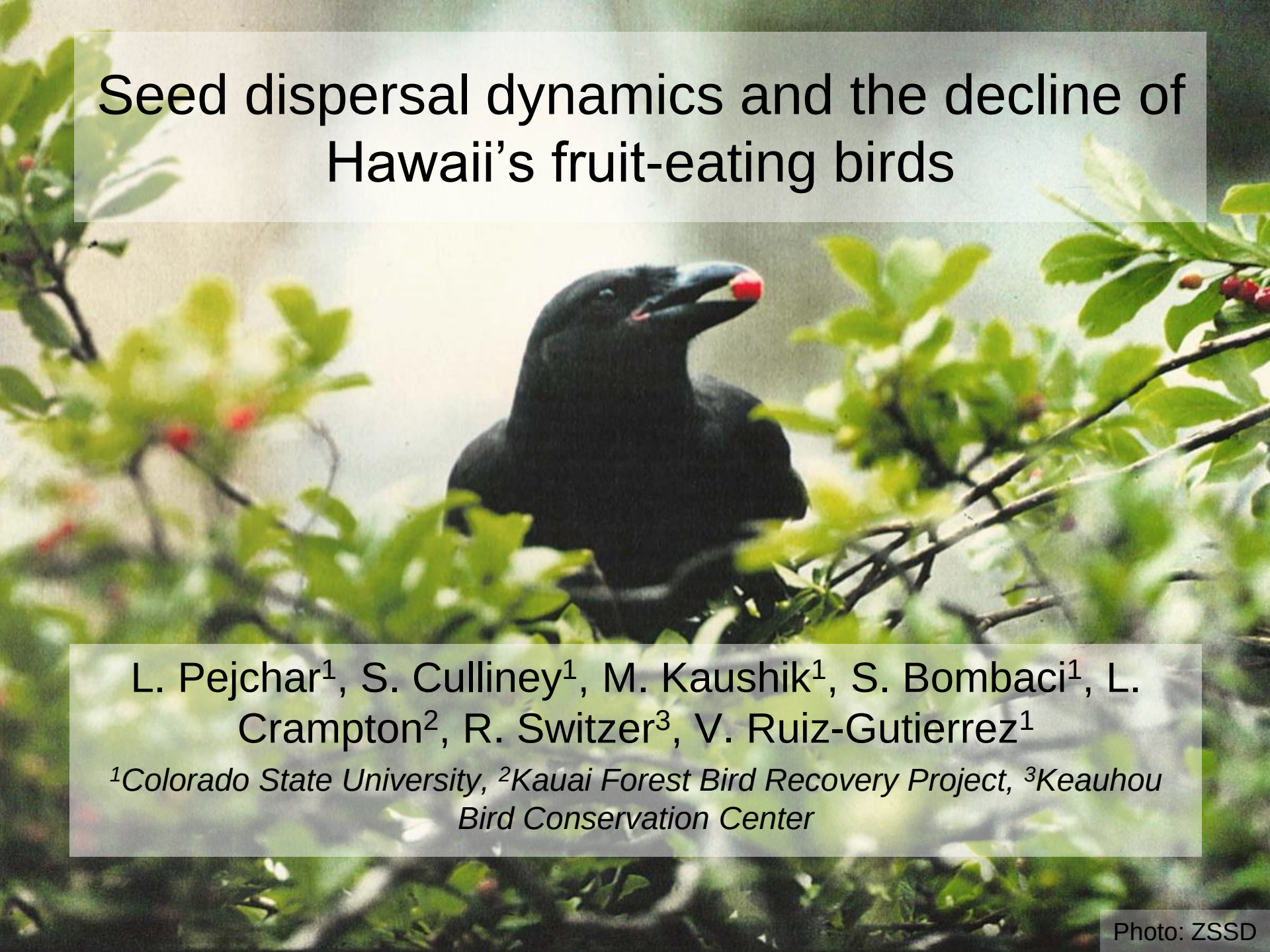
Seed dispersal dynamics and the decline of Hawaii's fruit-eating birds



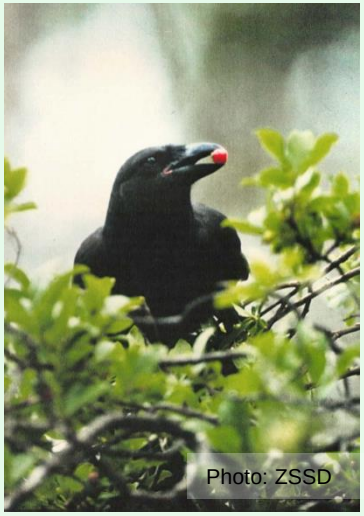
L. Pejchar[1], S. Culliney[1], M. Kaushik[1], S. Bombaci[1], L. Crampton[2], R. Switzer[3], V. Ruiz-Gutierrez[1]

[1]Colorado State University, [2]Kauai Forest Bird Recovery Project, [3]Keauhou Bird Conservation Center

Photo: ZSSD

How are birds important for seed dispersal?

