



Marine Population Ecology and Dynamics

ALEXANDRA DAVIS

COLE BROOKSON

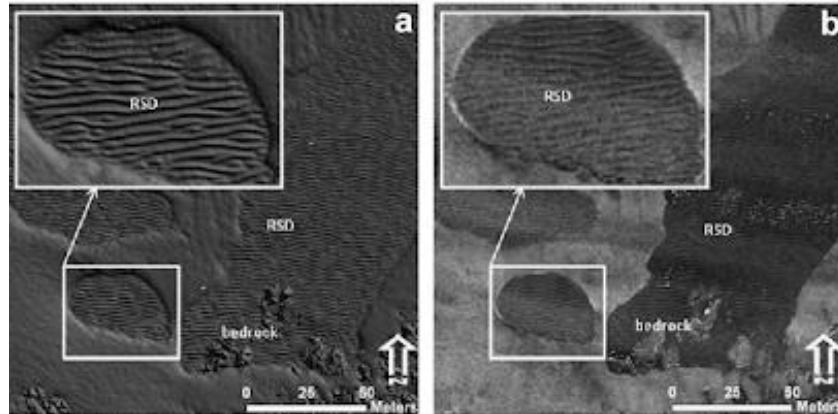
UNIVERSITY OF ALBERTA

13 OCTOBER 2021





California Seafloor Mapping Project



Continental Shelf Research
Volume 69, 15 October 2013, Pages 88-100



Research papers

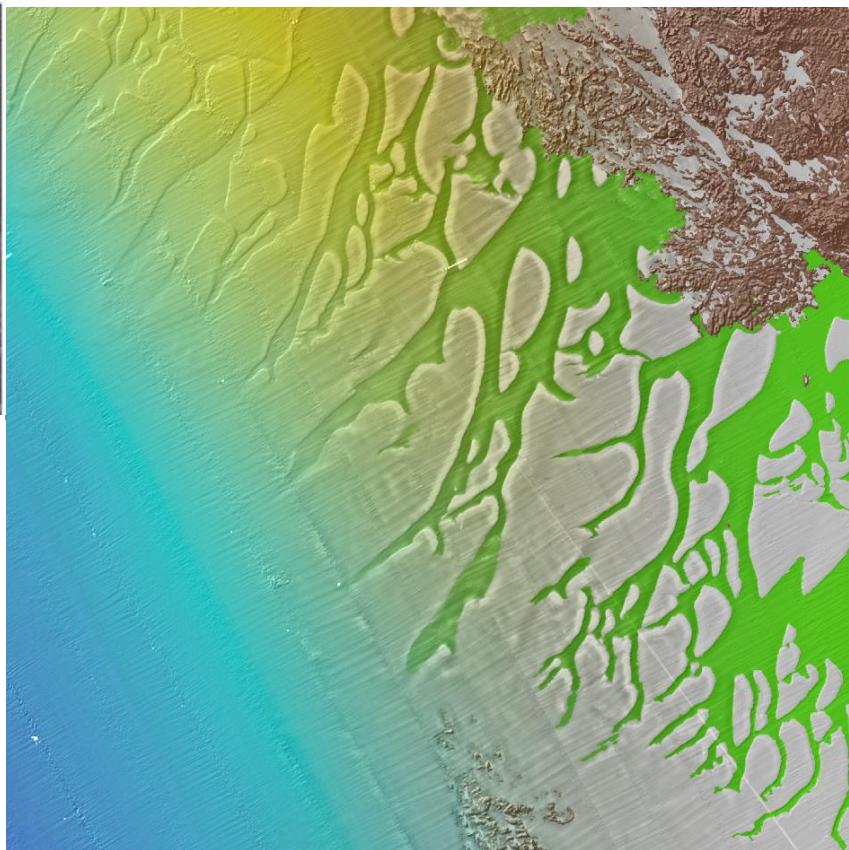
Distribution and abundance of rippled scour depressions along the California coast

Alexandra C.D. Davis ^{a,1}, Rikk G. Kvitek ^a✉, Craig B.A. Mueller ^a, Mary A. Young ^a, Curt D. Storlazzi ^b, Eleyne L. Phillips ^b

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<https://doi.org/10.1016/j.csr.2013.09.010>

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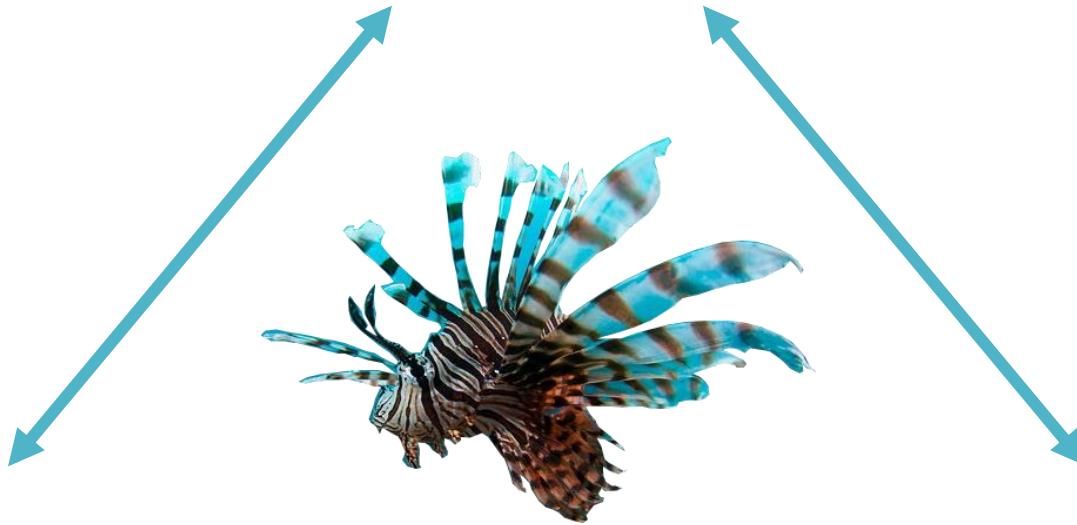
Hixon Lab, Corvallis OR



