

# REPRISE



# REPEAT REPLICATE

# A discussion of historic studies in Monterey Bay, selection criteria, and data management (briefly)

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# ESTABLISHING FOUNDATIONS FOR UNDERSTANDING LONG-TERM CHANGES IN MARINE BIODIVERSITY

**Megan Mach**, James T. Carlton, Robin Elahi, Fiorenza Micheli, John Pearse,  
Vicki Pearse, Timothy Thomas, James Watanabe

Hopkins Marine Station, Stanford University  
Pacific Grove Natural History Museum

# Shifting Marine Systems



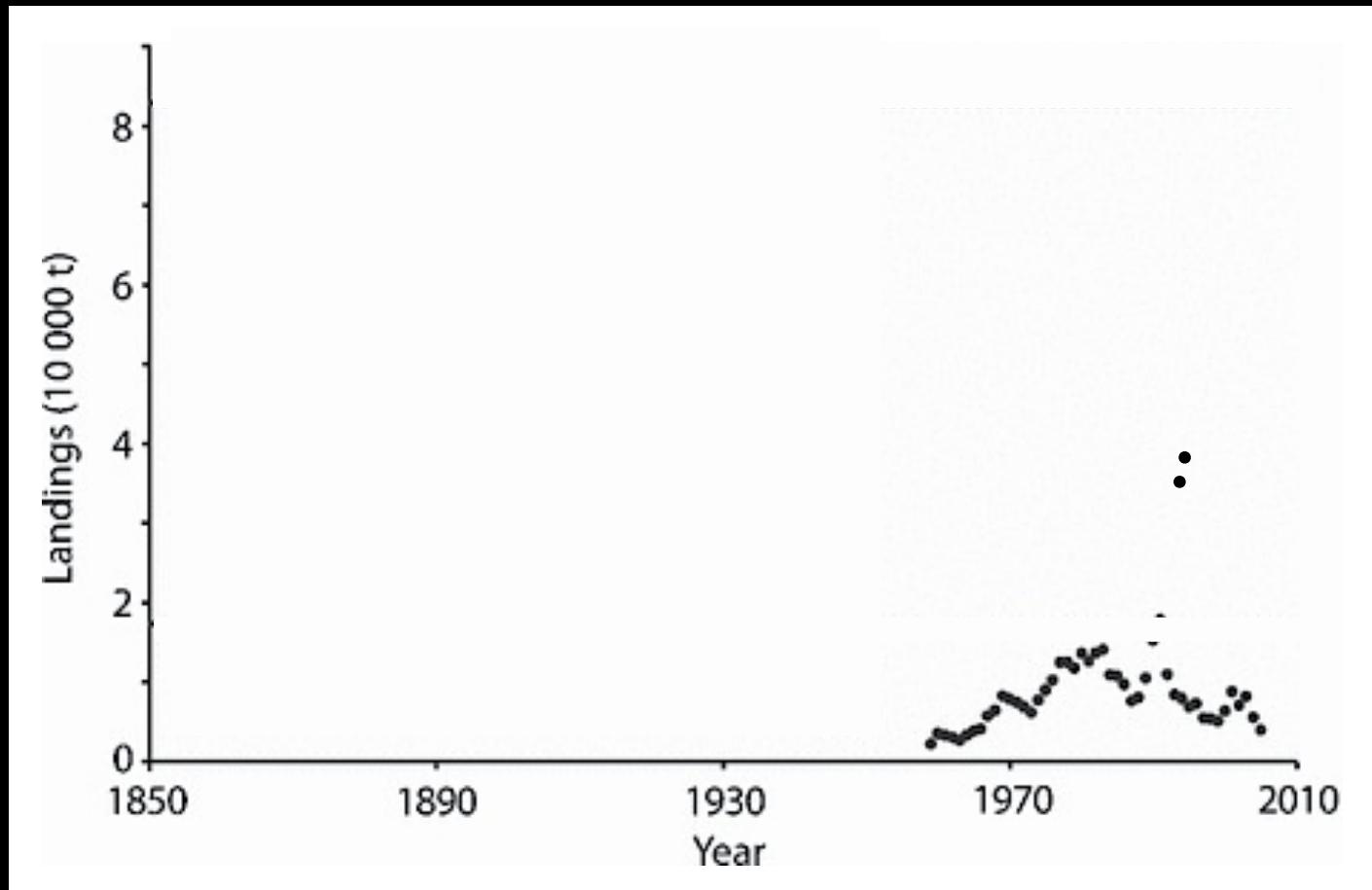
CLIMATE



FISHERIES

# Recent vs. Long Term Data

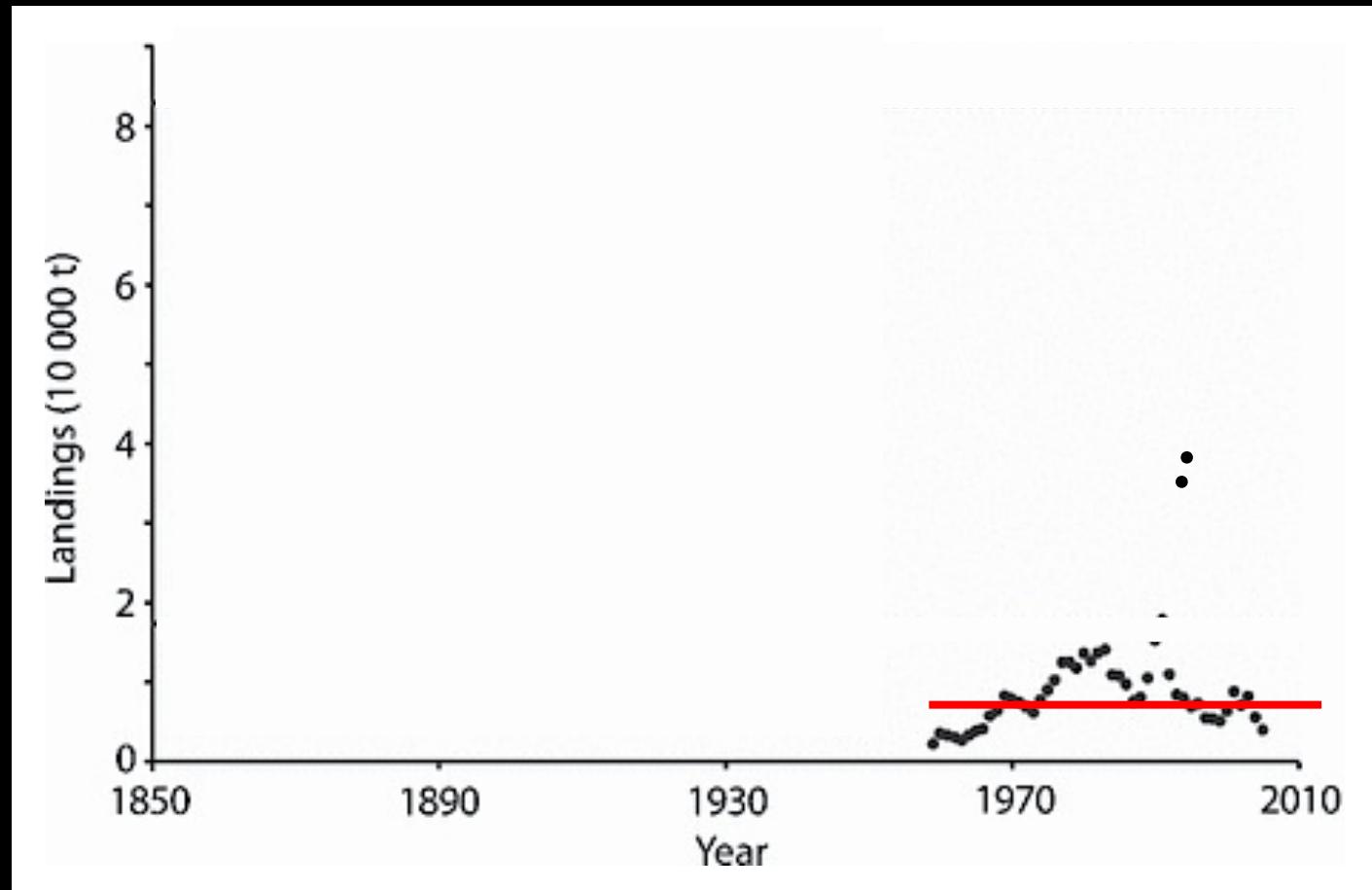
Gulf of Maine Cod



(Alexander et al., 2009)

