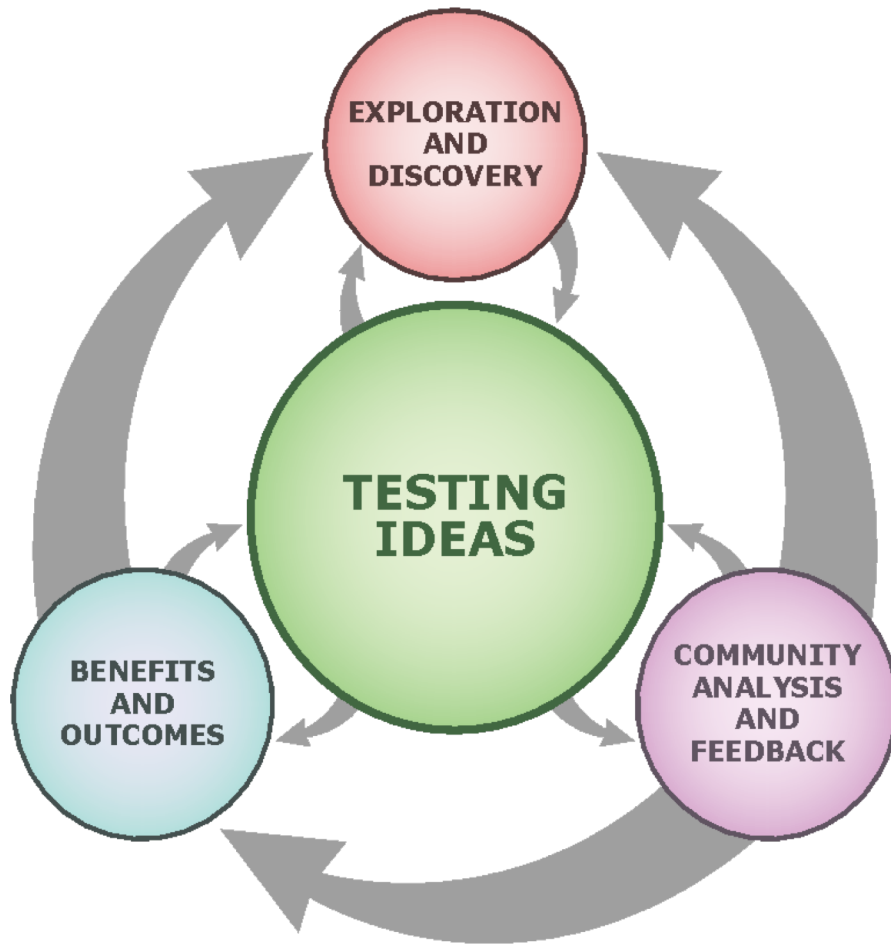


How science works



www.understandingscience.org

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What does it mean for scientists and students to “do science”?

How can we support students in explaining scientific phenomenon and/or solving a scientific problem?

How can we support students’ construction, evaluation, and revision of explanatory knowledge over time?

How can we support students in iterative investigations of their own questions and drawing insights into the research process?



Go To <https://undsci.berkeley.edu/>



Welcome! Take our [site tour](#), find out [what's new](#), or [subscribe](#) for updates.



A primer on the nature and process of science.

Quick links:
[Main page](#)
[What is science?](#) | [How science works](#)
[Why science matters](#) | [Science toolkit](#)



Our section of teaching resources on the nature and process of science.

Quick links:
[Main page](#)
[K-2](#) | [3-5](#) | [6-8](#) | [9-12](#) | [13-16](#)
[Resource database](#) | [Teaching tools](#)



A browsable archive of articles, tutorials, interactive features and more.

Quick links:
[Main page](#)
[Misconceptions](#) | [FAQs](#) | [See](#)
[How Science Works flowchart](#)

Try out the new How Science Works Web Interactive!

Chart your own course through the process of science with our [interactive journaling tool](#).

From the home page, scroll down and click on the How Science Works interactive



Go To <https://undsci.berkeley.edu/>



How Science Works

Choose your framework

Standard

Simplified

And now get started!

