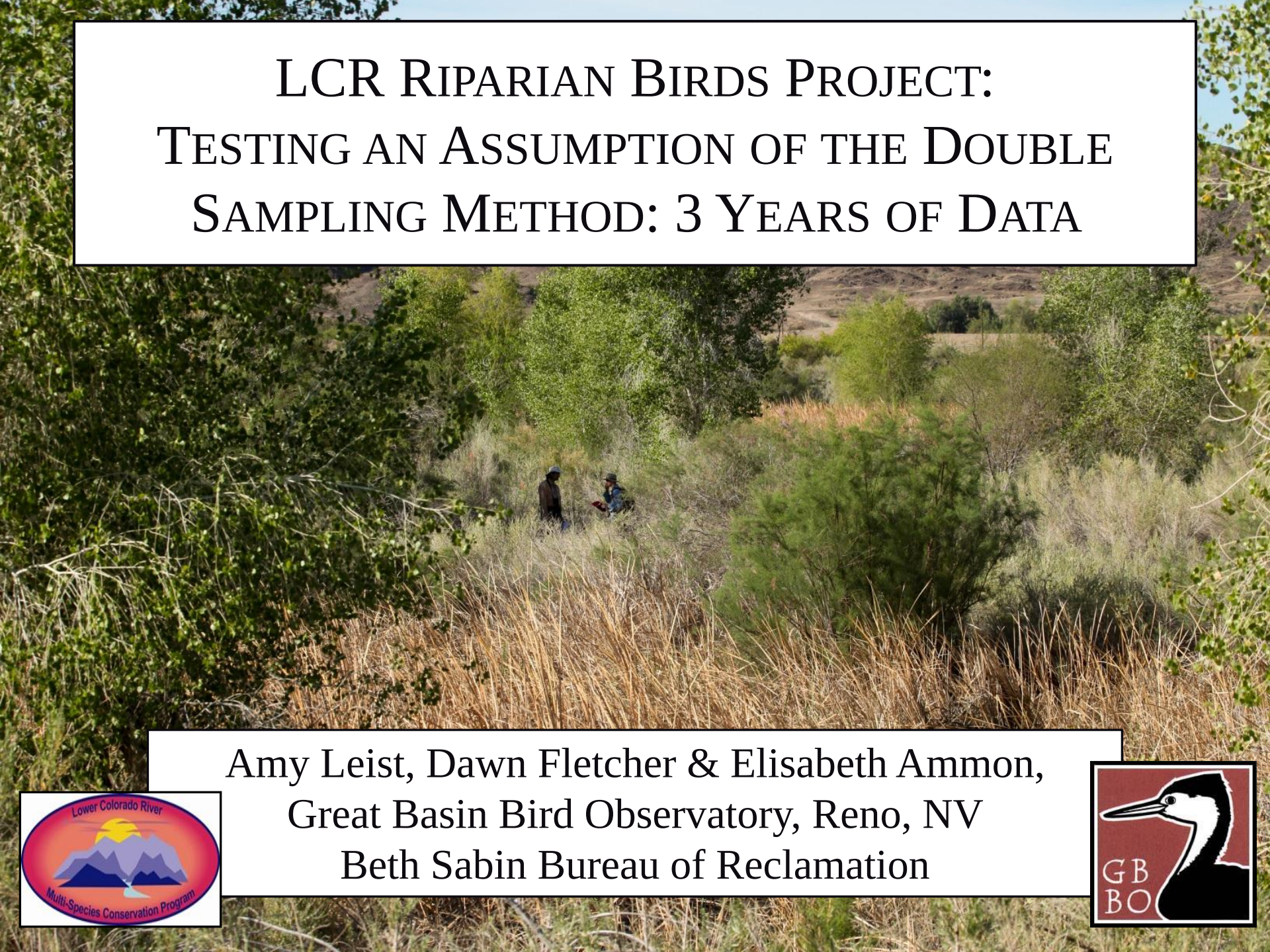
LCR Riparian Birds Project: Testing an Assumption of the Double Sampling Method: 3 Years of Data



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Background

Implement long-term system-wide monitoring of riparian birds with focus placed on 6 LCRMSCP covered species: Gila Woodpecker, Summer Tanager, Yellow Warbler, Bell's Vireo, Gilded Flicker, and Vermilion Flycatcher

Our Goals

- Determine presence and estimate breeding population sizes
- Derive recommendations for habitat creation and continued bird monitoring

2013 Project Components

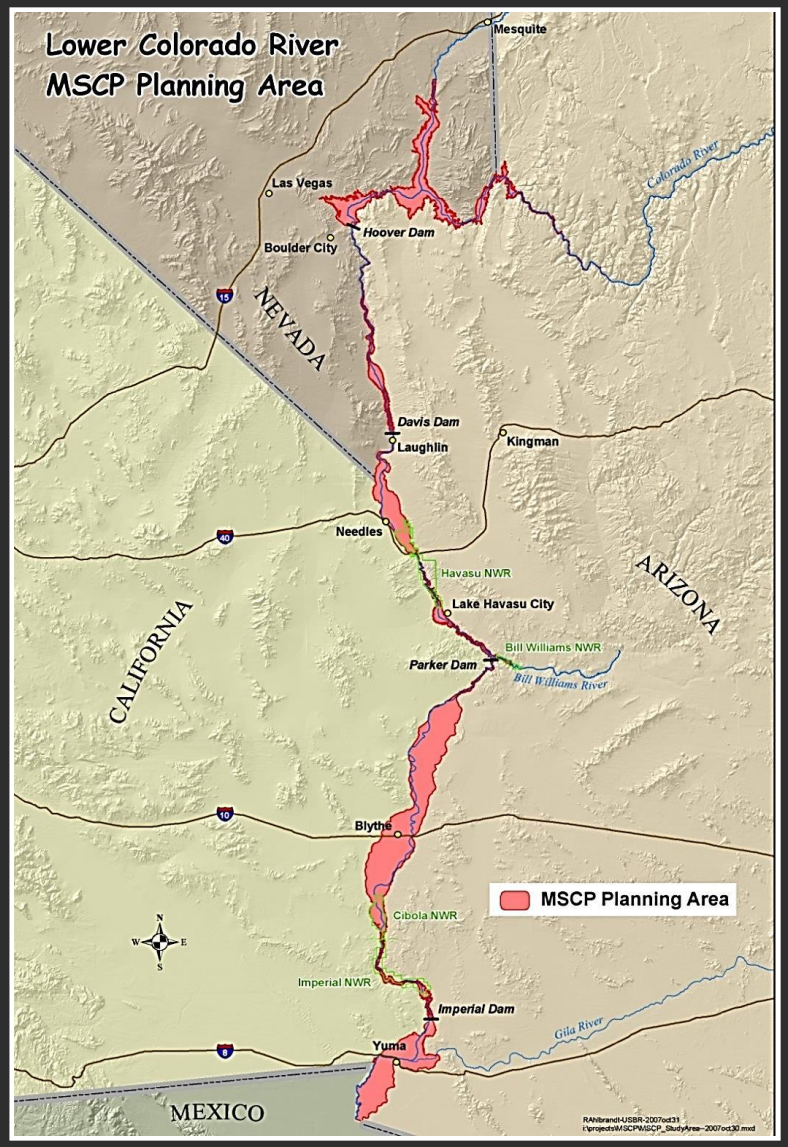
Component 1:
System-wide monitoring of riparian birds

