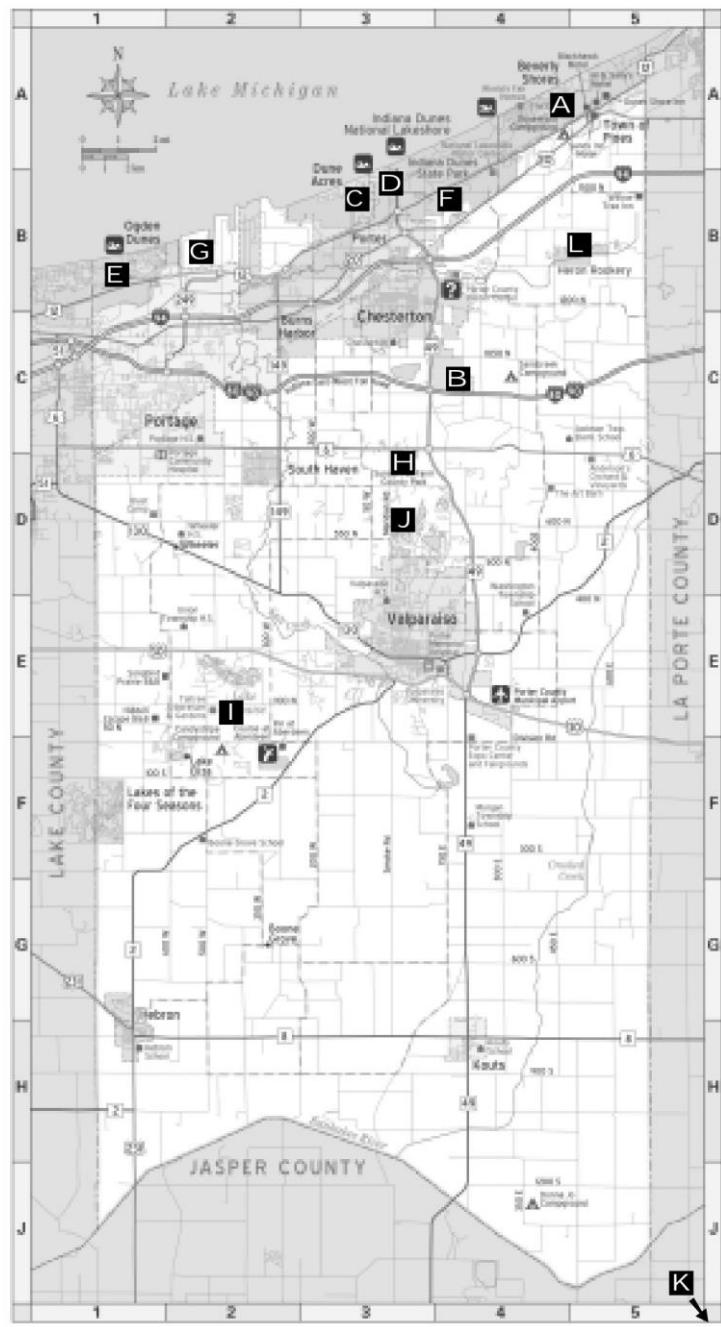
## ACCOMMODATIONS CHART

					Chesterton
\$	<b>Econo Lodge</b> State Road 49 and Indian Boundary Road	219/929-4416 or 800-55-ECONO			Portage
\$\$\$\$	<b>Hilton Garden Inn</b> State Road 49 and I-80/90	219/983-9500 or 800-774-1500			Porter
\$\$\$	<b>Indian Oak Resort &amp; Spa</b> State Road 49 and Indian Boundary Road	219/926-2200 or 800-552-4232			The Pines
\$\$	<b>Super 8 Motel</b> State Road 49 and Indian Boundary Road	219/929-5549 or 800-800-8000			Valparaiso
\$	<b>Castaway Motel</b> State Road 249 and U.S. Highway 20	219/762-4633			Bed & Breakfasts
\$\$\$	<b>Comfort Inn</b> State Road 249 and I-80/90	219/763-7177 or 800-228-5150			Campgrounds
\$\$	<b>Days Inn</b> State Road 249 and U.S. Highway 20	219/762-2136 or 800-325-2625			
\$	<b>Dollar Inn</b> State Road 249 and U.S. Highway 20	219/763-6601			
\$	<b>Don's Motel</b> State Road 249 and U.S. Highway 20	219/762-3317			
\$\$\$	<b>Hampton Inn</b> State Road 249 and U.S. Highway 20	219/764-1919 or 800-HAMPTON			
\$\$\$	<b>Holiday Inn Express</b> State Road 249 and I-80/90	219/762-7777 or 800-HOLIDAY			
\$\$	<b>Ramada Inn</b> State Road 249 and U.S. Highway 20	219/762-5546 or 800-437-5145			
\$\$	<b>Super 8 Motel</b> State Road 249 and U.S. Highway 20	219/762-8857 or 800-800-8000			
\$\$\$	<b>Spring House Inn</b> U.S. Highway 20 and Mineral Springs Road	219/929-4600 or 800-DUNES-00			
\$\$	<b>Al &amp; Sally's Motel</b> U.S. Highway 12	219/872-9131			
\$\$	<b>Blackhawk Motel</b> U.S. Highway 12	219/872-8656 or 800-908-8656			
\$	<b>Sands Inn Motel</b> U.S. Highway 20 and State Road 520	219/872-0717			
\$\$\$\$	<b>Courtyard by Marriott</b> State Road 49 and U.S. Highway 30	219/465-1700 or 800-321-2211			
\$\$\$	<b>Fairfield Inn</b> State Road 49 and U.S. Highway 30	219/465-6225 or 800-228-2800			
\$\$\$\$	<b>Hampton Inn &amp; Suites</b> State Road 49 and U.S. Highway 30	219/531-6424 or 800-HAMPTON			
\$\$\$	<b>Holiday Inn Express</b> U.S. Highway 30 and State Road 2	219/464-8555 or 800-HOLIDAY			
\$\$	<b>Super 8 Motel</b> State Road 49 and State Road 2	219/464-9840 or 800-800-8000			
\$	<b>Valparaiso Motel</b> U.S. Highway 30 and State Road 2	219/462-2752			
\$\$	<b>Dunes Shore Inn</b> U.S. Highway 12, Beverly Shores	219/879-9029			
\$\$\$\$	<b>Gray Goose Inn</b> State Road 49 and Indian Boundary Road, Chesterton	219/926-5781			
\$\$\$\$	<b>Hidden Escape</b> County Road 50 North, Valparaiso/Wheeler	219/759-4701			
\$\$\$\$	<b>The Inn at Aberdeen</b> State Road 2, Valparaiso/Boone Grove	219/465-3753			