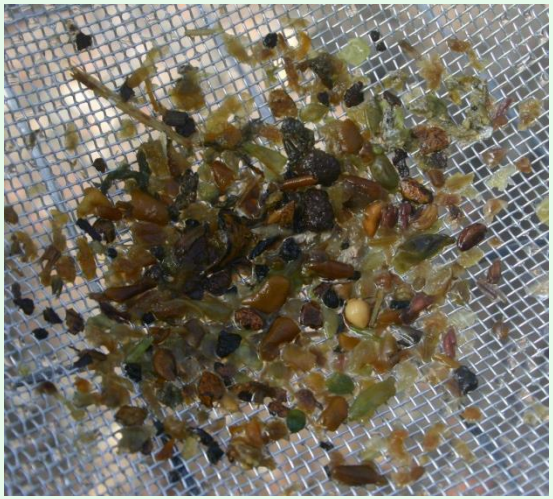
Distance dispersal



Directed dispersal

Germination benefits

Fertilizing effects



50% of Hawaii's native plants rely on seed dispersal by birds

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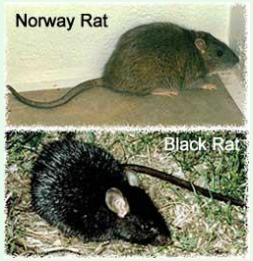
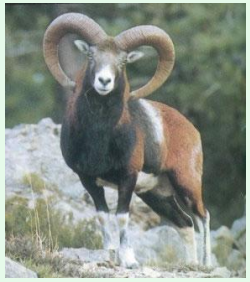
The Alala, Omao and Puaiohi are Hawaii's only extant native frugivores

Drivers of Decline and Extinction

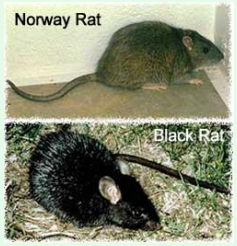
Predation



Habitat loss and degradation



Competition and disease



Captive population, future release?


Photo: ZSSD


Susan Culliney-ZSSD

Questions

1. What seed dispersal services are lost…and restored, by the extinction and recovery of Alala?

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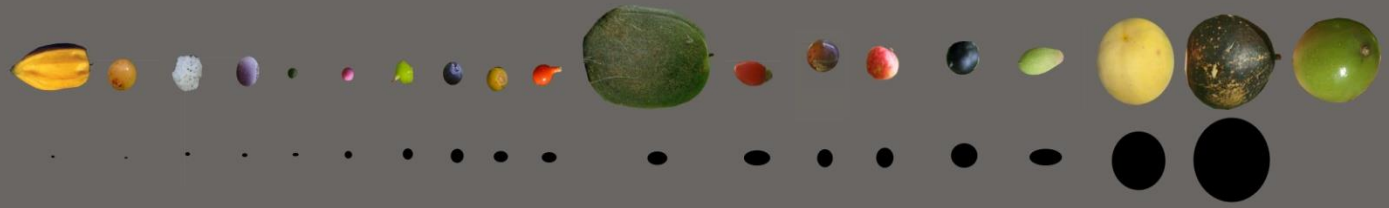


´Alalā

Corvus hawaiiensis
Native - extinct
in wild

Ōma´o

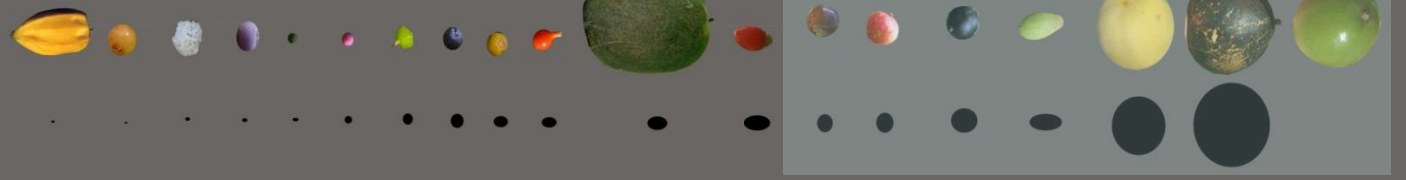
Myadestes obscurus
Native – narrow range

Leothrix

Leiothrix lutea
Exotic - widespread

Japanese White-eye

Zosterops japonicus
Exotic - widespread



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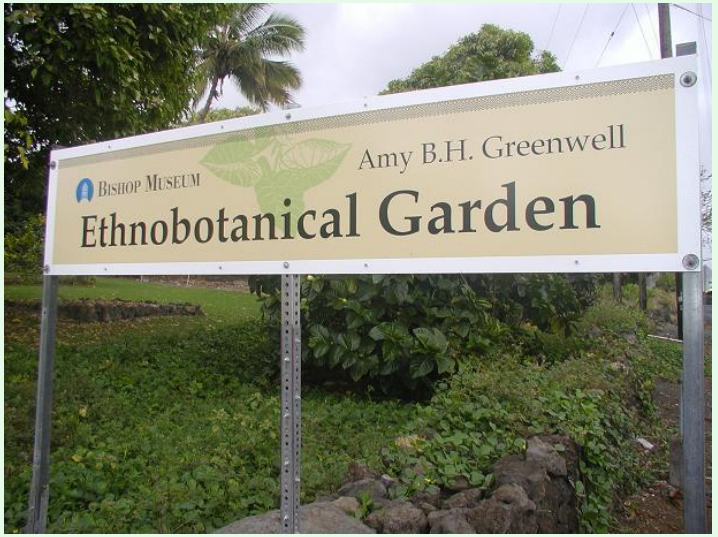
Keauhou Bird Conservation Center (Volcano, HI)



Plants Included in Study

Methods: Dispersal Behavior

1) Gave each ´Alalā suite of berries, observed (**Bird level**)