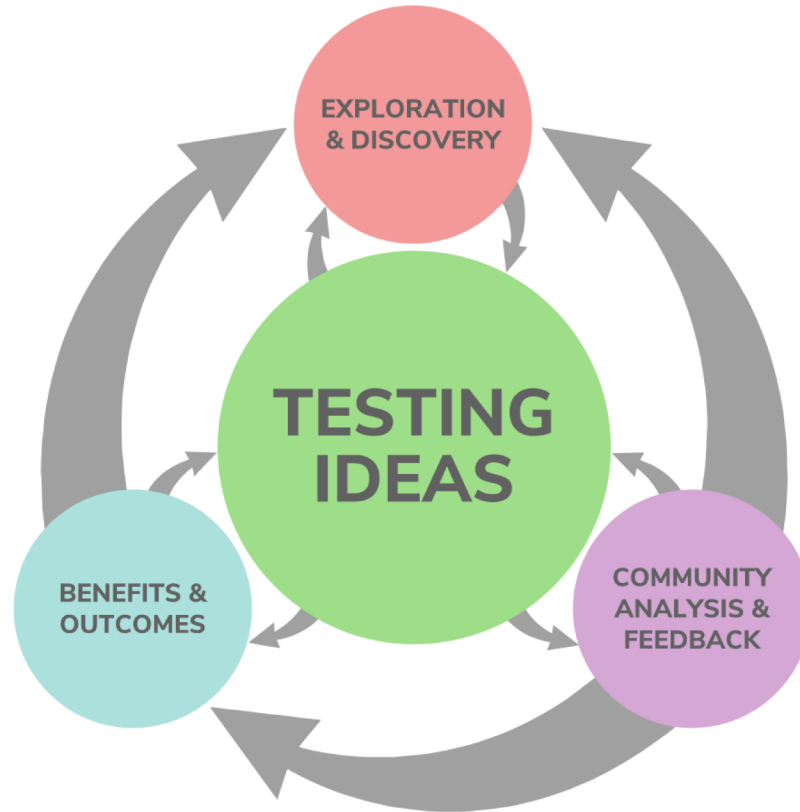


Intro

Skip Intro

Choose Standard and click
through the Intro

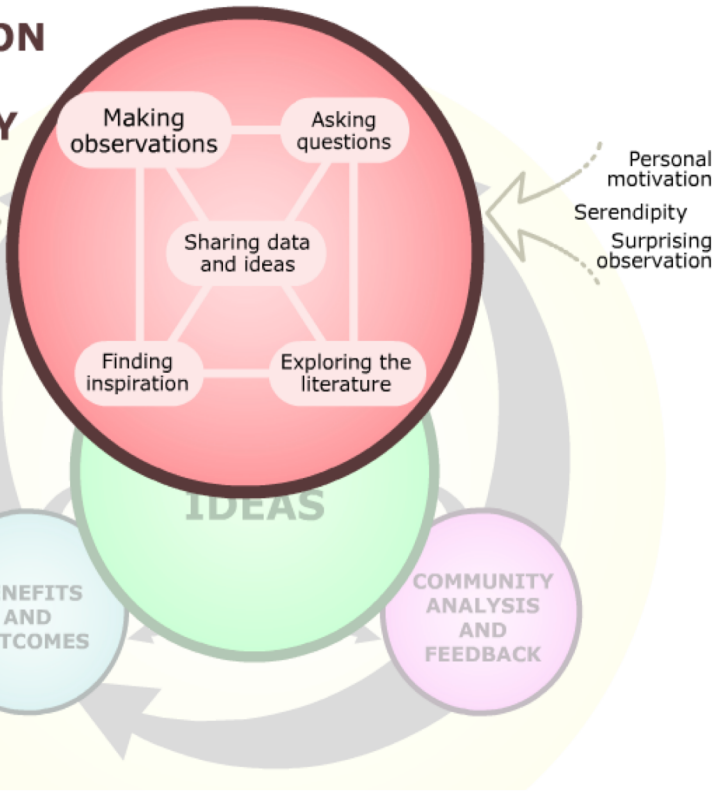
How science works flowchart



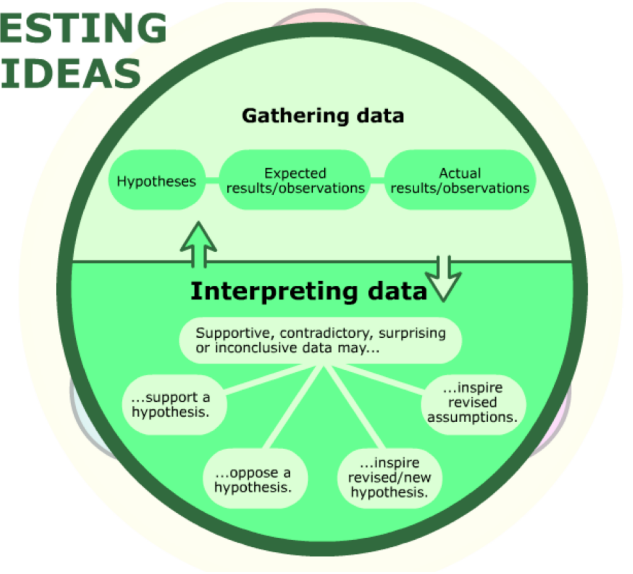
This flowchart represents the process of science, through which we build knowledge of the natural world. With this interactive, you can trace the development of a scientific idea or investigation. Most research takes a winding path, shaped by a unique combination of people and events. In contrast, journal articles or lab reports often portray science as a simple linear process.

