

# Thousands of Images and the Big Picture

Site-specific Long-term and  
Seasonal Monitoring using  
Wildlife Camera Trapping and  
Semi-Automated Object  
Counting in Remote Locations

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# Mission

## **Reduce the MCAS Iwakuni Risk Profile**

- **MCAS Iwakuni located on Seto Sea, Japan**
- **Numerous factors contribute to installation risk profile**
- **NRP identified as a “Major Aggregating Feature” in the 2018 WHA.**
- **Monitor efficacy of BASH team interventions and acoustic deterrent deployment**
- **Compare bird survey data to previous surveys supporting the MCAS Iwakuni WHA (July 2016 through July 2017).**
- **Assess efficacy for high risk bird species at NRP**

# Why is NRP Important?

- 54 acre / 22 Ha retention pond
- Adjacent to T/O area of Runway 2/20
- Foraging area for a large number of high-risk bird species (ospreys, cormorants, herons, egrets, ducks)
- Mostly freshwater, prey base (carp, mullets)
- Variety of depths, exposed mudflats, screening habitats
- Part of network of bird movements



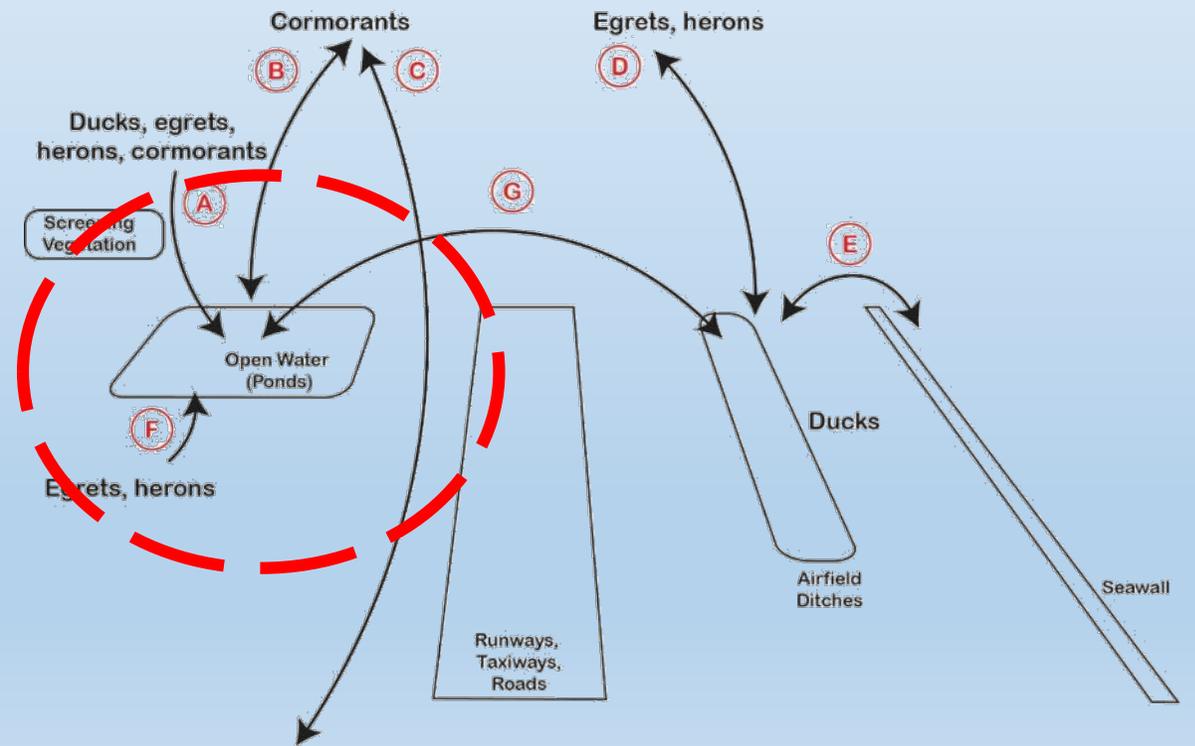
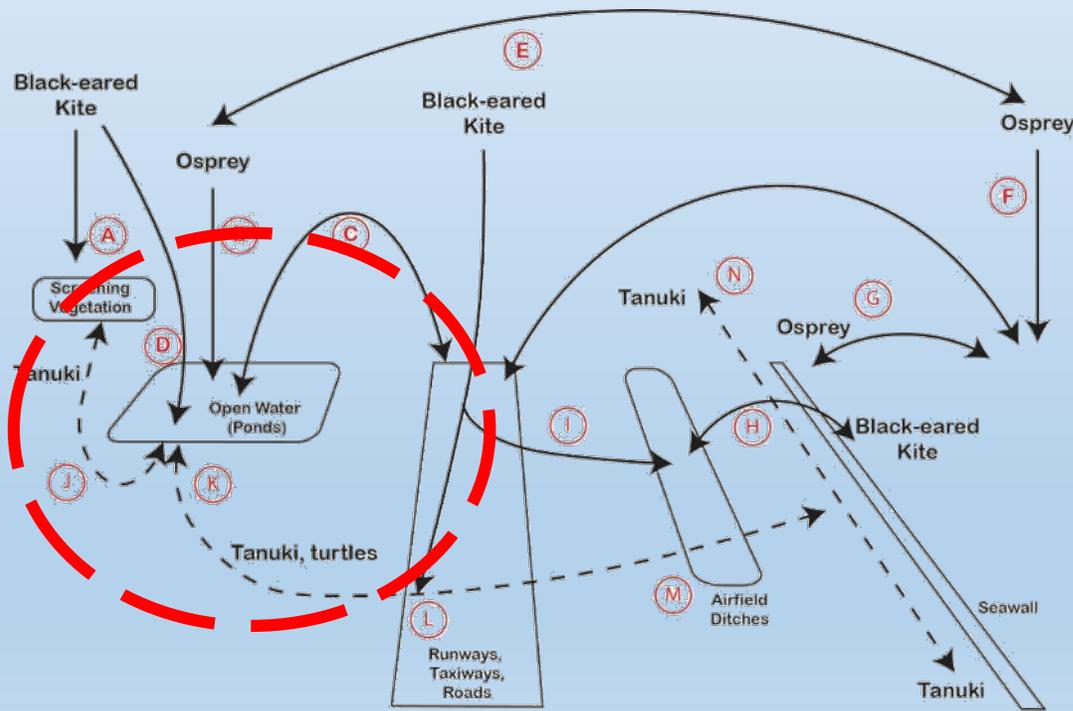


