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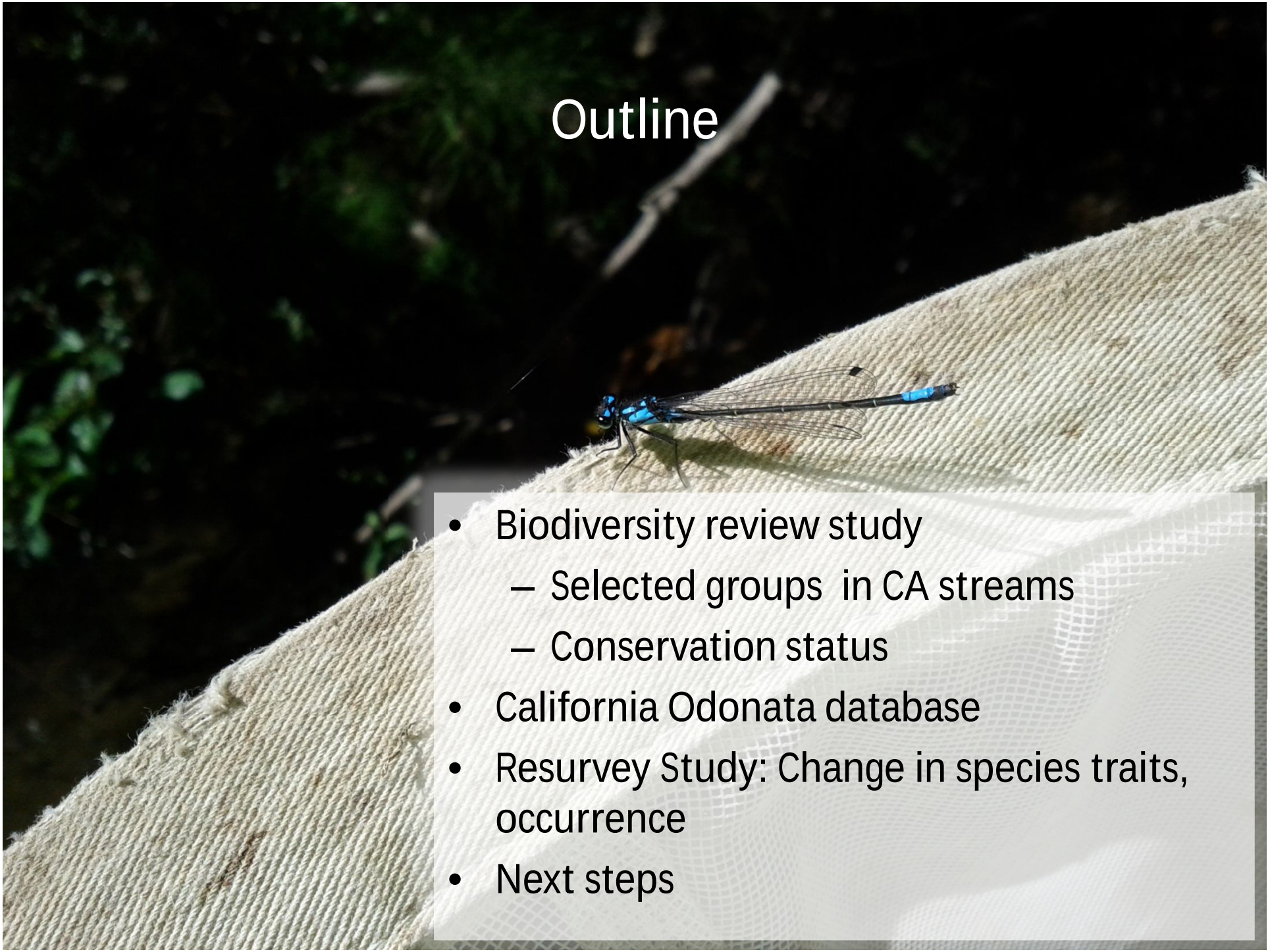
Outline



