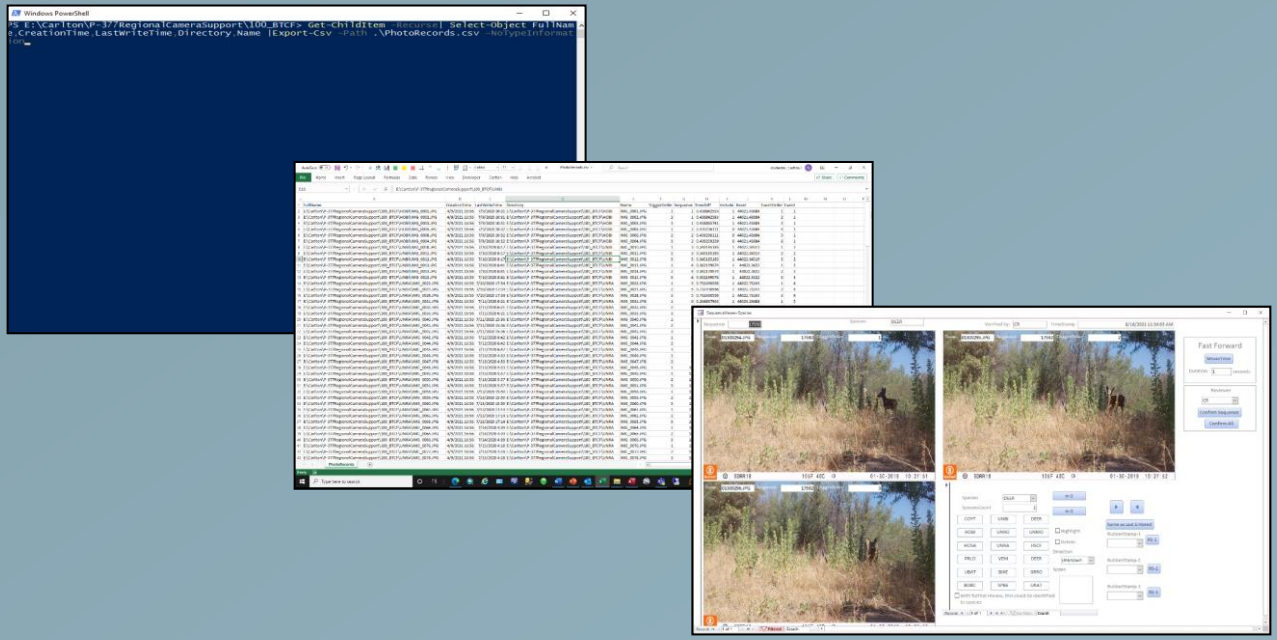
Wildlife Camera Photo Processing Protocol

February 10, 2022



Carlton J. Rochester and Robert N. Fisher
U. S. Geological Survey, San Diego, CA, U.S.A.

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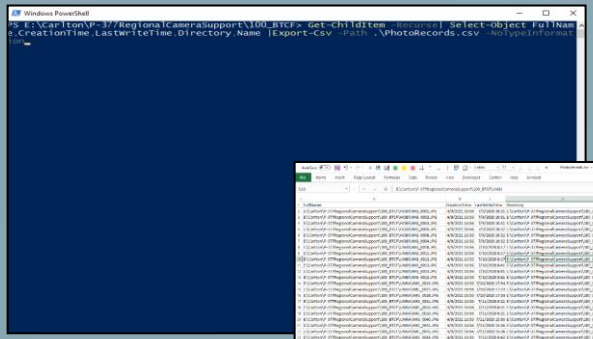
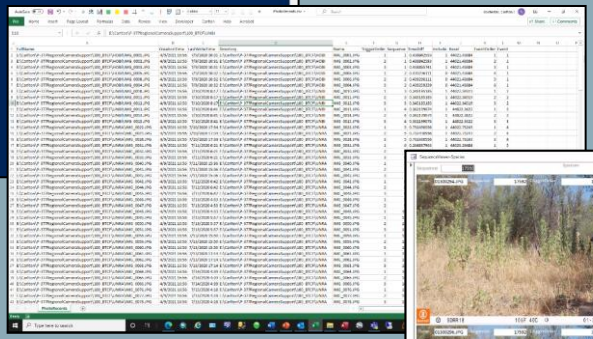
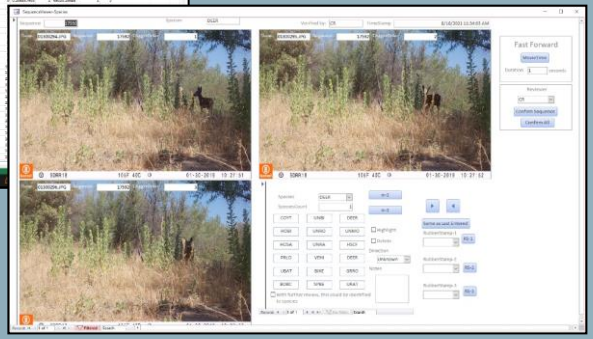