Habitat use and ecological interactions of invasive lionfish in the Bahamas



Seascape

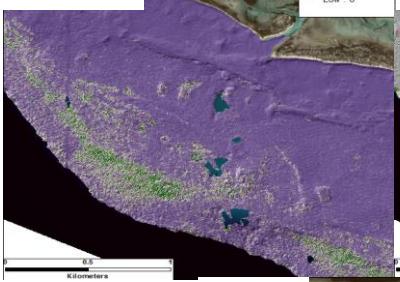


Individual

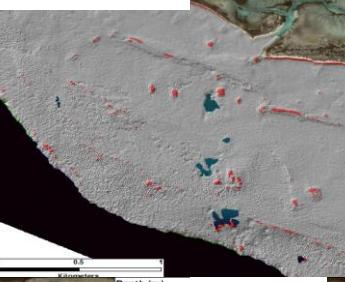
Community



Rugosity



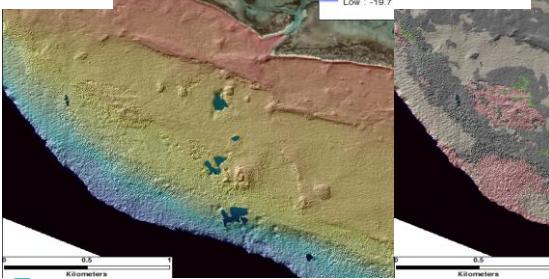
Highs & lows



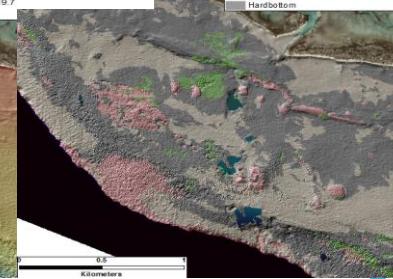
Curvature



Depth



Seafloor



Individual



Community





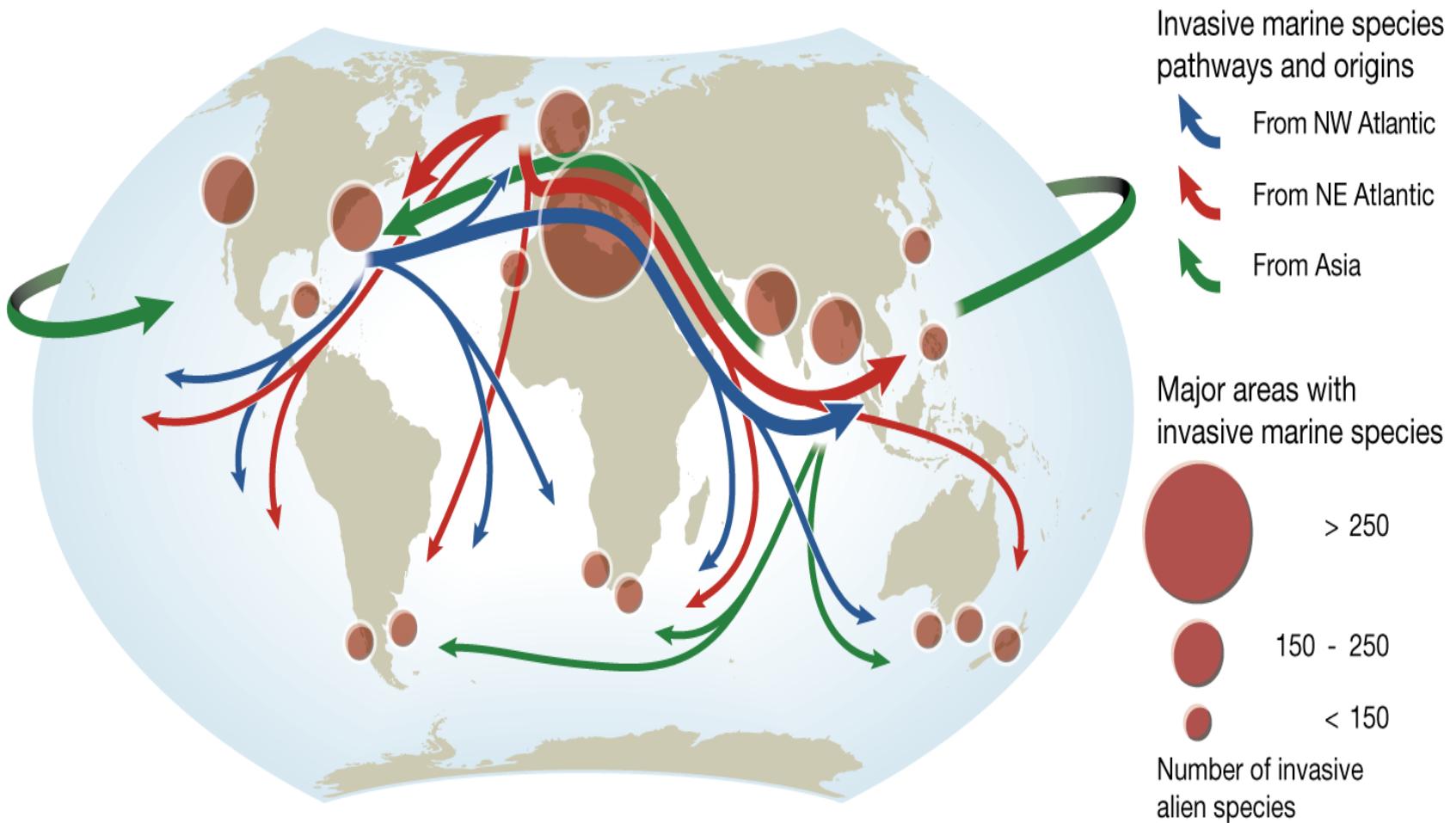
Creating tools
and teaching
skills to build
capacity for
invasive species
management

LIBER^Y ERO
FELLOWSHIP PROGRAM
PROGRAMME POSTDOCTORAL

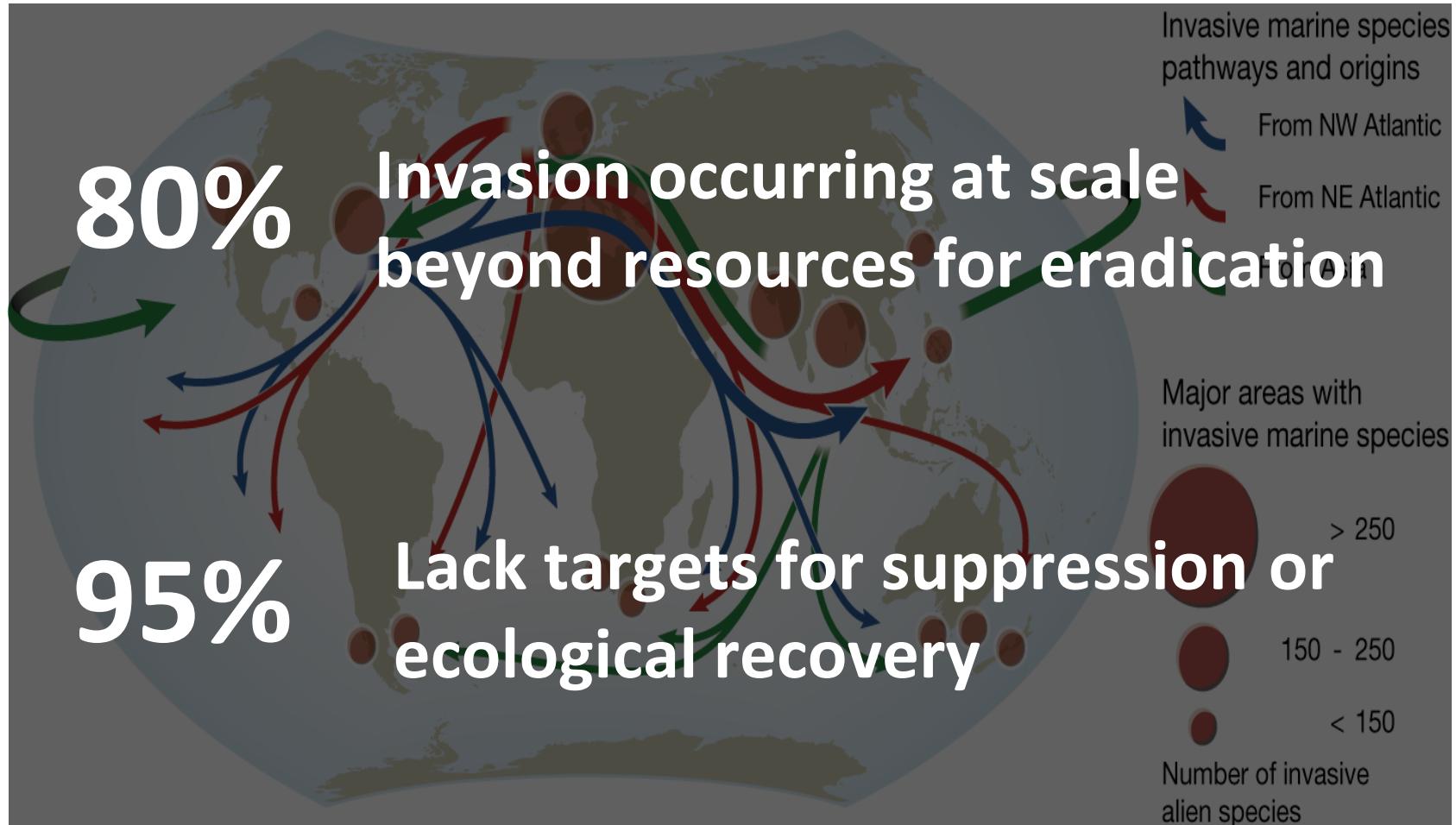
Invasive species
removal plans
and
conservation
outcomes



Marine invasive species



National survey of AIS managers and practitioners



Study species

PACIFIC LIONFISH

BAHAMAS AND FLORIDA



EUROPEAN GREEN CRAB

SALISH SEA



LIBER⁴ ERO
FELLOWSHIP PROGRAM
PROGRAMME POSTDOCTORAL

Study species

- ✓ Densities too high for eradication- functional eradication approach
- ✓ Reduction can limit ecosystem and economic impacts

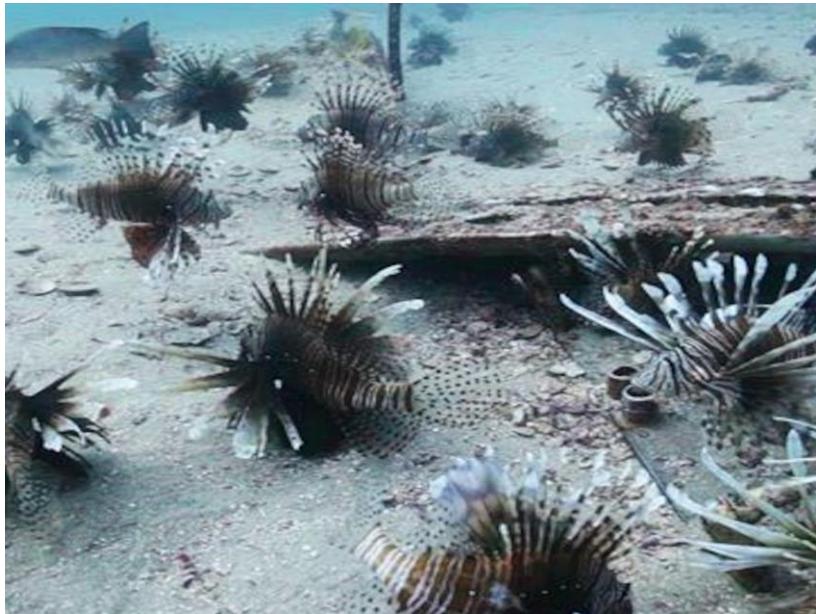


Photo Nat Geo



Photo Adrienne Akmajian

Three components for management:

Identify

Identify priority areas for removal

- Where is the invader found?
- Quantify negative effects on native communities



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Target

Target densities for suppression

- Identify densities of the invader that elicit community effects
- Use these are targets for control

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Prioritize

Understand efficient removal practices and identify targets

- Identify your limitations (time, money, gear, personnel)
- Subset priority locations based on valued resources

