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Comparing Methods of Monitoring Nesting Success of Florida Bay's Roseate Spoonbills: Mark/Revisit Versus Camera Traps

JEROME J. LORENZ, MAC STONE, ALEXANDER BLOCHEL, EMILY JOHNSON, PARKER DENTON, ERIC CLINE, MARK I COOK

Nesting Locations and Regional Primary Foraging Locations

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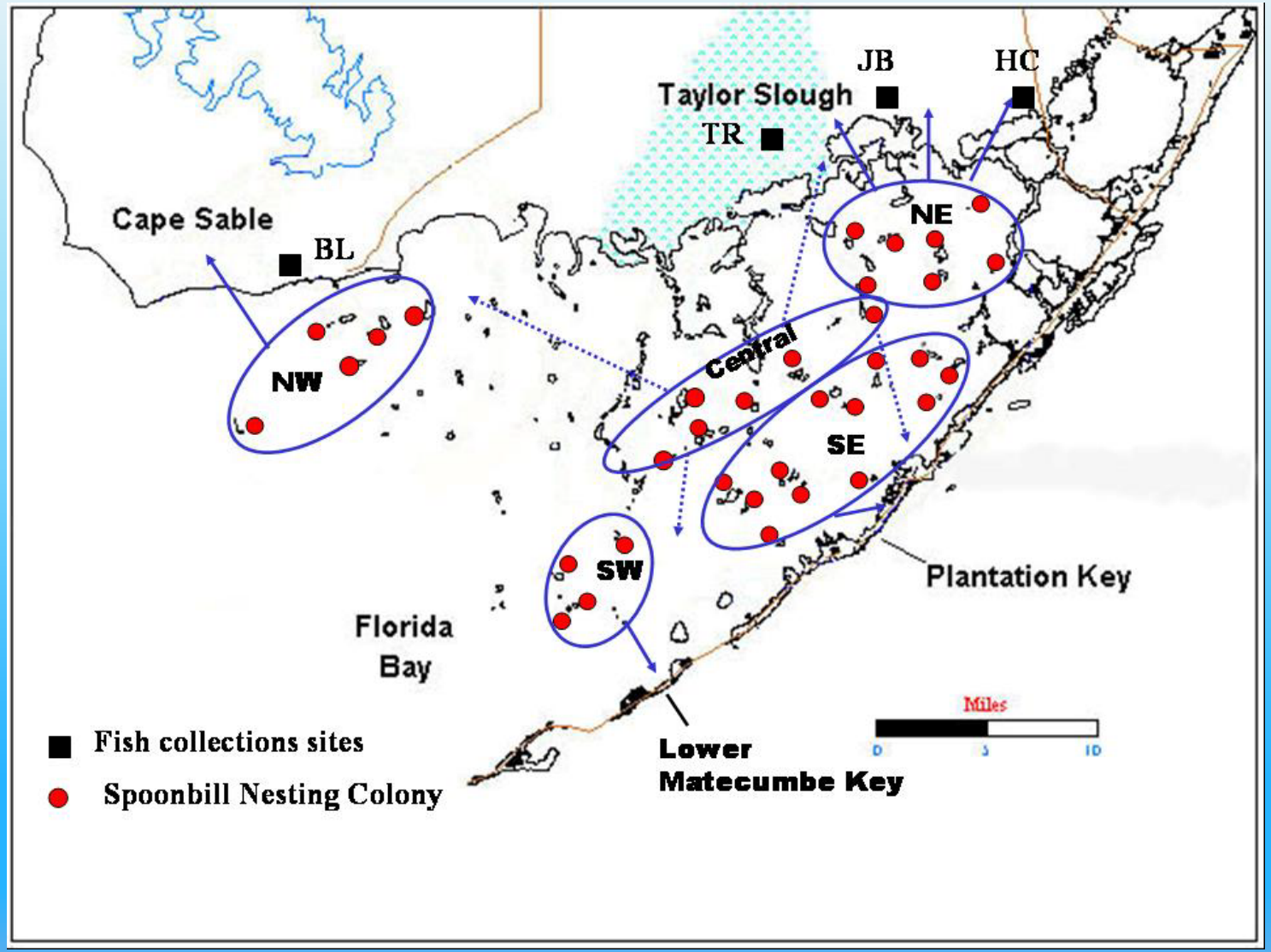
Physical Survey Methods of Wading Bird Colonies in Florida Bay were Established in late 1980's

