Benthic monitoring for marine invasions

SERC's approach

Gulf & South Atlantic Regional Panel,
ANS task Force

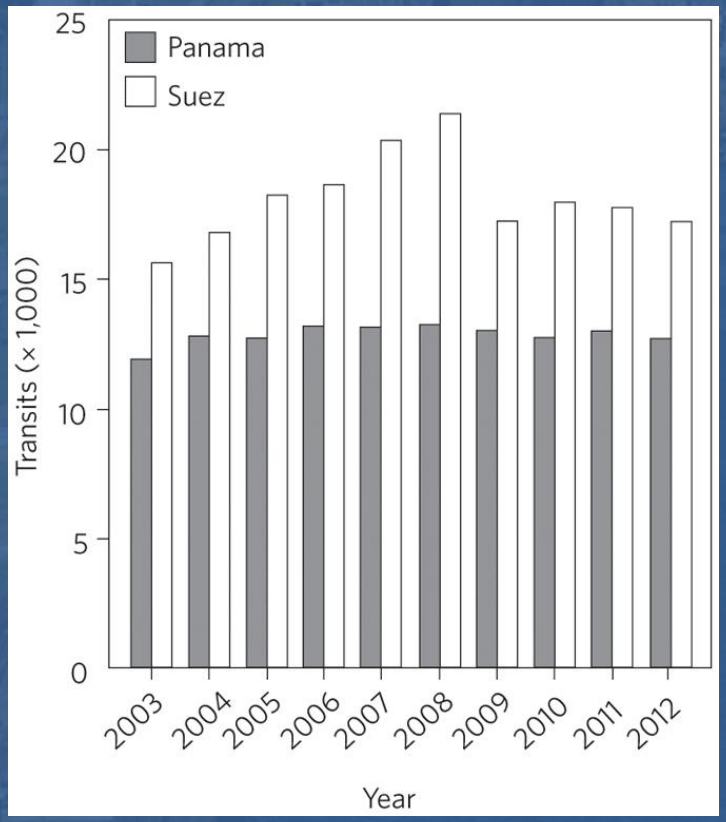
Fort Lauderdale, Florida,
May 5th, 2015

Canal connectivity:

6-months of shipping connections

Panama Canal Expansion

early 2016 opening date
more traffic, larger ships



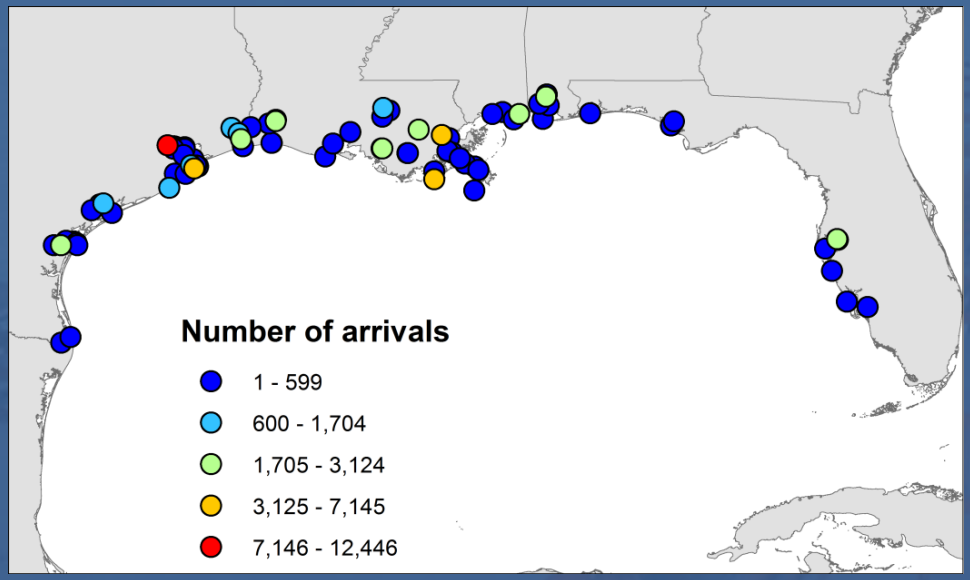
Miller & Ruiz (2014)

Gulf & Atlantic Coast ports react

NY/NJ
Norfolk
Savannah
Wilmington
Charleston
Miami
Port Everglades
Tampa
Mobile
Gulfport
New Orleans
Houston
Brownsville
& more

>$46 billion expansion plans

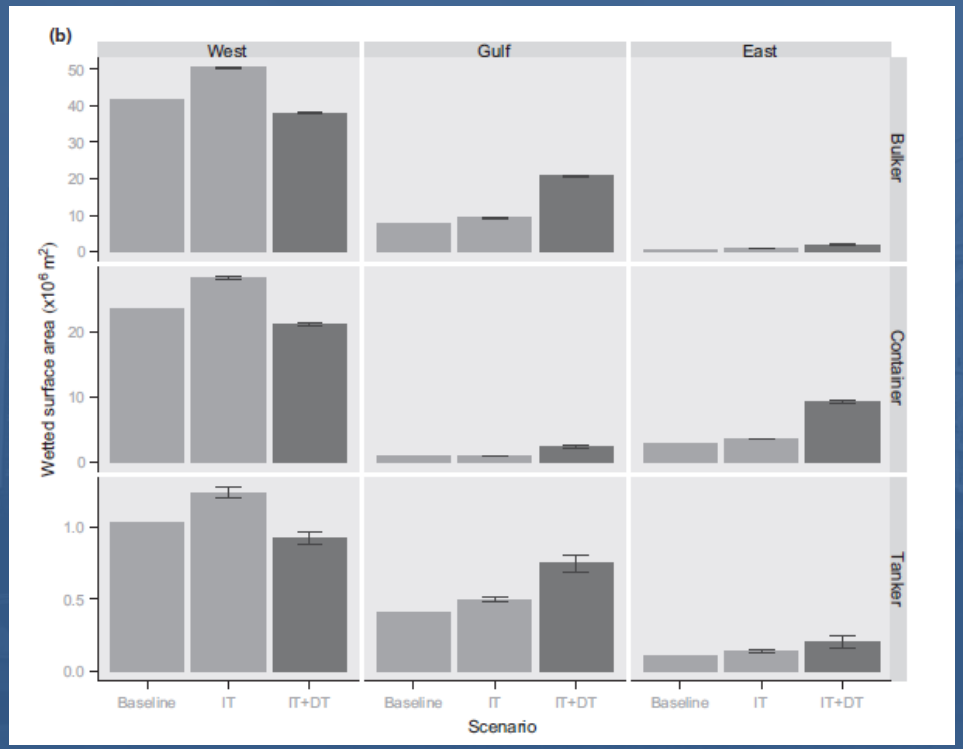
Gulf shipping



Projecting changes in traffic

Shipping from Asia

West Gulf East



Muirhead et al. (2015)

more invasion opportunity

Bulkers

Containers

Tankers

The challenge:

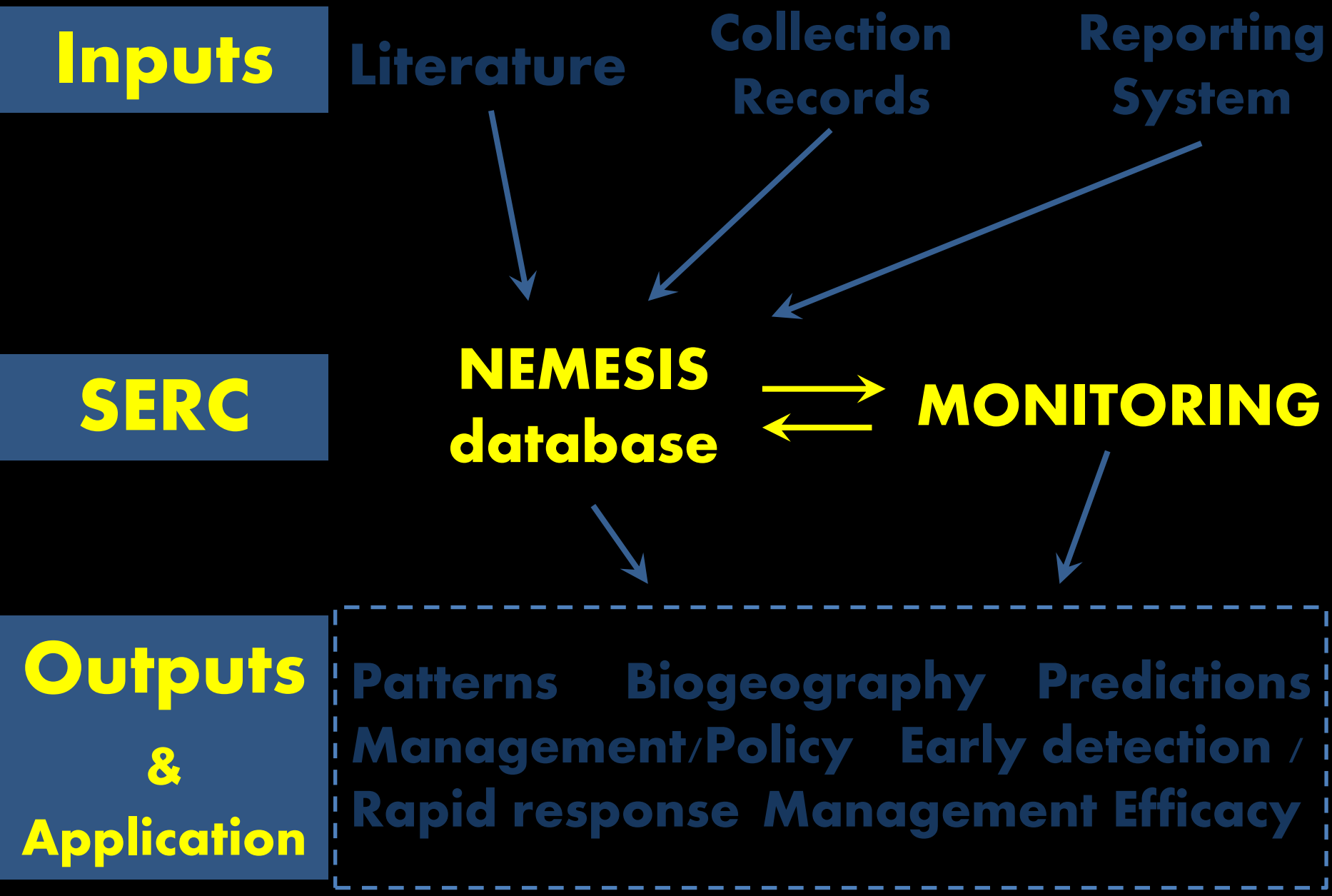
measure marine invasions

Sample communities
Detect species
Determine biogeography
Determine establishment status
Timing
Vectors

Synthesis of available data

National **E**xotic **M**arine & **E**stuarine **S**pecies **I**nformation **S**ystem

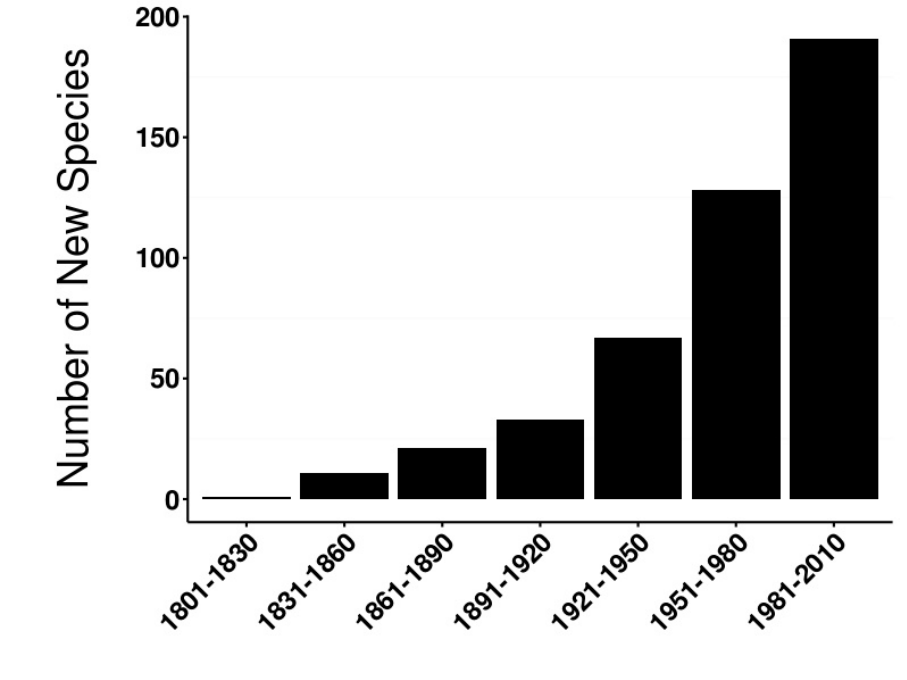
invasions.si.edu/**nemesis**


Inputs
Literature
Collection Records
Reporting System
SERC
NEMESIS database
MONITORING
Outputs & Application
Patterns
Biogeography
Predictions
Management/Policy
Early detection / Rapid response
Management Efficacy