EXPLORATION AND DISCOVERY

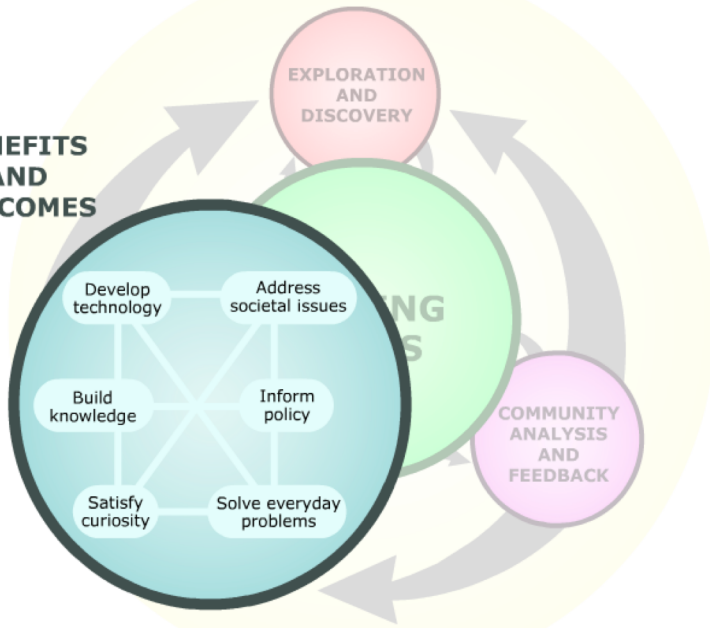
New technology
Practical problem
Curiosity



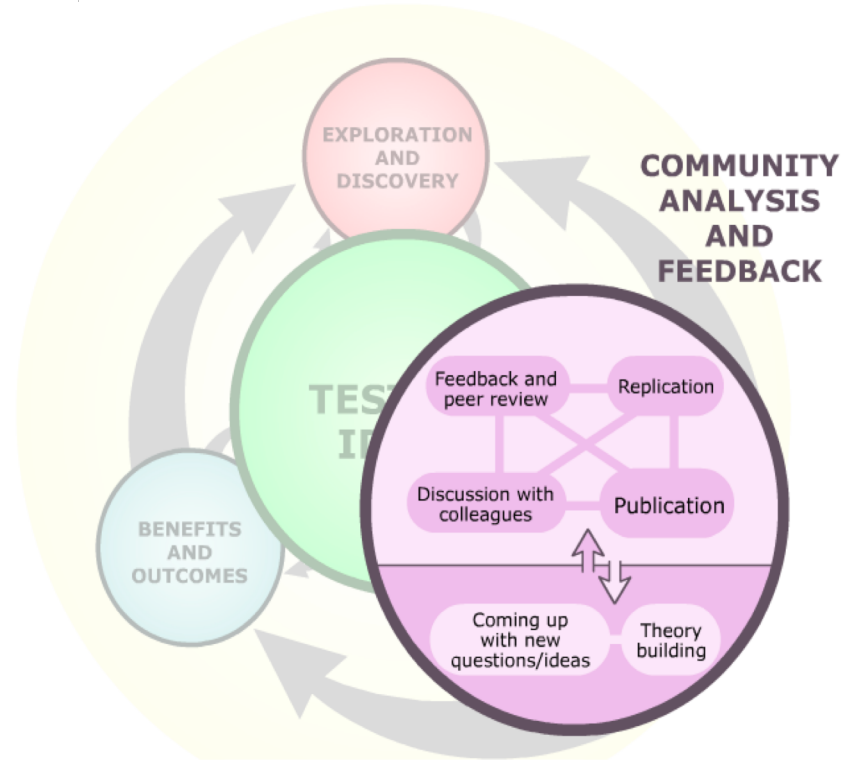
TESTING IDEAS



BENEFITS AND OUTCOMES



COMMUNITY ANALYSIS AND FEEDBACK



Mapping an instructional unit in the interactive tool

← → ↻ 🏠 <https://undsci.berkeley.edu/interactive/#/main> 90% ☆

How Science Works

Example Project Name
Add a description here...

Select an event on the map to get started.

EXPLORATION AND DISCOVERY

New technology
Curiosity
Practical problem
Personal motivation
Serendipity
New observation or idea

Making observations
Asking questions
Sharing data and ideas
Finding inspiration
Exploring the literature

Gathering data

Hypothesis
Expected results/observations
Actual results/observations

Interpreting data

Supportive, contradictory, surprising or inconclusive data may...

...support a hypothesis.
...oppose a hypothesis.
...inspire revised assumptions.
...inspire revised/new hypothesis.

