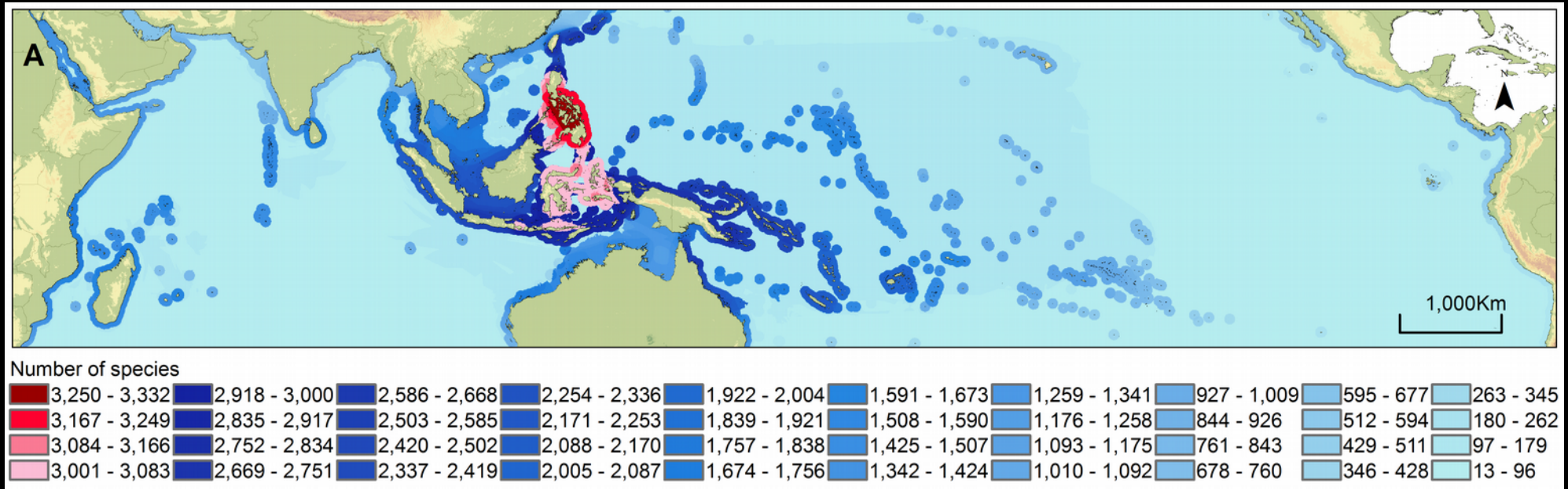


Using museum specimens to investigate biogeographic patterns in the Indo-West Pacific

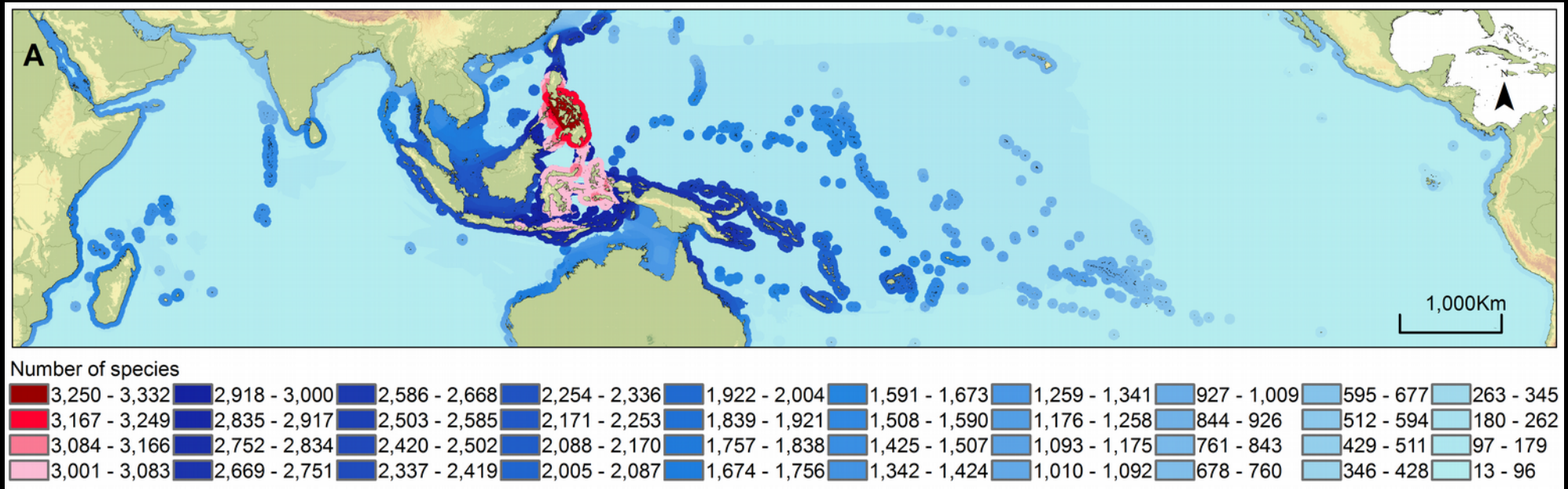
François Michonneau

ESA, Ft Lauderdale - Aug 10th, 2016



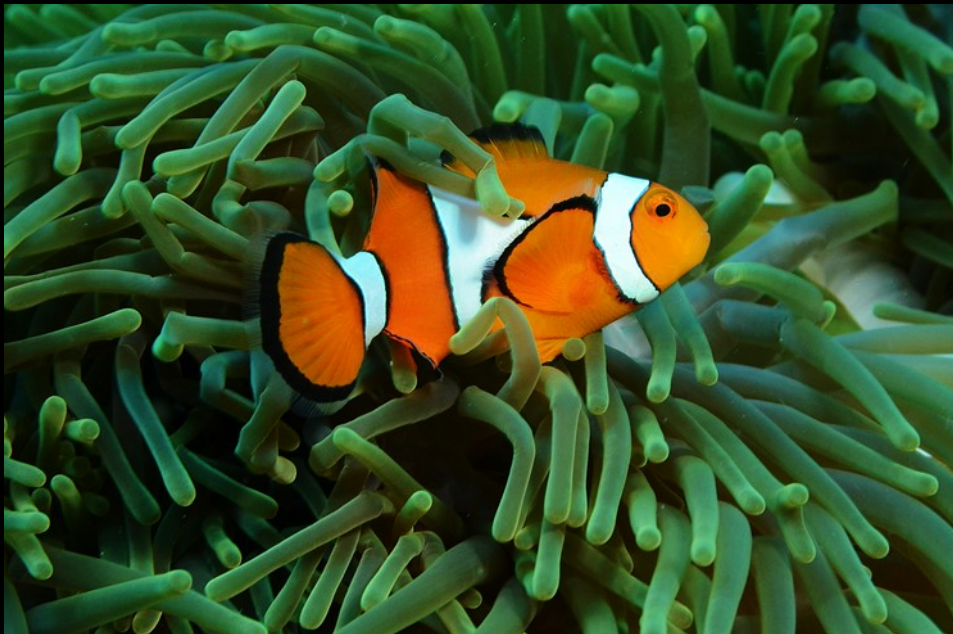
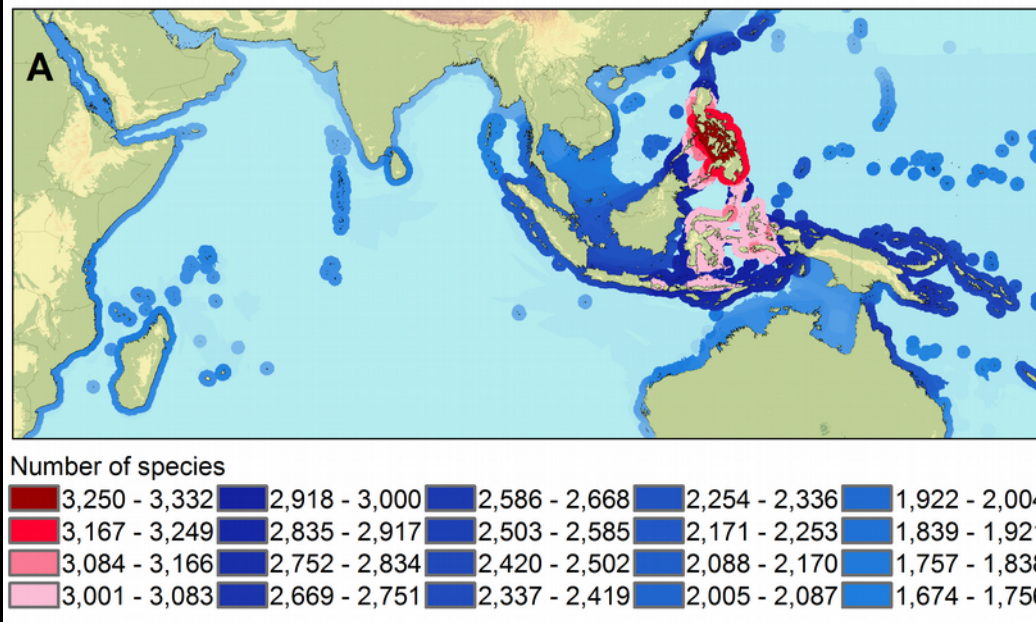
Geographic patterns of diversity

