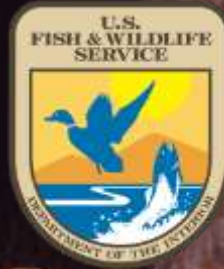


Monitoring the Florida Panther Population with Remote Cameras

Past Applications and Current Approaches

David Shindle
Wildlife Biologist







Feasibility of Using Remote Cameras to Survey South Florida's Rare and Elusive Carnivore

Feasibility of Using Remote Cameras to Survey South Florida's Rare and Elusive Carnivore: the Everglades Mink



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20 8:21

Feasibility of Using Remote Cameras to Survey Everglades Mink

Mink Bycatch



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CELEBRATING OUR PAST
SHAPING OUR FUTURE

23 17:12





7/04/2009 8:26 PM

Photo Credit: D. Shindle and L. Grassman



7/12/2009 7:40 AM

Photo Credit: D. Shindle and L. Grassman

Feasibility of Using Remote Cameras to Survey Florida Panthers

Study Period: 2000-2001

Study Areas: ENP and FPWNR



Shindle, D.B., E.D. Land, D. Onorato, M. Wessel, and P. Kubilis. 2008.
Feasibility of using remote cameras to survey Florida panthers.
FWC In-house Report Series IHR 2008-003.

Feasibility of Using Remote Cameras to Survey Florida Panthers

Study Period: 2000-2001

Study Areas: ENP and FPWNR



Results and Conclusions:

Remote cameras failed to provide adequate data for conventional mark-recapture analyses.

- Inconsistent detection of marks.
- Inability to consistently identify individual panthers.



Feasibility of Using Remote Cameras to Survey Florida Panthers

Study Period: 2000-2001

Study Areas: ENP and FPWNR



Results and Conclusions:

Demonstrated that remote camera surveys were a cost-effective, non-invasive capture technique.

- Provided important life-history data that could be incorporated into future population monitoring schemes and demographic analyses.



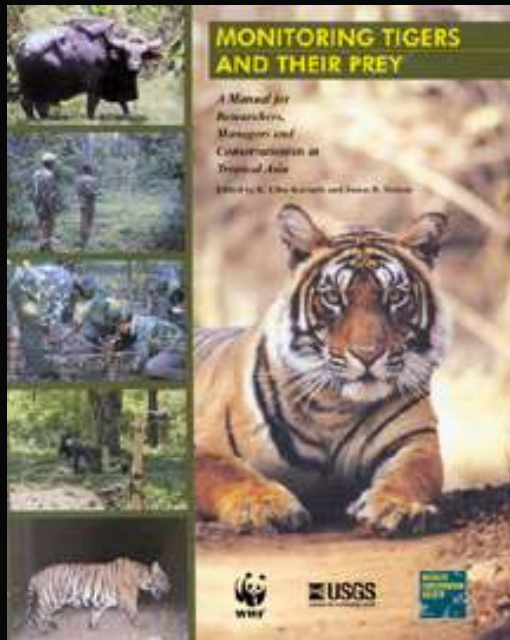


Carbone et al. 2001. *The Use of Photographic Capture Rates to Estimate Densities of Tigers and other Cryptic Mammals.* **Animal Conservation** 4:75-79.

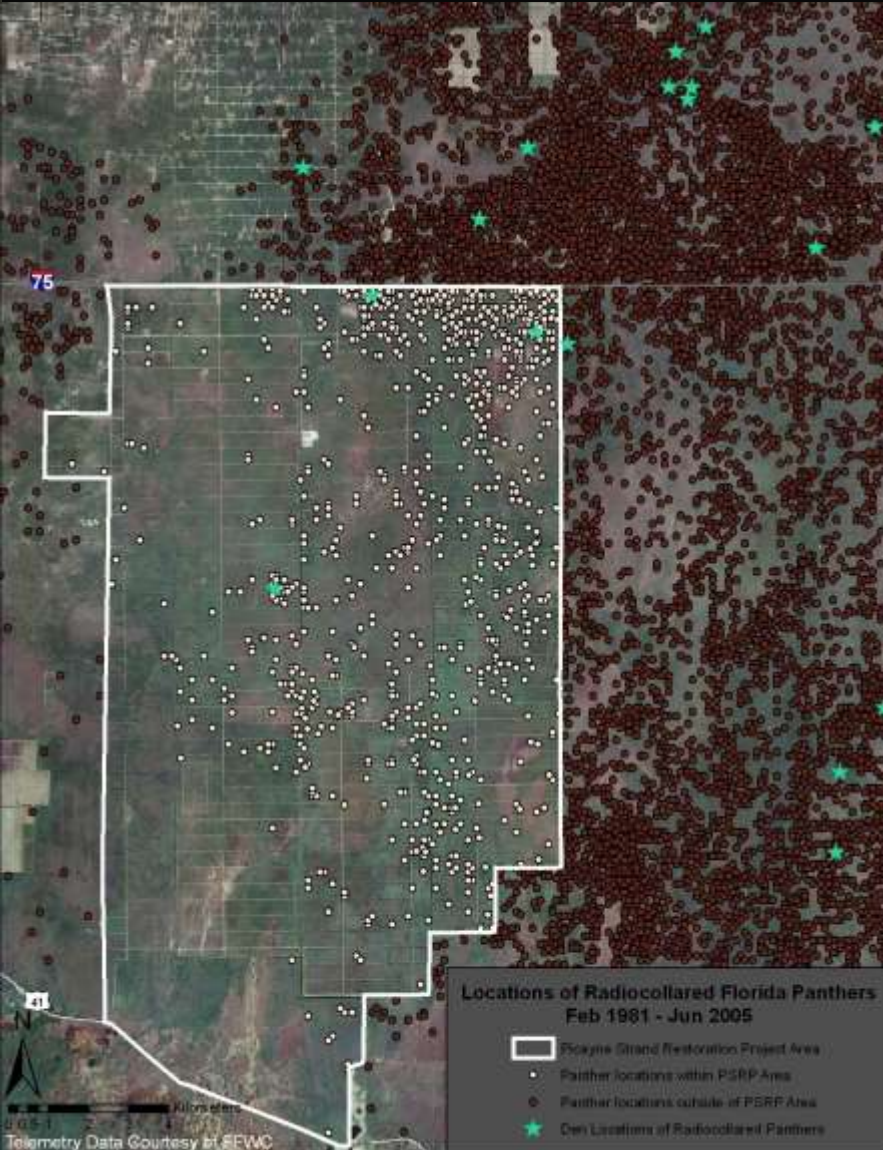
Functional relationship between photo capture rates of tiger and estimates of tiger density.

Capture rate method does not rely on animals identifiable as individuals.

A caveat of applying this technique is the necessity to calibrate density with capture rates.



Picayune Strand Restoration Project Area



Pre-construction Panther Prey Baseline Monitoring Survey in the Picayune Strand Restoration Project Area

Study Period: 2005-2007

Study Areas: PSRP Area, Fakahatchee Strand, and FPNWR

Picayune Strand Restoration Project Area Panther Prey Study
Infrared-Triggered Remote Camera Locations July 2005 - March 2007



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Pre-construction Panther Prey Baseline Monitoring Survey in the Picayune Strand Restoration Project Area