# Recent vs. Long Term Data

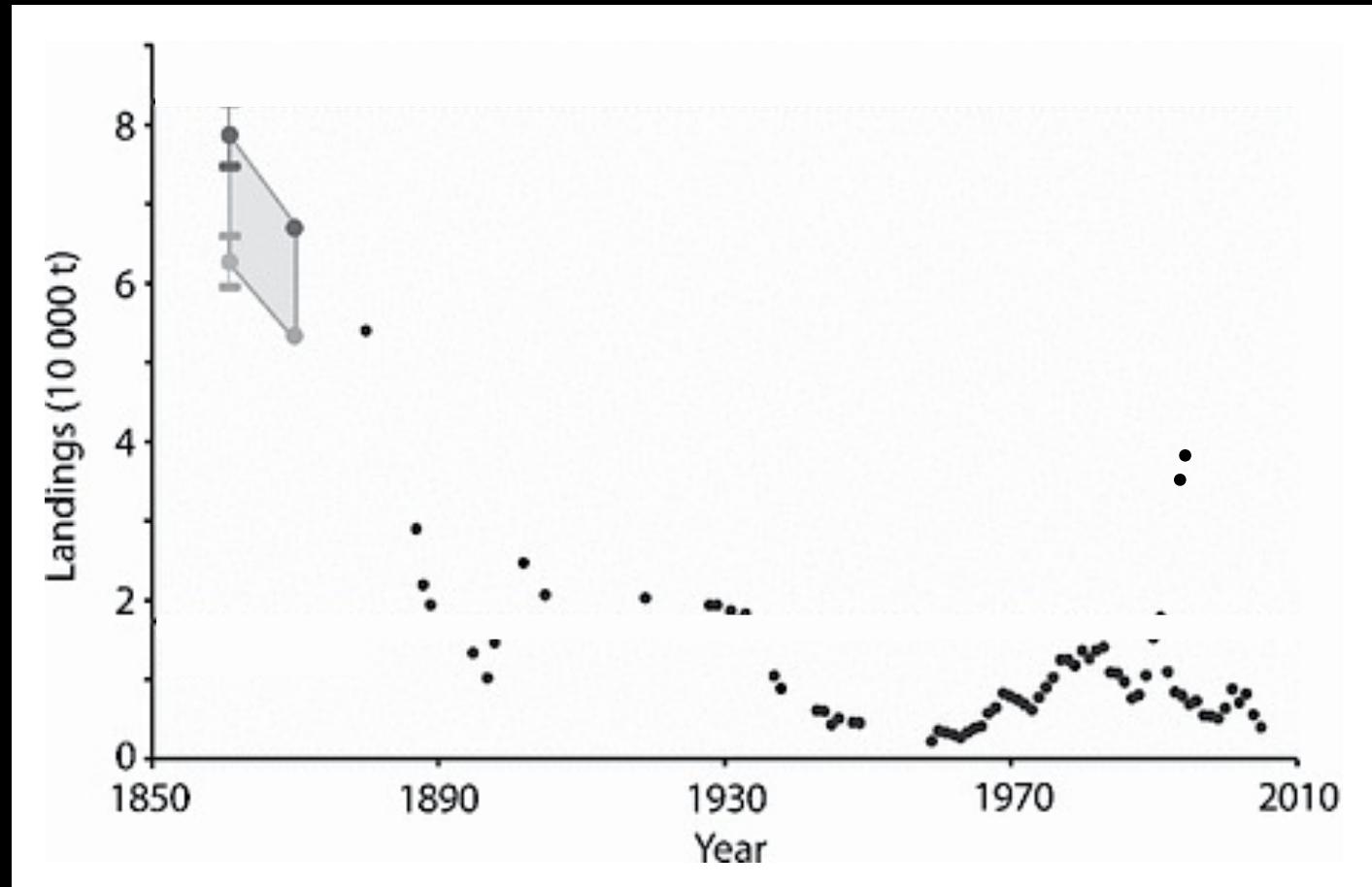
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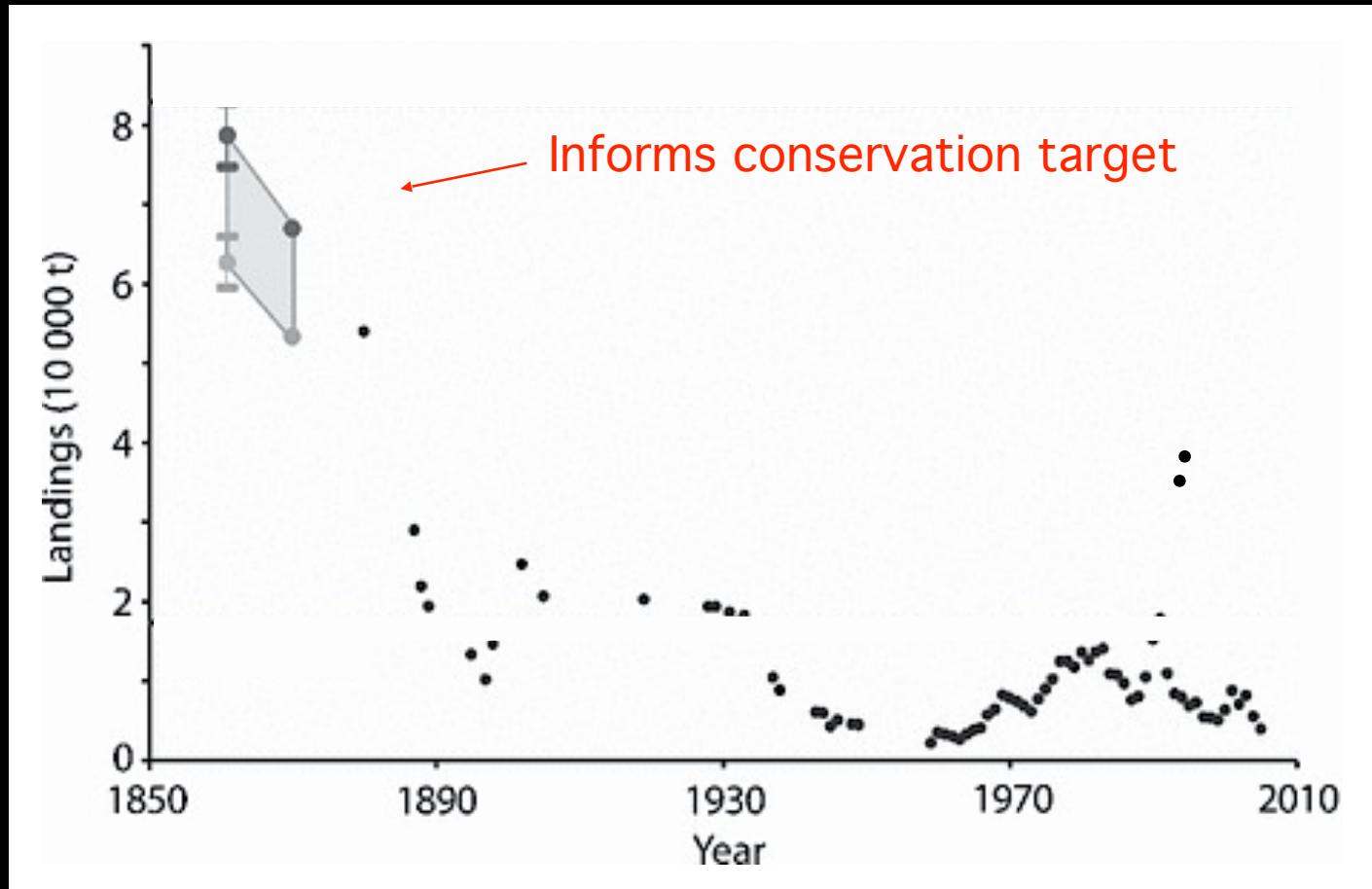
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# Recent vs. Long Term Data

## Gulf of Maine Cod

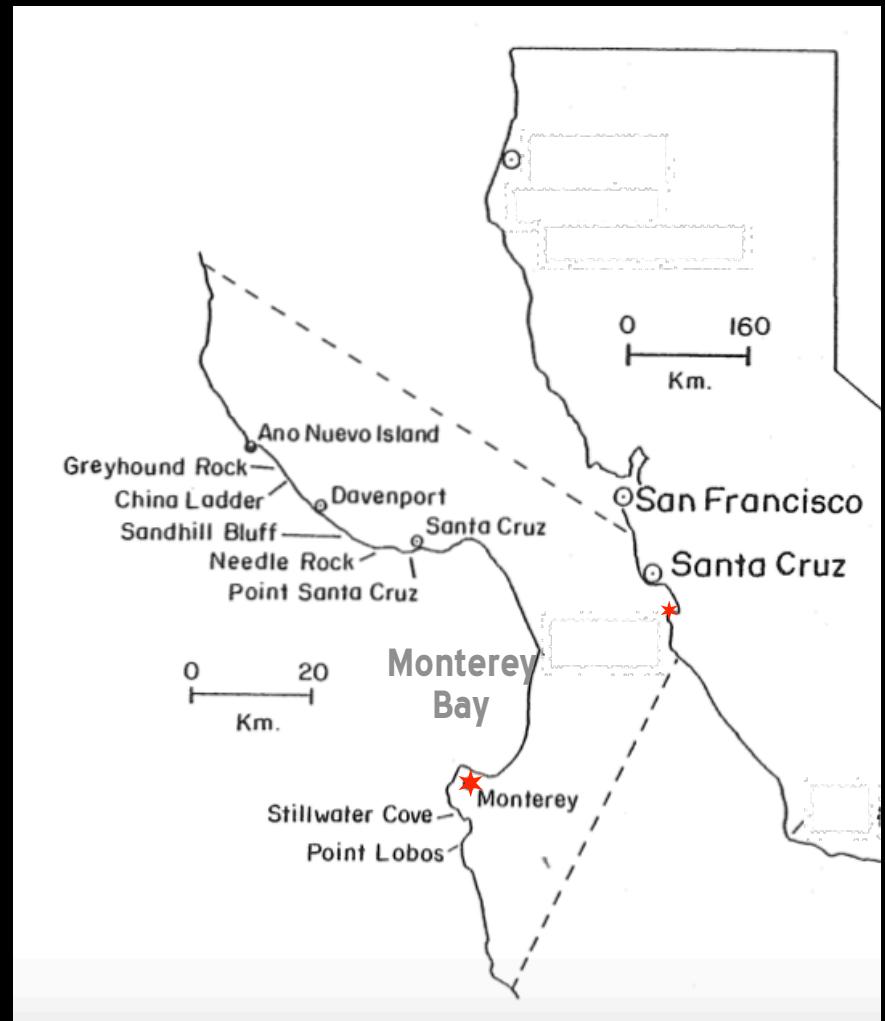


# Studying the Shoreline



# Research in Monterey Bay

Monterey Bay is one such place with a rich legacy of quantitative and qualitative work exceeding 150 years.

