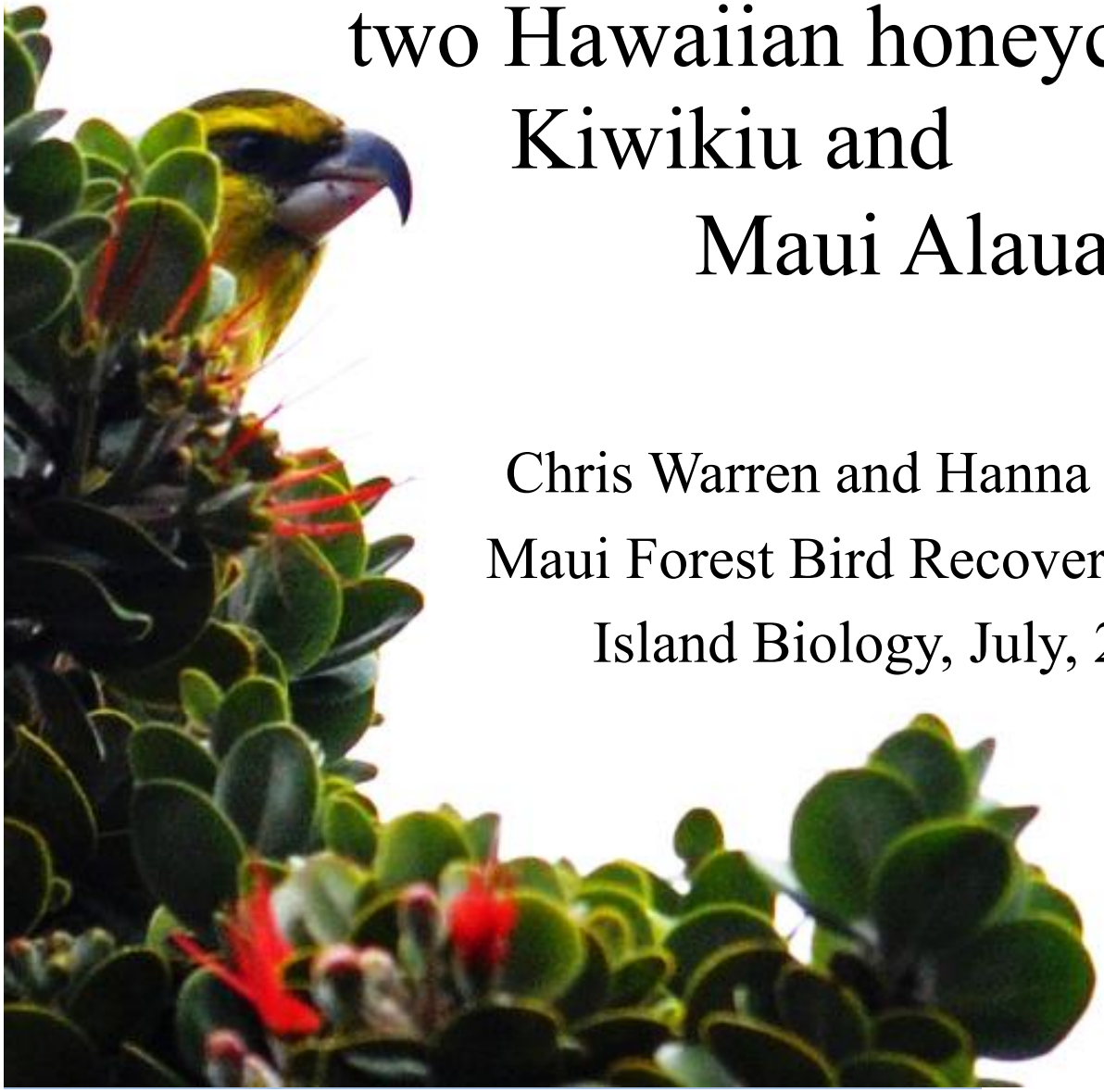
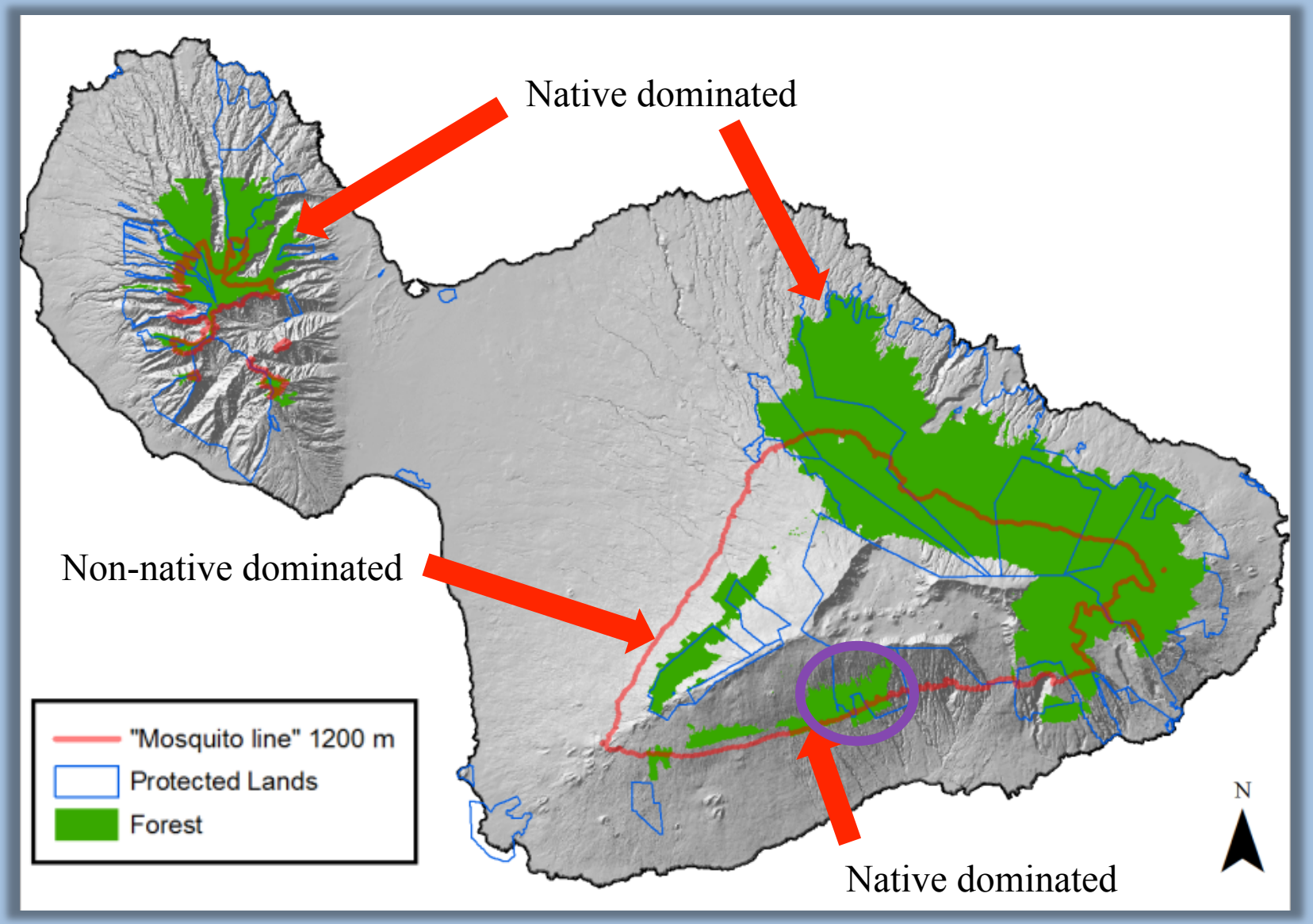
Home-range patterns of two Hawaiian honeycreepers; Kiwikiu and Maui Alauahio



Chris Warren and Hanna Mounce
Maui Forest Bird Recovery Project
Island Biology, July, 2013

Available Forest Bird Habitat



Nakula Natural Area Reserve (NAR) Restoration

- Current forest: Koa-dominated, Heavily grazed, “savanna”
- Site of future Kiwikiu reintroduction
- 170 ha fenced, ungulate-free area: Nov. 2012
- Restoration Trials: 2013-2015
- Outplantings: 2013-on-going