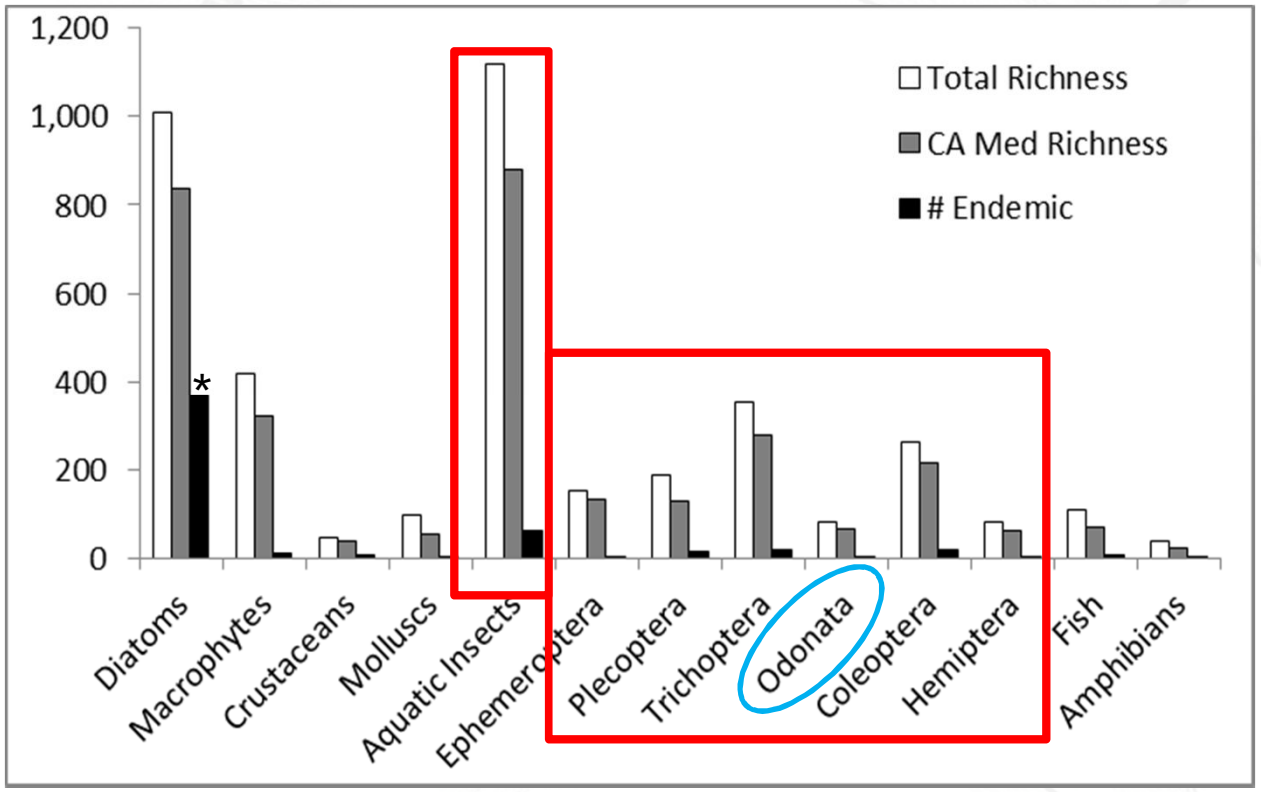
- Biodiversity review study
  - Selected groups in CA streams
  - Conservation status
- California Odonata database
- Resurvey Study: Change in species traits, occurrence
- Next steps

Biodiversity in California Streams

Study Groups

- Ephemeroptera, Plecoptera, Trichoptera, Odonata, Coleoptera, Hemiptera
- molluscs, crustaceans
- diatoms, macrophytes
- fish, amphibians