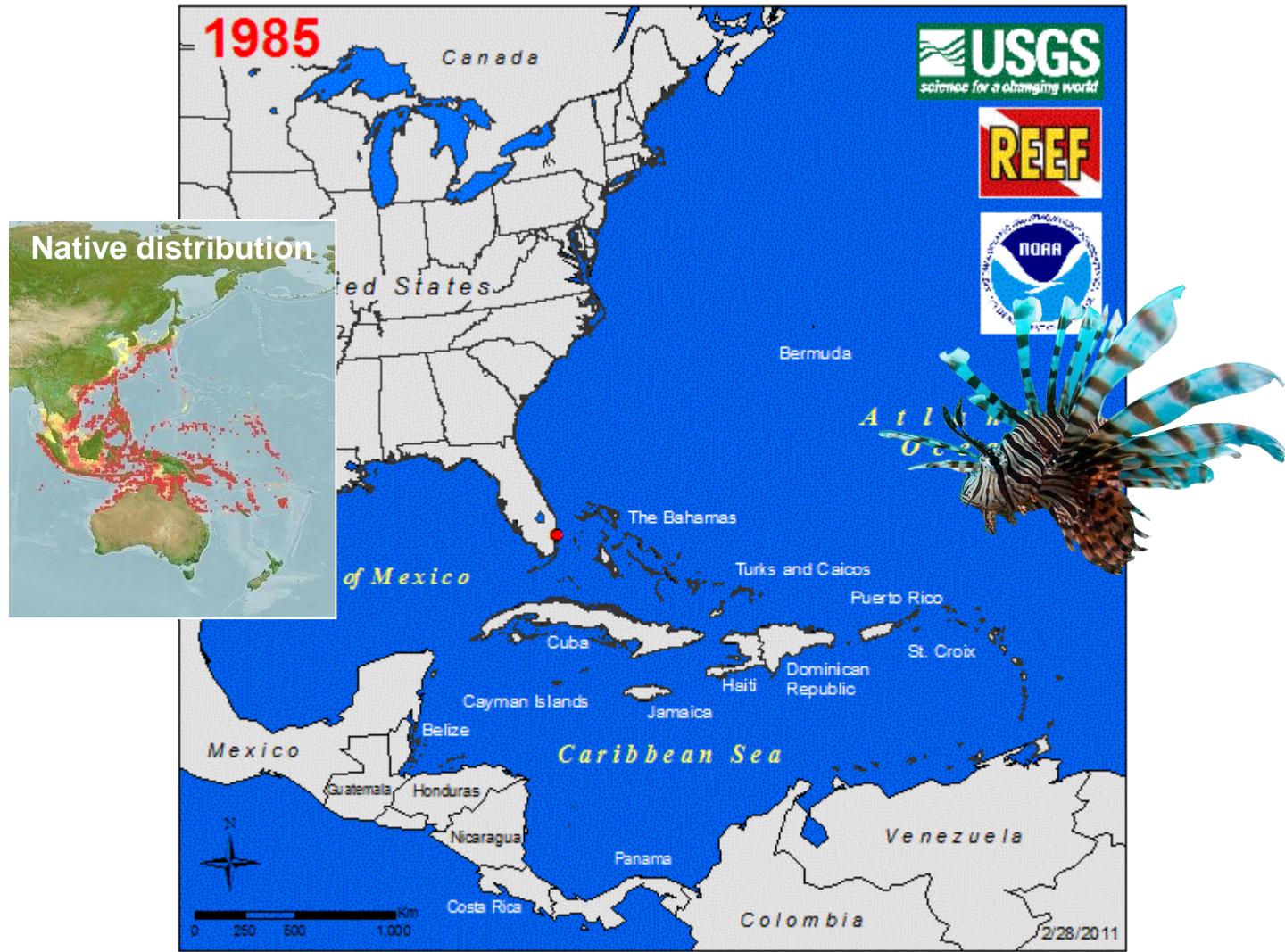


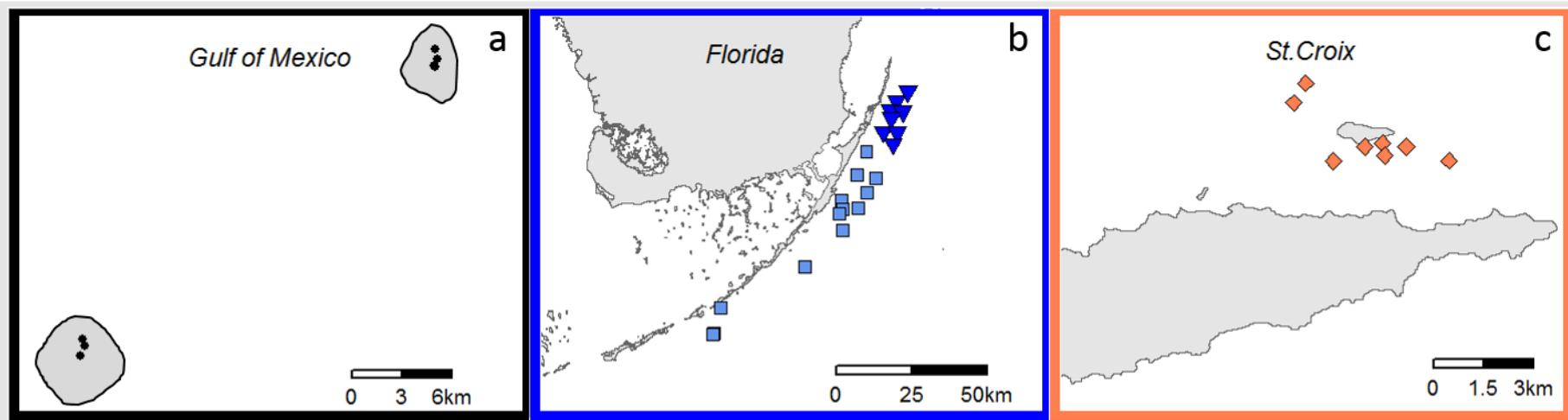
Three components for management:

Prioritize

Understand efficient removal practices and identify targets

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Strong negative effects



- High feeding & growth rates
- Generalist predator
- Native fish recruitment lowered by up to 90%
- Some local extinctions of native fishes
- High fecundity

Morris & Akins 2009; feeding rate: Côté & Maljkovic 2010, Cure et al 2010, Albins 2015, Ingeman 2016, Pusack et al 2016

Managing the invasion

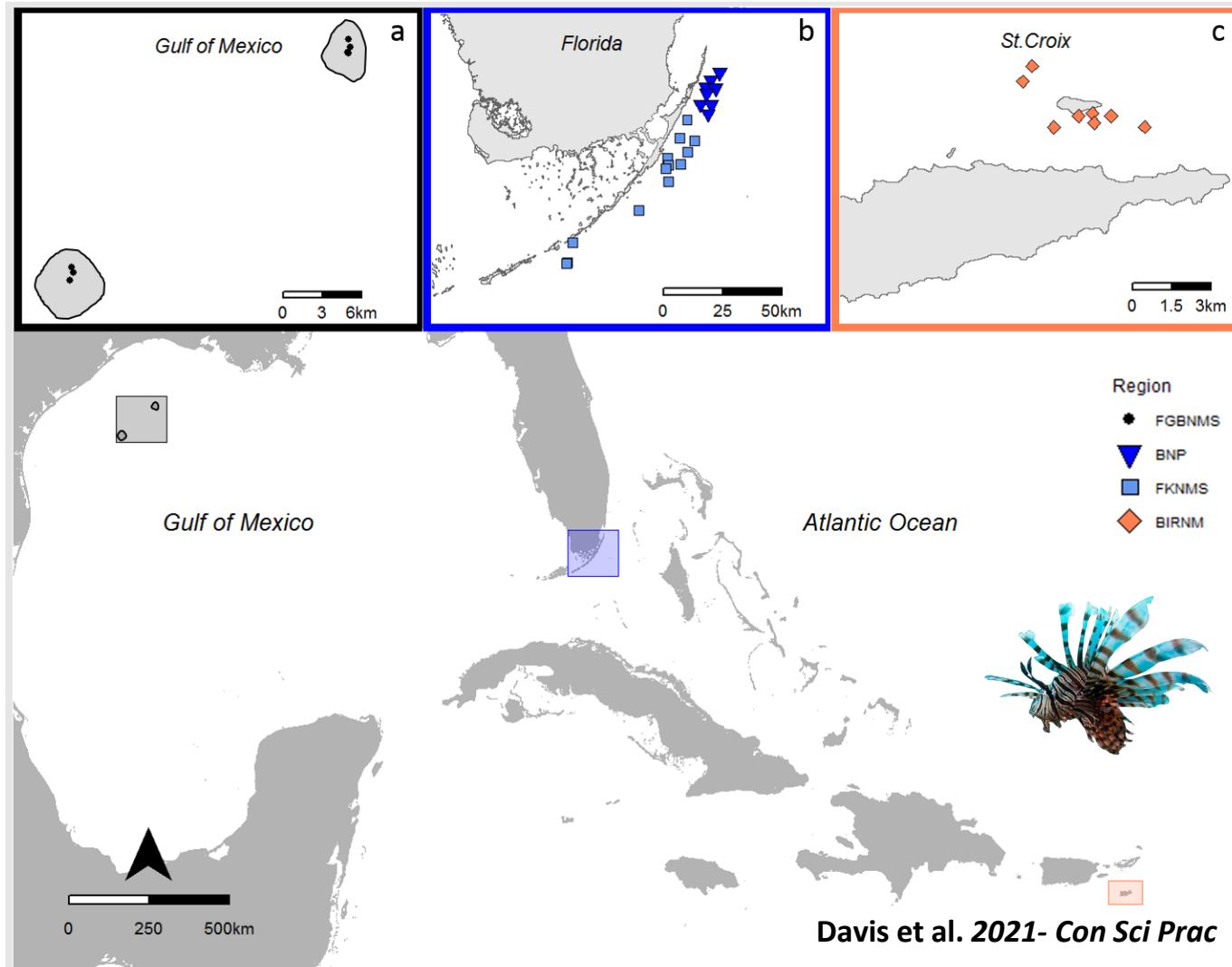


Management intervention

Regional coordination



**Data collection for three years
in four jurisdictions**



Limitations for efficient removal



Invader (Lionfish)