cmd window



MS Excel



MS Access

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What it is not

- -Not automatic photo processing
- -Not artificial intelligence (AI)
- -Not machine learning
- -Not the final database
- -Not the answer for everyone

What it is

- -Multi-step, multi-program process:
  - -cmd->MS Excel->MS Access
- -Tools to group, subsample, and review
- -How we have processed 6.6M photos
  - 91/71 Chino Hills wildlife movement (5.5M)
  - San Dieguito River/San Pasqual (0.7M)
  - Army Corps Dam sites (0.4M)

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Preprocessing

- -cmd window used to generate list of photos
  - -Photo name, file path, capture date/time
- -MS Excel used to group photos into sequences, events, and subsample class
  - -Sequences based on camera setting in the field (3 photos per trigger)
  - -Event based on 15 minute moving window to group potentially related photos
  - -Subsampling was used to remove potentially related photos, simulating a 5-minute quiet period on the camera settings
  - -MS Excel macro used to standardize and automate this step. The macro sorts the records, enter the equations, and filters out non-photo files.
- -Records imported into MS Access database and tested
  - -Confirm camera names
  - -Confirm file path is linking to photos

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typically done once per site per sample session

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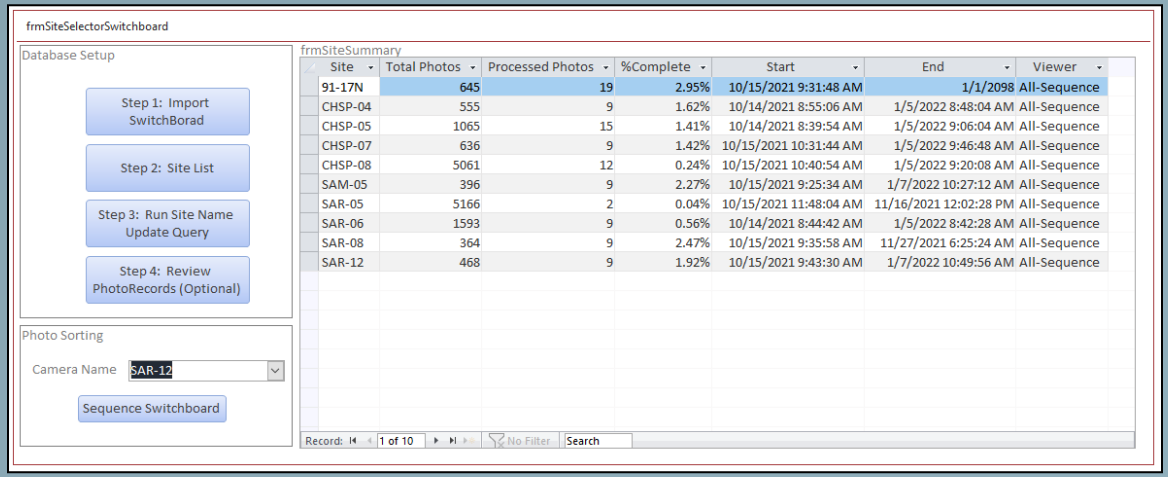
Preprocessing