California Streams: Species Richness and Endemism

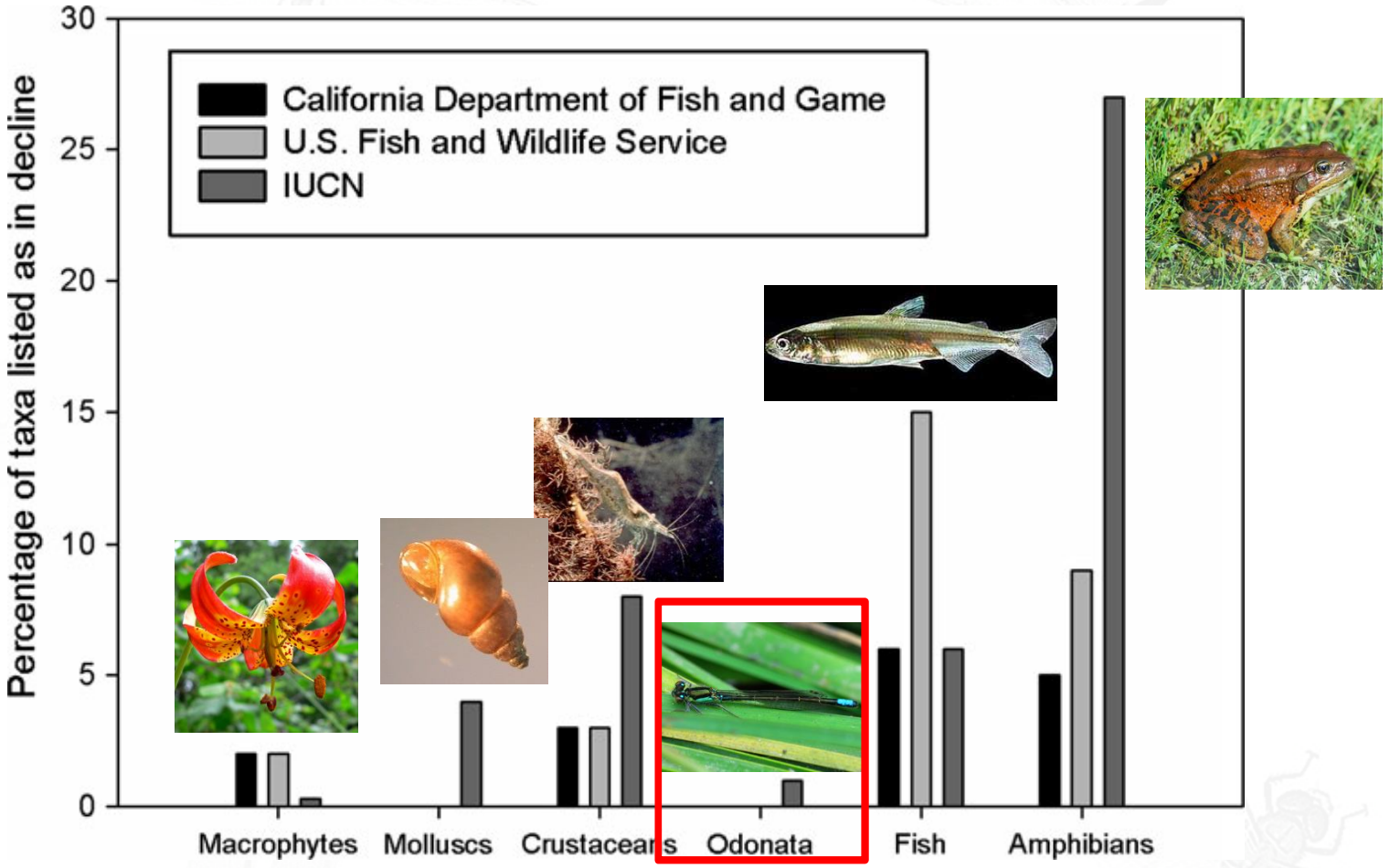


Total Species: 2,837

Aquatic Insects: 1,117

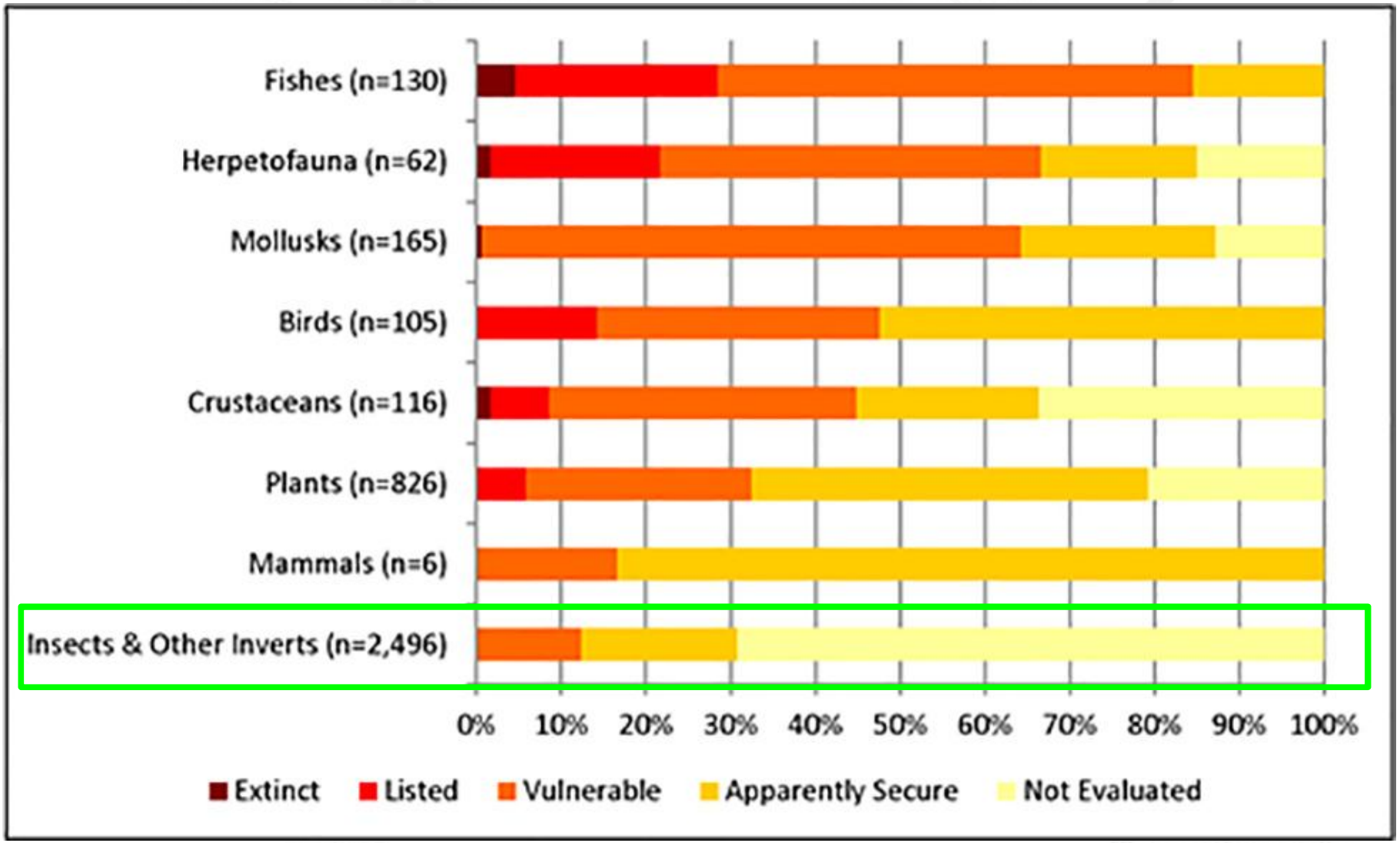
= 40% of total known diversity

California Streams: Conservation Status



Ball *et al*. Hydrobiologia. 2013

TNC Freshwater Taxa Conservation Status



Howard *et al.* Plos One. 2015.