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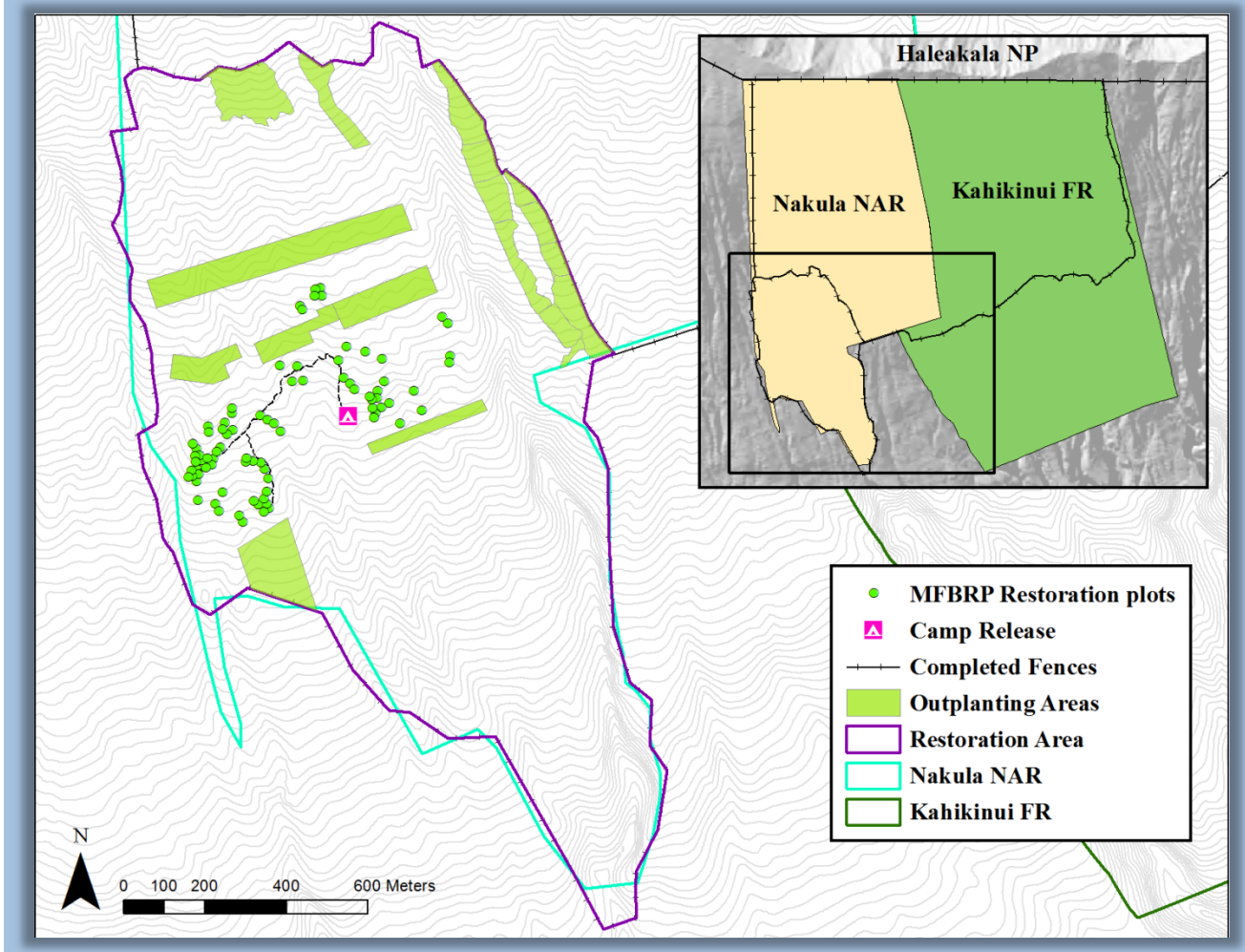

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Kiwikiu or Maui Parrotbill (*Pseudonestor xanthophrys*)

Maui Alauahio (*Paroreomyza montana*)

- Hawaiian “Honeycreepers” a.k.a. Finches
- Maui endemics, east Maui only
- Insectivorous

Kiwikiu or Maui Parrotbill (*Pseudonestor xanthophrys*)

- Critically endangered (IUCN)
- ~500 individuals
- Establishing 2nd population vital to long-term survival

Maui Alauahio (*Paroreomyza montana*)

- Threatened (IUCN)
- Range-limited
- ~55,000 individuals
- Surrogate study species

The Big Question

How many Kiwikiu/Alauahio will “fit” in Nakula NAR?

Purpose: To inform reintroduction plan; how many birds to release

How many Kiwikiu/Alauahio will "fit"?

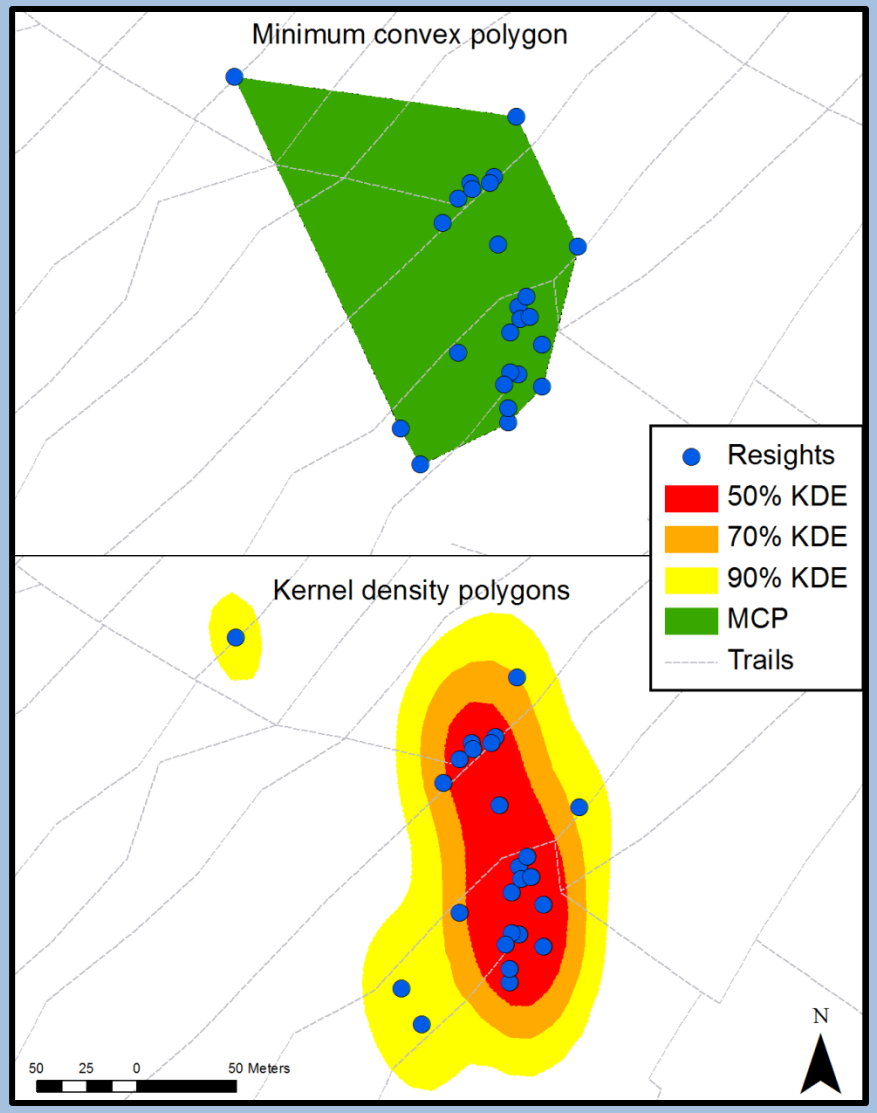
- How much area do Kiwikiu/Alauahio require?
- How much area do individuals utilize? = home-range area
- What variation exists throughout the species' range? Between sexes? Ages?
- How much home-range overlap to individuals allow?

To answer: Use home-range area in current range to make predictions about Nakula NAR

Home-range analysis: Data Collection

- Color-banding
- Repeated recapture (resighting) over time
- Naive Resights not Telemetry
- Huge effort ~3,000 person hrs./ yr.

