



Assessment of the distribution of Florida panthers north of the Caloosahatchee River

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CENTRAL FLORIDA PANTHER STUDY INTERIM REPORT

1 March 2019 – 30 June 2020

Introduction

The Florida panther (*Puma concolor coryi*) is federally listed as an endangered subspecies of puma whose known breeding range is restricted to southern Florida, mainly south of the Caloosahatchee River. An objective of the United States Fish and Wildlife Service (USFWS) Florida Panther Recovery Plan (Recovery Plan) is to expand the breeding portion of the population in South Florida to areas north of the Caloosahatchee River. In 2016, the Florida Fish and Wildlife Conservation Commission (FWC) documented a female panther north of the Caloosahatchee for the first time since 1973 via a combination of tracks and photographs from motion-activated trail cameras. Between 2016 and 2018, this female likely produced three litters of kittens and an additional female was photographed with an adult male. Monitoring with trail cameras provided no evidence that any offspring from these litters survived to independence. Successful recruitment of young panthers into the population is necessary in order to meet the objectives of the Recovery Plan. Despite increased monitoring effort, no additional females or breeding activity was verified in Central Florida (area between the Caloosahatchee River and Interstate 4) prior to 2019.

FWC monitoring from 2016 to 2019 was focused on the Telegraph Swamp area in southwestern Babcock Ranch Preserve (BRP). Panther observations outside of this area were opportunistic and were not associated with quantifiable monitoring efforts. Historical telemetry data from radio-collared male panthers (1988-2015) show panther utilization of a much larger area in Central Florida, including eastern BRP, large parts of Glades county, as well as southern and western Highlands county. In March 2019, in order to derive a more complete assessment of the current distribution of panthers and breeding activity in Central Florida, we: 1) significantly expanded the camera survey across these areas; 2) began quantification of our monitoring effort; and 3) developed a standardized data processing methodology for trail camera photos and videos in order to improve archiving and data mining for subsequent analyses. This report summarizes our knowledge of female panthers and breeding activity in Central Florida prior to 1 March 2019 and details our research from 1 March 2019 to 30 June 2020.

Background

In 1973, Roy McBride and his hounds treed a female Florida panther in Glades County north of Fisheating Creek. Over the next 43 years, occasional systematic track surveys, opportunistic observations of track and sign, telemetry locations from 6 radio-collared individuals (Figure 1), opportunistic discoveries of carcasses, and trail camera photos consistently provided evidence of male panthers north of the Caloosahatchee River, but documentation of females or breeding was conspicuously absent.

In October 2016, a combination of trail camera photos and track observations confirmed the presence of a female panther at BRP in Charlotte County. The FWC subsequently increased monitoring effort at BRP in order to document evidence of breeding. In January and February 2017, FWC trail cameras photographed a female exhibiting recently nursed teats, thereby documenting parturition and the likely presence of kittens in a nearby den. In March 2017, FWC trail cameras photographed the dam with two kittens. Combined evidence of temporally tagged photographs along with body size led FWC staff to the conclusion that the kittens were likely born in November or early December 2016. In April 2017, when the kittens were approximately 5 months old, the dam was photographed with an adult male on three separate occasions. On 27 April 2017, the dam was photographed with one kitten that showed signs of hind limb ataxia. In May 2017, this female was photographed with one kitten.

Neither the female nor a kitten was photographed again by FWC until 22 November 2017, when what we suspect was the same female was documented with a new litter of at least two kittens. This suggested that her pairing with the male in April 2017 had resulted in a successful breeding event and a litter with an inferred birth date of 15 July 2017. Because kittens from this dam's first documented litter were estimated to have been born in November/December 2016, it is unlikely they would have reached independence by July 2017. Additionally, because that litter was never photographed after the age of 6 months, it is assumed that they did not survive.

