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Environmental DNA of the Los Angeles River, 2019-Present

Environmental DNA on the LA River

Presenter: Rachel Meyer

On behalf of the CALeDNA team and the eDNA Explorer team

Sept
19 2023

CALeDNA
Revolutionize Conservation in California

Protecting our River
Monitoring LA River Biodiversity

Partner Acknowledgements

- LA River Summer 2019 Workshop Attendees
- Funders:

METABOLIC STUDIO

hhmi Howard Hughes Medical Institute

UCSC PALEOGENOMICS

UCLA Division of Life Sciences Ecology and Evolutionary Biology

- Protecting our River Collaborators:

The Nature Conservancy

environment LA SANITATION CITY OF LOS ANGELES

Heal the Bay

Audubon CENTER AT DEBS PARK

Council for Watershed Health

LOS ANGELES WATERKEEPER

FOLAR

ZOO MAGNET CENTER North Hollywood HS

NATURAL HISTORY MUSEUM LOS ANGELES COUNTY

DISC Diversity Initiative for the Southern California Ocean

SCCWRP Established 1969

Protecting our River (PouR): Phase One

CALeDNA
Revolutionize Conservation in California

Protecting our River
Monitoring LA River Biodiversity

- **Monitor the biodiversity** of the L.A. River system using researchers, conservation groups, and community scientists to measure current conditions and the impact of enhancement and conservation efforts.
- Create an **open-data platform** to provide access to biological and environmental data about the L.A. River from collaborating conservation groups, government agencies, and researchers
- **Connect scientists with local educators** to generate interest and provide career guidance to young students, especially those from groups underrepresented in STEM
- Engage the community by **sharing and archiving activities, interpretation of data, stories, and art from all participants.**

Site Diversity: Headwaters to Ocean

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Arroyo Seco vs Long Beach

Site Diversity: Hard vs Soft Bottom

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Tujunga Wash vs Verdugo Wash

Site Diversity: River Width

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Bowtie Parcel vs Bull Creek

Phase 1 Sampling Design

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- 10 sediment samples and 4 water samples collected at each site
  - Along ~100m transect
  - Sediment collected every ~10m
  - Water collected every ~50m
- 3 time periods:
  - Summer 2020 (July-September)
  - Fall 2020 (October- November)
  - Winter 2021/ post rainfall (January-February)

Phase 2: Sentinel Collections:
Collected but data are processing for 4 sites, 10 time points in 2022, 2023

How should we share the data? CALeDNA way

CALeDNA

ABOUT | EXPLORE DATA | GET INVOLVED | NEWS AND OUTPUTS | SIGN IN

Los Angeles River Pilot Summer 2019

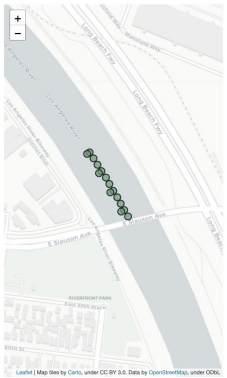
Intro | Overview | Organisms Tree | Sampling Types | Area Diversity | Plants and Animals | Detection Frequency | Appendix

Stats

Location	Sample Sites	Unique Taxa Identified
Arroyo Seco	37	2688
Maywood	15	1791
Total	52	3151

Arroyo Seco

Maywood



Sampling Types Edit

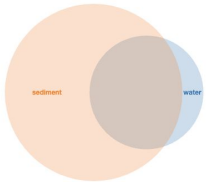
During our pilot bioblitz, we collected both soil/sediment samples and water samples. We wanted to compare the eDNA results from these two eDNA collecting methods.

This diagram compares the number of species:

- found only in water samples
- found only in soil/sediment samples
- found in both water samples and soil/sediment samples.

Click on the filters to toggle which kingdoms to examine.

Filters

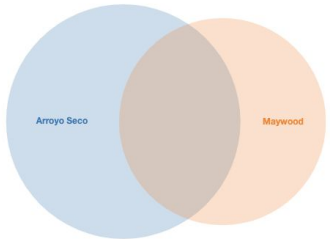


sampling type	species count
water	829
sediment	2016
water ∩ sediment	685

Plants and Animals Edit

While our project collects data about all kingdoms of life, we recognize that when most people talk about biodiversity, they mean plants and animals. Here are the plants (Streptophyta) and animals (Metazoa) that we found at Hahamongna and Maywood.