Component 3:
Test the assumptions of the double-sampling design

Component 4:
Standardized LCR MSCP habitat monitoring data collection

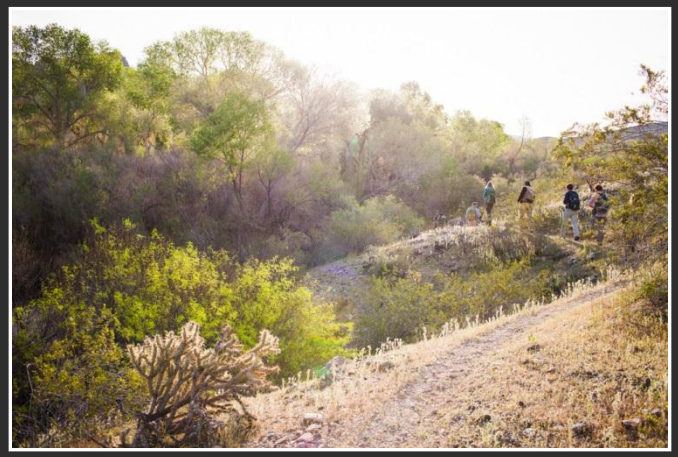
Component 5:
Evaluate effects of the saltcedar beetle (*Diorhabda carinulata*) on breeding riparian birds at established southwestern willow flycatcher sites

Study Area



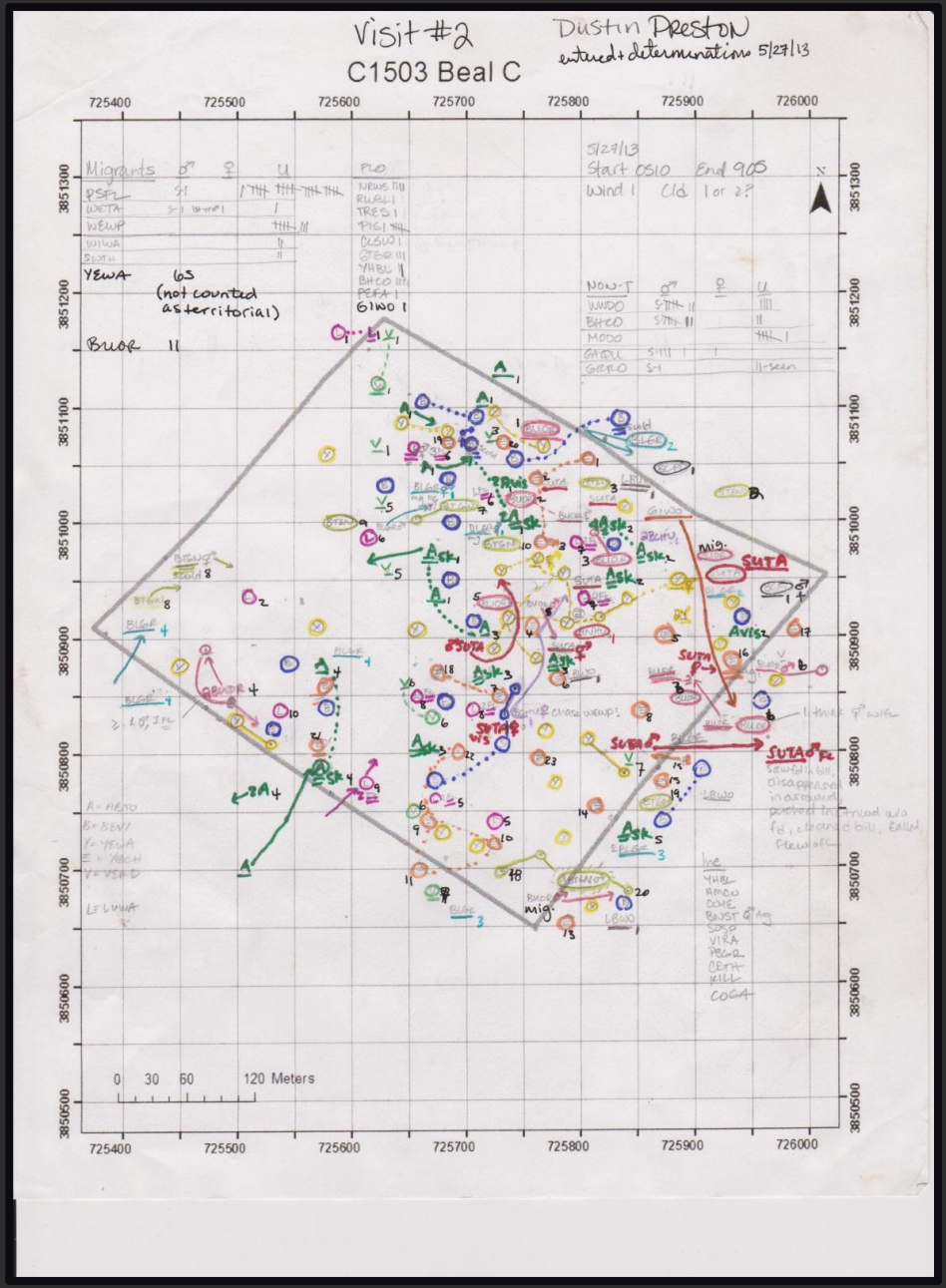
Riparian corridors within the historic floodplain of the Colorado River

Plots are selected using a stratified random design



Area Search Survey Method

- Begin at sunrise and last several hours
- Surveyed systematically passing within 50m of all points on plot
- Surveyor identifies and tallies all birds
- Bird sightings, locations, and breeding evidence recorded