Marine invasions in the US

invertebrates & algae

Introductions over time

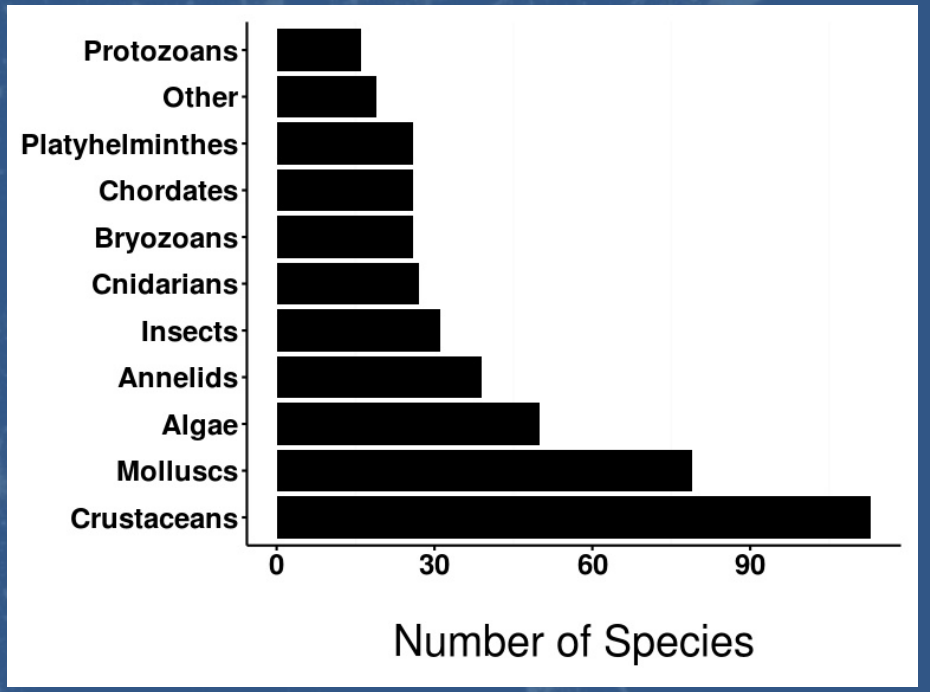


Ruiz et al. (2015)

Marine invasions in the US

invertebrates & algae

Taxonomic pattern

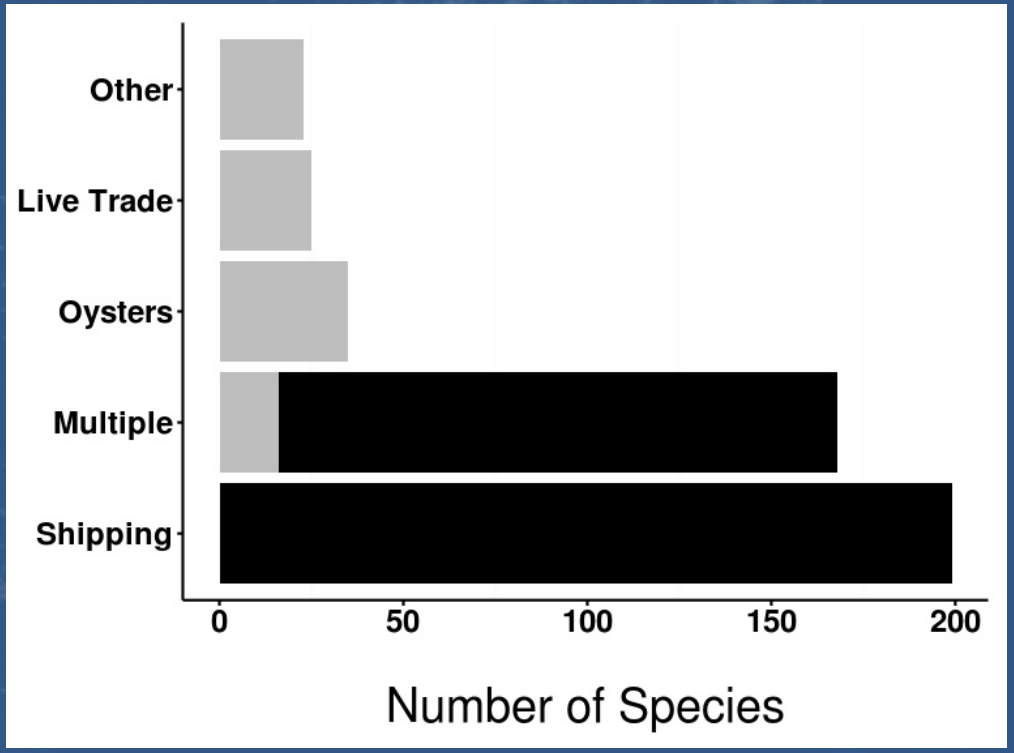


Ruiz et al. (2015)

