

BELIZE RAPTORWATCH MONITORING MANUAL

Belize Raptor Research Institute

In collaboration with
Toledo Institute for Development and the Environment
Ya'axché Conservation Trust

3rd Edition



Written by Ryan A. Phillips
Belize Raptor Research Institute

June 2015

Adopted and customized with permission from the Golden Gate Raptor Observatory's Manual



The mission of the Belize Raptor Research Institute (BRR) is to strive to protect Neotropical raptors in Belize through research, education and partnerships. BRR conducts long term scientific research to learn about the status and needs of raptors in the wild, while building local capacity, working with policy makers and educating local and international communities about raptor conservation.

The Belize Raptor Research Institute (BRR) is a 501(c)3 non-profit charitable organization founded in 2009 by like-minded conservationists, bird enthusiasts and environmentalists that wanted to assist in learning about Neotropical raptors and their conservation. Raptors globally face many threats and most are considered to be declining in size. Being apex carnivores, raptors play a vital role in ecosystems and are considered key indicator species, as well as flagship and umbrella species.

The Belize Raptorwatch Program is a collaborative effort between BRR, Toledo Institute for Development and Environment (TIDE), the Belize Forest Department and Ya'axché Conservation Trust (YCT).



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Belize Raptor Research Institute
Raptorwatcher's Manual
3rd Edition, 2015

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manual.

Preface

Unraveling the Mysteries of Neotropical Raptors

Raptors have captivated humans for thousands of years due to their keen senses, hunting capabilities, power, behaviors, complex migrations and key niches in ecosystems. Raptors play critical ecological roles often impacting ecosystems making them keystone and flagship species for conservation efforts. Using raptors as umbrella species in conservation can protect entire ecosystems and all the species that live within that community, due to their low densities, large area requirements, complex migrations and often specialized requirements.

The Neotropical region, which spans much of the Americas, holds one of the least understood raptor communities across the globe as basic natural history information is lacking for most species. Research in the Neotropics and other areas indicates that raptors are important environmental indicators and can determine how intact an ecosystem is. Yet as they are facing many threats, such as habitat loss and persecution, the need for their study and protection grows urgent.

Before a sound management plan for species preservation can be written and implemented, the species and ecosystems must be studied and understood. Therefore, due to the lack of information for most Neotropical raptor species, research on these species and their ecosystems is the first step in Neotropical raptor conservation and their protection. We strive to learn about raptor ecology, population dynamics, area requirements, habitat usage and threats to inform the scientific community, so that we can produce and implement sound management strategies and action plans, working with collaborators, for the conservation of raptor species in the Neotropics. Protecting and conserving raptors ultimately protects all biodiversity and the species and biological functions, we as humans, rely for our own survival.

This Raptorwatch Program will unravel many mysteries we have about raptors in the Neotropical region and will ultimately allow for the conservation of these species as we work closely with locals and partners to achieve our goals. I want to thank you on behalf of the Belize Raptor Research Institute for being part of this critical research and conservation program and your long hours in the field counting raptors as we embark on this journey, to protect biodiversity globally, together.

This program has benefited from the support of the Belize Forest Department and collaboration and support of the Toledo Institute for Development and the Environment and Ya'axche Conservation Trust. We are grateful for these key partnerships to reach our mutual goals.

Let's hit the field and count raptors!

Ryan Phillips, Executive Director
Belize Raptor Research Institute
June 2015

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Chapter One

Introduction

This 3rd edition of the BRRRI Raptorwatch Manual is an important reference to your experience as a BRRRI raptorwatcher in Punta Gorda, Belize. It describes in detail the methods, roles and responsibilities, and protocols of the BRRRI Raptorwatch Program. As a tool, this manual works best if you read it at least once before your first day of raptorwatching, keeping track of any questions or obscurities, then read it again, cover to cover after you've had a few raptor-filled days at the Cattle Landing count-site. Other references that will help you learn hawks are:

William S. Clark & Brian K. Wheeler. *The Peterson Field Guide to Hawks* -- first (1987) or second (2001) edition. Houghton Mifflin Co. Either edition is an excellent synopsis of all aspects of identification of US and Canada species. The second edition has more information, and more current info. Some prefer the color plates of the first edition for their simplicity.

Peter Dunne, David Sibley, & Clay Sutton. 1988. *Hawks in Flight, First Edition. Houghton Mifflin Co.* Dunne is perhaps the greatest wordsmith and pair of eyes we have when it comes to describing raptors in flight. HIF gives a better illustration of how people really learn raptor shapes and behaviors than any other book. Specific for hawk migration sites. Sibley's illustrations – it'll amaze you what black and white can show.

Peter Dunne, David Sibley, & Clay Sutton. 2012. *Hawks in Flight, Second Edition. Houghton Mifflin Co.* An entirely new presentation of the basic hawkwatching material as soon through the eyes of three Cape May. Dunne's precise and creative prose, combined with Sibley's art make this a critical and cutting edge book for hawk migration students. **An excellent book for every starting-out hawkwatcher.**

Jerry Liguori. 2005. *Hawks from Every Angle. Oxford University Press.* An excellent tool for advanced raptor migration students. The author has been a hawk counter at Cape May, NJ, and the Goshutes Mountains of Nevada. His critical eye and photographic talents have made his articles for *Birding* magazine among the best explanations of raptor plumages. HFEA is useful for learning how to "see" and evaluate hawks..

Jerry Liguori. 2011. *Hawks at a Distance. Oxford University Press.* Liguori surpassed his first book with this treatment. Although the two books work well in partnership, HAAD is a tighter, more-polished treatment of some of the same material. It has many more photos, and is published in a smaller more transportable format. Although the emphasis is on what we might call "hawkdots," the introductory material on each species includes the best basic ID info in one place I ever seen. **An excellent book for every advanced hawkwatcher.**

David A. Sibley. 2002. *Sibley's Birding Basics. Knopf.* A brilliant and readable handbook on aspects of identification (what most books don't tell you). It includes info on molt, behavior, field marks, gestalt. This is a gem of a book for learning the art and background of bird identification.

Brian K. Wheeler. 2003. *Raptors of Western North America. Princeton University Press.* Wheeler downloaded his raptor brain and gave us this brick (544 pp.) and its Eastern counterpart. What's great? The photos. Many many variations on one species. What's good? Practical advice about approaching raptors and their biology, and incredible detail on plumages and ranges. What's not as good? Incredible detail on plumages and ranges. What's not good as of late 2012? This book is hard to find for less than \$100, and is more library tome than field guide.

Crossley, Richard, Jerry Liguori, & Brian Sullivan. 2013. *The Crossley ID Guide - Raptors. Princeton University Press.* Cutting edge doesn't necessarily work for everyone, but this photo-shopped rapto-rama is worth a long look. Crossley is making a name for himself by cramming many images of one bird species onto one page, or across a 2-page spread. The result, he states, is hawks how you will see them, in context, against a backdrop of field, forest and sky. I get that, but 20 kestrels don't share an air-space without some fights taking place. That is, this is NOT how you see them; this is how you photo-shop them. Still, what you do get with Crossley is more images per square inch of book than any other book, and learning the variation of a species is more important than learning one middle-of-the-road plumage. This is a great way to

test your knowledge of all levels. Either at far distances or from odd angles .Finally, the species notes provided by Sullivan and Liguori are superb and innovative, and alone worth the price of the book

Howell, Steve & Webb, Sophie. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press. The best field guides for drawings of raptors for the region. The raptor plates are well done with both flight and perched drawings. The drawings are detailed and the most accurate plates in any Mexico or Central America field guide.

Bildstein, Keith. 2006. Migrating raptors of the world: their ecology and conservation. Comstock Publishing Associates. By far the most comprehensive book on raptor migration. This is a must read for any hawkwatcher to truly understand why and how migrating raptors do what they do. It is well written and Bildstein has a strong knowledge of the literature out there, as well as being one of the most experienced hawkwatchers.

Whitacre, David. 2012. Neotropical birds of prey: biology and ecology of a raptor forest community. Cornell University Press. If you want to learn more about the ecology and biology of little know neotropical raptors this is your source. This is one of least understood raptor communities, so to better understand the migration through Belize it is a must to understand their ecology. The downfall is that there are accounts for only 20 species, respectively.

Zalles, Jorge & Keith Bildstein. 2000. Raptor Watch: a global directory of raptor migrations sites. Hawk Mountain Sanctuary. A fantastic overview of the history of hawkwatches and where we are today with hawkwatching, as well as a global directory of all the hawkwatch sites.

You might also consider using Google Images to look at as many images of one species at a time, say “Hook-billed Kite.” If not copy-righted, you can save raptor photos to your desktop and then use Powerpoint to construct home-tests for yourself to review. *Just keep in mind that some googled web images are not correctly identified.* Also there may be you-tubes that show raptors on a species by species basis, but if you doubt the accuracy of the identification, send Ryan the link to verify it. DVDs are gradually becoming available that will help you with flight identification, but so far a comprehensive and high quality “Raptors of North America” video has not been made. Watch for anything by the late great Morley Nelson, the father of raptor filmmaking, and in many ways, modern raptor conservation.

Remember that your best single source of learning raptor identification is to hang out with the raptor enthusiasts in the field and getting lots of field time. Become an expert at asking your colleagues, “How did you know what that was?” Asking questions will help you quickly learn what characteristics to look for next time you observe that raptor in the field. Also, use the field guides to solidify what you observed or what you may have not seen in the field.

For the purposes of this manual, “raptor” and “hawk” and “bird of prey” all mean the same thing. They all refer to the bird species in the order Falconiformes and Accipitriformes, which until the 1990s had included falcons and caracaras (family Falconidae), hawks, buteos, eagles, kites, and harriers (Accipitridae), osprey (Pandionidae), and American vultures (Cathartidae). DNA hybridization and other genetic studies over the last 30 years continue to suggest fascinating and complicated re-writes of the arrangement and connections between these groups, but for BRRI purposes, these four groupings are worth knowing.

The bottom line is that there are fascinating studies being conducted on bird behavior, genetics, morphology, and plumage, all of which contribute to the constant tweaking of the accepted lines of bird evolution and relationships between species. This tells us that our classifications are works in progress, as we apply human structure to the glorious chaos of avian evolution, and the

question, “just what is a raptor?” is accordingly fuzzy. Still, the hawks, kites, falcons, eagles, vultures, buteos, and harriers that we study are linked by three characters, (1) eye visual cells 5 to 12 times more dense than those of humans; (2) a sharp, down-curved beak; and (3) sharp, down-curved talons, (unless they are not as in the case of vulture feet.) See -- there’s always an exception.

Chapter Two

A Short History of BRRI

The Belize Raptor Research Institute (BRRI) is a 501(c) 3 non-profit charitable organization founded in 2009 by like-minded conservationists, bird enthusiasts and environmentalists that wanted to assist in learning about Neotropical raptors and assist in their conservation. Raptors globally face many threats and most are considered to be declining in size, therefore the need to learn and protect these species is urgent.

Our Executive Director, Ryan Phillips, living in Belize and working on the Harpy Eagle Restoration Project, witnessed first-hand the persecution of raptors, the devoid of community involvement in raptor conservation and the limited knowledge of raptors in the Neotropics to make sound management strategies and conservation action plans. As a result of Ryan’s vision and co-founding members, Rich Kuehn, Marta Curti, Jan Meerman and Roni Martinez, passion and pursuit of this vision, BRRI was founded and strives to better understand raptor communities, assist in inspiring locals to conserve their raptors, giving Belizeans and international students opportunities in research and conservation and ultimately aid in the protection and conservation of raptors.

Belize is an ideal location for raptor research and conservation with 92 protected areas in various management structures comprising 44% (2.6 million acres) of the land area of Belize and approximately 70% of its native forest still intact. Although the country holds a small human population of roughly 350,000 people and is a very young country, native habitats are under a greater threat now more than ever. Over the past 15 years, outside corporations have targeted pristine habitat for construction of dams and other large-scale projects that have had a detrimental effect on wildlife. And this trend continues. There is a risk that habitat for many rare or little studied species, such as the Solitary Eagle, will be destroyed before scientific and conservation efforts can be implemented. Our goal is to assist in reversing this trend.

Currently, BRRI has three long-term projects, which include the Solitary Eagle Project, Hook-billed Kite Project and this Raptorwatch Program. We are dedicated to learning about every species in the Neotropical region of Belize, one species at a time. This will ensure that we have an understanding of Neotropical raptors before we lose populations or species, so that we can assist in reversing the trend of decline and extinction.

Chapter Three

Goals of the BRRI Raptorwatch

- I. To operate a consistent, long-term record of the visible autumn raptor activity within the study area around Punta Gorda, Belize.
 - A. The study area is defined as coastline and inland to the west centered at Cattle Landing soccer.
 - B. The study hours are 8:00 am to 4:00 pm from October 15 through December 15. Adverse weather conditions limit visibility and hours of coverage.
- II. To monitor long-term trends in raptor activity and species frequency in southern Belize and to analyze factors that may influence those trends.
- III. To use the raptor count data to contribute to the preservation of raptor populations. This will be accomplished through several routes:
 - A. by publishing results in the *Solitarius*, in scientific journals, and in popular newsletters and newspapers;
 - B. by publishing and presenting results (of both the annual Hawkwatch and advancements in techniques of hawkwatching and hawk counting) in scientific journals, at scientific conferences and for other organizations;
 - C. by collaborating with other organizations with mutual goals and agencies.
 - D. by continually involving a wide range of community volunteers who will learn the skills of identification and gain knowledge about raptor species, their behaviors, ranges, and ecology, and thereby will be more capable of protecting these species.

Project objectives include:

1. Better understand and quantify the raptor migration through Belize.
2. Learn if species that were thought to be sedentary are truly migratory (e.g. Hook-billed Kite) and quantify their migration.
3. Understand the seasonality of little known migratory species.
4. Fill a void of knowledge in raptor migration in Mesoamerica.
5. Establish a long-term Raptor Watch.
6. Participate in multinational conservation by monitoring migratory raptors that pass through multiple countries and two continents.
7. Raise research and conservation awareness of raptors and migratory birds to the region to ultimately help protect both migratory and resident raptor populations.
8. Build local capacity in conservation through this community based project.
9. Train future biologists and conservationists in research and conservation.
10. Build a community bird observation platform to benefit ecotourism and education of biodiversity in the region.