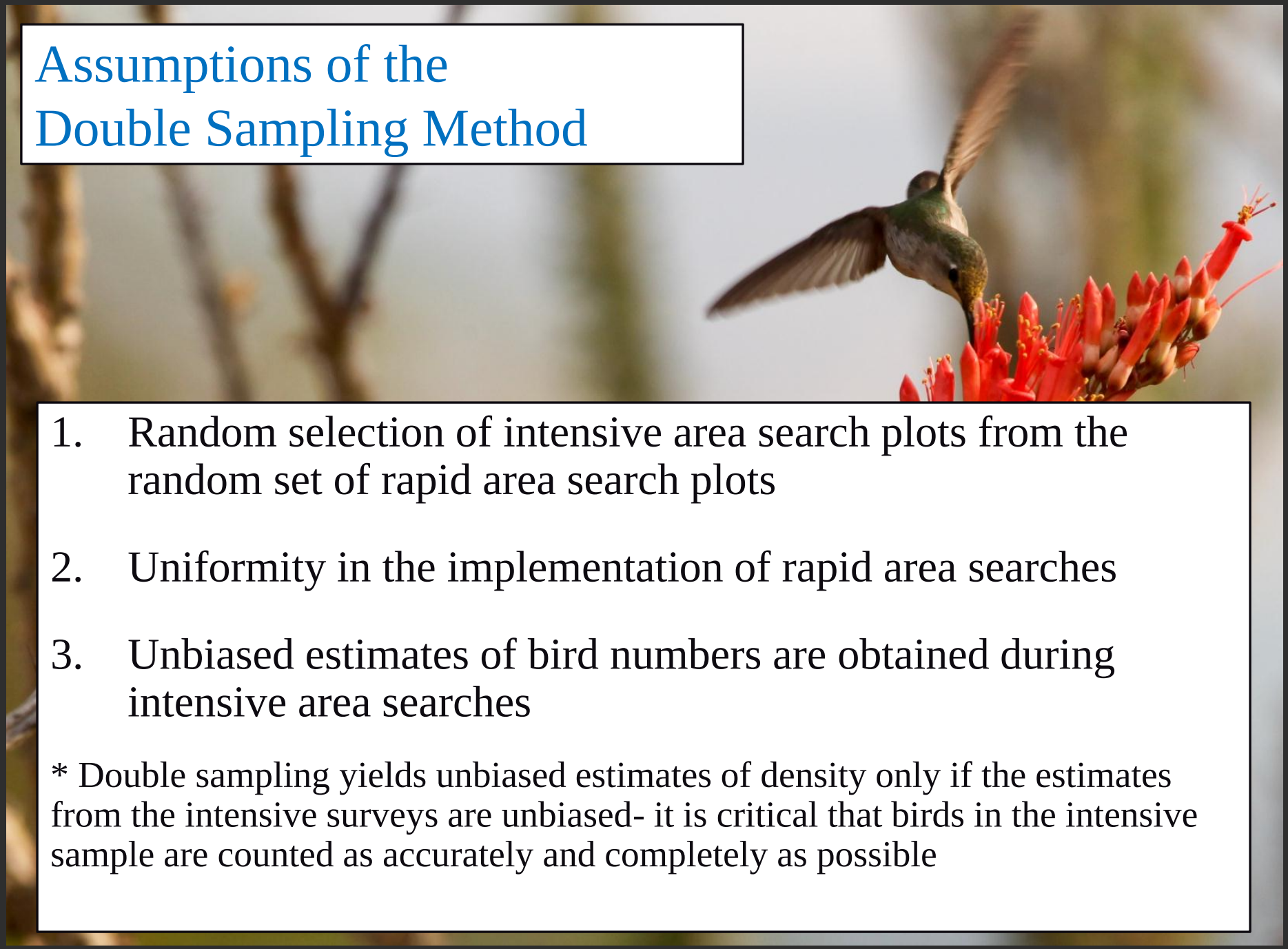


Sample of an intensive plot with territory mapping

Double Sampling

- 2 survey efforts: (survey using area search method)
- Rapid surveys (2 times/season) may result in biased estimates
- Intensive surveys (8 times/season) used to obtain an estimate of biases
- 2 different surveyors for each effort
- Intensive area searches used to estimate detection ratios

Assumptions of the Double Sampling Method



1. Random selection of intensive area search plots from the random set of rapid area search plots

2. Uniformity in the implementation of rapid area searches

3. Unbiased estimates of bird numbers are obtained during intensive area searches

* Double sampling yields unbiased estimates of density only if the estimates from the intensive surveys are unbiased- it is critical that birds in the intensive sample are counted as accurately and completely as possible

Are unbiased estimates of bird numbers obtained during intensive surveys?

Factors that could bias the estimates:

- Secretive species
- Density of vegetation
- Density of birds

Fieldwork Began 2011

Objectives of this Study:

- Evaluate the assumption that intensive surveys provide unbiased estimates of bird numbers

- Estimate the average error rate occurring during intensive surveys
- Suggest improvements to the intensive survey method

Triple Sampling Effort

- Independent observers survey a subset of 8 plots
  - 2 times/season (rapids)
  - 8 times/season (intensives)
  - 16 times/season (EI)
- Comparing the results of these 3 survey efforts within plots that exhibit variation in vegetation and bird density, we can calculate quantitative estimates of bias on a species-specific basis

Triple Sampling Effort Provides:

- More time for challenging species and edge and partial territories
- More visits allow the surveyor additional opportunities to observe breeding behavior:
  1. birds reaction to nest failures
  2. re-nesting and multiple-clutches
  3. post-fledging period

Results

Results:

- 24 plots were triple-sampled over three years (2011-2013, 8 plots/year)
- Over 1600 breeding pairs in over 70 species were detected with enough evidence to be deemed attempted breeders on the EI effort surveys.
- Of these, 21 species had a high enough sample size from the EI surveyor (n ≥ to 10) to be included in this analysis.

Results:

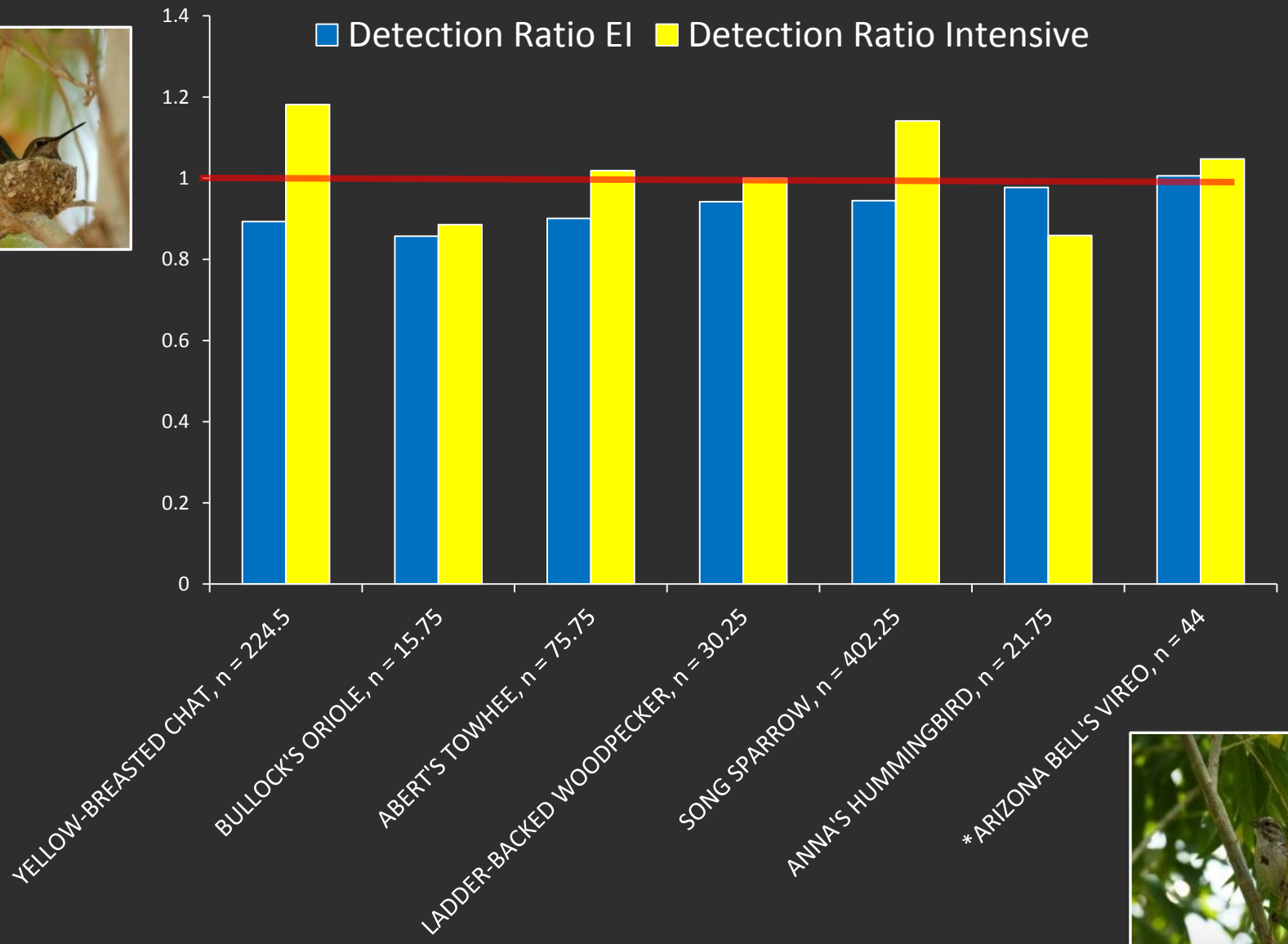
- To illustrate the differences between the EI and Intensive survey efforts, we used program DS to calculate detection ratios (DR) between both EI and rapid and Intensive and rapid data for the 24 plots.

- If all pairs present on the plots are detected in both survey methods the DR is 1.0

- If the EI and intensive DRs were the same for a species, the EI surveys would not add any additional information to the standard intensive survey effort for that species

- Species that showed the largest deviations from a detection ratio of 1.0 were those that bred early, arrived late, were challenging to detect, or had poorly defined territorial behaviors

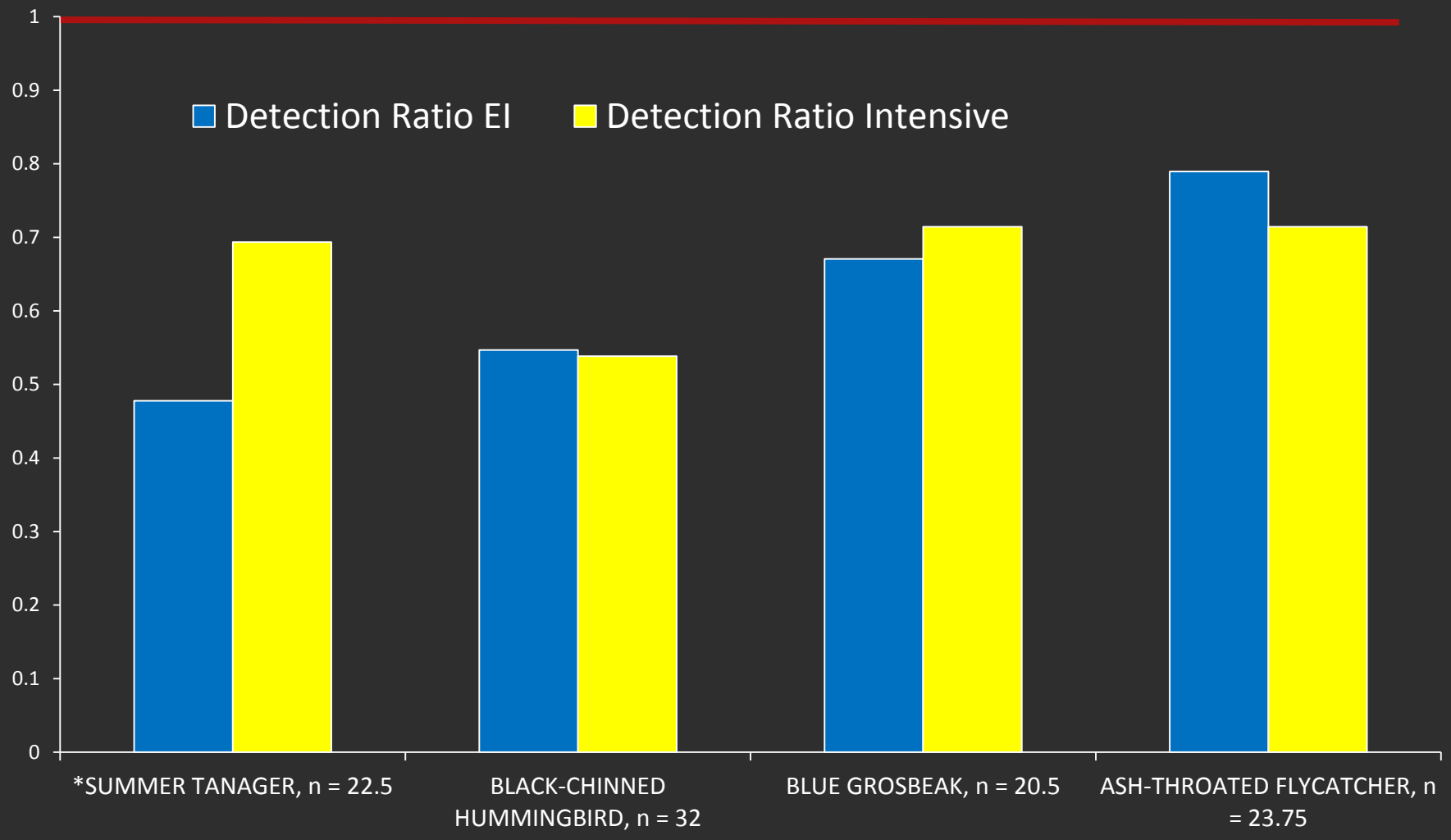
For some species the DR was close to 1.0 and the EI and Intensive DR were similar



These results biologically make sense for some species such as the Bell's Vireo because:

- Easy to detect and ID
- Small territory
- Maintain territory throughout the breeding season with little shifting between clutches
- Male BEVI sing consistently around their territory throughout breeding
- Counter-singing between males is common at edges of territory

For other species EI and Intensive surveyors were detecting similar #s of territories but detection rates were below 1.0 (meaning rapid surveyors were underestimating the # of territories compared to Intensive and EI surveyors.