\$\$\$\$	<b>Songbird Prairie</b> County Road 600 West, Valparaiso/Wheeler	219/759-4274 or 877-SONGBRD			
\$\$\$	<b>Willow Tree Inn</b> County Road 1500 North, The Pines	219/879-6790			
\$17+	<b>Candystripe Campground</b> Division Road, Valparaiso/Lake Eliza	219/462-0784			
\$19+	<b>Donna Jo Campground</b> County Road 350 East, Kouts	219/766-2186			
\$10+	<b>Dunewood Campground</b> U.S. Highway 12, Indiana Dunes National Lakeshore, Beverly Shores	219/926-7561 or 800-959-9174			
\$17+	<b>Sand Creek Campground</b> County Road 350 East, Chesterton	219/926-7482			
\$7+	<b>State Park Campground</b> State Road 49, Indiana Dunes State Park, Chesterton	219/926-4520			
\$28	<b>Yogi Bear's Jellystone Camp Resort</b> Old Porter Road, Portage	219/762-7757			

\$      \$20-\$40 price per room      \$\$      \$40-\$60 price per room  
 \$\$\$     \$60+ price per room      \$\$\$     \$80+ price per room



## PORTER COUNTY MAP



Porter County  
2012-03

- A - Beverly Shores
- B - Coffee Creek Watershed Preserve
- C - Cowles Bog
- D - Porter Beach
- E - West Beach
- F - Indiana Dunes State Park

- G - Port of Indiana
- H - Sunset Hill Farm County Park
- I - Taltree Arboretum & Gardens
- J - Rogers Lakewood Park
- K - Jasper-Pulaski Fish & Wildlife Area
- L - Heron Rookery

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**We're Ready to Welcome You!**



Don't sleep just anywhere. There are two great hotels in Valparaiso here for you, the Courtyard and Fairfield Inn by Marriott. Both friendly and modern, both offering all the amenities and services to make your stay enjoyable.

- Easy access from Route 49 and US 30
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**Fairfield Inn**  
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219-465-2225  
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219-465-1700  
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### Country Charm in the Heart of the Dunes

Nestled amid the woodlands and wildflowers of the Indiana Dunes, Springhouse Inn offers warm, comfortable surroundings complimented by thoughtful amenities and attentive service. You can enjoy the cozy warmth of a bed & breakfast inn, with the clean, friendly service of a hotel, featuring...

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Located just 40 minutes from Chicago, Springhouse Inn, one of Chesterton's finest hotels, provides a lodging and meeting retreat option only 2 miles from the Indiana Dunes.