Questions to be answered:

- What species annually migrate through Belize and what is their abundance?
 - What are the age structure, morph structure and sex ratio of each species?
 - When is peak migration for each species and is there any variation between years?
 - How many Hook-billed Kites pass through Belize?
 - Is the Hook-billed Kite migration annual or is their variation from year to year?
 - Are there any trends in seasonality of migration?
-

Chapter Four

The Quadrant System

To achieve the goals of the BRRR Raptorwatch, we are using a counting technique for spotting, identifying, and documenting raptors in the skies around Cattle Landing that was created by GGRO -- *the Quadrant System*.

We use a counting system that gave us the best chance at delivering a repeatable record of the raptors near Cattle Landing each year, *regardless* of the direction that they might be going, and *regardless* of what team of volunteers was conducting the count.

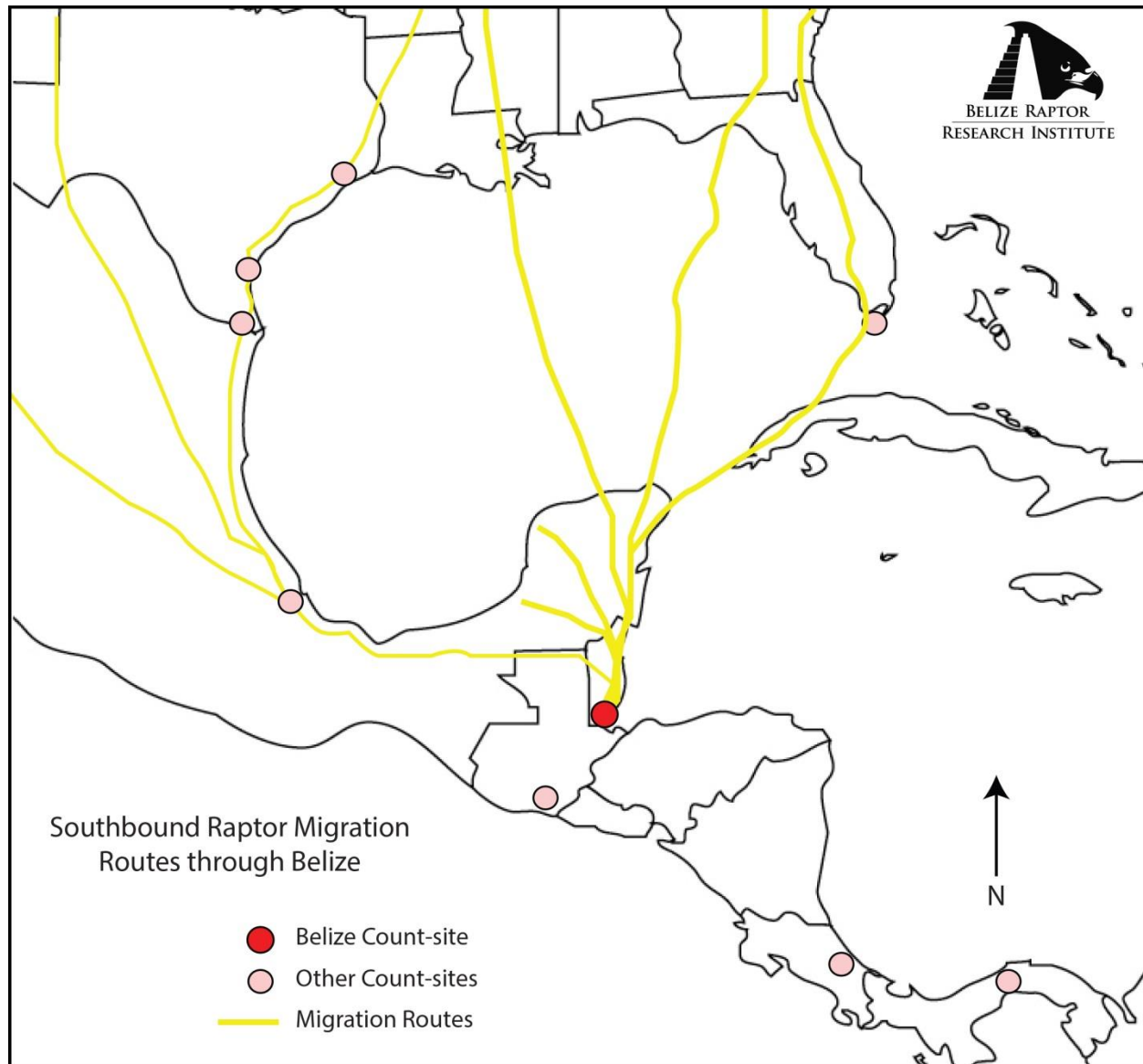
We wanted to develop a raptor counting system that could be documented in writing and, even centuries from now, could be re-read and reapplied, with comparable results. That documentation is the manual that you hold.

I. Behavior of Migrating Raptors in Belize

We suspect that most of the raptors observed during this count will be traveling north-south or northwest-southeast as they make their southbound migration. However, some individuals, or perhaps many, may move from the northeast-southwest as they 'island-hop' through the Caribbean before hitting the mainland in the Yucatan or Belize. Therefore, it is critical that the quadrants are monitored evenly, even though most raptors will be observed in the W quadrant. As raptors migrate through Mexico they congregate by being funneled in Veracruz, Mexico, which has the highest number of raptors anywhere in the world. Once they pass through Mexico they continue south either sticking to the Pacific coast of Guatemala or passing through eastern Guatemala or Belize. Some individuals stay further north and move through the Yucatan Peninsula before hitting the coastline. Once they reach the coastline they follow it through Belize into Guatemala and Honduras as numerous species will rarely cross large bodies of water. Punta Gorda in southern Belize is an ideal location for a raptorwatch because it will include individual raptors that will migrate along the coastline after passing through the Yucatan or the Peten of northern Guatemala, island-hopping across the Caribbean or making a further westerly movement through Guatemala moving more in a west to east movement. See the map for a visual explanation.

There may be northbound movements, which are not pure migration in the classic sense. They may be called *dispersal* movements, having no particular directional tendency and stimulated -- perhaps -- by low numbers of prey or high numbers of competing raptors in a given locale. A dispersing hawk will leave a prey-poor, hawk-heavy area to find a prey-rich, hawk-scarce area where she can survive the winter. However, this occurrence may be very rare, therefore we can

assume we are achieving an accurate count of the number of individuals as they pass over Cattle Landing heading south they do not reverse their migration. Further study will determine if we are re-counting individuals and how long they stay over the count-site.



II. The Count-site: Cattle Landing Soccer Field

The topography of the count-site is flat lowland broadleaf forest directly along the coastline. The BRRR Raptor Count is conducted on a soccer field located in Cattle Landing on a 20 foot tall observation platform. It is 40 feet from the ocean and is 22 feet in elevation. The site is located at 16.120218° latitude and -88.794307° longitude. It is approximately 2 kilometers north of Punta Gorda Town in the Toledo District of Belize.

As a result, raptors are primarily observed from below and often back and top lit making studying patterns and colors a challenge. Also, raptors are observed from a distance therefore understanding how to identify using silhouettes and overall general shape and appearance is critical at this count-site. However, this is all dependent on the weather conditions. If cloud cover is heavy and thermals minimal raptors may be observed at lower altitudes.

September through November is the rainy season in Belize and there may be consecutive days where weather conditions limit count hours. Part of this study is to understand how weather patterns influence raptor migration. Therefore weather data is recorded on an hourly basis.



III. The Quadrant System

To count migrating raptors, we are using a modified Quadrant System, which was created by Allen Fish of GGRO. Here is how it works:

Duties/Tasks:

Day Leader (Count Leader, Coordinator, or qualified team member)

Data Recorder (records weather, enters data sheets, strong communicator with counters)

Spotters (each have a designated quadrant)

We divide the visual sphere of the sky above and the landscape into TWO (not four) sections each divided by the N and S cardinal directions. **The distance out, that is, the radius of the visual sphere, is the distance that a hawkwatcher can spot a hawk with 7x to 10x binoculars.** The team size may vary from as few as 4 to as many as ten raptorwatchers. A ten-person team, for example, would consist of a Dayleader and nine hawkwatchers, some veterans and some apprentices: two hawkwatchers would take each quadrant, a Recorder would track observations on data sheets, and a Dayleader would work as a Floater, assisting wherever needed. **Quadrants are rotated every hour.**



Spotters fully scan their quadrant at least once every ten minutes when raptor activity is nil. Our objective is to spot, identify, and track every raptor observable within the study area -- the range of the binocular-aided eye.

When a raptor is first identified in a quadrant, the Counter calls it out to the Recorder and Team. When the bird passes to another quadrant, the first quadrant team alerts the NEXT quadrant team as to the hawk's presence, and the fact that it has been recorded. On peak days, when communication is frenzied, the Dayleader keeps information flowing. To the extent that we can continue to track an individual hawk around the sky, we can avoid double-counting it while it's continuously visible.

Thus, you should find yourself OFTEN saying something like, "East Quadrant! Juvenile Hook-billed Kite in the W quadrant been counted!" Hawkwatching is NOT for the shy and withdrawn souls among us. This is not a substitute for a quiet, solitary nature experience. **The Quadrant System requires all team members to be assertive, overstating, and even a bit loud.** Our goal is that as long as a raptor is continuously visible, it will not be counted more than once. The corollary rule here is that *if you doubt whether a particular raptor has been counted earlier, you must count it.*

We rotate hawkwatchers from one quadrant to another every hour, to share the raptor-busy quadrants as well as the raptor-slow ones. The Dayleader is responsible for managing the overall dynamics and personnel of the Quadrant System. **The Dayleader is responsible for transferring the visible raptor activity of the day to the data form. The Dayleader is**

the Coordinator or Compiler. Each days count team incorporates people with a mix of skill levels, from veterans to novices.

If there are two hawkwatchers in each quadrant, then the two people may decide how to split duties. Most often, one spotter is a relative experienced person, while the other is an apprentice, and so they may work together as mentor and student. In more equal pairings, one may spot high, the other low. One may look for hawks to the right, while the other looks left. Some teams may split between close and far birds. Often one hawkwatcher will call in all birds to the Recorder for an hour; this way the Recorder gets used to hearing a particular voice from that quadrant. Often one hawkwatcher may try to do most of the tracking, while the other spots for new raptors. Whatever the split, be sure to have some clear agreement with your partner(s) about who is doing what at the start of each hour.

If you are alone in your quadrant, obviously you will need to keep up with all duties, but be sure you can call on the Dayleader, Recorder, or a Floater to help if the going gets tough, which means, you have a wonderful, skyful of raptors.

IV. Communication Is Vital

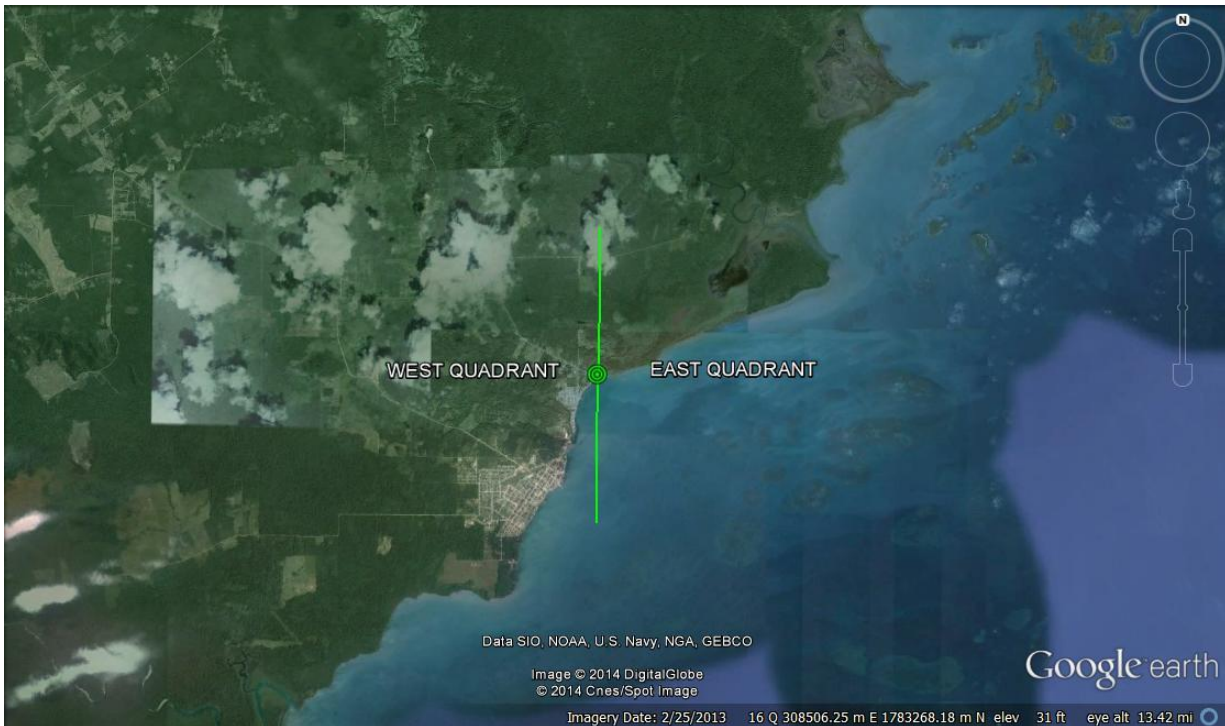
The most essential element in the Quadrant System is communication. Without constant communication between quadrants, we would have four separate teams at the count-site, counting hawks and calling them in to the Recorder, wildly over counting the raptor activity overhead. It is the responsibility of the Dayleader, the Recorder, and every quadrant staffer to make sure that everyone who needs a piece of information gets it.