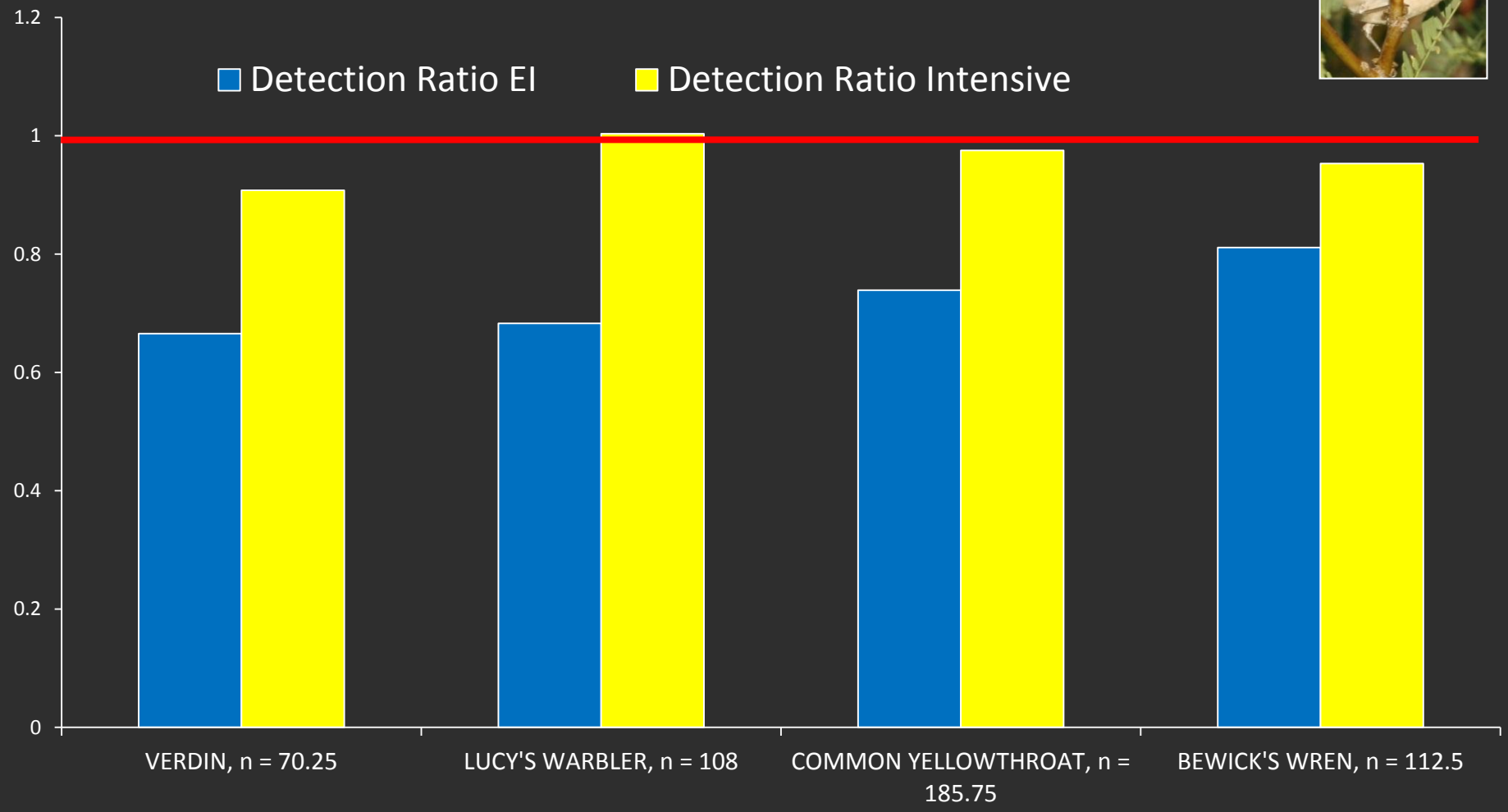
Rapids underestimates when compared to Intensive and EI surveys

Examples: BCHU, BLGR, ATFL, SUTA (somewhat underestimated)

Biological explanations could be:

1. Territory size- large, more challenging to map
2. Timing of breeding- BLGR arrives later
3. Detectability of SUTA
4. Natural history- BCHU males do not stick around
5. Partial territories make a big difference with small sample size

In some situations the DR was below 1.0 (not by much) for EI and Intensive but consistently lower for EI (meaning the rapid and the intensive efforts both underestimated the actual number of territories on the plot as counted by the EI effort).



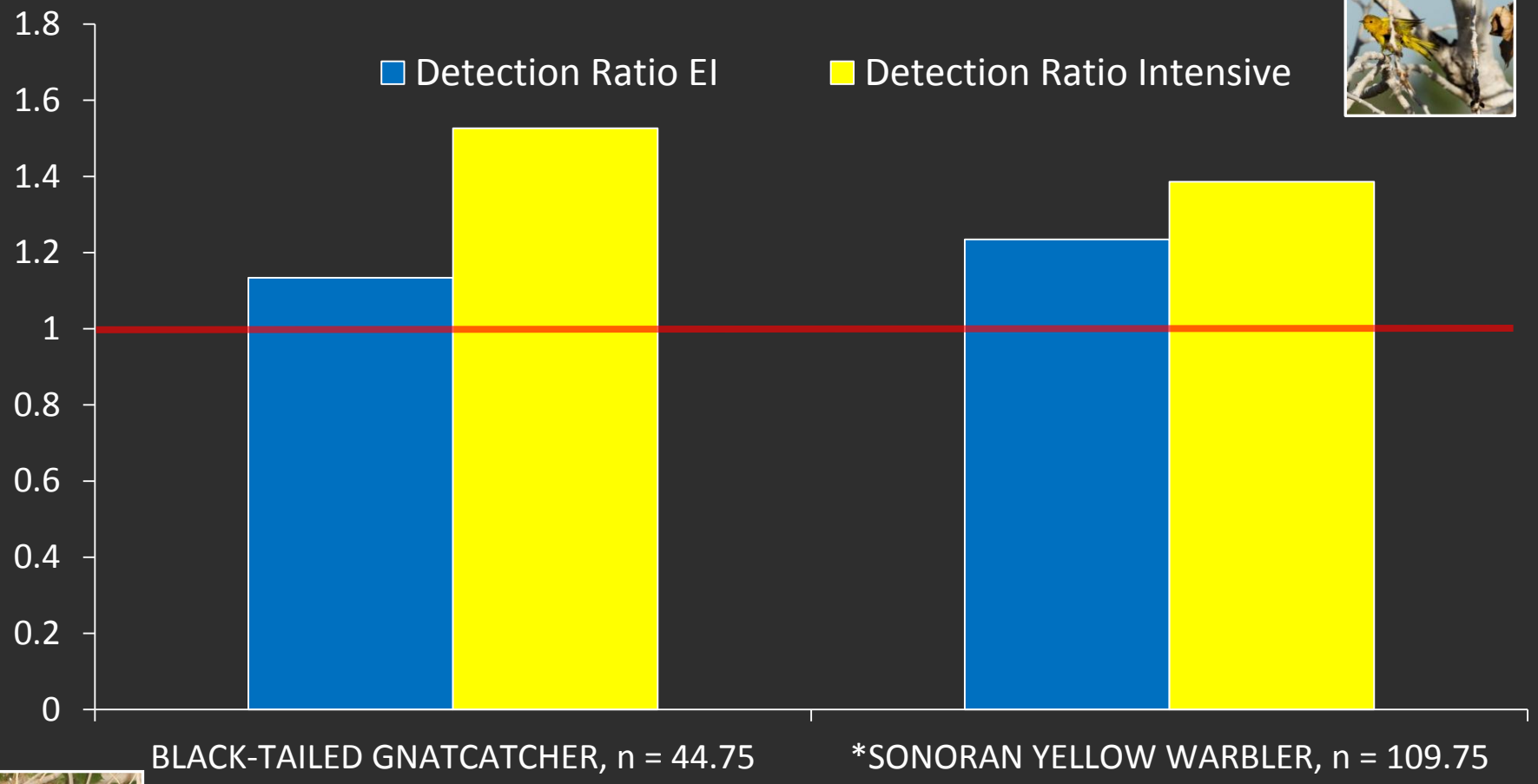
These results makes sense because we are using the EI number as the “true” number of territories and the EI surveyor had lots more time and information to figure out breeding territories.