## WELCOME TO BIRDING

---

### WELCOME TO THE WONDERFUL WORLD OF BIRDING!

If you like watching birds in your backyard or you want to travel the world to see all 10,000 bird species, use these ten tips to get started! You might also want to visit [WildBirds.com](http://WildBirds.com), a great site for newer birders!



**Hint #1:** You need a field guide for your area. A field guide is a book with pictures of the birds and tips for identifying them.

**Hint #2:** You need a binocular to see the birds. (Hint: you'd need four eyes to use binoculars.)

**Hint #3:** You need to know what to expect in your area. Checklists of birds in your area will tell you this. See pages 13-19 for the Porter County Bird Checklist.

**Hint #4:** You need to be able to find the birds. To do this, you should learn about the habitat each species of bird prefers. See page 13 for Habitat information and the Bird Checklist for where to spot each species.

**Hint #5:** Join a group of other birders. Birders are very friendly and helpful. They are always willing to share their knowledge. We were all beginners once.

**Hint #6:** Try a birding trip or tour. Local bird trips are sometimes advertised in the newspapers. Check out the Birding Sites information on pages 3-5 for information on local bird treks.

**Hint #7:** Read about birds. There are many good magazines about birds and birding. For North American birds: *Birder's World*, *Bird Watcher's Digest*, *Birding* and *WildBird* are magazines you might like.

**Hint #8:** Bring the birds to you. You can attract birds to your yard with just a little work. Planting the right flowers will attract hummingbirds. Sunflower seeds will bring lots of new birds to your house. You might even want to build a bluebird house.

**Hint #9:** Record your bird sightings. You might want to keep a "diary" or list of the birds you see in your yard. You can also keep a list of birds you see in your town or on your vacation. Birders often keep lists for their county, state or country. The Porter County Bird Checklist can be found in this guide on pages ...

**Hint #10: HAVE FUN. ASK LOTS OF QUESTIONS.  
BE KIND TO BIRDS.**

These hints are from the popular birding website - [BIRDING.com](http://BIRDING.com)

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## PORTER COUNTY BIRDERS CHECKLIST

### SEASONAL ABUNDANCE CODES:

**A = ABUNDANT:** Often observed and widespread throughout county

**C = COMMON:** Frequent in appropriate habitat

**U = UNCOMMON:** Infrequent in appropriate habitat

**R = RARE:** Unlikely, but possible in county

### HABITAT TYPES & LOCATIONS

**L-LAKE; B-BEACH:** Lake Michigan and its beachfront including: Beverly Shores, Indiana Dunes State Park, Indiana Dunes National Lakeshore

**D-DUNES:** Indiana Dunes State Park, Indiana Dunes National Lakeshore

**F-FIELDS:** Cultivated and roadside fields, open areas and prairies such as those found at Taltree Arboretum & Gardens, Indiana Dunes National Lakeshore, Sunset Hill Farm County Park and Coffee Creek Watershed Preserve

**FL-FLIGHT:** Observed in flight

**M-MARSH:** Areas regularly inundated by shallow water for much of the year: Interdunal marshes are found along Lake Michigan at Beverly Shores, Indiana Dunes National Lakeshore & Indiana Dunes State Park. Marshes are also found along county rivers, the most notable being the Kankakee River at the southern border of the county and at Kankakee Fish & Wildlife Area in neighboring Starke County

**P-PONDS:** Permanent bodies of water that include small lakes, ponds and wetlands: Long Lake, Taltree Arboretum & Gardens, Rogers Lakewood Park, Coffee Creek Watershed Preserve, Sunset Hill Farm County Park and Indiana Dunes National Lakeshore

**S-SWAMPS:** Wetlands that are poorly drained with trees growing throughout. There are numerous types of swamps in the county and they can be found at: Indiana Dunes State Park, Indiana Dunes National Lakeshore, Beverly Shores (along Beverly Drive), Coffee Creek Watershed Preserve, Taltree Arboretum & Gardens and the Kankakee River Floodplain

**W-WOODS:** Beverly Shores, Indiana Dunes National Lakeshore, Sunset Hill Farm County Park, Taltree Arboretum & Gardens, Indiana Dunes State Park, Coffee Creek Watershed Preserve

**WE-WOODED EDGES:** Coffee Creek Watershed Preserve, Taltree Arboretum & Gardens, Sunset Hill Farm County Park, Indiana Dunes National Lakeshore, and Indiana Dunes State Park