We've broken up the data into species unique to each area and species found in both areas.



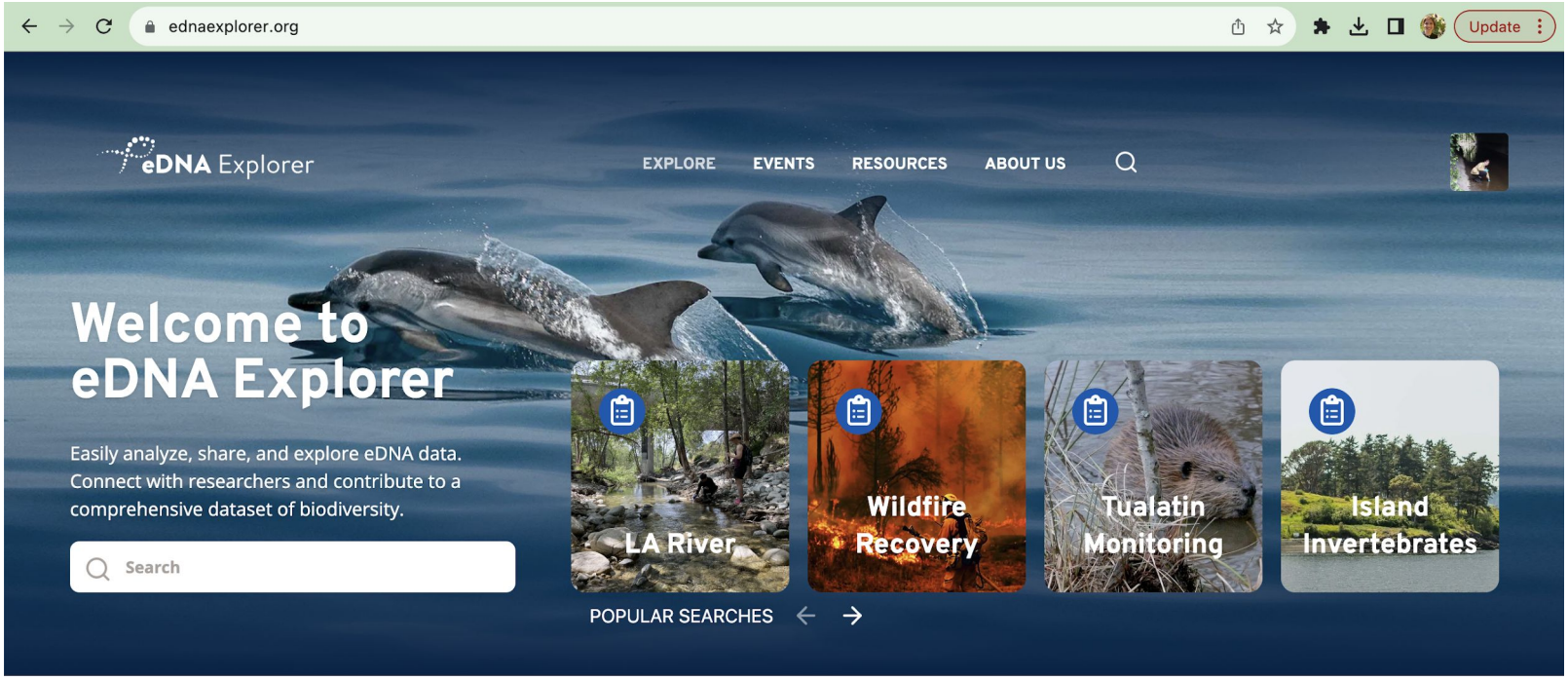
Locations: Arroyo Seco | Maywood | Arroyo Seco & Maywood

Needs

- Place where LA River practitioners can interact with the data and with each other, ask questions and interpret patterns
- Reference databases for eDNA improve! Need a place to update results
- LA River data should be compared to other places' data
  - CALeDNA is not the only LA River eDNA data producer! How do we make data interoperable?
- There is uncertainty with eDNA. Empower understanding
  - We allow **less** uncertainty in taxonomic accuracy when we are making species lists (bioinventory, bioindicators)
  - We allow **more** uncertainty when we are counting species for community ecology analyses (alpha and beta diversity)

eDNA Explorer

Welcome to your the eDNA tool made specifically for you!



How it Works

Analyze

Use eDNA Explorer to do things like identify species from environmental samples using Tronko, compare with existing observations, and look for trends in biodiversity.