# North Pond: Conceptual Ecological Model



For Raptors (black-eared kites, Ospreys)

For Waterbirds (ducks, cormorants, egrets, herons)



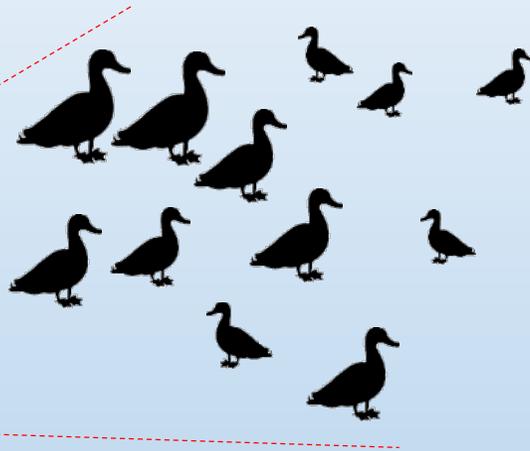
**North Pond is an important habitat feature for major high-risk species groups— raptors and waterbirds**

# Monitoring: 2016-2017 Data, General Avian Surveys

# Bird Strike 2019

- Provide an overview of the Risk Profile at MCAS Iwakuni
- Present field methods for monitoring remote locations using index surveys and wildlife cameras
- Present post-field methods for processing large volumes of photos (~10,000) to compare semi-autonomous counting and manual counting
- Present further refinements for machine learning improvements using MatLab software

# Monitoring: Wildlife Cameras, Periodic Photo Bird Counts, Untreated (2018) and Treated (2019)



Reconyx cameras programmed to capture images every 60 minutes. Use software to count birds, build database. Compare 2018 untreated results to 2019 treated results.



Reconyx 1: Shallow mudflats  
Reconyx 2: Deeper, open water, with mudflats  
Reconyx 3: Airfield ditch, untreated, displacement (?)