Study Period: 2005-2007

Study Areas: PSRP Area,
Fakahatchee Strand, and FPNWR

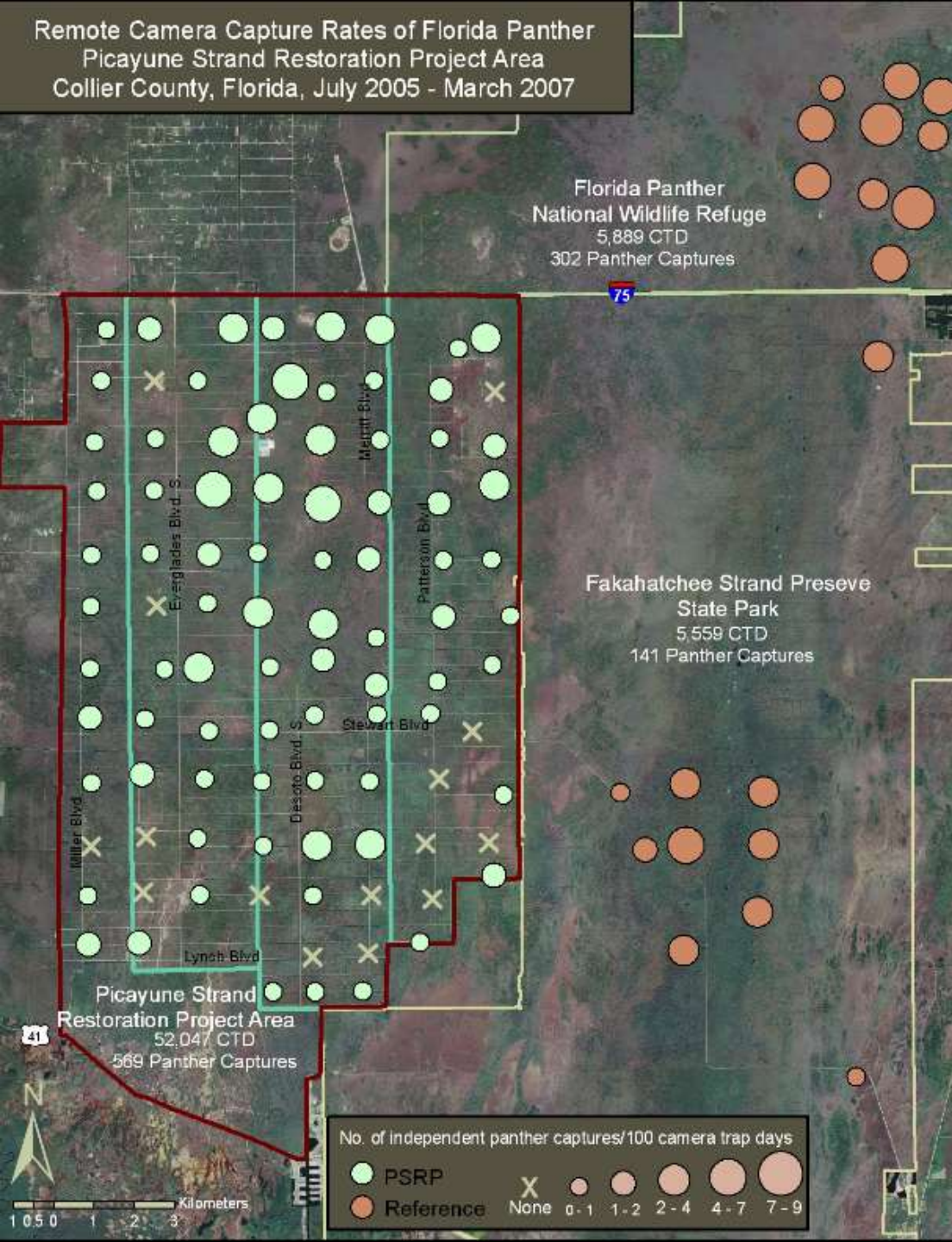
Indices of Florida Panther and their Primary Prey

- Panther and prey presence-absence (spatial distribution).
- Relative abundance of panther and prey based on photographic capture rates.
- Minimum number of adult panthers known alive (MNA).



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Remote Camera Capture Rates of Florida Panther
 Picayune Strand Restoration Project Area
 Collier County, Florida, July 2005 - March 2007



Florida Panther

Total No. of Photos

PSRP	FAKA	FPNWR
569	148	321

No. of Independent Captures

PSRP	FAKA	FPNWR
569	141	302

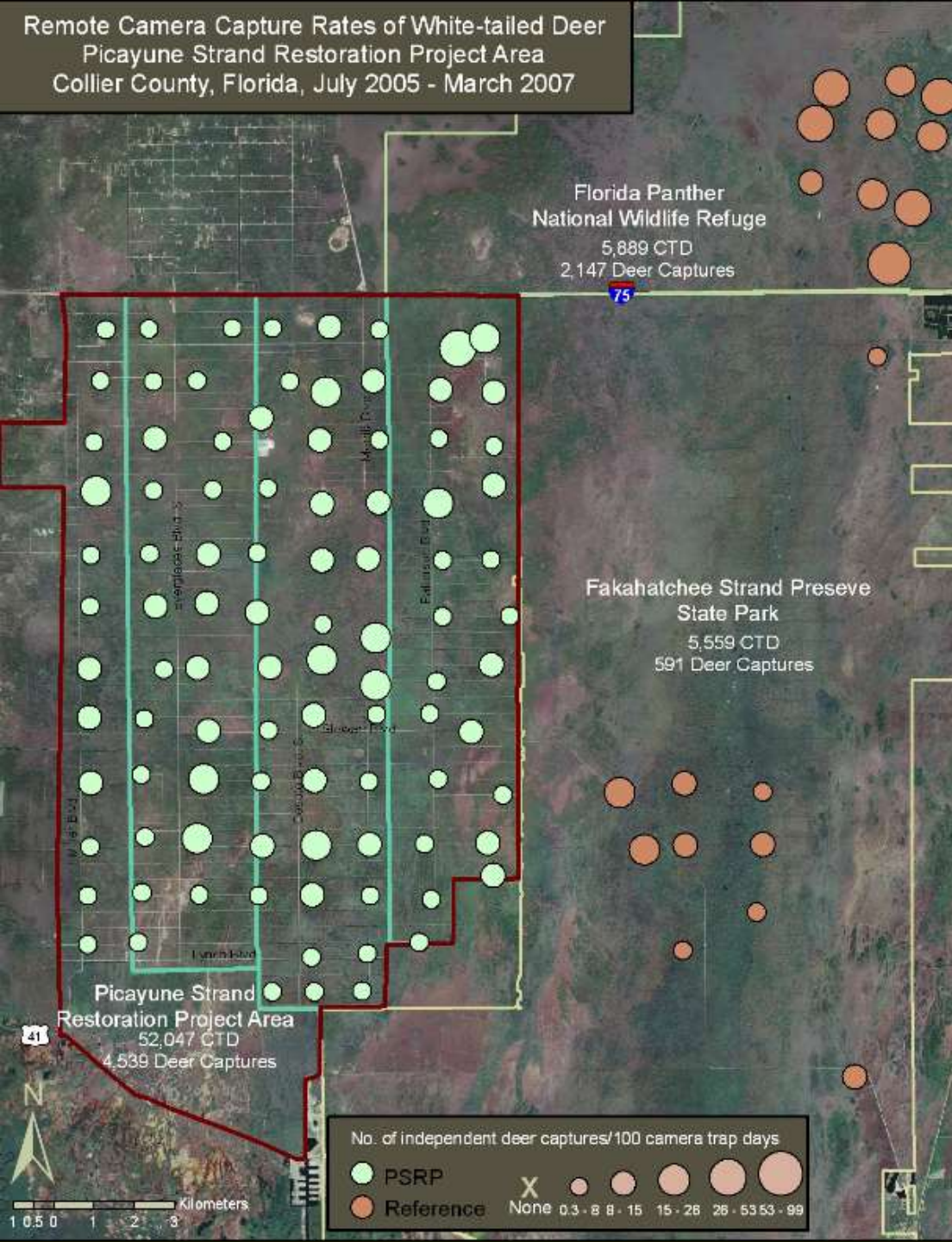
Mean Capture Rate

PSRP	FAKA	FPNWR
1.1 ± 0.2	2.5 ± 1.0	5.2 ± 1.7

% of Area Occupied

PSRP	FAKA	FPNWR
88%	100%	100%

Remote Camera Capture Rates of White-tailed Deer
 Picayune Strand Restoration Project Area
 Collier County, Florida, July 2005 - March 2007



Florida Panther
 National Wildlife Refuge
 5,889 CTD
 2,147 Deer Captures

Fakahatchee Strand Preserve
 State Park
 5,559 CTD
 591 Deer Captures

Picayune Strand
 Restoration Project Area
 52,047 CTD
 4,539 Deer Captures



White-tailed Deer

Total No. of Photos

PSRP	FAKA	FPNWR
5,760	1,411	2,548

No. of Independent Captures

PSRP	FAKA	FPNWR
4,539	591	2,147

Mean Capture Rate

PSRP	FAKA	FPNWR
8.6 ± 1.5	10.7 ± 4.0	36.1 ± 18.9

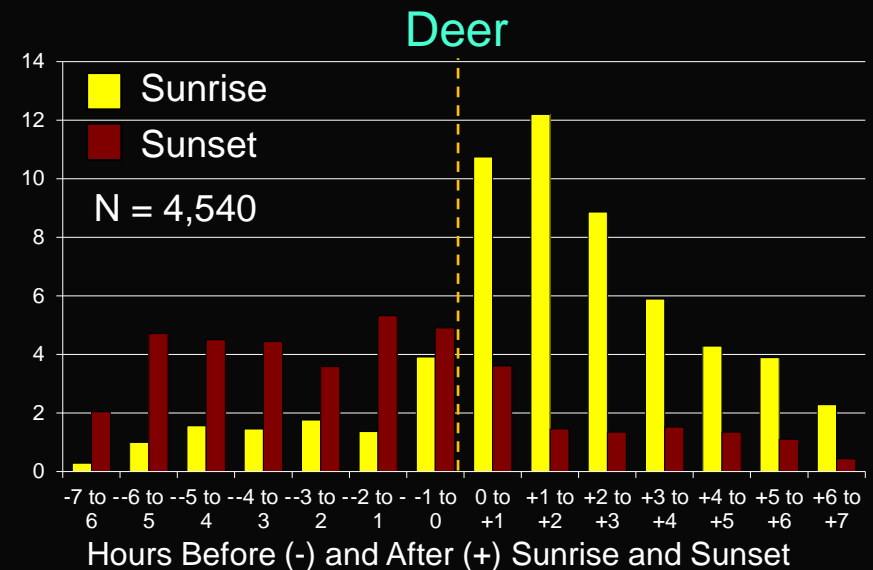
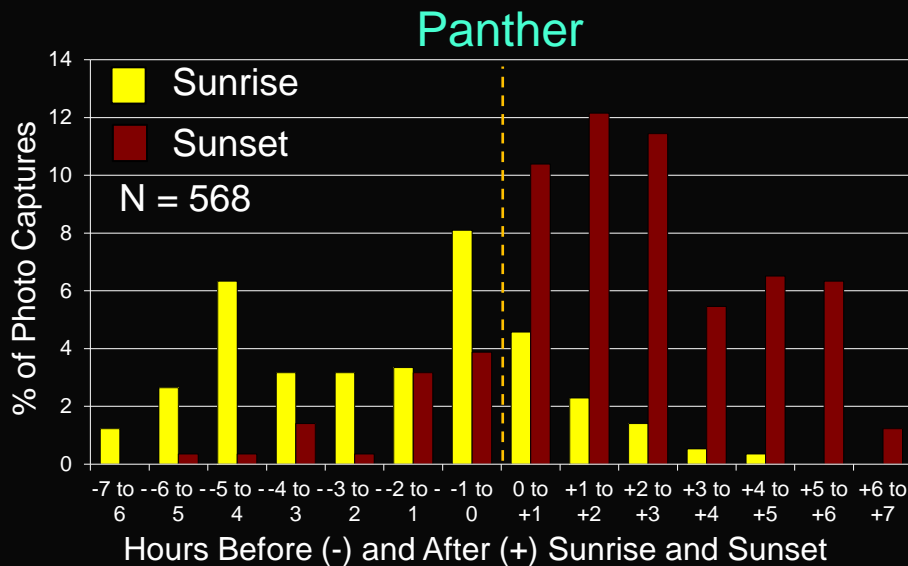
% of Area Occupied