Includes camera name, total photo count, processed photo count, and effective sample range

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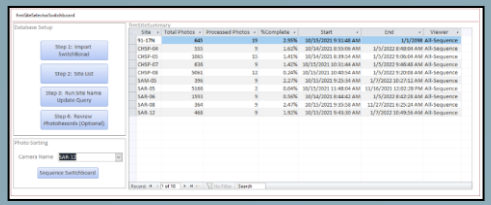
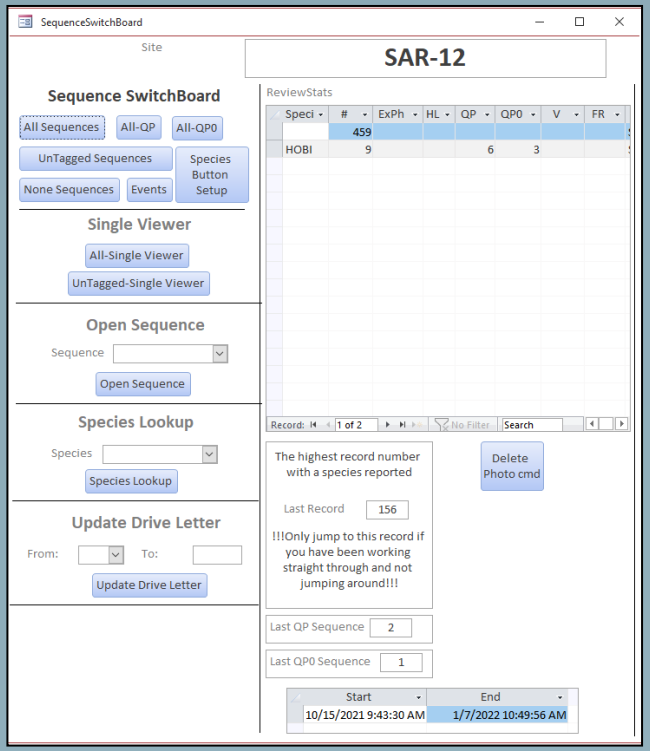
Processing

- The primary reviewer
- Review and tag sequences
- All cameras within a site for the sample session
- Species buttons customization





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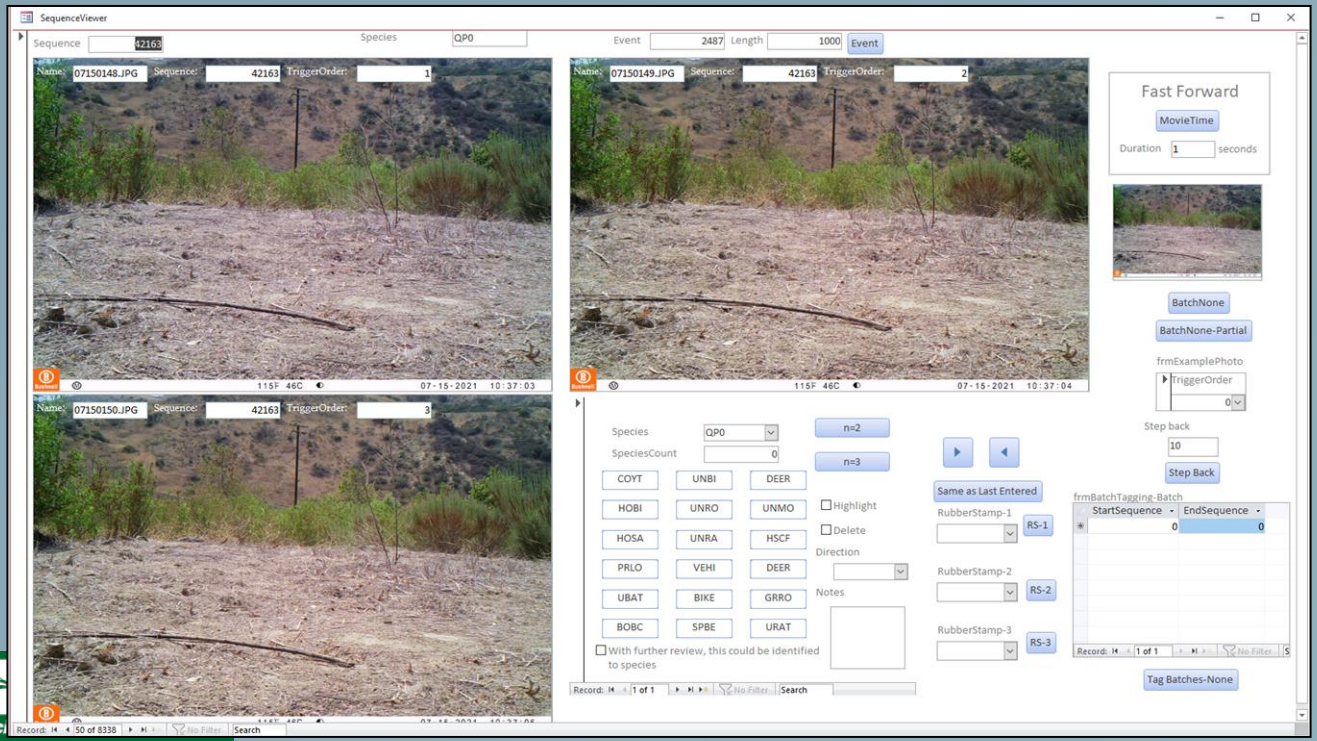