Density, behavior, and position
on the reef

Limitations for efficient removal



Invader (Lionfish)

Density, behavior, and position
on the reef



Habitat

Depth and distance from shore
Complexity and habitat composition

Limitations for efficient removal



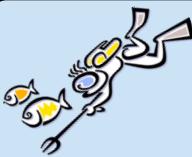
Invader (Lionfish)

Density, behavior, and position
on the reef



Habitat

Depth and distance from shore
Complexity and habitat composition



Removal

Type of gear used
Experience of the remover

Limitations for efficient removal



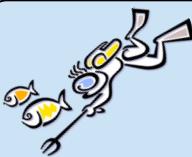
Invader (Lionfish)

Density, behavior, and position
on the reef



Habitat

Depth and distance from shore
Complexity and habitat composition



Removal

Type of gear used
Experience of the remover



Environment

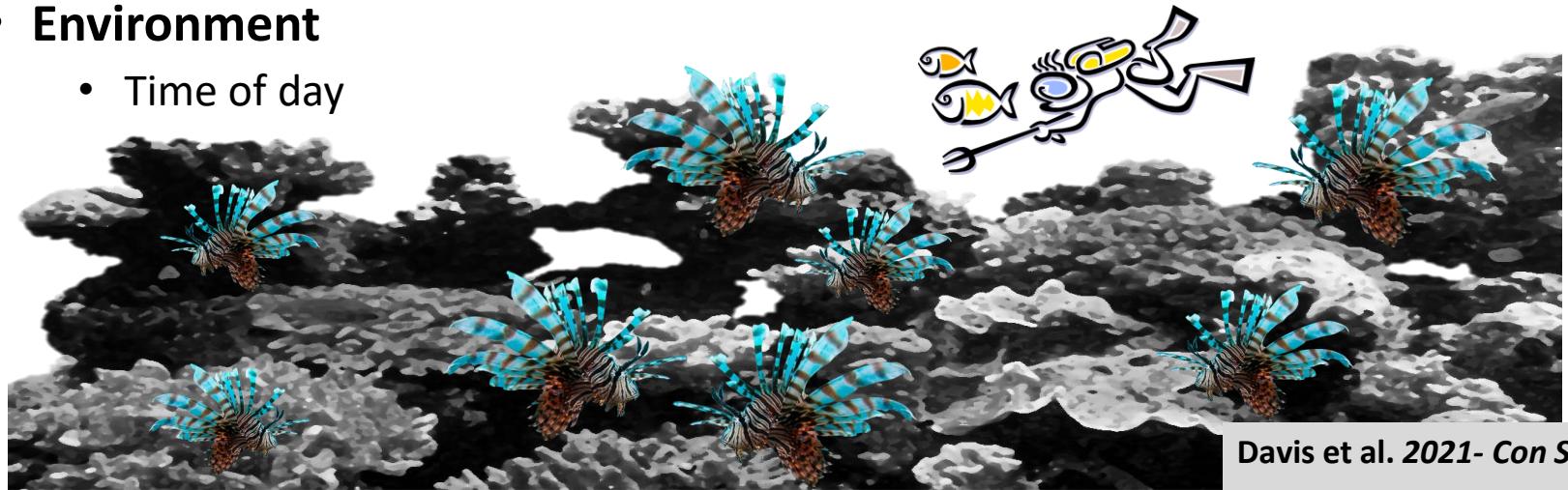
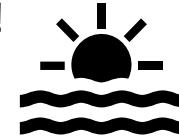
Cloud cover, currents/ tides, time of day

Implications for management: what saves time? 

Implications for management: what saves time? ⏰

- **Invader (Lionfish)**
 - ↑Size
 - ↑Density
- **Remover experience**
- **Environment**
 - Time of day

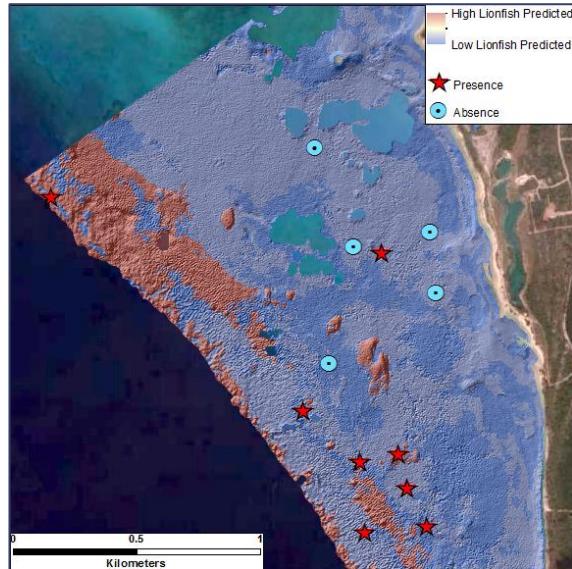
Removing lionfish at dawn and dusk takes 1 minute less per fish for all experience levels!



Davis et al. 2021- *Con Sci Pract*

Currently

Models to predict high densities of lionfish and recolonization rates



Davis 2019, MEPS

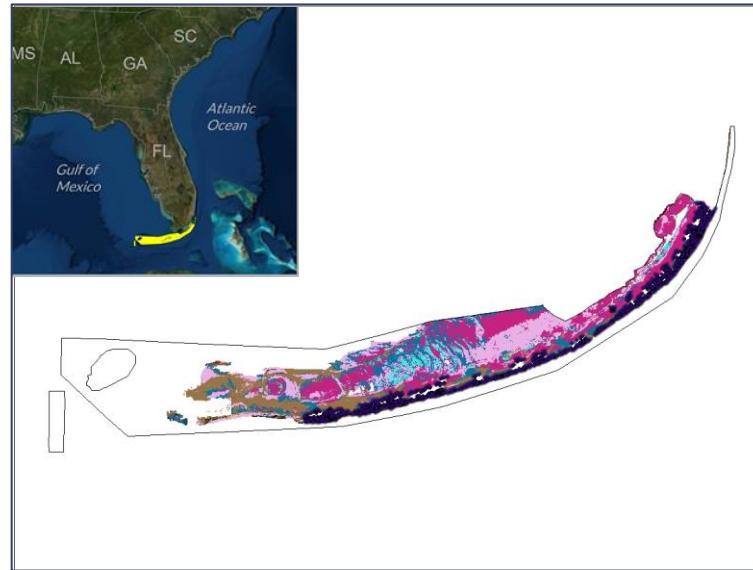


Image modified from Courtney Stewart

Next steps

Add in management priorities and valued resources

- Fisheries species
- Reefs with high coral cover or biodiversity



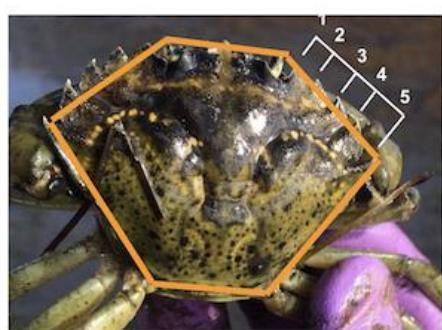
Juvenile fish habitat



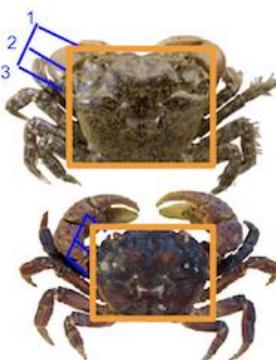
Marine Protected Areas

European Green Crab (*Carcinus maenas*)

- A single female green crab can produce 185,000 eggs in a single year
- Green crabs eat a wide variety of shellfish, preying on oyster, clam, mussel, lobster, and crab populations across the world
- While foraging for food green crabs “slice” through eelgrass, destroying the plant. Eelgrass provides nursery habitat for juvenile fish and shellfish and in turn serves as feeding ground for many migratory bird species and sea turtles