Communication begins when a hawk first appears in the study area. Rather than waiting until the identification is definite, the observer should call out "I have a bird over the church!" or "Dot high over W quadrant!" -- something to alert others to the activity. Once the ID is definite, even if it's only "unidentified raptor," the Recorder is notified and the quadrant into which the bird is moving is alerted.

V. Quadrant Ranges

Ideally, each quadrant is a 180-degree slice of the sky and earth, and the spotters for each quadrant should center their wedge on north and south. Moreover, spotters and trackers must pay attention to the edges of their quadrant as well; when a raptor crosses into an adjacent quadrant you want to watch carefully until you've made complete vocal contact with your adjacent teammates. Your Dayleader can guide you in learning these geographic marks, but these are the rough edges:

	North Edge:	South Edge:	Area:
West Quad	Wood house on stilts (N)	Coastline (S)	Over land
East Quad	Wood house on stilts (N)	Coastline (S)	Over ocean



VI. Striving for Repeatable Raptor Data

The Quadrant System evolved from a belief (another of our basic assumptions) that a well-orchestrated group of people, working together but focused on separate quadrants, could make roughly the same count as another group of people using the same technique. The second group of people might be counting the next day, the next year, or fifty years in the future. By using the same method to measure activity in the same study area, they could gather comparable data, and draw conclusions from changes seen in the data over the years. With the Quadrant System, we believe we are achieving our goal: documenting raptor migration in Punta Gorda in the most consistent and repeatable way.

The single most difficult challenge in achieving a high quality raptor count is the collective and individual ability of the team to identify the hawks correctly. Therefore, the most important thing you can do as a new or returning hawkwatcher is to improve your hawk identification ability. Please practice and aspire to improve; enjoy the challenge.

VII. What the Results Look Like

With most Hawkwatch data, numbers of hawks is not unit of measurement. It is typically the *rate* of hawk activity rather than the absolute number of hawks. Although it is sometimes refer to the number of raptor-sightings per season, the most useful unit of measurement is the *number of raptor-sightings per hour*, often written as hph, as in, hawks per hour. However, at the Belize count-site nearly all of the migrant raptors are moving in a straight line and do not circle back over the site, therefore we can use number of individuals here. The tables below show our results from 2013, which include: the number of raptor-sightings per season and per day for the 32 species observed, the phenology of raptor migration in Belize, average daily activity and the Osprey migration.

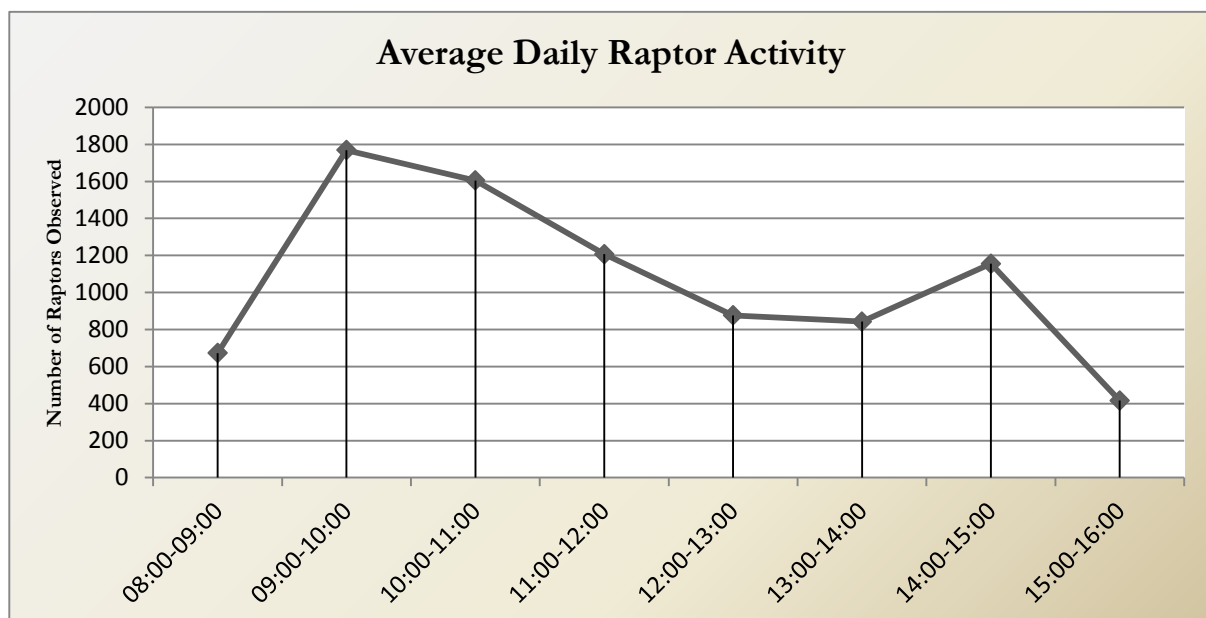
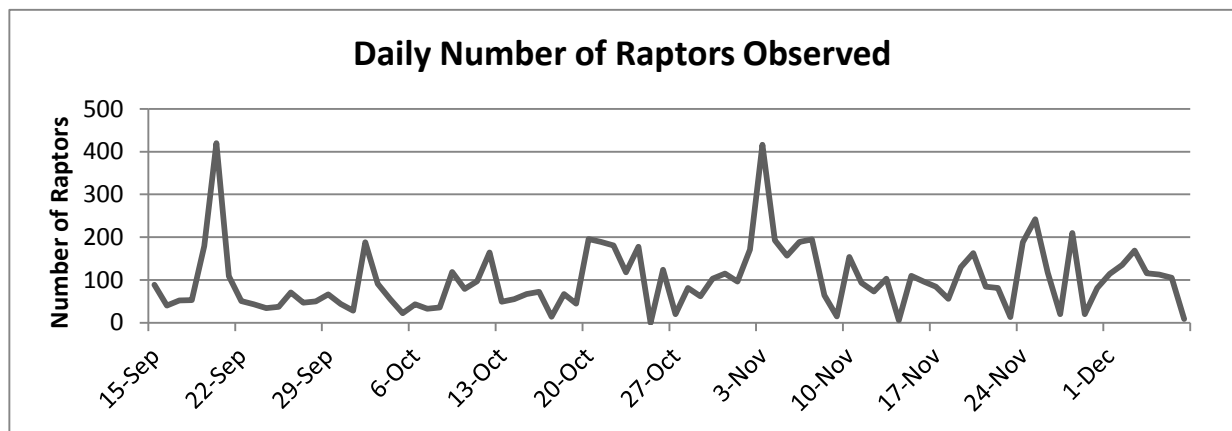
SPECIES	SIGHTINGS PER SEASON	MEAN PER DAY
Black Vulture	3,617	45.04
Turkey Vulture	853	10.62
Lesser Yellow-headed Vulture	48	0.60
King Vulture	106	1.32
Osprey	376	4.68
Gray-headed Kite	2	0.02
Hook-billed Kite	744	9.27
Swallow-tailed Kite	21	0.26
White-tailed Kite	5	0.06
Snail Kite	2	0.02
Mississippi Kite	817	10.17
Northern Harrier	11	0.14
Sharp-shinned Hawk	18	0.22
Cooper's Hawk	36	0.45
Common Black-Hawk	318	3.96
Great Black-Hawk	2	0.02
Roadside Hawk	8	0.10
Broad-winged Hawk	348	4.33
Gray Hawk	21	0.26
Short-tailed Hawk	263	3.28
Swainson's Hawk	6	0.07
Zone-tailed Hawk	11	0.14
Red-tailed Hawk	2	0.02
Black Hawk-Eagle	6	0.07
Ornate Hawk-Eagle	1	0.01
Crested Caracara	1	0.01
Laughing Falcon	3	0.04
American Kestrel	11	0.14
Merlin	23	0.29
Bat Falcon	5	0.06
Orange-breasted Falcon	1	0.01
Peregrine Falcon	434	5.40

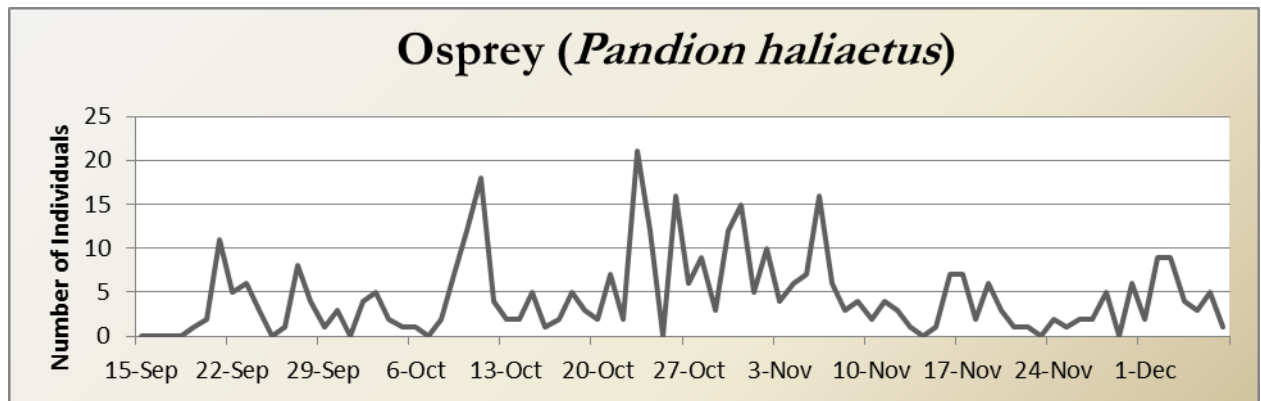
<i>Species</i>	<i>total</i>	<i>% of all migrants</i>	<i>passage dates</i>	<i>single day high</i>	<i>single day high date</i>
Mississippi Kite <i>Ictinia mississippiensis</i>	817	28.6	15 Sep - 4 Nov	376	20 Sep
Hook-billed Kite <i>Chondrohierax uncinatus</i>	744	26.0	12 Oct - 4 Dec	143	25 Nov
Peregrine Falcon <i>Falco peregrinus</i>	434	15.2	17 Sep - 21 Nov	85	12 Oct
Osprey <i>Pandion haliaetus</i>	376	13.2	19 Sep - 7 Dec	21	23 Oct
Broad-winged Hawk <i>Buteo platypterus</i>	348	12.2	22 Sep - 2 Dec	92	4 Nov

Cooper's Hawk <i>Accipiter cooperii</i>	36	1.3	22 Sep - 2 Dec	3	*
Merlin <i>Falco columbarius</i>	23	<1.0	24 Sep - 2 Dec	5/42	Dec/30Oct
Swallow-tailed Kite <i>Elanoides forficatus</i>	21	<1.0	15 Sep - 11 Oct	6	21 Sep
Sharp-shinned Hawk <i>Accipiter striatus</i>	18	<1.0	18 Sep - 19 Nov	2	**
American Kestrel <i>Falco sparverius</i>	11	<1.0	15 Oct - 6 Nov	3	15 Oct
Zone-tailed Hawk <i>Buteo albonotatus</i>	11	<1.0	22 Sep - 15 Nov	4	18 Oct
Northern Harrier <i>Circus cyaneus</i>	11	<1.0	30 Sep - 30 Nov	3	24 & 30 Oct
Swainson's Hawk <i>Buteo swainsoni</i>	6	<1.0	28 Sep - 8 Oct	3	28 Sep
Red-tailed Hawk <i>Buteo jamaicensis</i>	2	<1.0	15 Oct - 28 Nov	1	15 Oct/28 Nov
Total	2,858				

*Multiple dates: 22 Sep; 15 Oct; and 3 & 28 Nov

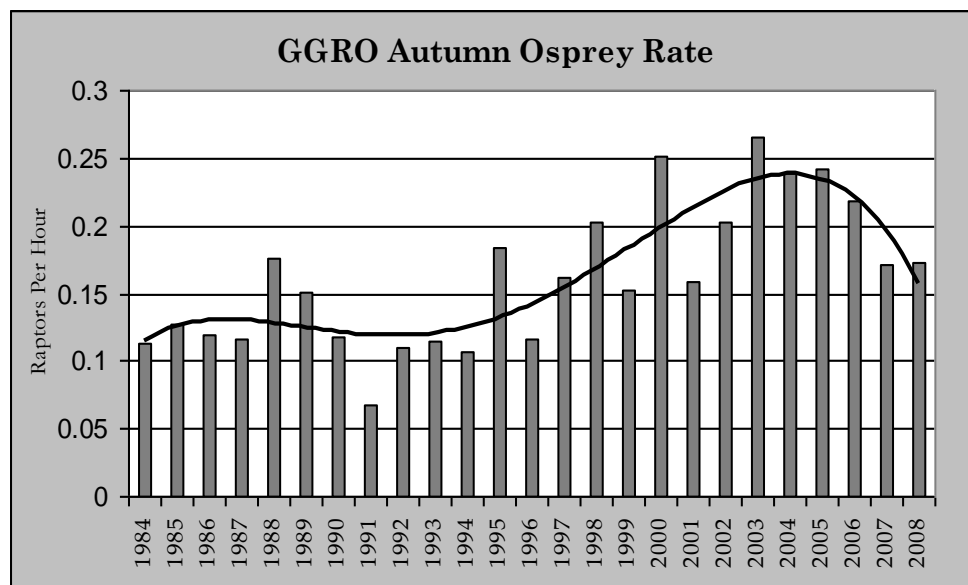
**Multiple dates: 18 Oct; 23 Oct; and 2 Nov





The “hph” approach also helps to correct for years in which we have more hours lost to thick fog or rain. Comparing total hawks seen from different years, when the hours spent hawkwatching vary so widely, would be meaningless. Year-to-year and long-term comparisons are more useful when we express our data in terms of hawks per hour.