**U-URBAN:** Urban areas throughout the county



## PORTER COUNTY BIRDERS CHECKLIST

### Seasons

Bird	SP	S	F	W	Habitat
<b>Loon &amp; Grebes</b>					
<input type="checkbox"/> Common Loon	C	R	C	R	L
<input type="checkbox"/> Pied-billed Grebe	C	C	C	R	M,P
<input type="checkbox"/> Horned Grebe	U		C	R	L,H
<b>Cormorants</b>					
<input type="checkbox"/> Double-crested Cormorant	C	U	C	R	L
<b>Bitterns &amp; Herons</b>					
<input type="checkbox"/> American Bittern*	U	U	U	R	M
<input type="checkbox"/> Least Bittern*	R	R	R	R	M
<input type="checkbox"/> Great Blue Heron	A	A	A	R	M,P
<input type="checkbox"/> Great Egret	C	U	C	R	M
<input type="checkbox"/> Green Heron	C	C	C		M,P
<input type="checkbox"/> Black-crowned*	U	U	U		M
Night Heron					
<input type="checkbox"/> Yellow-crowned*	U	U	U		M
Night Heron					
<b>Swans, Geese &amp; Ducks</b>					
<input type="checkbox"/> Mute Swan	C	C	C	C	L,P
<input type="checkbox"/> Tundra Swan	U		U	R	L
<input type="checkbox"/> Canada Goose	A	A	A	A	L,M,P
<input type="checkbox"/> Wood Duck	A	A	C	R	P,S
<input type="checkbox"/> Green-winged Teal	C	R	U	R	M,P
<input type="checkbox"/> Black Duck	C	R	C	U	L,M
<input type="checkbox"/> Mallard	A	A	A	C	L,P,M,
<input type="checkbox"/> Northern Pintail	U	R	U	R	M,P
<input type="checkbox"/> Blue-winged Teal	C	U	C	R	M,P
<input type="checkbox"/> Northern Shoveler	C	R	U	R	M,P
<input type="checkbox"/> Gadwall	C	R	C	R	M,P
<input type="checkbox"/> American Wigeon	C	R	C	R	M,P
<input type="checkbox"/> Canvasback	U	R	R	U	M,P
<input type="checkbox"/> Redhead	C	R	U	R	L,P
<input type="checkbox"/> Ring-necked Duck	C	R	C	R	M,P
<input type="checkbox"/> Greater Scaup	U	R	U	U	L,P
<input type="checkbox"/> Lesser Scaup	C	R	C	U	L,P
<input type="checkbox"/> Black Scoter	R	R	U	R	L
<input type="checkbox"/> White-winged Scoter	R	R	U	R	L
<input type="checkbox"/> Common Goldeneye	C	R	C	A	L
<input type="checkbox"/> Bufflehead	C	R	C	A	L
<input type="checkbox"/> Hooded Merganser	U	R	U	R	L
<input type="checkbox"/> Common Merganser	U	R	U	C	L
<input type="checkbox"/> Red-breasted Merganser	C	R	C	U	L,P
<input type="checkbox"/> Ruddy Duck	C	R	U	R	L,P
<b>Vultures</b>					
<input type="checkbox"/> Turkey Vulture	A	A	C	R	FL
<b>Eagles &amp; Hawks</b>					
<input type="checkbox"/> Bald Eagle*	U	R	R	R	FL
<input type="checkbox"/> Northern Harrier*	U	R	U	R	F
<input type="checkbox"/> Sharp-shinned Hawk	C	C	C	C	WE,W
<input type="checkbox"/> Cooper's Hawk	C	C	C	C	WE,W
<input type="checkbox"/> Northern Goshawk	R	R	R	R	W
<input type="checkbox"/> Red-shouldered Hawk	U	R	U	R	WE
<input type="checkbox"/> Broad-winged Hawk	U	U	U	U	W