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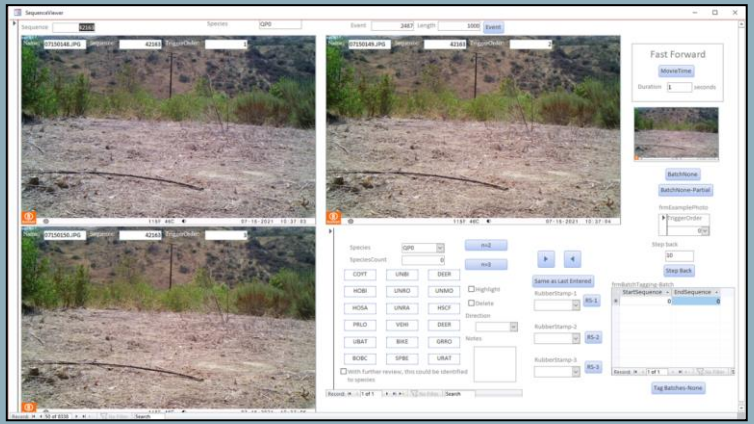
Processing by Sequence

- Photos grouped by sequence
- Sequences tagged with species, not individual photos
- Potential to enter species multiple ways
  - Lookup list
  - 18 predefined buttons
  - Same as last
  - “Rubber stamp”
- Blank sequences do not need to be tagged individually



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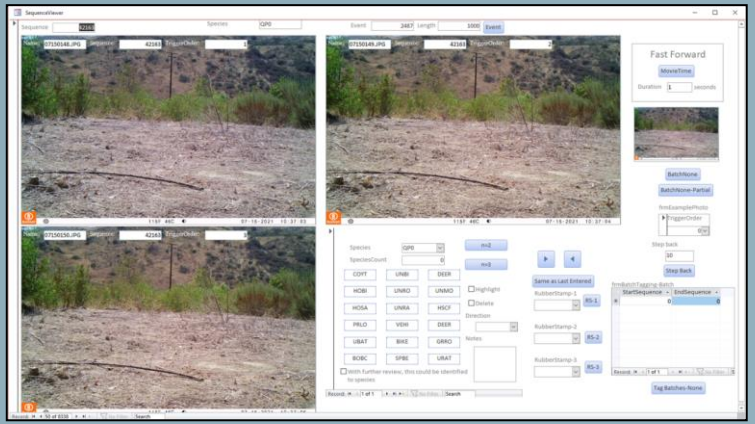
Processing by Sequence

- Fast forward by selected interval
- Preview of next sequence
- Record direction of animal movement
- Tag a sequence as a highlight
- Tag a photo as an example of the species identified
- Tag a sequence for deletion due to inappropriate behavior