- All keys that ROSP ever nested on from 1935 to present were surveyed every year
  - 34 Keys in 2004
- Bay divided into five regions based on primary foraging grounds for each region
- Nest initiation was consistently between Nov 1 and Dec 31 for all years surveyed from 1935 to 2000 (Alvear 2000)
  - All nesting completed and surveys terminated usually by end of March
- Keys that hadn't been used in last 10 years visited 3 times a year
- Keys active within 10 years visited every 30 days



Map from 2004 South Florida Wading Bird Report

Spoonbill Nest Monitoring Protocol

Photo: Mac Stone

- When ROSP nests found they were tagged for re-visitation
- Colonies ranged in size from 1 or 2 nest to the largest colonies having 150-200 nests
- Large colonies (>50 nests) tended to nest in “packets” of high nest density
  - Tagged a “representative” subset
  - Somewhat arbitrary and based on wading bird disturbance and chick safety
  - Tried to limit time to 15 minutes in one “packet” area and overall in a colony to <1 hour

Spoonbill Nest Monitoring Protocol

- Revisited active colonies on a 10-14d cycle to evaluate nest content
  - Recorded nest contents and estimated age (post–hatch) of chick based on size
  - Marked and recorded contents of all new unmarked nests

- Terminated surveys when all nests within a colony either failed or chicks reach 21d
  - At 21d “nestlings” become “branchlings” and move from the nests and the nest is considered a success

Photos: Mac Stone

Primary Target Parameters

- **Hatch Date: Date and time first egg hatched for each nest**
- **Production: Number of chicks to make it to 21d post hatch (presumed branchling phase) in each nest**
- **Percent Success: Percentage of nests in each colony that had at least 1 chick survive to 21d.**

Changes in Nesting and Foraging Patterns Due to SLR

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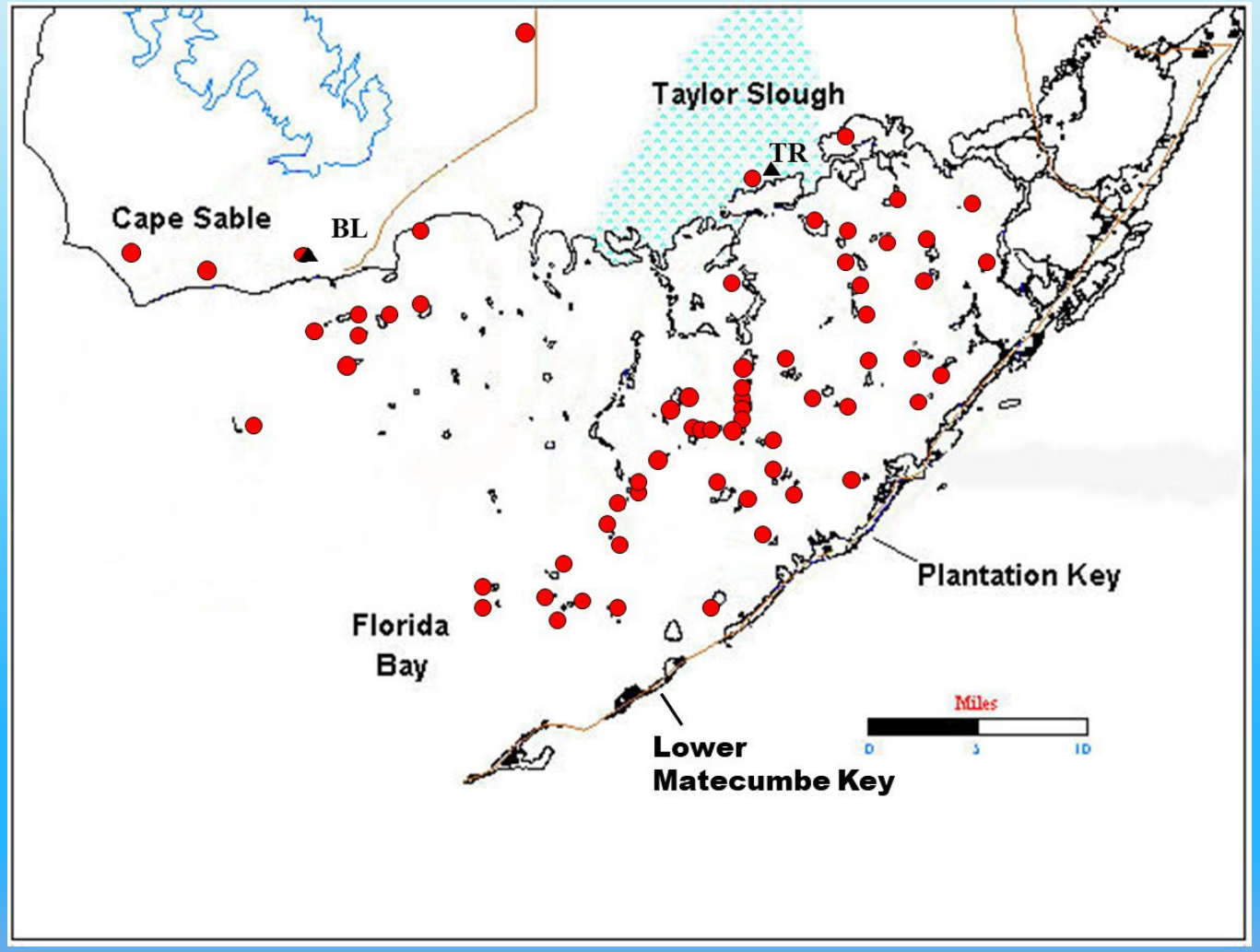
Nesting Locations in 2020