UPLOAD YOUR DATA

Share

Choose to share your project with just your team or with the world to help others learn from your work.

JOIN OUR COMMUNITY

Learn

Get help with learning about what eDNA is and how to use it for your project(s).

SEE RESOURCES

Projects shared with eDNA Explorer

Water Primrose Invaded Delta

Water primrose (Ludwigia hexapetala) is one of the most globally invasive aquatic weeds. The goal of this project is to determine which traits may be leading to marsh mortality after an invasion in California's Bay-Delta. This study is testing hypotheses related to growth strategy, allelopathy, and factors related to marsh community structure and biodiversity.

POUR: Los Angeles River

A network of LA River monitoring organizations co-designed and facilitated the project, selecting a sampling regime covering 12 locations over 3 temporal windows from 2020-2021, which happened to span the three first waves of COVD-19 outbreak in Los Angeles.

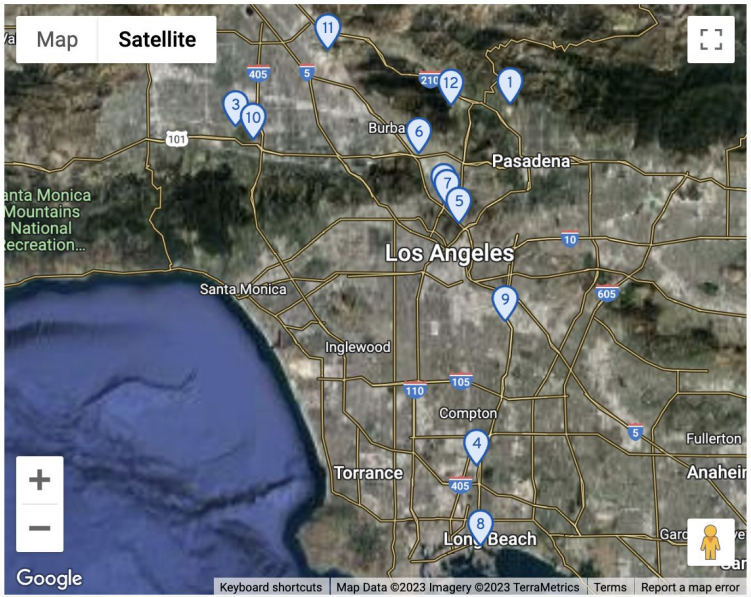
Wildfire at Swanton Pacific Ranch

Swanton Pacific Ranch was badly burned in the 2020 CZU complex fire. However there are two small areas on the property that were largely protected from fire (lightly singed!). We collected soil samples at the surface as well as 10 cm depth to compare the difference in microbial communities after wildfire disturbance and collected both in both "burned" and "unburned" areas.

eDNA Explorer

EXPLORE EVENTS RESOURCES ABOUT US

MAP SITE PHOTOS CHANGE LOG



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POUR: seasonal eDNA of the LA River 2020-2021

Last Updated
09/17/2023

Project timeline
07/23/2020 - 02/20/2021

Contributors
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DOI

Overview

Organism List

How was this data processed?

Filters include 427/435 samples: Taxonomic level: Species, Max 25 mismatches, Min 0.003% relative abundance, more...

Search | **Sort by:** Most common | **Primer:** 16S_Bacteria | Filters

ANIMALIA (6)	ARCHAEA (71)	BACTERIA (6552)	CHROMISTA (104)	FUNGI
4% Virgulinella fragilis	33% Candidatus Nitrosopelagicus brevis	93% Verrucomicrobium sp. IMCC25901	67% Planoglabratella opercularis	6%
1% Porphyridium aerugineum	18% Methanobacteriaceae archaeon enrichment culture clone B1-A-1	85% Burkholderiales bacterium X4	51% Nannochloropsis oceanica	3%
0% Parastrongyloides trichosuri	14% Methanospirillum psychrodurum	84% Luteitalea pratensis	49% Vischeria sp. CAUP Q 202	3%
0% Porphyridium purpureum	14% Thermoplasmatales archaeon Gpl	83% **B Proteobacteria** bacterium Ellin6095	48% Cymbella subturgidula	2%
0% Porphyridium sordidum	11% Methanoregula formicica	83% **beet** beta proteobacterium TEGAF014	39% Pseudo-nitzschia seriata	2%
0% Thorea hispida	8% Methanomicrobiales archaeon enrichment culture clone B1-A-77	80% Hyphomicrobiaceae bacterium WX185	35% Amphora ovalis	2%