Eat

Carry

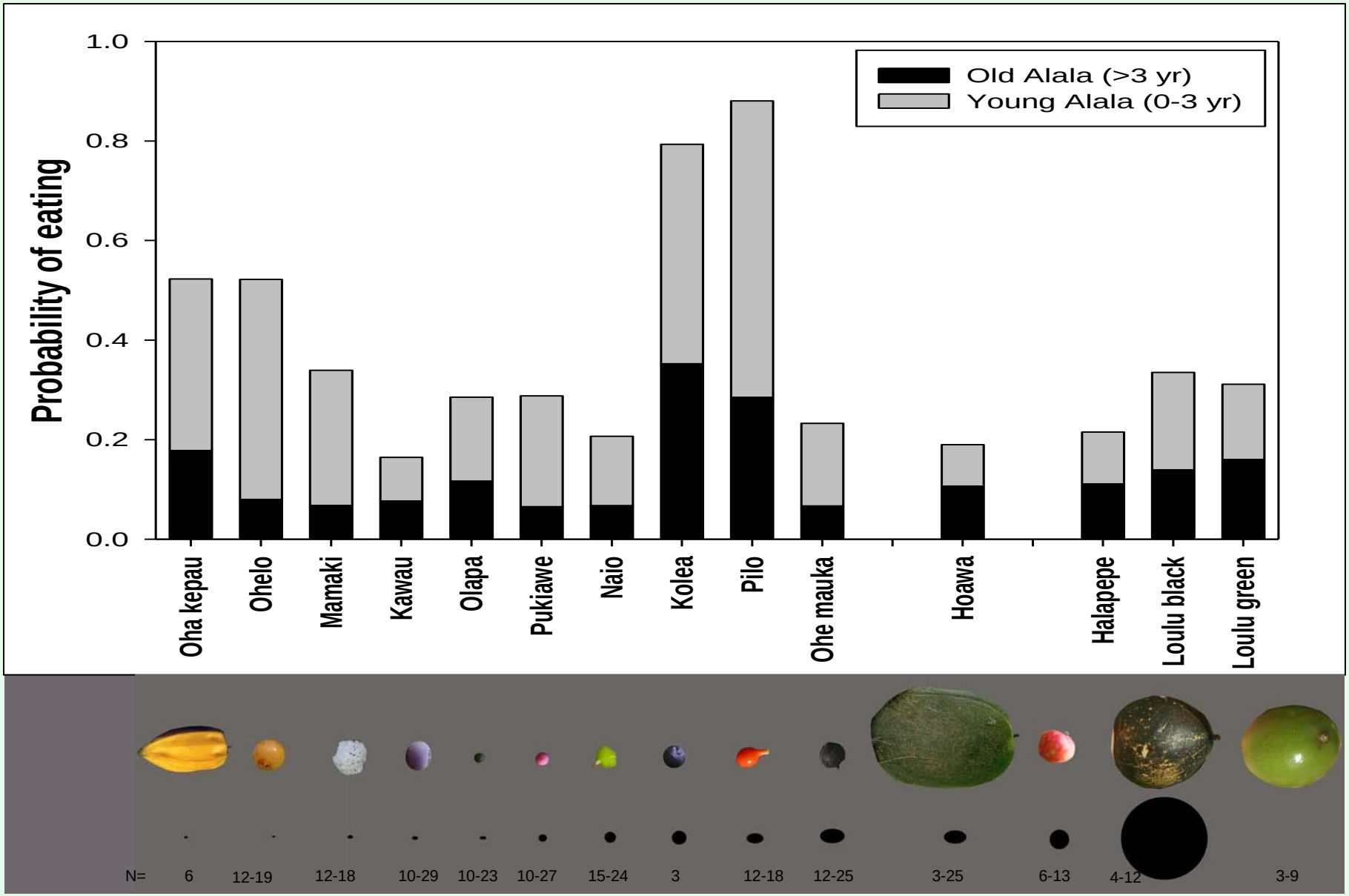
Cache

2) Fate of seeds discovered next day (**Flock level**)