Home-range analysis: Analysis



- Minimum Convex Polygons (MCP)
  - Traditional approach
  - Good for small sample size
  - All points are equally weighted
- Kernel Density Estimators (KDE)
  - "Contour" or "heat" map
  - Polygons of frequency "peaks"
  - Limited by small sample size/ individual

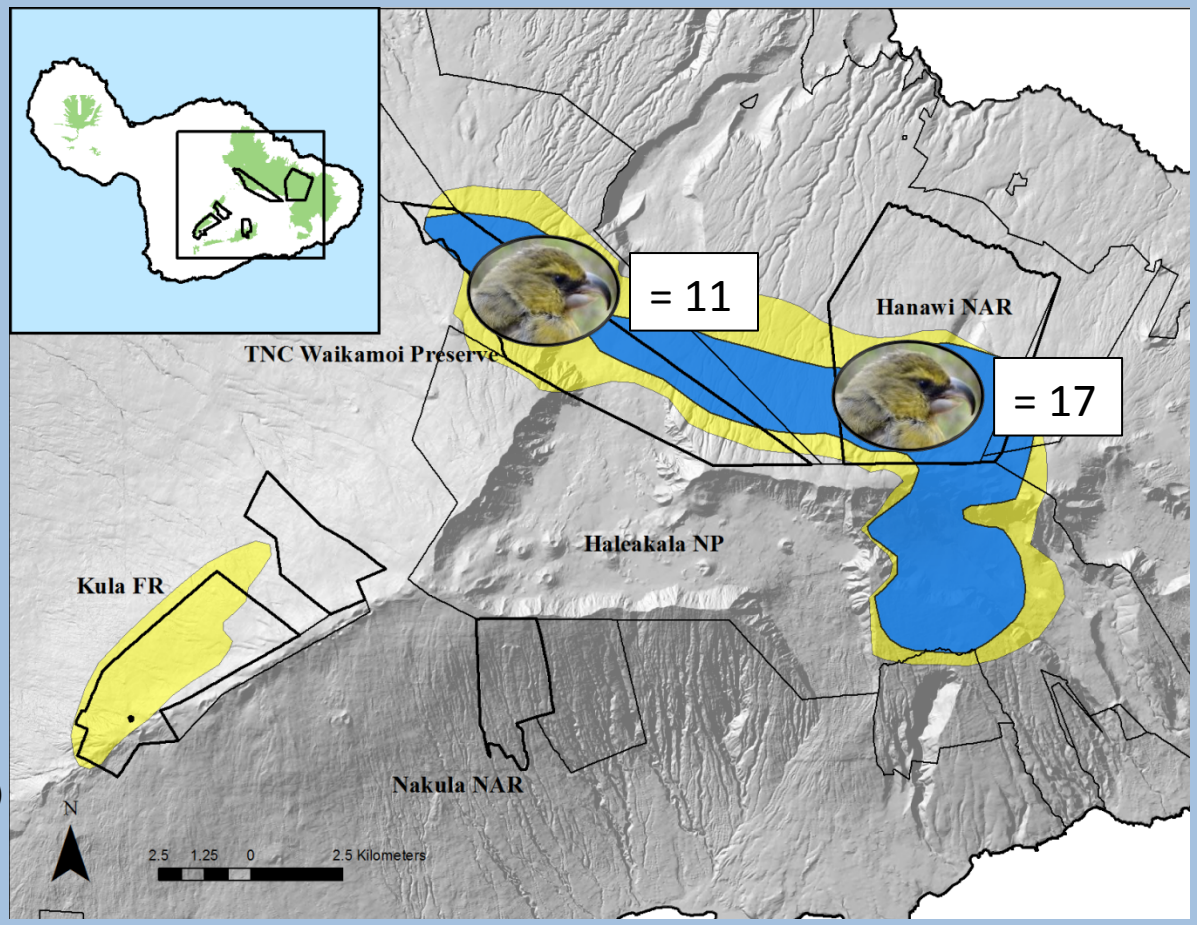
- Geospatial Modelling Environment, Program R and ArcMap10.0
- Linear mixed effects models and Type III ANOVA

Our Data: Sample Size

- Analyzed data 2007 - 2013

- Kiwikiu
  - 2 study sites
  - 167 banded (1992-2013)
  - 93 resighted
  - **28 analyzed** (≥ 10 resights)
  - Pair identity for some individuals

- Alauahio
  - 3 study sites
  - 808 banded
  - 495 resighted
  - **100 analyzed** (≥ 10 resights)
  - No pair information