TESTING IDEAS


Feedback and peer review
Replication
Discussion with colleagues
Publication
Coming up with new questions/ideas
Theory building

COMMUNITY ANALYSIS AND FEEDBACK

BENEFITS AND OUTCOMES

Develop technology
Address societal issues
Build knowledge
Inform policy
Satisfy curiosity
Solve everyday problems



Mapping an instructional unit in the interactive tool

 How **Science** Works

Teaching Demonstration
Add a description here...

1

MAKING OBSERVATIONS







How will I engage students in this part of the process?:
What will students be doing?:

What will students learn?:
How and why will students be motivated to learn more?:
[Browse for files to attach.](#)

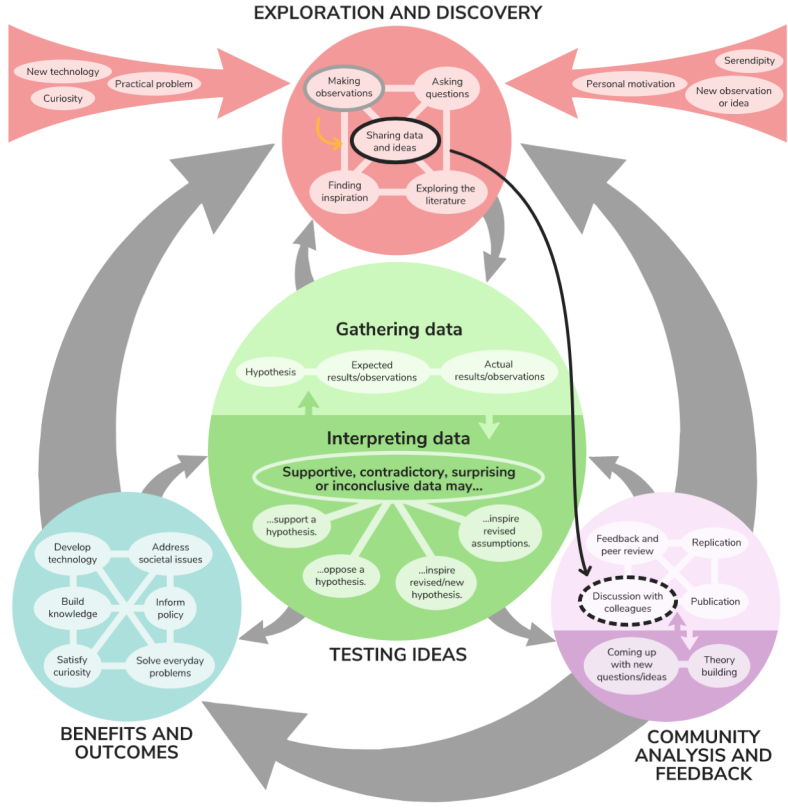
2

SHARING DATA AND IDEAS




3

DISCUSSION WITH COLLEAGUES

100%     





About Educator Resources Help Glossary


   **UNIVERSITY OF CALIFORNIA**
MUSEUM OF PALEONTOLOGY




Fill out for each step:


**Export to PowerPt or
save to your computer**


 **How Science Works**


Teaching Demonstration 
Add a description here...

1 MAKING OBSERVATIONS 


 How will I engage students in this part of the process?:
What will students be doing?:
What will students learn?:
How and why will students be motivated to learn more?
 Browse for files to attach. 