Below is a graph of the GGRO Hawkwatch counts for Osprey for 25 years. Visually you can see that there’s a lot of up and down annually, however, there’s also a very slight downward trend until 1992, and then a slight upward trend from 1992 to 2004. Then a slide from 2004 to 2008. Were 1990s Ospreys rebounding from some DDT era downturn? Are Ospreys in serious decline right now? No way to know exactly, however, with some continued years of counts, we may be able to correlate our Osprey trends with large population-level events. We also need to seek out other sources of Osprey trend data for the Pacific States, say breeding studies for Oregon, or even Christmas Bird Counts for southern California. We can do the same for species passing through Belize and potential climate change issues that may impact species such as the Hook-billed Kite.



VIII. Analyzing Raptor Count Data

Since this is the third year of this Raptorwatch, we have not analyzed any year to year data. However, we can take what other Hawkwatches have collected to help us analyze our data and how to obtain that data appropriately.

For example the Marin Headland in California, United States had 21.5 hph in 1989, 28.8 hph in 1990, 43.7 hph in 1993, and 69.2 hph in 1999, what does this tell us? At this stage, not much. With 21 years of data (since GGRO started the Quadrant System in 1989), they have made tremendous progress toward setting up a system of long-term hawk counting, but we still don't know what the background fluctuations, and significant changes, are. About 15 years ago, biostatisticians Bill Gould and Sandy Lewis (1998, 2000) analyzed problems of background noise and variables at seven raptor migration count sites, including GGRO, and they determined – for 80% statistical certainty -- how long we must conduct our autumn hawk counts to detect certain percentages of decline in certain species. Their results for GGRO:

At GGRO, they could detect declining trends of the percentage below in:

	<u>10 years</u>	<u>15 years</u>	<u>20 years</u>	<u>25 years</u>
Cooper's Hawk	-5%	-3%	-2%	-2%
Red-tailed Hawk	-8%	-4%	-3%	-2%
Red-shouldered Hawk	**	-6%	-4%	-3%
Sharp-shinned Hawk	**	-7%	-4%	-3%
American Kestrel	**	**	-6%	-4%
Peregrine Falcon	**	**	-8%	-5%
Osprey	**	**	-9%	-6%
Merlin	**	**	-10%	-6%

** These combinations could only detect decreasing trends greater than 10%

So, for example, since they have conducted the GGRO Hawkwatch consistently for more than 15 years (1992 to 2008), we should be able to detect as small a change as a 7% decline in the population of fall migrant Sharp-shinned Hawk during that time. If we can collect data for just eight more years, we will be able to detect a 3% change.

GGRO's data are most useful **among species that appear in large numbers and with minimal background noise**, that is, those species that show consistent annual values over time. The sample sizes for Sharp-shinned, Cooper's, and Red-tailed hawks are large enough to show meaningful trends over the years. On the other hand, they get a very small number of Swainson's Hawks on the Pacific coast, so the fact that they saw 0 in 1989 and 8 in the next year says nothing about population trends for the species.

IX. Comparing the Quadrant System to other Count Systems

Many hawk migration lookouts in the United States use a single official counter who may work alone or with a group. For BRRI, the advantage of the Quadrant System over a single official counter is thoroughness.

The Quadrant System also minimizes observer fatigue. The size and flexibility of the team allows for occasional breaks from the intensity and concentration required of all hawkwatchers. Part of the Dayleader's job is to respond to fatigue and inattentiveness by moving spotters and giving them breaks as needed. The advantage of the Quadrant System as opposed to a crowd of eager observers is consistency.

The Quadrant System also routes information through observers with reliable skills. Sometimes the count-site crowd includes unknown observers (each of whom is a potential future BRRI volunteer!). If an unknown spotter claims to see an unusual hawk not seen by any other observer, we have to figure out, tactfully, if the identification is accurate. Information from non-BRRI observers is valuable, but must be confirmed by the appropriate quadrant spotter, with the assistance of the Dayleader. Thus we ensure greater consistency of the data.

Chapter Five The People Who Make it Work

I. Hawkwatchers

- A. *Your Commitment:* Accepting the task of being a BRRI volunteer hawkwatcher is no small commitment. Aside from being ready to hawkwatch from 8:00 am to 4:00 pm or on your shift with your team, we expect that *you will make every effort to learn and improve at raptor identification. If you do not want to improve your skills, year after year, at identifying the many species of raptor micro-dots that may cross overhead, then this is not the volunteer experience for you.* On the other hand, if you *do* want to learn these skills, you have come to the best place to get started.

BRRI's Commitment: BRRI staff, Dayleaders, and your fellow volunteers are all ready to help you with your identification skills, to trade ideas on field marks, and to all learn something new. **The bottom line is that the BRRI needs volunteer hawkwatchers who will bravely and constantly challenge themselves to improve their identification skills over time, and not just allow more veteran hawkwatchers to “carry” them along.**

B. Preparing for your Hawkwatch day

- I. *Attendance:* Coordinate with either the Coordinator or Count Leader, depending on who is leading that day, for departure to count-site, at a time that you can arrive at the count-site at least 20 minutes (7:40am) prior to when the count officially begins. Some days you will only have a 4 hour monitoring block. Either 8:00-12:00 or 12:00-4:00.

2. *Apparel:* Appropriate clothing is the next item to consider. The weather can change drastically and there is only a small canopy! Clouds and rain can appear at anytime and change a clear day into a wet, wind-swept nightmare! So dress appropriately with a rain jacket and waterproof duckpacks or dry bags to keep your gear dry!

Some essentials to bring are: hat (for shade and/or warmth), rain jacket, long-sleeved shirt, sunglasses, sunscreen, and chapstick. You'll need comfortable shoes since you will be on your feet for about eight hours (there will be chairs that can be used). Don't forget your BRRR Raptorwatch t-shirt or hat. This will identify you to the public.

3. *Provisions:* Bring your own food (breakfast, lunch and snacks) and beverages. There are no food facilities at the count-site. Bring at least 1 gallon of water, as water is NOT on site. Food should be easy to manage, and nourishing. Finger food and munchies throughout the day work well. Remember to protect your binocular eyepieces from crumbs and juicy or gooey food (the latter is not recommended). Bring plenty of fluids including water and fruit juices to fight dehydration and fatigue. Please, no alcoholic beverages.
4. *Preparation:* Study the panoramic view in the appendix to familiarize yourself with the various landmarks. Read through this manual at least twice before your first day at the count-site. Ask your Dayleader about anything unclear. Don't forget to review your hawk identification notes and field guides.
5. *Binoculars:* Binoculars are described by two numbers, eg, 7 x 35. The first number is the magnification (7-times); the second is the size of the objective lens (35 mm). For BRRR hawkwatching, any binocular from 7 to 10 power will be fine, but 10 is recommended. A larger objective lens is better for searching the sky and hills for hawks. Skinny pocket binoculars with a field of view of 20 to 30 are generally insufficient and will be hard to use over a long day. To offset the neck strain of holding your binos around your neck for 8-hour stints, try using a wide soft neoprene strap, or a binocular harness.
6. *Field Guide:* The *Peterson Guide to Hawks* is the most consistently useful for hawkwatching. Ideally, everybody should have one close at hand. *Hawks in Flight*, the *Photo Guide to Raptors*, and a *Sibley Guide* will be available at the count-site.
7. *Chairs:* Chairs are generally discouraged in the Hawkwatch since it is difficult to adequately scan a quadrant from a sitting position. The reason for this is that when you move around, you greatly increase the angles of view (called "parallax") in front of you, and are more apt to see the whole quadrant and to spot a new raptor. However there will be limited chairs at the site that can be used to rest the legs.
8. *High-tech Equipment:* Leave them home except in emergencies. When you are hawkwatching we need you to be alert to the sky at all times

Cell phones may be used quickly and rarely, and please let your Dayleader know if you need to make a call for more than a few seconds.

9. *Still Cameras.* It is okay to bring a still camera and to carry and use it while hawkwatching. Photos may need to be obtained as a raptor may be needed to be identified later. **The BRRI needs photos not only of hawks in flight, but also of volunteers at work.** However, if your Dayleader thinks that your attention to hawkwatching is being compromised by being a shutterbug, they may ask you to put the camera away.
10. *Smoking:* Please do not smoke anywhere near the count-site or while Quadrant counting. If you need to have a cigarette, check in with your Dayleader, and walk to the far west side of the field.

C. On your Hawkwatch Day

Arrive at the count-site no later than 7:40am if you are on the morning shift, so you can have all your gear set-up by 8:00am, when the count begins!! Coordinate the day before with either the Coordinator or Count Leader as to when and where you will meet to drive to the site together.

The Dayleader or assigned technician will check that the equipment pack is complete, with data sheets, field equipment (weather meter, compass, pencils), field guides, banner, educational materials, canopy, table and chairs. Don't forget your own gear (you'd be amazed how often this happens.)

D. On Count Day-- Roles and Responsibilities

1. *The Dayleader:* The Dayleader's job is to manage the team and oversee hawkwatching activities at Cattle Landing count-site. He or she makes quadrant assignments, helps out where needed, and provides on-site training and encouragement. When controversies arise over identification, the Dayleader is the final authority on entries on the data sheets. The Dayleader acts as "player-coach-cheerleader-referee." So be kind to Dayleaders -- they often forget which hat they're wearing!
2. *The Recorder:* The Recorder is responsible for data sheet entries. He or she must be alert to raptor sightings and maintain communication with the Spotters and other team members. The Recorder shall acknowledge the sighting (a simple "adult Broad-winged Hawk in East -- got it!" will suffice). The Dayleader has ultimate responsibility for monitoring the accuracy of calls! The Recorder may require assistance from the Dayleader or Floater in communicating with team members and confirming identifications. The Recorder takes the weather readings at the top of each hour. Generally, the Dayleader will rotate volunteers through the recorder role each hour.
3. *The Spotter:* The Dayleader assigns at least one Spotter per quadrant. The Spotter is responsible for spotting and tracking raptors in the quadrant and alerting the team if/when the hawks move into another quadrant. The Spotter is also

responsible for notifying the Recorder. The Spotter's job is not finished until the Recorder has acknowledged the report.

Spotters actively scan for raptors (proactive) rather than waiting for a raptor to catch their attention (reactive). Scan the quadrant with binoculars using the "S" scan or "M" scan method (See "Tricks of the Trade," page 36) at least once every 10 minutes when the flight is slow. Scan the entire quadrant from top to bottom or side to side. Practice peering deeply, changing your depth perception, shifting your weight from side to side.

Hawks can be especially hard to see when there is vegetation in the background. One trick is to *assume* there is always a raptor flying in view in your quadrant; your job is to find it.

"See a hawk, start to talk!" When a hawk is located, start talking. This is not a volunteer program for the shy and unassuming! Alert the team! Where is it? What is it doing? What does it look like? What can you see? **Don't wait until you are certain of its identification before alerting the team;** it may be too late for anyone to make a positive ID of a pefa-merlin hybrid. (Scary prospect.)

If there are two Spotters in a quadrant, then one should stay on the hawk while the other relays the information to the Recorder and the rest of the team. Keep your eyes on the hawk until it is passed to the next quadrant, then resume scanning your quadrant. When there are several hawks in your quadrant, don't stay on one hawk for too long. Make your best call (or get help) and then move on to the other hawks. **Do not wander away or turn your back on your quadrant.** We count on you to alert the team to the hawks in your quadrant.

Remember, when you are the BRRI spotter/team in a quadrant, it is YOURS! You are the BRRI official in that quadrant and you are responsible for spotting raptors, making identifications, asking for help when necessary, and calling in the ID to the recorder. If you are not confident calling birds yet, it is the Dayleader's job to help you get competent ASAP. And remember: even great hawkwatchers make mistakes. In fact, the greater hawkwatchers make *more* mistakes. It's a critical part of the learning process.

4. *The Floater:* An experienced hawkwatcher (often the Dayleader) fills this position. The Floater is free to move throughout the quadrants to assist as needed, coaching and facilitating communication.

E. After a day of counting:

The Dayleader will organize Hawkwatchers to complete each task:

1. At 4:00pm gather up all materials from the site (table, chairs, canopy, banner, field equipment, data sheets).
2. Drive team back to housing.
3. Complete data sheets. Sum each column and total each row. The sum of totals should equal the total of sums! Be sure all fields are filled, including the bottom line: hph, total minutes, total hawks. Assign this to a team member that only worked a 4 hour day and give the full 8 hour day members a break.
4. Compute hph. Enter data in computer. Backup on hard drive
5. Send email with daily summary to Supervisors (Ryan Phillips and Roni Martinez), designate a person for each day.
6. You will usually be finished no later than 5:00 pm

F. Hawkwatch Etiquette

1. Enjoy your fellow hawkwatchers, but remember your quadrant responsibilities and *keep your eyes on the sky*. Unlike business or social situations, Hawkwatch etiquette encourages you to hold conversations without making eye contact with the other person.
2. Be courteous to visitors at the count-site, but still *keep your eyes on the sky*. Explain that you are responsible for watching a quadrant and draw them into the process. Feel free to offer them a BRRRI newsletter or any information on the raptorwatch Or you can ask your Dayleader to speak with the visitors.
3. *When time allows, ask questions, ask questions, ask questions*. Talk about field marks and ID tricks. Just about everybody knows *something* that will advance your skill level. Think of everybody as a library of raptor experience that *you* get to read and learn from. *Repeat the phrase, "How did you know what that was?" over and over again*.
4. As you gain skills as a hawkwatcher share your skills and help teach hawkwatchers who are less skilled than you. So share your knowledge, but don't bulldoze others. Help make the count-site a laboratory of learning about raptor identification and behavior. That act may be more important to raptor conservation than *any amount* of raptor data we may collect.
8. Your Dayleader is here to help you. Don't hesitate to voice problems, ideas, questions.

10. Hawkwatch is over when all end-of-day chores are completed.
11. Hawk ID is an acquired skill. Do as much hawkwatching *everywhere* as possible. Take field trips, or go out on your own. Share your knowledge of good hawkwatching sites. Cattle Landing is a great classroom, so come out as often as you can, whether it's your day or not.
12. Remember that accuracy is vital both when identifying hawks and recording them. Information gathered will be used for years to come.
13. Make it your personal drive to sponge up as much information as you can about raptor identification – there is no better place in Belize to develop such skills. At the same time, there is a vast world of knowledge (and mostly questions) about the lives of raptors around the world.