The BRP female was photographed frequently with her second litter from late November 2017 to mid-February 2018. However, this female was also photographed with an adult male on 27 January 2018. On two occasions in April 2018, a kitten was photographed without the female, and on 23 April 2018, the female was photographed appearing to be late-term pregnant, indicating that the pairing with the male three months earlier once again resulted in pregnancy. In May 2018, the female was photographed showing nursed teats, once again verifying parturition before the previous litter had likely reached independence. That, in combination with the absence of photos of kittens > 9 months-of-age, suggests that the second litter also likely failed. The third litter was never photographed. This female was last documented on 16 May 2018.

Our experiences deploying grids of motion activated trail cameras, such as those used for this study, has attested to the fact that it is unlikely a female panther with a nearby den would suddenly shift its home range significantly enough to avoid detection. Nevertheless, we could not rule out this possibility entirely. The more parsimonious explanation was that this female died shortly after the last photograph, which would have also resulted in the failure of the third litter. In order to effectively assess the status of this female and others, a more systematic and extensive monitoring approach was necessary.

Methods

In March 2019, we began expanding our trail camera monitoring area to include: eastern BRP, private lands in Muse, Bob Janes Preserve, Caloosahatchee Regional Park, Telegraph Creek Preserve, Fisheating Creek Wildlife Management Area (FEC), Platt Branch Wildlife and Environmental Area, Highlands Hammock State Park, Avon Park Air Force Range (APAFR), Kissimmee Prairie Preserve State Park (KPPSP), and Sun 'n Lake Preserve (Figure 1). To detect panthers, Reconyx HC500 and Browning Strike Force HD Pro trail cameras were placed such that no 50-km² section within a study site would be without a camera. Cameras were deployed primarily along off-road vehicle trails or firebreaks, but occasionally on graded roads or well-used game trails. Cameras were typically attached to trees or other stationary objects approximately 60-cm above ground. When presence of females was confirmed or suspected, we used an adaptive monitoring approach by increasing the density of cameras in the vicinity to improve the probability of timely detection of breeding activity and documentation of kittens. As a result, monitoring effort was not consistent across the entire study area. Monitoring effort varied temporally at some study sites, especially APAFR and KPPSP, due to seasonal or logistical accessibility challenges.

Sex was determined for males by presence of testicles or penis sheath hairs and for females by absence of testicles, presence of nursed teats (including sign of previously nursed teats), or presence of dependent aged offspring. When females were photographed traveling with males, the male was considered independent aged if it was clearly significantly larger than the female, acknowledging the

fact that nearly independent males may be slightly larger than adult females. In some cases in which distinguishing criteria were not apparent, sex was determined by associating uniquely identifying characteristics with individuals for which sex had been determined from other images. Trail camera settings and placement were optimized to minimize motion blur and maximize probability of photographing sex-determining characteristics.

Detection rate was measured as the number of independent detections of adult panthers per 100 camera trap days at any given camera location. Any two detections were considered independent if they were separated temporally by ≥ 1 hour or if they could be incontrovertibly distinguished as two different individuals. An image of dependent aged offspring was only considered an independent detection if the offspring were photographed independently of an adult. Detection rates were only calculated for cameras that were deployed for at least 100 trap days. Camera trap data collected prior to 2019 were reviewed and included if trapping effort could be calculated; this added three additional properties to the study area: Hendrie Ranch, Duette Preserve, and Archbold Biological Station (Figure 1).

For comparative purposes, we also calculated detection rates for three camera trapping studies previously conducted south of the Caloosahatchee within the core panther breeding range. These study sites included: the Immokalee Ranch Study (FWC, in 2017-2018) in northeastern Collier County and southwestern Hendry County; the North Addition Lands Study (FWC in 2014) in northeastern Big Cypress National Preserve; and the Refuge Area Study (FWC and the Conservancy of Southwest Florida in 2011-2014) in the Florida Panther National Wildlife Refuge, Fakahatchee Strand Preserve State Park, and Picayune Strand State Forest.