## Camera Placement Positions

- Camera 1: captures mudflats and former phragmites stands
- Camera 2: captures mudflats and open water
- Camera 3: Airfield Ditch at Romeo 4

# Camera Assembly

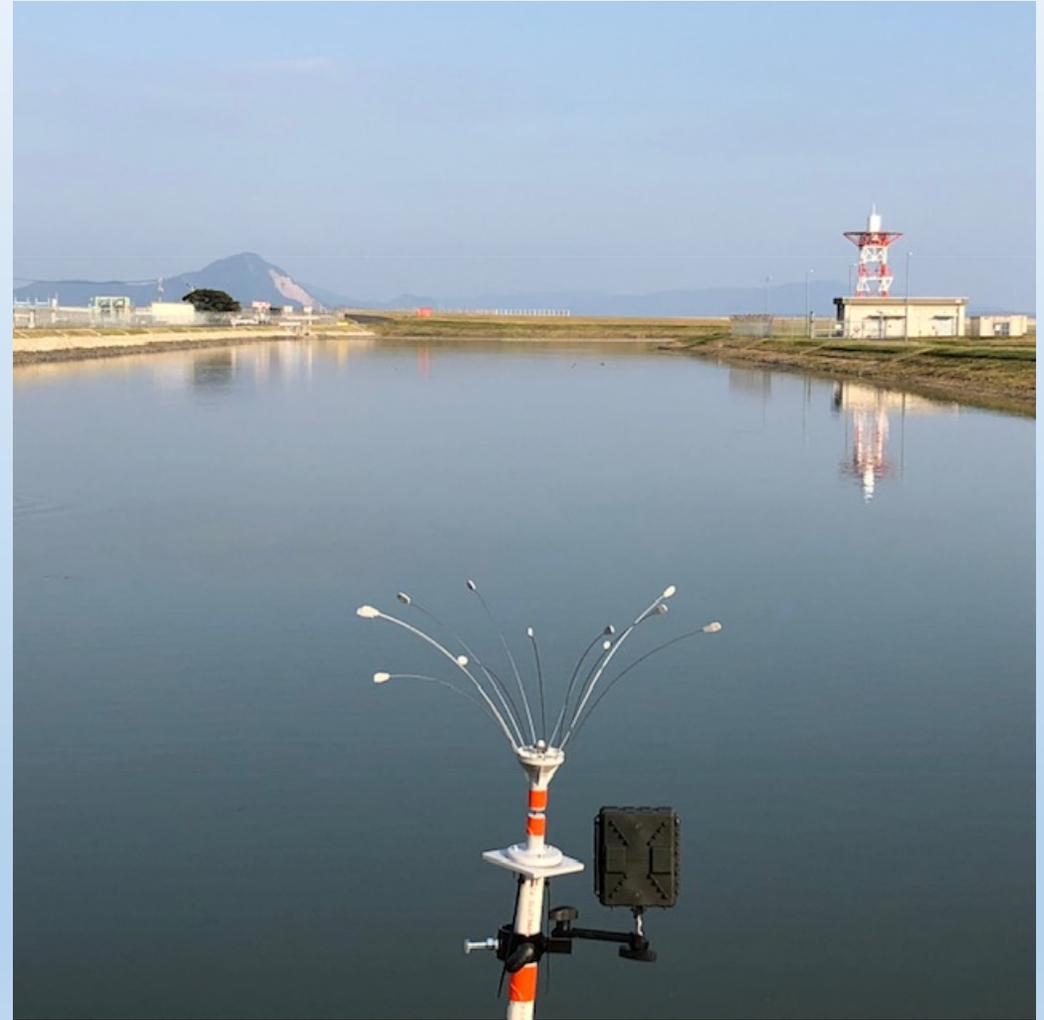
- Picture left shows fully assembled units, note perch deterrent on top, ballasted bucket (25 kg), and airfield orange coloring. Reconyx cameras are using PVC pole attached universal mounts. Cameras capture images every 30 minutes stored on 16GB SD cards.
- Picture right shows assembly space.
- Each camera powered by 10 AA lithium batteries



# Camera 1



# Camera 2



# Camera 3





Hmm... Let's see... 1 picture every 30 minutes is 48 per day....

...OK... 48 pictures per day times 30 days in a month... times 12 months... is...

...Hold on... not too good at math... errr... where's my calculator.... Oh yeah, 3 cameras...