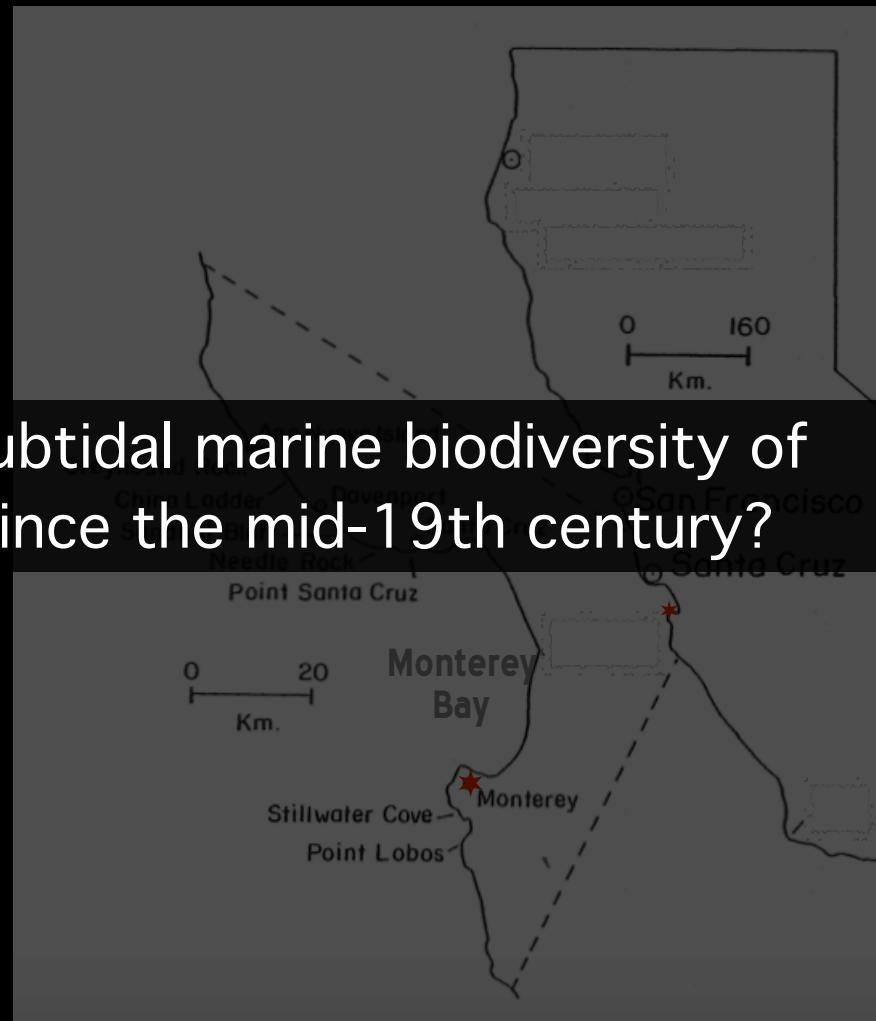


(Rose 1979)

# Research in Monterey Bay

Monterey Bay is one such place with a rich legacy of quantitative and qualitative work exceeding 150 years.

How has intertidal and shallow-subtidal marine biodiversity of Monterey Bay region changed since the mid-19th century?



(Rose 1979)

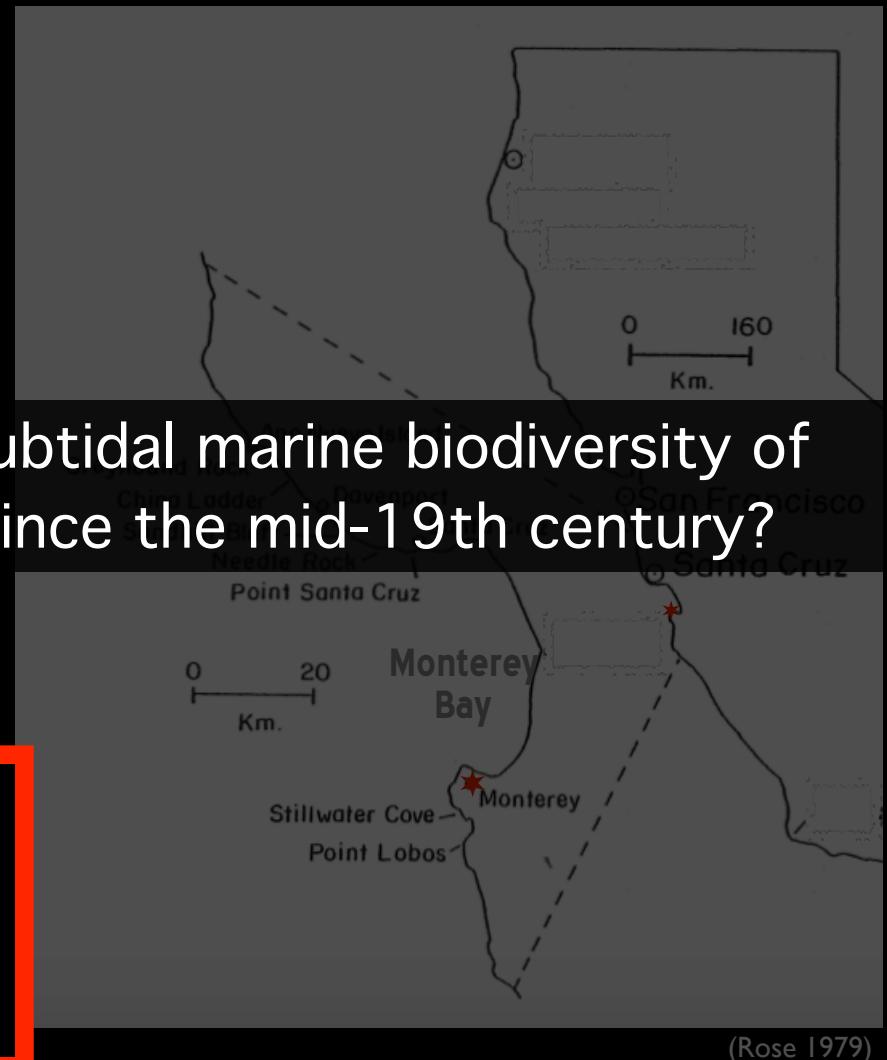
# Research in Monterey Bay

Monterey Bay is one such place with a rich legacy of quantitative and qualitative work exceeding 150 years.

How has intertidal and shallow-subtidal marine biodiversity of Monterey Bay region changed since the mid-19th century?

The one striking limitation ->  
these data are not assembled.

So the first question becomes:  
What data exist to answer this question?



# Complementary Approaches

- Historic data search:

INTERTIDAL AND SUBTIDAL COMMUNITIES



- species turnover
- change in abundance

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- Historic data search:

## INTERTIDAL AND SUBTIDAL COMMUNITIES



- species turnover
- change in abundance

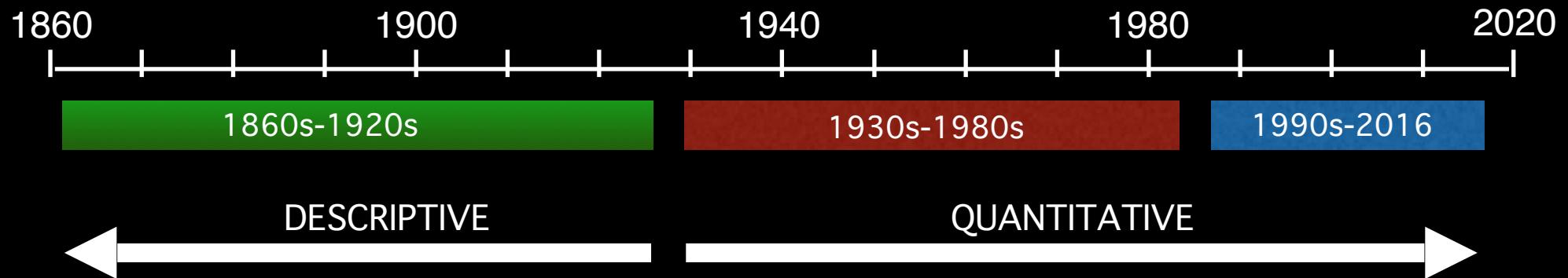
- Oral Histories: 1950s, '60s and '70s

## RESEARCHERS AT HOPKINS MARINE STATION

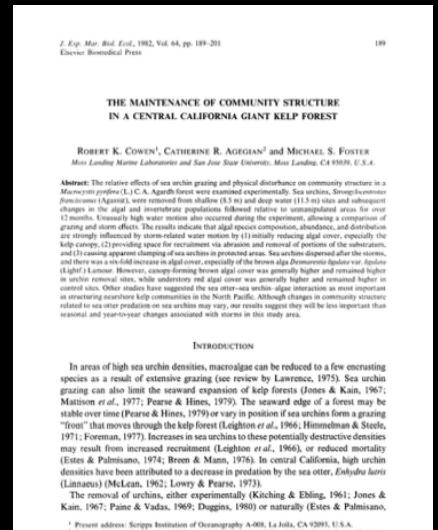
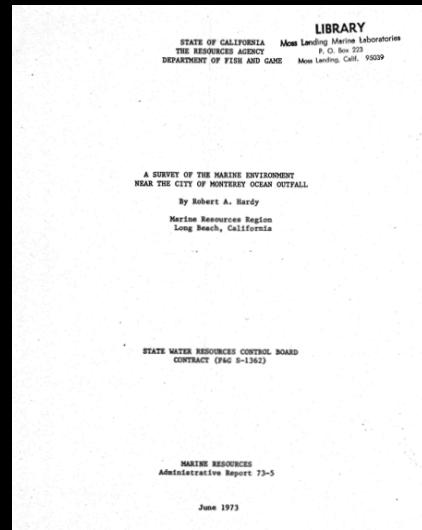
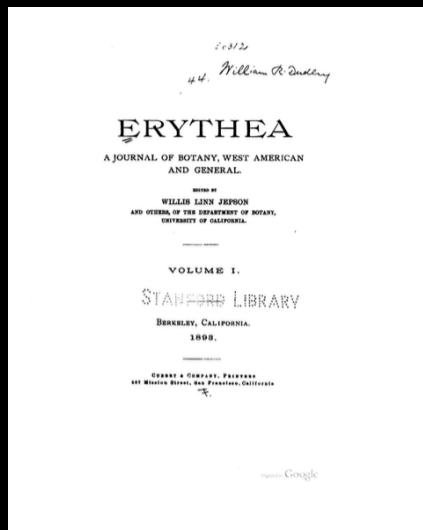
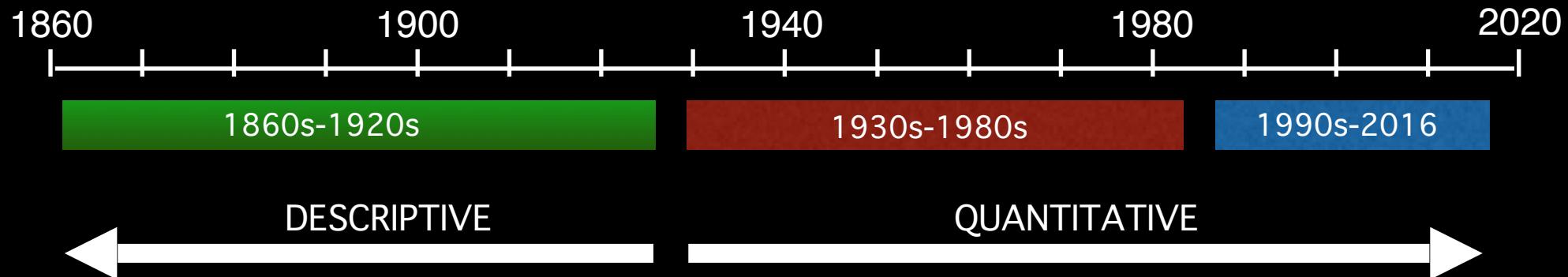
- complement ecological data
- highlight species not in datasets
- develop hypotheses