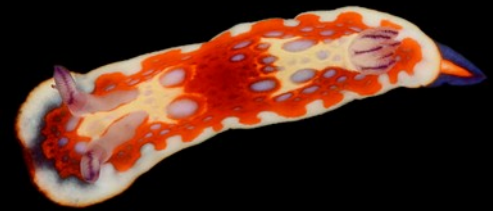
- Why are some areas more diverse than others?

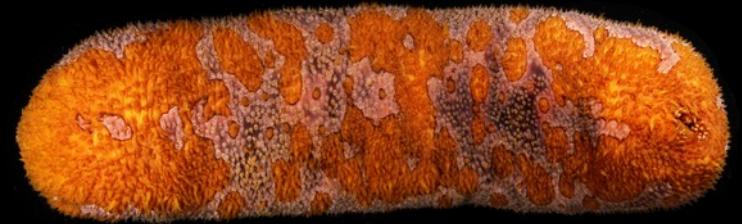
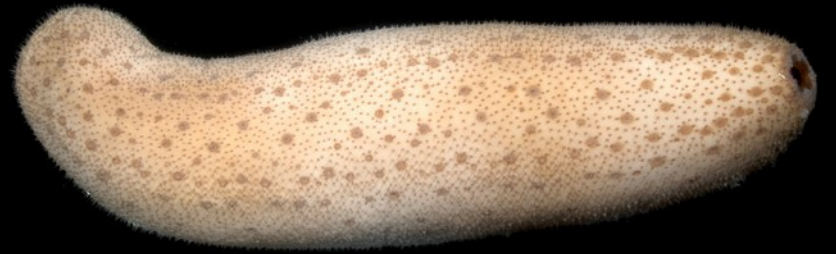


Geographic patterns of diversity

- Why are some areas more diverse than others?
 - Comprehensive geographic sampling
 - Clear understanding of species limits







one



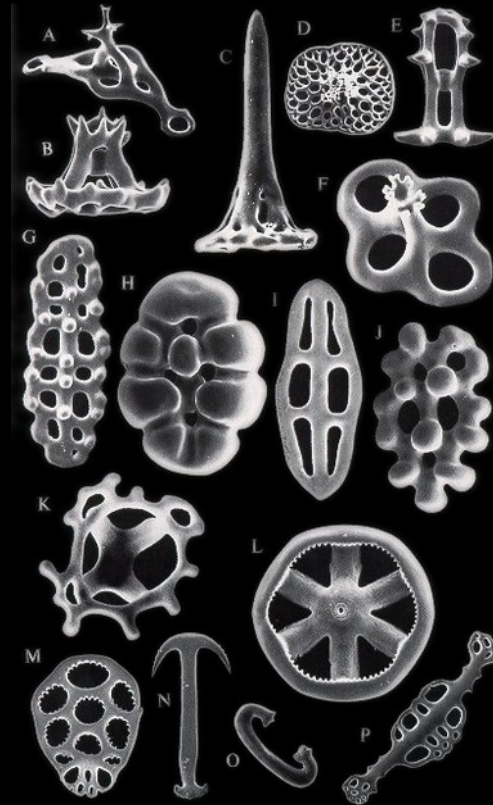
MAKE GIFS AT GIFSOUP.COM



SENORGIF.COM







*"Slimy, disgusting
Holothuriae",
Darwin 1845*

*"A mass of repulsive
slime",
HL Clarke 1922*

Sea cucumbers
are poorly
known

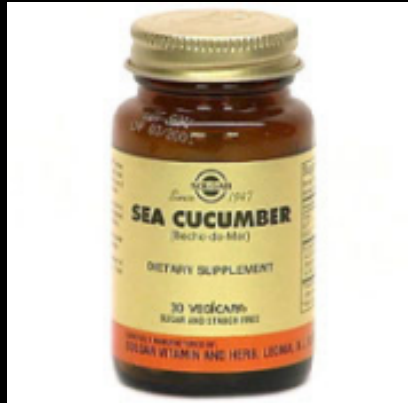
- Focus on skeletal elements
- Few specimens considered
- Nocturnal
- Fall apart