Chart Key

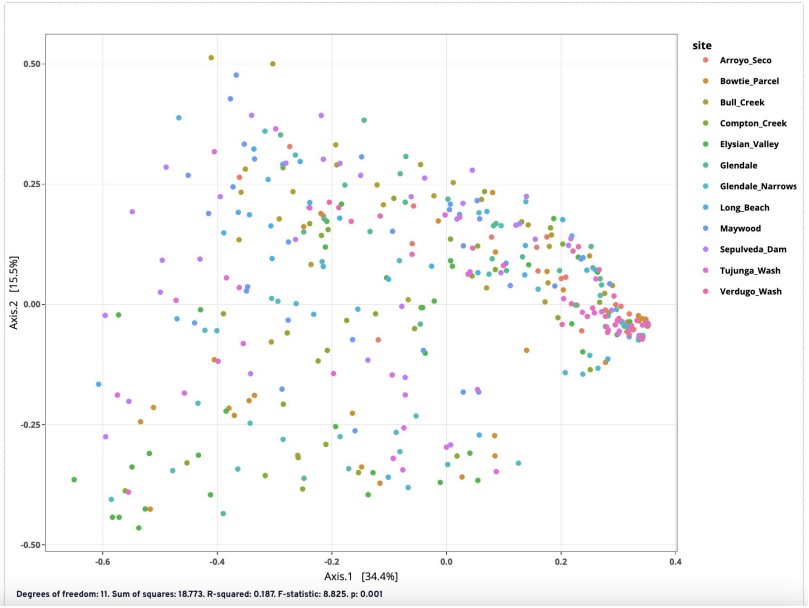
Percentage (%) of eDNA samples indicating presence

Why this matters

How similar or different were the samples in this project?

Filters include 435/443 samples: Taxonomic level: Species, Max 3 mismatches, Min 0.001% relative abundance, more...

Variable: Site | Primer: vert12S | Beta Diversity: chao | Filters

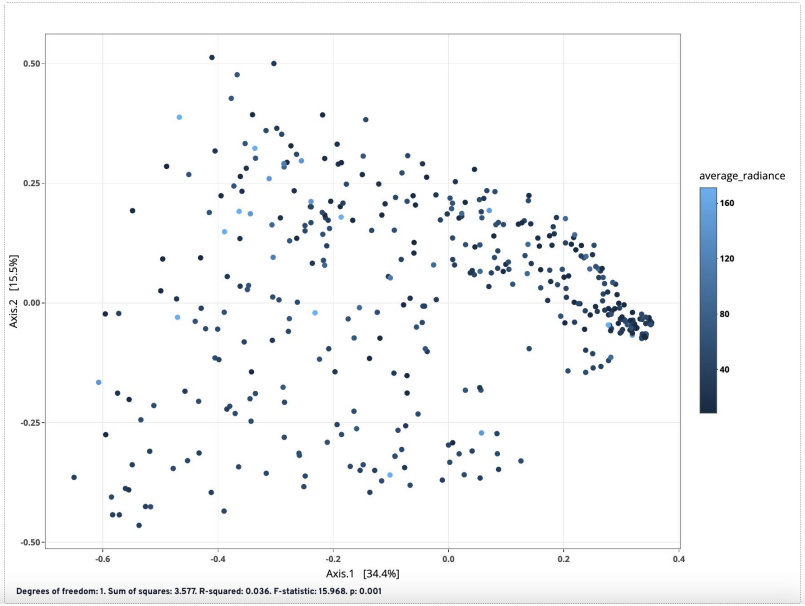


Degrees of freedom: 11. Sum of squares: 18.773. R-squared: 0.187. F-statistic: 8.825. p: 0.001

How similar or different were the samples in this project?

Filters include 435/443 samples: Taxonomic level: Species, Max 3 mismatches, Min 0.001% relative abundance, more...

Variable: Brightness from artificial lights at night | Primer: vert12S | Beta Diversity: chao | Filters



Degrees of freedom: 1. Sum of squares: 3.577. R-squared: 0.036. F-statistic: 15.968. p: 0.001

Organism Across Sites

Filters include 339/435 samples: Taxonomic level: Species, Max 25 mismatches, Min 0.003% relative abundance, more...