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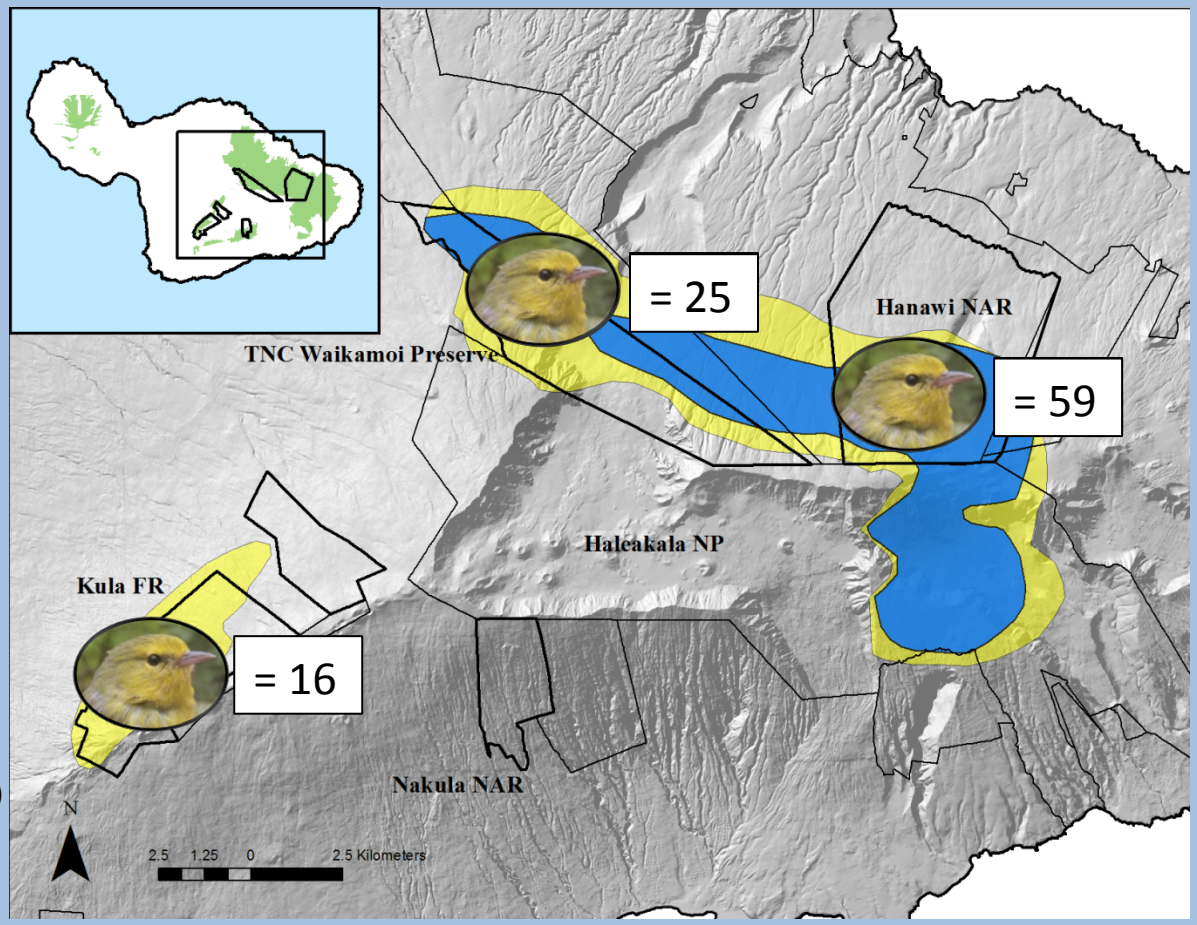
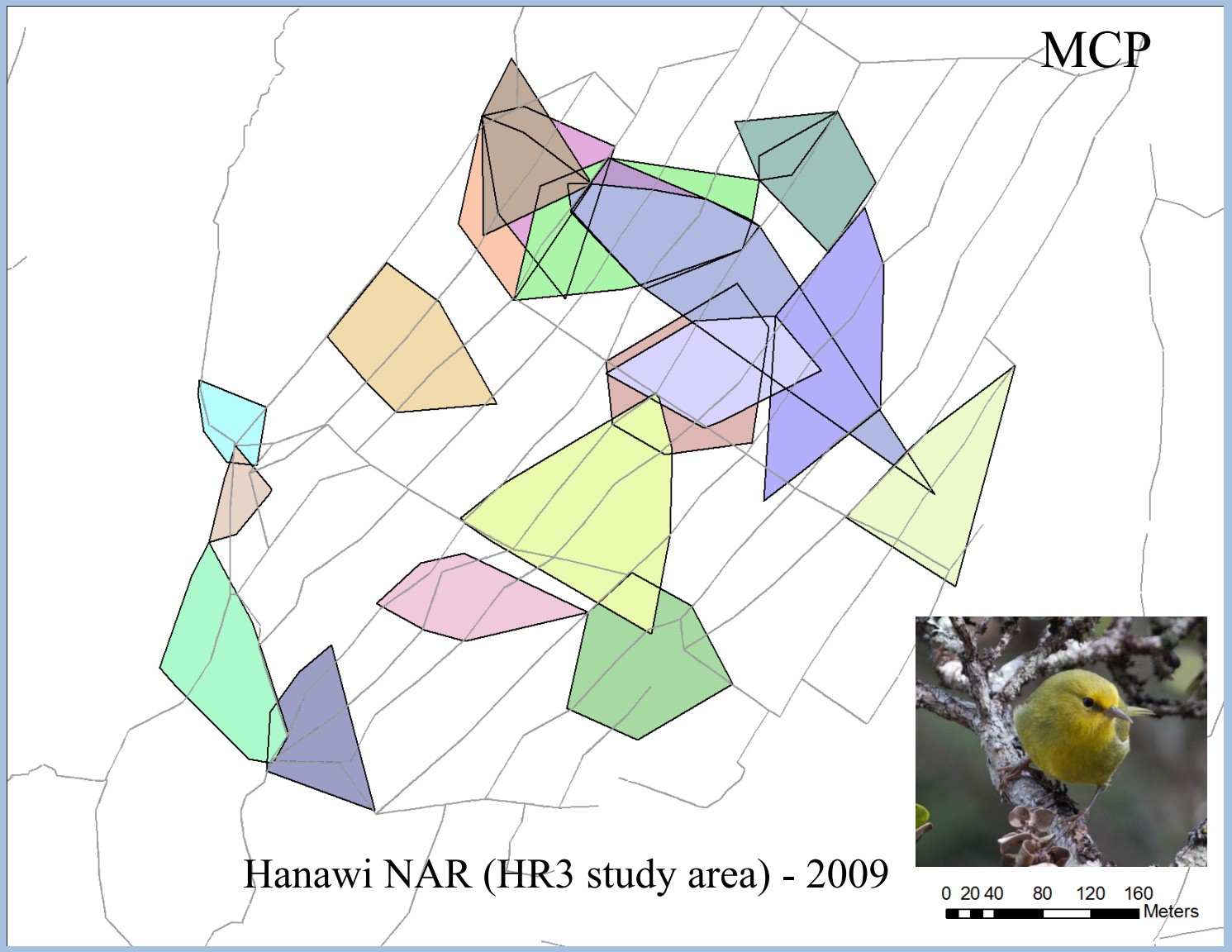
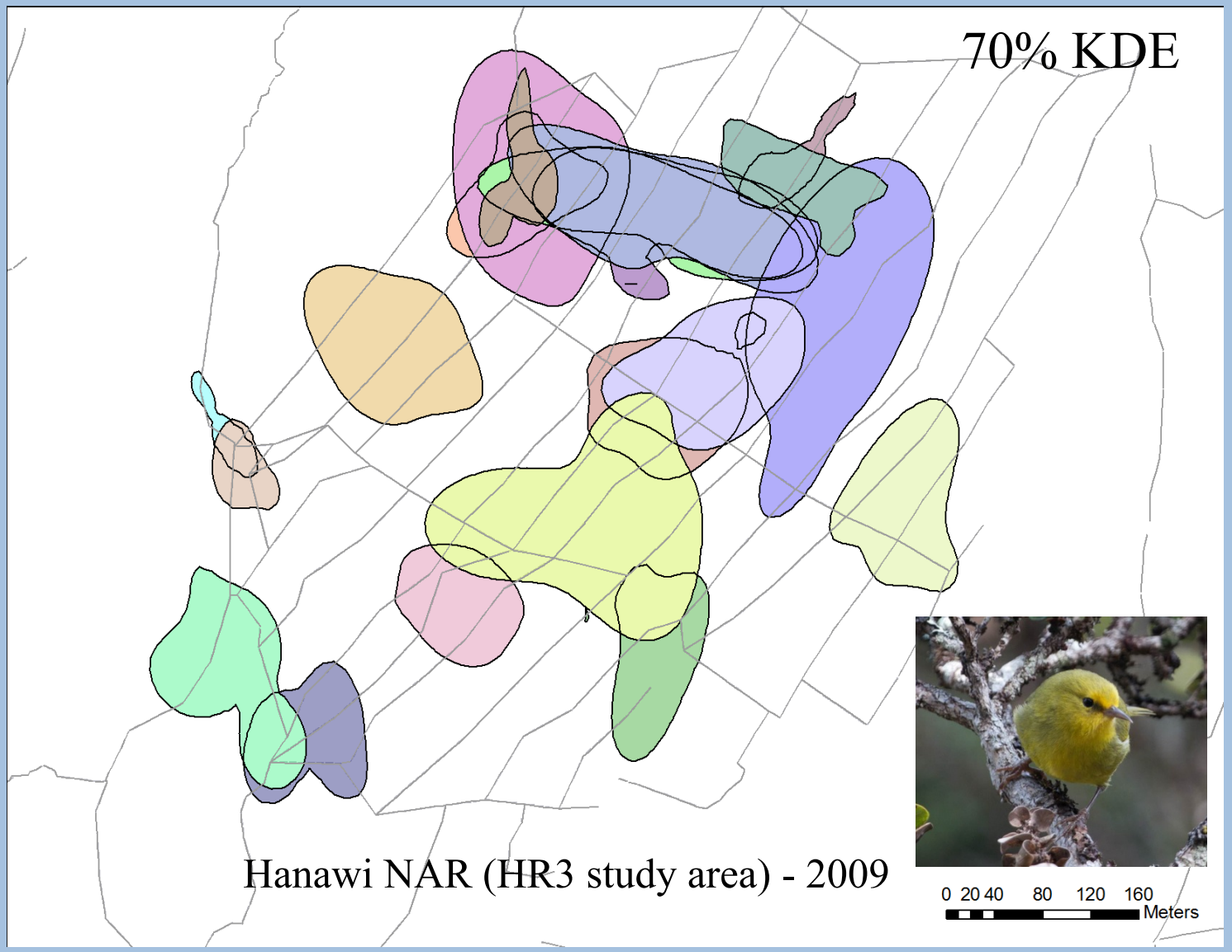