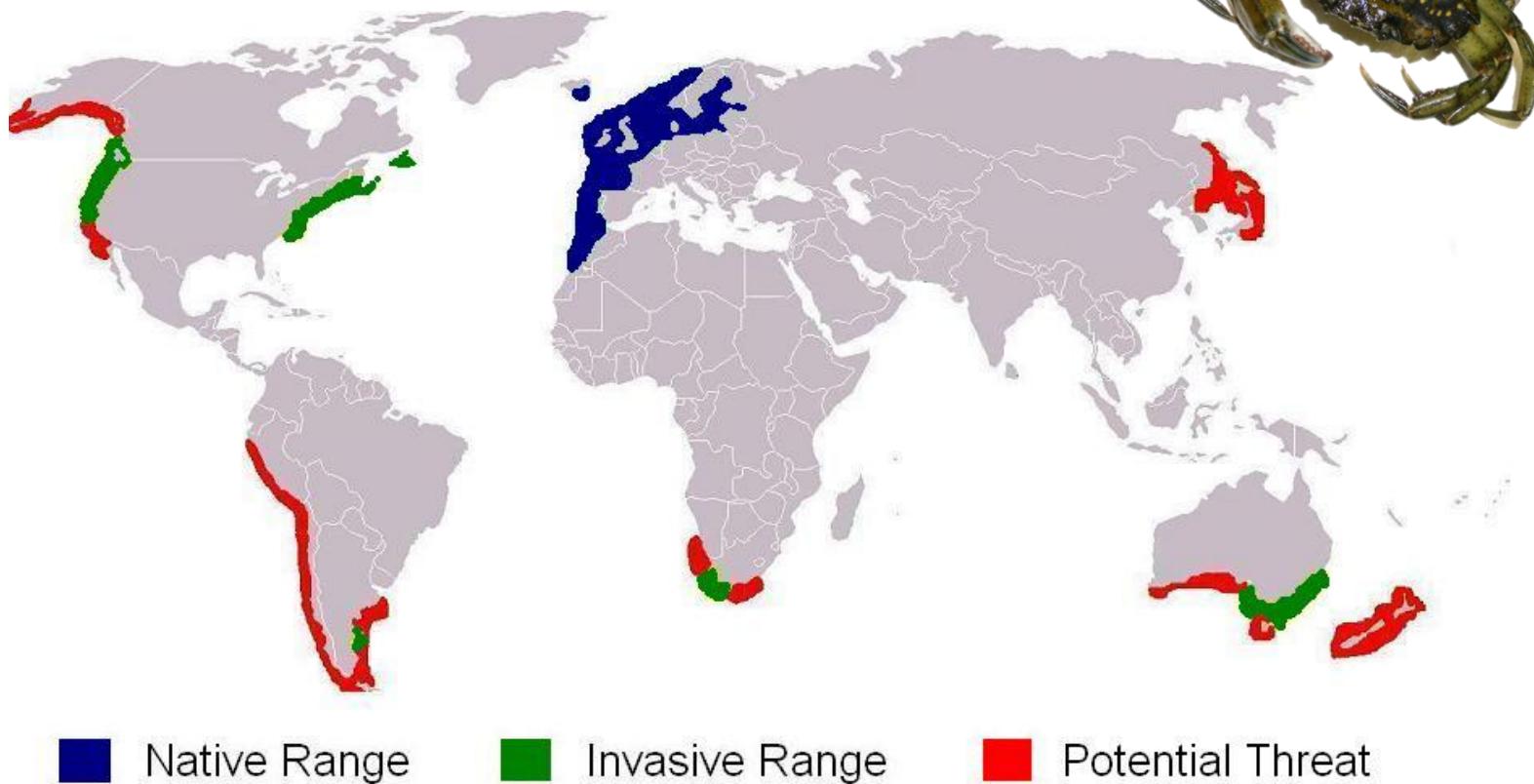
European green crab
Carcinus maenas



Native shore crabs
Hemigrapsus spp.

LIBER  **ERO**
FELLOWSHIP PROGRAM
PROGRAMME POSTDOCTORAL

Range expanding





Salish Sea Case Study

1. Model comparison

- a) Predictive models for likelihood, or hotspots of green crab
- b) This still gives us 500+ sites in the Salish Sea alone

2. Stakeholder survey

- a) This survey is designed to collect information where management for EGC is happening, what valued resources may be affected by the presence of EGC, and what types of additional resources or data are needed to help improve management strategies.



COASTAL LANDMARKS IN VICTORIA BC



What do you want to conserve?



Economic
resource



Ecological
resource

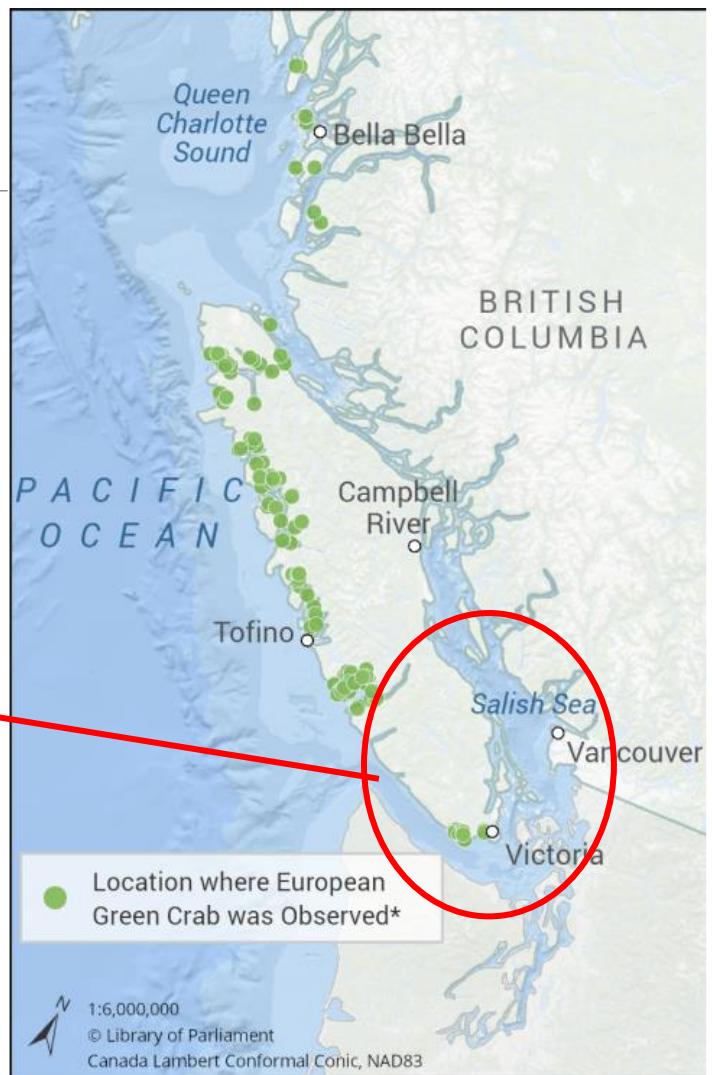


Cultural
resource

Spatial extent of removal



<https://www.epa.gov/salish-sea/shellfish-harvesting>



Collaboration on Green Crab

Tom Therriault and Brett Howard – Fisheries and Ocean Canada

Chelsey Buffington- Washington Dept of Fisheries and Wildlife

Emily Grason- Washington Sea Grant Green Crab Team

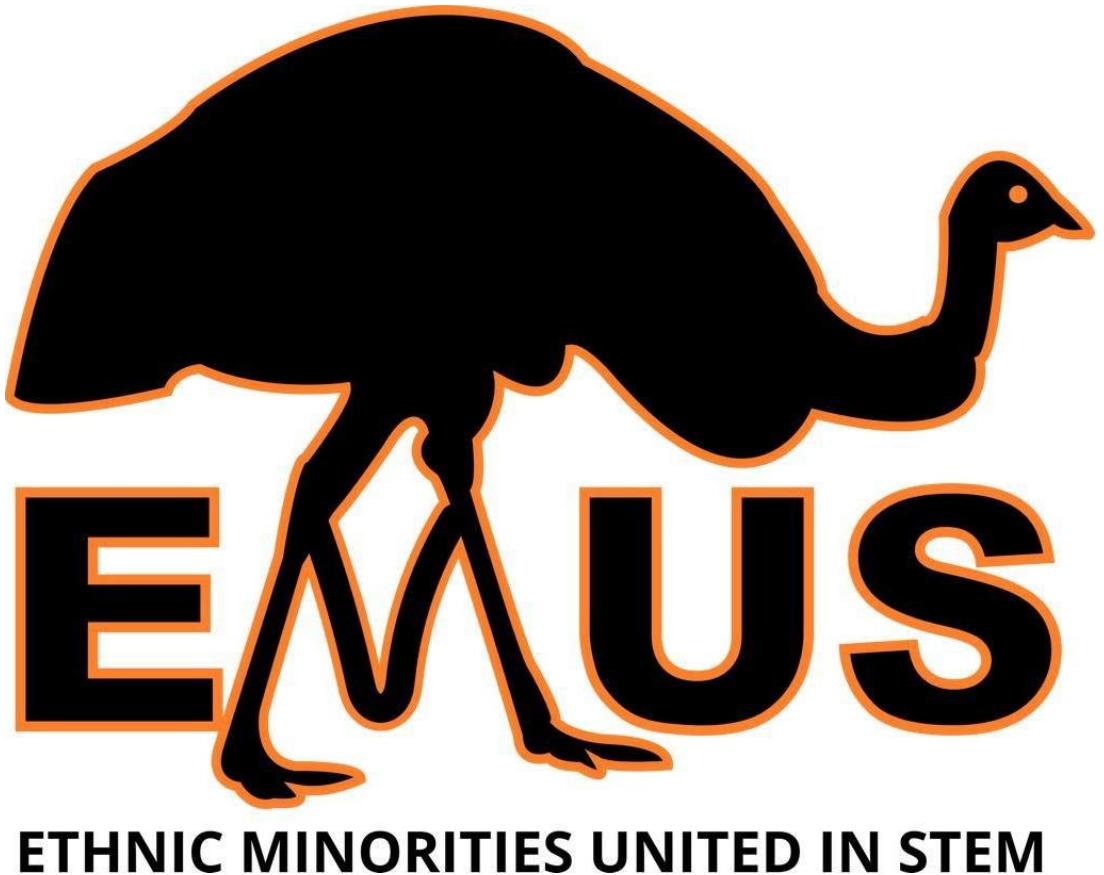
Tammy Davis- Alaska Invasive Species Partnership

Many others!



Survey Link:

https://ualbertadbs.ca1.qualtrics.com/jfe/form/SV_eIDW05IEnTtjqqW



Twelve Principles Trainees, PIs, Departments, and Faculties Can Use to Reduce Bias and Discrimination in STEM

Lisa M. Willis,* Devang Mehta, and Alexandra Davis



Cite This: ACS Cent. Sci. 2020, 6, 2294–2300



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Metrics & More

Article Recommendations

Supporting Information

ABSTRACT: There is an overwhelming amount of evidence demonstrating that people from marginalized groups, including women, racialized and Indigenous peoples, people with disabilities, immigrants, and LGBTQ+ individuals, continue to face substantial discrimination in STEM, manifested as both overt bias and unconscious bias. These biases result in discrimination against individuals in marginalized groups, and independent biases collectively contribute to a culture that systematically discriminates against people from marginalized groups. Representation from marginalized groups in postsecondary degrees in natural science and engineering has not substantially improved in over a decade. A set of 10 concrete principles are presented that trainees, principle investigators, departments, and faculties can use to enhance the participation and lived experiences of people in marginalized groups in STEM.