We hypothesize that rapid and intensive efforts are underestimating for several species due to

- Natural history/biological explanations
- The rules we use to determine if a detection can be called a breeding territory.

Examples include: VERD, BEWR, COYE, LUWA

In some situations the DR was above 1.0 for EI and Intensive but consistently lower for EI (meaning the rapid and the intensive efforts overestimated the number of territories on the plot (as counted by the EI effort).



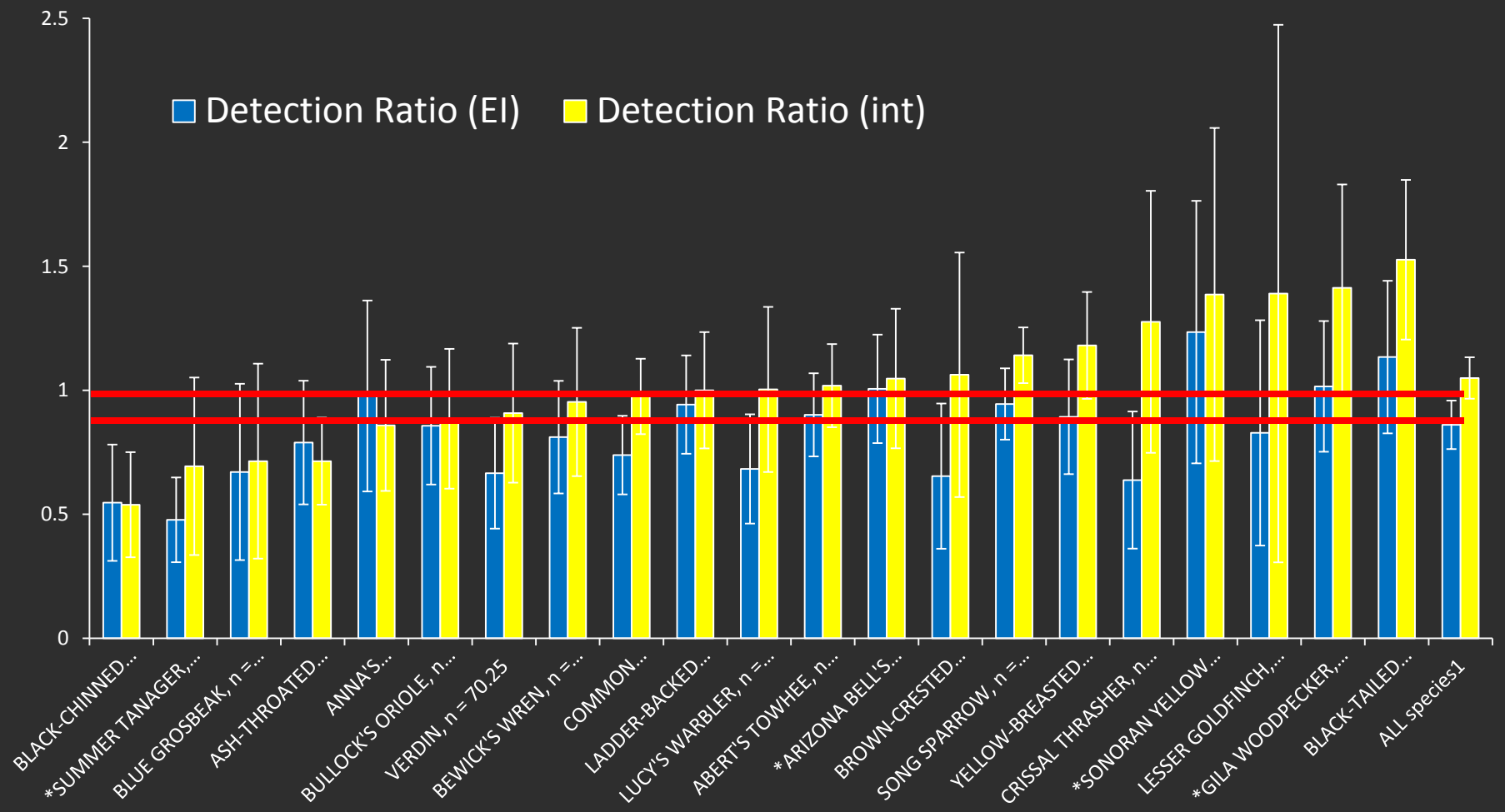
Examples: YWAR, BTGN

Why? Hypotheses include…

- YWAR- presence of migrants throughout most of our season
- BTGN- confusion after first clutch is independent and there are many re-nesters, independent young, and families from other plots with dependent young all in the same area

We calculated 85% CI (n=24) for each DR to determine if they included the "all species" mean DR (EI = 0.86, I = 1.05).