# Search



# Search



# Categories

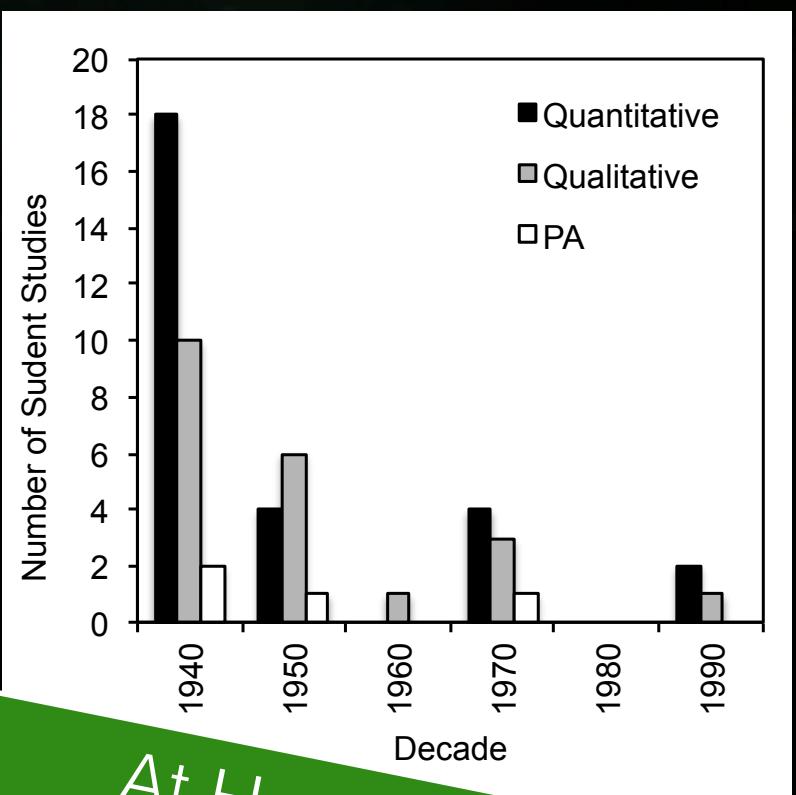
	Qualitative	Quantitative	Descriptive
Cat I: Repeated >1x			
Cat II: Once 1x			
Cat III: Consider for Replication			

# Results

- 83 studies
- 98 unique data-sets
- 50 student papers
- 31 in-person interviews

# Timeline

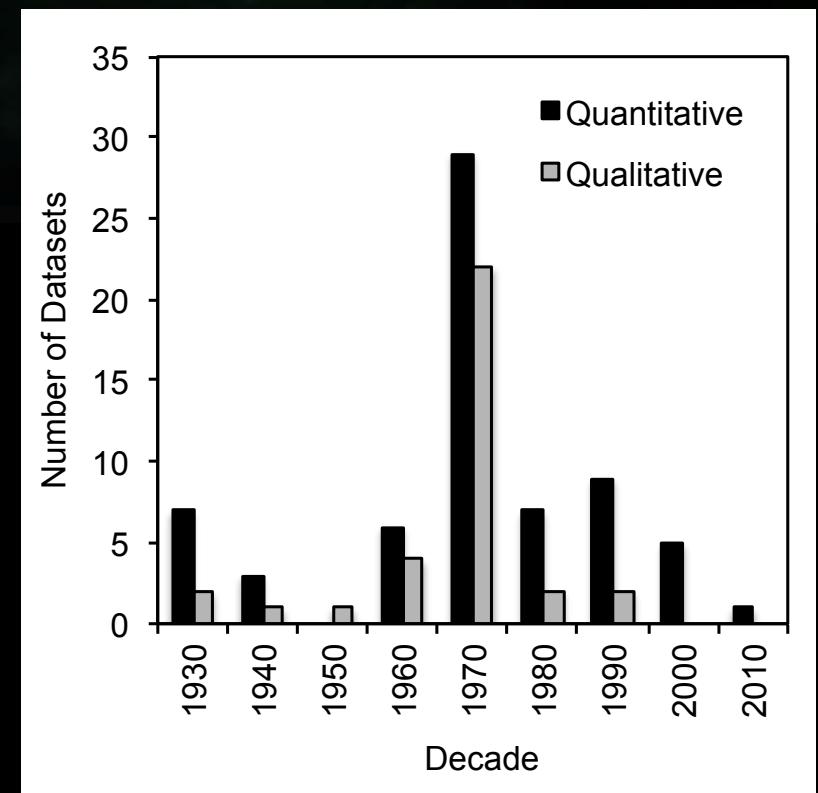
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*At Hopkins  
65% Rocky Intertidal*

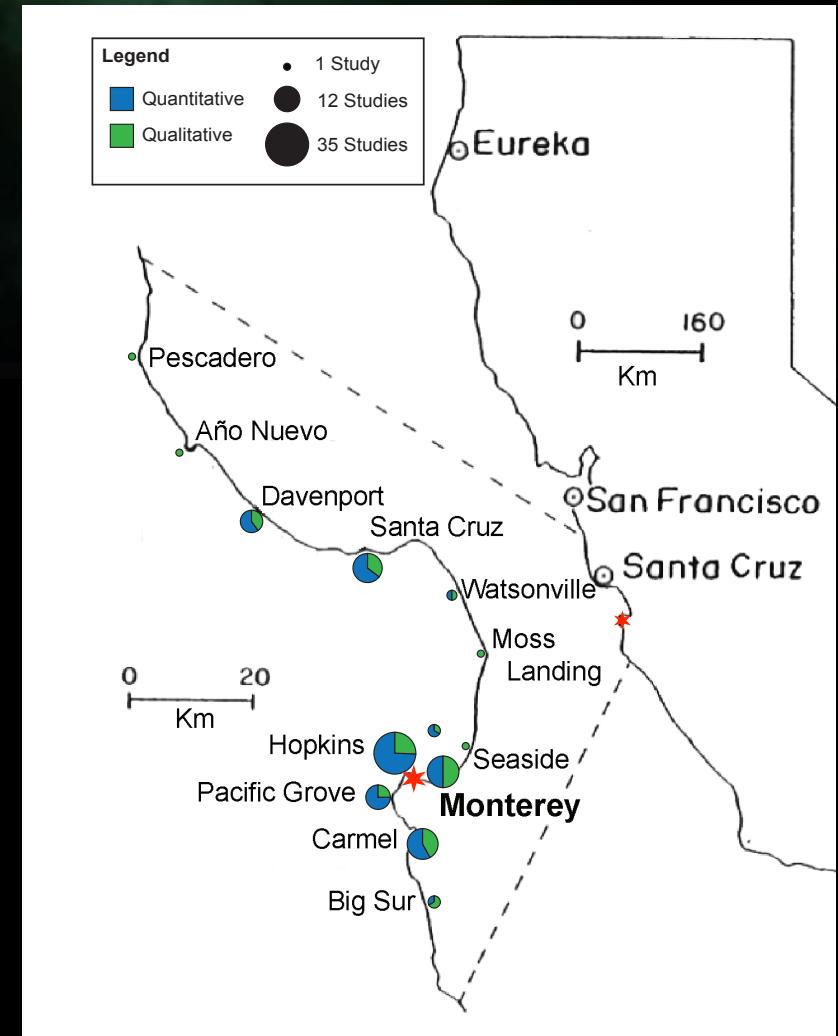
# Timeline

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# Locations

- 83 studies
- 98 unique data-sets →
- 50 student papers
- 31 in-person interviews



# Habitats

Of 67 quantitative studies:

## SUBTIDAL (n=40)

Habitat	Studies
Kelp	18
Sandy	7
Sandy/Rocky	3
Kelp/Rocky	3
Kelp holdfast	3
Rocky	2
Fouling	2
Drift algae	1
Breakwater	1

## INTERTIDAL (n=27)

Habitat	Studies
Rocky	15
Alga <i>Endocladia muricata</i>	4
Mussel <i>Mytilus californianus</i>	3
Sandy	2
Surfgrass <i>Phyllospadix</i> spp.	2
Alga <i>Gigartina</i> spp.	1

# Studies Repeated

Despite the strong foundations laid by multiple institutions, few studies have been replicated

Habitat	Study Years
1. Rocky intertidal inverts	1933, 1993*, 1996, 1999, 2002, 2005, 2009, 2011, 2014, 2015, 2016
2. Kelp holdfast inverts	1934, 1971*
3. Endocladia inverts/algae	1959, 1996*
4. Kelp forest inverts/algae	1971, 1980
5. Sandy bottom inverts	1971, 1997
6. Rocky intertidal inverts	1972, 1996
7. Kelp forest inverts	1972, 1995
8. Rocky intertidal inverts	1977, 2002
9. Kelp forest inverts/algae	1978*, 1981*, 1993