- Beginning in about 2000 SLR raised water levels on primary foraging grounds
- Eliminated reliable high quality foraging patches on the primary foraging grounds
- Because food resources were unreliable synchronous nesting deteriorated as cues to where and when to start nesting become less apparent
  - Nesting success abysmally low in 1990's
  - Total colonies nearly doubled (65 in 2020)
  - Nest numbers plummeted from about 500 in early 2000's to less than <200 after 2020
  - Colony size much smaller:
    - 25 nests was a large colony
  - Nesting initiated as late as March

Effort and costs of surveys greatly increased

- Cost in time and effort
  - More colonies to visit with fewer nests
  - Smaller colonies harder to locate once on Key
  - Much longer survey period (Nov-May or even June)
- Cost in dollars
  - Triple the boat time each season
  - More employees for longer periods
- **Increased disturbance to all nesting wading birds**
  - **Increased morbidity in chicks**

Photo: Mac Stone

Four year study to determine if trail cameras could be used to reduce effort, cost and disturbance

- **Purchased 40 Browning Special Ops Edge Trail Cameras in 2020 and 2021**
- Selected because of affordability not performance
- **Began by deploying 13 (pilot study) in 2020-21 nesting season**
- **Ideally deployed during incubation period but would place cameras on nests with chicks**
- **Continued physical survey protocol**
- **Double blind data processing**
- One team doing surveys and deploying cameras
- One team processing photographic data

Camera Deployment and Settings

- **Cameras clamped to tree branches with view of active nests**
- This, surprisingly, limited which nests could be included
- **Motion activated with a ten minute reset after each picture was taken**
- **Left in place for duration of nesting cycle**
- **Based on pilot study set targets of 40%, 50% and 60% coverage in 3 largest colonies**
- Proved unattainable due to temporal asynchrony of nesting within a colony
- **94 active nests throughout Florida Bay were equipped with cameras over 4 year period**