2 SHARING DATA AND IDEAS 

3 DISCUSSION WITH COLLEAGUES 

Save Open Export 

My Computer
Google

Save Open Export 

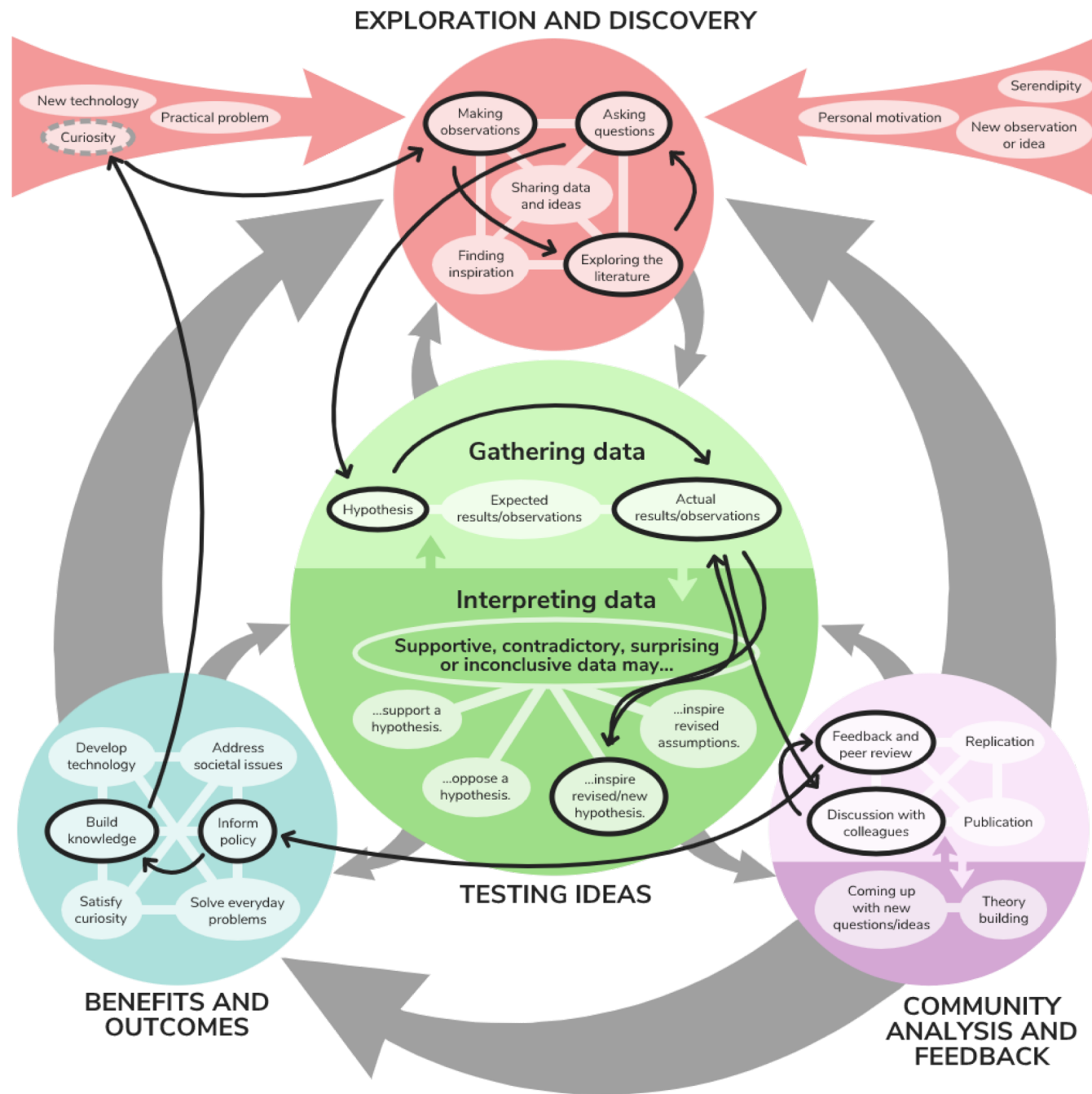
Power Point

Personal motivation
New observation or idea

Saving to your computer saves as a .csv file in a Zip folder

project

| Title | Description | Image Count | Attachment Count |
|------------------------------------|--------------------|-------------|------------------|
| Making observations | Coastal photograph | 2 | 0 |
| | Tide pools | | |
| Expected results/observations | | 0 | 1 |
| Develop technology | | 2 | 0 |
| Discussion with colleagues | | 1 | 0 |
| Coming up with new questions/ideas | | 0 | 0 |
| Theory building | | 0 | 0 |



- 1 Curiosity
- 2 Making observations
- 3 Exploring the literature
- 4 Asking questions

5 Hypothesis

6 Actual results/observations

7 ...inspire revised/new hypothesis.