It was expected (and consistent with sampling error) that 15% (or 3 species) would fall outside the grand mean

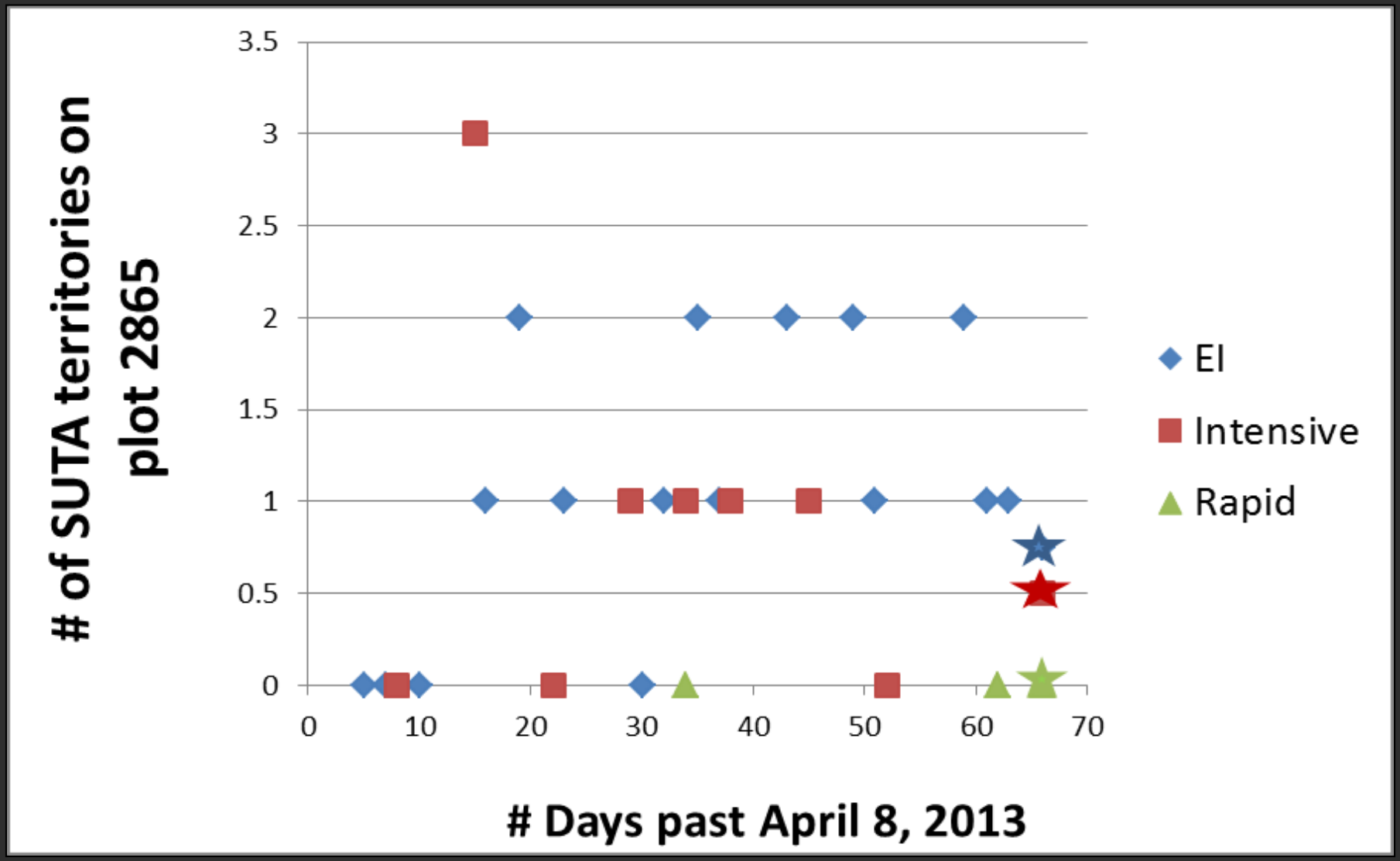


For the Intensive CI, 3 species' error bars did not include the "all species" DR (1.05): BCHU, ATFL, and BTGN.

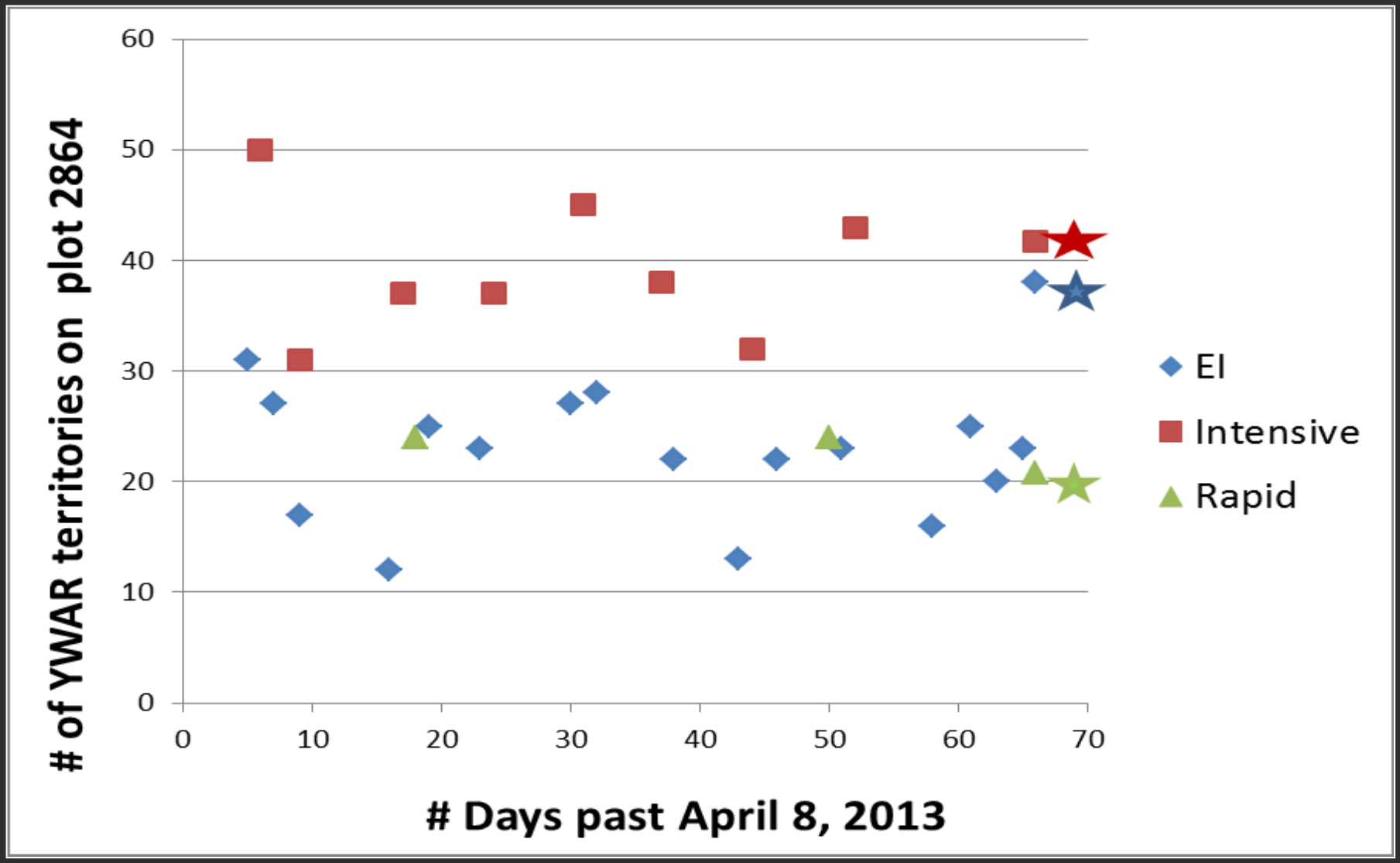
For the EI CI, 2 species' error bars did not include the "all species" DR (0.86): BCHU and SUTA.