G. Fighting fatigue at the Count-site

Sometimes, towards the end of a long day of hawkwatching, you may find you're not really interested in raptors anymore. As a matter of fact, all you're really interested in is a nice cup of black tea, maybe a chocolate-chip cookie, and a nap. But it's only 1:00 pm, there are three hours to go, and was that a bird or a plane that just flew by? Uh-oh. The dreaded RAPTOR FATIGUE!

Watching, focusing, concentrating, and thinking uses calories. Constant exposure to the sun and wind may increase the stress. By just being at the count-site all day, you're subjecting your body to some adverse conditions. How then, do you avoid the natural result?

The key word is "avoid." It's much easier to prevent fatigue than it is to revitalize yourself after it sets in. Here are some suggestions:

1. First of all, bring plenty of fluids with you. Drink them during the day.
2. Be sure to bring a lunch, and be sure to eat it. We know there's no noon lull, so you should eat either before or after noontime, or both. (You can eat at noon if you want to, just blow the crumbs off your binoculars so you don't report any Caribbean sea monsters. Be smart about what you munch: processed sugars and thick fruit juices are undeniably delicious, but they also may cause you to sugar crash after the fact.
3. Protect your body. Use sunscreen, even on cloudy days. Be prepared with clothing and bring extra layers. Wear something that will protect you from the sun, rain and wind. Cover your head! Wearing a hat protects you from the sun, the wind, and the heat, and helps your brain maintain its temperature.
4. Take breaks. Hawkwatchers may take two short breaks during the day, by each volunteer's request, and coordinated by the Dayleader so that no quadrant will be left vacant. Lunch is taken during one of the breaks or "on the run."

Let's say you've done all this, and you still end up worn out by 1:00 pm. None of your preventive measures worked - what do you do? Take a break. Stretch, swing your arms, run in place. Take

a short walk. (That will be the time when a Crested Eagle flies over, guaranteed.) If you're going to turn off for a few minutes, let your Dayleader know about it.

II. Dayleaders

Many people have the mistaken impression that the Dayleader is the master birder, the best ID person. Actually, the Dayleader is the manager who makes the Quadrant System run effectively while maximizing each volunteer's experience. Not an easy job.

If you view the quadrant team as an organism, a "quadrant creature," the Dayleader is the nervous system. The Dayleader sends the signals that command the creature to alertness, concentration, movement, thought, speech. He or she displays constant attentiveness, caring, diplomacy, and responsibility for morale and productivity. Being a Dayleader is demanding.

A. Definition of a Dayleader

B.

1. *Director.* As a movie director coordinates the actors, lighting, scenery, and cameras, the Dayleader manages all the elements of the Hawkwatch. The Dayleader assumes responsibility for setting up the quadrant structure and for keeping the system rolling, communications flowing and identifications accurate.
2. *Coach.* Being a Dayleader also requires paying attention to each team member -- teaching, encouraging, praising, guiding, and drawing each hawkwatcher out so as to maximize talents, develop skills, and enhance experience. Many are first-time volunteers as well as beginning hawkwatchers. Perhaps they didn't realize they would have responsibilities as well as fun. The Dayleader's job is to synthesize the responsibility and the fun. It is also to guard against potentially detrimental interactions: the know-it-all hanging out with a novice and overwhelming him or her.
3. *Diplomat.* Many levels of diplomacy are exercised at the count-site. Since team members are volunteers, the need to urge them to greater alertness and attention to the quadrant must be tempered. Members of the public who visit the count-site and engage the hawkwatchers in conversation to the detriment of their duties have as much right to be there as we do. Self-designated visiting experts are valuable adjuncts, but their identifications must be confirmed by team members. We don't want to offend people, but we do want our data to be consistent.
4. *Liaison.* Dayleaders are the communication links between the BRRl Director and Supervisors. They have attended workshops and bring information to the team. They provide feedback to the staff about ideas, needs, techniques, and problems.
5. *Interpreter.* There are occasions when the Dayleader is the person who gets asked questions by a reporter or visitor. Public relations skills come into play in interpreting BRRl Raptorwatch for the press or public.
6. *Recruiter.* Dayleaders need to draw volunteers into other aspects and projects of BRRl – to expose them to information about research and off-season projects and

encourage their involvement. Above all, encourage the members of your team to come back for a second, third, fourth year.

7. *Arbiter.* Sometimes there is disagreement about the identification of a particular bird. The Dayleader is not necessarily the final authority as to who is right or wrong, but rather the person who makes the final decision as to what is recorded on the datasheet, even if it is "unidentified."

III. The BRRI Staff

As of September 2014, BRRI has a Project Director, Ryan Phillips, a Project Supervisor, Roni Martinez and a Raptorwatch Coordinator, Victor Bonilla.

Ryan Phillips is a California native with a passion for the Neotropics. He spent much of his teen years studying in Costa Rica through study abroad programs, while traveling throughout the Neotropics. During this time, his experiences observing massive kettles of migrating raptors, large flocks of Scarlet Macaws flying from their roost to their foraging grounds, Long-tailed Manakins displaying and Resplendent Quetzals feeding in groups on avocados sparked his passion for Neotropical birds and became an avid birder, but was enthralled by all biodiversity. From there, Ryan knew he wanted to pursue ornithology as a career. He received his Bachelor of Science in Wildlife, Fisheries, Conservation Biology with a specialization in Ornithology from the University of California at Davis. While attending UC Davis, Ryan was a research assistant to PhD candidates studying Wood Ducks and Deer Mice, the Field Project Crew Leader for Wildlife Society- Davis Chapter, a guide and Teaching Assistant for the AIFS Study Abroad Group in Costa Rica, an Avian Field Technician for the WFCB Museum at UC Davis and staff at the California Raptor Center. After UC Davis, Ryan received a position in Belize with The Peregrine Fund's Harpy Eagle Restoration Project, where he spent three years on the project. During this time, Ryan worked on the Orange-breasted Falcon Project monitoring eyries, as well as conducted independent studies on Belize raptors. After working for The Peregrine Fund, Ryan returned to California and received a teaching position at De Anza College in the Kirsch Center for Environmental Studies, where he currently teaches Conservation Biology, Biodiversity, Wildlife Corridors, Introduction to Connectivity, Raptors of Santa Clara County, Tracking, Birds of Coyote Valley and other field studies courses. Ryan is also the lead Field Studies Instructor and the Co-Principal Investigator for the field research projects of the Wildlife Science Program in the Kirsch Center for Environmental Studies, which are studying connectivity issues in the Central Coast ecoregion of California. As well as teaching and being the Executive Director of BRRI, Ryan sits on the Belize Bird Record Committee, guides various bird trips and is currently working on a photographic field guide on the raptors of Belize and the region. After witnessing first-hand the persecution of raptors, the lack of understanding and research on Neotropical raptor communities and little community involvement in raptor research and conservation, in 2009, Ryan Co-founded the Belize Raptor Research Institute, which represented the culmination of one of his lifelong goals of creating a bird conservation organization.

Roni Martinez is a native of Belize who worked as a natural history guide at Blancaneaux Lodge in Belize from 2004 until 2009. It was there that he developed a passion for birds and other wildlife, as well as conservation. In 2009, Roni became Blancaneaux's first Conservation Officer and the first for Belize. As a result of this position, he worked along with many different researchers and conservation NGOs who share the same vision. He left Blancaneaux in 2014 to achieve more of his personal goals and to focus on conservation and research. Currently, his

work involves research and collaboration on several projects specifically related to birds. He currently serves as the President of the Belize Raptor Research Institute. He is a consultant for the Belize Audubon Society and Supervisor of the Scarlet Six Biomonitoring Team. His work with other conservation organizations has been crucial in maintaining a proactive effort in conserving biodiversity in Belize.

Victor Bonilla is from Indian Creek. He worked as ranger and bird researcher with Ya'axché Conservation Trust from 2004 to 2015 and currently works for TIDE. A very experienced ranger, Victor showed a genuine passion for the protection of the Bladen Nature Reserve and the Golden Stream Corridor Preserve and was always on call during emergencies. Victor's bird knowledge is second to none and he is one of the best birders in Belize. With a number of first sightings for Toledo he is well known to the author of "Birds of Belize", H. Lee Jones. He has taken a leave of absence from TIDE to be our Raptorwatch Coordinator.

IV. Personalities and other Conflicts

An organization like ours is a huge balancing act. We balance between volunteers and staff, and between short-term fun and long-term goals. And we balance between personalities. Since our goals are important and clear – to conduct studies and offer educational experiences that promote raptor conservation – we do not want to spend much time forcing an interaction between two people who do not see eye to eye.

So – if you have a problem with someone at the BRRI, here are your lines of recourse: (1) know that we will take your problem seriously and work quickly toward a resolution; (2) if your problem is with a volunteer teammate, consult with your Dayleader; (3) if your problem is with your Dayleader, consult with Ryan Phillips or Roni Martinez; (4) if your problem is with Ryan, consult with Roni; and if your problem is with Roni consult with Ryan. Do be aware that we do not tolerate behind-the-back approaches at BRRI and prefer to air issues with equal opportunities for all participants to speak.

Any form of harassment or discrimination will not be tolerated at the BRRI and will be dealt with appropriately.

I. Datasheets

Datasheets are the historical archive. They are permanent records, the source material for computer documentation of our observations. They must be completed fully, accurately, and legibly by the team. (Please see sample Daily datasheet in Appendix A.) Although you won't be asked to fill one out alone, we'd like you to know your way around a datasheet. There are 3 different data sheets that need to be filled out throughout the day. They include: the main daily form, the Age, Sex, and Morph metadata form, and the Hook-billed Kite metadata form.

At the top of the Daily datasheet, fill in the day of the month, the month, the day of the week, the Dayleader and the entire count team for the day. **Always double-check that you are in the correct column for the hour. Do not leave spaces empty. Enter "--" if you don't have data.**

A. Definitions

The weather data are taken at the start of every hour; think of them as a *snapshot* of the conditions of the sky as opposed to an averaging of the previous or future hour. Although your mentors and Dayleader will teach you how to do a weather check in the field, here's a short description:

1. *Wind Speed.* Use the anemometer on the Kestrel 2500 to record wind-speed with no one standing in front of you. Be sure the units – shown just below the numerical read-out – are miles per hour (mph). *Hold the wind meter in the wind for thirty seconds and then use the highest gust in that time.* The mph reading is then converted to the Beaufort Scale, which is listed in a table taped to the clipboard.
2. *Wind From* direction – use the compass to obtain the direction the wind is coming from. Use some grass to determine that direction then take a compass bearing. Make sure you use the correct cardinal direction.
3. *Air Temperature* is measured by a hand-held pocket weather meter, called – no kidding – the Kestrel 2500. Keep the Kestrel's sensor in the shade and give the readout *thirty seconds* to reach air temperature.
4. *Humidity* will not be recorded although there is a column.
5. *Barometric Pressure* is measured using the Kestrel 2500. It is recorded in inches.
6. *Cloud Cover* is a generalization about the cloud conditions at the start of each hour, when you should be taking the reading. Construct an imaginary circle looking up out no more than 2 kilometers and estimate the percentage of cloud cover.
7. *Maximum visibility* and *Minimum visibility.* When you stand at the Cattle Landing soccer field and turn to look in every direction, the **maximum visibility is the farthest you can see** in any direction. (Because we don't have a list of distance markers in every direction, you may have to use your own knowledge of geography to make a rough

estimate.) The **minimum visibility is the shortest distance you can see in any direction before fog/smog/haze/clouds/rain obscures your view.** Estimate distance of visibility. If max record 'max' if min record 'min.'

8. *Precipitation* is recorded using a 0-5 scale. See attached weather metadata sheet.
9. *Flight Direction* is the average direction the migrants are moving over that 1 hour period. Record a compass bearing. If there is a single individual or individuals going in a reverse direction, this needs to be noted in the comments.
10. *Height of flight* is the height raptors are traveling over the count-site. This is recorded using a 0-7 scale. See the metadata sheet for codes.
11. *Observers* refers to the number of BRRF observers on the Raptorwatch Team, but also may include helpers if **they are participating as spotters**. Ultimately, all inclusions are at the Dayleader's discretion, however the point of this field is to describe the level of effort accurately.
12. *Visitors*. Every person who visits the count-site is affected, to some degree, by BRRF activities and/or by the movement of raptors through the sky, and we'd like to keep track of how many people we affect. In order to keep track of the numbers of visitors, the recorder should keep a running tally of **any new people or crowds who show up**. The recorder might carry a clicker for this purpose, which is in the pack, and is also useful for BIG flights. Care must be taken when transferring the clipboard to another recorder to let that person know who has been counted. This could get a little intense on peak weekend days but the recorder should make the best estimates possible. Alternatively, one of the spotters may be designated the *Visitor Clicker Holder*.
13. *Minutes per hour*. Enter the actual number of minutes your team spent observing during the hour -- usually 60, sometimes 30, but never ever more than 60.

B. Recording raptor observations

1. Again, be sure you are in the correct column and row. It is very easy to put a tally in the wrong location. This is critical!
2. Make tally marks in sets of five: the first four birds are represented by slashes and a back-slash represents the fifth bird: *////*. Begin in the upper left corner of the space allotted for that species. Mark left to right across the top of the box, then begin a new row of notations below. If a large number of one type is counted at one time (i.e., 74 Hook-billed Kites), write the number in the correct box and circle it!
3. Once you record the overall daily sheet first then go to the Age, Sex, Morph Structure Form (Appendix B) to record the appropriate data. Where you note what species the morph raptor belongs to, also note the age and sex if known. Your resulting totals for each species should be the same on both data sheets. If at the end of the day they do not match there was an error in the data and make a

note and those missed individuals will be recorded as unknown age, sex and morph.