Black Women

in Ecology, Evolution, and Marine Science
#BWEEMS



We Exist and We're Shaping The Future

Join our network, rewrite the narrative and drive innovation



rigour

noun [U] UK (US *rigor*)

UK /'rɪg.ə/ US /'rɪg.ə/

formal approving

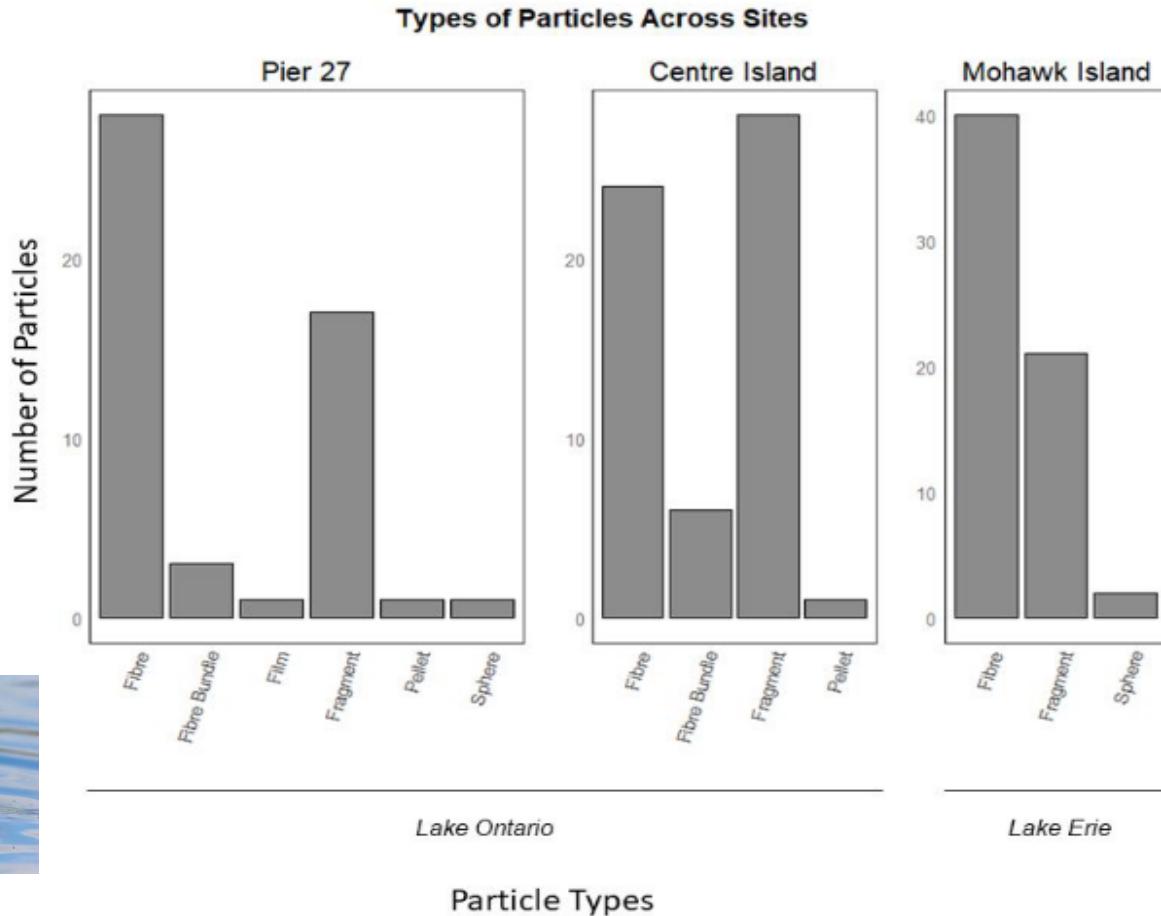
the quality of being detailed, careful, and complete:

- *Her arguments lacked intellectual rigour.*

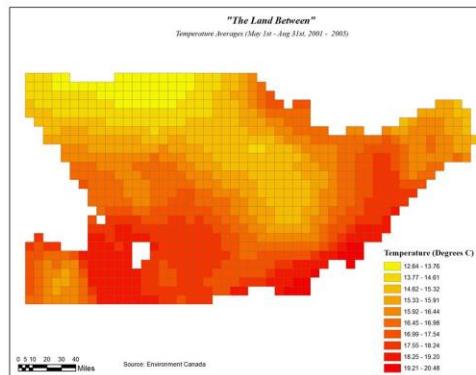
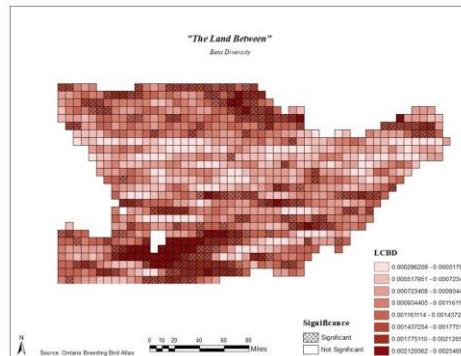
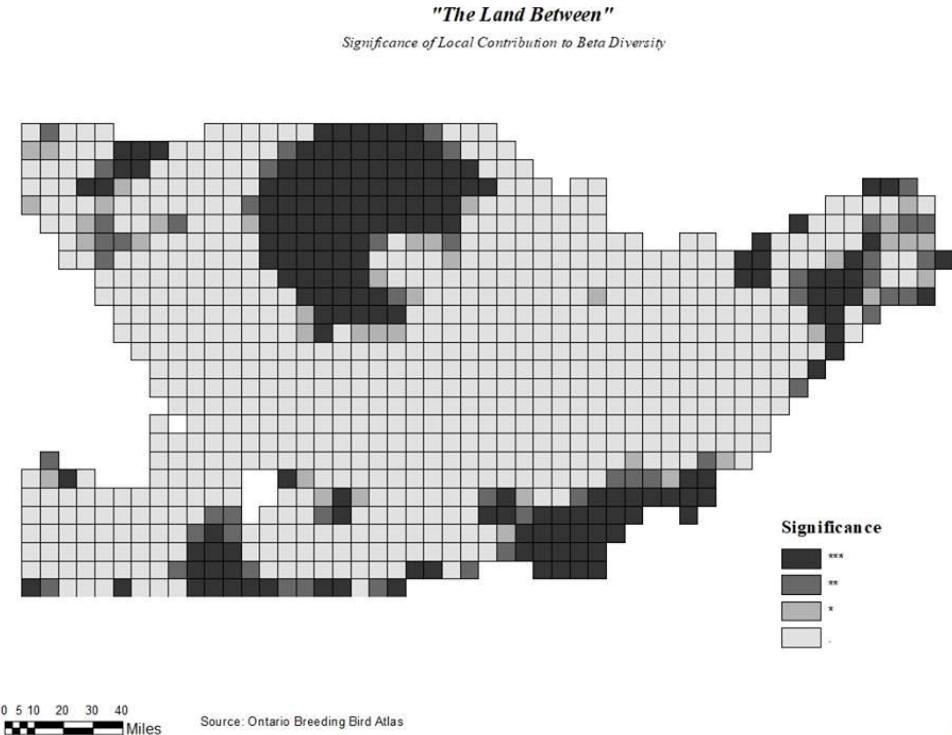
Science is about
relationships



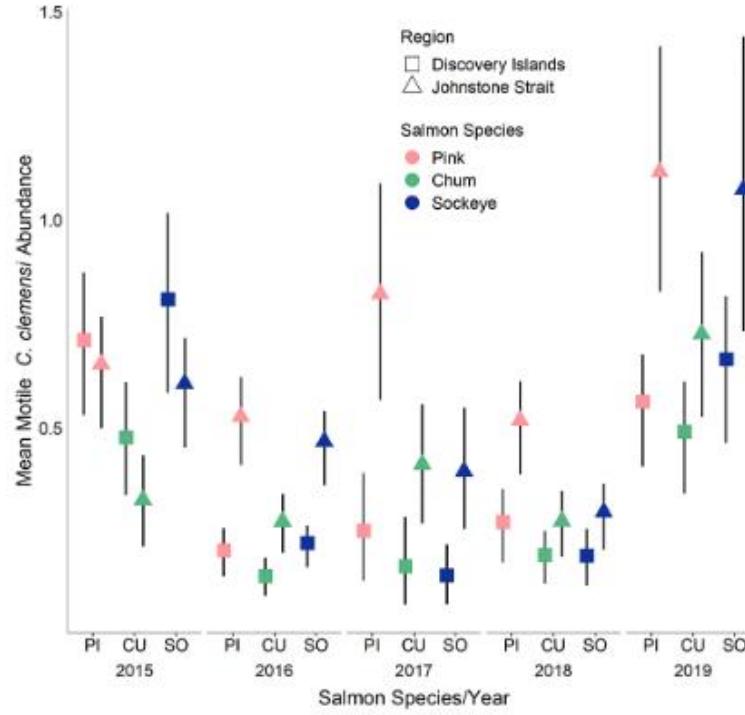
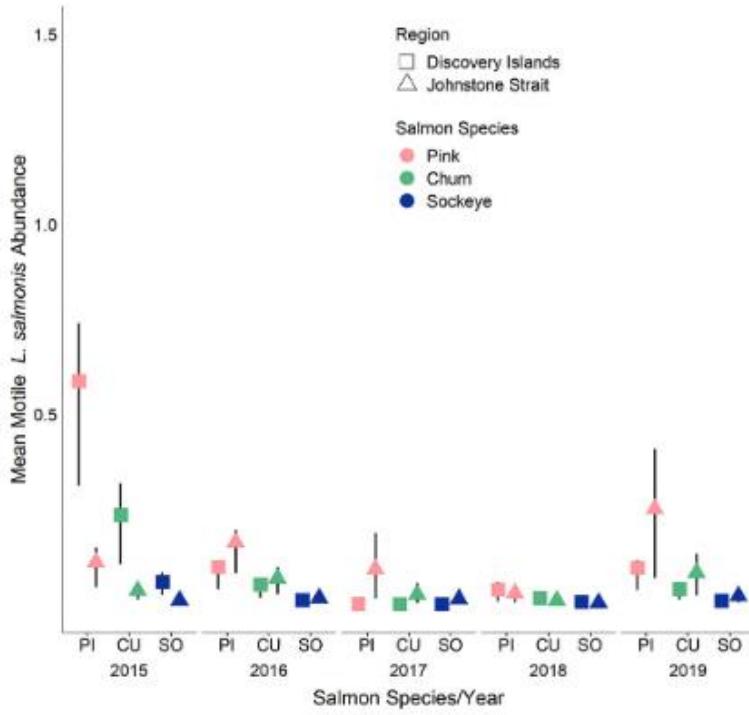
Are microplastics present in the guts of nestling cormorants?