Marine invasions in the US

invertebrates & algae

Vector pattern



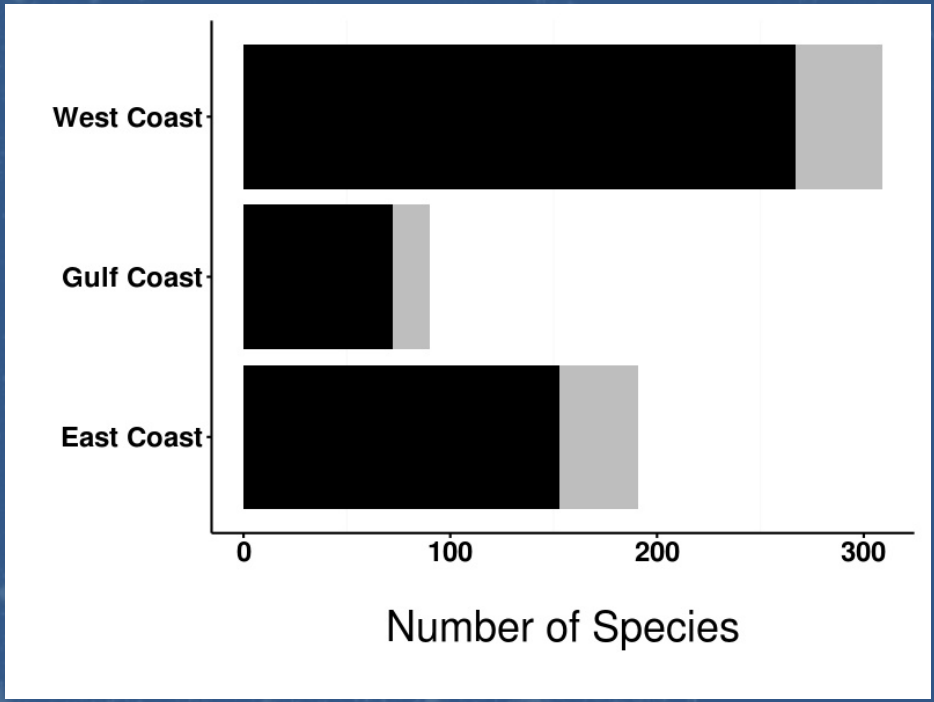
Ruiz et al. (2015)

Marine invasions in the US

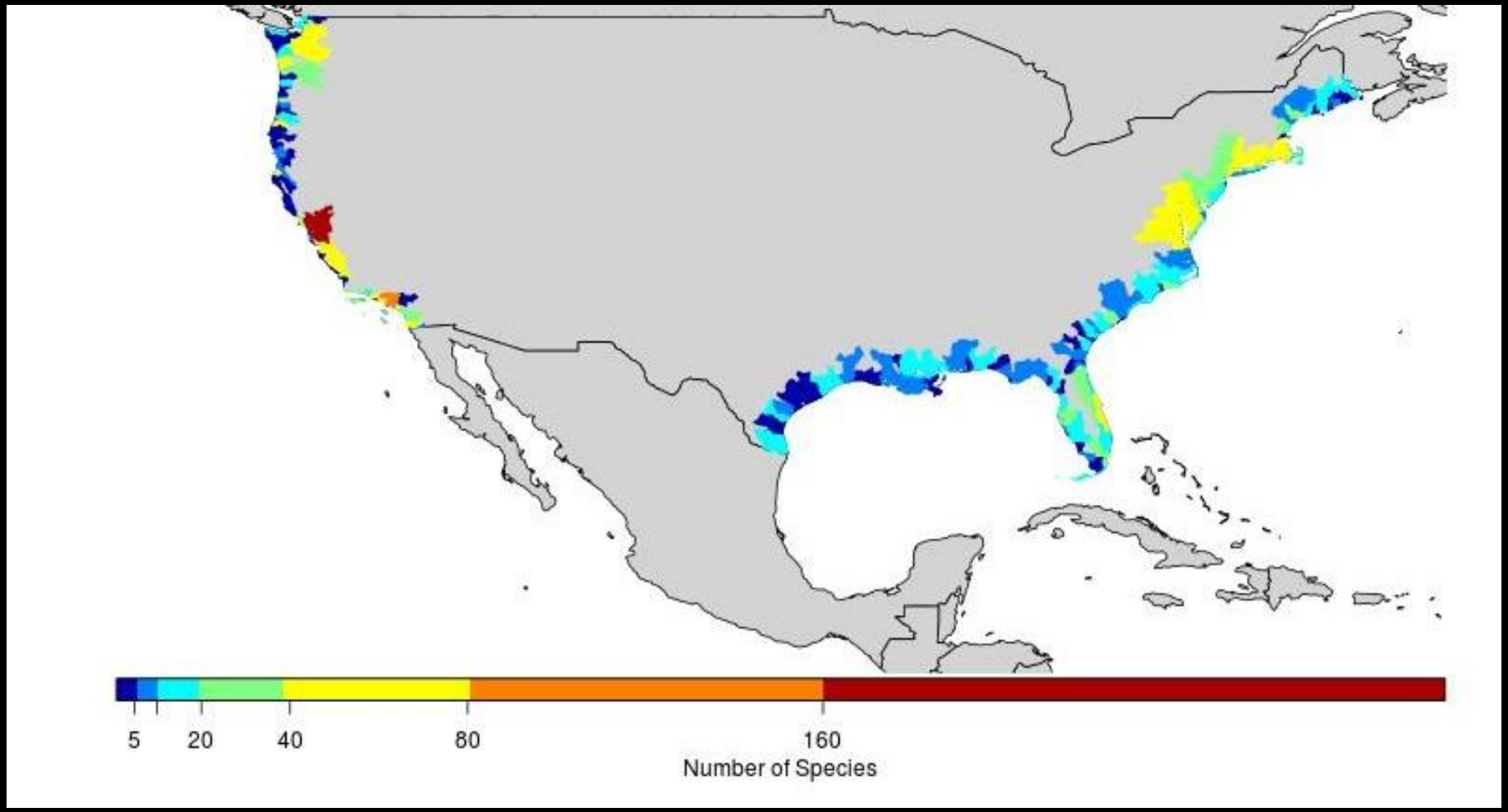
invertebrates & algae

Ruiz et al. (2015)

Regional pattern



Bay-level richness of introduced species



Biases

Search Effort
- space
- time
- taxonomy

Systematics
- smalls rule

Biogeography & surveys
- Chesapeake vs San Francisco Bay

Carlton's "smalls rule"

"if it's small, it's native"