**Wait!!!**  
That's 51,840 images!!!

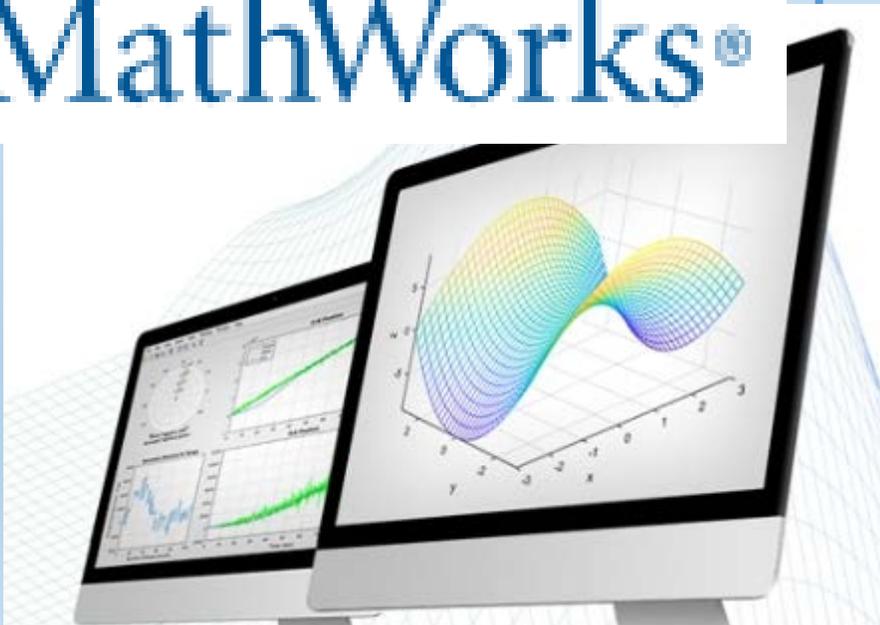
What now?

必要は発明  
の母!

My name is  
"Necessity"  
Meet my baby:  
"Invention"