What is the beta-diversity of breeding birds in Southern Ontario?



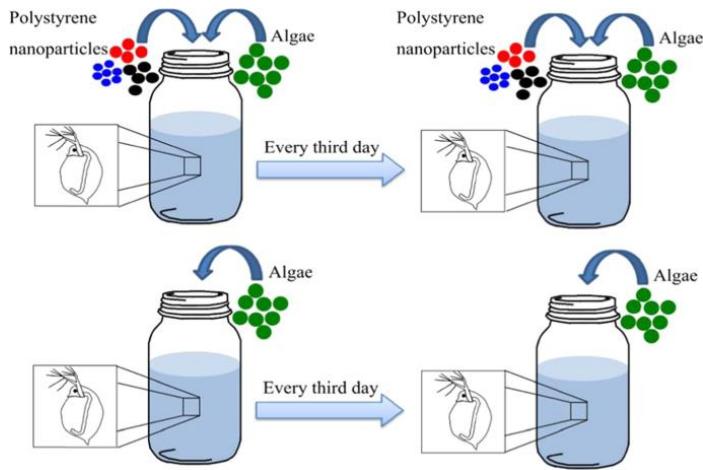
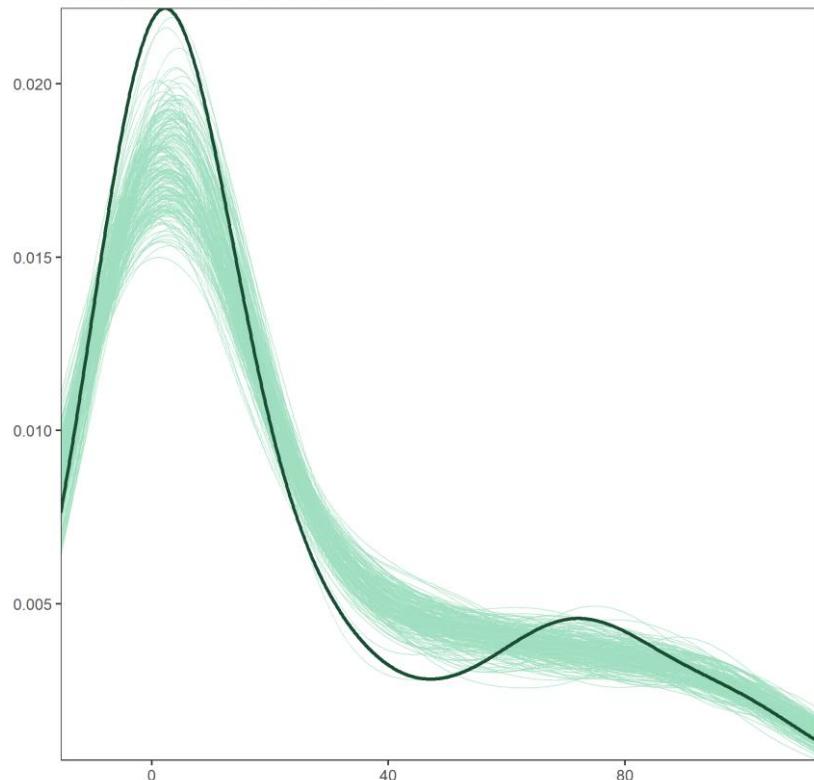
How do parasite loads differ between parasite species and host species in wild Pacific salmon?



Bayesian dynamic energy budget toxicology models to scale individual-level toxicology data to population-level effects

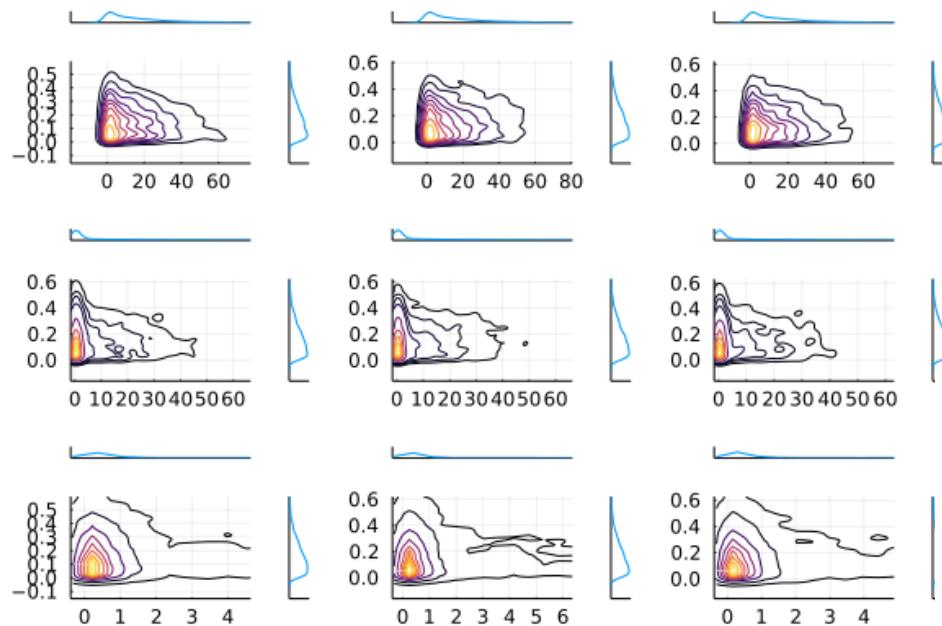


Empirical vs. Estimated Distribution
of Cumulative Reproduction Data (PS400 Treatment)
Showing 200 Draws from the Posterior





Trait-based models to understand near- and long-term dynamics of food web rewiring under global change

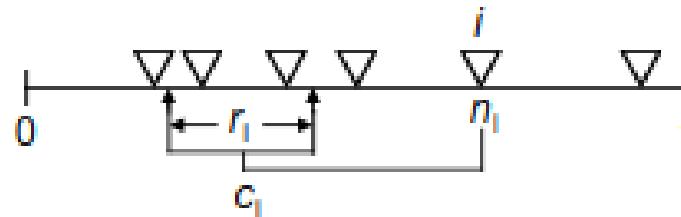


$$\frac{dX_i}{dt} = P_i(X_i) + X_i \sum_{j=0}^{N-1} \eta_{ij} F_i(X_j) - m_i X_i - X_i \sum_{j=0}^{N-1} F_j(X_i)$$

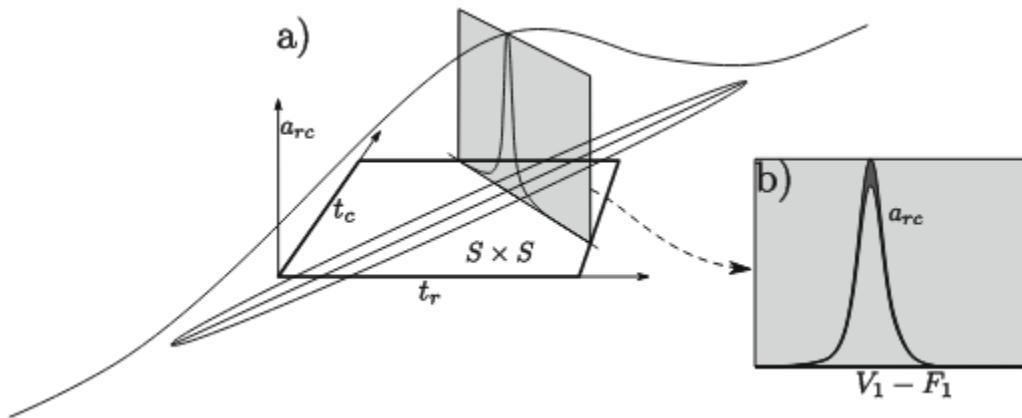
$$F_i(X_j) = \frac{a_{ij} X_j^{q_{ij}}}{1 + \sum_{n=0}^{N-1} a_{in} h_{in} X_n^{q_{in}}} \quad \text{where } a_{ij} \propto f(\alpha_{ij}, n_j, b_{ij})$$

$$P_i(X_i) = \begin{cases} 0 & \text{if } \sum_{j=0}^{N-1} F_i(X_j) \neq 0 \\ r_i X_i (1 - \frac{X_i}{K_i}) & \text{if } \sum_{j=0}^{N-1} F_i(X_j) = 0 \end{cases}$$