Results

Data collection synopsis

From 1 March 2019 to 30 June 2020, cameras were deployed for ≥ 100 days at each of 112 Central Florida locations (Figure 1), yielding a monitoring effort of 30,679 camera trap-days. A total of 273,577 images were cataloged, including 1,916 panther images representing 390 independent detections (Table 1). An additional 108,662 archived images collected between 24 February 2014 and 1 March 2019 were also processed and cataloged, increasing the total number of camera locations to 121 and monitoring effort to 44,477 trap-days between 24 February 2014 and 30 June 2020. Monitoring effort over time is summarized in Table 2 and Figure 2.

Panther detections in Central Florida

Panthers were detected ≥ 1 time at 68 of 121 camera locations in Central Florida that were active for ≥ 100 trap days and 5 additional camera locations that were active for < 100 trap days. Female and/or dependent-aged panthers were detected at 34 of these camera locations. Detection rates at individual camera sites ranged from 0 to 20.5 panther detections/100 trap days, with a mean of 1.3 detections/100 trap days (Table 2). The mean detection rate for BRP cameras was 2.3 detections/100 trap days, which was the highest of all study sites in Central Florida. Excluding camera locations at which no panthers were detected, the mean rate for cameras north of the Caloosahatchee was 1.7 panther detections/100 trap days.

Females, dependent-aged panthers, and breeding activity in Central Florida

A total of 249 images of female panthers representing 51 independent detections were cataloged between 1 March 2019 and 30 June 2020. Two kitten photos were cataloged, representing 1

independent detection. No kittens were detected traveling with females. Males were detected paired with females on 2 occasions.

Female panthers at Babcock Ranch Preserve- Since the last photo in May 2018 of the adult female suspected of having 3 failed litters, there have been no detections of female panthers in western BRP through April 2020. However, images from October and December 2019 confirmed the presence of a different adult female panther in eastern BRP. While it is not possible to distinguish the two females in all images, some images show a marking on the inner right foreleg of the eastern BRP female that are absent in the western BRP female and could not have developed over time. Conversely, it is not possible to discern if the eastern BRP female is a distinct individual from a female recorded > 22 km to the northeast at Platt Branch in 2017 because photos were not of high enough quality to observe any potential distinguishing characteristics. The eastern BRP female has been recorded consistently in 2020 and was photographed with a male in April 2020.

Dependent-aged panther at Bob Janes Preserve- A single, dependent-aged panther < 6 months old was detected on Bob Janes Preserve in November 2019. It was not photographed with an adult and has not been documented again, hence there is currently no evidence it survived.

Female panther at Fisheating Creek- Photos from March 2020 confirmed the presence of an adult female panther at FEC. A distance of >20km along with short time intervals between the nearest BRP female and FEC female images make it unlikely to be the same individual. The FEC female was photographed with a male in March 2020.

Discussion and Conclusions

Of the 121 cameras deployed for ≥ 100 days in Central Florida, 44% failed to detect a panther. By comparison, only 4% of cameras deployed for studies in South Florida failed to detect panthers. Nevertheless, there were specific camera locations in Central Florida that had high detection rates. The pattern of detections at camera sites across Central Florida indicates panthers are distributed unevenly with some localities having higher abundances. Rudimentary comparisons to study data from core panther breeding range in South Florida provides some context to panther abundance documented in Central Florida. For instance, the Immokalee Ranch Study had panther detection rates that ranged from 0 to 13.2 detections/100 camera trap days with a mean of 4.1 detections/100 camera trap days (Table 2). In comparison summary data for sites in Central Florida revealed rates of 0-20.5 panther detections/100 camera trap days, but with a mean of 1.3 detections/100 camera trap days. Additional comparisons with studies in South Florida are presented in Table 2. We note the need to interpret these comparisons cautiously given the fact that cameras in Central Florida were deployed via an adaptive monitoring protocol when females were detected, hence this may increase associated detection rates.