% seeds digested

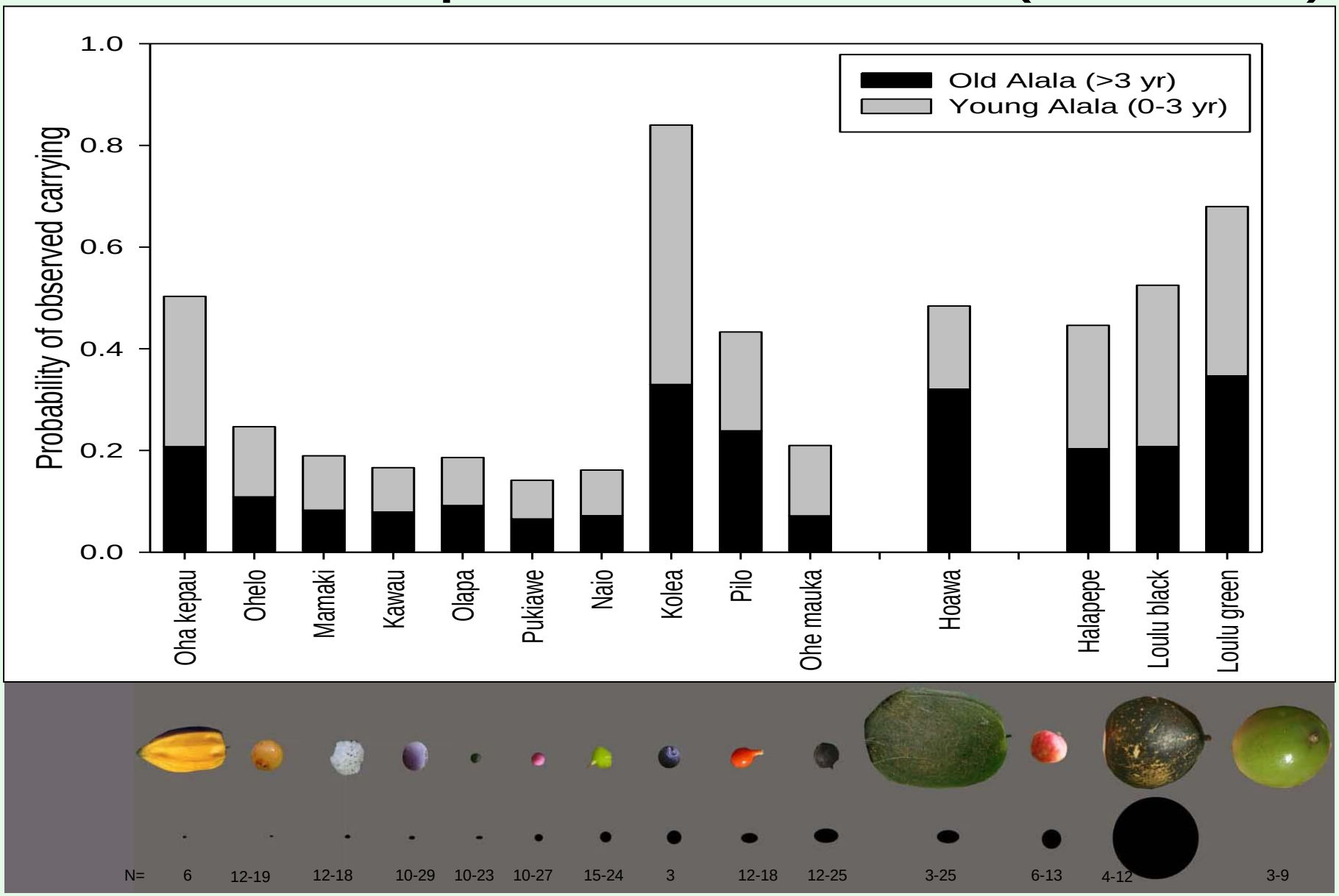
% seeds plucked/moved

Results: Dispersal Behavior (EAT)



´Alalā flock consumed all plants in the study, a form of seed dispersal

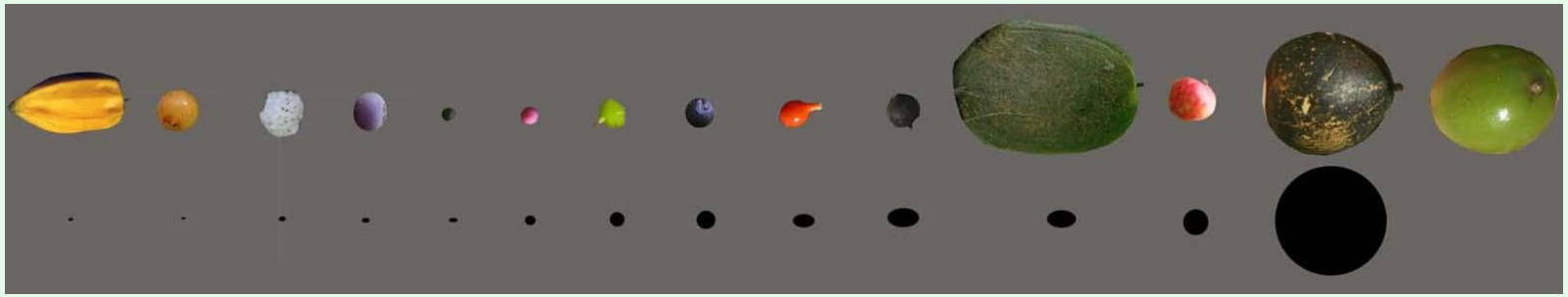
Results: Dispersal Behavior (CARRY)



´Alalā flock carried all plants, a form of seed dispersal

Results: Dispersal Behavior (CACHE)

	Oha kepau	Ohelo	Mamaki	Kawau	Olapa	Pukiawe	Naio	Kolea	Pilo	Ohe mauka	Hoawa	Halapepe	Loulu black	Loulu green
% times cached	1.2	2.2	0.7	1.1	0.5	0.2	1.2	3.6	2.4	1.5	2.9	3.9	0.6	0.8



´Alalā flock cached all plants, a form of seed dispersal

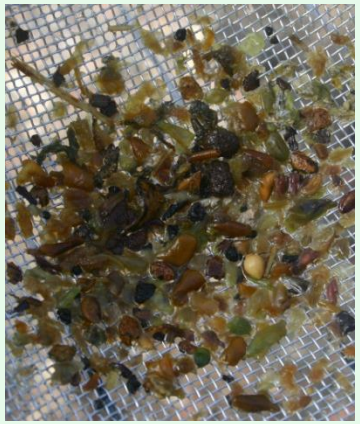
Methods: Germination Benefits

Compared germination success among four treatments:

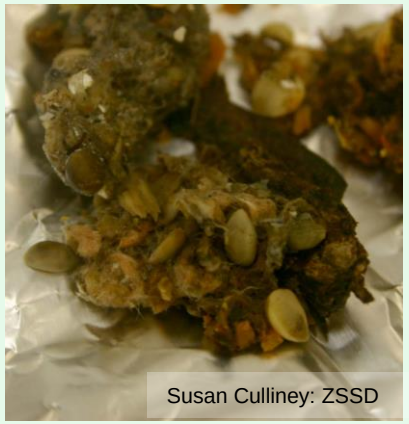
Whole

Cleaned

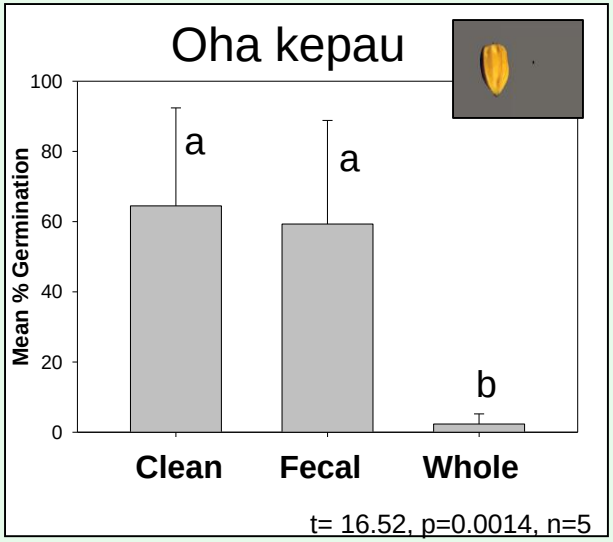
Fecal

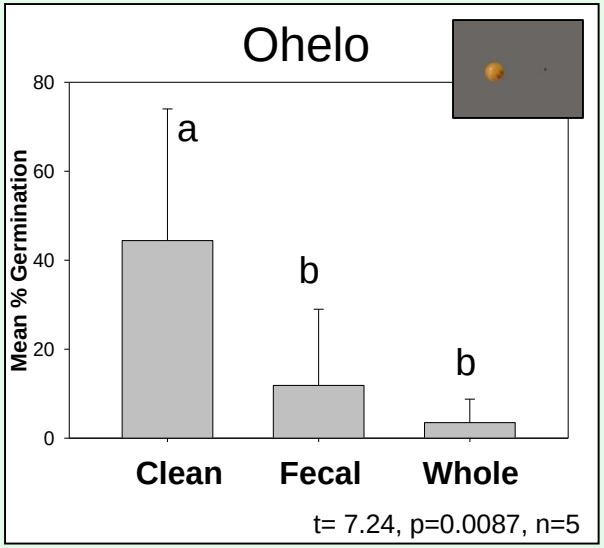


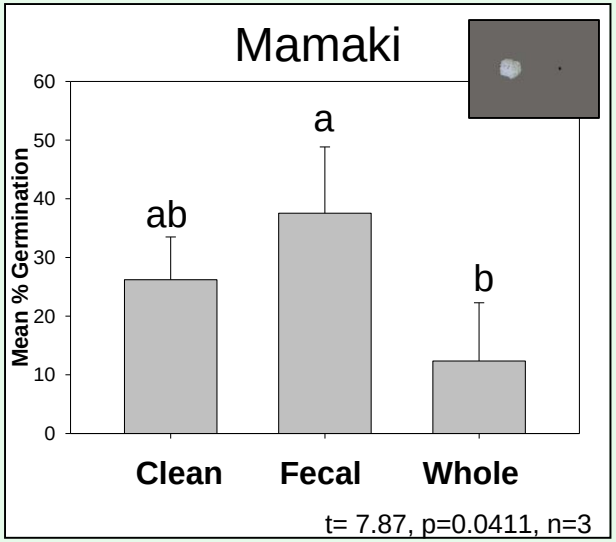
Pellet

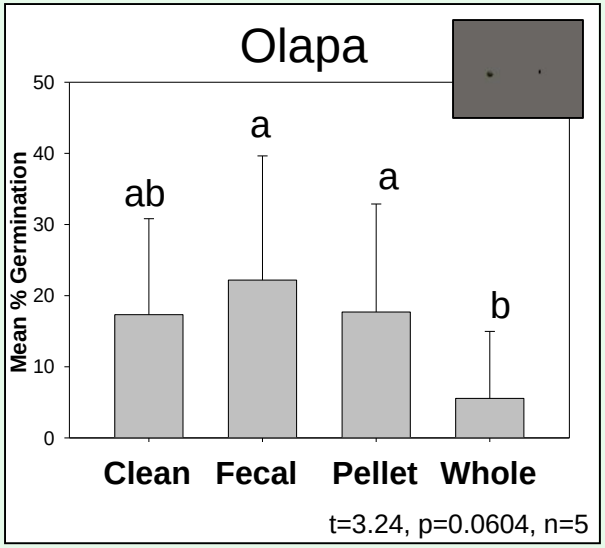


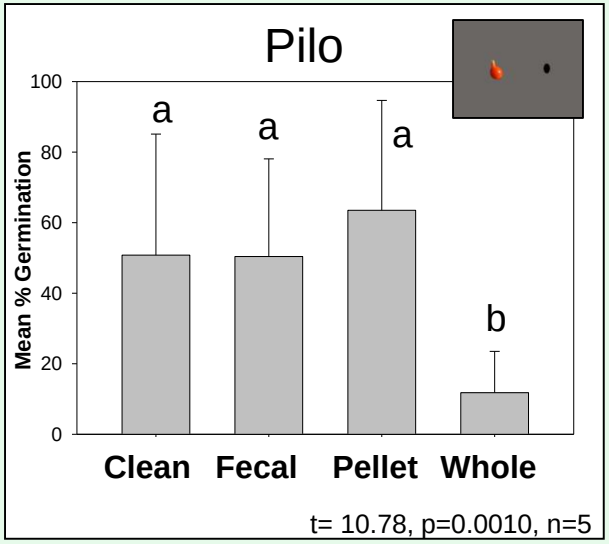
Results: Germination Success (%)