Assessing vulnerability through analysis of change over time: a case study using Odonata

Odonata Occurrence Database (1879 – 2013)

ODONATA CENTRAL

Specimen data – Calbug:

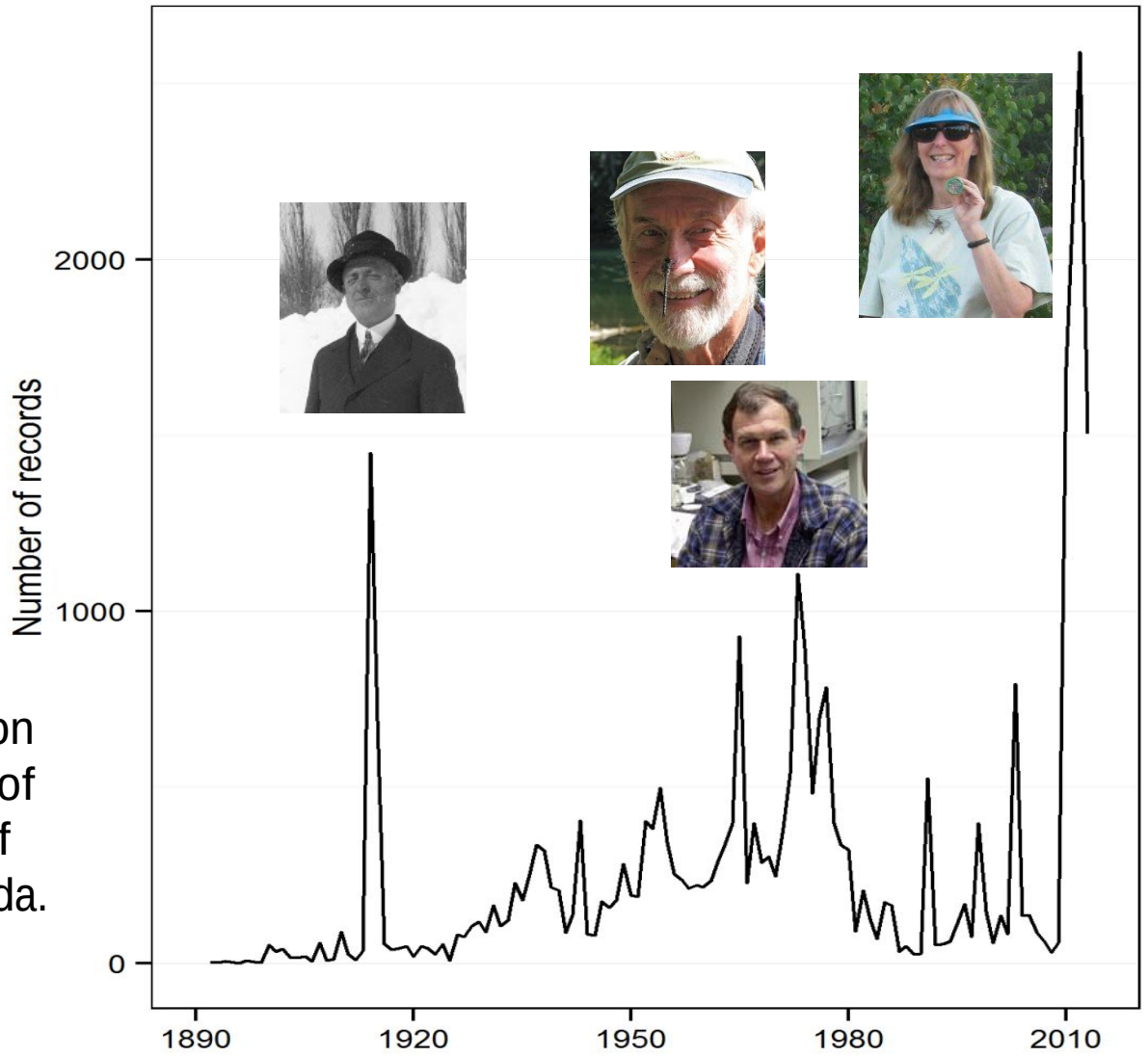
- 9 museums
- Private collections

Observation data – vetted records:
-CalOdes (2010-2013)
-Odonata Central

Ball-Damerow *et al.* Zookeys. 2015

Distribution of records over time

Totals:
32,025 records
106 species



Kennedy, C.H. 1917. Notes on the life history and ecology of the dragonflies (Odonata) of Central California and Nevada. *Proceedings of the National Museum.*