Increased and systematic camera monitoring effort in Central Florida between 1 March 2019 and 30 June 2020 resulted in the documentation of 2 female panthers and 1 dependent-aged panther over 30,679 trap days. We also confirmed the absence of the original BRP female and her suspected litter from May 2018. Two actively monitored females were photographed paired with males in spring 2020. Because of the apparent high failure rate of litters born north of the Caloosahatchee River, detection of breeding activity should continue to be a priority for adaptive trail camera monitoring. It is plausible that breeding activity has and continues to occur on private lands in western Glades and southwestern Highlands County. Historical telemetry data has documented panthers utilizing these areas, but access

to private lands by FWC biologists or cooperative camera monitoring efforts with private landowners would enable a more complete understanding of panther occupancy and breeding activity. Communication with private landowners to inform them of the goals of this project and assess their willingness to permit access continues to be an objective of this research.

We caveat our findings by noting detection rates are a more accurate reflection of panther activity than panther abundance. However, if current levels of panther activity at BRP are sustained and if successful recruitment can be documented at BRP and FEC, it would suggest that eastern Charlotte County and western Glades County may support a reproductively viable portion of the panther population. The low detection rates and the absence of female detections at study sites north of State Road 70 suggest that this area of Central Florida may only be occupied by a small number of wide-ranging male panthers.

Notes

Three additional components of this research are not mentioned here: prey species monitoring, Felid Leukomyelopathy (FLM) monitoring, and images submitted by the public. Valuable camera trap data on non-target species, including panther prey, has been collected as bycatch during this research. All images collected through 30 June 2020 have been cataloged by species. Detection rates of non-target species will be included in the final report. However, because of the extensive labor involved in cataloging all non-target images, these will not be cataloged during year 2 of the study. All images will be retained, but only panther and bobcat images will be cataloged. Bobcat images have been determined to be useful in assessing presence/absence of FLM within the study area.

Many photos of panthers have been received from the public via the FWC Panther Sightings Website. While these photos are not associated with trapping effort and therefore cannot be included in analyses involving detection rates, they can be valuable for filling in knowledge gaps about occupancy of panthers in areas where FWC biologists do not have access. One instance involved a video of a female panther with two kittens that was posted online, purportedly recorded in September 2019 on private land east of BRP. At this point, the exact date, time, and location of the video has not been verified, but if it was the same female currently being monitored in eastern BRP, it would indicate that the litter failed, as no kittens were photographed with that female subsequently. It is possible that the kitten photographed on Bob Janes Preserve was one of these kittens. Another image of a female with two kittens was submitted, purportedly from Glades County, but neither the owner nor the location of the photo is known, therefore it cannot be verified. No other photos submitted to FWC provided incontrovertible evidence of females or breeding activity in Central Florida. We encourage continued submissions from private landowners, lessees, and other members of the public. A summary of images submitted by the public will be included in the final report.

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Table 1. Selected species identified via camera trapping by the Florida Fish and Wildlife Conservation Commission in Central Florida from 1 March 2019 to 30 June 2020 as part of increased monitoring to identify breeding activity and areas utilized by Florida panthers. Other species identified and cataloged but not included: Gray Fox, Eastern Spotted Skunk, Striped Skunk, Donkey, Goat, Domestic Cat, Flying Squirrel.

Species	Number of photos
Cattle (<i>Bos taurus</i>)	62,918
Feral Pig (<i>Sus scrofa</i>)	54,892
White-tailed Deer (<i>Odocoileus virginianus</i>)	42,042
Wild Turkey (<i>Meleagris gallopavo</i>)	34,942
Human (<i>Homo sapiens</i>)	30,591
Raccoon (<i>Procyon lotor</i>)	10,848
Coyote (<i>Canis latrans</i>)	5,753
Bobcat (<i>Lynx rufus</i>)	4,190
Armadillo (<i>Dasybus novemcinctus</i>)	2,251
Opossum (<i>Didelphus virginiana</i>)	2,173
Rabbit (<i>Sylvilagus spp.</i>)	2,149
Florida Panther (<i>Puma concolor</i>)	1,916
Squirrel (<i>Sciurus spp.</i>)	1,043
Domestic Dog (<i>Canis familiaris</i>)	805
Horse (<i>Equus caballus</i>)	408
Black Bear (<i>Ursus americanus</i>)	247
Alligator (<i>Alligator mississippiensis</i>)	99
Otter (<i>Lontra canadensis</i>)	41