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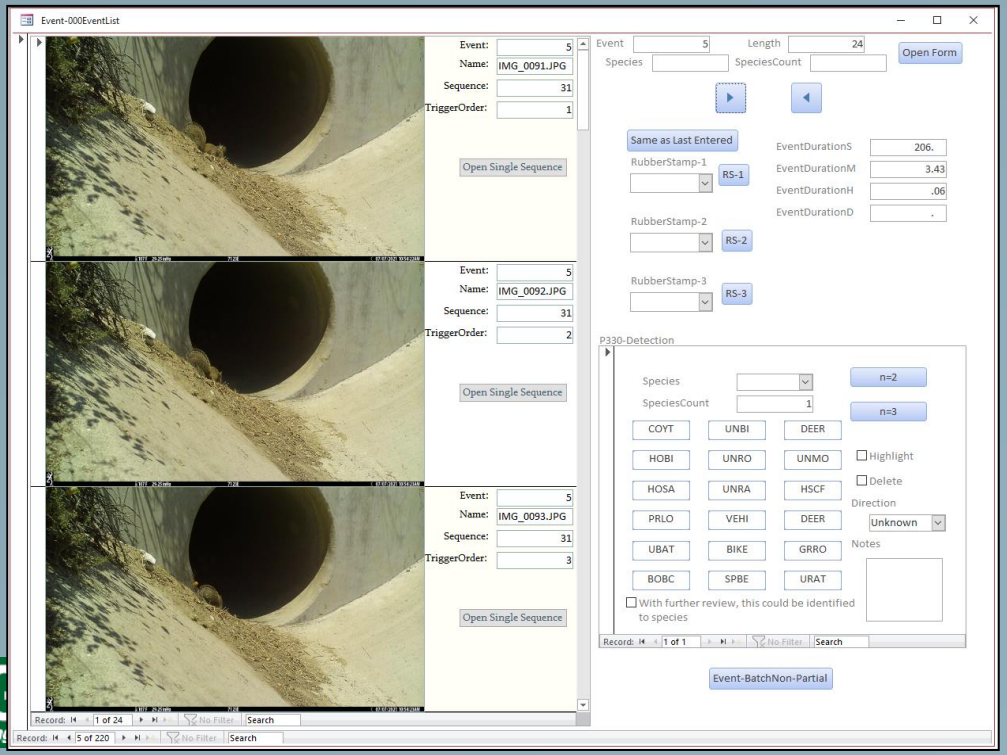

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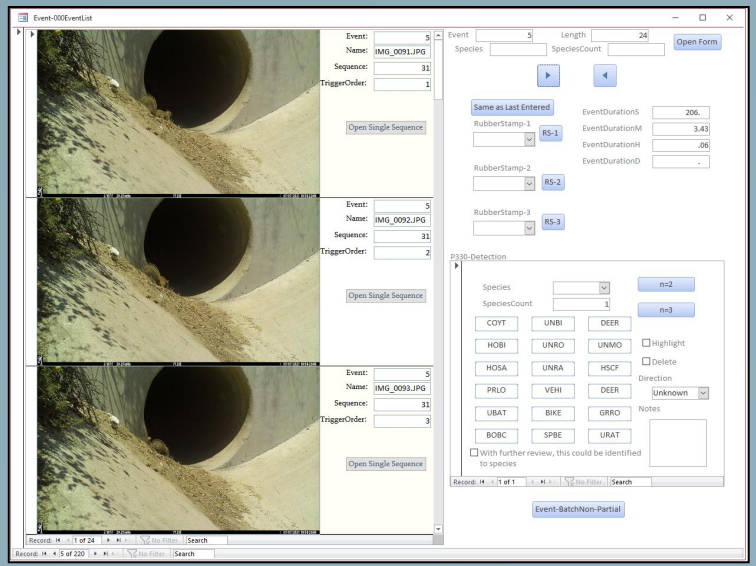
Processing by Event