1914-1915 Resurvey Study

- Biological traits
- Individual species occurrence

Ball-Damerow *et al.* Biodiversity and Conservation. 2014

Resurvey Sites

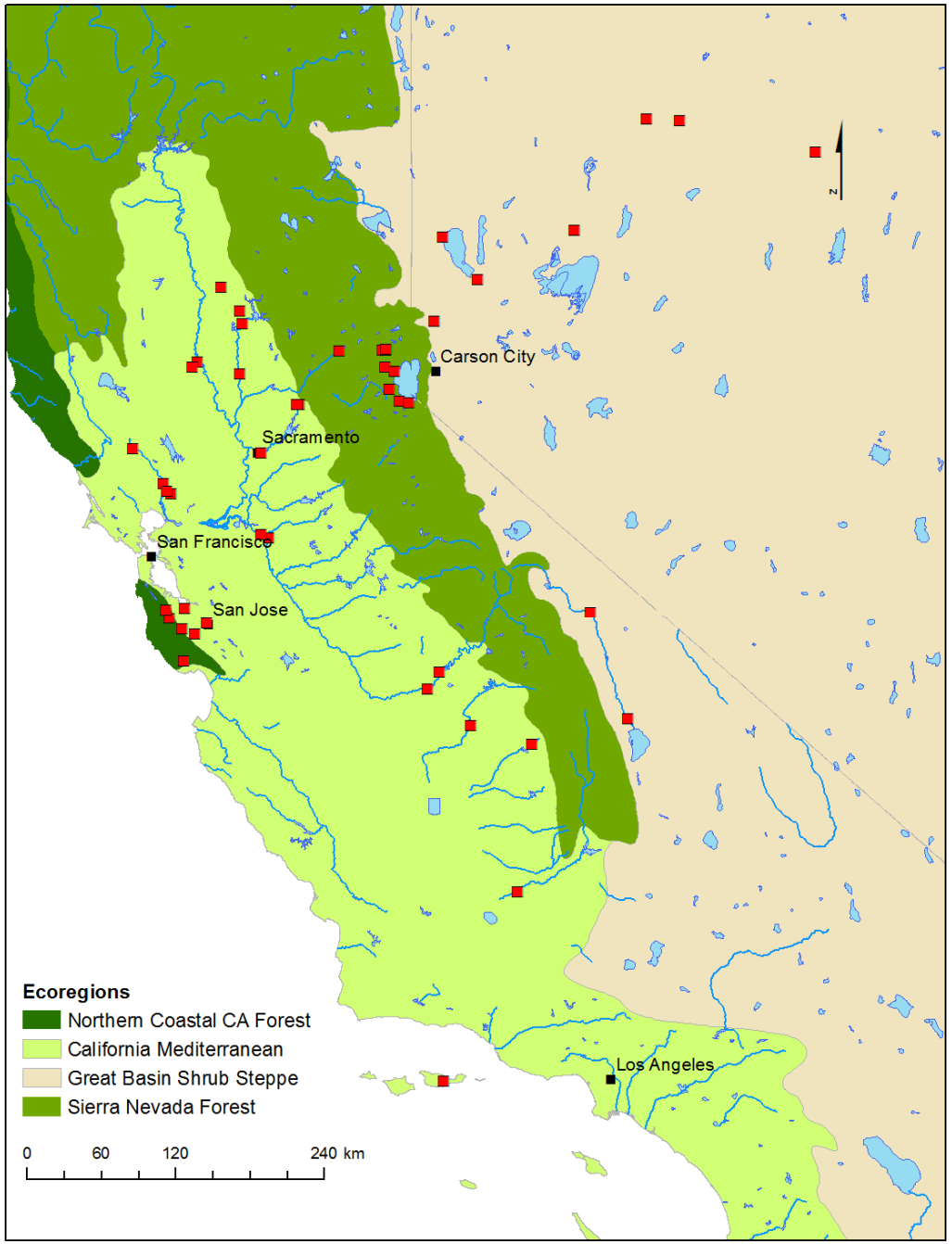
Adult surveys

45 Sites across Central CA and NV

Late April – Mid Sept

Within 1-2 weeks of original date

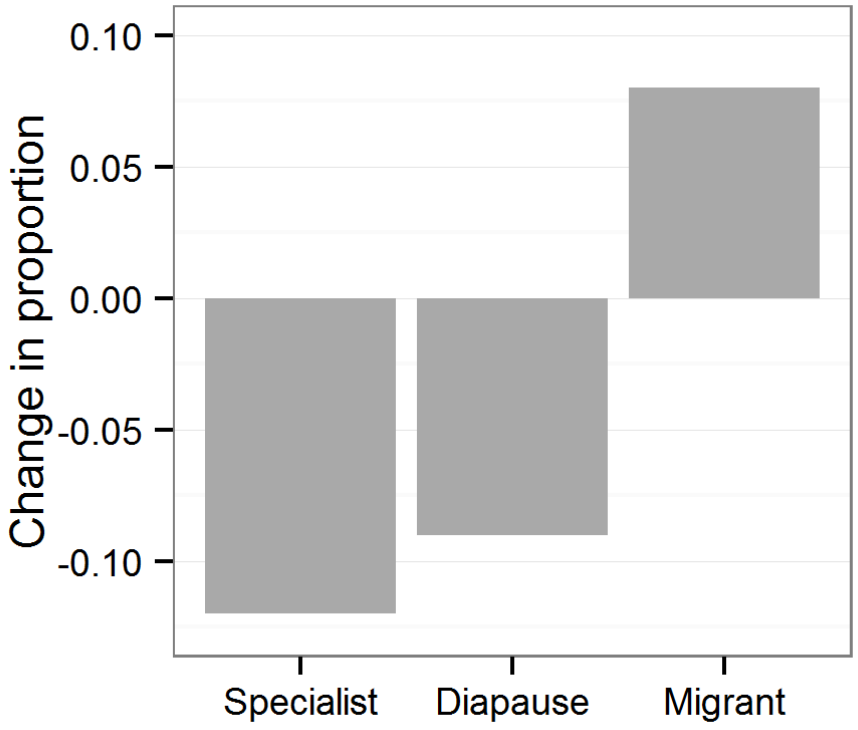
Replicate effort:
2-5 visits over 2011-13



Change in Species Traits since 1914-15

- Multi-species GLMM, logit link function, binomial error distribution
- Traits: dispersal, habitat specialization, tolerance value, generation time, diapause

Species detection = intercept + era x species traits + random effects (family, genus, species, site)



Habitat Specialists (-0.31, p=0.029)

Overwintering Diapause (-0.36, p=0.006)

Migrant (3.42, p<0.001)

Change in Species Occurrence

Species with the highest declines in occurrence		
Sympetrum pallipes	-11	G
Lestes congener	-11	G
Sympetrum obtrusum	-7	S
Macromia magnifica	-6	S
Sympetrum danae	**-6**	**S**
Ophiogomphus morrisoni	-5	S
Progomphus borealis	-5	S
Ophiogomphus occidentis	**-5**	**S**
Hetaerina americana	-4	S
Aeshna interrupta	-4	S
Stylurus olivaceus	-4	S

Species with the highest increases in occurrence		
Enallagma civile	**18**	**G**
Anax junius	15	G
Pantala hymenaea	15	G
Tramea lacerata	14	G
Libellula saturata	9	G
Libellula luctuosa	**9**	**G**
Rhionaeschna multicolor	8	G
Pachydiplax longipennis	8	G
Ischnura cervula	7	G
Sympetrum corruptum	6	G
Enallagma clausum	5	S

Specialists: restricted to streams, wetland, forests, or elev.
21% increased, 78% declined
Generalists: inhabit ponds, lakes, streams, canals
62% increased, 37% declined

Avg. % Generalists at each site increased by 18%
(t-test, $p<0.001$)

Homogenization

Photo by Ray Bruun

Next steps in determining vulnerability of aquatic insects

Targeted conservation assessments

Protect freshwater habitats


Photo by Ray Bruun

- Rare species
- Geographically restricted
- Species that have declined over time
  - Identify particular species
  - Traits: habitat specialization (streams, high-elevation)
- Sensitive biological indicators (low tolerance value, EPT)
- Genus-level assessments, use bioassessment data

Need More data

- Specimen databases for other groups
- Life history, ecology studies

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