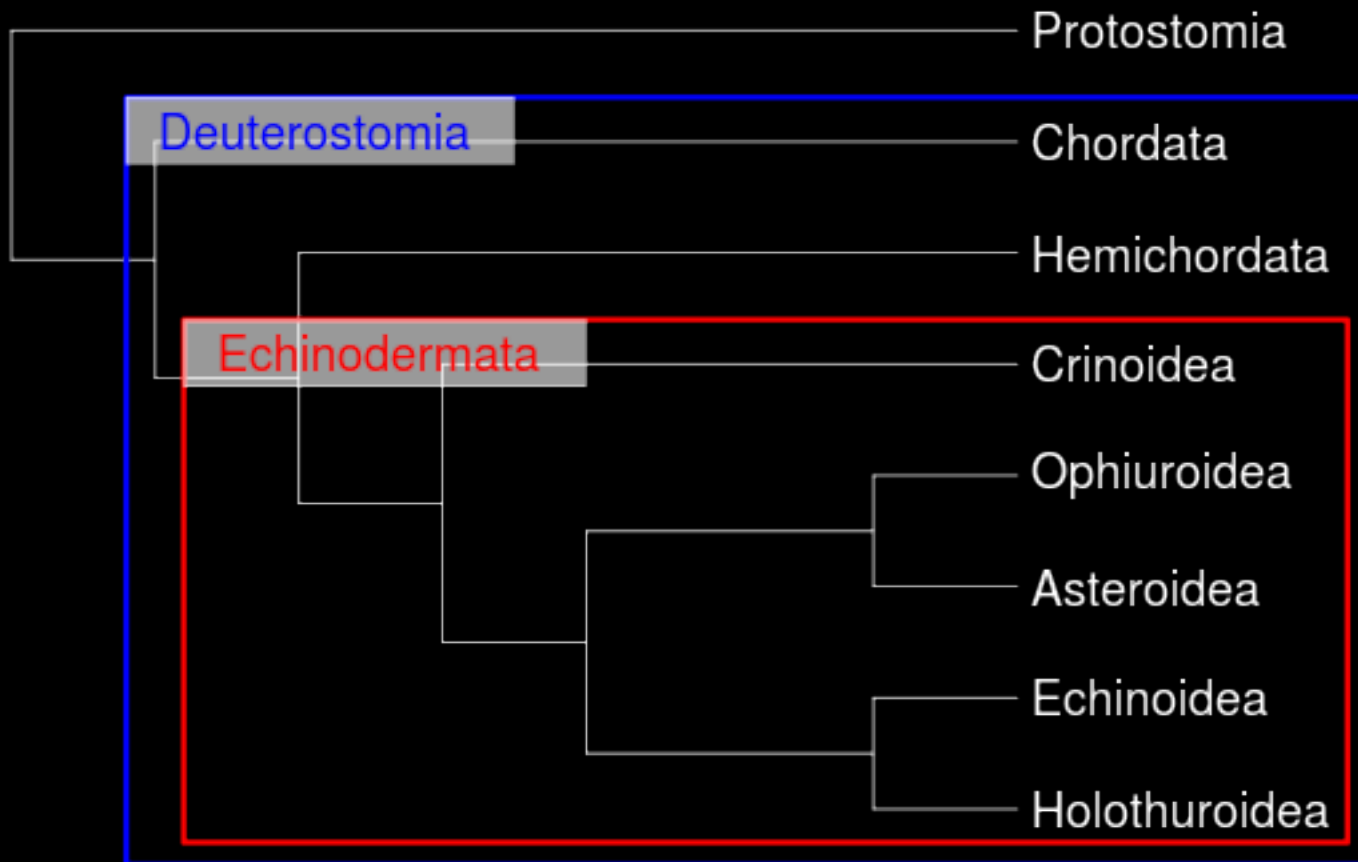


Multi-million
dollar industry



© Islands Photo Studio 2015







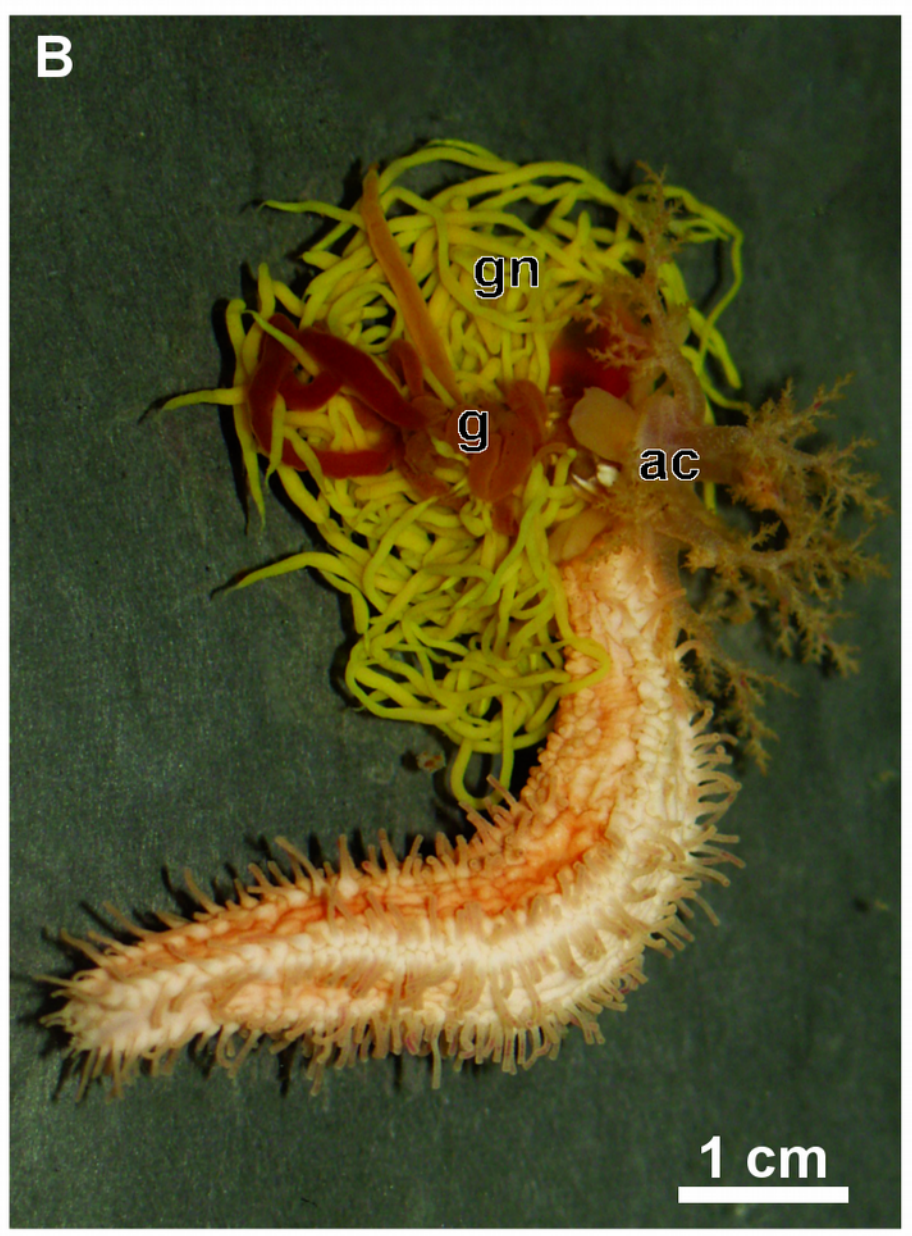
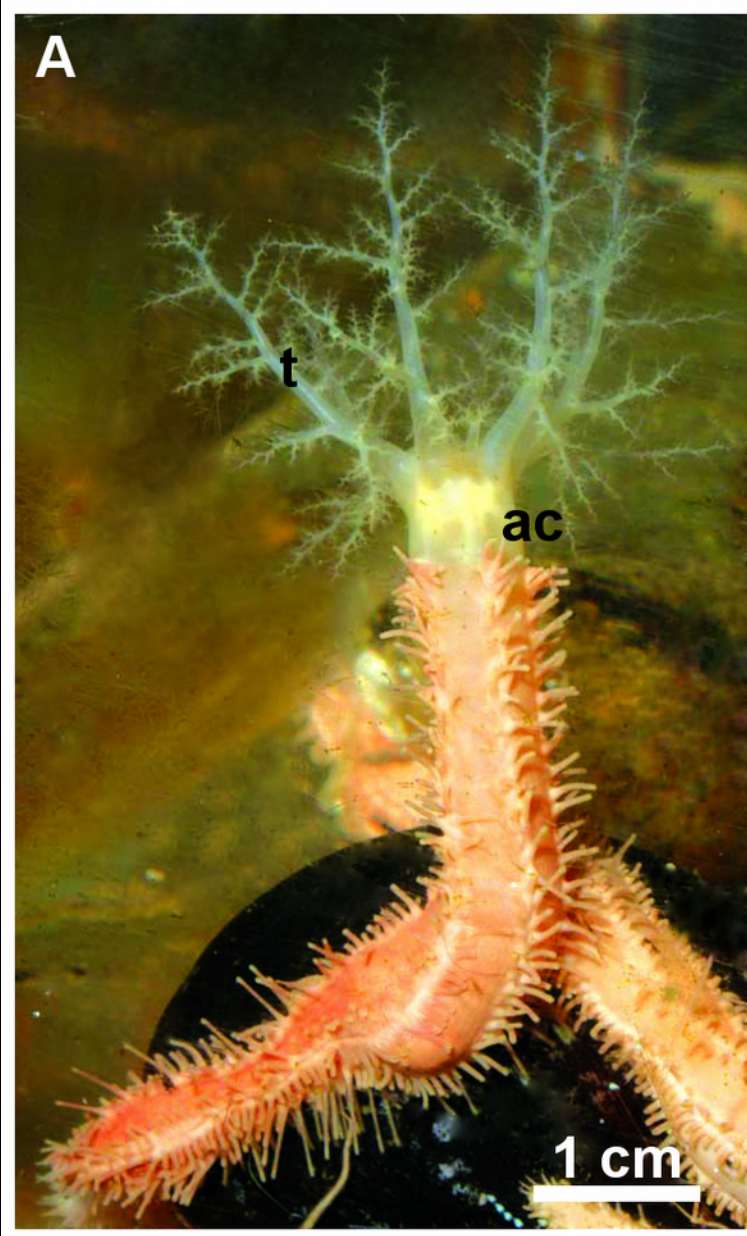
Cuvierian
tubules