PSRP	FAKA	FPNWR
100%	100%	100%



Activity Patterns of Florida Panther and White-tailed Deer Predator Avoidance Behavior in Action?

Locomotory Activity Patterns of Florida Panther and White-tailed Deer
Relative to Sunrise and Sunset in the Picayune Strand Restoration Project Area



How Many Panthers in the Blocks? 2005-2007



Minimum Number Known Alive

7 Adult Males; 5 Adult Females

9 Kittens

***Insert caveats here _____*

****4 adult females raising kittens in
late 2006 and early 2007.**



Radiotelemetry and Remote Camera Capture Locations
of Florida Panther FP146
in the Picayune Strand Restoration Project Area
Collier County, Florida, 08 March 2006 - 30 March 2007





Radiotelemetry and Remote Camera Capture Locations
of Florida Panther FP119
Relative to the Picayune Strand Restoration Project Area
Collier County, Florida, 06 July 2005 - 30 March 2007



21-19:59

Picayune Strand Restoration Project Area Post-Construction Monitoring Plan



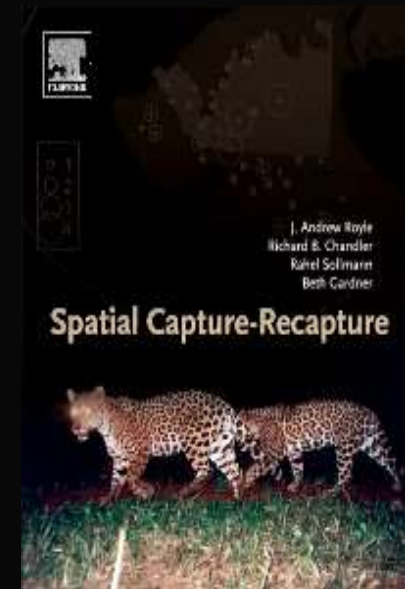
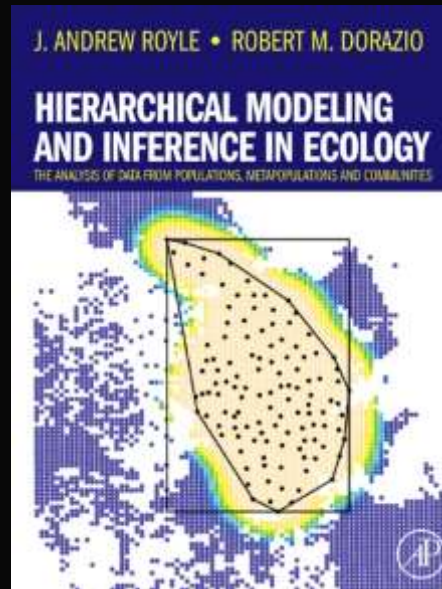
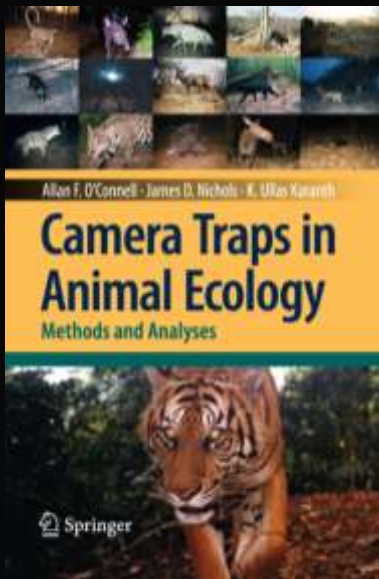
Florida panther prey base monitoring will begin after the first full wet season upon completion of the entire PSRP (2018-2019).

Monitoring events will cover a 2-year period and be performed every 5 years, or until the year 2050.

Targets:

- Trends in spatial distribution and abundance that examine whether panther and prey populations are remaining relatively stable or increasing.
- The maintenance or increase of a reproducing population of panthers is important.

Review of Camera Trap Survey Data of the Florida Panther ~~and their Prey~~ in Southwestern Florida: Analyses using Statistical Estimation Methods and Recommendations for Future Survey Design



Radiotelemetry and Remote Camera Capture Locations
of Florida Panther FP119
Relative to the Picayune Strand Restoration Project Area
Collier County, Florida, 06 July 2005 - 30 March 2007



Spatial Mark-Resight



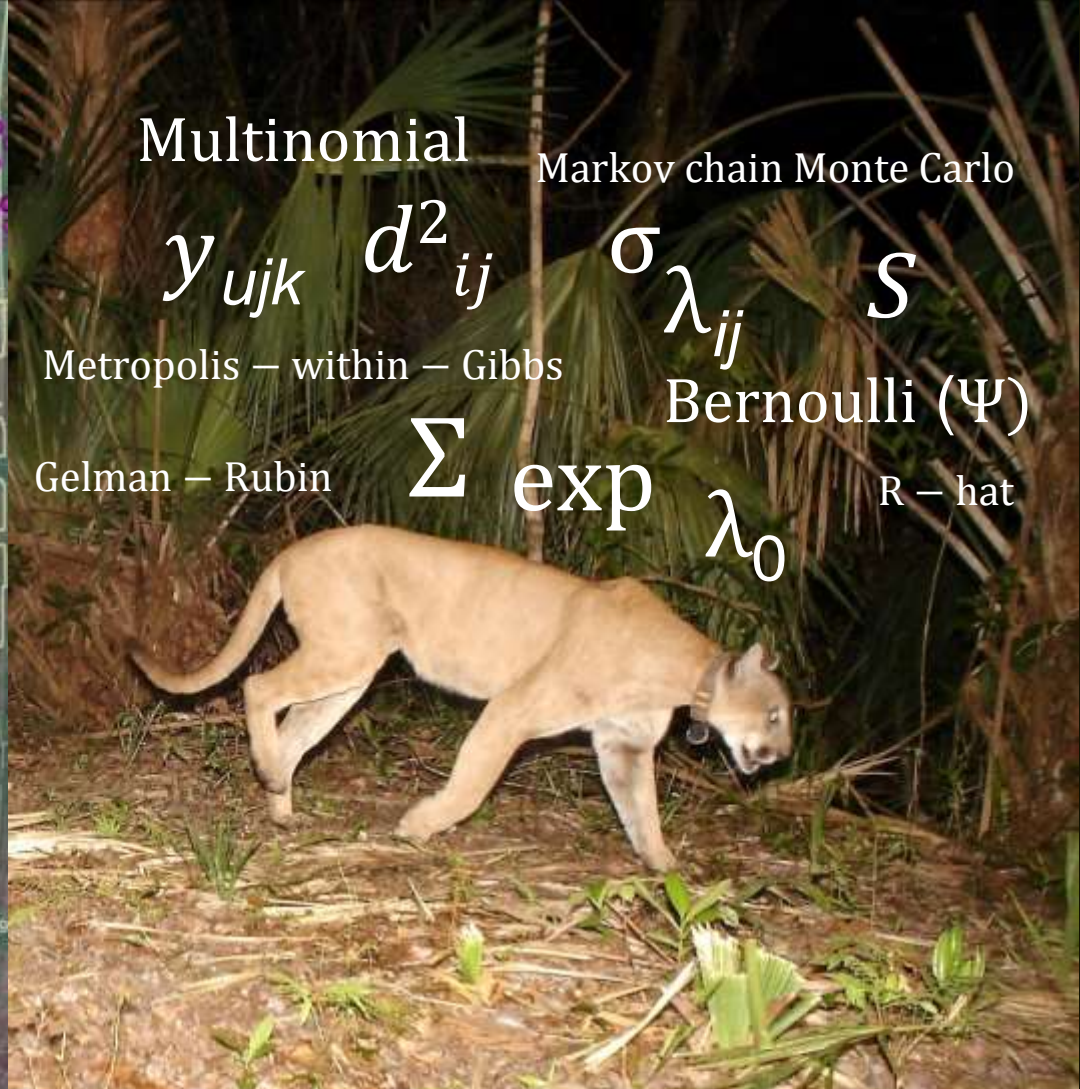
Sollmann, R., B. Gardner, R. B. Chandler, D. B. Shindle, D. P. Onorato, J. A. Royle, and A. F. O'Connell. 2013. *Using Multiple Data Sources Provides Density Estimates for Endangered Florida Panther*. *Journal of Applied Ecology* 50:961-968.