\* State endangered



## PORTER COUNTY BIRDERS CHECKLIST

### Seasons

Bird	SP	S	F	W	Habitat
<input type="checkbox"/> Red-tailed Hawk	C	C	C	C	F,WE
<input type="checkbox"/> Rough-legged Hawk	U	U	U	U	F,M
<b>Osprey &amp; Falcons</b>					
<input type="checkbox"/> Osprey*	U	R	U	R	L
<input type="checkbox"/> American Kestrel	C	C	C	C	F
<input type="checkbox"/> Peregrine Falcon*	U	U	U	U	FL
<b>Quail, Pheasant, Turkey</b>					
<input type="checkbox"/> Northern Bobwhite	U	U	U	U	F,WE
<input type="checkbox"/> Ring-necked Pheasant	U	U	U	U	F
<input type="checkbox"/> Wild Turkey	U	U	U	U	F,W
<b>Rails &amp; Coots</b>					
<input type="checkbox"/> Virginia Rail*	U	U	U	U	M
<input type="checkbox"/> Sora Rail	C	U	U	U	M
<input type="checkbox"/> Common Moorhen	R	R	R	U	M
<input type="checkbox"/> American Coot	A	A	A	U	M,P,L
<b>Crane</b>					
<input type="checkbox"/> Sandhill Crane (Jasper-Pulaski Site)	C	U	C	U	F,M
<b>Plovers</b>					
<input type="checkbox"/> Black-bellied Plover	U	R	U		B,P
<input type="checkbox"/> American Golden Plover	C	R	U		B,P
<input type="checkbox"/> Semipalmated Plover	U	R	U		B,P
<input type="checkbox"/> Piping Plover*	R	R			B
<input type="checkbox"/> Killdeer	A	A	C	R	M,D,F
<b>Sandpipers &amp; other Shorebirds</b>					
<input type="checkbox"/> Greater Yellowlegs	U	R	R		M,P
<input type="checkbox"/> Lesser Yellowlegs	U	U	U		M,P
<input type="checkbox"/> Solitary Sandpiper	C	U	U		M
<input type="checkbox"/> Spotted Sandpiper	C	C	U		M,S
<input type="checkbox"/> Semipalmated Sandpiper	U	R	C		B,P
<input type="checkbox"/> Least Sandpiper	U	U	U		B,P
<input type="checkbox"/> Pectoral Sandpiper	C	R	U		M,P
<input type="checkbox"/> Baird's Sandpiper		R	U		B
<input type="checkbox"/> Ruddy Turnstone	U	R	U		B
<input type="checkbox"/> Sanderling	R	C	C		B
<input type="checkbox"/> Dunlin	U	R	U		B,P
<input type="checkbox"/> Red Knot	R		R		B
<input type="checkbox"/> Purple Sandpiper	R		R		B
<input type="checkbox"/> Short-billed Dowitcher	R	R	R		P
<input type="checkbox"/> Red Phalarope			U		L,B
<input type="checkbox"/> Common Snipe	U	R	U	R	M,P
<input type="checkbox"/> American Woodcock	C	C	C	R	S,W
<b>Jaegers</b>					
<input type="checkbox"/> Parasitic Jaeger			U		L,B
<input type="checkbox"/> Pomarine Jaeger			R		L,B
<b>Gulls</b>					
<input type="checkbox"/> Little Gull	R	R	U	R	L
<input type="checkbox"/> Bonaparte's Gull	C	R	C	U	L,B
<input type="checkbox"/> Laughing Gull	U	R	R	R	L
<input type="checkbox"/> Ring-billed Gull	A	C	A	C	L,B

\* State endangered



## PORTER COUNTY BIRDERS CHECKLIST

### Seasons

Bird	SP	S	F	W	Habitat
<input type="checkbox"/> Herring Gull	A	U	A	A	L,B
<input type="checkbox"/> Thayer's Gull	R		R	U	L,B
<input type="checkbox"/> Iceland Gull	U		R	R	L
<input type="checkbox"/> Glaucous Gull	R		R	U	L,B
<input type="checkbox"/> Great Black-backed Gull	U	R	R	U	L
<input type="checkbox"/> Sabine's Gull		U	R		L
<input type="checkbox"/> Black-legged Kittiwake	R	R	U	R	L
<b>Terns</b>					
<input type="checkbox"/> Caspian Tern	C	U	R	R	L,B
<input type="checkbox"/> Common Tern	C	R	U		L,B
<input type="checkbox"/> Forster's Tern	U	R	U		L,B
<input type="checkbox"/> Black Tern*	R	U	R		M,B
<b>Doves</b>					
<input type="checkbox"/> Rock Dove	C	C	C	C	U
<input type="checkbox"/> Mourning Dove	A	A	A	A	F,W
<b>Cuckoos</b>					
<input type="checkbox"/> Black-billed Cuckoo	U	U	U		WE
<input type="checkbox"/> Yellow-billed Cuckoo	U	U	U		WE
<b>Owls</b>					
<input type="checkbox"/> Short-eared Owl	R	R	R	U	F,M
<input type="checkbox"/> Great Horned Owl	C	C	C	C	W
<input type="checkbox"/> Snowy Owl			R	R	B
<input type="checkbox"/> Barred Owl	C	C	C	C	S
<input type="checkbox"/> Northern Saw-whet Owl	R			R	W
<input type="checkbox"/> Eastern Screech Owl	C	C	C	C	W
<b>Goatsuckers</b>					
<input type="checkbox"/> Common Nighthawk	C	A	C		WE,F
<input type="checkbox"/> Whip-poor-will	C	U	U		W
<b>Swifts</b>					
<input type="checkbox"/> Chimney Swift	A	A	A		U
<b>Hummingbirds</b>					
<input type="checkbox"/> Ruby-throated Hummingbird	C	C	C		F,WE
<b>Kingfishers</b>					
<input type="checkbox"/> Belted Kingfisher	C	C	C	R	M,P
<b>Woodpeckers</b>					
<input type="checkbox"/> Red-headed Woodpecker	C	C	C	C	W
<input type="checkbox"/> Red-bellied Woodpecker	C	C	C	C	W
<input type="checkbox"/> Yellow-bellied Sapsucker	C	R	U	R	W
<input type="checkbox"/> Downy Woodpecker	C	C	C	C	W,WE
<input type="checkbox"/> Hairy Woodpecker	U	U	U	U	W
<input type="checkbox"/> Northern Flicker	C	C	C	U	W
<input type="checkbox"/> Pileated Woodpecker	U	U	U	U	W