"Melting" body wall



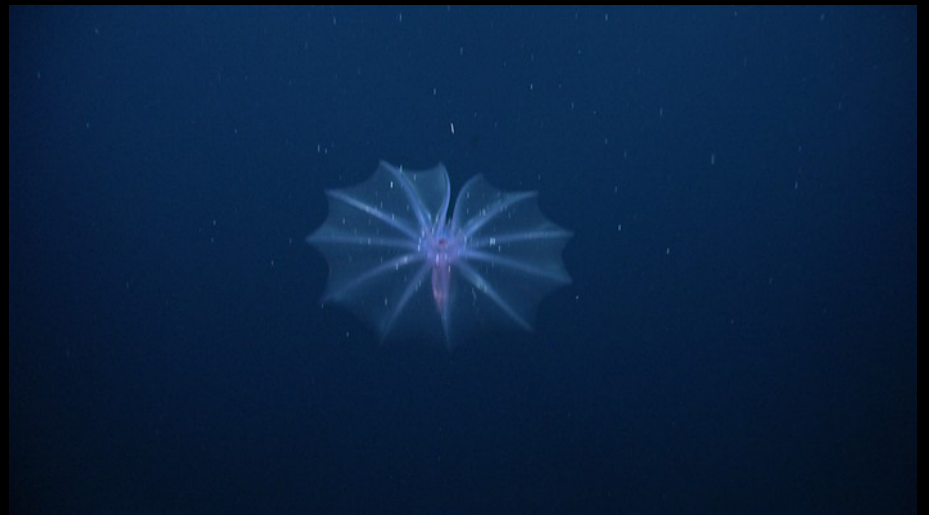
Asexual
reproduction

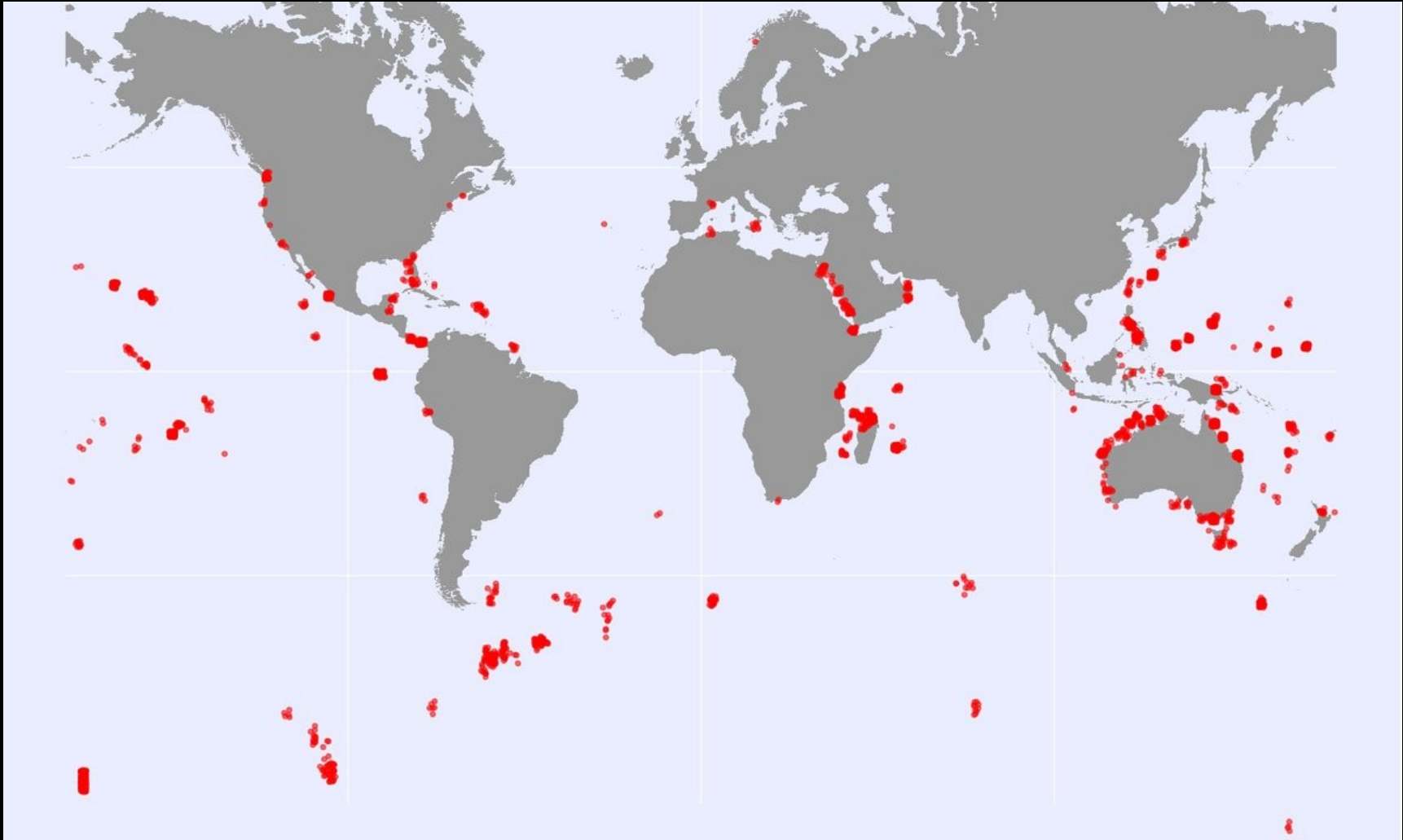


Evisceration



Hosts



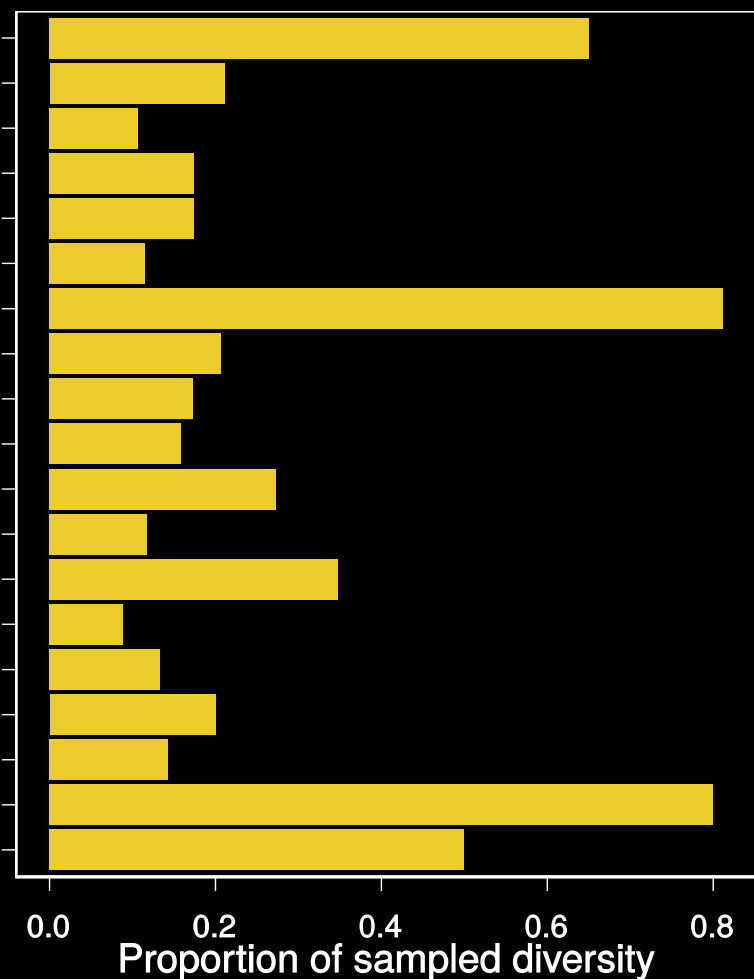
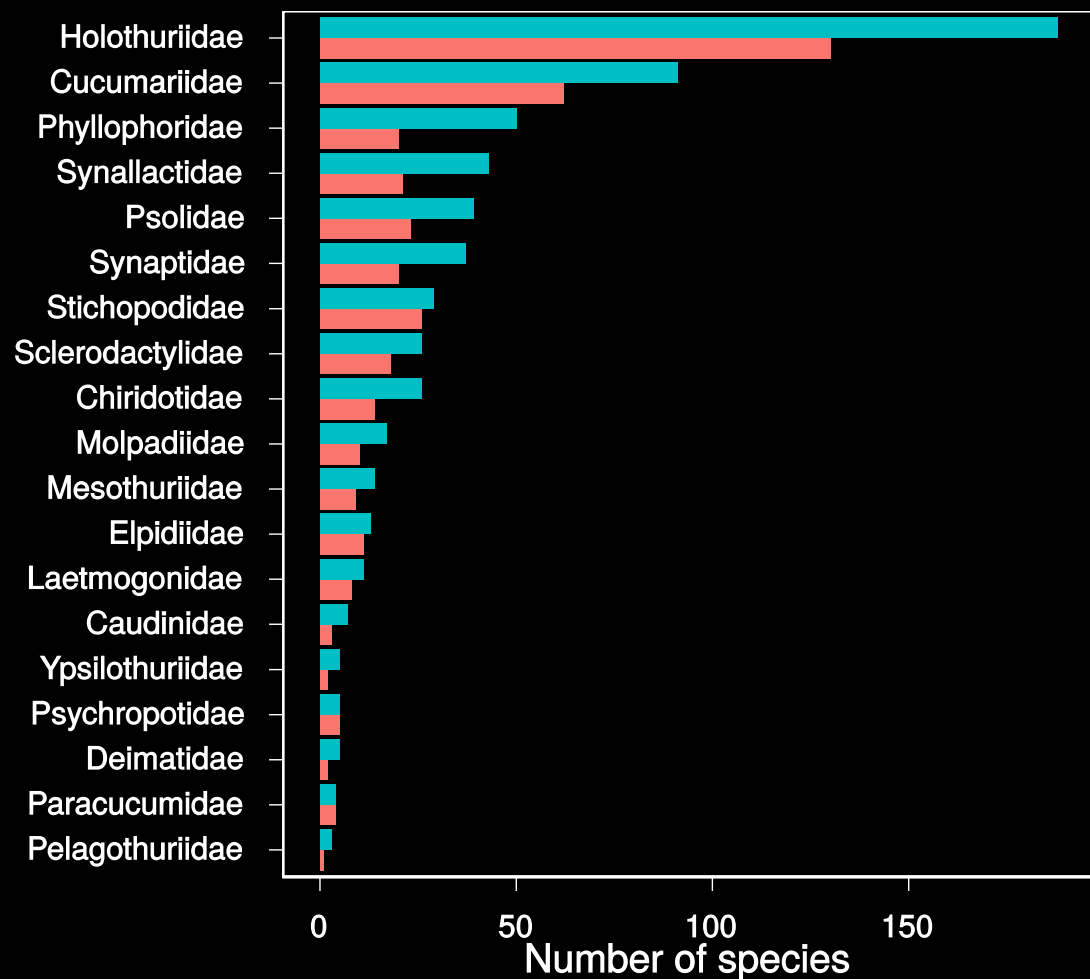