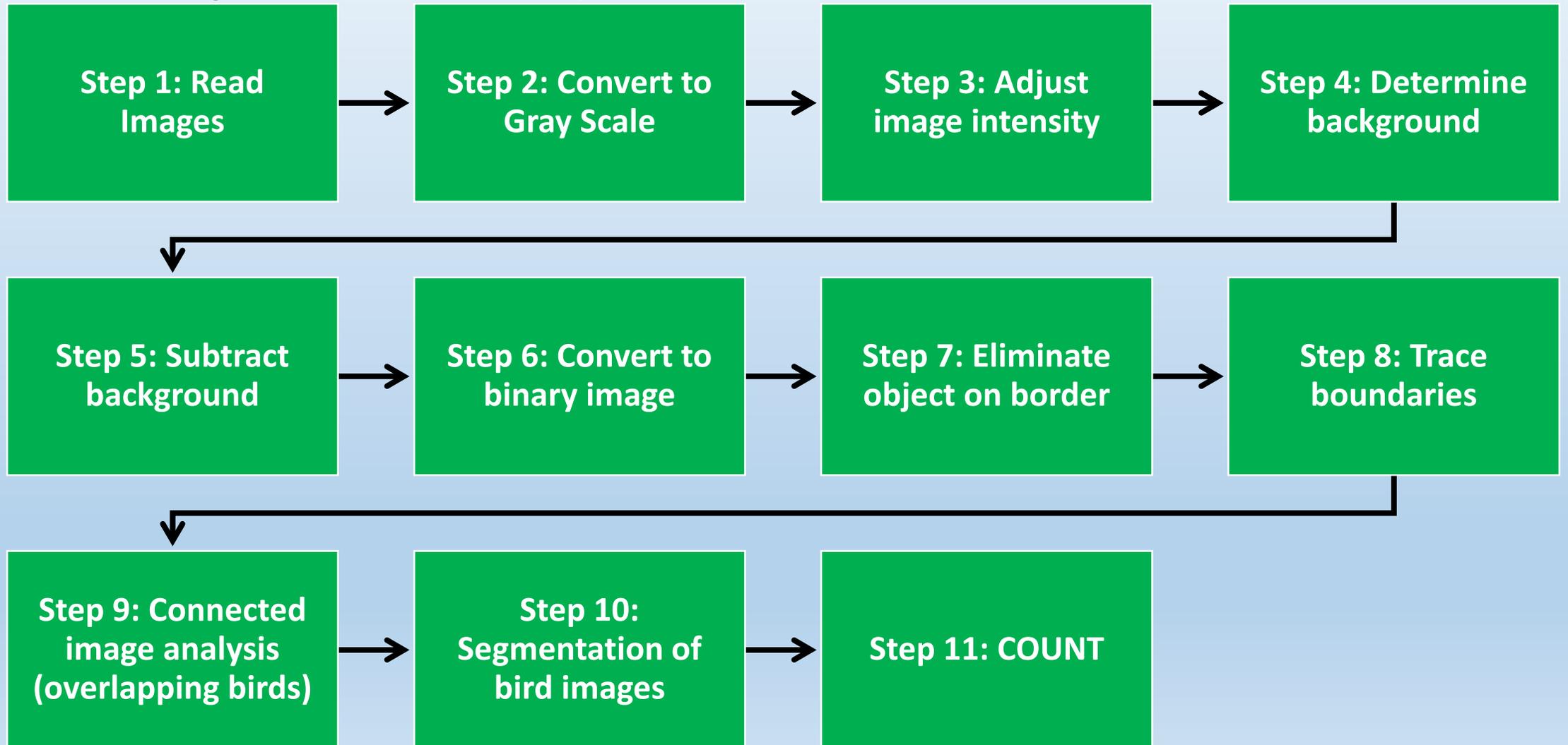


# MATLAB

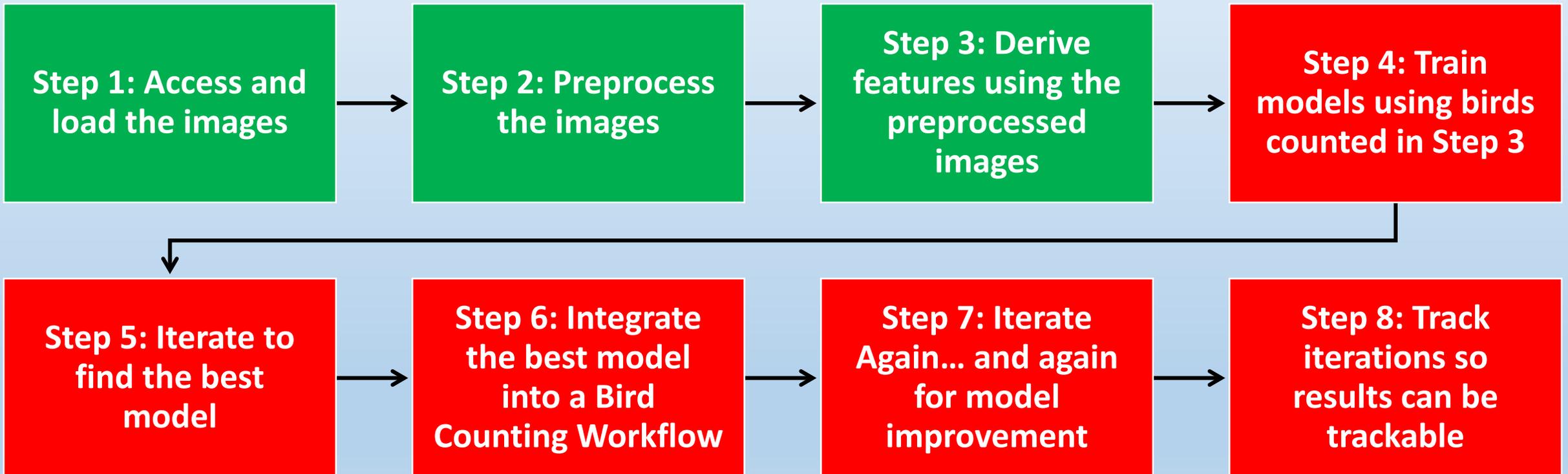


- Platform to analyze data, develop algorithms and create mathematical models
- Specific modules provide coding environment for image analysis
- Ready to go function lists to assist in counting objects