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Radiotelemetry and Remote Camera Capture Locations
of Florida Panther FP119
Relative to the Picayune Strand Restoration Project Area
Collier County, Florida, 06 July 2005 - 30 March 2007



Multinomial

Markov chain Monte Carlo

$$y_{ujk} \quad d^2_{ij}$$

$$\sigma \quad \lambda_{ij} \quad S$$

Metropolis – within – Gibbs

Bernoulli (Ψ)

Gelman – Rubin

$$\Sigma \quad \exp$$

λ_0 R – hat

Sollmann, R., B. Gardner, R. B. Chandler, D. B. Shindle, D. P. Onorato, J. A. Royle, and A. F. O'Connell. 2013. *Using Multiple Data Sources Provides Density Estimates for Endangered Florida Panther*. *Journal of Applied Ecology* 50:961-968.



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Spatial Mark-Resight



Unmarked Captures

Assumed to occur via the same processes as marked panther captures.



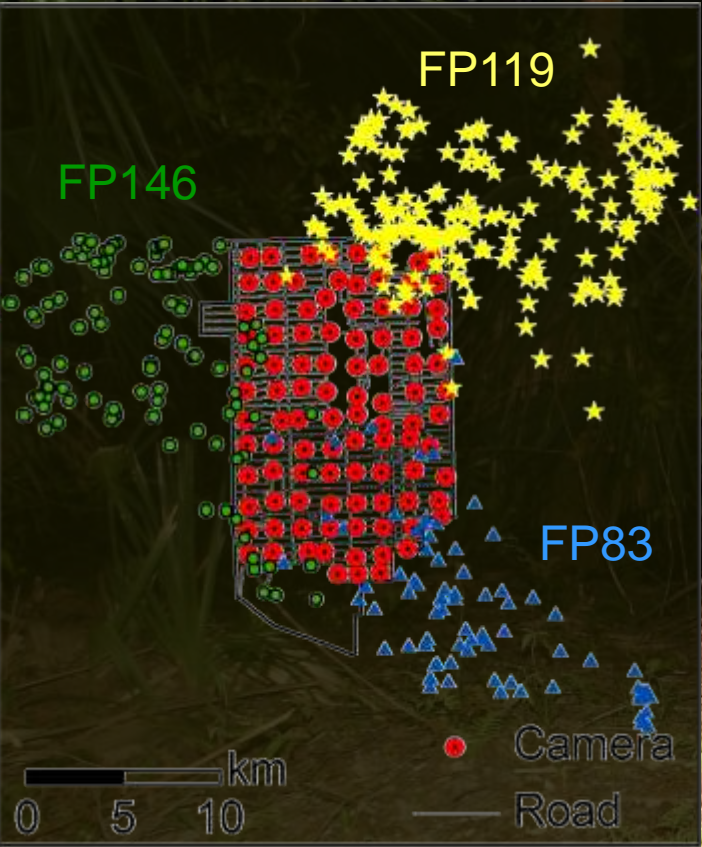
Marked Captures

Radiocollared panthers provide information on individual detection and movement.



- Uses simultaneously collected camera trapping and telemetry data.
- Allows for only a portion of the population to be identified.
- Links abundance to a clearly defined area.

Spatial Mark-Resight



	<u>Density [per 100 km²]</u>	<u>Confidence Interval</u>
Occasion 1	1.51	0.81 – 2.73
Occasion 2	1.46	0.76 – 2.97

Precision of model and future density estimates should improve with an increased number of radiocollared panthers and recaptures.



Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge



Study Period: 2012 - in progress



Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

Objective

Establish inventory and monitoring protocols for Florida panther and white-tailed deer.



Provide MNA, population demographics, and long-term trend data for panthers.

Study Period: 2012 - in progress



FPCAM_Master Catalog_Shieldle [Puma concolor] - Media Pro

File Edit View Action Data Window Scripts Help

Thumbnail **Media**

FPCAM30_2012-10-5-17-18-2.JPG

10/5/2012 5:18 PM

1201 x 2033 pixels @ 42% | 2.8 MB | 20%

10/5/2012 5:18:02 PM

Catalog: 1.9 GB | 12179 hidden | 4313 items in list | 1 selected (1/50)

Annotations

- Date Created: 10/5/2012
- Creator: David Shields
- Location: FPCAM30
- Latitude: N 28° 11' 00.28"
- Longitude: W 88° 25' 57.58"
- Species: Puma concolor
- Quantity: 1
- Age: Adult
- Sex: Male
- Radiolar A: No
- Winged Tail A: No
- Coviled A: No
- Individual ID A:
- Age B:
- Sex B:
- Radiolar B:
- Winged Tail B:
- Coviled B:
- Individual ID B:
- Capture Description:
- Independent Call: No
- Keywords:

Click here to add keywords.

Description

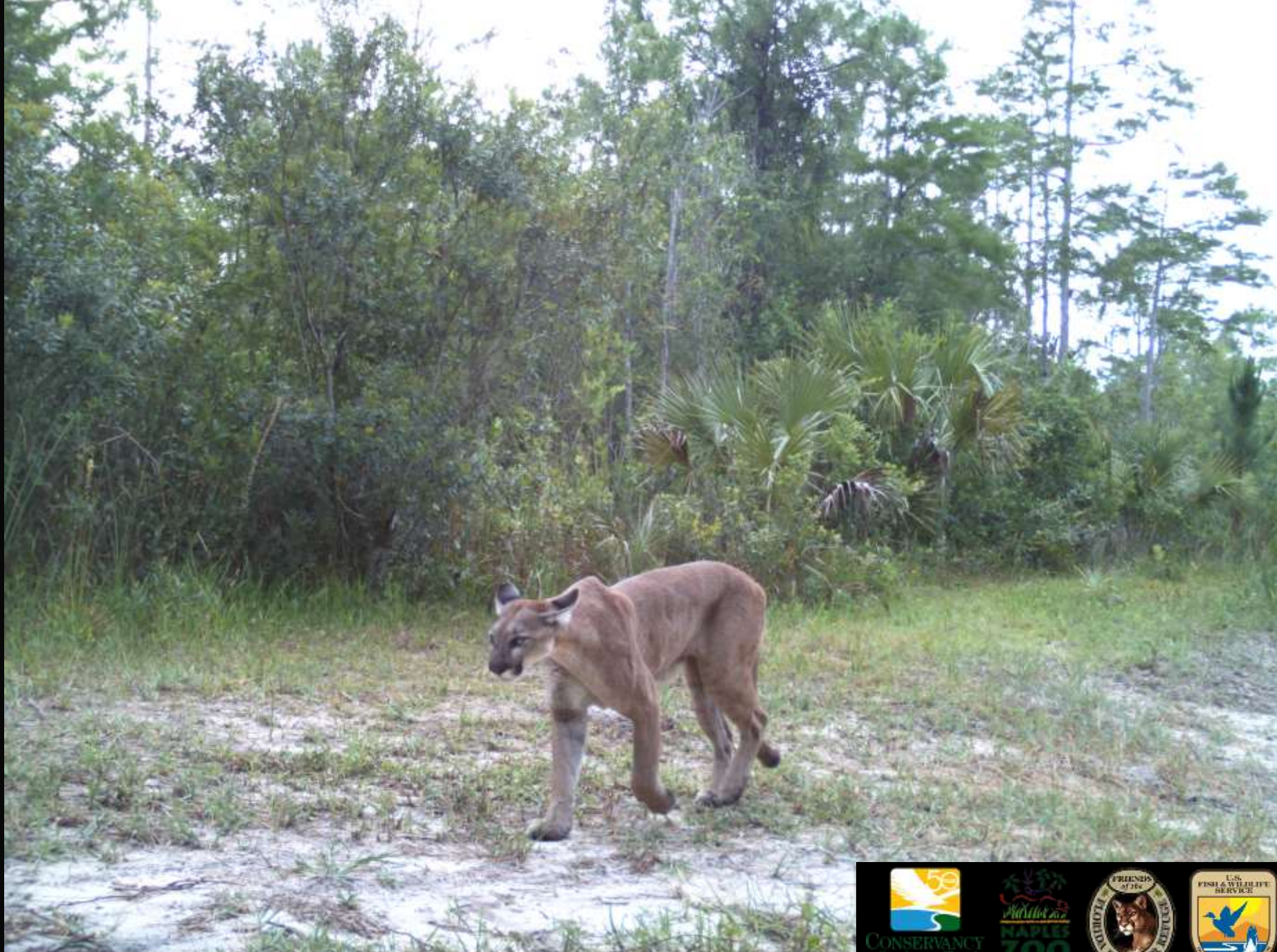


Attack

2/10/2012 4:28 PM



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Attack

5/13/2012 3:51 PM



Photo credit: Richard and Cynthia Mello
Golden Gate Estates
Submitted to FWC as sighting report



“Constriction” on tail (also noted in video)

54°F 04/27/2012 03:42AM MYCAMERA

Cowlick not clearly discernible (maybe because of motion blur) but is apparent in video.