3050 individuals sequenced
390 recognized species
Species delineation with DNA data

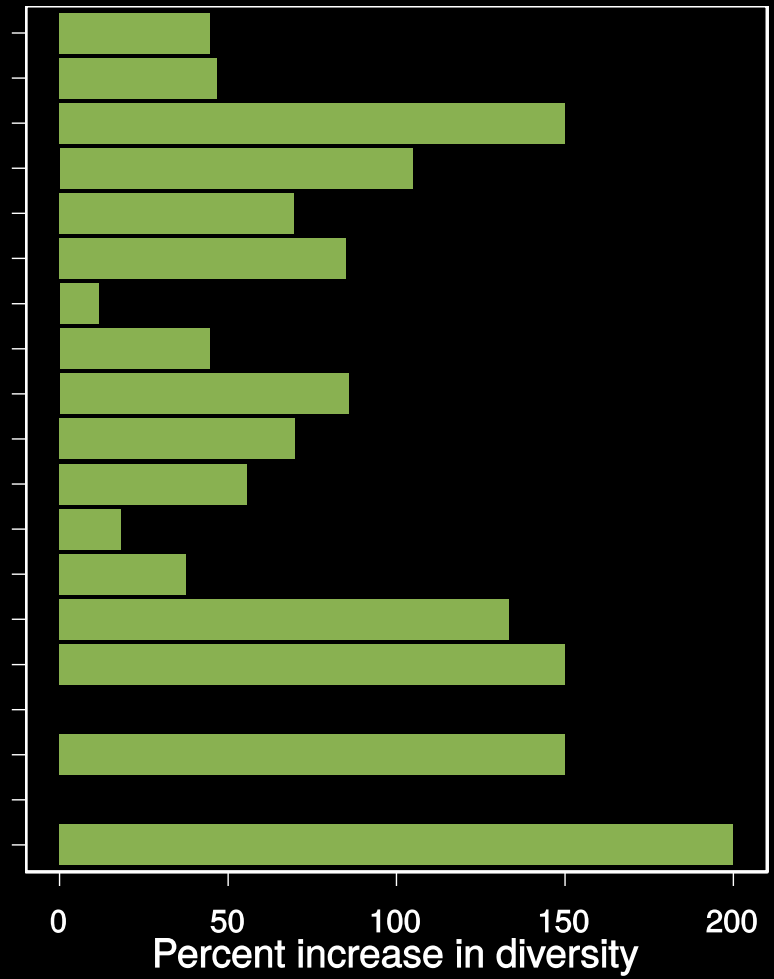
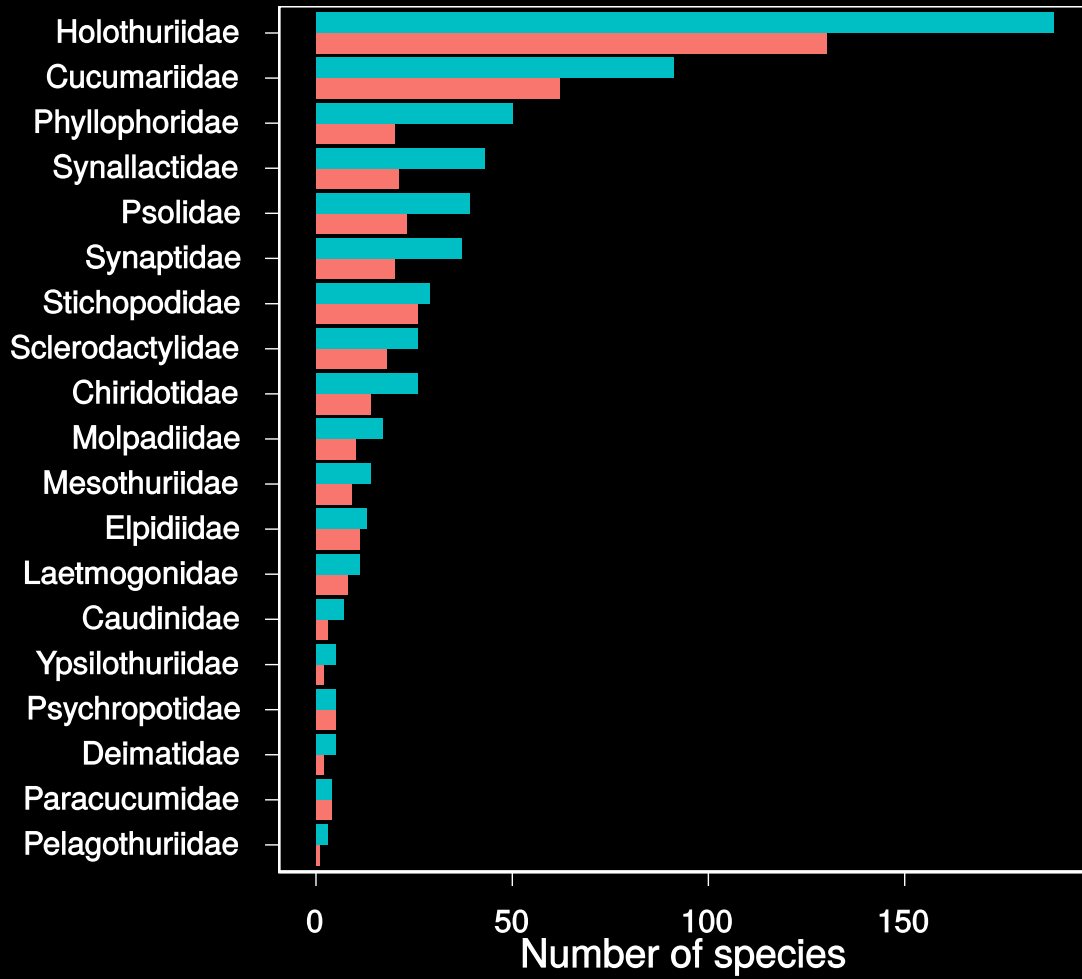
- Goal 1