Photo: Mac Stone

Camera Performance

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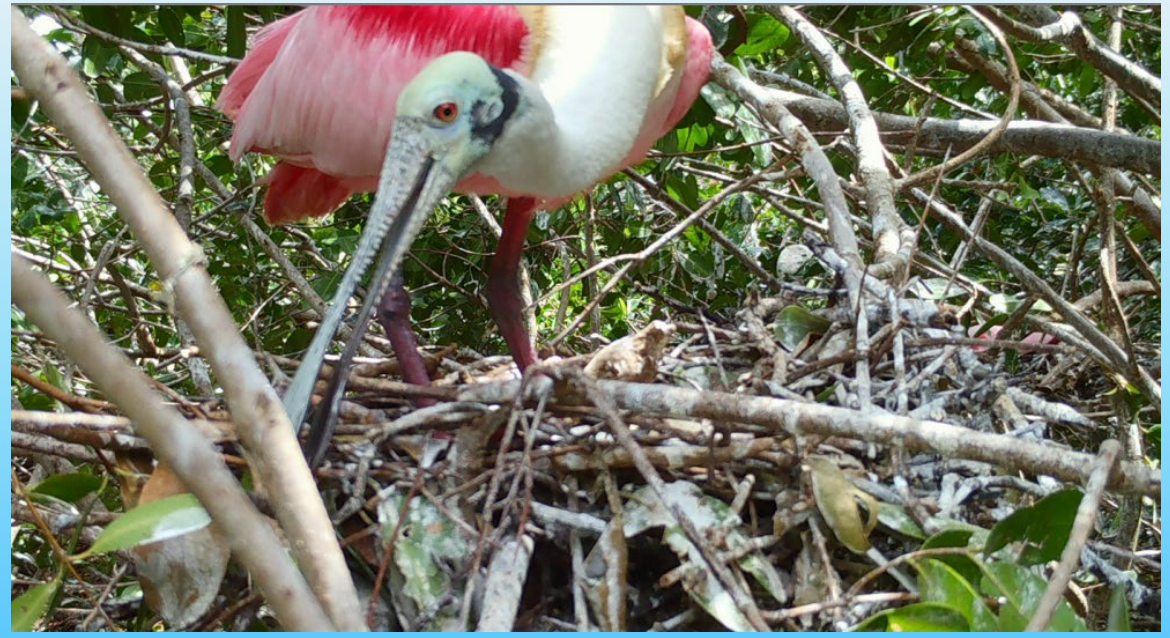
Manufacturer Malfunctions

- Only 6 cameras failed by not taking pictures or only a few (94% success)
- Annoying Programing
  - Time Warp: Most cameras turned off on Jan 31 at 23:59 and skipped the next 48 hours turning back on at 00:01 on Feb 3
  - Some also skipped April Fools Day (no kidding)
    - This occurred 28 times during critical nesting periods and in 10 cases resulted in partial loss of data (hatch dates, causes of mortality)
  - Several also failed to turn off IR during the day rending everything pink
  - Pixilation

Deployment Malfunctions: Poor Placement



Deployment Malfunctions: Mount Failure

Photo: Mac Stone

Deployment Malfunctions: Mount Failure

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Deployment Malfunctions: Mount Failure

Deployment Malfunctions: Disturbance

Camera Malfunctions Quantified

Loss of Data	Manufacturer Malfunction	Bad Placement	Failed Mount	Disturbed	Total
All	6	0	3	4	13
Partial	10	13	2	7	29

- 13 Cameras resulted in no usable data
- 29 additional partial loss but could estimate most if not all target parameters
- Reduced total number nesting cycles with photographic record to 81
- Learning curve: got better with experience

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- Reduced total number nesting cycles with photographic record to 81
- Learning curve: got better with experience
- Many times deployment issues were noticed and corrected during surveys but that defeats the purpose of the project: eliminate surveys

Nest to nest comparisons: Hatch date example

Year	Colony	# of Nests	Survey Est. Hatch Date	Camera Hatch Date	Difference
2020-21	C. Jimmie	4	26-Jan-21	26-Jan-21	0
2020-21	N.Nest	5	26-Jan-21	26-Jan-21	0
2020-21	Pigeon	4	26-Jan-21	26-Jan-21	0
2020-21	Diamond	5	1-Apr-21	31-Mar-21	0
2021-22	C. Jimmie	2	2/6/22	2/8/22	2
2021-22	Calusa	1	3/13/22	3/10/22	-3
2021-22	Lil Black Betsy	5	3/27/22	3/28/22	1
2021-22	Little Calusa	4	3/28/22	3/28/22	0
2021-22	Diamond	19	3/29/22	3/30/22	1
2022-23	Calusa	2	18-Feb-23	19-Feb-23	1
2022-23	C. Jimmie	1	28-Feb-23	25-Feb-23	-3
2022-23	East	1	25-Feb-23	27-Feb-23	2
2022-23	Little Black Betsy	4	17-Feb-23	16-Feb-23	-1
2022-23	Little Calusa	3	5-Feb-23	19-Feb-23	14
2022-23	Little First Mate	1	29-Jan-23	30-Jan-23	1
2022-23	Manowar	1	6-Feb-23	3-Feb-23	-3
2022-23	Pollock	2	31-Jan-23	4-Feb-23	4
2022-23	South Twin	2	29-Dec-22	31-Dec-22	2
2022-23	Sandy	4	31-Jan-23	29-Jan-23	-2
2022-23	Stake	1	27-Jan-23	30-Jan-23	3
2023-24	Alligator Point	3	2/17/2024	2/24/24	7
2023-24	Captian	1	2/2/2024	1/31/24	-2
2023-24	Clive	5	2/28/24	2/28/24	0
2023-24	Diamond	1	DNH	DNH	0
2023-24	Lil Betsy	4	2/14/24	2/12/24	-1
2023-24	Little Calusa	3	1/7/24	1/16/24	9
2023-24	Palm	3	DNH	DNH	0
2023-24	Sandy	3	1/12/24	1/10/24	-2