Table 2. Summary of camera trapping effort by the Florida Fish and Wildlife Conservation Commission and detection rates at each study site in Central Florida from 2014 to 2020. Detection rates are measured as number of independent panther detections per 100 camera trap days. Data from camera studies completed in South Florida(*) from 2011 to 2018 are for comparative purposes.

Property	Camera Sites	Independent Detections	Trap Days	Maximum Detection Rate	Mean Detection Rate
Babcock Ranch Preserve	55	434	19123	20.5	2.3
Fisheating Creek + Platt Branch	41	74	11670	1.9	0.6
Avon Park Air Force Range	12	9	2610	1.0	0.3
Lee County Parks	14	16	2986	1.6	0.5
Highlands Hammock + Sun n Lake	6	12	1550	2.7	0.8
Kissimmee Prairie Preserve SP	11	8	2153	0.8	0.4
Muse Private Properties	4	0	980	0	0.0
Archbold Biological Station	1	1	1307	0.1	0.1
Duette Preserve	1	2	869	0.2	0.2
Hendrie Ranch	1	3	1229	0.2	0.2
Florida Panther NWR + Picayune + Fakahatchee*	88	3394	68076	11.3	5.0
North Addition Lands*	50	259	7851	16.1	3.3
Immokalee Ranch*	50	739	17986	13.2	4.1
Cumulative North of Caloosahatchee	146	559	44477	20.5	1.3
Cumulative South of Caloosahatchee*	188	4392	93913	16.1	4.7