Home Ranges: Alauahio

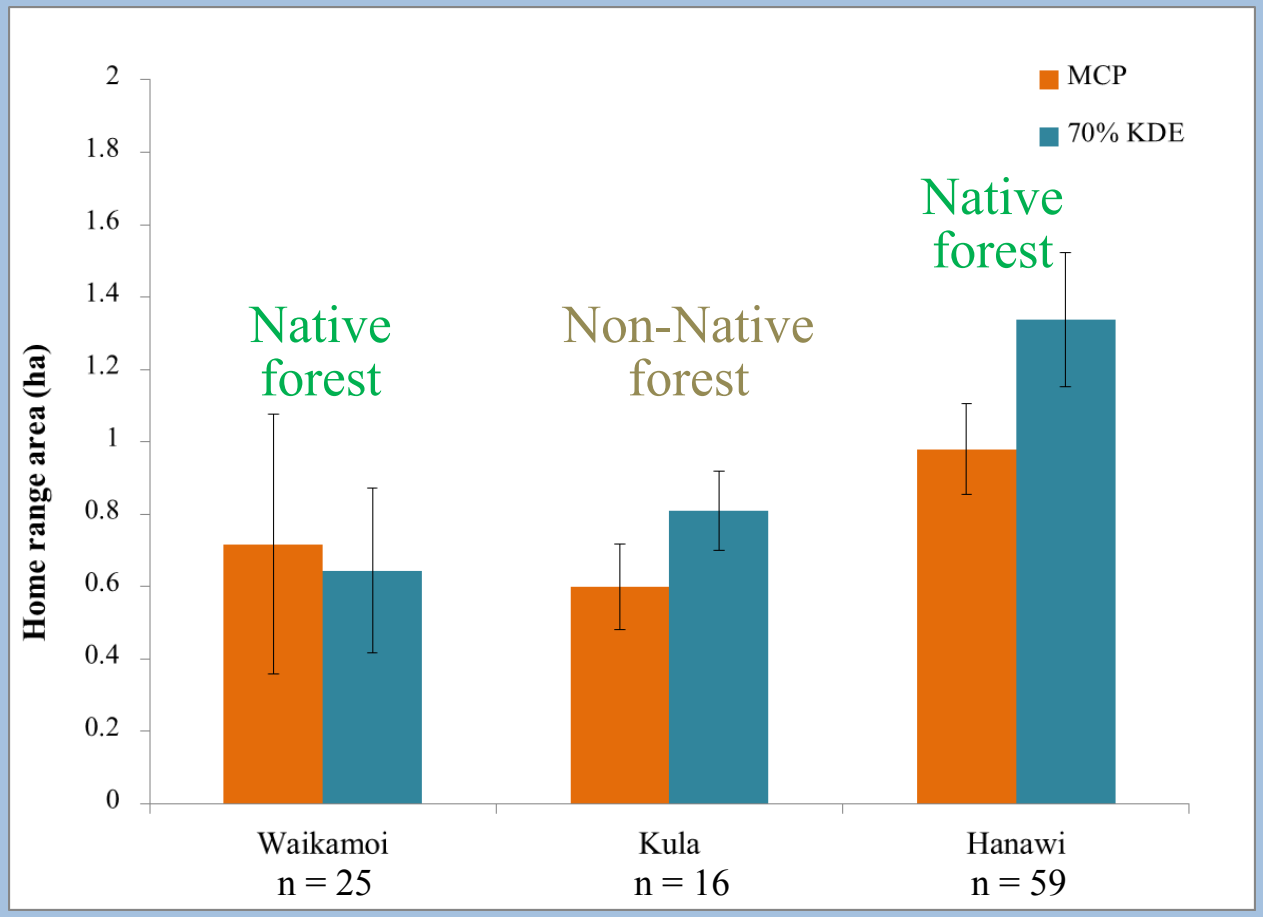


Home Ranges: Alauahio

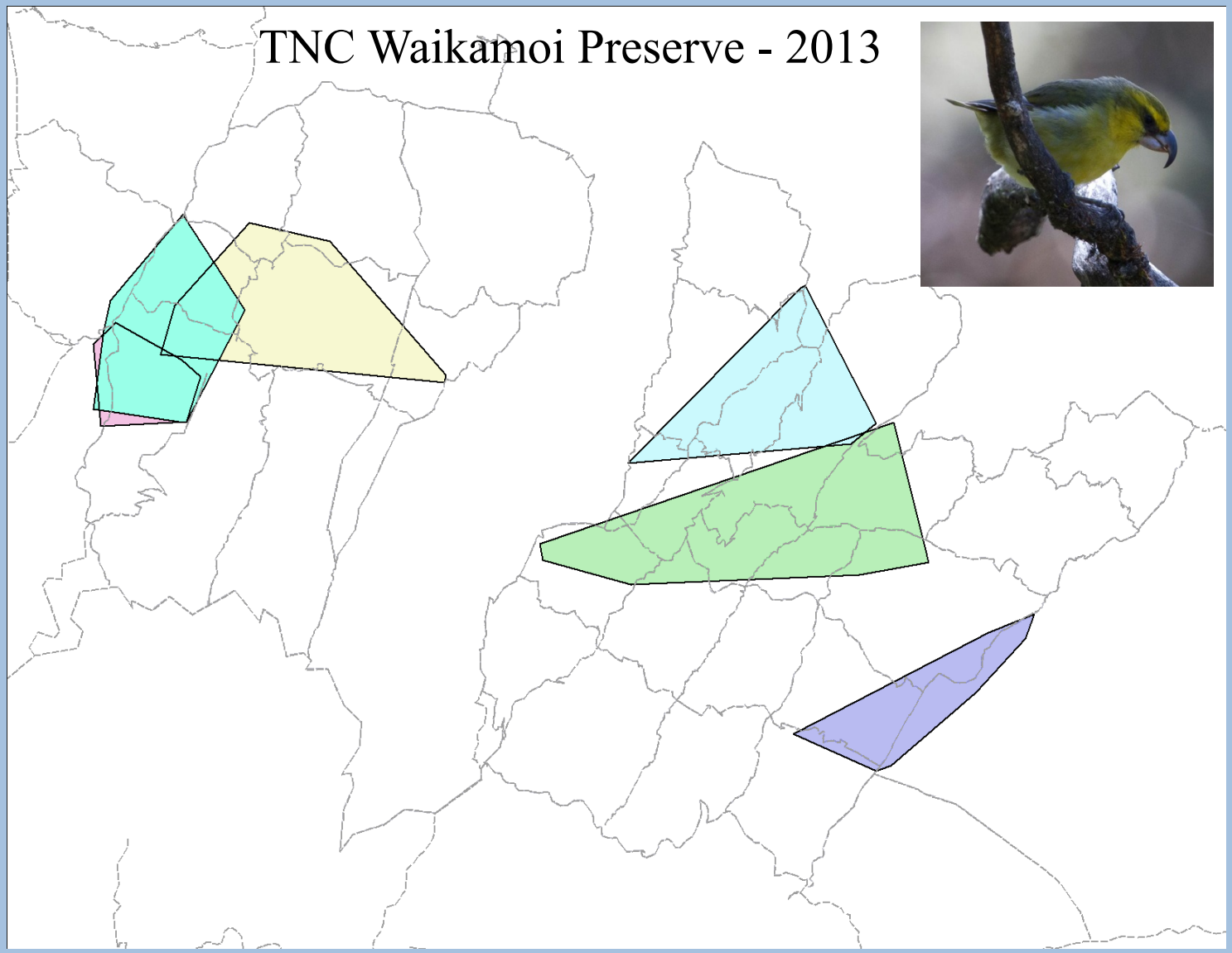


Home Range Size: Alauahio

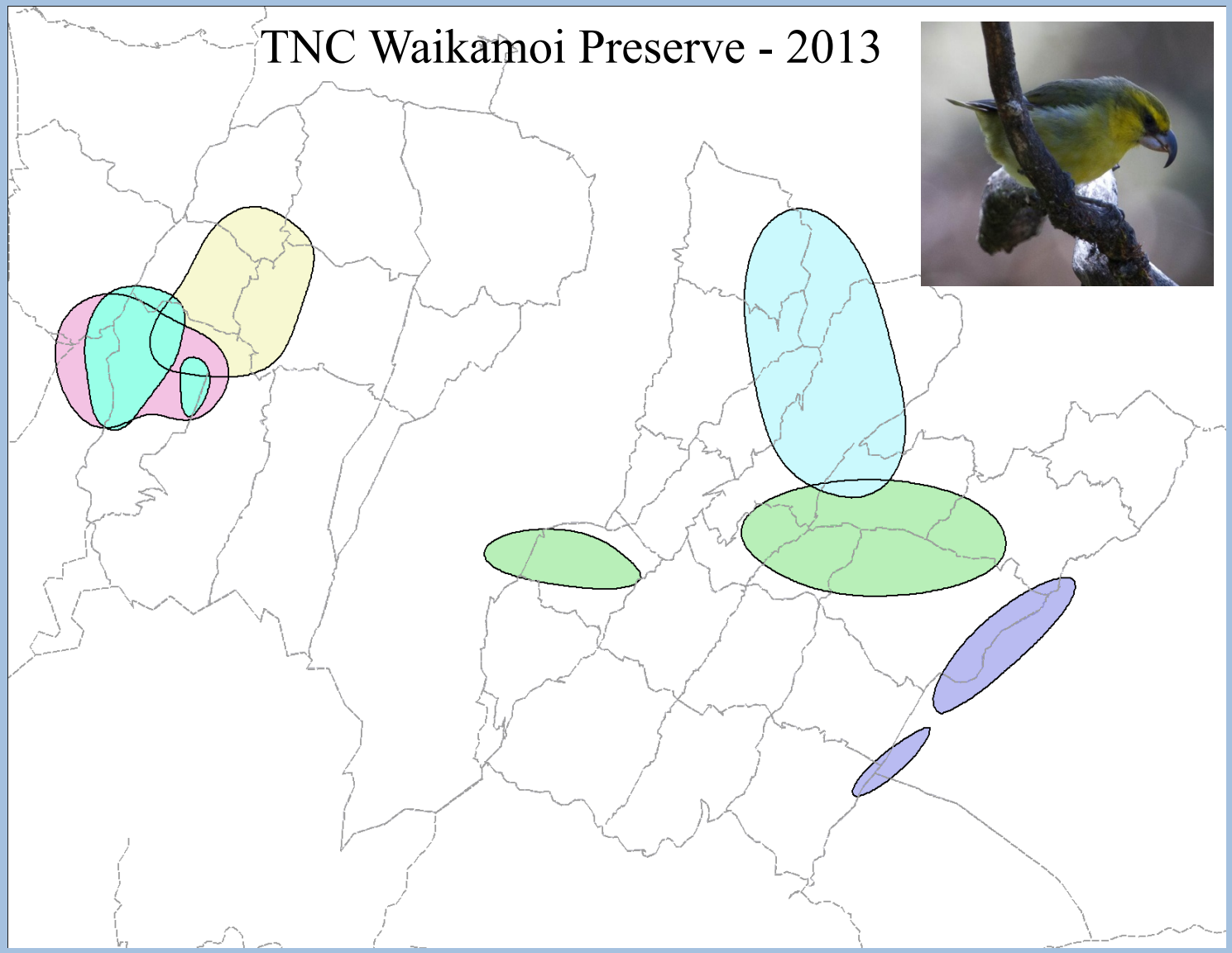
- Overall averages:
  - MCP = 1.17 ± 0.19 ha
  - KDE = 0.95 ± 0.12 ha
- No effect of age
- Sites differed
  - WAI < HAN
  - WAI = KFR
  - KFR = HAN