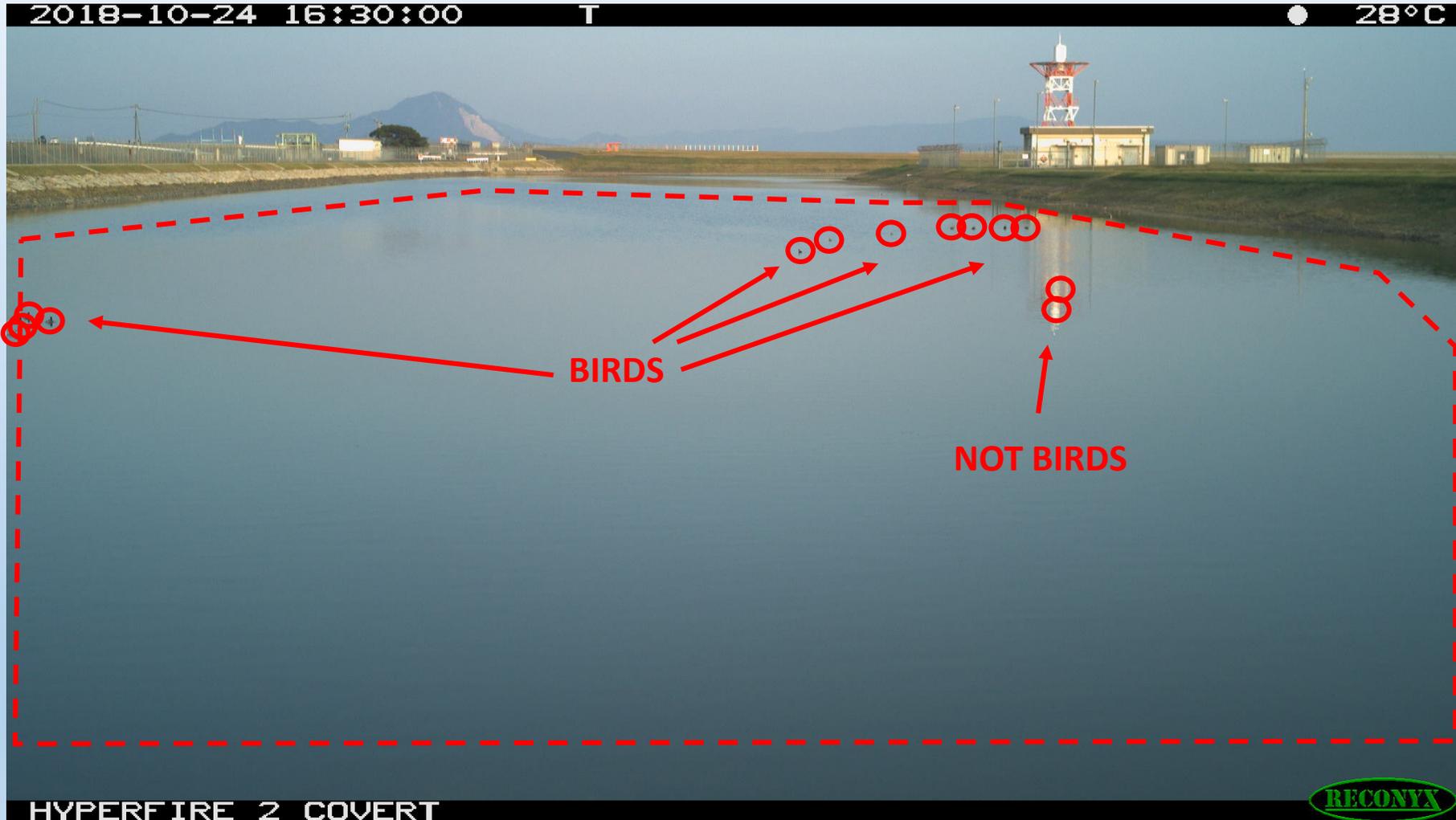
# Image Processing Steps to Count Birds (11 Step Overview)