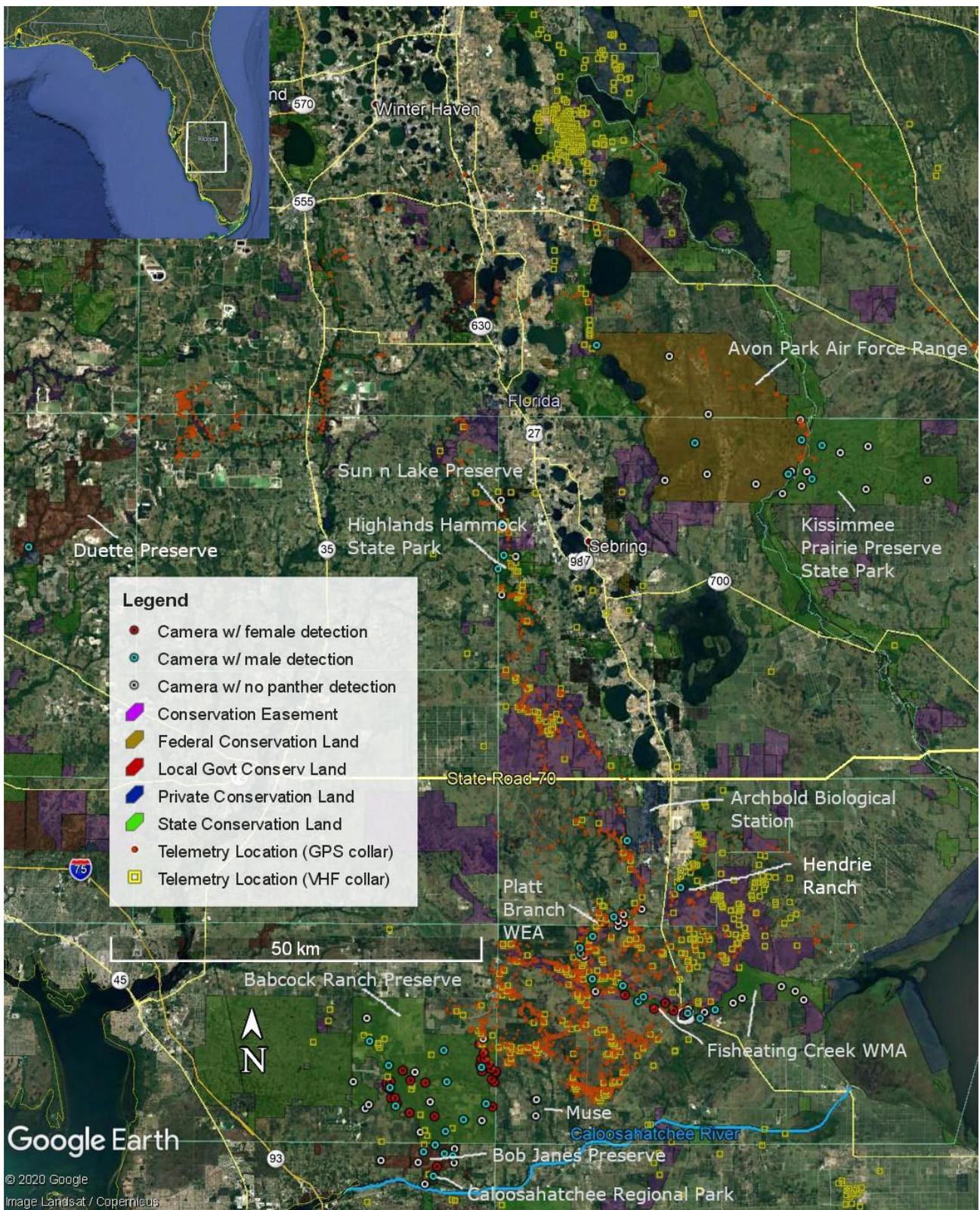


Figure 1. Study area for the assessment of Florida panther distribution in Central Florida by the Florida Fish and Wildlife Conservation Commission. Trail camera locations (2014-2020) and historical telemetry data (1988-2015) overlaid on study sites and Florida conservation lands. Note: all cameras with female detections (red circles) also detected males.