Home Ranges: Kiwikiu

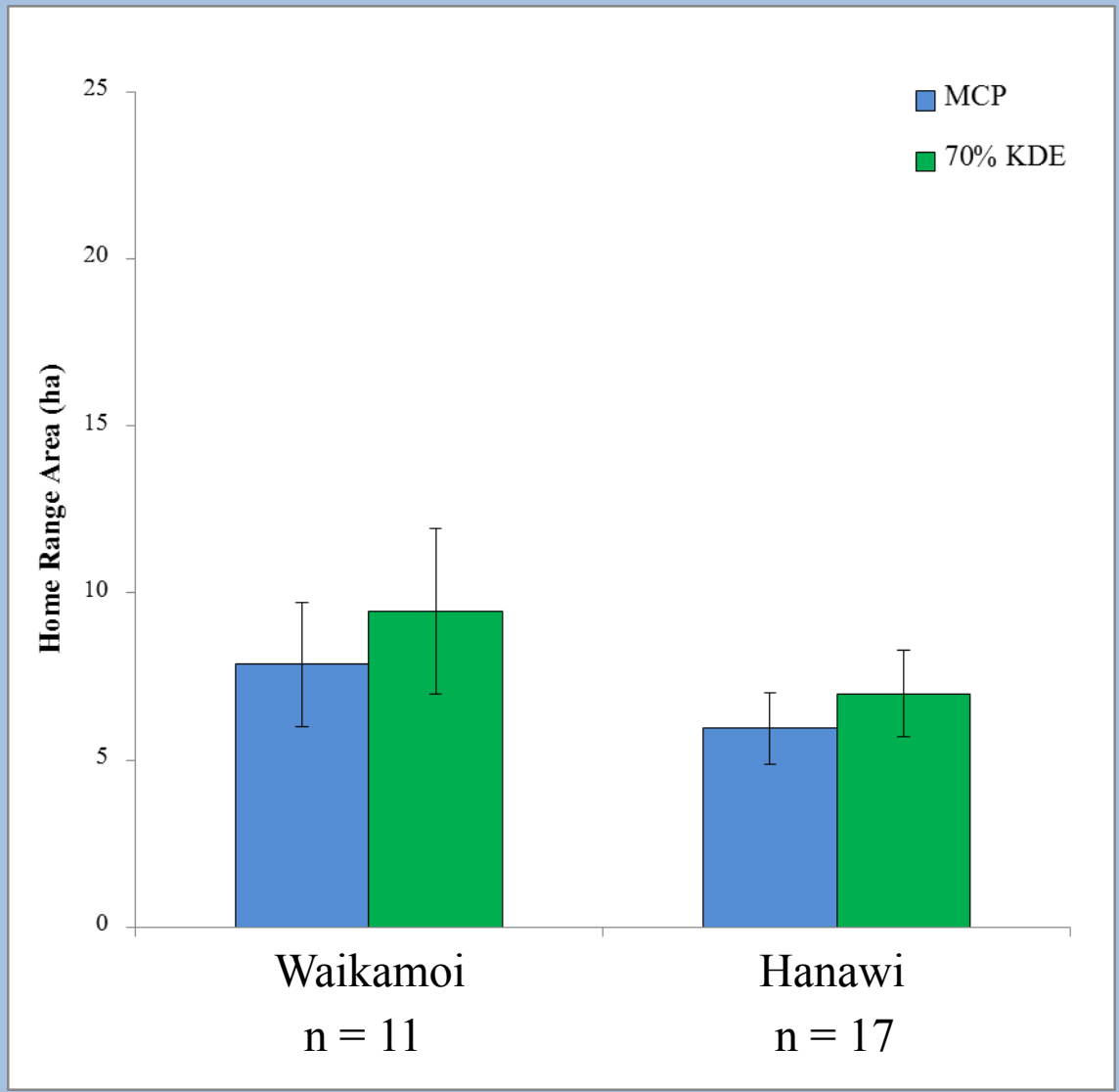


Home Ranges: Kiwikiu

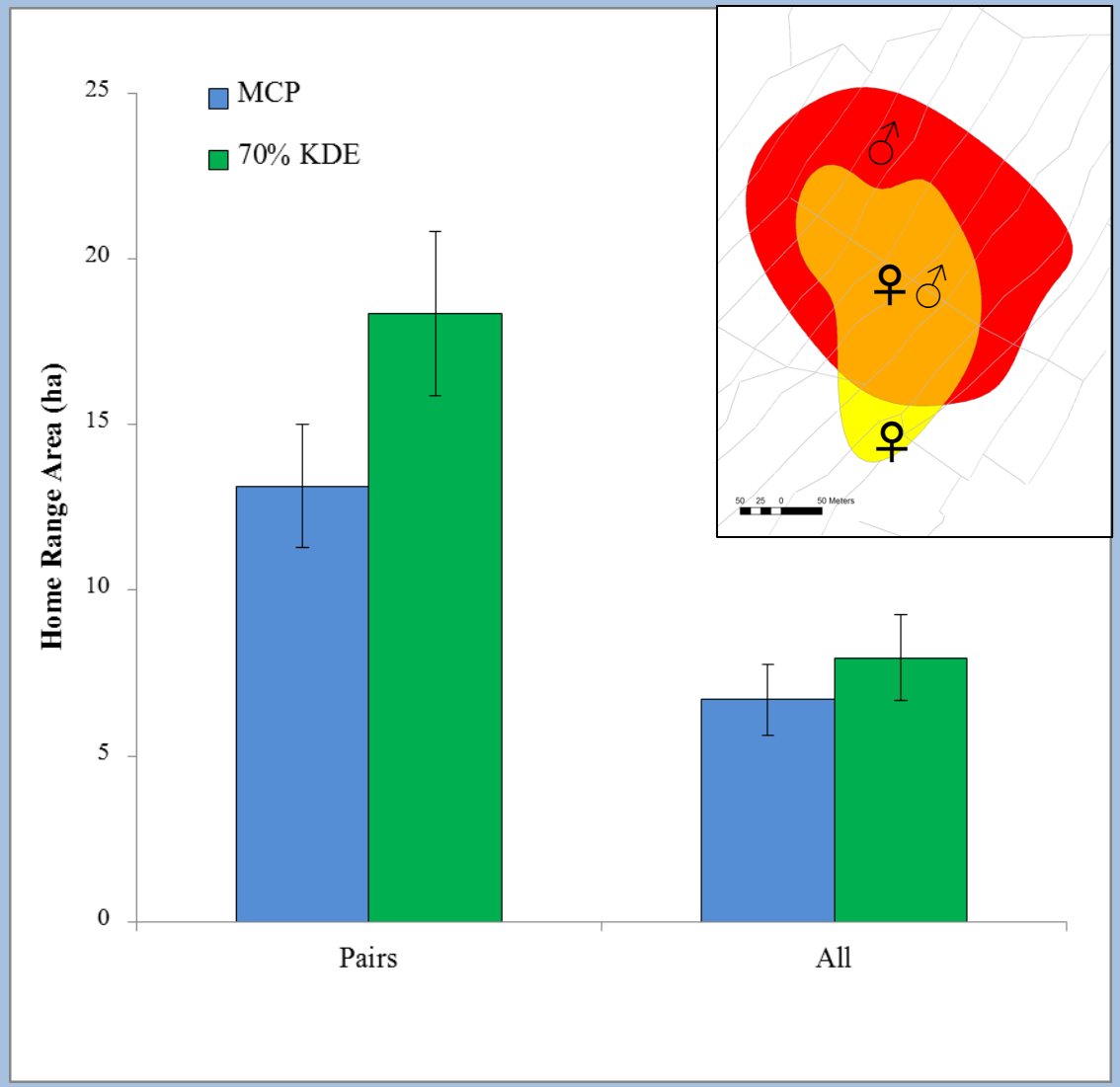


Home Range Size: Kiwikiu

- Overall averages:
  - MCP = 6.7 ± 0.98 ha
  - KDE = 7.96 ± 1.25 ha
- No effect of sex
- Sites did not differ