- 24 of 28 colonies had estimated hatch dates within 3 days of those recorded in photos
- The mean difference for those 24 colonies was zero days different

Photo: Mac Stone

Summary of camera to survey comparisons for individual nests

- Cameras were better and more precise than surveys in estimating Hatch Date but both were accurate enough given asynchrony of nest timing

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Summary of camera to survey comparisons for individual nests

- Cameras are better and more precise than surveys in estimating Hatch Date but both are accurate given asynchrony of nest timing
- Both methods were nearly identical in estimating Percent Success
- Cameras were better at estimating production but the differences were marginal
  - Only different when branchlings fled from surveyors

Hatch Colony to Colony comparison

Year	Colony	Total nests	# Marked Nests	% total nests marked	Survey Est. Hatch Date	# of Cameras	% total nests w/ Cameras	Camera Hatch Date	Difference
2020-21	C. Jimmie	27	26	96%	19-Jan-21	4	15%	26-Jan-21	8
2020-21	N.Nest	26	24	92%	21-Jan-21	5	19%	26-Jan-21	5
2020-21	Pigeon	12	12	100%	25-Jan-21	3	25%	26-Jan-21	2
2020-21	Daimond	13	12	92%	6-Apr-21	5	38%	31-Mar-21	5
2021-22	C. Jimmie	3	3	100%	2/1/2022	1	33%	2/8/22	7
2021-22	Calusa	5	5	100%	1/25/2022	1	20%	3/10/22	44
2021-22	Lil Black Betsy	9	9	100%	3/27/2022	5	56%	3/28/22	0
2021-22	Little Calusa	11	11	100%	2/10/2022	3	27%	3/28/22	45
2021-22	Diamond	37	37	100%	3/30/2022	17	46%	3/30/22	1
2022-23	Calusa	7	7	100%	25-Jan-23	2	29%	19-Feb-23	25
2022-23	Central Jimmie	1	1	100%	28-Feb-23	1	100%	25-Feb-23	3
2022-23	East	5	5	100%	27-Feb-23	1	20%	27-Feb-23	0
2022-23	Little Black Betsy	7	7	100%	19-Feb-23	2	29%	16-Feb-23	3
2022-23	Little Calusa	6	6	100%	24-Jan-23	4	67%	19-Feb-23	26
2022-23	Little First Mate	13	13	100%	9-Feb-23	1	8%	30-Jan-23	10
2022-23	Manowar	5	5	100%	11-Feb-23	1	20%	3-Feb-23	8
2022-23	Pollock	5	5	100%	21-Jan-23	2	40%	4-Feb-23	14
2022-23	South Twin	3	3	100%	29-Dec-22	2	67%	31-Dec-22	2
2022-23	Sandy	16	15	94%	26-Jan-23	4	25%	29-Jan-23	3
2022-23	Stake	2	2	100%	4-Feb-23	1	50%	30-Jan-23	5
2023-24	Alligator Point	4	4	100%	17-Feb-24	3	75%	24-Feb-24	7
2023-24	Captain	5	5	100%	1-Feb-24	1	20%	31-Jan-24	1
2023-24	Clive	16	16	100%	25-Feb-24	5	31%	28-Feb-24	3
2023-24	Lil Betsy	5	5	100%	14-Feb-24	4	80%	12-Feb-24	2
2023-24	Diamond	12	12	100%	DNH	1	8%	DNH	0
2023-24	Lil Calusa	5	5	100%	16-Jan-24	3	60%	16-Jan-24	0
2023-24	Palm	11	11	100%	17-Jan-24	3	27%	DNH	0
2023-24	Sandy	21	21	100%	24-Jan-24	3	14%	7-Feb-24	0
Totals/Me	28	292	287	98%		88	30%		8