- All Sequences that are part of the same Event can all be tagged at the same time
- Same species entry tools as Sequence viewer
- Summary of Event
  - Number of photos
  - Duration of Event in seconds, minutes, hours, and days



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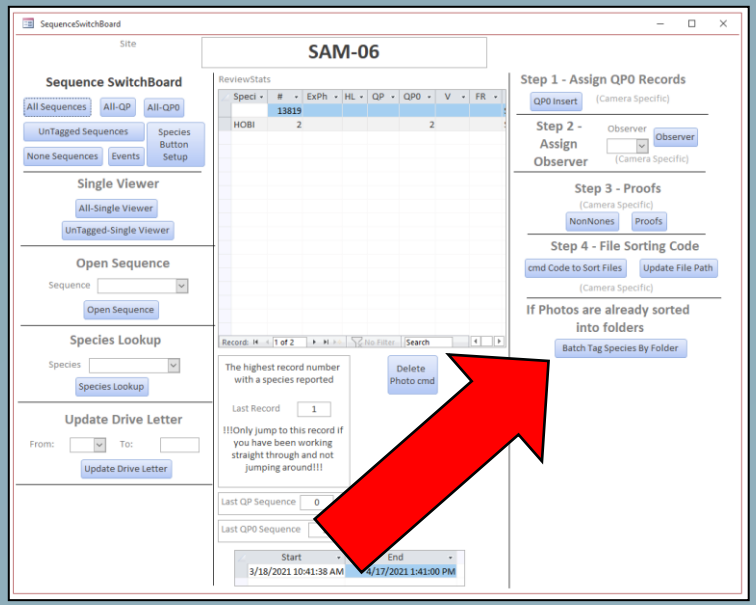
Processing by Species Folder

- If the photos have already been sorted into species folders, the folder name can be used to make species records
- Why?
  - Legacy datasets
  - Preference
  - Can still make database records



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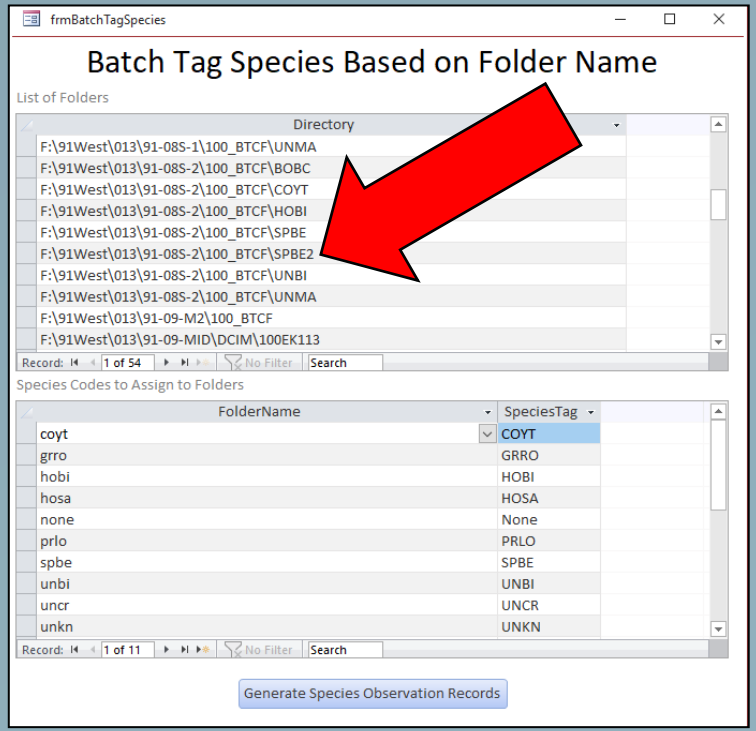
Processing by Species Folder

- Summary of folders
- Identify the folder name and the species code to assign to all the photos in a folder with that name

This tool does not currently include a means to include the count of individuals that may be included in the folder name