\*student papers

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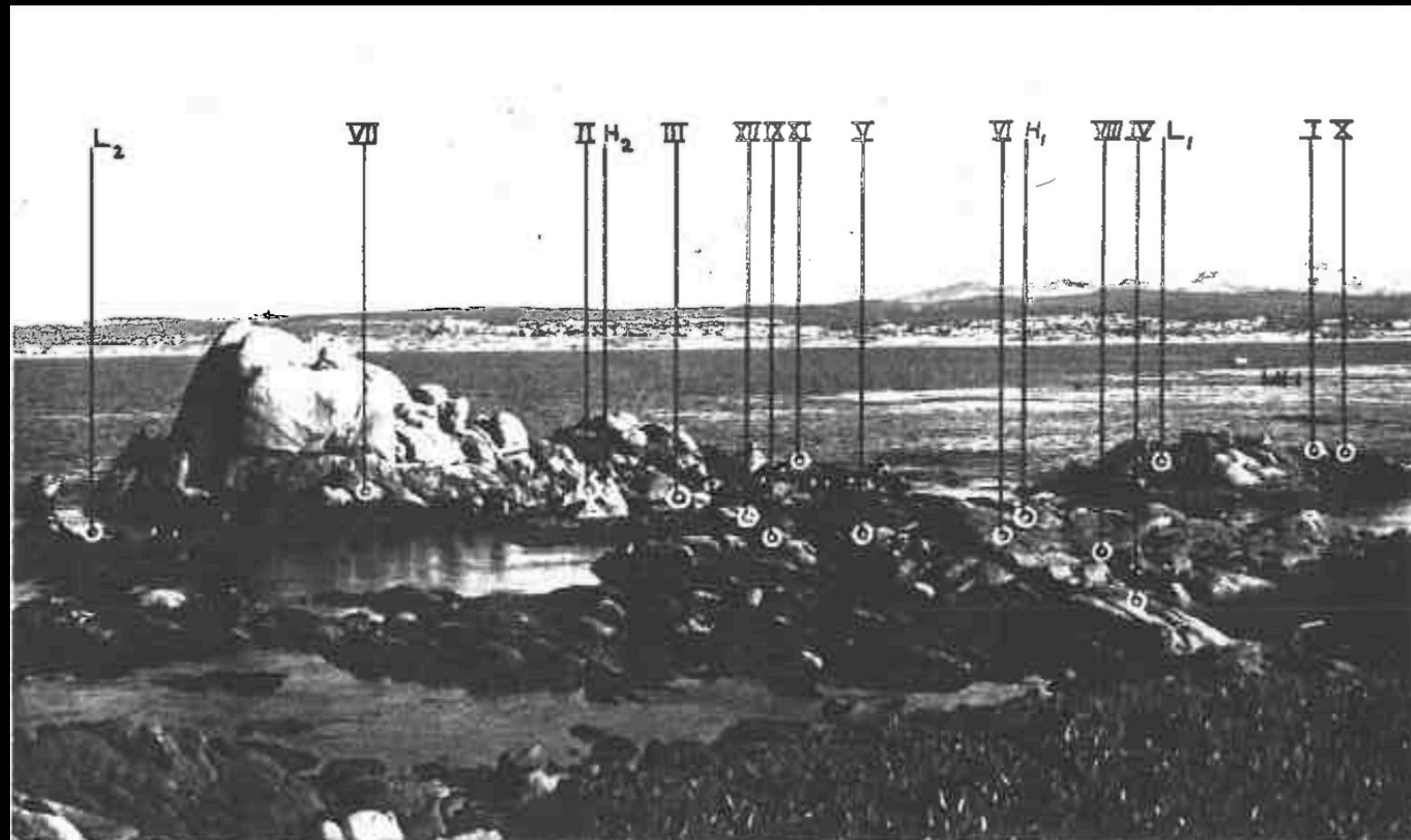
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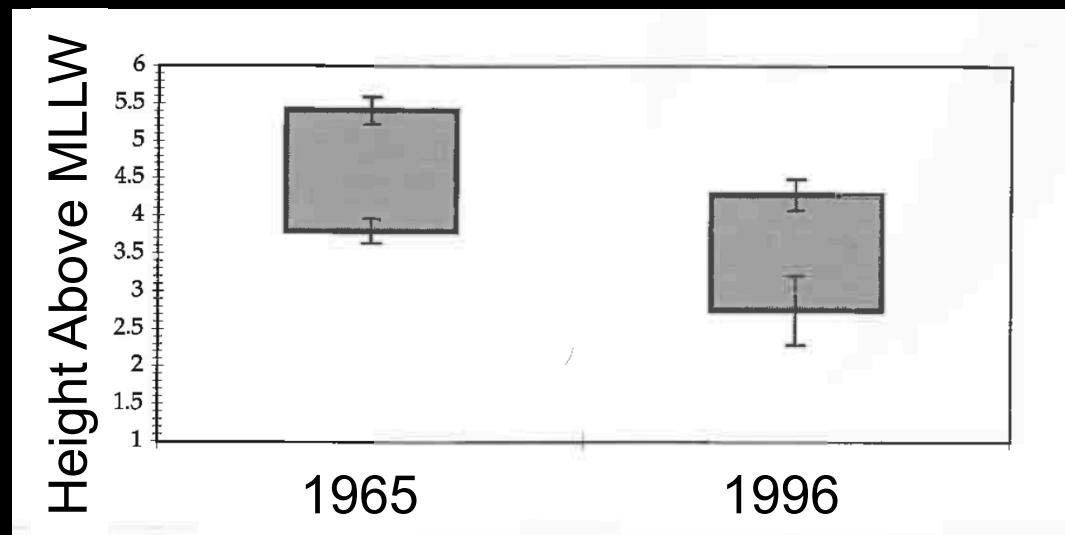
LONG TERM CHANGES IN THE *Endocladia-Balanus*  
COMMUNITY AT HOPKINS MARINE STATION,  
PACIFIC GROVE, CALIFORNIA

Original: Peter Glynn (1965)

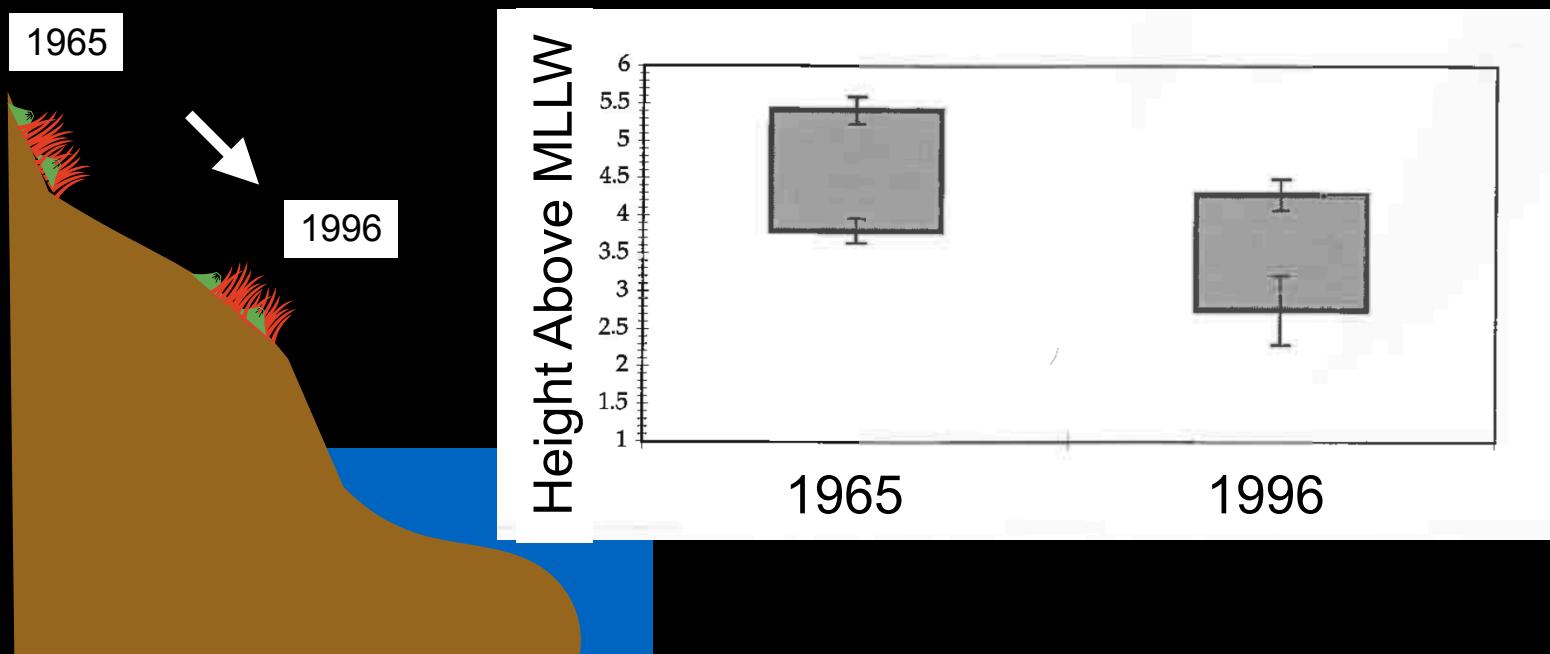
Repeat: Ashley Simons & Erin Leydig (1996)