- At the colony level only one survey had less than 90% of the nests marked but cameras coverage was rarely above 40%

Hatch Colony to Colony comparison

Colonies	Total nests	# Marked Nests	% total nests marked	# of Cameras	% total nests w/ Cameras	Days Different
28	292	287	98%	88	30%	8

- Only 15 of 28 colonies had estimated hatch dates within 3 days of those recorded in photos
- 6 colonies had a difference of >10d (10,14, 25, 26, 45, 45)
- Simply did not have enough camera coverage to accurately estimate colony hatch date

Summary of colony to colony comparison

Percent Success

- Cameras reported 100% success 11 times while surveys only had 4
- Percent success estimates for each method were within 20 percentage points only 9 times

Production

- Production estimates at the colony scale varied greatly between methods
- 12 of 28 colony production estimates differed by more than 0.5 C/N
  - 6 of those were 1 C/N or more different
- Very troubling given that 1 C/N is the criterion for a successful nesting attempt.

Summary of results

- Cameras more accurate than surveys at the scale of individual nests but small sample size limited the accuracy of scaling up to the colony or regional level

Lessons learned: methods for better success

1. Get better cameras (and mounts) with cellular telemetry
   A. May limit use on some keys in central Florida Bay
   B. Initial visit: place cameras on all active nests
2. Continue to return to active colonies on a 7-10 cycle
   A. Use telemetry to check placement of all cameras in the colony in advance of visit
   B. Target nests with cameras out of alignment, ignore those providing good pictures (i.e., no mirror pole surveys: takes too much time)
   C. Count, mark and deploy cameras on any new nests
   D. Take down cameras that have completed the nesting cycle
      i. Allows use as new nests are initiated (asynchrony)

         a. Apple “Center Stage” Technology?
         b. Band nestlings when eligible size?

Photo: Mac Stone

Ancillary information of ecological importance

- Causes of nest failure and mortality
  - Predators
    - Eagles, Vultures, Crows, Raccoon, Rats,
    - Kelptoparasitism from other wading birds

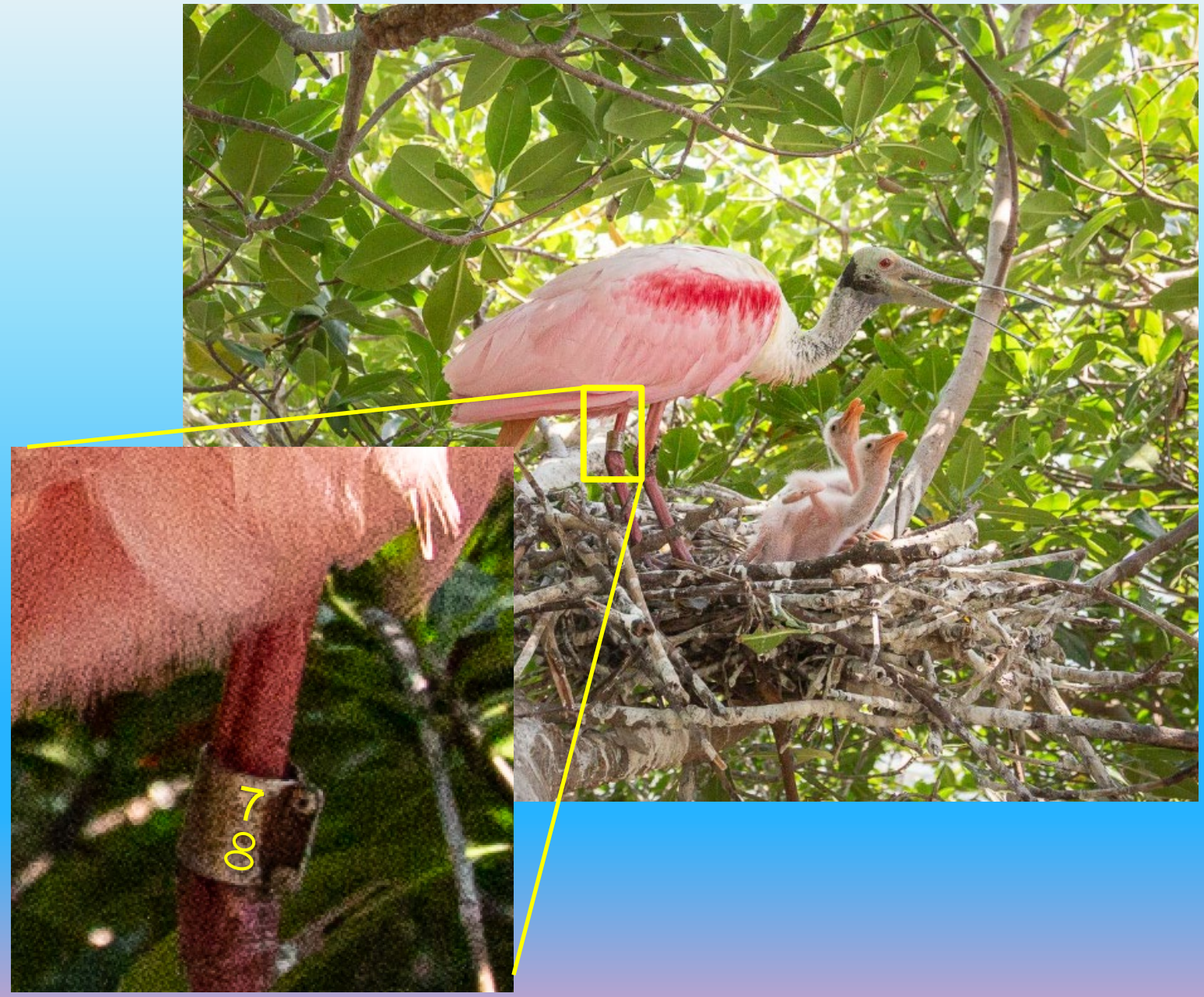
Ancillary information of ecological importance