8 Actual results/observations

9 Discussion with colleagues

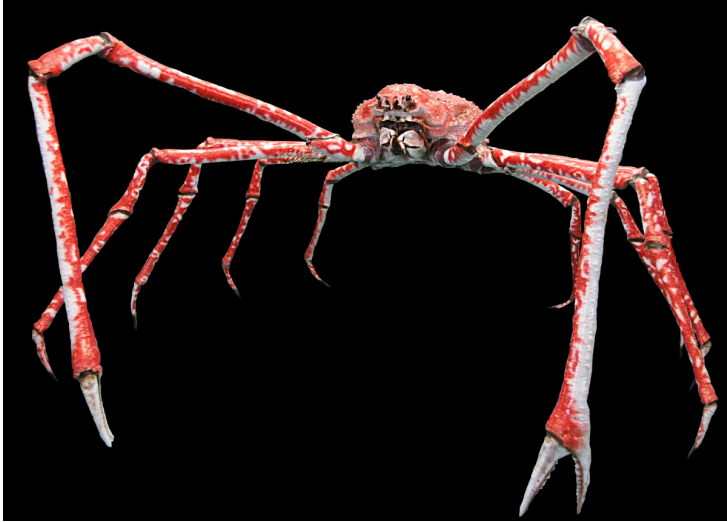
10 Feedback and peer review

11 Inform policy

12 Build knowledge

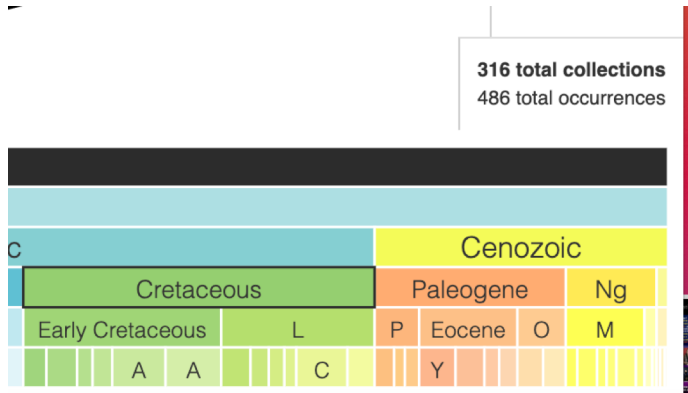
13 Curiosity

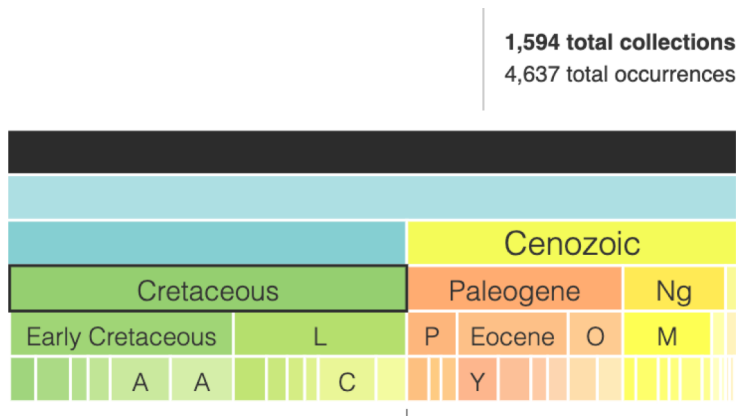




Crabs are cool!

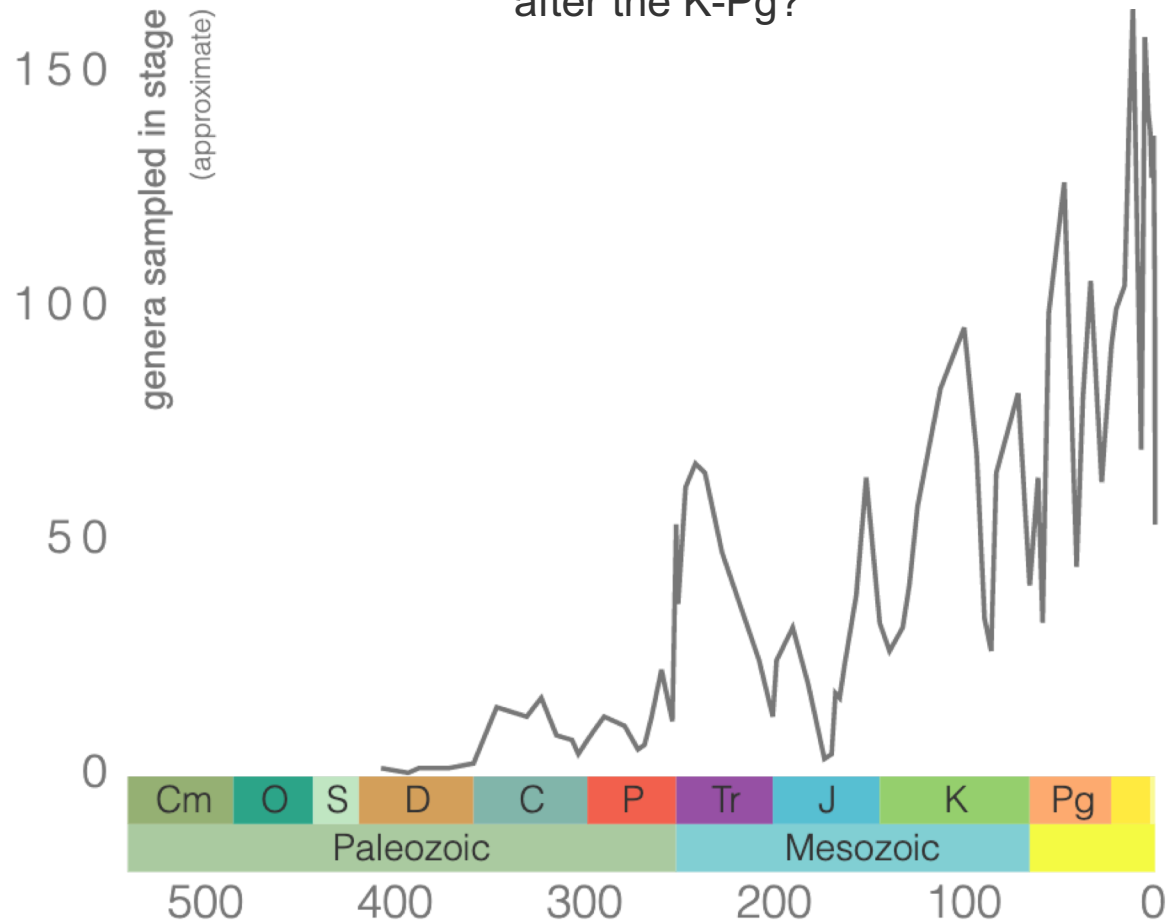
Crabs don't have a good fossil record :(