4. Small boxes are in the lower section of the hourly spaces of each species. At the end of each hour, enter the total for that species for the hour in the box. Sum each column as you finish the hour. At the day's end, total each row. The sum of totals and total of sums should be equal. If not, find the mistake and correct it!
5. If these requirements seem unnecessarily strict, volunteer for data entry duty and LEARN how important clear, legible notations are!
6. Since Hook-billed Kites are our focal species there is a separate datasheet for all Hook-billed Kite observations, titled, "Hook-billed Kite Structure Form" (Appendix C). This form was added in 2014. This is a critical component of this research and must be filled out for each Hook-billed Kite observed. This will give us insight into the structure of this migratory population through Belize. For each Hook-billed Kite group that is observed you will record, the number of individuals in the group. This can be tricky as these groups can be spread out when streaming. Also, sub-groups may form larger groups at thermal sites. Therefore it is critical that the team watches these group pass over the site completely, so they are not counted multiple times. Once the number of individuals is determined then using a spotting scope or if low, binoculars, try to identify how many individuals are light or dark morph (there are only two morphs of Hook-billed Kites, dark and light). Once morph is determined then try to identify age (tricky in dark morphs, but easy in light morphs). Lastly, do your best to identify gender. This will only be possible for light morph adults and the occasional light juvenile if it has gone through a pre-formative molt (showing some adult feathers) and low flying. To assist in the identification of the groups one team member should be assigned to take photos. When photos are taken reference the photo number on the data sheet. This metadata is the most challenging to obtain, but can be done with a good communicating team and members that are good with spotting scopes and identification. This is where studying these ID characteristics will make you a stronger counter.

II. Non-Raptor Documentation

For the purposes of this study we are only interested in raptors, but to understand the avian fauna in the area, which may to interest of others, it is important to document other taxa of birds. Therefore a daily bird list with interesting notes will be kept in the data binder.

III. Weather Meter – The Kestrel 2500

The Kestrel 2500 is an ingenious little handheld machine that records a variety of measurements as well as temperature, wind chill, wind speed, maximum wind gust, barometric pressure, average wind speed and altitude. (Yes, this goes way beyond our needs.) Be sure to practice with this

unit before you have to measure something in the field. The instruction manual is in the data binder.

IV. Binoculars and Scopes

A. Binoculars

Binoculars define the study area for the BRRI Raptorwatch and they are every hawkwatchers' primary tool. The count includes every raptor that can be seen by binocular-aided observers. Binos are used to find and identify raptors from the count-site. The only purpose for scopes is to refine the identification (or lack thereof) already made with binos. Do not add birds picked up by the scoper while verifying another bird. If not found using binos or bare vision, it doesn't belong in the count.

Any binoculars from 7x to 10x will suffice. It is a beginner's rule that bigger is better, but, like with any benefit, increased bino magnification is a trade-off.

What you lose with the higher power binocular may be more important to hawkwatching than what you gain. Ten-power binoculars have: (1) less field of view (7x have a bigger "screen" -- good for searching for that hawk-dot); (2) more handshake (it is harder to hold a higher magnification binocular steady); and (3) less clarity (this is the amount of light that is captured by the binocular and delivered to your eye). Thus, the 7x is a more relaxing binocular on the eye for long stretches of use. Ultimately, the optic quality (along with cost) of the binocular is a bigger factor than the magnification.

Make certain that your binoculars can be focused correctly: when the two images come together correctly, you should not have to work your eye muscles to hold them together. If you do, your binos are out of alignment. Seek advice from your Dayleader.

The quality of your binoculars can make *all the difference* in your ability to fully enjoy and appreciate the raptors. Take the opportunity to check out the binos used by other hawkwatchers. Get the best pair you can afford or borrow for your own use. We have 2 pairs of vortex at the count-site for use. If you are interested in purchasing your own pair contact Ryan.

B. Scopes

Since raptors are generally moving quickly across the sky, scopes are of marginal value when observing hawks close to the count-site, until there appears a distant kettle of buteos and/or eagles that is spotted by someone's sharp binoculars, and someone has to identify all the species. Yikes! Have no fear. Simply pull forward the BRRI's Vortex Viper HD spotting scope, take a deep breath and get to work. If you have your own scope, that's all the better. People are usually better at using their own equipment.

For beginners, scopes take practice to learn to use, but once you get the knack for locating a moving hawkspot and focusing in on it, then you'll be amazed at the magic of a good spotting scope. So, make sure that your Dayleader gives you time and tutoring on the BRRI scope. If your Dayleader isn't available, ask others to help you.

Chapter Seven

Tricks of the Trade

I. Is anything out there? Using Scanning and Searching --

The goal of the Belize Raptorwatch is to document all raptor activity within the study area, the radius of which is the distance one can see with the binocular-aided eye. So the hawkwatcher's job is not merely to wait for raptors to present themselves to be noticed, but to search and scan constantly. Raptors quite close but camouflaged against the hills and valleys may not be noticed unless the hawkwatcher is peering through binoculars and scanning the landscape. Raptors passing high overhead may not be seen unless someone aims binos straight over head.

Some people advocate S-scans, going from left to right, moving up a bino-width, scanning back from right to left, moving up and scanning until the whole of the study area has been scanned. The scan must cover the entire area from the ground and up, right up to straight overhead.

Some people advocate M-scans, moving up, over, down, over, up, over, etc. The reasoning is that if the bird is moving horizontally, the watcher is less likely to sweep past it if the scans are vertical, at 90-degree angles to the bird's flight. Also, if you have to describe your mid-sky location to another person, you might have a chance of having remembered what part of the landscape you are lined up with.

How you scan is somewhat important. That you do a complete scan, at minimum, every ten minutes and look deeply into your field of view is essential.

Scattervision is another method of detecting movement against the landscape. It's difficult to describe, but involves *unfocusing* your eyes and holding them quite still. Allow your vision to seep out to the peripheral extremes. If you are not focusing on a single point, you are more likely to notice movement. It takes a while but you can train your brain to pick up any movement within your field of view using this technique.

II. Where is it? Using Landmarks and Clockfaces --

One of the most frustrating experiences for a hawkwatcher is trying to find a hawk that someone is pointing to "right there." *Practice describing to one another exactly where a distant hawk is.* The Hawkwatch clipboard and this manual carry a panoramic diagram of the landscape around Hawk Hill, with many landmarks labeled. Other landmarks can be designated informally within the group, as long as everyone understands the reference.

One useful method of describing the position of a hawk is to visualize a clockface on a vertical plane in the distance where you see the hawk. Pick a landmark to call the center of the clock, then describe where the hawk would be on the clockface. "Big hawk at ten o'clock from the east" or "Possible falcon at two o'clock from over the church, going right" will help others to find the hawk. There are few landmarks in the sky, but you can describe a bird as being "two bino-widths over the ocean" or "going right above the north cardinal direction."

When you are trying to describe the location of a hawk, think of the following cues:

Where is it in relation to a fixed point?

What direction is it moving and how fast?

What can you see beyond the hawk as it moves (blue sky, water, rocks, etc.)?

A talkative Spotter will keep up a running commentary: "I've got a hawk 2 o'clock from the church top - it's moving southeast - it has large, rounded wings - it's rising - over the canopy now - circling - it's an adult Hook-billed Kite!" The hawk is tracked and 'handed' over to the next quadrant. It is counted once but tracked from one quadrant to the next until it is out of sight. Simple or what?

When all else fails at finding a hawk someone else is tracking, try standing behind the one who sees the hawk and sighting along his or her binos. It's surprisingly effective.

III. How many are there? Counting Kettles --

Teamwork and practice will help you arrive at a good count when there are too many hawks to count individually. Count by fives or tens, get someone else to count as well. Count the kettle from top down, or bottom up. Or wait until the birds reach the top of the thermal and begin to "line out" or glide to the next thermal to count them. If you have time, count the whole flock again. Compare, consult with others and give the recorder your best estimate of species, ages and sexes.



IV. What can it be? Undocumented and Unidentifieds --

Make identifications by the field marks and behavior actually observed, not by information inferred. Ignore remarks like "It's probably juvenile because most adults come later," or "Those are the same five TV's that flew by here an hour ago." Who could know this?!

We are looking for *positive data*, not guesses, intuition, or wishful thinking. There is no shame in marking a Broad-winged Hawk as "undocumented age" when you can't see age-indicative markings. There is no shame in marking "unidentified accipiter" if a Sharpie head flies by with a Cooper's Hawk tail. It is better to make the "undocumented" or "unidentified" decision and go on to the next hawk than to spend too much time on one bird or to record unsupportable conclusions. A busy day with a datasheet showing no unidentified birds is suspicious indeed.

Never, ever default! Its mid-October, you've been seeing Broad-wings all day; a small *buteo* comes into view, soaring in the distance. The sun is behind it. You can't see any field marks or even a good wing profile before it drops behind a hill and out of sight. **DO NOT** assume it was a Broad-wing. Log it as an *unidentified buteo*. This is not a failure!! This entry is just as accurate an observation as "adult Broad-wing" would be if the broad-wing were visible.

Some species are identified as to male, female, juvenile, and adult. These species also have a column for "undocumented." Suppose a small accipiter comes into view. You can see the square tail, "no neck" and "twinkling" flight, even the large eye; but you can't get any color from the bird or see the underside. Log it as an "undocumented Sharp-shinned Hawk." This is not a failure!! This is just as accurate as "juvenile Sharp-shinned Hawk," if you had seen the heavy breast streaking.

All entries on the datasheets must be accurate!! All entries are based on what we do see and not what we think we see or expect to see!

V. Hows and Whys of Counting Vultures

- A. Turkey Vultures are large, wide-ranging carrion-eaters that need big territories. They provide a barometer of environmental health. They're not as pretty as a canary, but just as effective in detecting poison in the atmosphere.
- B. Distant flocks of TVs dismissed as uninteresting may turn out to harbor a Zone-tailed Hawk or Crested Caracara.

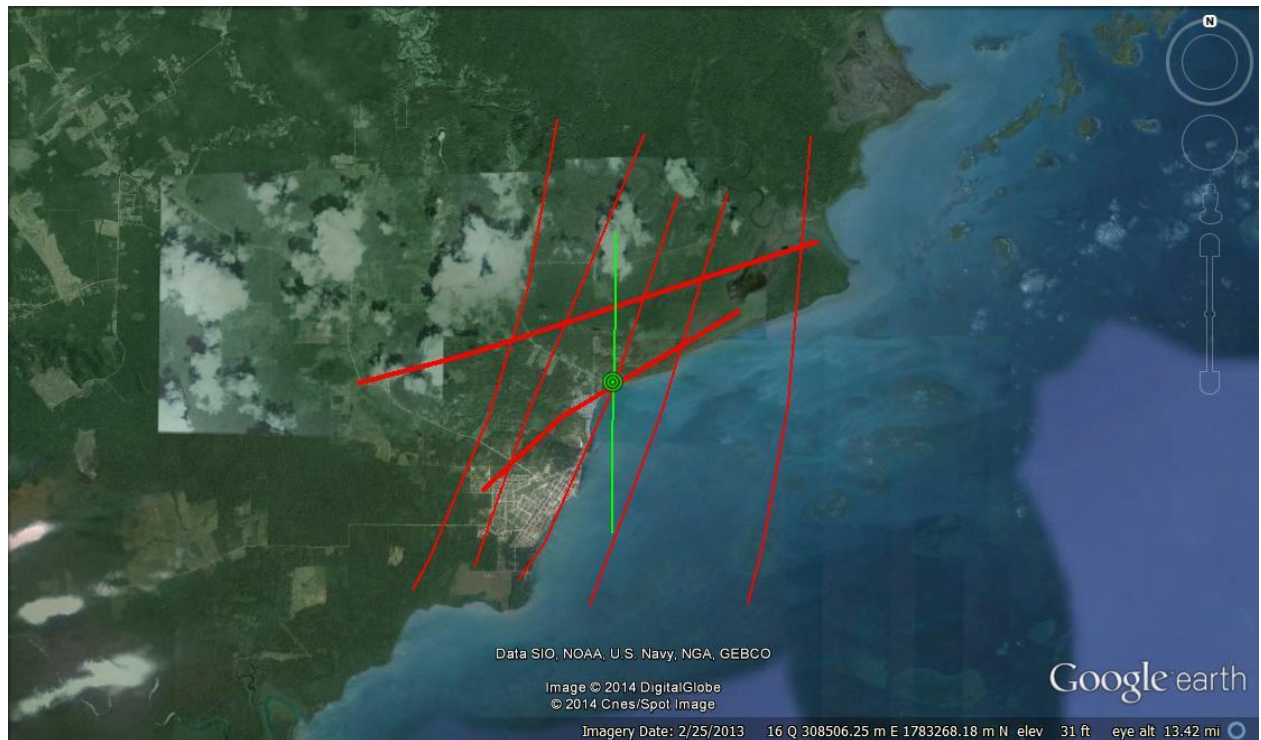
They are the most difficult to count of all the species we monitor. Not the most difficult to identify, but the most difficult to count. They don't simply fly overhead and away. Instead, they glide across the ground below the Hill, disappear from one quadrant, appear in another.

Turkey Vultures provide a big challenge to the Quadrant System. More than any other species, they require tracking and communication among quadrants to limit double-counting. Keeping track of them in the study area requires great diligence.

VI. Passing Hawks to other Quadrants --

Okay, let's say that you're the Spotter in the W quadrant. You've spotted a hawk, identified it as a juvenile Sharp-shinned, and called it in to the Recorder. The little hawk darts out to the east and with a few flaps leaves your quadrant. Whew! Your job is done. Right? **WRONG!** You've got to pass the hawk! It's like handing candy to a kid. Simply call over to the east quadrant Spotter: "East quadrant! Juvie Sharpie coming at you! I called it in already. You see it?" And then make sure he/she responds to you: "I got it!" or "I hear you. I'm still looking for it."

This can get pretty frantic when the raptors hum by at peak season. You'll be yelling at each other, but be nice, courteous, and understanding at the same time. Help the other Spotters when you can, and they will help you, too. It gets tricky when a raptor passes directly overhead and you have to pass it to the opposite quadrant -- usually from NW to SW. **When passing, it is imperative that you know the names of all your teammates so you can yell immediately and clearly. Also keep the humor up and the spirit of doing the best job you can.** Hawkwatching is not a perfect art -- no field biology is. Raptor flights weren't invented to fit on a datasheet. We're doing something pretty artificial but also pretty necessary in order to get a "pulse" on the status of raptor populations.