- Unanticipated ancillary information outside of nest timing and success
  - Causes of nest failure and mortality
    - Predators
  - Band detection

Photo: Mac Stone

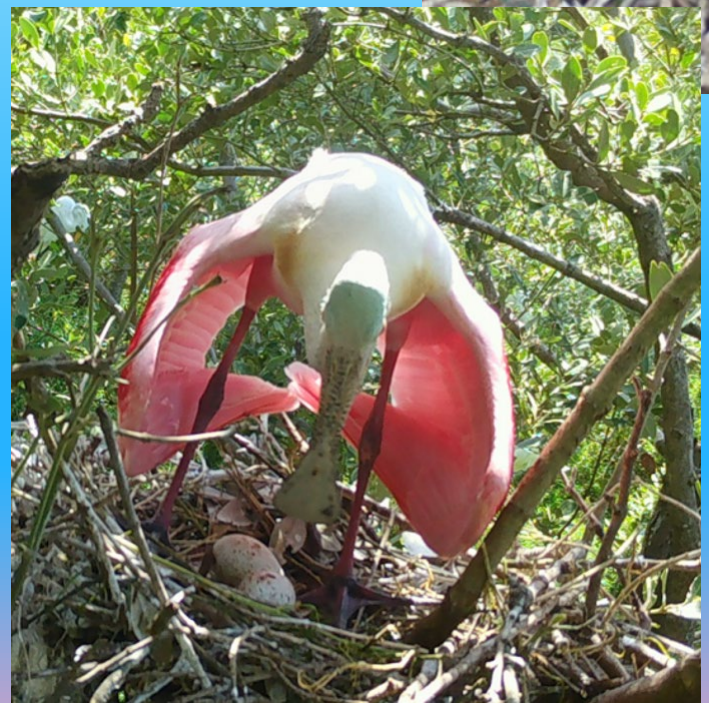
Ancillary information of ecological importance

- Prior to our banding program the oldest documented roseate spoonbill in the wild was 7 years old
- “78” was banded in 2003 and was more than 18 years old when it was photographed nesting on Black Betsy Key in 2022
- 10 Adult nesting birds were banded and 7 of them were 14 years older or older
  - Most birds still nesting in Florida Bay were hatched in the good old days



Ancillary information of ecological importance

- Unanticipated ancillary information outside of nest timing and success
  - Causes of nest failure and mortality
    - Predators
  - Band detection
  - Previously undocumented behaviors



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Thank you and Goodbye!

(for now?)