50°F 04/27/2012 03:33AM MYCAMERA



Attack

12/14/2011 11:32 AM

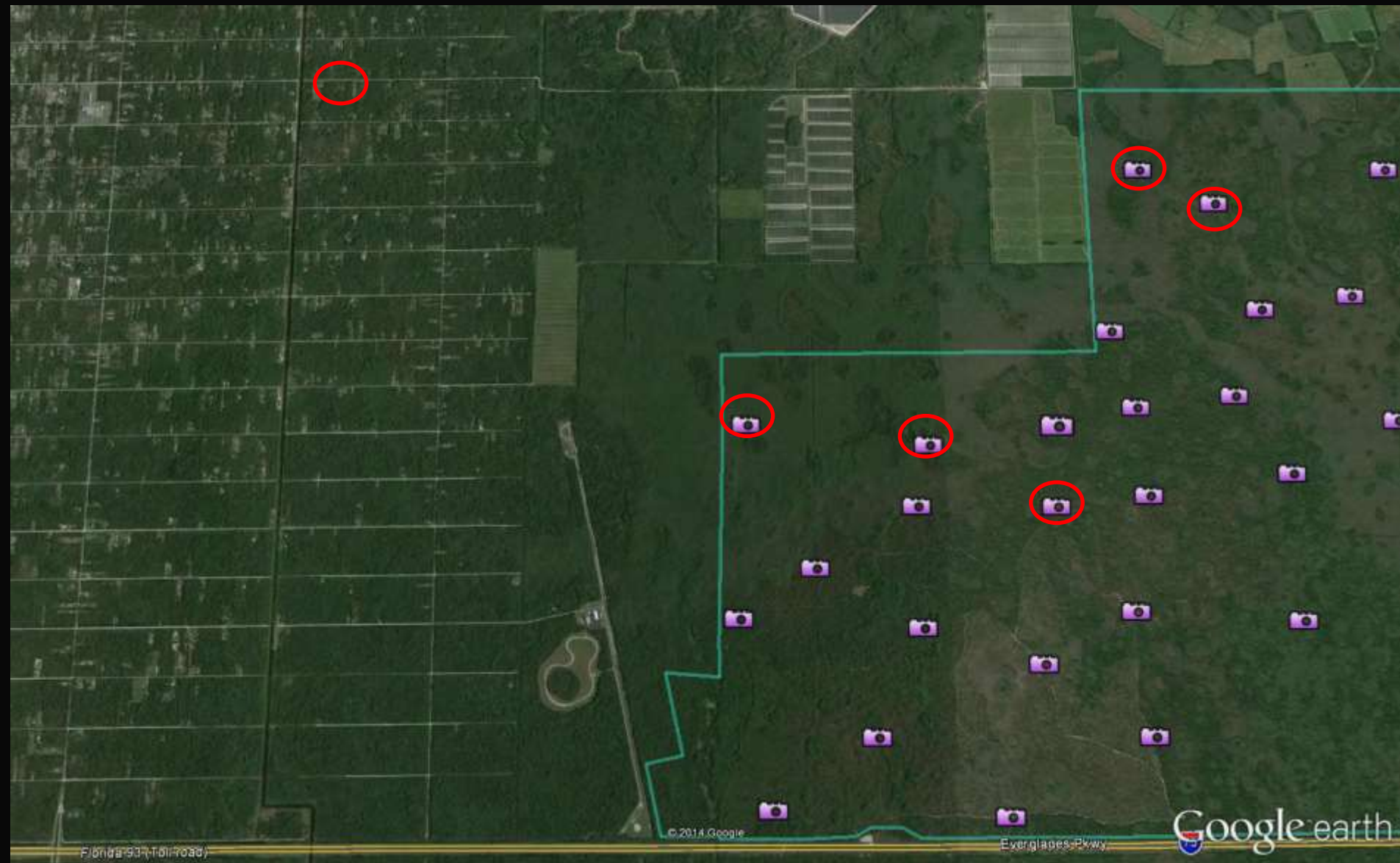




Attack

1/26/2013 5:55 PM ID:14

A row of four logos. From left to right: 1. A logo for the 50th anniversary of the Conservancy of Southwest Florida, featuring a stylized sun and water. 2. The logo for the Naples Zoo, featuring a tree and the text 'Naples Zoo' and 'GAMBEL'S QUARTER'. 3. The logo for the Florida Panthers, featuring a panther's head and the text 'FRIENDS OF THE FLORIDA PANTHERS'. 4. The logo for the U.S. Fish & Wildlife Service, featuring a bird and the text 'U.S. FISH & WILDLIFE SERVICE'.



Google earth



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Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

2012 FPNWR Female A



Attack

10/27/2012 8:15 AM



Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers



Attack

9/24/2012 11:48 AM



Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers



Attack

9/24/2012 3:40 PM



Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers



Attack

9/25/2012 12:34 AM



Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

2012 FPNWR Female B



Attack

11/2/2012 8:22 PM



Reproductive Status and Kitten Age as a Means to Assist in the Segregation and Identification of Individual Adult Female Panthers

2012 FPNWR Female C



Attack

12/1/2012 12:46 AM ID:9



Using Camera Traps as a Tool to Monitor Important Demographic Parameters of the Florida Panther Population: Reproductive Success and Kitten Survival

2012 FPNWR Female A



Attack

1/4/2013 10:32 AM ID:48





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Attack

10/17/2013

11:49 AM

ID:69





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Attack

12/13/2013

6:47 AM

ID:64





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Attack

6/8/2014

7:15 PM

ID:45



Florida Panther National Wildlife Refuge 2013 Annual Panther Count Data Submitted to Mr. Roy McBride, Rancher's Supply, Inc.

Uncollared

Adult Female FPNWR_F2 with 2 kittens

Adult Female FPNWR_F4 with 3 kittens

Adult Female FPNWR_F7 with 3 kittens

Radiocollared

Adult Female FP113** with 1 kitten

Adult Female FP222 with 3 kittens

Adult Female FP195

Adult Female FP215

7 Adult Females

12 Kittens

Uncollared

Adult Male FPNWR_M2

Adult Male FPNWR_M4

Adult Male FPNWR_M5

Radiocollared

Adult Male FP183

Adult Male FP216**

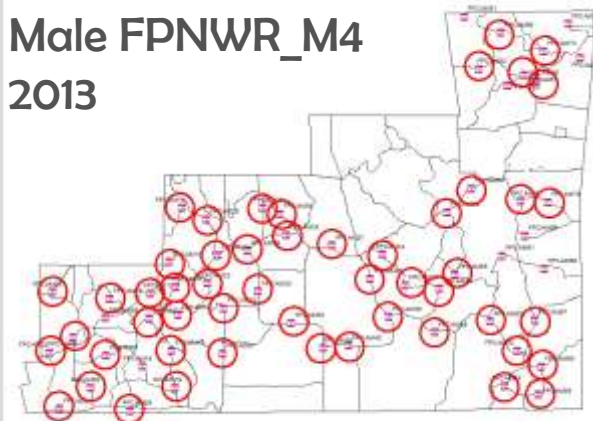
****failed radiocollar**

5 Adult Males



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Male FPNWR_M4
2013



Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

Objective

Establish inventory and monitoring protocols for Florida panther and white-tailed deer.



Provide MNA, population demographics, and long-term trend data for panthers.