\* State endangered

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## PORTER COUNTY BIRDERS CHECKLIST

### Seasons

Bird	SP	S	F	W	Habitat
<b>Flycatchers</b>					
<input type="checkbox"/> Olive-sided Flycatcher	U	R	U		S
<input type="checkbox"/> Eastern Wood Pewee	C	C	C		W
<input type="checkbox"/> Yellow-bellied Flycatcher	U	R	R		W
<input type="checkbox"/> Acadian Flycatcher	C	C	R		W
<input type="checkbox"/> Alder Flycatcher	U	U	U		M
<input type="checkbox"/> Willow Flycatcher	C	U	R		M
<input type="checkbox"/> Least Flycatcher	C	R	C		W,WE
<input type="checkbox"/> Eastern Phoebe	C	C	U		F,W,WE
<input type="checkbox"/> Great-crested Flycatcher	C	C	U		W
<input type="checkbox"/> Eastern Kingbird	C	C	U		F,M
<b>Larks</b>					
<input type="checkbox"/> Horned Lark	C	U	U		F
<b>Swallows</b>					
<input type="checkbox"/> Purple Martin	C	C	C		F,P
<input type="checkbox"/> Tree Swallow	C	A	C		F,M
<input type="checkbox"/> Rough-winged Swallow	U	U	U		F,M
<input type="checkbox"/> Bank Swallow	C	C	C		B,D
<input type="checkbox"/> Cliff Swallow	R	R	R		F
<input type="checkbox"/> Barn Swallow	C	A	C		F
<b>Jays &amp; Crows</b>					
<input type="checkbox"/> Blue Jay	A	A	A	A	W,WE
<input type="checkbox"/> American Crow	A	A	A	A	ALL
<b>Titmice</b>					
<input type="checkbox"/> Black-capped Chickadee	C	C	C	C	W
<input type="checkbox"/> Tufted Titmouse	C	C	C	C	W
<b>Nuthatches</b>					
<input type="checkbox"/> Red-breasted Nuthatch	U	R	U	U	W
<input type="checkbox"/> White-breasted Nuthatch	C	C	C	C	W
<b>Creepers</b>					
<input type="checkbox"/> Brown Creeper	C	R	C	U	W
<b>Wrens</b>					
<input type="checkbox"/> Carolina Wren	U	U	U	U	WE,U
<input type="checkbox"/> House Wren	C	C	C		WE,U
<input type="checkbox"/> Winter Wren	U	R	U	R	W
<input type="checkbox"/> Marsh Wren*	U	U	U		M
<input type="checkbox"/> Sedge Wren*	U	R	R		F,M
<b>Old World Warblers, Thrushes &amp; Allies</b>					
<input type="checkbox"/> Golden-crowned Kinglet	C	R	C	R	W
<input type="checkbox"/> Ruby-crowned Kinglet	C	R	C	R	W
<input type="checkbox"/> Blue-gray Gnatcatcher	C	U	R		W
<input type="checkbox"/> Eastern Bluebird	C	C	C	U	F,WE
<input type="checkbox"/> Veery	U	U	U		W
<input type="checkbox"/> Gray-cheeked Thrush	U	U			W