Flight Paths over the count-site.

Chapter 8

Who Watches Out for Raptors?

The world of bird study is a subculture with journals, magazines, conferences, and memberships. Here are some notes about a few of the groups related to BRRI's line of work.

- I. **The American Ornithologists' Union**, founded in the 1880s, is the foremost scientific bird group on this continent, with several thousand members. They make decisions about bird names. They decide the American Kestrel won't be called Sparrowhawk anymore, and we listen to them. They were responsible for the Black-shouldered/White-tailed Kite turnaround. If you are a PhD ornithologist or a college professor teaching birds, these are your people. But amateurs find the AOU interesting, too. If you want to stay abreast of the scene, this is the cutting edge of American bird study.

The quarterly AOU journal, *the Auk*, is filled with technical articles ranging from the fascinating ("Foraging strategy of Wandering Albatrosses through the breeding season: a study using satellite telemetry") to the boring ("Trends in the evolution of hindlimb musculature in aerial-foraging birds") to the bizarre ("Sperm competition and the reproductive anatomy of the male Superb Fairy Wren.")

AOU meetings are annual and may take place anywhere on the continent. The 2010 AOU conference will be in San Diego, CA, in August. The AOU membership and subscription to *the Auk* and the less formal *Ornithological Newsletter* are \$42 per year. Inquire about memberships with:

American Ornithologists' Union
Ornithological Societies of North America
PO Box 1897
Lawrence, KS 66044
www.aou.org

- II. **The Raptor Research Foundation**, founded in the mid-1960s, now has more than 1100 members in 50 countries. RRF is the bird of prey-specific scientific organization for the US, although they do fairly well in reaching out to an international audience. Their membership reaches deeper into the amateur world than does AOU, primarily because many raptorphiles come from rehabilitation, falconry, and hawkwatching circles.

The Journal of Raptor Research generally comes out quarterly and is shorter than most journals, but the articles tend to be more readable and natural history-oriented. Some titles from the September 1999 journal: "Status of Nesting Bald Eagles in Arizona," "Northern Goshawks Nesting on a Private Industrial Forest in Western Washington," and "Food Habits of the Rufous-legged Owl in the Mediterranean Sclerophyllous Forest of Central Chile." "Raptor" is rarely technically defined, but RRF journal articles run the gamut from hawks to owls, from shrikes to ravens, and from old world to new world vultures. For information on membership (\$35 per year) contact:

Raptor Research Foundation
Ornithological Societies of North America
PO Box 1897

Lawrence, KS 66044
<http://biology.boisestate.edu/raptor/>

- III. **The Peregrine Fund** began in the early 70s as a group of biologists, falconers, and conservationists committed to the Peregrine Falcon's recovery. It since has evolved into one of the most effective and far-reaching group of global raptor conservation biologists that we have. They work on vultures in Asia, Harpy Eagles in Panama, Gyrs in Greenland, rare falcons in Africa, the Hawaiian Crow – the list goes on. Please support the P-Fund.

The Peregrine Fund
World Ctr. For Birds of Prey
5668 West Flying Hawk Lane
Boise, ID 83709
tpf@peregrinefund.org
www.peregrinefund.org

- IV. **The Hawk Migration Association of North America** (HMANA) is an all-volunteer organization composed people interested in bird of prey movements. Founded in 1974, HMANA seeks to add to the knowledge and understanding of raptor migration across North America and to help protect these birds. HMANA coordinates data collection from hundreds of volunteer observers across the continent and compiles the information in a central repository.

Hawk Migration Studies is HMANA's semi-annual newsletter of the data from these hawkwatch projects. HMS publishes articles on field identification and hawk behavior, book and literature review, meetings and conferences and special features. Membership is \$25 to:

Mark Blauer
164 ½ Washington St
Carbondale, PA 18047
570-282-3954
mblauer@evenlink.com
<http://www.hmana.org>

V. Many other societies and associations exist to encourage information exchange on raptors and raptor conservation, often within broader interests. Most have newsletters and or journals, and some kind of annual conference. Here's a partial list of organizations.

American Birding Association	www.americanbirding.org
American Bird Conservancy	
Association of Field Ornithologists	www.afonet.org
American Ornithologists Union	www.aou.org
BirdLife International	www.birdlife.org
Cooper Ornithological Society	www.cooper.org
Cornell Lab of Ornithology	www.birds.cornell.edu
Hawk Migration Assoc of NA	www.hmana.org
Hawk Mountain Sanctuary	www.hawkmountain.org
Hawkwatch International	www.hawkwatch.org
National Audubon Society	www.audubon.org
Point Reyes Bird Observatory	www.prbo.org
Raptor Research Foundation	www.raptorresearch.org
Raptors are the Solution	www.raprsarethesolution.org
San Francisco Bay Bird Observatory	www.sfbbo.org
Santa Cruz Predatory Bird Group	www.scpbrg.org
Society for Conservation Biology	www.conbio.net
Western Bird Banding Association	www.westernbirdbanding.org
Western Field Ornithologists	www.westernfieldornithologists.org
The Wildlife Society	http://www.wildlife.org/
Wilson Ornithological Society	www.wilsonsociety.org
World Working Group on Birds of Prey	www.raptors-international.de

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Appendix A

Raptorwatch Daily Form



Belize Raptorwatch Daily Form

Date _____
 Count Leader _____
 Count Team _____

TIME	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3		
Wind Speed										
Wind Dir. (From)										
Temp. (Deg. C)										
Humidity										
Bar. Pressure										
Cloud Cover										
Visibility										
Precipitation										
Flight Direction										
Height of Flight									Total	
No. of Observers										
No. of visitors										
Dur. of Obs. (min)										
Turkey Vulture									TV	
Black Vulture									BV	
King Vulture									KV	
Osprey									OS	
Gray-headed Kite									GK	
Hook-billed Kite									HK	
Swallow-tailed Kite									SK	
White-tailed Kite									WK	
Snail Kite									SK	
Double-toothed Kite									DK	
Mississippi Kite									MK	
Plumbeous Kite									PK	
Northern Harrier									NH	
Sharp-shinned									SS	
Cooper's Hawk									CH	
White Hawk									WH	
Gray Hawk									GH	
Common Black-Hawk									CB	
Roadside Hawk									RH	
Broad-winged									BW	
Short-tailed Hawk									SH	
Swainson's Hawk									SW	
White-tailed Hawk									WT	
Zone-tailed Hawk									ZT	
Red-tailed Hawk									RT	
Laughing Falcon									LF	
American Kestrel									AK	
Merlin									ML	
Aplomado Falcon									AF	
Peregrine Falcon									PF	
Unid. Vulture									UV	

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Unid. Accipiter										UA	
Unid. Buteo										UB	
Unid. Eagle										UE	
Unid. Falcon										UF	
Unid. Raptor										UU	
Other (From Back)										OO	
TOTAL										TH	

Appendix B

Raptorwatch Age, Sex, Morph Structure Datasheet

Belize Raptorwatch: Age, Sex, Morph Structure Form

Date:	Location:	Observers:
-------	-----------	------------

Species	AGE			SEX			MORPH				Total
	Juvenile	Immature	Adult	Male	Female	Unknown	Light	Int.	Dark	N/A	Ind.
L. Y.-head Vulture											
Turkey Vulture											
Black Vulture											
King Vulture											
Osprey											
Gray-headed Kite											
Hook-billed Kite											
Swallow-tailed Kite											
White-tailed Kite											
Snail Kite											
Double-toothed Kite											
Mississippi Kite											
Plumbeous Kite											
Black-collared Hawk											
Northern Harrier											
Sharp-shinned Hawk											
Cooper's Hawk											
Bicolored Hawk											
Crane Hawk											
White Hawk											
Gray Hawk											
Common Black-Hawk											
Roadside Hawk											
Broad-winged Hawk											

Short-tailed Hawk												
Swainson's Hawk												
White-tailed Hawk												
Zone-tailed Hawk												
Red-tailed Hawk												
B&W Hawk-Eagle												
Black Hawk-Eagle												
Ornate Hawk-Eagle												
Barred Forest-Falcon												
Collared Forest-Falcon												
Crested Caracara												
American Kestrel												
Merlin												
Aplomado Falcon												
Peregrine Falcon												
Total												

Appendix C

Hook-billed Kite Structure Form

[illegible]

Appendix D

Datasheets Metadata information

Raptorwatch Data Sheet Instructions

GENERAL INSTRUCTIONS:

There are 2 data sheets (Daily report and Age, Sex and Morph) to be filled out daily

For groups of species flying over, count the # of individuals and write the number and circle it on the data sheet

For single or few individuals record using tally marks on data sheet

If you run out of space in the data sheet boxes use another data sheet (make sure you note that there are multiple data sheets for the day)

For weather, enter the data at the start of each hour of the raptorwatch (ie. 7:00, 8:00, 9:00, 10:00,..... 14:00)

Make all comments on the back of the data sheet (ie. if you record a species not on the sheet, observe interesting behaviors etc.)

Weather and Observation

Codes

Wind Speed: Enter code:

0- less than 1 km/h, (calm, smoke rises vertically)

1 - 1-5 km/h, (smoke drift shows wind direction);

2 - 6-11 km/h, (leaves rustle, wind felt on face);

3 - 12-19 km/h, (leaves, small twigs in constant motion; light flag extended);

4 - 20-28 km/h (raises dust, leaves, loose paper; small branches in motion);

5 - 29-38 km/h (small trees in leaf sway);

6 - 39-49 km/h (larger branches in motion; whistling heard in wires);

7 - 50-61 km/h (whole trees in motion; resistance felt walking against the wind);

8 - 62-74 km/h (twigs small branches broken off trees; walking generally impeded);

9 - Greater than 75 km/h.

Wind Direction: Enter compass direction from which the wind is coming, i.e., N, NNE, SE, etc. If variable, enter VAR.

Temperature: Record temperature in degrees Celsius.

Humidity: Record the percent relative humidity.

Barometric Pressure: Record barometric pressure in inches.

Cloud Cover: Record percent of sky with background cloud cover.

Visibility: Judge from your longest view and enter distance in kilometers. To convert miles to kilometers multiply by 1.61.

Precipitation: Enter code: 0 for none, 1 for Haze or Fog, 2 for Drizzle, 3 for Rain, 4 for Thunderstorm, 5 for hurricane!

Flight Direction: Enter compass direction migrants are heading, i.e., S, SSW, etc.

Height of Flight: Height of Flight. Enter code: 0 - Below eye level; 1 - Eye level to about 30 meters; 2 – Birds seen easily with

unaided eye (eyeglasses not counted as aids); 3 - At limit of unaided vision; 4 - Beyond limit of unaided eye but visible with

binoculars - to 10X; 5 - At limit of binoculars; 6 - Beyond limit of binoculars 10X or less, but can detect with binoculars or

telescope of greater power (Mark "1" in COMMENT box and note magnification); 7 - No predominant height.

Observers: Number of observers **CONTRIBUTING** to the count for the hour noted.

Duration of Observation: Specify time in minutes.

Appendix E

Raptors of Belize List including Sub-species

<i>Scientific Name</i>	<i>Common Name</i>	<i>Resident/Migrant</i>
<i>Coragyps atratus</i>	Black Vulture	Resident
<i>Cathartes aura aura</i>	Turkey Vulture	Resident
<i>Cathartes aura meridionalis?</i>	Turkey Vulture	Transient/Winter Resident
<i>Cathartes burrovianus</i>	Lesser Yellow-headed Vulture	Resident/Migrant?
<i>Sarcoramphus papa</i>	King Vulture	Resident
<i>Pandion haliaetus ridgwayi</i>	Osprey	Resident
<i>Pandion haliaetus carolinensis</i>	Osprey	Winter Resident/Transient
<i>Leptodon cayanensis cayanensis</i>	Gray-headed Kite	Resident
<i>Chondrohierax uncinatus uncinatus</i>	Hook-billed Kite	Resident/Summer Resident?/Transient?
<i>Elanoids forficatus forficatus</i>	Swallow-tailed Kite	Transient
<i>Elanoids forficatus yetapa</i>	Swallow-tailed Kite	Summer Resident
<i>Elanus leucurus majusculus</i>	White-tailed Kite	Resident
<i>Rostrhamus sociabilis major</i>	Snail Kite	Resident/Migratory?
<i>Harpagus bidentatus fasciatus</i>	Double-toothed Kite	Resident
<i>Ictinia mississippiensis</i>	Mississippi Kite	Transient
<i>Ictinia plumbea</i>	Plumbeous Kite	Summer Resident
<i>Busarellus nigricollis nigricollis</i>	Black-collared Hawk	Resident
<i>Circus cyaneus</i>	Northern Harrier	Winter Resident/Transient
<i>Accipiter striatus velox</i>	Sharp-shinned Hawk	Transient/Winter Resident
<i>Accipiter cooperii</i>	Cooper's Hawk	Transient/Winter Resident
<i>Accipiter bicolor bicolor</i>	Bicolored Hawk	Resident
<i>Geranospiza caerulescens nigra</i>	Crane Hawk	Resident
<i>Pseudastur albicollis ghiesbreghtii</i>	White Hawk	Resident
<i>Buteogallus anthracinus anthracinus</i>	Common Black-Hawk	Resident
<i>Buteogallus urubitinga ridgwayi</i>	Great Black-Hawk	Resident
<i>Buteogallus solitarius sheffleri?</i>	Solitary Eagle	Resident
<i>Buteo magnirostris griseocauda</i>	Roadside Hawk	Resident
<i>Buteo magnirostris conspectus</i>	Roadside Hawk	Resident
<i>Buteo platypterus platypterus</i>	Broad-winged Hawk	Transient/Winter Resident
<i>Buteo plagiatus</i>	Gray Hawk	Resident
<i>Buteo brachyurus fuliginosus</i>	Short-tailed Hawk	Resident
<i>Buteo swainsoni</i>	Swainson's Hawk	Transient
<i>Buteo albicaudatus hypsopodius</i>	White-tailed Hawk	Resident
<i>Buteo albonotatus</i>	Zone-tailed Hawk	Winter Resident/Transient
<i>Buteo jamaicensis kemsiesi</i>	Red-tailed Hawk	Resident
<i>Buteo jamaicensis calurus?</i>	Red-tailed Hawk	Winter Resident/Transient