There could be explanations why these species were not in the mean- related to behavior (migrants) or other biological issues

SUTA Territories observed by EI, Intensive, and Rapid Surveyors throughout the season on a single plot



YEWA Territories observed by EI, Intensive, and Rapid Surveyors throughout the season on a single plot



Discussion: Effects of Survey Methods

Intensive surveys capture ~90% of the breeding pairs on a plot (as determined by the EI study). To improve, we could consider the following options:

- Refine the sampling plan by increasing the number of intensive effort visits from 8 to 10
- Set lower monitoring goals for some species with low DR (not including MSCP covered species)
- Change some of the current rules for classifying a breeder during intensive and rapid surveys

Discussion: Habitat Effects

1. Plots selected for the triple-sampling effort were some of the most challenging plots within the study area
    - Not representative of most of the project area
    - Have extremely dense vegetation
    - Overall have lower detection rates than average LCR MSCP plots.
2. Significant difference between the intensive and EI surveys on “hard” plots compared to “easy/medium” plots
    - in challenging habitats with dense vegetation and/or dense bird territories, on average intensive surveyors did not record as many breeding territories as the EI surveyors
3. In the future we will explore grouping by habitat type to calculate DRs

Discussion: Natural History Effects on Species Detectability

1. There are many biological reasons why detection rates were different among sampling efforts

2. Gained a wealth of life history knowledge for many of the riparian species

3. For each species we wrote detailed descriptions of the following:
   - Basic results of triple-sampling study
   - Factors that may influence rapid, intensive, and EI numbers
   - Training best practices

Discussion: Natural History Effects on Species Detectabilities cont.

Abert's Towhee

RESULTS: Rapid and intensive surveys underestimated by a small amount.

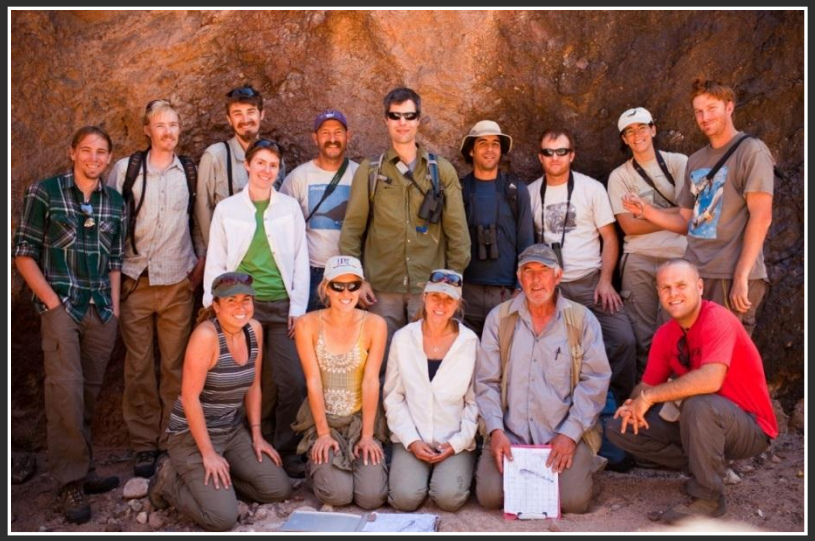
Factors that may cause low rapid and intensive survey numbers

- The first few surveys to the plot are most useful in determining how many towhee territories are on your plot, because once there are family groups moving around it is very difficult to discern individual territories.
- Towhees can also be very quiet for long periods of time during nesting and therefore could be easily missed during the first surveys to the plot. This might be why the numbers for rapid and intensive surveys are slightly lower than for EIs. The EI surveyors simply had more opportunities to record individual territories at the beginning of the season.
- This species also stays within a small area while nest building and incubating. If this area is mostly off the plot, this species might be easily missed during the first visits to the plot.
- Once the young have fledged, the family group is not only very vocal, but expands their area of activity. This means that on the second rapid survey or later visits to the plots for intensive surveys, towhees can suddenly appear where there were none detected before, adding to the confusion of territory delineation.
- Unfortunately, with squeak duets occurring between family members all over the plot, it is essentially impossible to distinguish the squeak duets of one family group from those of another, with the tendency perhaps to assume all towhees calling are from a single family group.
- This tendency to lump (or inability to distinguish between) different family groups would result in the rapid and intensive surveyor determining fewer towhee territories than the EI surveyor, who has more chances to detect quiet towhees during the first half of the season and distinguish between pairs

Training Best Practices

- To get a better sense of how many pairs are actually on the plot, surveyors can be instructed to try to follow individuals when possible
- Study territory sizes from years past (often not that large)
- Addressing how to deal with wandering family groups should be clarified during training. Abert's towhees often remain close to the nesting area during that time.
- Since the species can maintain a territory across several seasons, how to identify family groups for this species may need to be addressed and clarified during training.
- Specify that family groups can be counted as breeders, as they are non-migratory and tend to stay on the same territory across seasons.
- Territory Mapping/Partial Territories: Territories can be very difficult to map as towhees are most easily detected during the second half of the season when they are family groups. Perhaps boundary determinations should be weighted on data collected during the earlier part of the season, before family groups occur.

Acknowledgements



- US Bureau of Reclamation Wildlife Group
- USGS Snake River Field Station: Jon Bart
- National Wildlife Refuge Staff
  (Bill Williams, Havasu, Imperial, Cibola)
- GBBO Staff
- Awesome field crews over the years (2008-2010), 2011, 2012, and 2013

Discussion: Natural History Effects on Species Detectability ABTO

RESULTS: Rapid and intensive surveys slightly underestimated

Factors that may influence low rapid and intensive survey numbers

1. 1st surveys to the plot are most useful in determining the # of territories, because once family groups are moving around it is difficult to discern individual territories.

2. Could easily miss ABTOs the first few surveys because they are often quiet for long periods of time during nesting.

Discussion: Natural History Effects on Species Detectability ABTO Continued:

3. Once the young have fledged, the family group is not only very vocal, but expands their area of activity.
   - This means that on the 2nd rapid survey or later visits to the plots for intensive surveys, ABTOs can suddenly appear where there were none detected before

4. It can be difficult to distinguish the squeak duets of 1 family group from those of another, perhaps to assuming all towhees are from a single family group.
   - This tendency to lump territories for different family groups would result in the rapid and intensive surveyor determining fewer towhee territories than the EI surveyor

Discussion: Natural History Effects on Species Detectability ABTO Continued:

Training Best Practices

1. Study territory sizes from years past (often not that large)

2. Address how to deal with wandering family groups. Abert's towhees often remain close to the nesting area during that time.

3. Specify that family groups can be counted as breeders, as they are non-migratory and tend to stay on the same territory across seasons.

4. Partial Territories can be very difficult to map as towhees are most easily detected during the 2nd half of the season when they are in family groups.
   - Perhaps boundary determinations should be weighted on data collected during the earlier part of the season, before family groups occur.