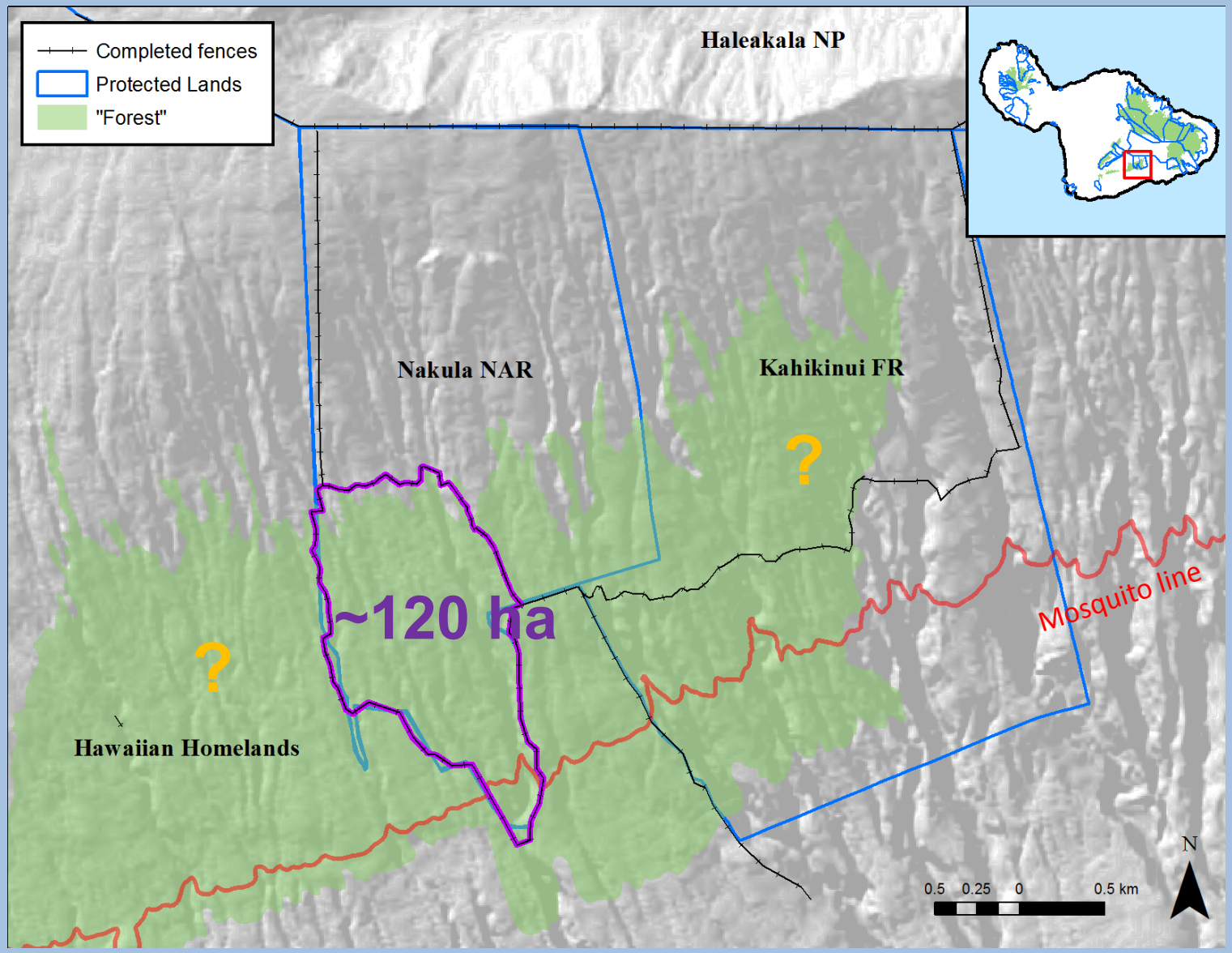
Home-range Size: Kiwikiu Pairs



- n = 6 pairs
- Mate overlap:
  66.4% (MCP) - 71.6% (KDE)
- Combined area average
  - MCP: 13.28 ± 4.63 ha
  - KDE: 18.3 ± 5.47 ha
- 35% - 41% > individual HR
- **<u>Adjusted pair home range:</u>**

  9 ha (MCP) - 11 ha (KDE)
  (Average indiv. × % increase)

How much habitat?



Hypotheses

1. Home-range (HR) area in Nakula will be **> HR** area in current range
   - More open forest = fewer resources (stem density) = increased HR size
2. HR area in Nakula will be **< HR** area in current range
   - "Preferred habitat" = higher quality resources = smaller HR size
3. HR area in Nakula will be **= HR** area in current range
   - "Preferred habitat" = higher quality resources + fewer resources = similar HR size

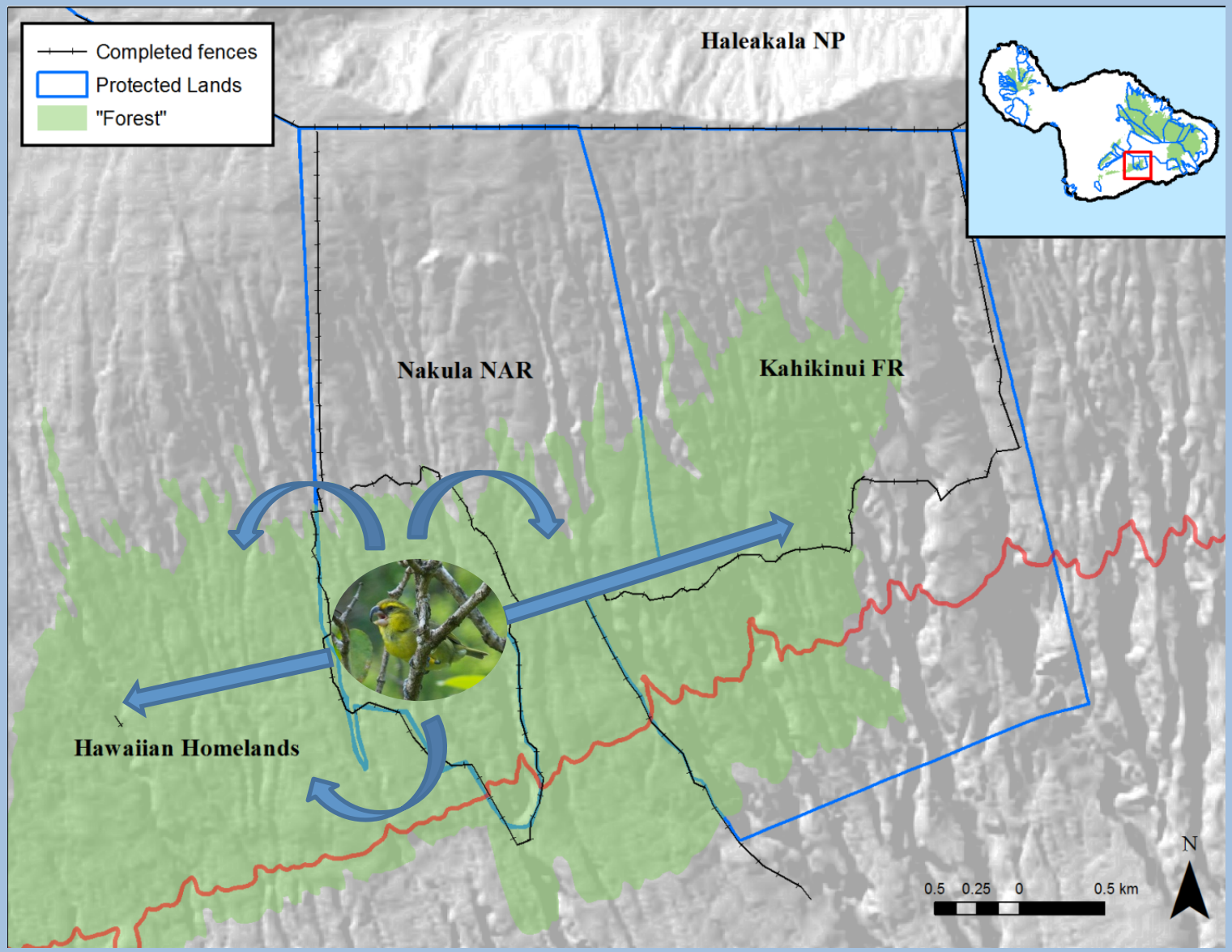
How many Kiwikiu/Alauahio can "fit"?