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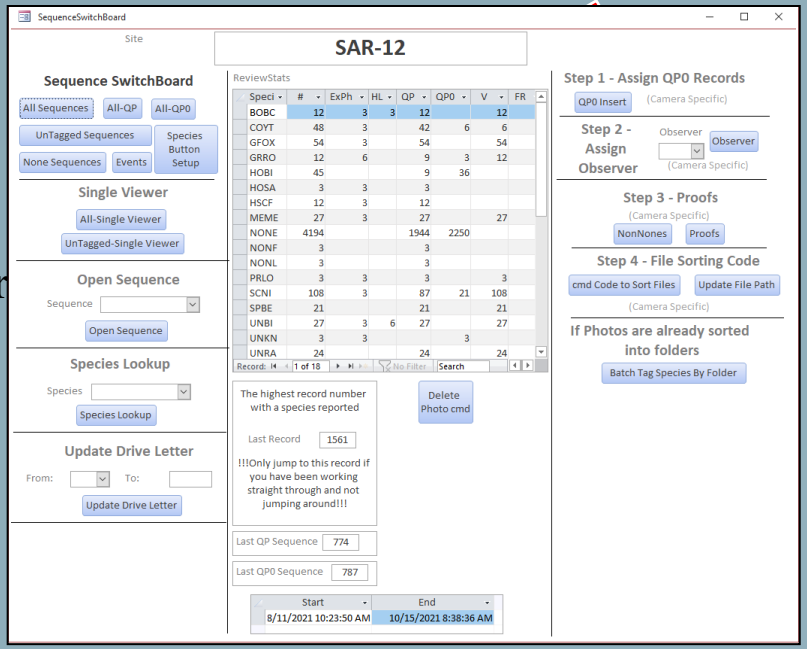
Post-processing

- Secondary reviewer
- Spot-check species identification
- Confirm rare and target species
- Assign primary reviewer initials
- Run proofs
- Sort into folders by species



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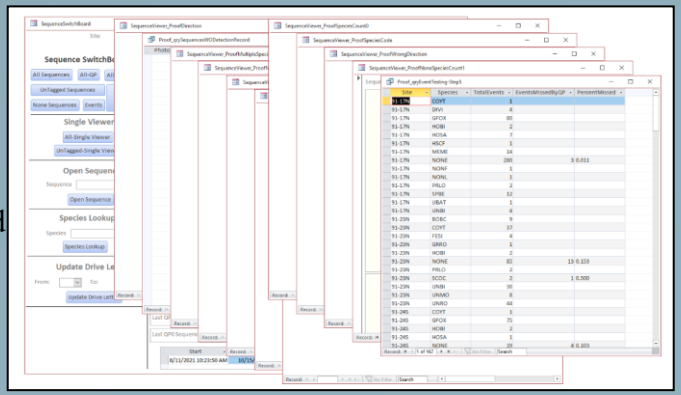
Post-processing

- Proofs
  - Sequences with two records for the same species
  - Sequences without a species record
  - . . . without direction reported for a camera that requires a direction
  - . . . with a direction reported for a camera that does not require a direction
  - . . . without a species count
  - . . . with a species but a count of 0
  - . . . with a species record and a none record
  - . . . with an undefined species code
  - . . . with a record but no species listed
  - . . . has been tagged for further review
- Why? Because all these things happen and the computer is pretty good at finding them



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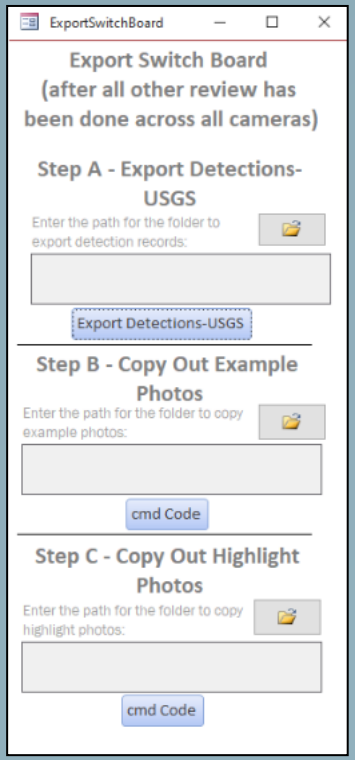
Post-processing

- Sort photos into species folders – cmd code
- Copy out example photos – cmd code
- Copy out highlight photos – cmd code
- Delete inappropriate photos – cmd code
- Export results for migration into final database



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Why have separate databases for sorting photos and the final results?