<i>Buteo jamaicensis borealis?</i>	Red-tailed Hawk	Winter Resident/Transient
<i>Morphnus guianensis</i>	Crested Eagle	Resident
<i>Harpia harpyja</i>	Harpy Eagle	Resident
<i>Spizaetus tyrannus serus</i>	Black Hawk-Eagle	Resident
<i>Spizaetus ornatus vicarius</i>	Ornate Hawk-Eagle	Resident
<i>Spizaetus melanoleucus</i>	Black-and-white Hawk-Eagle	Resident
<i>Micrastur ruficollis guerilla</i>	Barred Forest-Falcon	Resident
<i>Micrastur semitorquatus naso</i>	Collared Forest-Falcon	Resident
<i>Caracara cheriway auduboni</i>	Crested Caracara	Resident
<i>Herpetotheres cachinnans chapmani</i>	Laughing Falcon	Resident
<i>Falco sparverius sparverius</i>	American Kestrel	
<i>Falco columbarius columbarius</i>	Merlin	Winter Resident/Transient
<i>Falco columbarius richardsoni</i>	Merlin	Winter Resident
<i>Falco femoralis septentrionalis</i>	Aplomado Falcon	Resident
<i>Falco ruficularis petoensis</i>	Bat Falcon	Resident
<i>Falco deiroleucus</i>	Orange-breasted Falcon	Resident
<i>Falco peregrinus tundrius</i>	Peregrine Falcon	Winter Resident/Transient
<i>Falco peregrinus anatum</i>	Peregrine Falcon	Winter Resident/Transient
<i>Tyto alba</i>	Barn Owl	Resident
<i>Megascops guatemalae</i>	Vermiculated Screech-Owl	Resident
<i>Lophotrix cristata</i>	Crested Owl	Resident
<i>Pulsatrix perspicillata</i>	Spectacled Owl	Resident
<i>Bubo virginianus</i>	Great Horned Owl	Resident
<i>Glaucidium griseiceps</i>	Central American Pygmy-Owl	Resident
<i>Glaucidium brasilianum</i>	Ferruginous Pygmy-Owl	Resident
<i>Athene cunicularia</i>	Burrowing Owl	Vagrant
<i>Ciccaba virgata</i>	Mottled Owl	Resident
<i>Ciccaba nigrolineata</i>	Black-and-white Owl	Resident
<i>Asio stygius</i>	Stygian Owl	Resident
<i>Asio flammeus</i>	Short-eared Owl	Vagrant
<i>Psuedoscops clamator</i>	Striped Owl	Resident

Appendix F

Belize Estimated Migratory Raptor Peaks and Average Number of Individuals observed Annually Compared to other nearby Watch Sites

Watch Sites	<i>Florida Keys</i>		<i>Mexico</i>		<i>Costa Rica</i>		<i>Belize</i>	
Species	Peak	Average	Peak	Average	Peak	Average	Est. Peak	Rank**
Turkey Vulture	28 Oct	3,870	17 Oct	803,259	27 Oct	-	-	-
Osprey	1 Oct	1,086	26 Sep	814	1 Oct	-	23 Oct	4
Northern Harrier	20 Oct	640	27 Sep	216	-	-	24 Oct	12
Hook-billed Kite	-	-	18 Oct	192	-	-	25 Nov	2
Snail Kite	-	-	-	-	-	-	-	-
Swallow-tailed Kite	15 Sep*	15	29 Aug	89	27 Aug	-	21 Sep	8
Mississippi Kite	16 Sep*	30	1 Sep	112,290	15 Sep	-	20 Sep	1
Plumbeous Kite	-	-	-	-	23 Sep	-	15 Aug	-
Sharp-shinned Hawk	20 Oct	2,967	7 Oct	1,927	22 Sep?	-	18 Oct	9
Cooper's Hawk	28 Sep	574	15 Oct	1,006	4 Nov	-	15 Oct	6
Gray Hawk	-	-	30 Oct	313	-	-	-	-
Broad-winged Hawk	10 Oct	4,085	7 Oct	765,934	10 Oct	-	10 Oct	5
Swainson's Hawk	9 Nov	82	17 Oct	384,374	27 Oct	-	21 Oct	13
Short-tailed Hawk	21 Oct	27	-	-	-	-	-	-
White-tailed Hawk	-	-	-	-	-	-	-	-
Zone-tailed Hawk	-	-	22 Sep	82	16 Oct	-	26 Sep	11
American Kestrel	1 Oct	2,325	7 Oct	1,714	26 Sep	-	11 Oct	10
Merlin	30 Sep	475	1 Oct	44	23 Oct	-	5 Oct	7
Peregrine Falcon	11 Oct	2,144	2 Oct	130	4 Oct	-	6 Oct	3

*This watchsite begins on 15 September therefore their low count and peak date reflect the end of the Swallow-tailed and Mississippi Kite migration peaking 24 August Sep 1 in Mexico.

**Rank is the number of individuals that were observed in 2013 at the count-site from September 15 to December 7 with 1 being the most individuals observed.

-Represents that this species as a migrant is not observed at this watchsite or data is unavailable

Appendix G Quick Identification Guide: Morph, Age and Gender

Species	Morph	Age	Gender
Black Vulture	None	No	No
Turkey Vulture	None	Yes (J,I,A)	No
Lesser Y-headed Vulture	None	Yes (J,I,A)	No
King Vulture	None	Yes (J,I,A)	No
Osprey	None	Some (J,A)	No
Gray-headed Kite	Only in J (lt, int, dk)	Yes (J,A)	No
Hook-billed Kite	Yes (lt,dk)	Yes (J,A both morphs)	Yes (J,A, lt ONLY)
Swallow-tailed Kite	None	Some (J, A)	No
Snail Kite	None	Yes (J,I,A)	Yes (A)
Mississippi Kite	None	Yes (J,I,A)	No
Northern Harrier	None	Yes (J,I,A)	Yes (I,A)
Sharp-shinned Hawk	None	Yes (J,A)	Some (J,A)
Cooper's Hawk	None	Yes (J,A)	Some (J,A)
Common Black-Hawk	None	Yes (J,I,A)	No
Great Black-Hawk	None	Yes (J,I,A)	No
Roadside Hawk	None	Yes (J,A)	No
Broad-winged Hawk	None	Yes (J,I,A)	No
Gray Hawk	None	Yes (J,I,A)	No
Short-tailed Hawk	Yes (lt,dk)	Yes (J,A)	No
Swainson's Hawk	Yes (lt,int,dk)	Yes (J,I,A)	No
Zone-tailed Hawk	No	Yes (J,A)	Some (A)
Red-tailed Hawk	Yes (lt,int,dk)	Yes (J,I,A)	No
Crested Caracara	None	Yes (J,I,A)	No
Laughing Falcon	None	No	No
American Kestrel	None	No	Yes (J,A)
Merlin	None	No	Some (M)
Bat Falcon	None	No	No
Orange-breasted Falcon	None	Yes (J,A)	Some (J,A)
Peregrine Falcon	None	Yes (J,A)	Some (J,A)

A= Adult

I= Immature (Second Year +)

J= Juvenile (First Year)

Lt= Light

Int= Intermediate

Dk= Dark

M= Male

Appendix H Some Raptor Migration Count Sites

There are approximately 388 hawkwatching sites worldwide listed in the new compendium, *Raptor Watch – a Global Directory of Raptor Migration Sites* (Zalles & Bildstein 2000) – a glorious directory of sites from Tunisia to Tennessee. The following list shows some of the sites that tally ten thousand or more hawks in a migration season. The largest known RMC sites in the world are those at Veracruz, Mexico (4 to 8 million raptors) and Eilat, Israel (2 to 3 million). Some of these are monitored by biologists. Few outside of North America are monitored constantly. And some are still sites of recreational shooting and hunting of birds of prey. Some are in areas of such martial strife that conservation biologists are not able to go there safely.

Suez, Egypt
Lake Langano, Ethiopia
Cap Bon, Tunisia
Kibale National Park, Uganda
Beidaihe, China
Eilat, Israel
Chokpak Pass, Kazakhstan
Tanjung Tuan, Malaysia
Sheting, Taiwan
Al-Kadan, Yemen
Skagen, Denmark
Organbidexka Col, France
Straits of Messina, Italy
Tarifa/Gibraltar, Spain
Falsterbo, Sweden
Bosphorus, Turkey
Punta Rasa, Argentina
Combeima, Colombia
Veracruz, Mexico
Southern Canal Zone, Panama
Holiday Beach, Ontario, Canada
Marin Headlands, California, US
Grassy Key, Florida, US
Whitefish Pt., Michigan, US
Hawk Ridge, Minnesota, US
Goshute Mountains, Nevada, US
Braddock Bay, New York, US
Central Park, NY, US
Hawk Mountain, Pennsylvania, US
Montclair, New Jersey, US
Cape May Point, NJ, US
Corpus Christi, Texas, US
Kiptopeke, VA, US

Appendix I Annotated Raptor Book List

The Peterson Guide to Hawks

by William S. Clark & Brian Wheeler

The best single field guide for N. Amer. species, excellent natural history information, and the 2000 second edition made great improvements over the 1987 edition. This is the standard all-around field guide for GGRO use.

Hawks in Flight

by Pete Dunne, David Sibley, & Clay Sutton

A hawkwatcher's view of the world, only covering identification of hawks in flight. Great reading, especially after you've had the experience of seeing that bird. Highly accurate B&W renderings by Sibley who has his own guide out later this year. HIF has a big Eastern bias, but is 90% applicable to GGRO.

A Photographic Guide to N. Amer. Raptors

by Brian K. Wheeler & William S. Clark

A superb book of excellent color raptor photos with tight, informative descriptions of field ID techniques. My only frustration is the clunky graphics. An excellent complement to the Peterson Guide above.

Hawks From Every Angle

by Jerry Liguori

ANGLE is something of a hybrid between the previous two books. Liguori uses his own stunning flight photos to make points of subtle detail and gestalt about each species. I just don't get why he didn't give us White-tailed Kites. Then it'd be the perfect California hawkwatcher book.

Wheeler Guide to N Amer Raptors: Western

by Brian Wheeler

The artist-photographer from two of the guides above, Brian Wheeler took it upon himself to write something of an encyclopedia (a touchable Wikipedia for you teenagers) on birds of prey of the US. Some of the best info on plumages, subspecies, age and sex differences, and ranges are here. If you want to be at the top of your raptor game, buy this book.

Birds of Prey

by Noel & Helen Snyder

Written by two of the most diligent raptor biologists around, this book of personal essays looks like a coffeetable book on the outside. The inside holds fascinating glimpses into the thought-processes of two conservation-driven raptor professionals.

Flight Strategies of Migrating Hawks

by Paul Kerlinger

Best scientific, current account about what is known and what isn't known in this young field. Excellent, though sometimes sleep-inducing reference by the former director of Cape May Bird Observatory.

How Birds Migrate

by Paul Kerlinger

A concise intro into the state of knowledge of bird migration by one of its long-time students.

*Season at the Point – the Birds & Birders of
Cape May*

by Jack Connor

The ins and outs of a long-term hawk migration research project, not too different from the GGRO. Connor creates a fascinating circle of stories portraying the reality of how these weird observatories run. Fun to read.

Raptors of the World

by James Ferguson-Lees

An excellent overview of the 300-ish diurnal raptor species of the planet. GREAT raptor biology summaries at the front end.

Eagles, Hawks, and Falcons of North America

by Paul Johnsgard

Excellent, recent, and readable text on N. Amer. species and general raptor issues, like evolution and behavior.

Living on the Wind

by Scott Weidensaul

This book spins some fascinating essays around the world of bird migration research. Particularly informative are Chapter 5 on the spectacular raptor migration at Veracruz, Mexico, and Chapter 8 on the Swainson's Hawks Die-Offs in Argentina.

The Wind Masters

by Pete Dunne

A collection of great and imaginative stories from Pete Dunne's great and imaginative brain. Wonderful David Sibley illustrations.

The Birds of North America (species monographs)

by various authors

The most current (published starting in 1990's) series of notes describing the state-of-knowledge of the biology of each species. There are completed chapters now for most western diurnal raptors. Order at roughly \$8 per species from Buteo Books (web address above).

Migrating Raptors of the World

by Keith Bildstein

A superb review of the state of knowledge of raptor migration. An excellent readable text for GGRO volunteers.

Falcons of North America

by Kate Davis

An excellent readable summary of our falcon species by the founder of Raptors of the Rockies. The writing is excellent, well-informed, and the color photos are outstanding.

Birds of Prey

by Floyd Scholz

Unusual but stunning book of close-up raptor photos, especially for use by sculptors and other artists. N.Amer. species only. A kind of intimate celebration of the patterns, textures, and shapes of hawks, including interesting notes on how to look at hawks.

Appendix J

BRRI Stats

Founded: 2009

Location: U.S.A Address P.O. Box 110234 Campbell, CA 95008
Belize, Little Vaqueros Enclave, Mountain Pine Ridge, Cayo District

STAFFING

Staff: Volunteer Executive Director and Business office Manager
Paid Raptorwatch Coordinator, Count Leader and Supervisor

Research Interns: 10 in 2013 and 16 in 2014

Volunteers: 30+

RESEARCH and COOPERATORS

Under Permits from: Belize Forest Department

Cooperative Research: Toledo Institute for Development and the Environment, Programme for Belize, Hidden Valley Inn, Blancaneaux Lodge, Center for the Study of Tropical Birds, Inc., Ya'axché Conservation Trust, Golden Gate Raptor Observatory, The Belize Zoo and Tropical Education Center

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