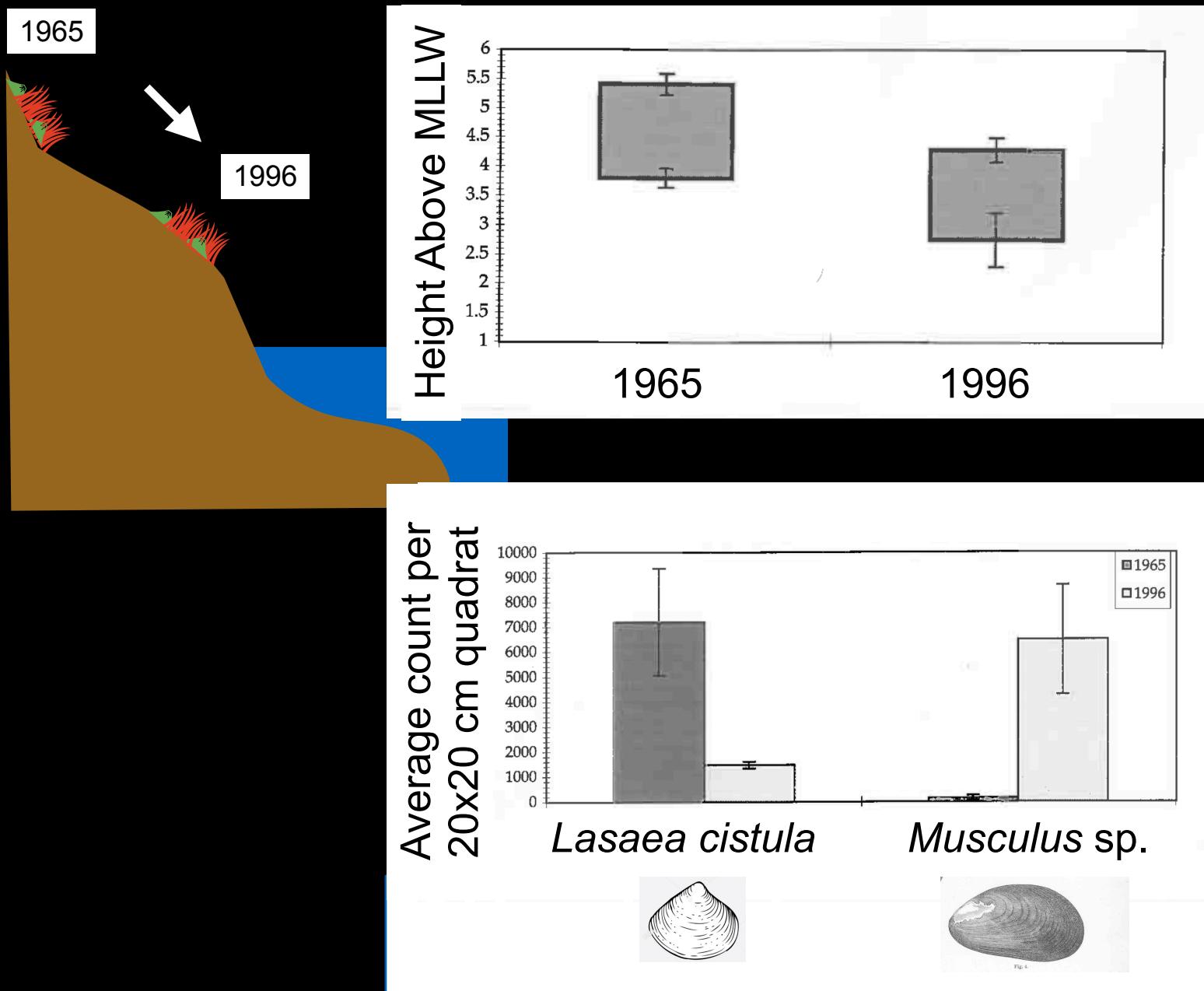
# Endocladia - Balanus Community Tidal Height



# Endocladia - *Balanus* Community Tidal Height



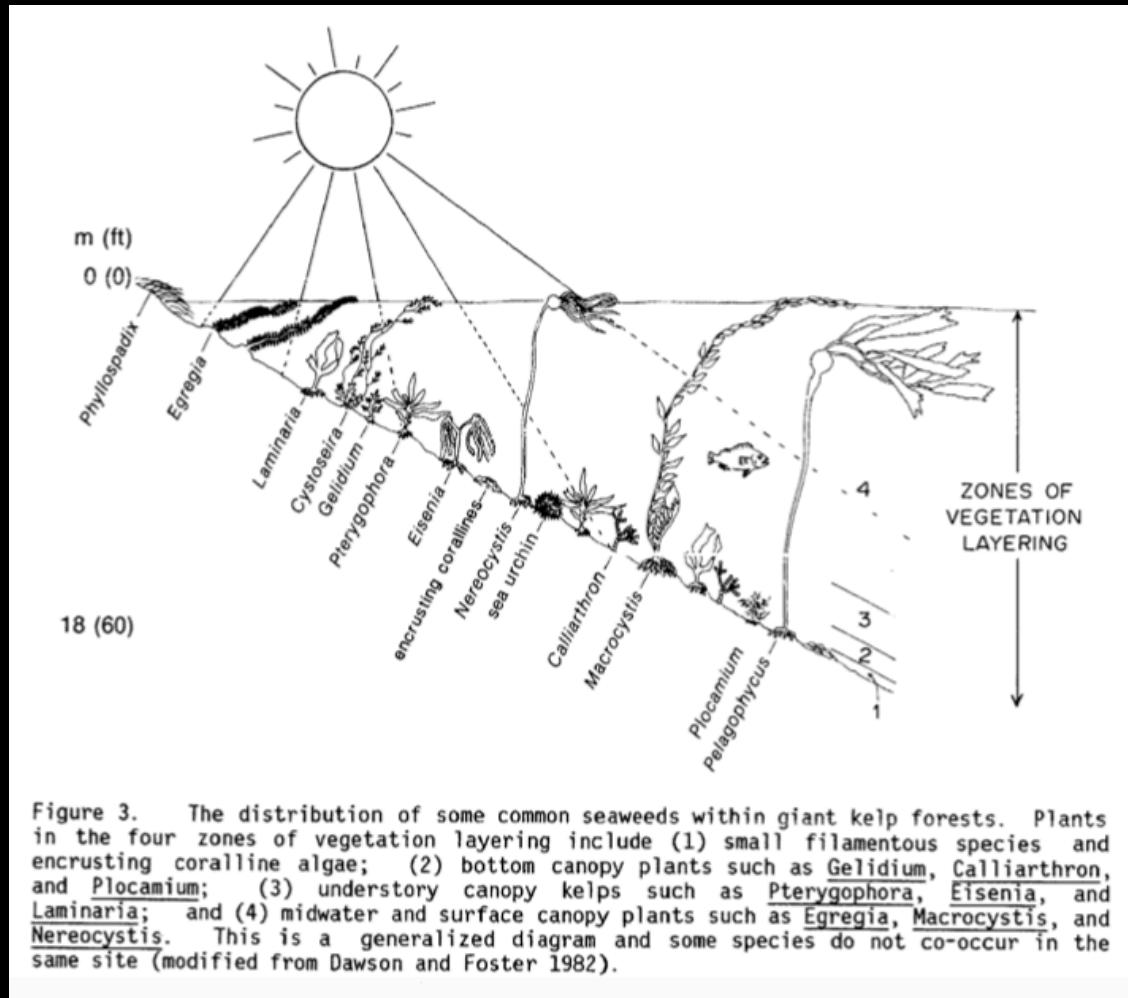
# Endocladia - *Balanus* Community Tidal Height



# Selecting Studies to Repeat

Criteria for selecting:

- (a) high quality taxonomy
- (b) quantitative
- (c) replicated
- (d) seasonal



# Studies to Repeat

Scored a 4 on the selection criteria: a) high quality taxonomy; (b) quantitative; (c) replicated; (d) seasonal

Study	Years	Community
Glynn 1965*	1959 - 1962	Endocladia: Intertidal inverts/algae
Gerard 1976	1973 - 1975	Drift algae: Subtidal algae
Yellin, Agegian, & Pearse 1977	1974 - 1976	Kelp forest: Subtidal inverts/algae
Rose 1979	1977 - 1978	Kelp forest: Subtidal inverts/algae
Breda 1982	1979 - 1980	Kelp forest: Subtidal algae

# Selection Criteria Brainstorm



Searching for and helping you manage data:



DataONE facilitates easy access to a network of data repositories.

Searching for and helping you manage data:



DataONE facilitates easy access to a network of data repositories.

KAYAK      Hotels      Flights      Cars      Packages      More

Round-trip ▾      1 adult ▾      Economy ▾

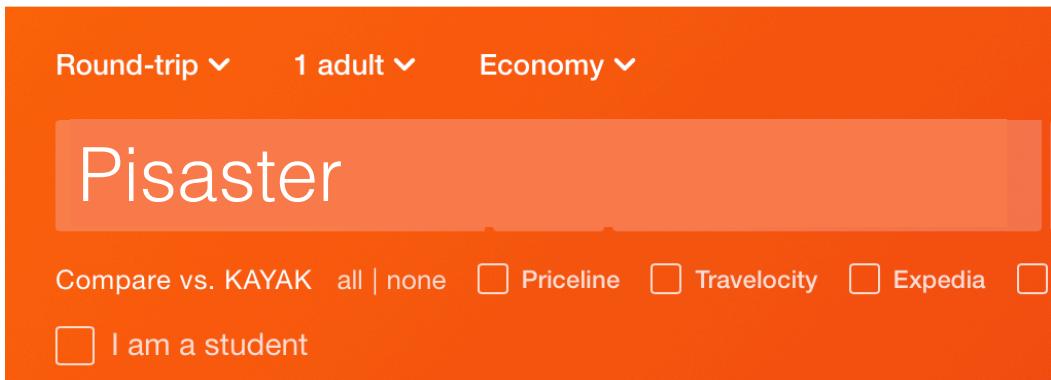
 Friday Harbor (FRD)             Seattle (SEA)

Compare vs. KAYAK   all | none    Priceline    Travelocity    Expedia     
 I am a student

Searching for and helping you manage data:



DataONE facilitates easy access to a network of data repositories.

A screenshot of a travel search interface. At the top, the DataONE logo is on the left, followed by navigation links: Hotels, Flights (highlighted in orange), Cars, Packages, and More. Below this is a search bar with dropdown menus for "Round-trip ▾", "1 adult ▾", and "Economy ▾". A large orange search input field contains the text "Pisaster". At the bottom, there are links for "Compare vs. KAYAK" (with "all | none" selected), and checkboxes for "Priceline", "Travelocity", "Expedia", "I am a student", and an unlabelled checkbox.

Searching for and helping you manage data:



DataONE facilitates easy access to a network of data repositories.