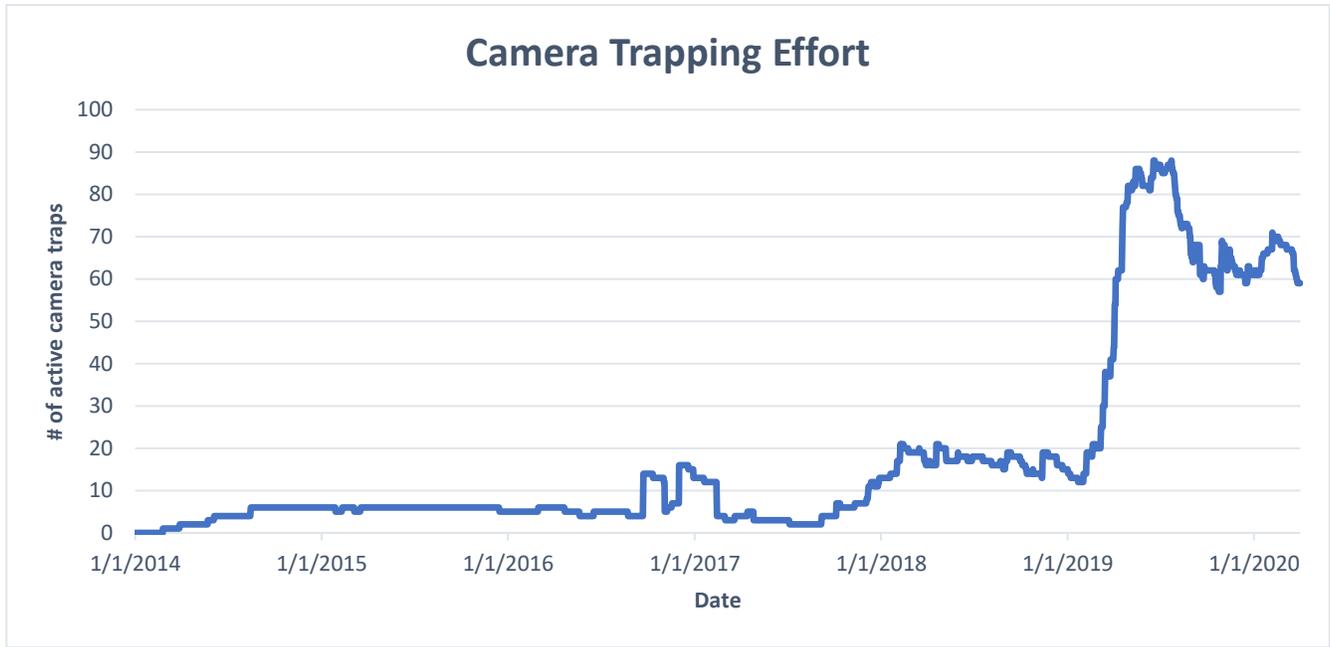


Figure 2. Number of active camera traps per day in areas of Central Florida north of the Caloosahatchee River (1 January 2014 to 1 April 2020).

**Appendix 1- Timeline of
Important Photo
Detections of Panthers**



1 November 2016
Confirmation of female at Babcock Ranch Preserve



15 March 2017
2 kittens photographed at Babcock



26 March 2017
Male and female photographed at Platt Branch WEA. Given that Babcock female had kittens at the time, this photo location was too far away to have been the same female.



11 April 2017
Male and female photographed at Babcock. This pairing resulted in female becoming pregnant and denning before current litter had reached independent age.



28 November 2017
Female with 2 new kittens at Babcock. This confirmed that first litter had failed.



27 January 2018
Male and female photographed together at Babcock. This once again resulted in a pregnancy, causing female to den before 2nd litter had reached independent age.



7 May 2018
Female at Babcock showing nursed teats, confirming a 3rd litter had been born before 2nd litter reached independent age. The 3rd litter was never photographed, and the female was last photographed 9 days later.



3 October 2019
A new female is confirmed at Babcock.



3 November 2019
A kitten is photographed at Bob Janes Preserve. No female was photographed with the kitten, and the kitten was never photographed again.



17 March 2020
A female is confirmed at Fisheating
Creek WMA and photographed with
a male.





20 April 2020
A suspected female is photographed with a male at Babcock.

Appendix 2- Timeline of Female and Breeding Events

Comprehensive list of photo events or inferred events associated with female panthers in Central Florida, 2015-2020. Only photos with verified dates and locations are included. Not all photos provided definitive evidence of sex.

Central Florida Female & Breeding Timeline

date	location	notes
1/20/2015	Babcock Ranch	unconfirmed female
4/25/2015	Babcock Ranch	unconfirmed female
4/30/2015	Babcock Ranch	unconfirmed female
5/26/2016	Babcock Ranch	unconfirmed female
9/30/2016	Babcock Ranch	unconfirmed female
10/3/2016	Babcock Ranch	unconfirmed female
11/1/2016	Babcock Ranch	confirmed female - pregnant
12/1/2016	Babcock Ranch	inferred date of birth of first litter
1/13/2017	Babcock Ranch	nursed teats
1/14/2017	Babcock Ranch	nursed teats
1/15/2017	Babcock Ranch	nursed teats
1/22/2017	Babcock Ranch	nursed teats
1/29/2017	Babcock Ranch	nursed teats
2/11/2017	Babcock Ranch	nursed teats
2/16/2017	Babcock Ranch	nursed teats
3/3/2017	Babcock Ranch	nursed teats
3/11/2017	Babcock Ranch	female
3/15/2017	Babcock Ranch	with 2 kittens
3/18/2017	Babcock Ranch	with 1 kitten
3/26/2017	Platt Branch	paired with adult male
3/29/2017	Babcock Ranch	nursed teats
3/30/2017	Babcock Ranch	1 kitten without dam
3/31/2017	Babcock Ranch	nursed teats
4/3/2017	Babcock Ranch	nursed teats
4/6/2017	Babcock Ranch	nursed teats
4/7/2017	Babcock Ranch	female
4/8/2017	Babcock Ranch	female
4/9/2017	Babcock Ranch	female
4/11/2017	Babcock Ranch	paired with adult male
4/13/2017	Babcock Ranch	paired with adult male
4/14/2017	Babcock Ranch	female
4/15/2017	Babcock Ranch	paired with adult male
4/15/2017	Babcock Ranch	female
4/17/2017	Babcock Ranch	female