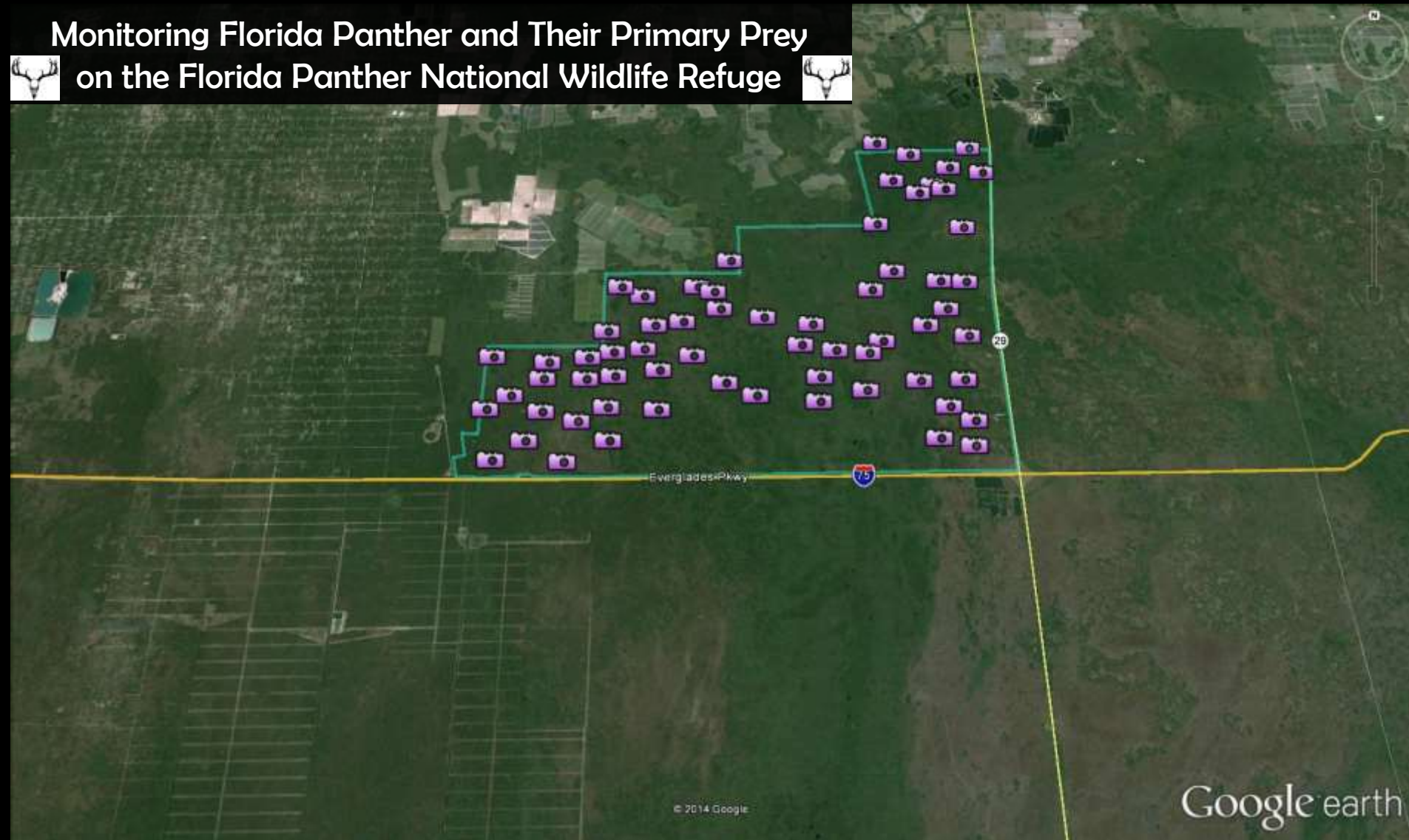


Facilitate the refinement of the spatial mark-resight panther camera model.

Study Period: 2012 - in progress

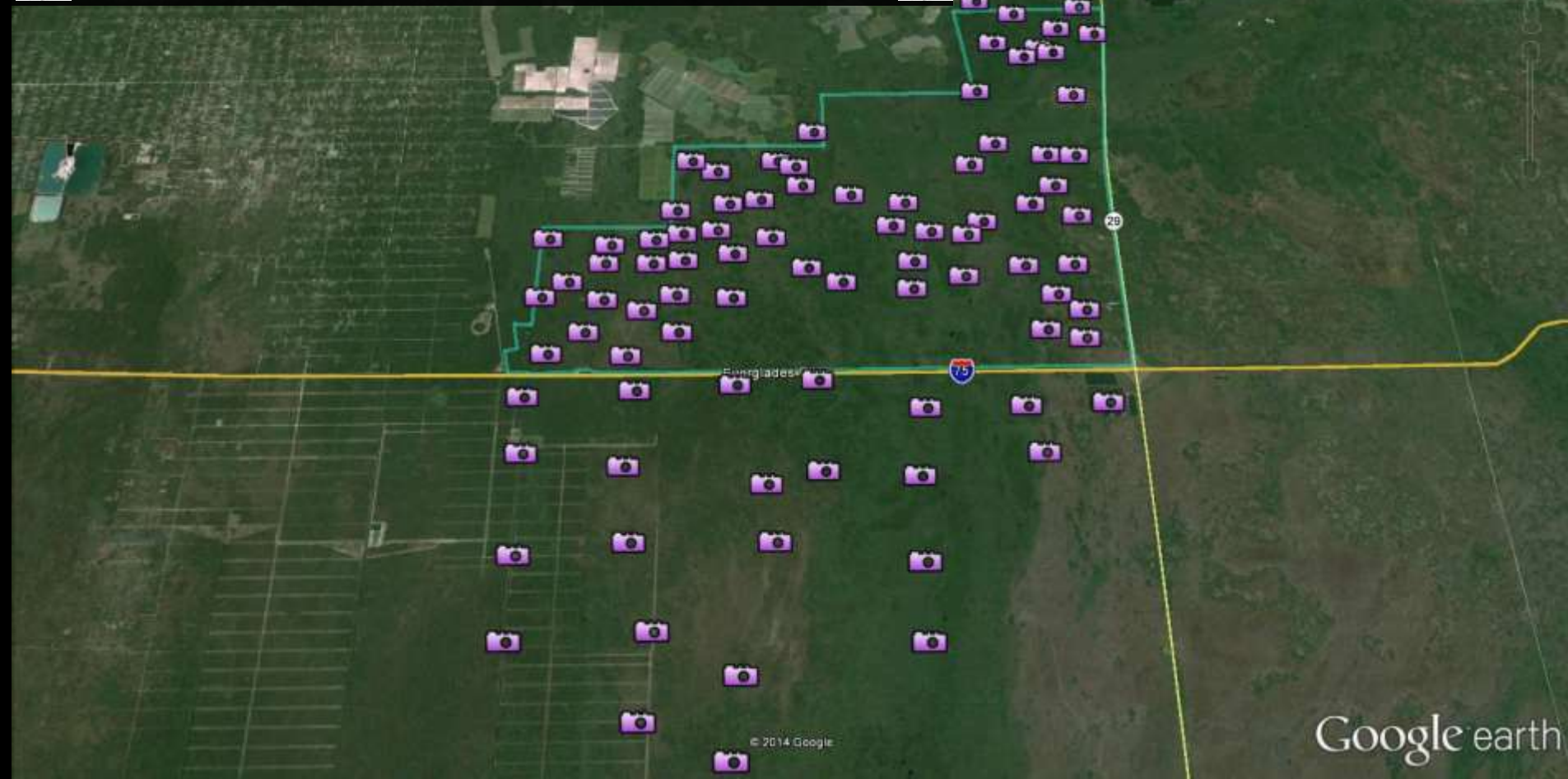


Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge



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Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge and Beyond





Attack

3/23/2013 8:01 AM ID:23

A row of four logos: 1. A logo for the 50th anniversary of the Conservancy of Southwest Florida, featuring a sun and water. 2. The Naples Zoo logo, featuring a tree and the text 'NAPLES ZOO'. 3. The Friends of the Florida Panthers logo, featuring a panther's head. 4. The U.S. Fish & Wildlife Service logo, featuring a bird and water.



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Monitoring Florida Panther and Their Primary Prey on the Florida Panther National Wildlife Refuge

Objective

Establish inventory and monitoring protocols for Florida panther and white-tailed deer.



Provide MNA, population demographics, and long-term trend data for panthers.



Facilitate the refinement of the spatial mark-resight panther camera model.



Assess the utility of camera data to monitor demographics and trends of deer herd.