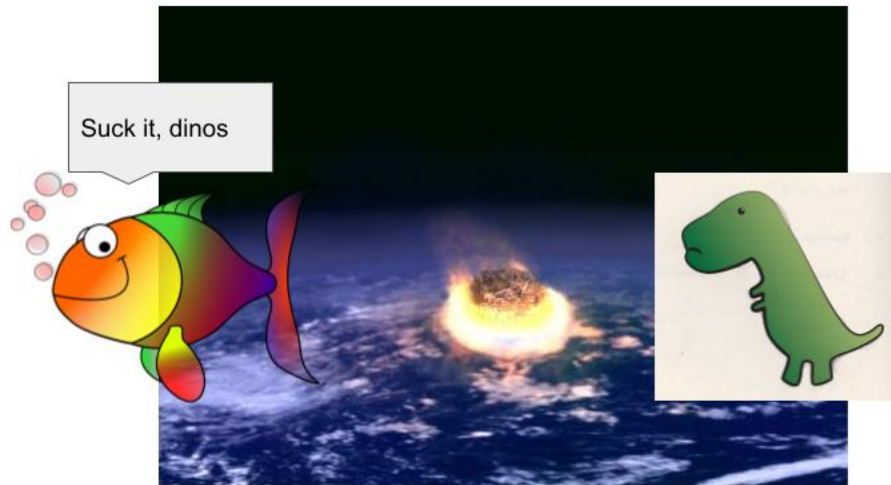


But ray-finned fishes do! They make up 50% of all living vertebrates, that's crazy. And they skyrocket in diversity at the K-Pg. Wasn't everything supposed to die then?

Why do ray-finned fishes increase in diversity after the K-Pg?

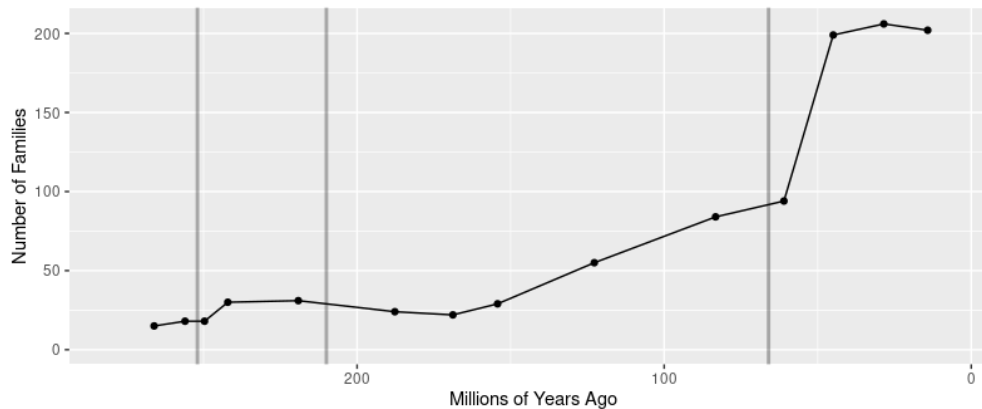


Ray-finned fish occupied ecological niches that were advantageous after the K-Pg.

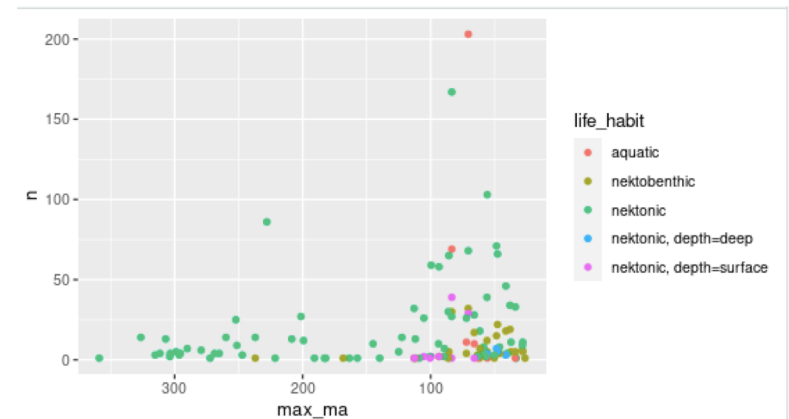
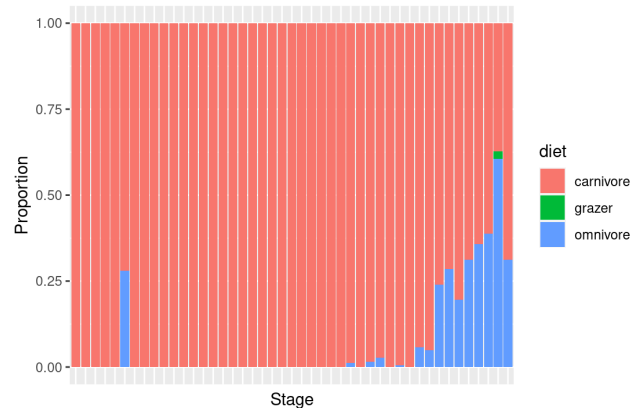