- Assessing diversity in sea cucumbers using genetic data

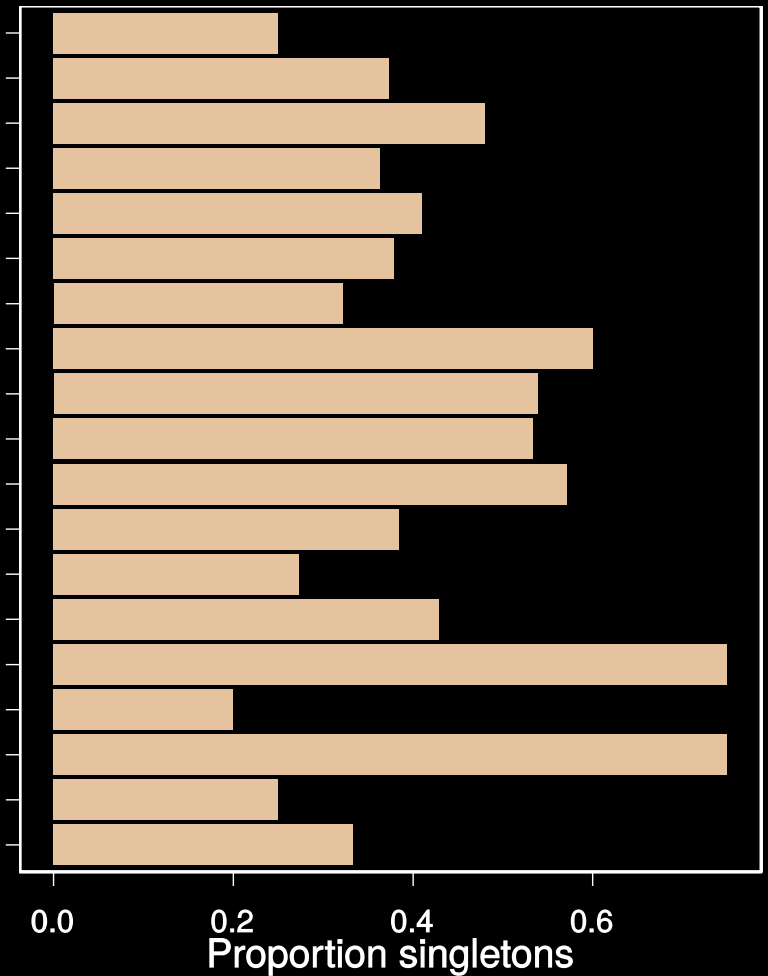
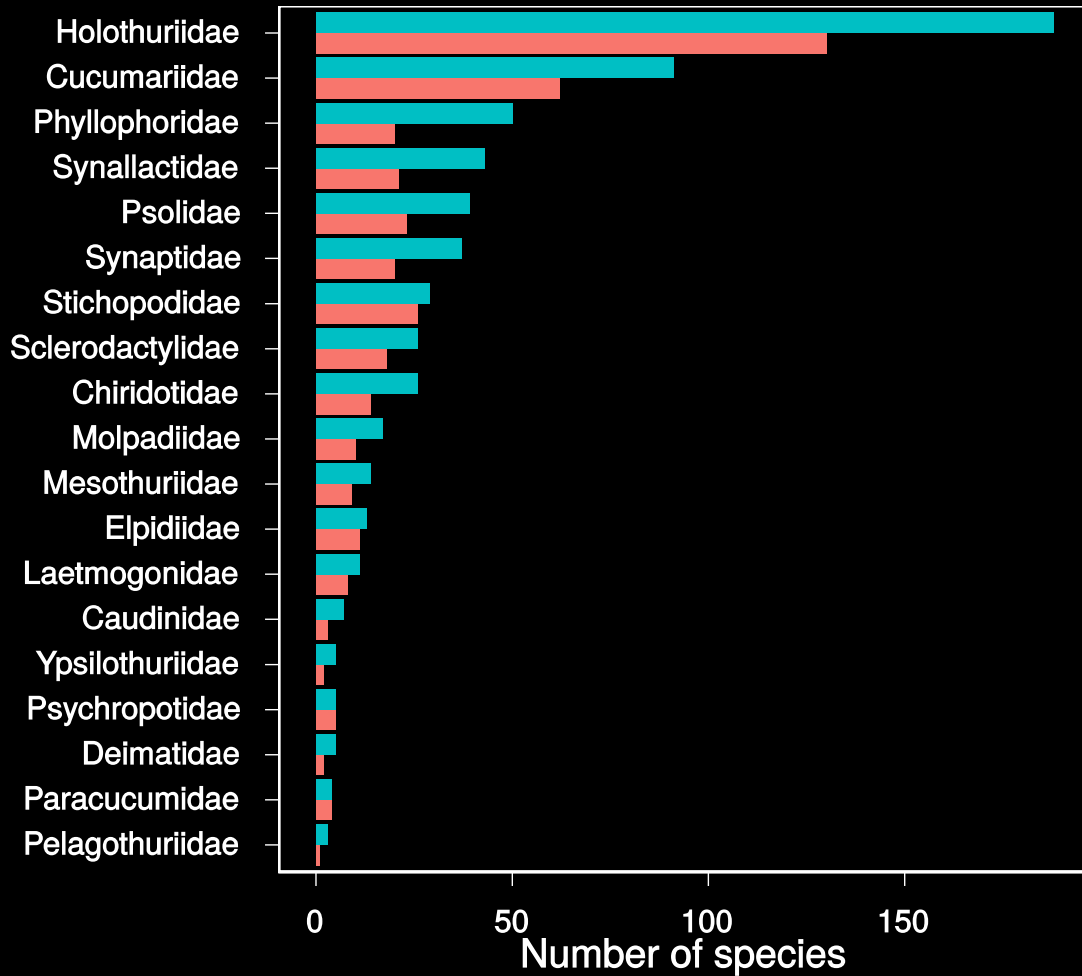
- How many species does the genetic data suggest?
- How does it compare to the number of species inferred from morphology?



■ # Genetic species
 ■ # Morpho-species



■ # Genetic species ■ # Morpho-species



■ # Genetic species ■ # Morpho-species

Overall

- For all sea cucumbers
 - Proportion of sampled diversity 25%
 - Number of morpho-species sampled 390
 - Number of genetic species found 613
 - Percent increase in diversity 58%
 - Proportion of singletons 37%