Study Period: 2012 - in progress





Attack

7/14/2012

10:28 AM





Attack

9/7/2012 12:19 PM



Attack

9/4/2012 3:29 PM



Attack

8/30/2012 6:44 PM





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Attack 2/22/2012 12:15 PM 



Attack

2/11/2012 4:46 AM





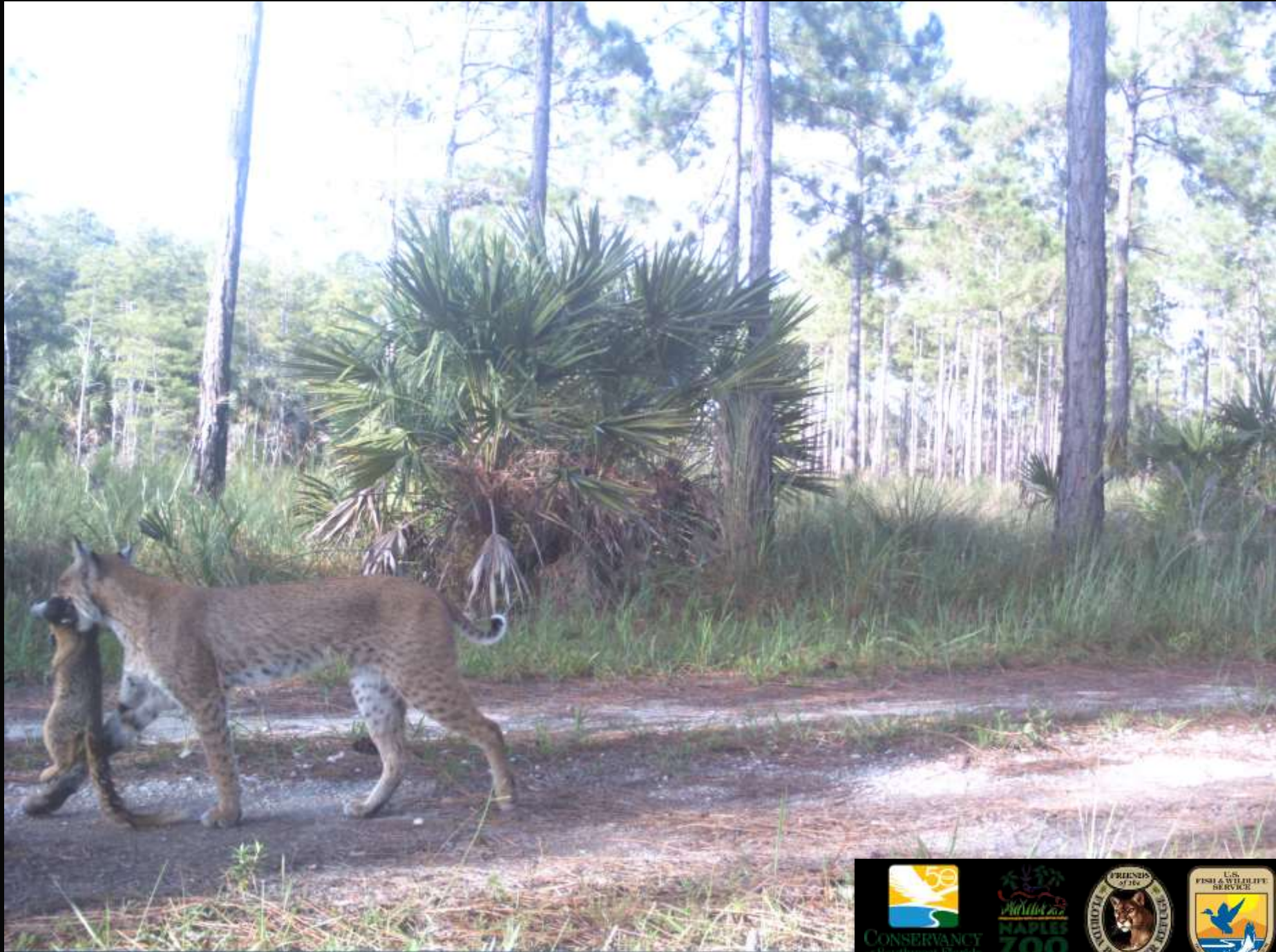
Attack

4/23/2014

9:34 PM

ID:64





Attack

7/28/2014

5:18 PM

ID:10



FPCAM_Master Catalog_Shindle [Odocoileus virginianus] - Media Pro

File Edit View Action Make Window Scripts Help

2012-5-2009 preview | 3.3 MB | 20%

YPMWR Camera Survey\FPCAM\YPCAM01_2012-5-21-14-08.JPG

Catalog Fields

- Dipterus
- Eukaryota
- Fungi
- Invertebrata
- Mammalia
- Nematoda
- Ophiurozoa
- Liliaceae
- Malvaceae
- Myricaceae
- Nyctaginaceae
- Odocoileus virginianus
- Prunella
- Prunella
- Ruminantia
- Sauria
- Sauria
- Sauria
- Sauria
- Sauria
- Sauria
- Testudines
- Vertebrata

Hierarchical Keywords

Catalog Folders

- YPMWR Camera Survey
 - FPCAM01
 - FPCAM02
 - FPCAM03
 - FPCAM04
 - FPCAM05
 - FPCAM06
 - FPCAM07
 - FPCAM08
 - FPCAM09
 - FPCAM10
 - FPCAM11
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 - FPCAM13
 - FPCAM14
 - FPCAM15
 - FPCAM16
 - FPCAM17
 - FPCAM18
 - FPCAM19
 - FPCAM20
 - FPCAM21
 - FPCAM22
 - FPCAM23
 - FPCAM24

Grid of image thumbnails showing various deer (Odocoileus virginianus) in a forest setting. Each thumbnail includes a filename below it, such as FPCAM01_2012-5-12-09-24-11.JPG, FPCAM02_2012-5-12-09-25-14.JPG, FPCAM03_2012-5-12-10-13-16.JPG, FPCAM04_2012-5-12-10-15-19.JPG, FPCAM05_2012-5-12-11-47-46.JPG, FPCAM06_2012-5-12-17-54.JPG, FPCAM07_2012-5-12-17-59-36.JPG, FPCAM08_2012-5-13-02-24.JPG, FPCAM09_2012-5-13-04-50.JPG, FPCAM10_2012-5-13-04-50.JPG, FPCAM11_2012-5-13-05-37.JPG, FPCAM12_2012-5-13-09-36.JPG, FPCAM13_2012-5-13-16-36.JPG, FPCAM14_2012-5-14-01-30.JPG, FPCAM15_2012-5-15-04-47.JPG, FPCAM16_2012-5-15-12-15-30.JPG, FPCAM17_2012-5-16-03-38-36.JPG, FPCAM18_2012-5-16-09-23.JPG, FPCAM19_2012-5-16-09-54-16.JPG, FPCAM20_2012-5-16-10-29-22.JPG, FPCAM21_2012-5-16-11-14-42.JPG, FPCAM22_2012-5-16-11-42-3.JPG, FPCAM23_2012-5-16-11-46-3.JPG.

Catalog 1.9 GB | Media 15.1 GB

1680 images | 2862 items in list | 1 selected (1680)



- Annotations
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- Creator: David Shindle
- Location: FPCAM21
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- Longitude: W 081° 20' 48.22"
- Species: Odocoileus virginianus
- Quantity: 1
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- Sex A: Buck
- Radio-collar A:
- Radio-tag A:
- Collar A:
- Individual ID A:
- Age B:
- Sex B:
- Radio-collar B:
- Radio-tag B:
- Collar B:
- Individual ID B:
- Default Description:
- Independent Catalog:
- Keywords:
- Order Index:
- Customize to add keywords...



Attach

5/16/2012 11:48 AM



FPCAM21_2012-5-16-11-48-33PM
5/16/2012 11:48:03 AM

Remote Camera Data Used for Evaluating Population Trends and Demographics of the White-tailed Deer Herd on the FPNWR



Fawn:Doe and Buck:Doe Ratios
as indicators of habitat quality and herd health



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Recruitment as a measure of
deer reproductive success



**Fawning Period, Antler Shedding,
Antler Hardening, and Activity Periods**



Attack

6/10/2013 12:33 AM ID:15



Long-term Remote Camera Monitoring of White-tailed Deer in Southern Florida: a Snapshot of Unique Selection Pressures and Regional Adaptations



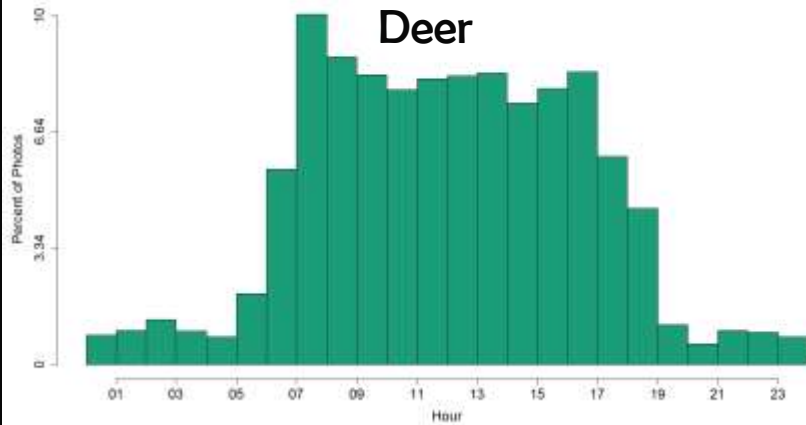
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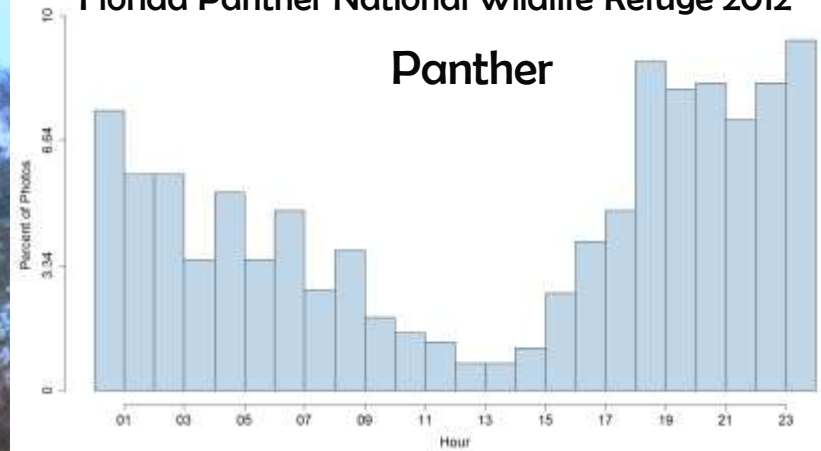
2014 Southeastern Deer Study Group Meeting, Athens, GA



Florida Panther National Wildlife Refuge 2012



Florida Panther National Wildlife Refuge 2012



“Deer move most at dawn and dusk. End of story. Like taxes and death, you can count on two things when talking about mature bucks: they move most at dawn and dusk, and during the rut.

Deer are crepuscular. It’s built into their DNA.” Quality Deer Management Assoc.

Anywhere But Here Theory

All a prey animal needs to do is be anywhere the predator isn't — it doesn't matter if it's a foot away, or a hemisphere — and it will live another day. The predator, on the other hand, must be exactly where its prey is, and at exactly the same moment, or it will starve. Thus for a predator, mastery of both time and space — in addition to a thorough understanding of terrain and prey behavior — are crucial.