Actinopterygii diversity actually started steadily increasing in the Cretaceous. This diversity increase coincided with actinopterygians beginning to become omnivorous. Something seems to be changing with its life habit too but that's confusing.

Family-Level Diversity of Actinopterygii in the Mesozoic and Cenozoic



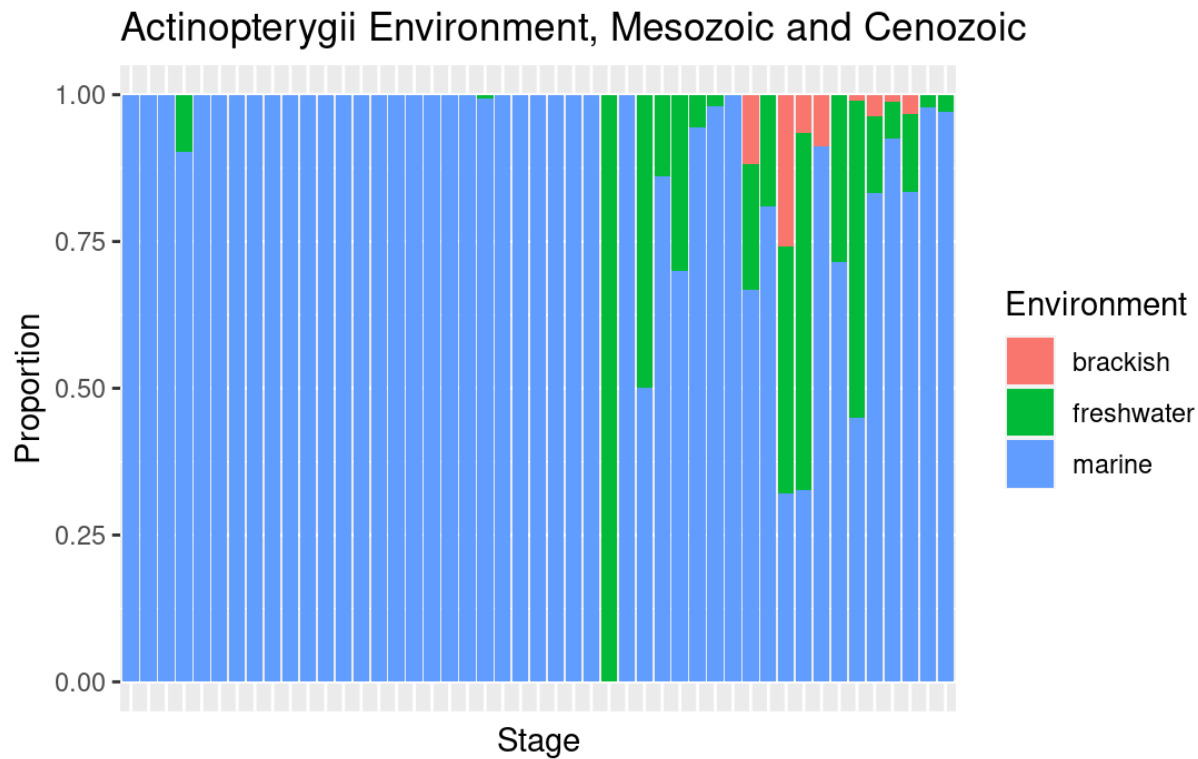
Actinopterygii Diet, Mesozoic and Cenozoic



PBDB also offers taxon environment data, maybe that would tell us something similar to life habit in a more intuitive way.



Indeed it did! More and more actinopterygians live in freshwater throughout the Cretaceous, and it increases even more after the K-Pg.



Our team looked at the literature and found that others have noted that warming environmental conditions may have been favorable to increasing actinopterygian diversity throughout the Cretaceous. We think that changing actinopterygians were able to take advantage of those traits after the K-Pg when new niches opened up.