Biases

Search Effort
- space
- time
- taxonomy

Systematics
- smalls rule

Biogeography & surveys
- Chesapeake vs San Francisco Bay

Standardized repeated measures

Port surveys

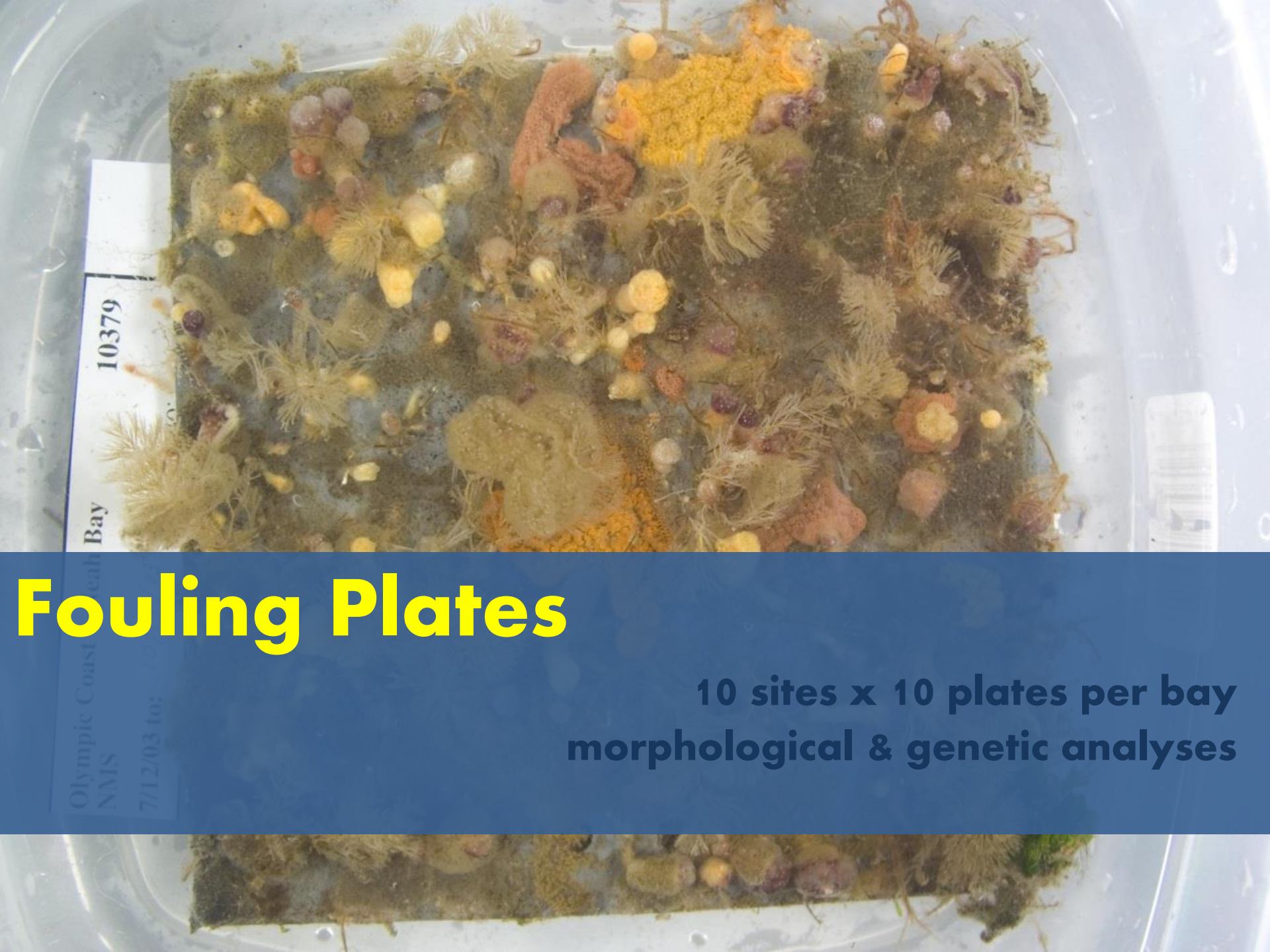
Sessile benthic (fouling panels)

Infauna (benthic grabs)

Plankton (net tows & pumps)