High-dimensional algebraic methods for identifying trait-based shifts in Albacore tuna



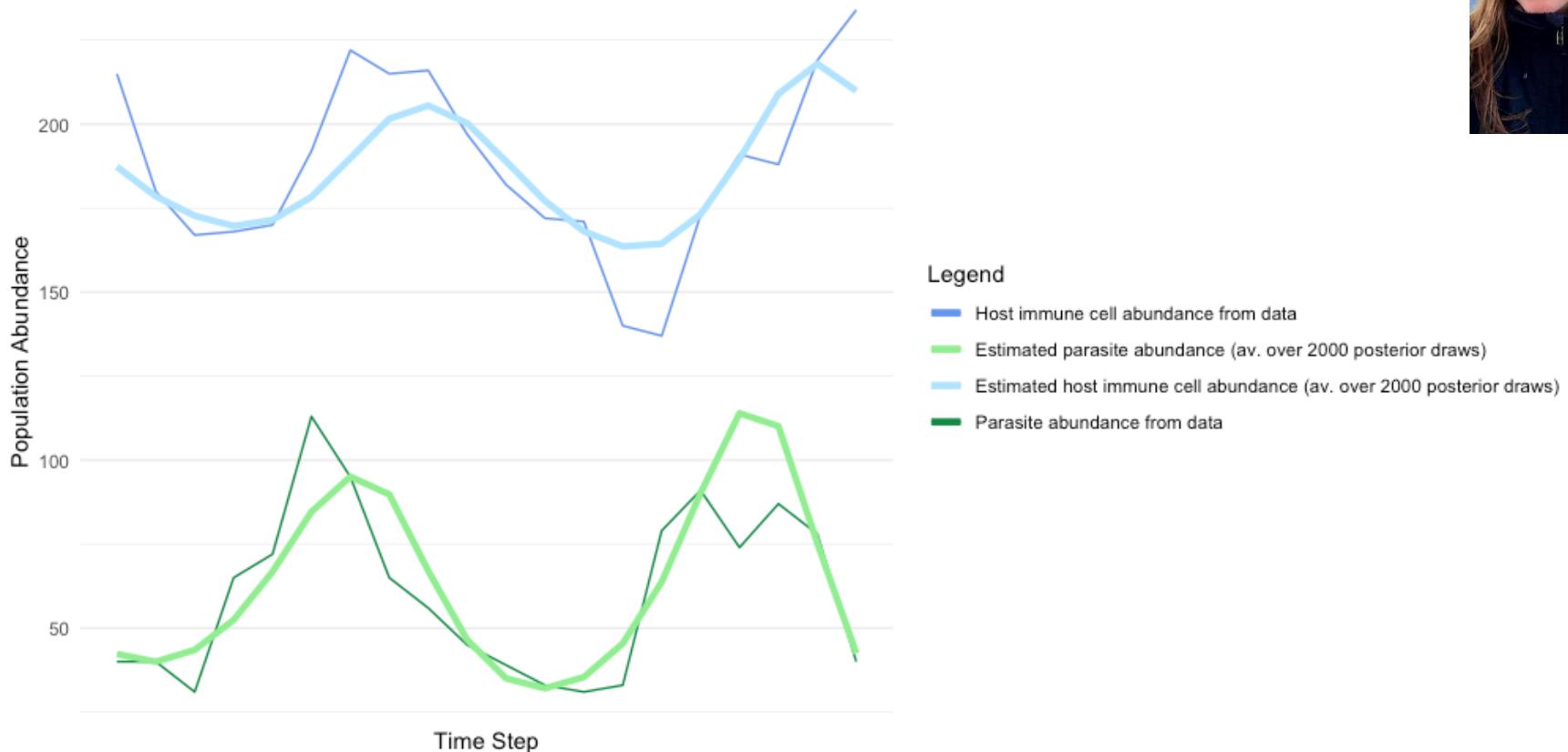
$$\ln a_{rc} = \ln a_0 + \sum_{i=1}^{2m} \mathbf{b}^T \mathbf{e}_i (V_i - G_i) + \frac{1}{2} \sum_{i=1}^{2m} \lambda_i (V_i - G_i)^2.$$



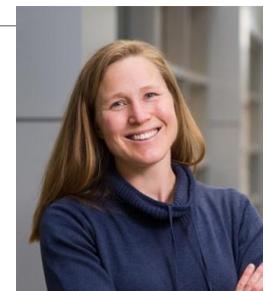
How can within-host responses to parasite proliferation be modeled using classic predator-prey models?



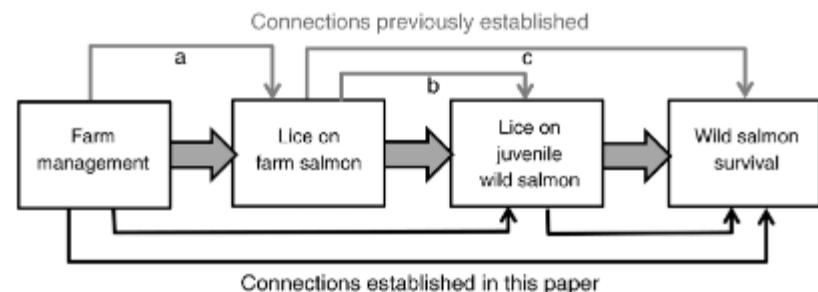
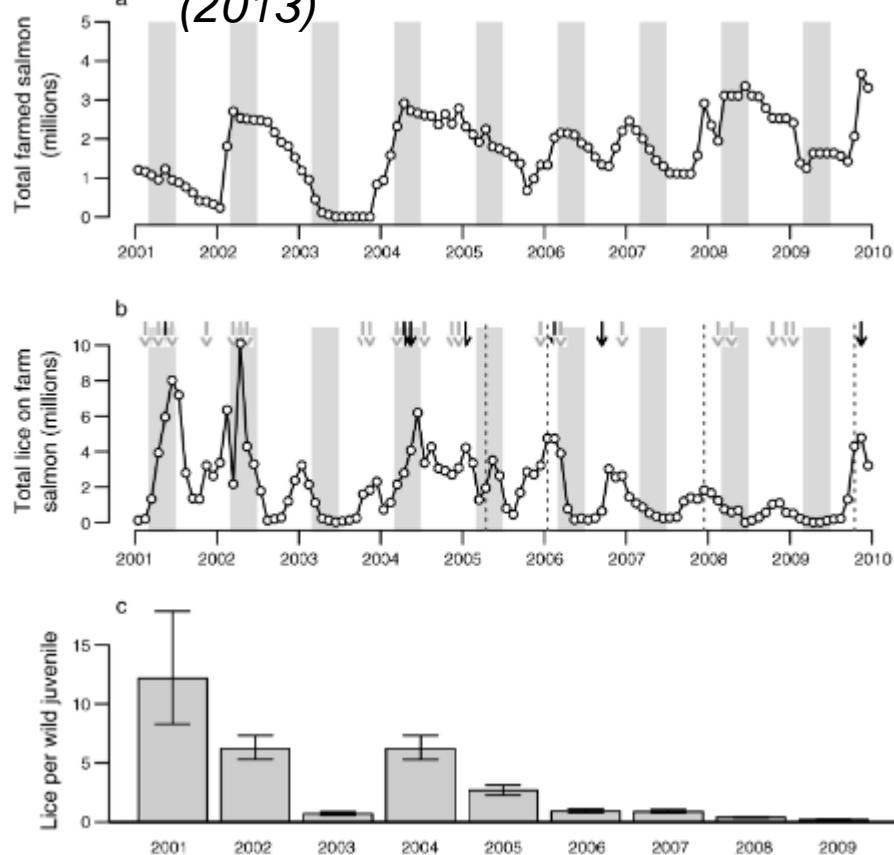
Posterior Estimates Plotted Against Data



What am I doing next...



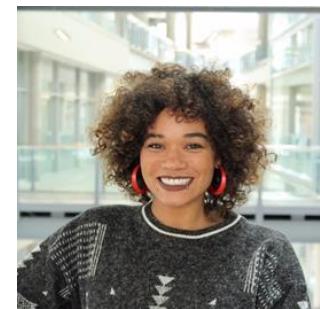
Peacock et al.
(2013)



Other things I sometimes do...

- Think about open science practices
- Try to further computational education in the biosciences
- Freelance software development
- Coach basketball
- 5 million other jobs...

Does conservation science practice what it preaches?



- 20,000+ papers sampled
- >1300 journals investigated
- >500 NGOs, Government agencies, colleges & universities contacted

How “open” is conservation science?



THE CARPENTRIES



*R*OpenSci



BIOS²

cíee
icéé

canadian institute of ecology and evolution
institut canadien d'écologie et d'évolution

Office hours and availability

ALEX

Lower-level office (usually occupied by Aneri)

Bad at checking slack especially after 4pm when her brain goes into atrophy

WILL check slack and email every morning before starting

COLE

Office space TBD but will literally live there

Always on his phone bc he is a dumb bi*ch

Manically replies to messages

Tell us about yourself!

Name

Pronouns

University and major

Why you decided to come to Bamfield

DS project

Future goals

One thing you are looking forward to in MPED