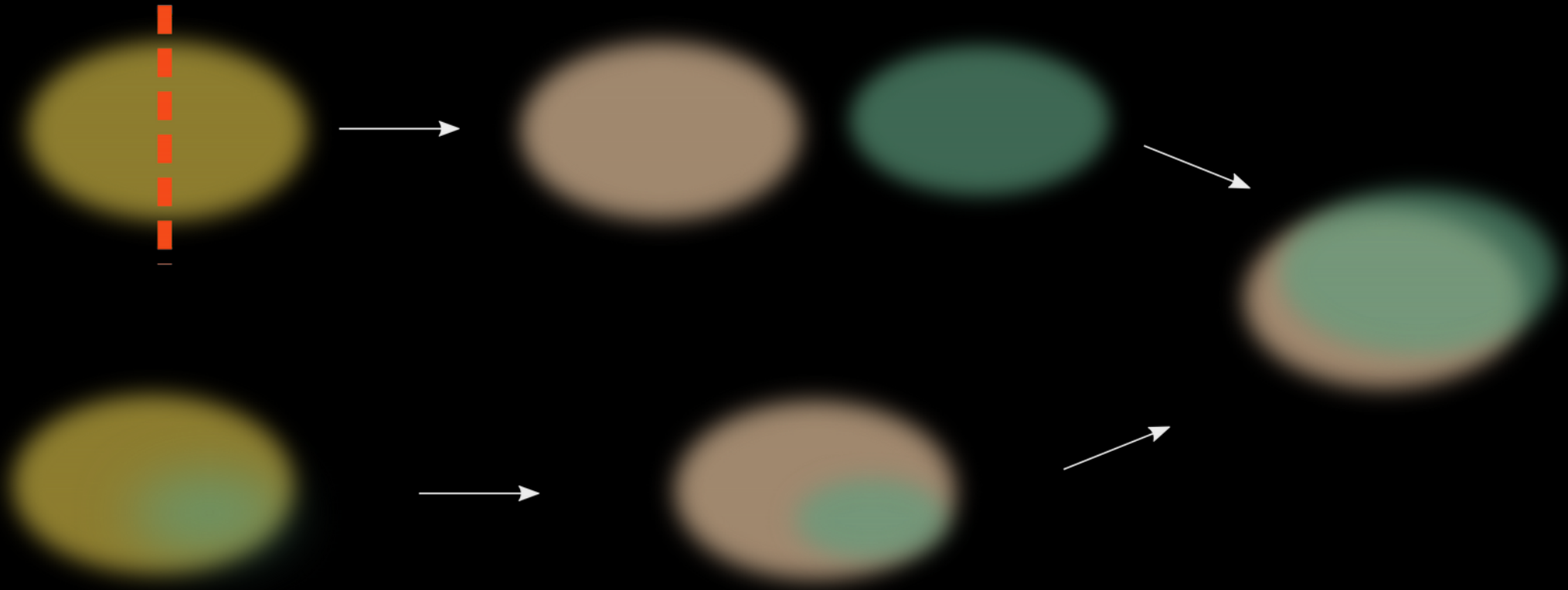


- Goal 2

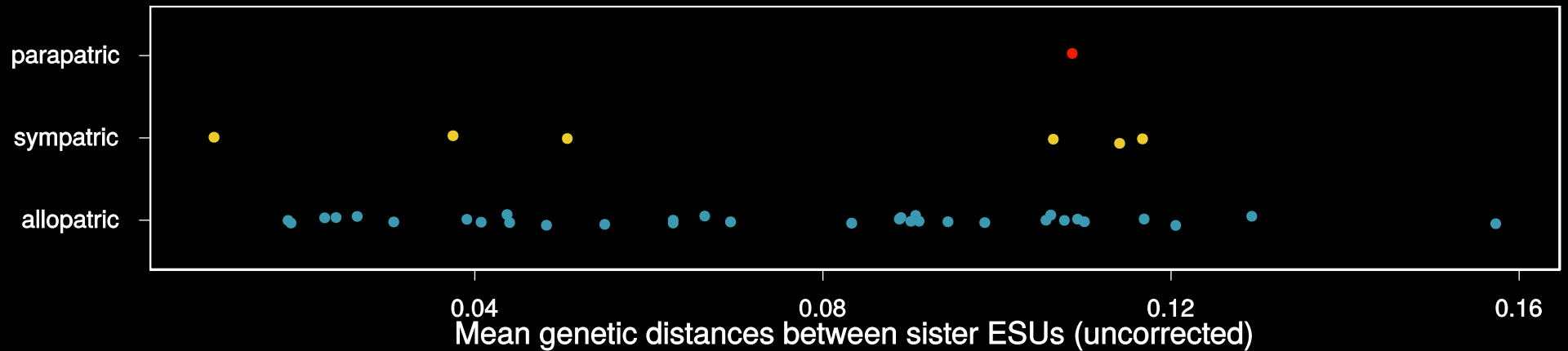
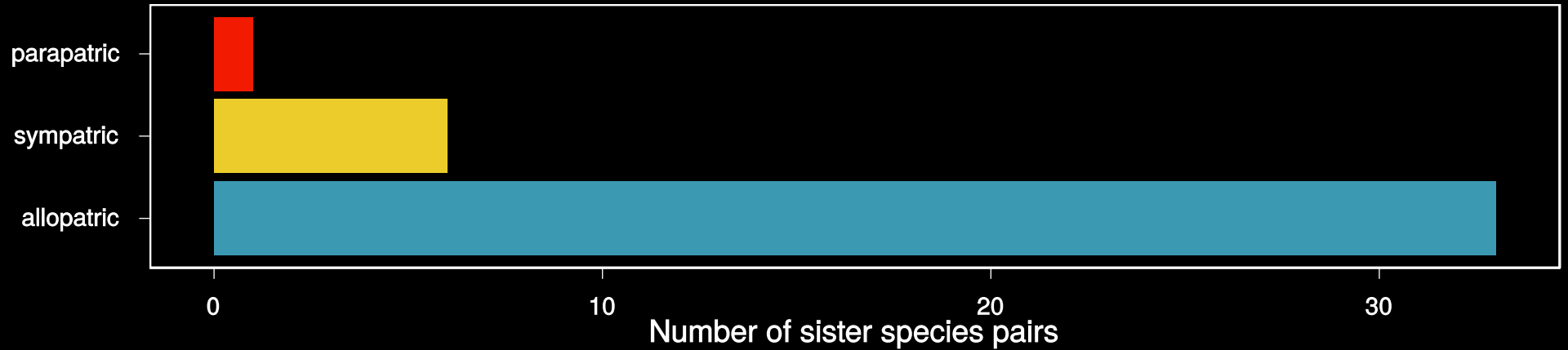
- What can we learn about the spatial and temporal context of diversification?

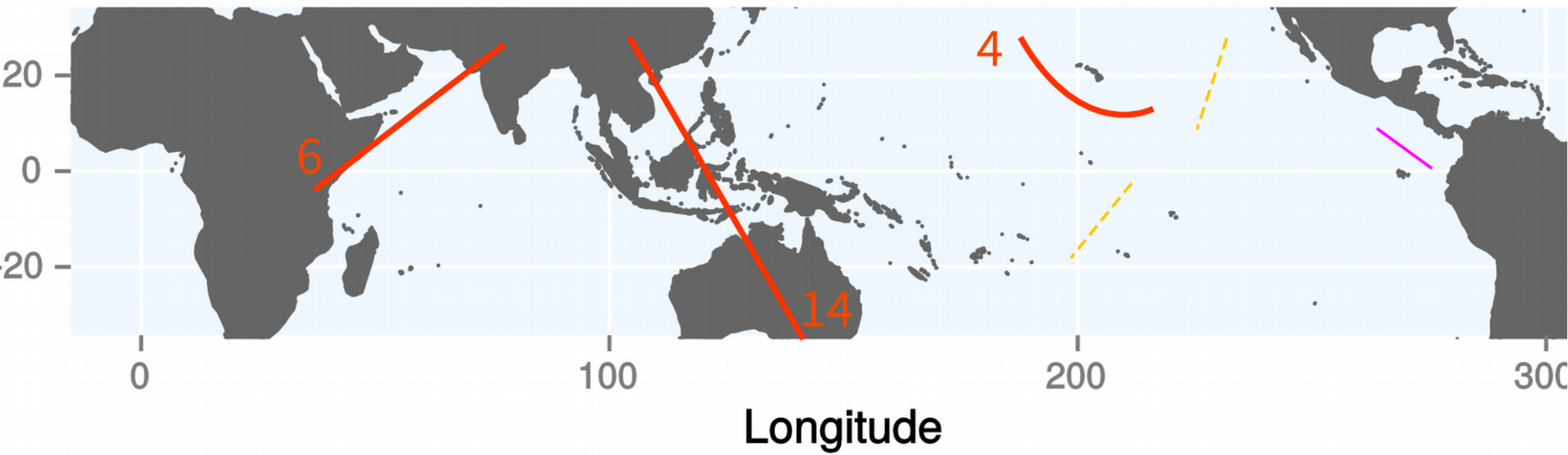
- What is the geographical setting of sister species?
- Is there a signal for sympatric speciation?