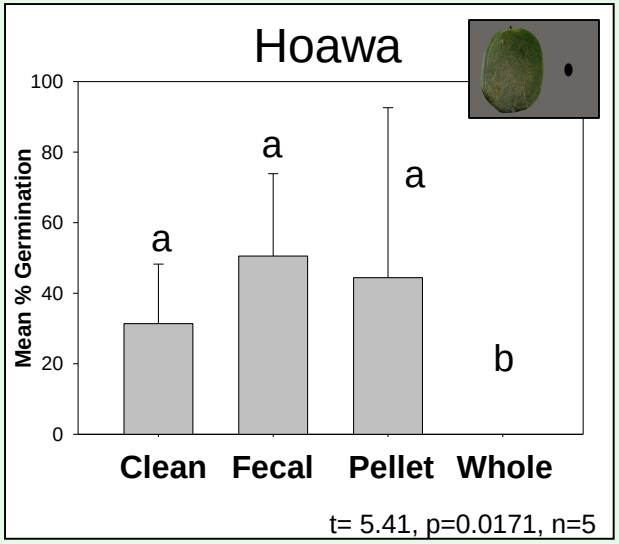






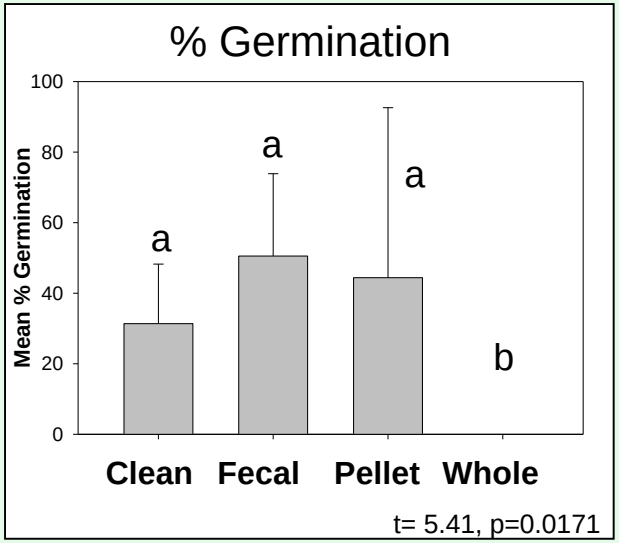






For most plant species ´Alalā digestion increased germination success probably by removing fruit pulp from seeds

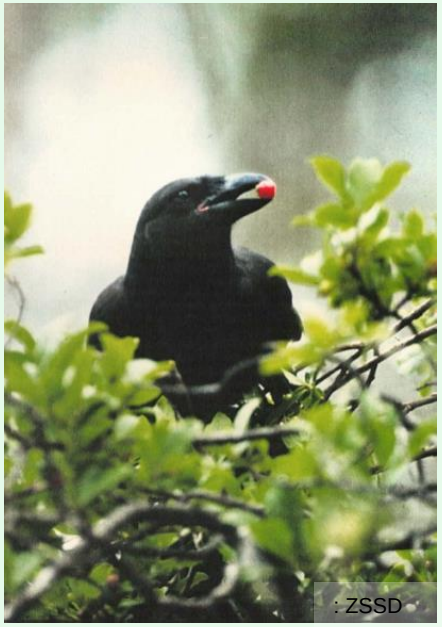
Hoawa (*Pittosporum hosmeri*)



Summary

´Alalā:

- Dispersed seeds of all plants
- Dispersed seeds via multiple mechanisms
- Increased germination success for some species



Culliney et al. 2012 Ecological Applications

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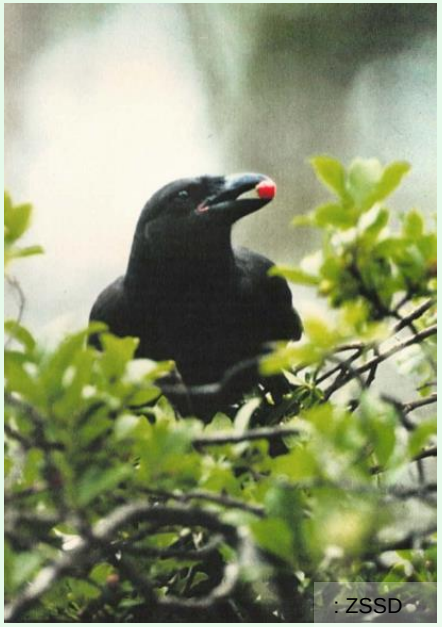