\* State endangered



## PORTER COUNTY BIRDERS CHECKLIST

### Seasons

Bird	SP	S	F	W	Habitat
<input type="checkbox"/> Swainson's Thrush	U		C		W
<input type="checkbox"/> Hermit Thrush	C		C	R	W
<input type="checkbox"/> Wood Thrush	U	U	U	R	W
<input type="checkbox"/> American Robin	A	A	A	U	F,W
<b>Thrashers</b>					
<input type="checkbox"/> Gray Catbird	C	C	C		WE
<input type="checkbox"/> Northern Mockingbird	U	U	U	R	F,WE
<input type="checkbox"/> Brown Thrasher	C	C	C	R	WE
<b>Waxwings</b>					
<input type="checkbox"/> Cedar Waxwing	C	U	C	U	W,M
<b>Starlings</b>					
<input type="checkbox"/> European Starling	A	A	A	A	ALL
<b>Vireos</b>					
<input type="checkbox"/> White-eyed Vireo	U	R	U		W
<input type="checkbox"/> Solitary Vireo	U	R	U		W
<input type="checkbox"/> Yellow-throated Vireo	C	U	U		W
<input type="checkbox"/> Warbling Vireo	C	C	U		WE,P
<input type="checkbox"/> Philadelphia Vireo	U	R	U		W
<input type="checkbox"/> Red-eyed Vireo	C	C	C		W
<b>Warblers</b>					
<input type="checkbox"/> Blue-winged Warbler	C	U	U		WE
<input type="checkbox"/> Golden-winged*	R	R	R		WE
Warbler					
<input type="checkbox"/> Tennessee Warbler	C	R	C		W
<input type="checkbox"/> Nashville Warbler	C	R	C		W
<input type="checkbox"/> Northern Parula	U	R	R		W
Warbler					
<input type="checkbox"/> Orange-crowned	U	R	U		W
Warble					
<input type="checkbox"/> Yellow Warbler	C	C	R		WE,M
<input type="checkbox"/> Chestnut-sided	C	R	U		W,WE
Warbler					
<input type="checkbox"/> Magnolia Warbler	C	R	C		W
<input type="checkbox"/> Cape May Warbler	C	R	C		W
<input type="checkbox"/> Yellow-rumped	C	R	C		W,M
Warbler					
<input type="checkbox"/> Black-throated	C	R	C		W
Green Warbler					
<input type="checkbox"/> Blackburnian	C	R	C		W
Warbler					
<input type="checkbox"/> Prairie Warbler	U	U	R		D
<input type="checkbox"/> Palm Warbler	C	R	C		WE,M
<input type="checkbox"/> Bay-breasted	C	R	C		W
Warbler					
<input type="checkbox"/> Blackpoll Warbler	C	R	C		W
<input type="checkbox"/> Cerulean Warbler	C	C	R		W
<input type="checkbox"/> Black and White	C	R	C		W
Warbler					
<input type="checkbox"/> American Redstart	C	U	C		W
<input type="checkbox"/> Ovenbird	C	C	U		W
<input type="checkbox"/> Northern	U	R	U		WE,M
Waterthrush					
<input type="checkbox"/> Louisiana	U	R	U		S
Waterthrush					
<input type="checkbox"/> Mourning Warbler	R	R	R		WE

\* State endangered



## PORTER COUNTY BIRDERS CHECKLIST

### Seasons

Bird	SP	S	F	W	Habitat
<input type="checkbox"/> Common Yellowthroat	C	C	C		M
<input type="checkbox"/> Hooded Warbler	U	R	R		S
<input type="checkbox"/> Wilson's Warbler	C	R	C		W
<input type="checkbox"/> Canada Warbler	C	R	C		W
<input type="checkbox"/> Yellow-breasted Chat	U	R	R		M,WE
<b>Tanagers</b>					
<input type="checkbox"/> Scarlet Tanager	C	C	U		W
<b>Cardinals &amp; Buntings</b>					
<input type="checkbox"/> Northern Cardinal	A	A	A	A	F,WE
<input type="checkbox"/> Rose-breasted Grosbeak	C	C	C		W
<input type="checkbox"/> Indigo Bunting	C	C	C		F,WE
<input type="checkbox"/> Dickcissel	U	U	U		F
<b>Sparrows</b>					
<input type="checkbox"/> Eastern Towhee	C	C	C	R	WE
<input type="checkbox"/> Tree Sparrow	C	C	C		F,WE
<input type="checkbox"/> Chipping Sparrow	C	C	C		F,WE,D
<input type="checkbox"/> Field Sparrow	C	C	C	U	F,D,M
<input type="checkbox"/> Vesper Sparrow	U	U	U		F,D
<input type="checkbox"/> Savannah Sparrow	U	U	U		F,D
<input type="checkbox"/> Grasshopper Sparrow	U	U	U		F
<input type="checkbox"/> Fox Sparrow	C		C	R	WE
<input type="checkbox"/> Song Sparrow	C	C	C	U	M,WE
<input type="checkbox"/> Lincoln's Sparrow	U		U		W
<input type="checkbox"/> Swamp Sparrow	C	C	C	U	M,S
<input type="checkbox"/> White-throated Sparrow	C		C	R	WE
<input type="checkbox"/> White-crowned Sparrow	C		C	R	WE
<input type="checkbox"/> Dark-eyed Junco	C		C	A	WE
<input type="checkbox"/> Lapland Longspur	R		R	R	B
<input type="checkbox"/> Snow Bunting	R		U	U	F,B
<b>Blackbirds &amp; Orioles</b>					
<input type="checkbox"/> Bobolink	C	C	R		F
<input type="checkbox"/> Red-winged Blackbird	A	A	A	U	F,M,S
<input type="checkbox"/> Eastern Meadowlark	C	C	C		F
<input type="checkbox"/> Western Meadowlark	R	R	R		F
<input type="checkbox"/> Yellow-headed Blackbird*	R	R	R		M
<input type="checkbox"/> Rusty Blackbird	U	R	U	R	S
<input type="checkbox"/> Common Grackle	C	C	C	U	M,F
<input type="checkbox"/> Brown-headed Cowbird	C	C	C	U	W,WE
<input type="checkbox"/> Baltimore Oriole	C	C	U		W,WE
<input type="checkbox"/> Orchard Oriole	U	U	U		W,WE
<b>Finches</b>					
<input type="checkbox"/> Purple Finch	U	U	U	U	W
<input type="checkbox"/> House Finch	A	A	A	A	U
<input type="checkbox"/> Common Redpoll	R		R	U	WE
<input type="checkbox"/> Pine Siskin	R		R	U	WE
<input type="checkbox"/> American Goldfinch	A	A	A	A	F,WE,U
<input type="checkbox"/> Evening Grosbeak	R		R	U	WE
<b>Old World Sparrows</b>					
<input type="checkbox"/> House Sparrow	A	A	A	A	U