1/29/01


Random Rank
22

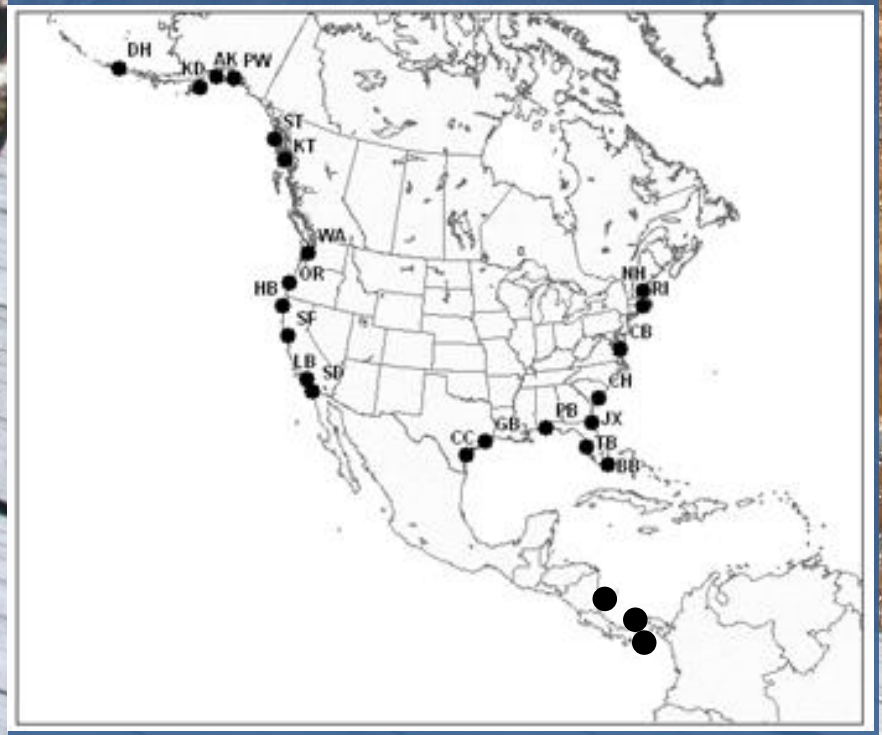


Fouling Plates

10 sites x 10 plates per bay

morphological & genetic analyses

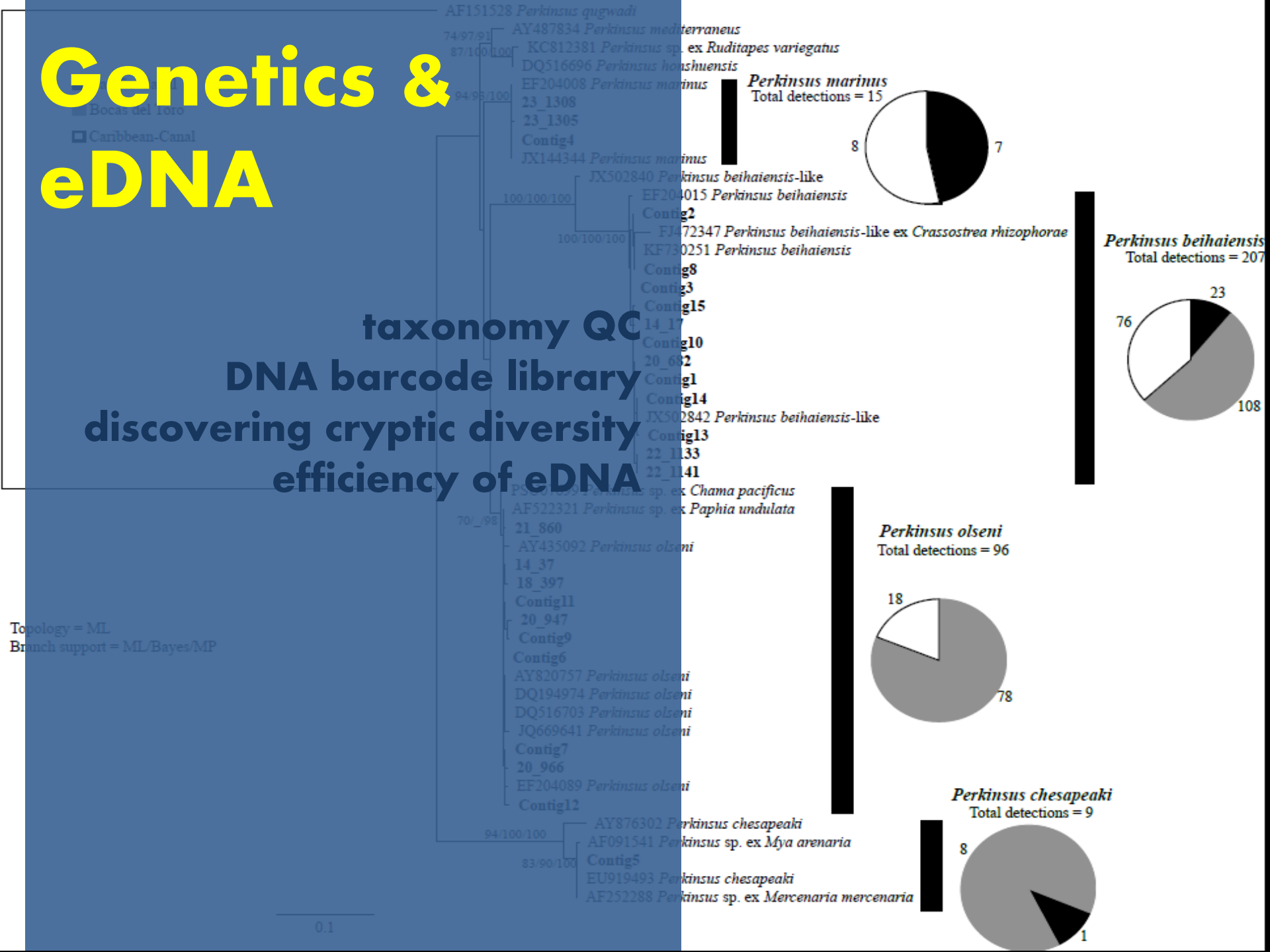
North America plate sampling



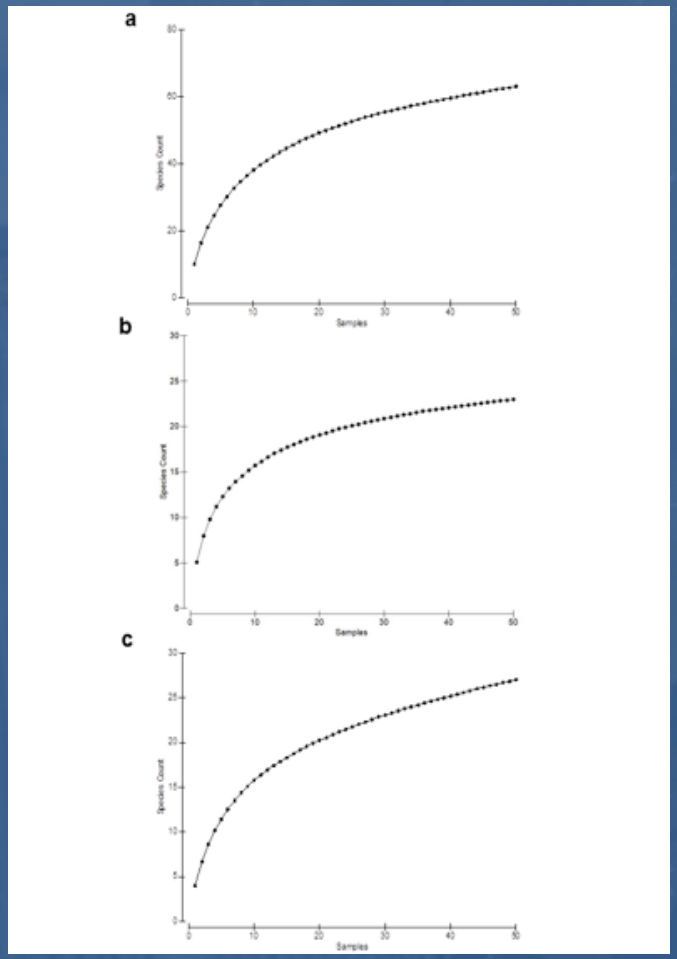
Voucher library

Genetics & eDNA

taxonomy QC
DNA barcode library
discovering cryptic diversity
efficiency of eDNA



Reaching asymptote



Summer fouling communities in San Francisco Bay

2001, 2002, 2007

2008, 2013, 2014

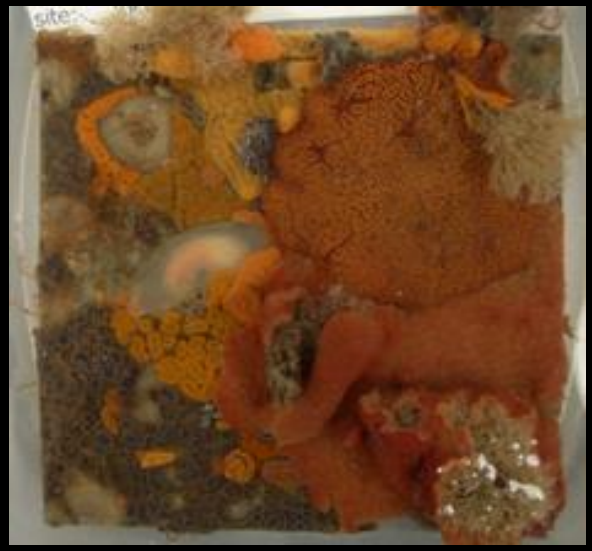
2015?