1. Feed Alala native fruit prior to release

2. Select/restore reintroduction sites with popular fruiting plant species

3. Alala may be critically important for some large-fruited species…yet another reason to invest in recovery efforts

Culliney et al. 2012 Ecological Applications

Questions

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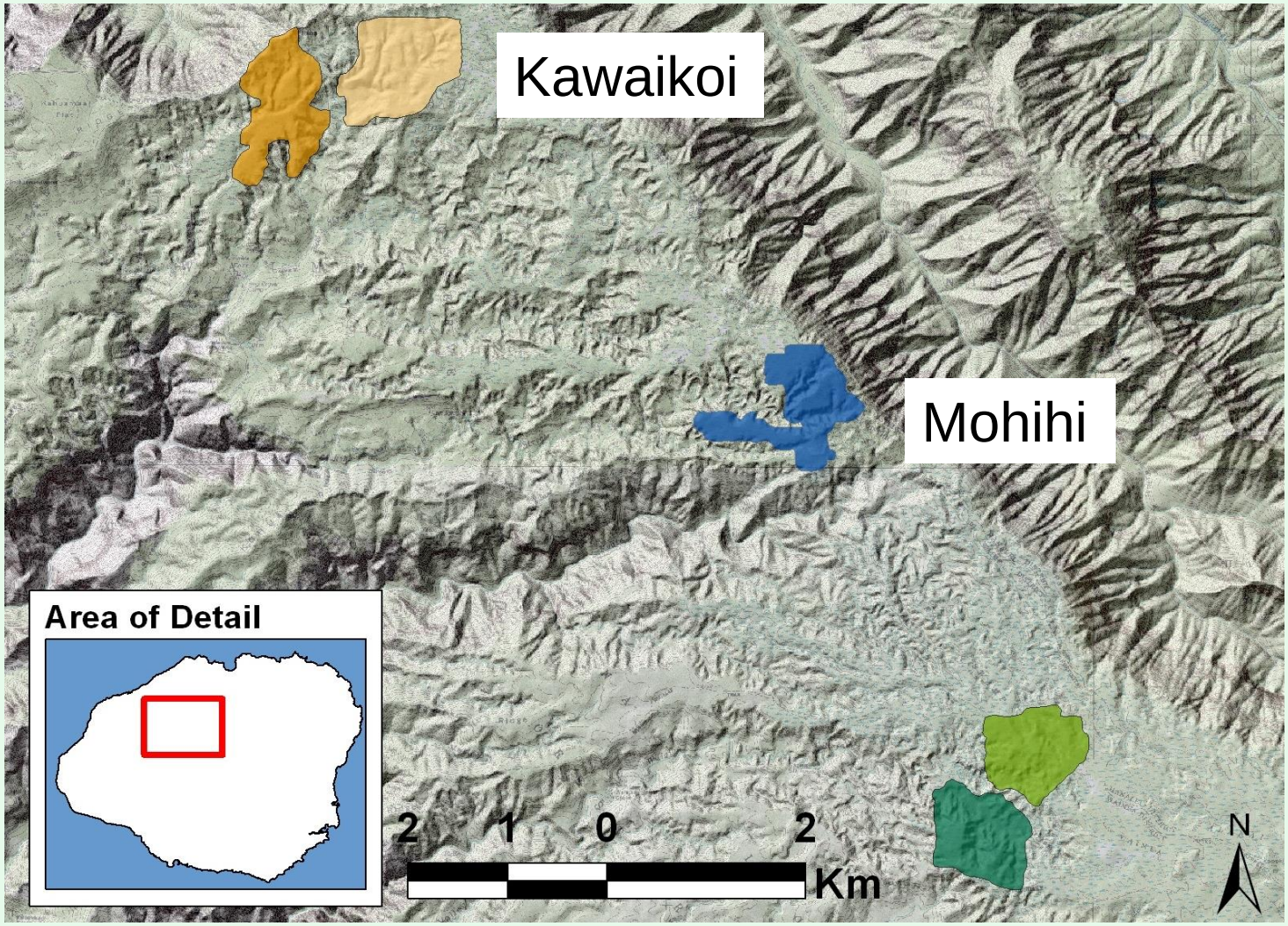
How does the decline of Kauai's last native frugivore impact seed dispersal dynamics?

Are introduced birds filling the gap?

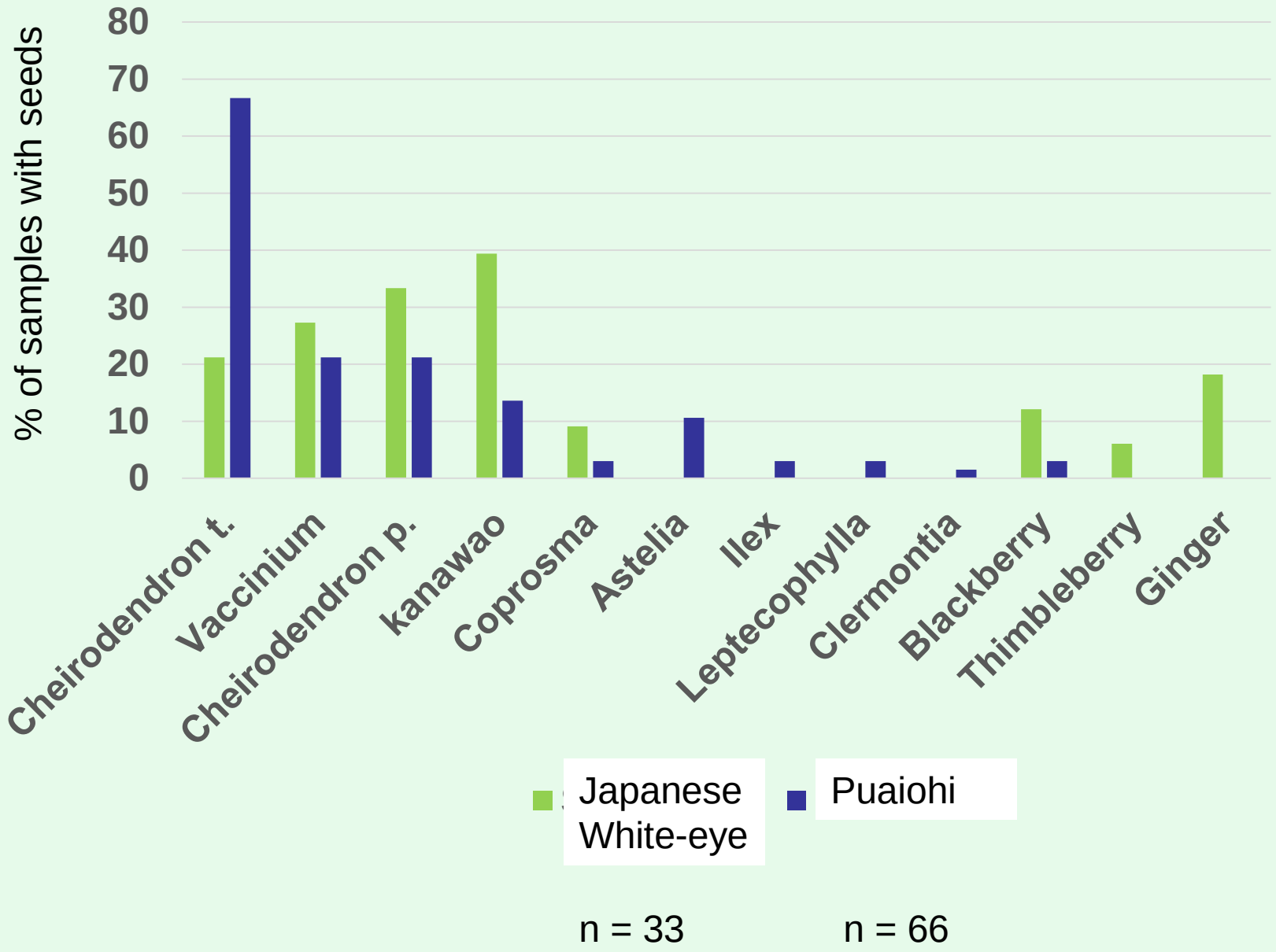


s	Kawaikoi	Mohihi
Exotic frugivores	37.15 birds/ha	43.22 birds/ha
Puaiohi	1-2 territories	17-19 territories