We also provide resources to help manage your data and make it more accessible.

# I need data and I need it now!

Data are diverse—spanning time, space, and disciplines—and are being generated at unprecedented rates.



of researchers believe the **lack of data access** is still a major impediment to science.

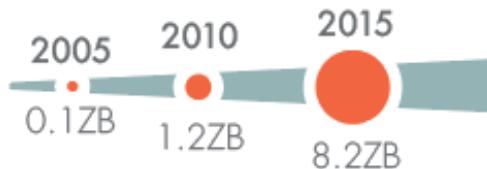
SOURCE: TENOPIR ET AL. 2011 PLOS ONE



of data scientists said **collecting data sets** is one of their most time consuming tasks

SOURCE: CLOUDFLOUR 2015 DATA SCIENTIST REPORT

But there are so many digital data!



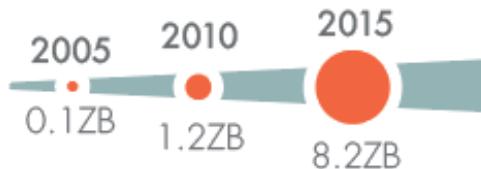
IDC predicts the  
Digital Universe  
will reach  
40 zettabytes  
by 2020

I can't find the data!  
What a waste of...

- time
- opportunity
- collaboration
- my lunch hour

SOURCE: IDC, 2012. DIGITAL UNIVERSE STUDY BY EMC

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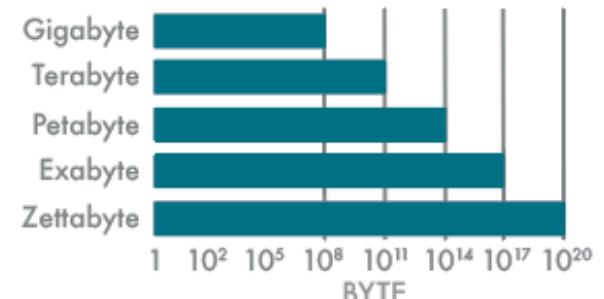


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#### WHAT IS A ZETTABYTE?



SOURCE: IDC, 2012. DIGITAL UNIVERSE STUDY BY EMC

If only there were one place to find data,  **FAST**

# DataONE

1 Easy search and filter    2 Sourced from multiple data repositories    3 All data files in one place    4 Data available from all regions of the world

Search  

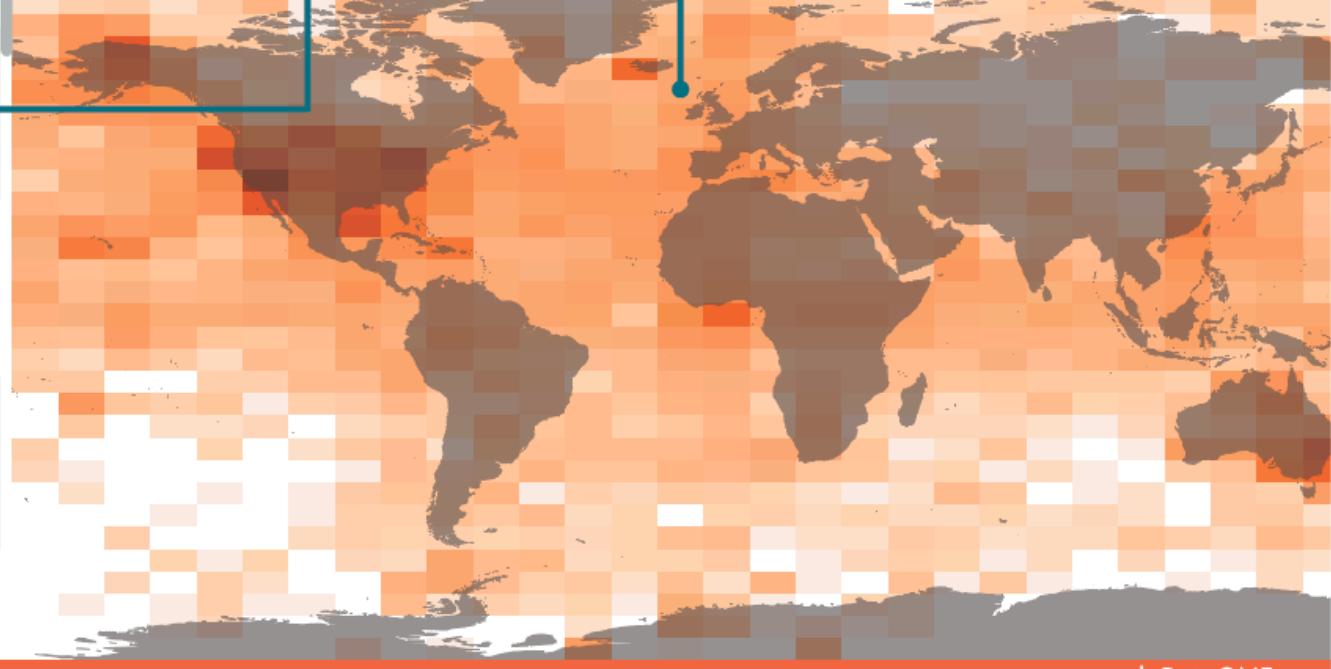
Filter:

- Author, Author, and Author. 2017. Title, Year collected. Repository DOI: 
- Author, Author, Author, et al. 2017. Title, Year collected. Repository DOI: 
- Author. 2017. Title, Year collected. Repository DOI: 
- Author, Author, and Author. 2017. Title, Year collected. 

763K Datasets 

Author, Author, and Author. 2017. Title, Year collected. Repository DOI: 