- If H_3 is correct and 120 ha of habitat available now
  - **15 to 17 Kiwikiu individuals**
  - **10 to 13 Kiwikiu pairs**
  - **102 to 126 Alauahio individuals**

- If H_1 or H_2 are correct, estimate will be > or <

- Home-range overlap

The birds will follow the habitat!



Acknowledgements

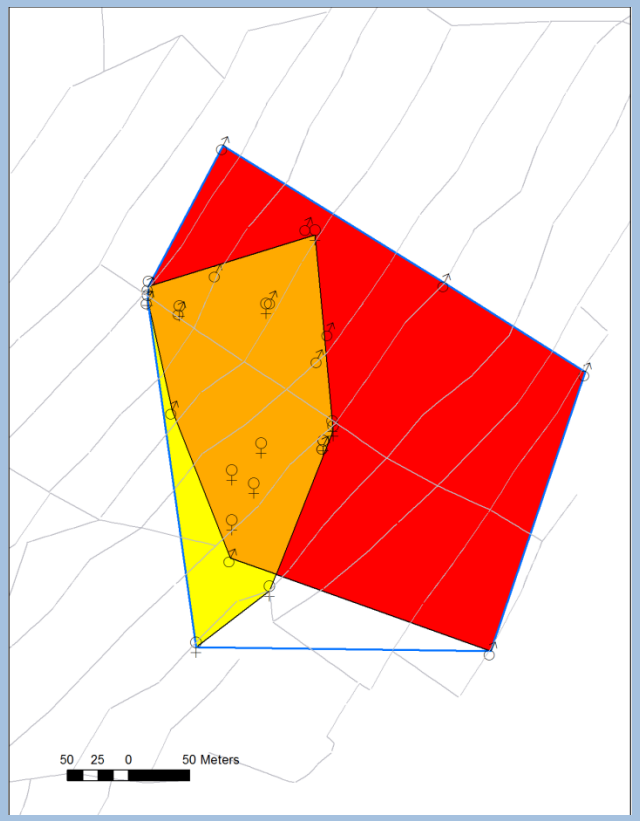
- Mahalo to all our supporting partners

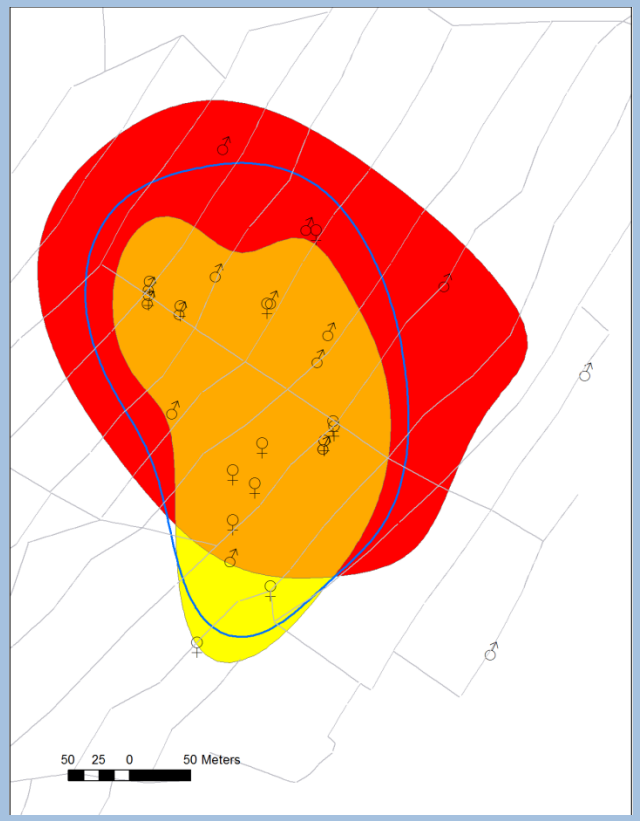
- Thank you to Wildlife Restoration and State Wildlife Grants for funding

- Massive effort by staff, technicians and volunteers


Questions?
chris@mauiforestbirds.org

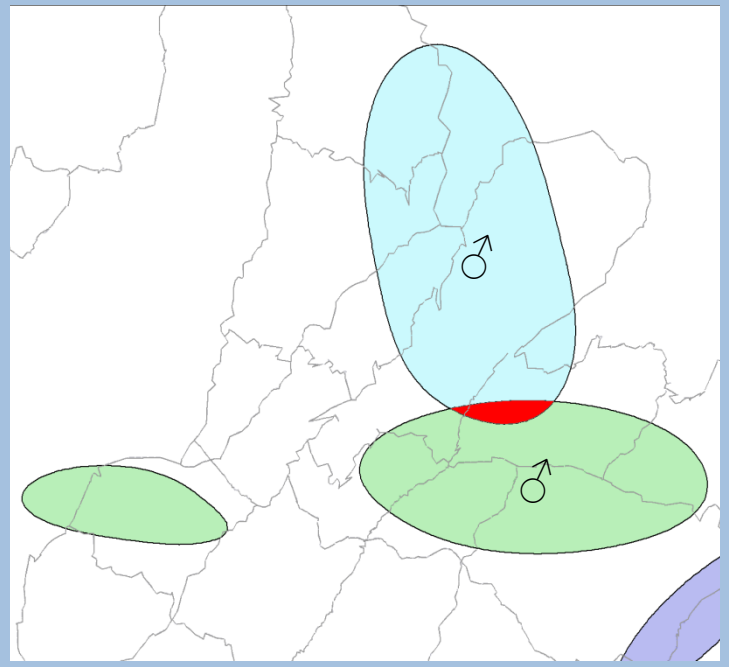
Home Range Size: Kiwikiu Pairs cont.

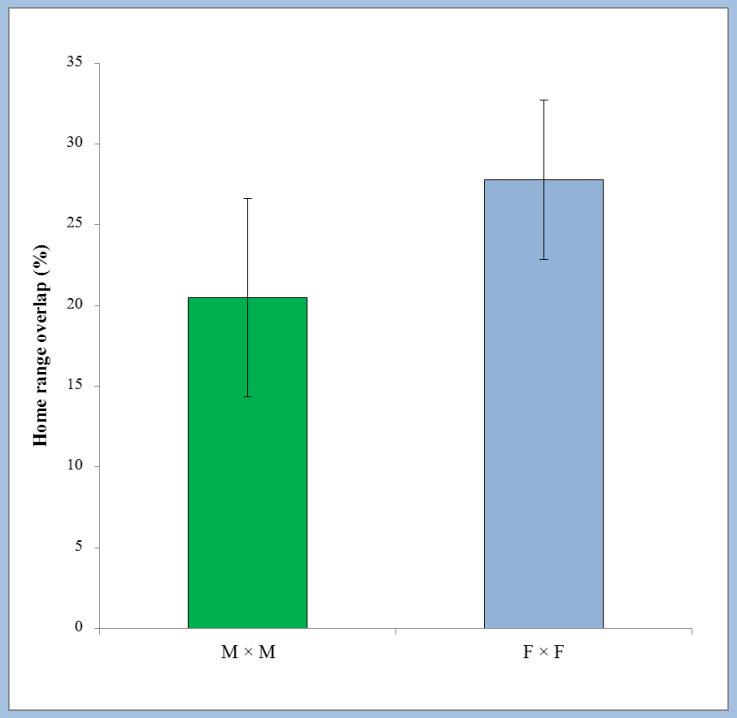




- Combined area HR calculation for MAPA pairs
  - M (red) + F (yellow) + overlap (orange) = Additive Pair HR
  - M & F together as one individual (blue line) = Collective Pair HR
- MCP – Collective is always ≥ Additive
- KDE – Collective >, <, or = Additive

- Additive :
  - MCP: 13.28 ± 4.63 ha
  - KDE: 18.3 ± 5.47 ha
- Collective:
  - MCP: 15.71 ± 4.95 ha
  - KDE: 9.26 ± 3.37 ha





Home-range: Overlap

- Unshared area per individual =
  (% overlap × # neighbors) * HR area
- 70% kde only, like-sex only
- Limited Sample Size
  - ♂ × ♂: n = 8 (4)
  - ♀ × ♀: n = 6 (3)
- Measured for overlap of <u>One individual/ territory</u>
  - 23.6 ± 4.09 % overlap
- <u>Do MAPA overlap?</u>
  - YES, at times to a fair degree