1. Does seed rain differ in the absence of Puaiohi?

2. How similar is the diet of Puaiohi and Japanese White-eye?

Composition of seeds in fecal samples



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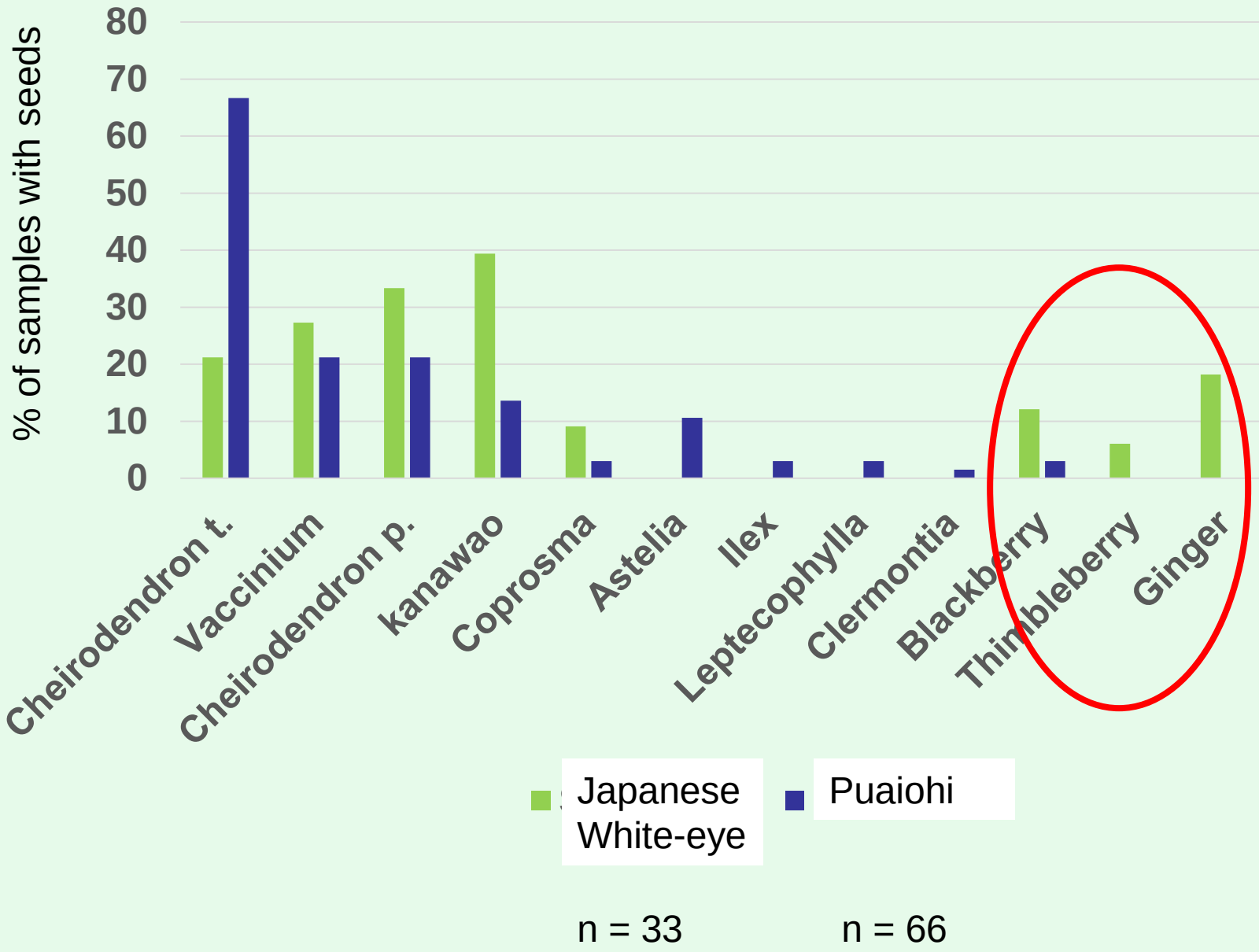

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Research Questions

1. How does bird density and diversity in and out of sanctuaries affect the rate and pattern of seed dispersal?

2. What is the relationship between sanctuary size, bird diversity and seed dispersal dynamics?

3. Do sanctuaries have “spillover effects”, thus altering seed dispersal dynamics beyond the fence?

Conclusion

- ´Alalā disperse a wide variety of native plants, and enhance germination for many

- In the absence of Puaiohi, we predict a shift towards smaller-seeded & exotic plants

- New Zealand's mainland islands and the ecological consequences of bird reintroductions…stay posted!

Acknowledgements

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Alan Lieberman, Richard Switzer, Jeremy Hodges, Robby Kohley, Blake Jones, Sarah Bebus, Rachel Kingsley, Lynne Neibar, Pete Bibeault, Lisa Komarczek, Jen Holler, Kyle Parsons, Kara Kneubuhler, Angie Sewell, Rebecca Espinoza, & numerous interns.

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Thank you!

Liba Pejchar
Dept. of Fish, Wildlife and Conservation Biology
Colorado State University
Liba.Pejchar@colostate.edu
http://warnercnr.colostate.edu/~liba/
Lab twitter: @TheLibaLab