- Final database is on government server
- Stand alone MS Access database runs faster than processing photos directly from server
- Stand alone MS Access database can be used off-line
- Can be distributed to volunteers

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Processing time – how long is it taking to review photos using these tools?

- Depends on the site and whether the photos were subsampled (primary photo review)
  - Cameras that require a direction of movement = **1,300 photos/hour**
    - Range: 1,000 to 1,900 depending on primary reviewer
  - Cameras without direction and less than 6,000 photos = **1,800 photos/hour**
    - Range: 1,127 to 2,235 depending on primary reviewer
  - Cameras without direction and more than 6,000 photos = **5,080 photos/hour** (subsampled)
    - Range: 4,355 to 6,000 depending on primary reviewer
  - Overall rate = **2,000 photos/hour**

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Subsampling – how we're doing it

- Depends on the site and number of photos
- Not subsampled
  - Cameras at culverts and bridges
  - Cameras in habitat with less than 6,000 photos
- Subsampled
  - Cameras in habitat with more than 6,000 photos
    - All photos between 4 PM and 8 AM
    - Artificial 5-minute quiet period

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Development Process

- Colorado Parks and Wildlife – Colorado Photo Warehouse
  - Starting point
  - Much of the viewer for primary review
  - Much of the database for the final database
- Input from project leads / field leads / primary reviewers / secondary reviewers
  - Project leads: C. Brehme, C. Hitchcock, C. Rochester
  - Field leads: D. Adsit-Morris, D. Williams
  - Primary reviewers: M. Wong, L. Marsten, T. May, S. O'Dell, M. Newton, C. Stafford, A. Sumarli, J. Levy, A. Louros, J. Heath
  - Secondary reviewers: T. Edgarian, J. Kingston

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Questions?

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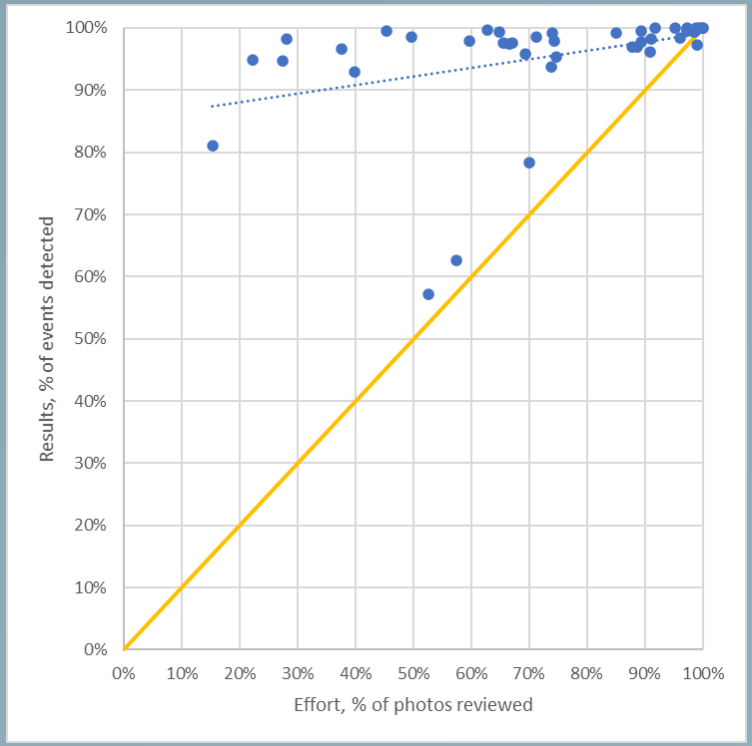

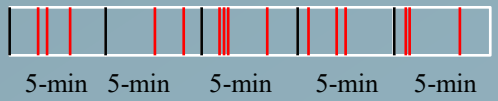

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