4/20/2017	Babcock Ranch	female
4/22/2017	Babcock Ranch	female
4/24/2017	Babcock Ranch	female
4/25/2017	Babcock Ranch	female
4/26/2017	Babcock Ranch	female
4/27/2017	Babcock Ranch	with 1 kitten
5/5/2017	Babcock Ranch	female
5/7/2017	Babcock Ranch	female
5/8/2017	Babcock Ranch	female
5/10/2017	Babcock Ranch	female
5/11/2017	Babcock Ranch	female
5/14/2017	Babcock Ranch	with 1 kitten
6/5/2017	Babcock Ranch	female
7/7/2017	Babcock Ranch	female
7/15/2017	Babcock Ranch	inferred date of birth of 2nd litter
8/17/2017	Babcock Ranch	nursed teats
11/22/2017	Babcock Ranch	with 2 kittens
11/26/2017	Babcock Ranch	with 2 kittens
11/28/2017	Babcock Ranch	with 2 kittens
12/2/2017	Babcock Ranch	female
12/5/2017	Babcock Ranch	with 2 kittens
1/13/2018	Babcock Ranch	with 2 kittens
1/24/2018	Babcock Ranch	female
1/27/2018	Babcock Ranch	paired with adult male
1/29/2018	Babcock Ranch	with 2 kittens
1/30/2018	Babcock Ranch	with 2 kittens
2/6/2018	Babcock Ranch	female
2/7/2018	Babcock Ranch	female
2/9/2018	Babcock Ranch	with 2 kittens
2/10/2018	Babcock Ranch	with 2 kittens
2/12/2018	Babcock Ranch	with 2 kittens
3/10/2018	Babcock Ranch	female
3/27/2018	Babcock Ranch	female
4/7/2018	Babcock Ranch	kitten without dam
4/20/2018	Babcock Ranch	kitten without dam
4/23/2018	Babcock Ranch	pregnant
4/27/2018	Babcock Ranch	inferred date of birth of 3rd litter
5/7/2018	Babcock Ranch	nursed teats
5/13/2018	Babcock Ranch	nursed teats
5/16/2018	Babcock Ranch	female
10/3/2019	Babcock Ranch	possible nursed teats
11/3/2019	Bob Janes	kitten without dam
12/8/2019	Babcock Ranch	female
12/17/2019	Babcock Ranch	female

12/18/2019	Babcock Ranch	female
12/19/2019	Babcock Ranch	female
12/20/2019	Babcock Ranch	female
12/22/2019	Babcock Ranch	female
12/28/2019	Babcock Ranch	female
1/13/2020	Babcock Ranch	female
2/22/2020	Babcock Ranch	female
2/24/2020	Babcock Ranch	female
3/17/2020	Fisheating Creek	paired with adult male
3/21/2020	Babcock Ranch	female
4/5/2020	Fisheating Creek	female
4/10/2020	Babcock Ranch	female
4/11/2020	Babcock Ranch	female
4/13/2020	Babcock Ranch	female
4/14/2020	Babcock Ranch	female
4/15/2020	Babcock Ranch	female
4/16/2020	Babcock Ranch	female
4/20/2020	Babcock Ranch	paired with adult male
4/22/2020	Babcock Ranch	female
5/2/2020	Fisheating Creek	female
5/13/2020	Babcock Ranch	female
5/29/2020	Babcock Ranch	female
6/4/2020	Babcock Ranch	female