—Clark Barrett, excerpt from *The Tiger*



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Attack

12/13/2011

8:32 AM





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Attack

12/17/2011

10:34 AM





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Attack

1/22/2012 9:57 AM





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OUR WATER, LAND, WILDLIFE, FUTURE.
CELEBRATING OUR PAST
SHAPING OUR FUTURE

South Florida Deer Research Project



Objectives



Understand what factors influence deer population dynamics in South Florida.



Develop a survey method using remote-sensing cameras that will provide dependable deer density and abundance estimates at a large-scale.



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A NATIONAL TIGER ACTION PLAN
FOR
THE UNION OF MYANMAR



Interpretation of Tiger Population Status
From Field Observations

Population Status

Interpretation

Reproductive population

Observations of pregnant females, juveniles, and /or cubs

Present, but not necessarily reproductive

Observations of adult male or non-pregnant adult female individuals

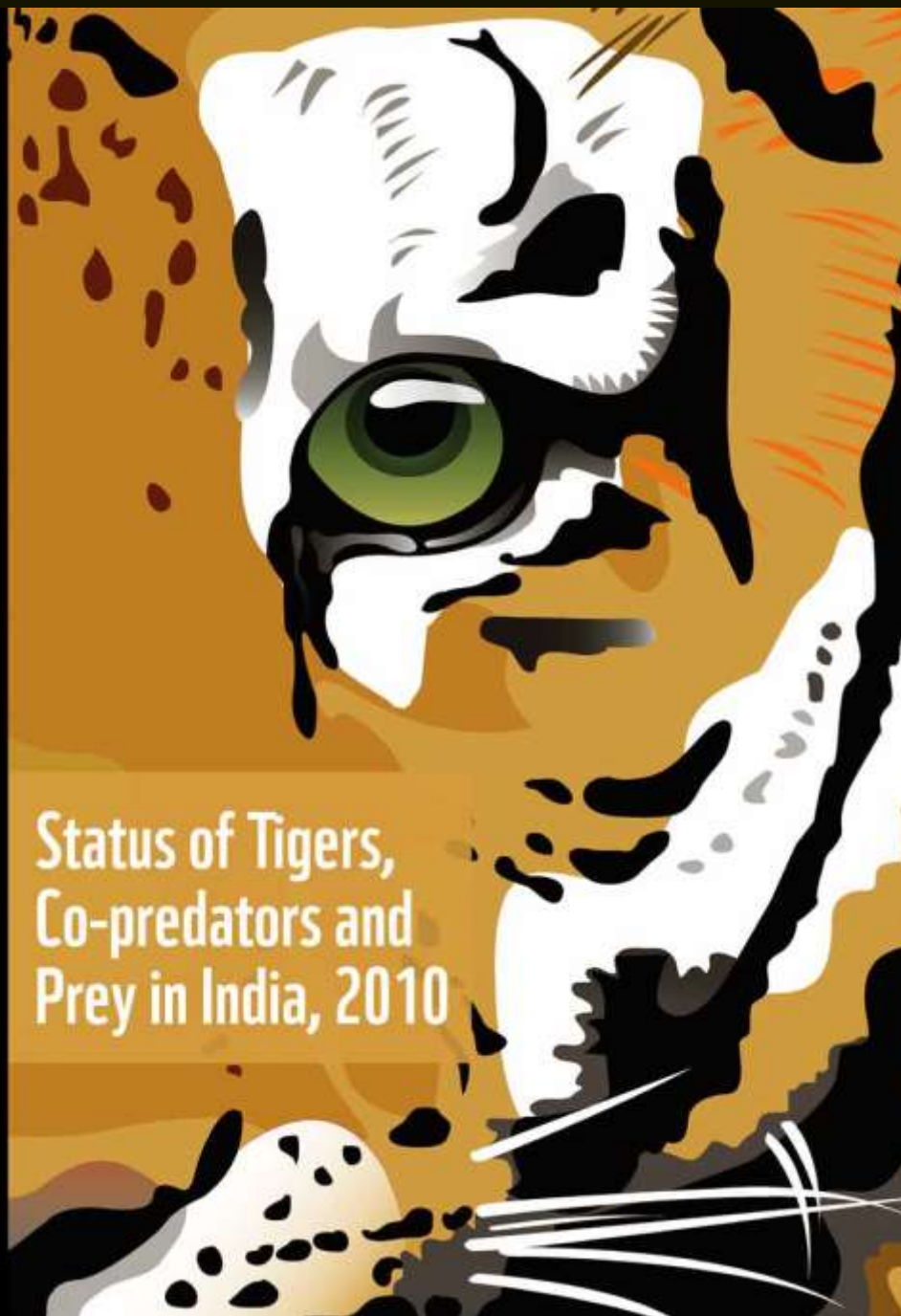
Low density, ecologically effective absence

Tigers may be present at low density but are not recorded

True absence

Tigers are not recorded over a period of monitoring at a site



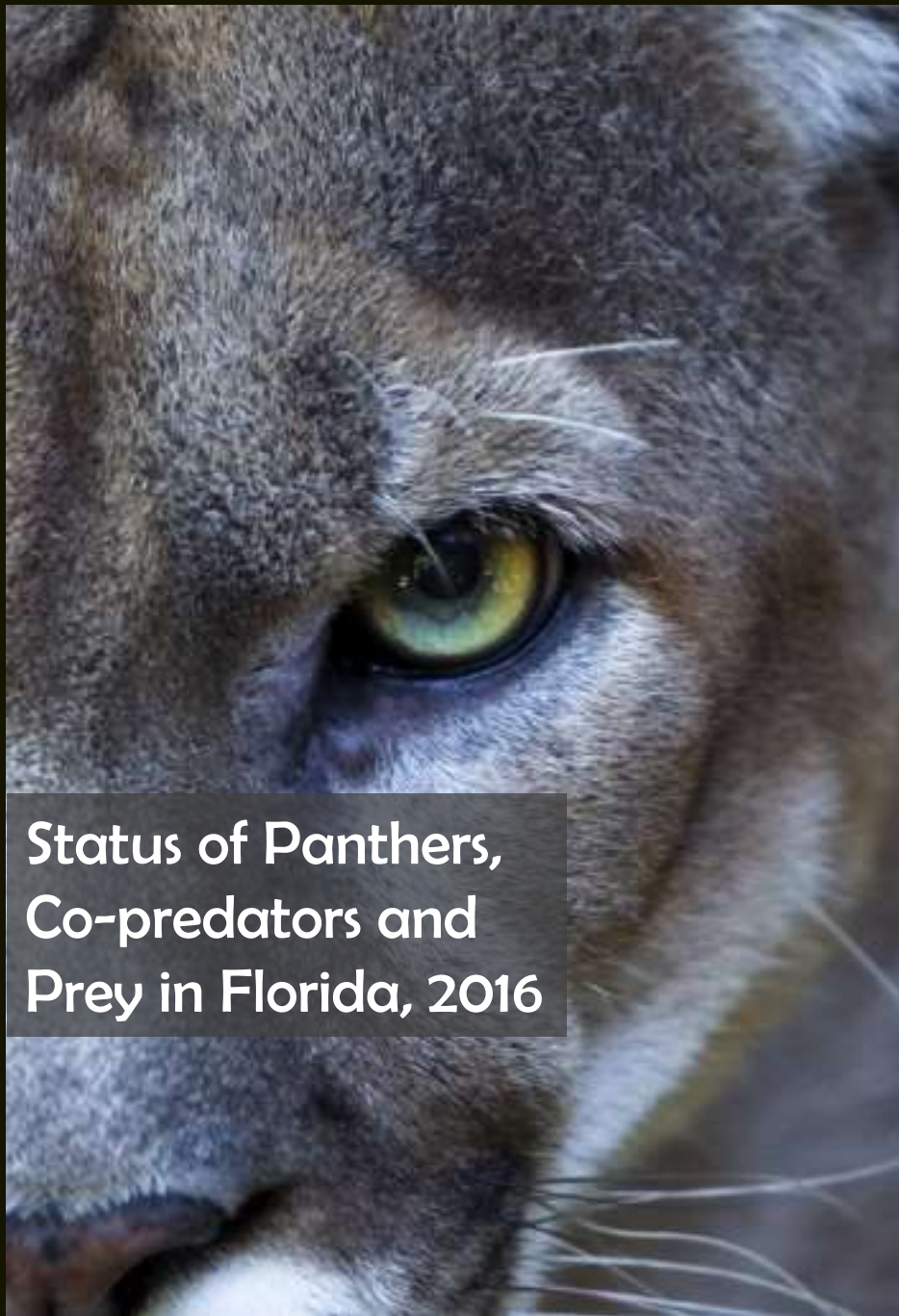


Status of Tigers,
Co-predators and
Prey in India, 2010



Project Tiger

National Repository of Camera Trap
Photographs of Tigers (NRCTPT)



Status of Panthers,
Co-predators and
Prey in Florida, 2016



Project Panther



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The End!



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FOR WILDLIFE, LAND, RECREATION, & SCIENCE