DRY

2003, 2004, 2005

2009, 2010, 2012

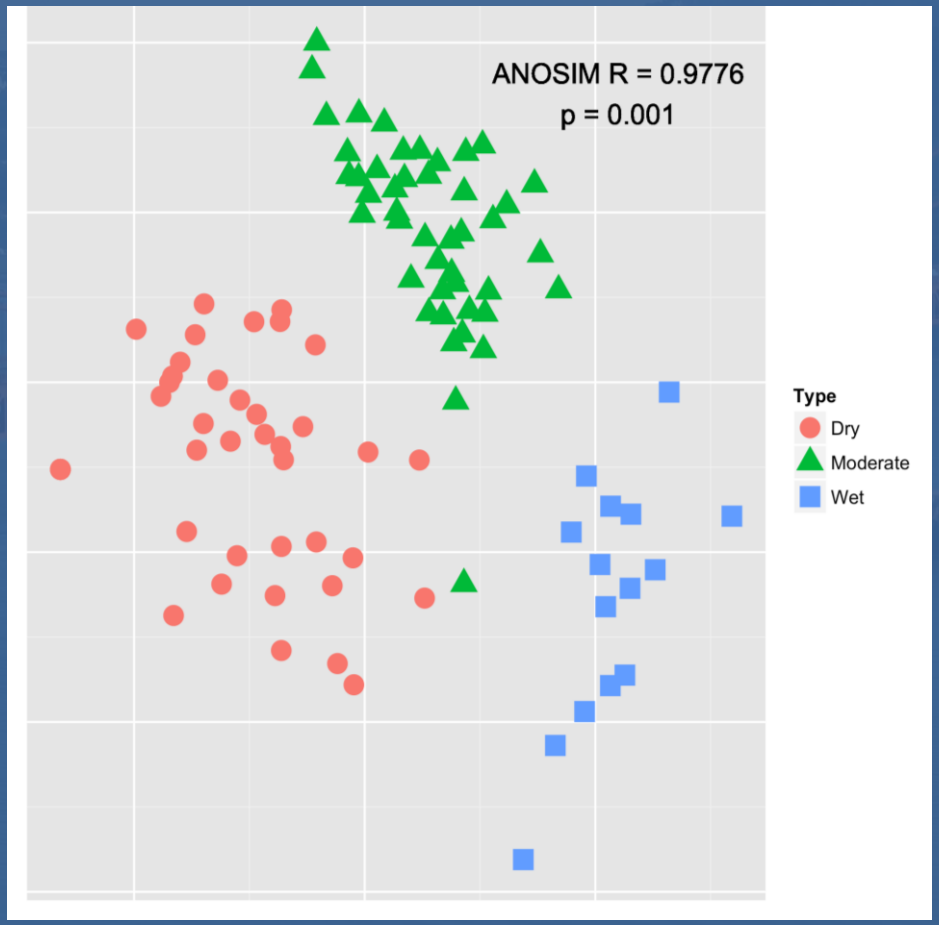
MODERATE



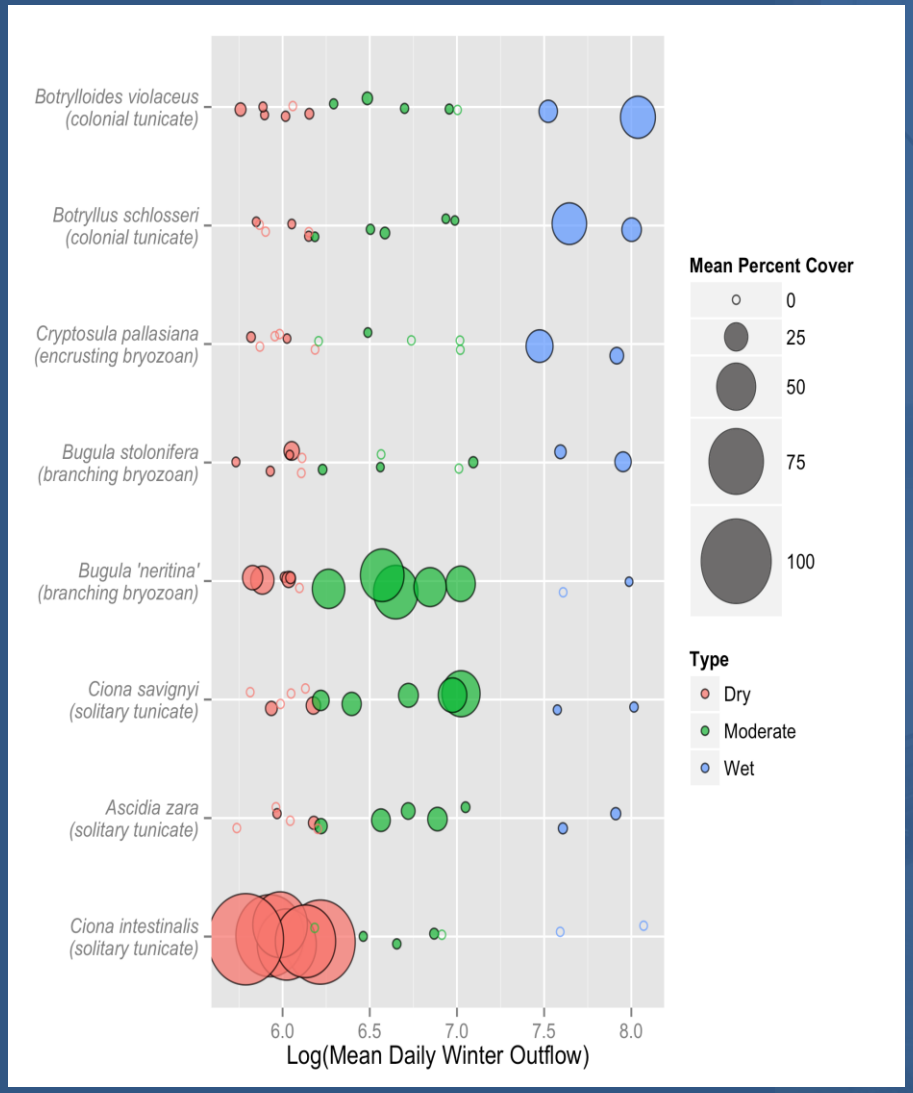
2006, 2011

WET

San Francisco Bay wet-dry variation



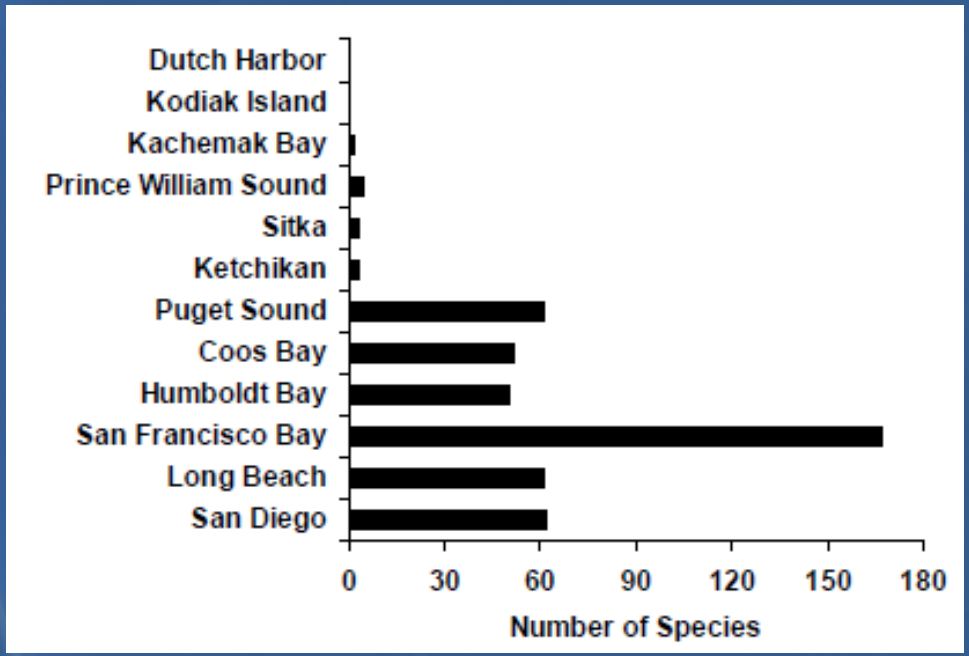
San Francisco Bay wet-dry variation



Summer **species abundances vary as a function of the *previous winter's* outflow (salinity)**

Synthesis data

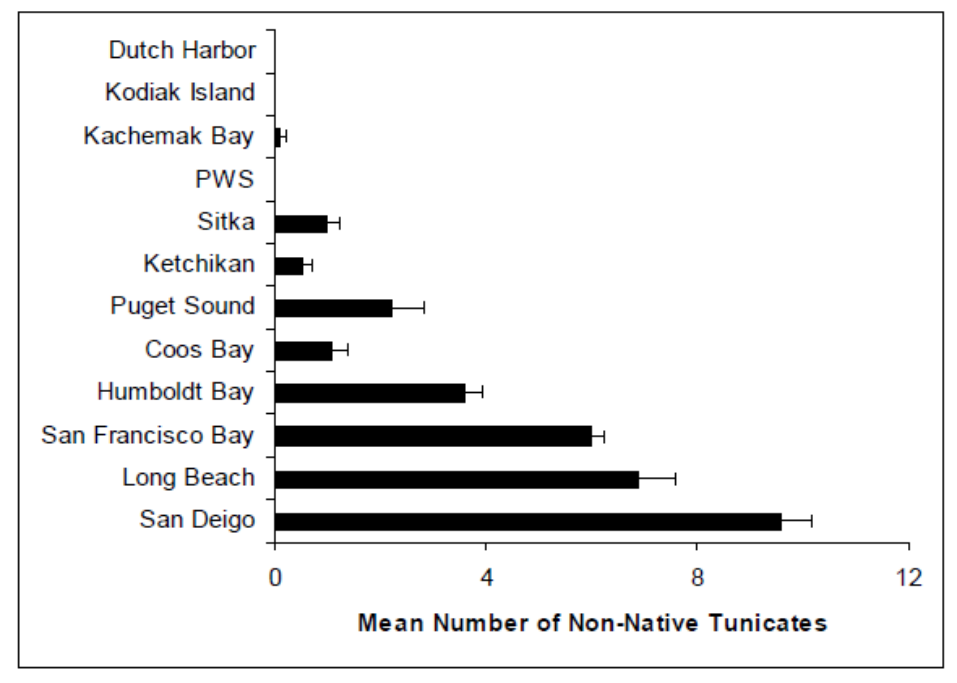
non-native marine invertebrates



Ruiz & Hewitt (2009)

Standardized data

non-native tunicates



SERC report (2006)

Port Survey Model

- Improve completeness of invasion inventories
- Improve comparison among sites
- Improve comparison over time
- Identify management options to disrupt pattern/rate
- Evaluate management efficacy

Thanks

http://www.serc.si.edu/labs/marine_invasions/

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