\* State endangered

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## ACKNOWLEDGEMENTS

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*The Porter County Convention, Recreation & Visitors Commission (PCCRVC) would like to give special thanks to David Oberst, Director of Education and Naturalist at Taltree Arboretum & Gardens, and Taltree board member, Laurie Eberhardt, Ph.D., for their help in creating this guide. The PCCRVC is truly grateful for their help.*

### **TALTREE ARBORETUM & GARDENS: “A SPECIAL PLACE TO BIRD”**

*Taltree offers the birder a wide variety of habitat at one location: Prairie, Savanna, Woods, Wooded Edges, Swamp, Pond and open Wetland, can all be easily observed at this 300+ acre site. More than 60 species of birds have been identified on Taltree's property. The Bluebird Trail derives its name from the numerous Bluebird nesting boxes along its route, Eastern Bluebirds are a common site at Taltree. The trail directs visitors along the perimeter of the prairie in an effort to reduce disturbance to wildlife and restore habitat to natural nesting conditions. As a result grassland-nesting birds, such as the Bobolink, that need a large area of undisturbed habitat for survival have abundantly returned. This trail also traverses a 7-acre open wetland, which holds abundant migratory waterfowl in the spring. Wood Ducks are a common site as they utilize nesting boxes in the wetland. In 2002, a Hooded Merganser successfully nested at Taltree. Migrating spring warblers can be viewed in abundance along the Heron Pond Woodlands and Owl Trails. Taltree is an excellent site to view raptors. Red-tailed, Cooper's and Sharp-shinned Hawks are year round residents. During the winter and early spring months a pair of Northern Harrier Hawks regularly patrol the open space at the arboretum. Wild Turkey, Ring-necked Pheasant and Bobwhite Quail are also present. Other birds of particular interest are American Woodcocks, Eastern Meadowlarks, Dickcissels, Indigo Buntings, Rose-breasted Grosbeaks, Baltimore Orioles and the Savanna and Grasshopper Sparrows. Taltree Arboretum & Gardens: A Natural Inspiration....*

### **Bibliography**

**Brock, Kenneth J.** *Birds of the Indiana Dunes.* (Revised Edition) Shirley Heinz Environmental Fund, 1997.

**Sibley, David Allen.** *The Sibley Guide to Birds.* Alfred A. Knopf, Inc., 2000.

**United States.** *Birds of the Indiana Dunes National Lakeshore.* (Revised Edition) Indiana Dunes National Lakeshore, 1991.

*Special thanks to Ken Brock for permission to use information about birding in the Indiana Dunes directly from his book, **Birds of the Indiana Dunes**.*



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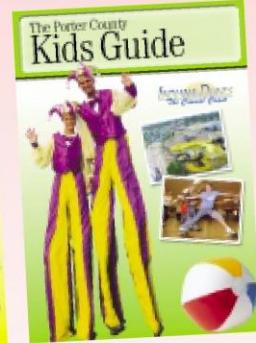
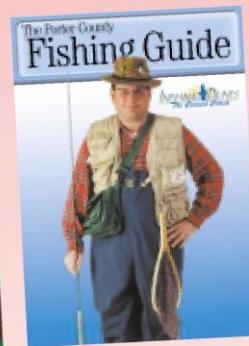
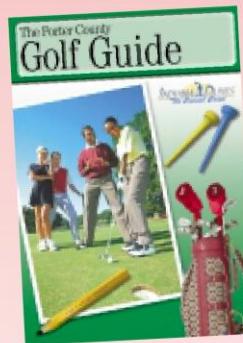


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### Appendix N – John Doe Bookmarks

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