Sort 



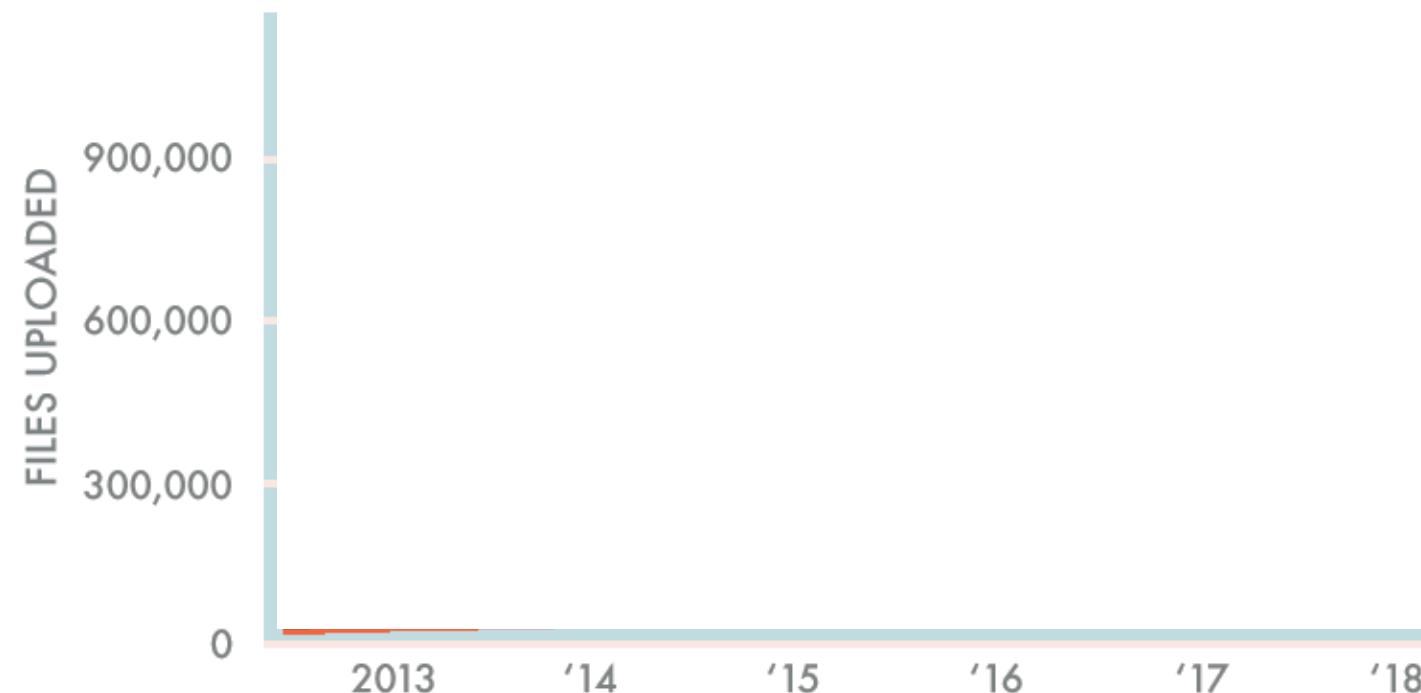
Sign in

search.DataONE.org

# Quick! Do they have the data I need?

## DATA ON THE DOUBLE

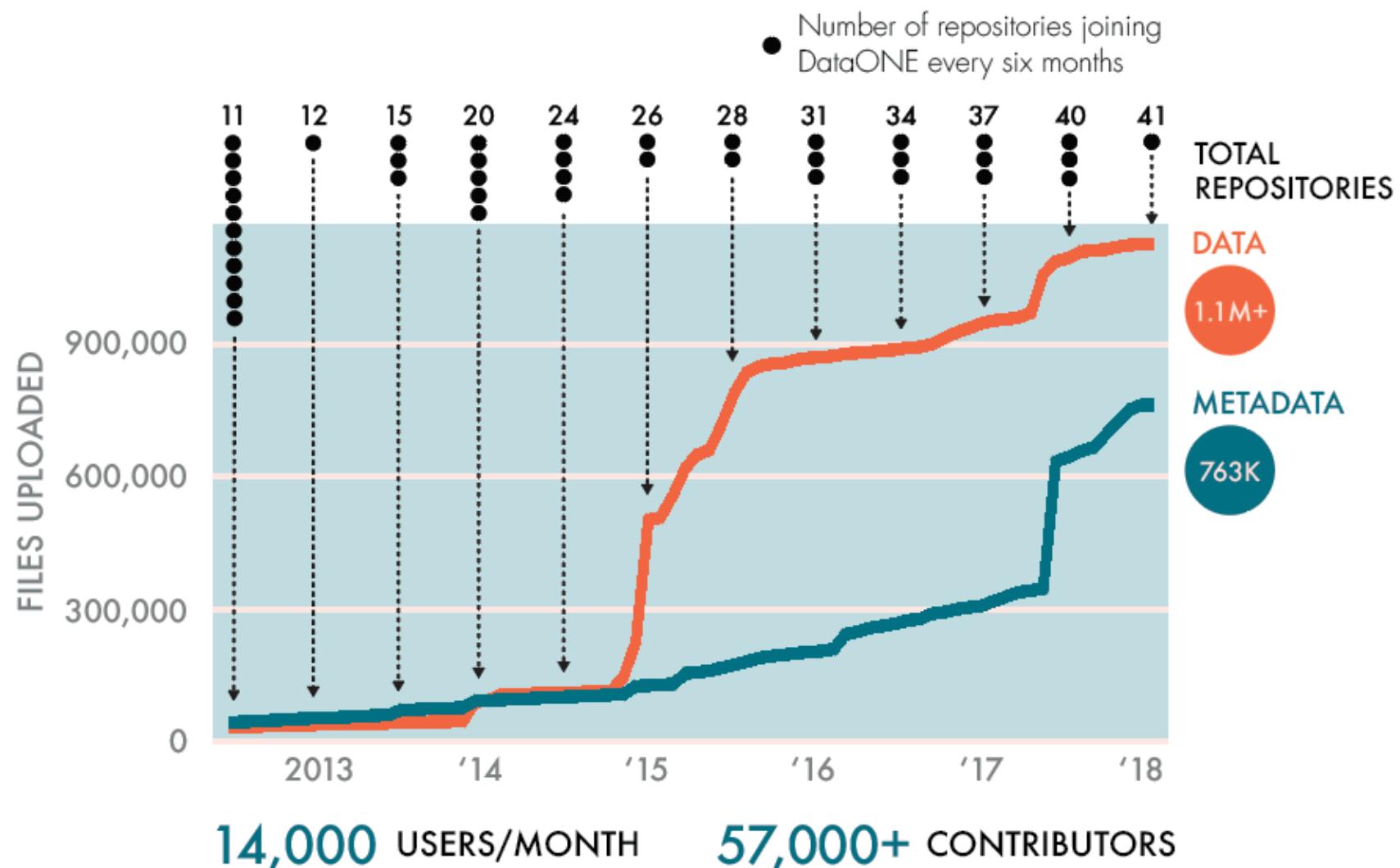
DataONE launched in 2012 with 11 data repositories focused on Earth and environmental science.



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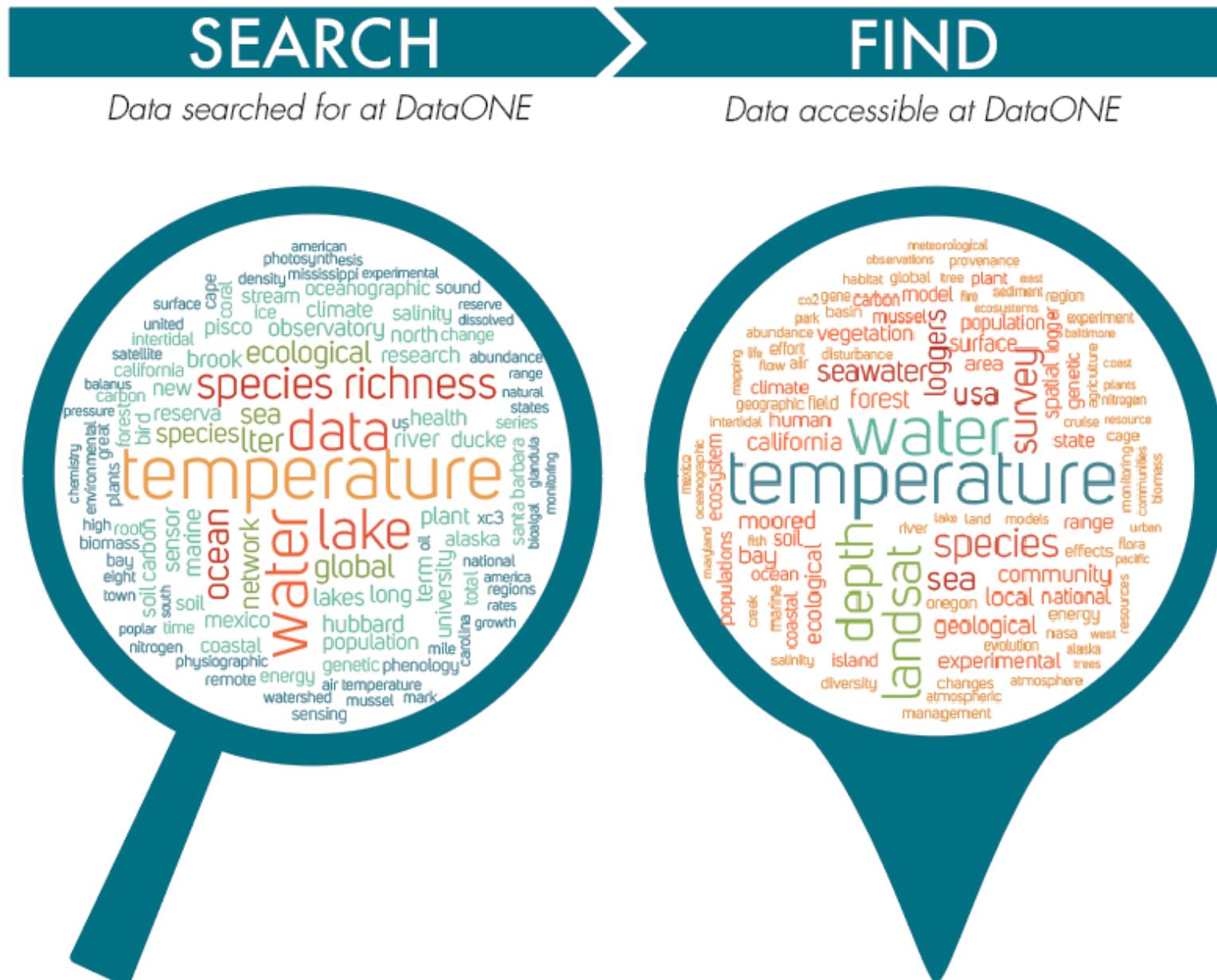
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## SEARCH SUCCESS

Researchers who use DataONE find what they are looking for.



# What is Metadata?

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(a) New Resume.docx

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- (a) New Resume.docx
- (b) mach\_resume\_aquarium\_180402.docx

## THE DIGITAL DATA GAP

Very little digital data is accurately described with metadata, making it nearly impossible to find and analyze.

OF 2.8ZB OF DIGITAL DATA AVAILABLE IN 2012:

*Data useable, if tagged and analyzed*



*Tagged*



*Analyzed*



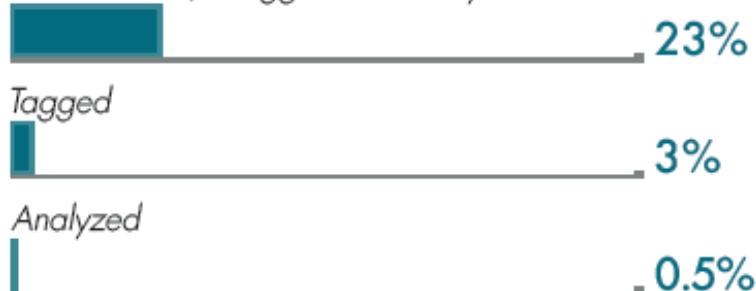
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## MAKING TIME FOR METADATA

Data discovery is vastly enhanced if the data are described using known standards. Yet many researchers create their own or use none at all, slowing down your search for data.

### PROJECTS STANDARDS FOR METADATA ARE LIMITED, ACCORDING TO 1700 INTERNATIONAL SCIENTISTS:



SOURCE: TENOPIR ET AL. 2011 PLOS ONE

## HERE TO HELP

With more than 5000 users trained, DataONE can help you learn about common metadata standards and methods for efficiently managing your own data.

## FIND HELP WITH DATA MANAGEMENT

- |   |  |
|---|--|
|  User Stories  |  Best Practices       |
|  Lesson Plans |  Video Tutorials     |
|  Webinars    |  In-person Training |

[www.DataONE.org](http://www.DataONE.org)

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[www.DataONE.org](http://www.DataONE.org)

<https://www.dataone.org/education-modules>

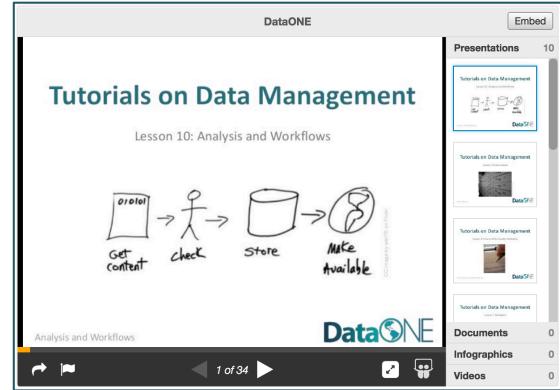
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[www.DataONE.org](http://www.DataONE.org)



The screenshot shows a DataONE interface for 'Tutorials on Data Management'. The main content area displays a flowchart titled 'Lesson 10: Analysis and Workflows' with four steps: 'Get content' (document icon), 'check' (person icon), 'Store' (cylinder icon), and 'Make available' (globe icon). Below the flowchart is a navigation bar with arrows and the text '1 of 34'. To the right is a sidebar titled 'Presentations' with a count of 10, showing a list of 'Tutorials on Data Management' entries. The sidebar also includes sections for 'Documents', 'Infographics', and 'Videos', all with a count of 0.



#DWS2018  
@DataONEorg  
[www.DataONE.org](http://www.DataONE.org)



<https://www.dataone.org/webinars>

# Thanks