# Basic Machine Learning Process for Counting Birds (8 Step Overview)



# Count Outputs from Camera 2: 1630 24 October 2018



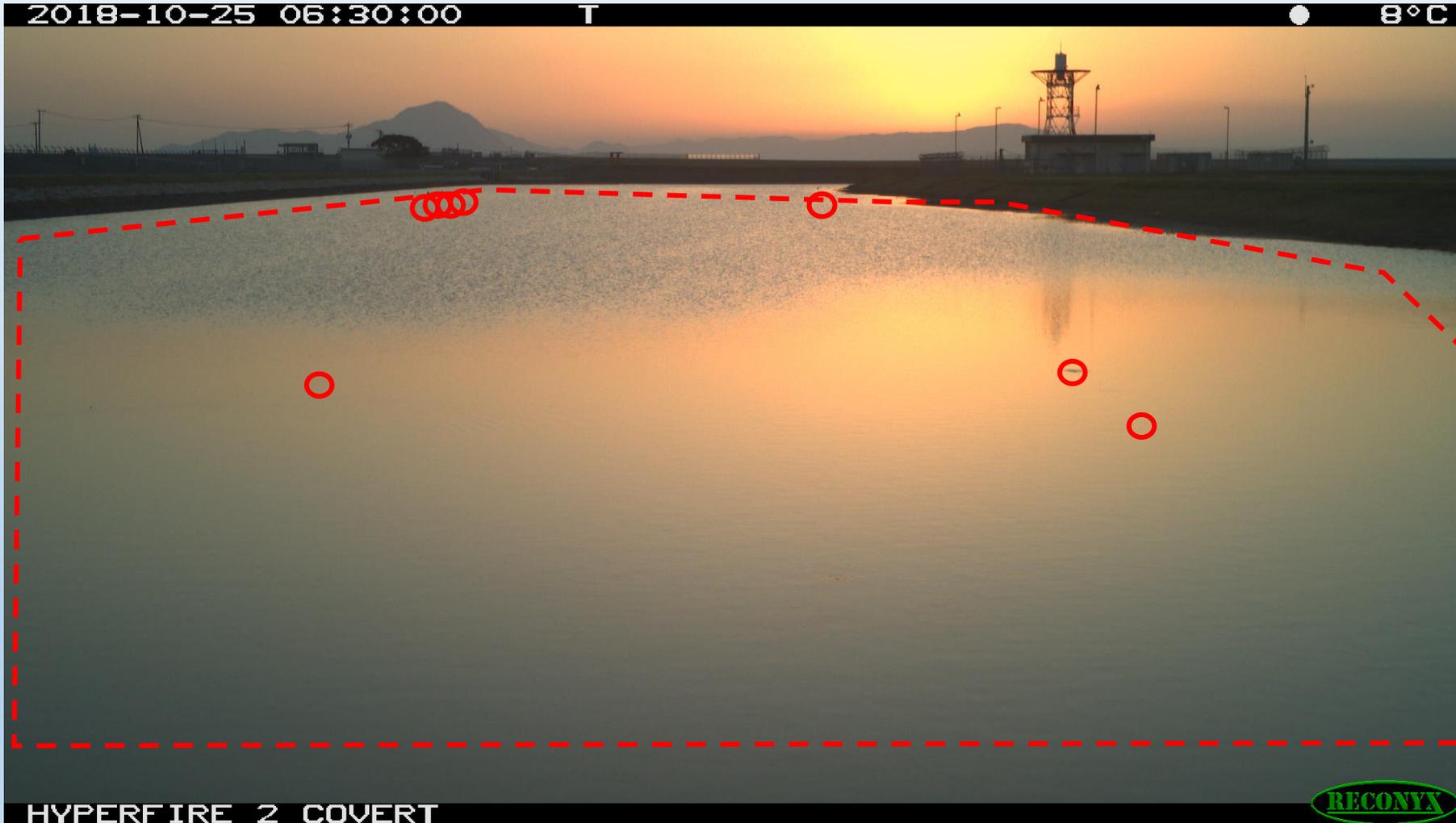
Following the image process steps:

- First run output = 12 birds
- Manual count = 9 birds

Following the machine learning steps (using the MatLab module):

- First run output = 7 birds
- Iteration 1 = 12 birds
- Iteration 2 = 9 birds
- Iteration 3 = 9 birds

# Count Outputs Camera 2 Location: 0630 25 October 2018



Following the image process steps:

- First run output = 5 birds
- Manual count = 10 birds

Following the machine learning steps (using the MatLab modules):

- First run output = 5 birds
- Iteration 1 = 8 birds
- Iteration 2 = 9 birds
- Iteration 3 = 10 birds

# Next Steps

- **Predictive models with other inputs:**
  - Seasonal information
  - Tidal flows
  - Water elevation
  - Strike data
  - Avian radar
- **Establish airfield-wide applications**
- **Fine tune field methods and camera settings to optimize analysis phase**

# Conclusions

- **We demonstrated that our semi-automated approach for processing time-lapse camera trap photos has the capacity to reduce effort and overall monitoring costs for birds**
- **A cost-effective index survey method to be integrated into an existing BASH program**
- **Camera placements can improve desired outcomes**
- **So far, only applies to gross total bird counts (no individual species IDs).**

# Parting thoughts

- **BASH professionals are entrepreneurial by nature. We work the problem!**
- **Most experimentation happens on the airfield**
- **Innovations can happen off the airfield, too, with tools like Matlab and data science**

# Domo Arigato!

*Questions &  
Comments?*



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