Assessing geography of diversification



Most sister species are allopatric





Biogeographic
barriers

A RESEARCH PAPER

THE NARRATIVE

THE DATA

THE CODE

Methods
(part 2)

A RESEARCH PAPER

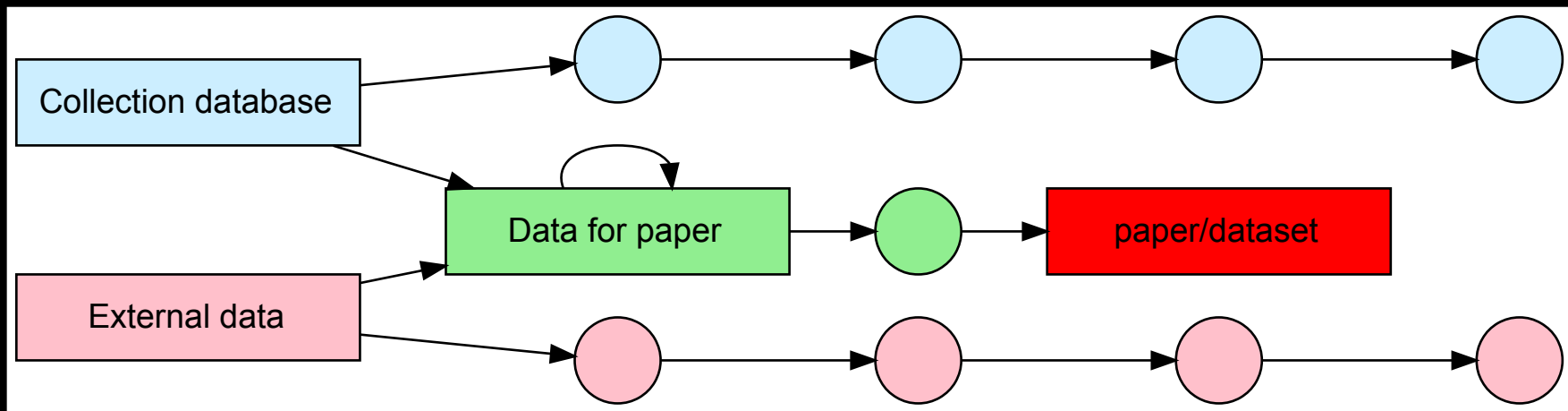
THE NARRATIVE

THE DATA

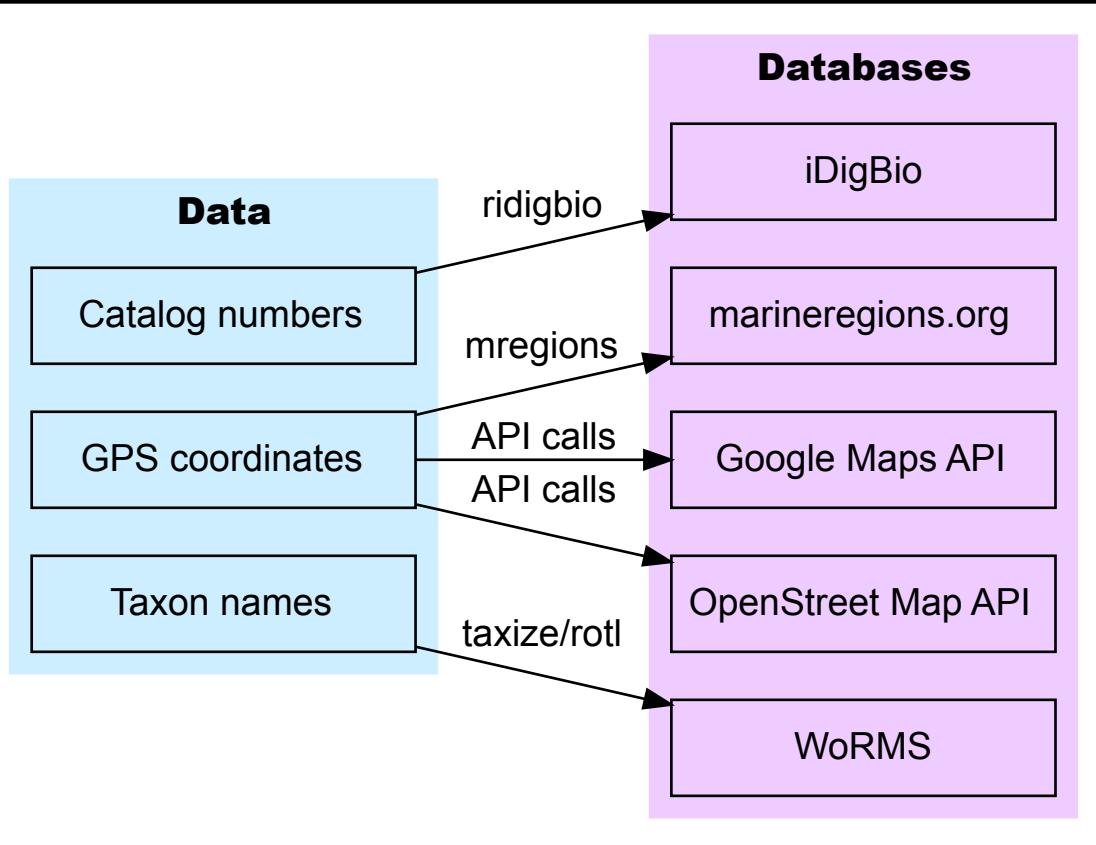
THE CODE

Methods
(part 2)

Workflows - data validation



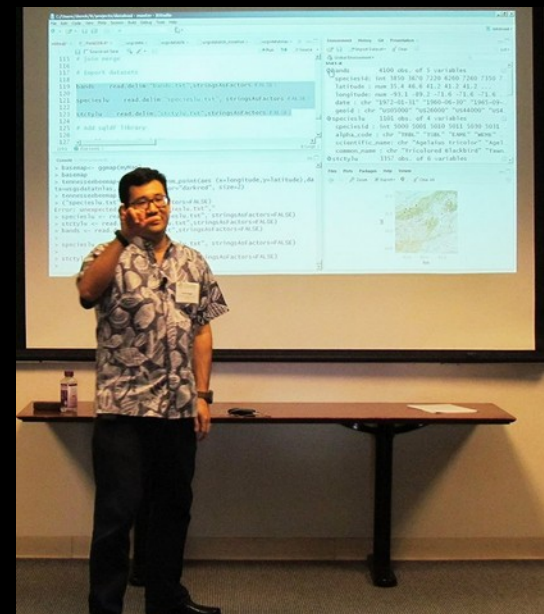
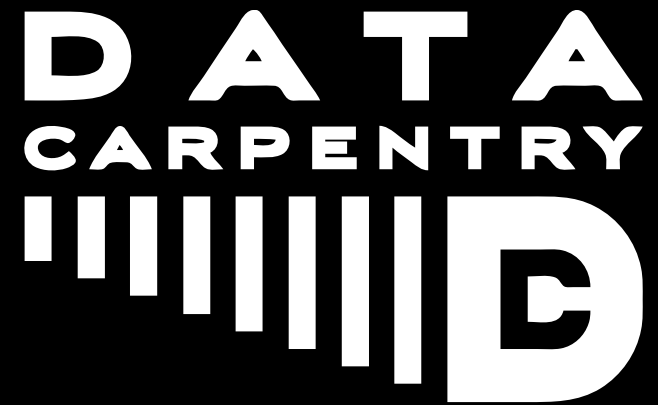
Workflows - data validation



<https://ropensci.org>

Training

- Data Carpentry
 - <https://datacarpentry.org>
- Reproducible Science Curriculum
- Field to Database workshop



Acknowledgments

- iDigBio
- NSF PEET & DDIG
- Collaborators
 - Mark O'Loughlin
 - Yves Samyn
 - Didier VanDenSpiegel
- rOpenSci
- Data Carpentry
- Pre-print: “More than meets the eye: diversity and geographic patterns in sea cucumbers”
<http://biorxiv.org/content/early/2015/01/23/014282>

Workflows