Search | **Sort by:** Most common | **Primer:** CO1_Metazoa | Filters

SPECIES (878)	1 ARROYO_SECO	2 BOWTIE_PARCEL	3 BULL_CREEK	4 COMPTON_CREEK	5 ELYSIAN_VALLEY	6 GLENDALE	7 GLENDALE_NARROWS	8 LC
Galactomyces candidum	52.0%	38.7%	75.0%	89.3%	54.2%	65.5%	50.0%	
aquatic oligochaete worm Chaetogaster diastrophus	24.0%	61.3%	66.7%	28.6%	58.3%	41.4%	63.2%	
Fusarium solani	20.0%	64.5%	62.5%	85.7%	54.2%	44.8%	47.4%	
Emericellopsis minima	36.0%	51.6%	70.8%	28.6%	37.5%	96.5%	28.9%	
Fallceon quilleri	28.0%	67.7%	33.3%	0.0%	66.7%	82.8%	65.8%	
Vexillifera expectata	20.0%	41.9%	54.2%	89.3%	37.5%	34.5%	52.6%	

Chart Key

Percentage (%) of eDNA samples indicating presence

Organism presence in study area over time

Filters include 339/435 samples: Taxonomic level: Species, Max 25 mismatches, Min 0.003% relative abundance, more...

Search | **Sort by:** Most common | **Primer:** CO1_Metazoa | Filters

SPECIES (199)

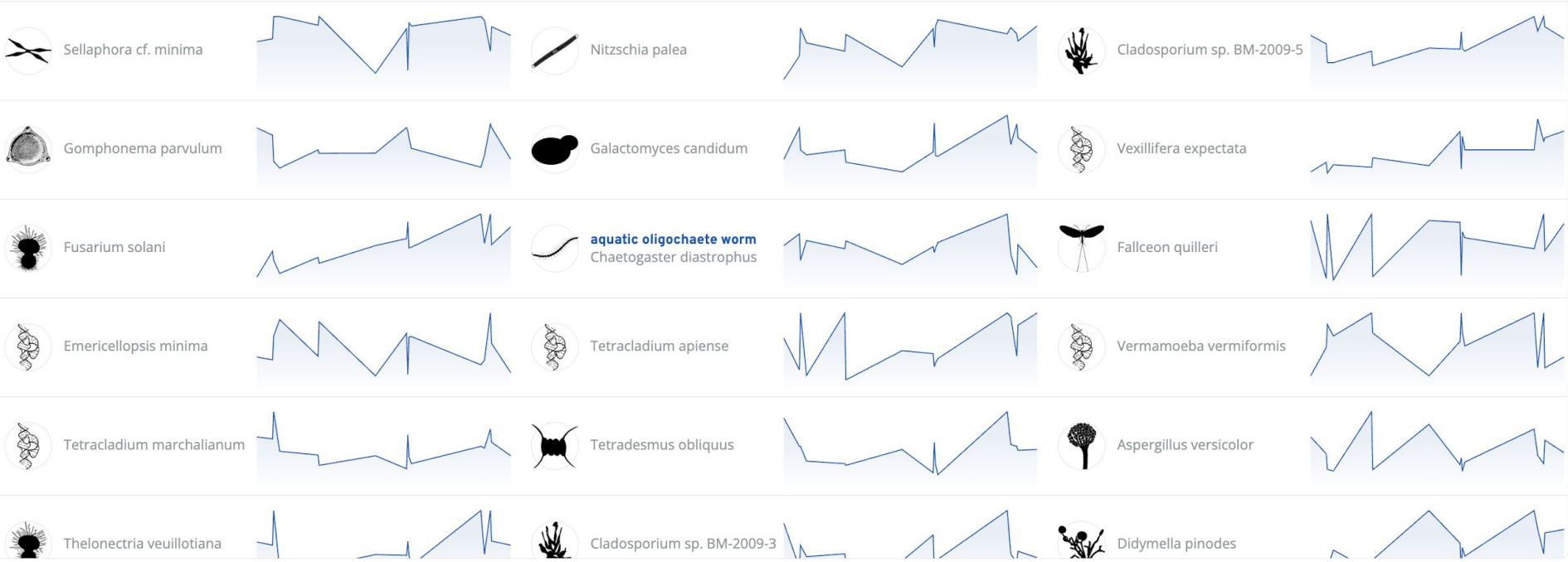


Chart Key

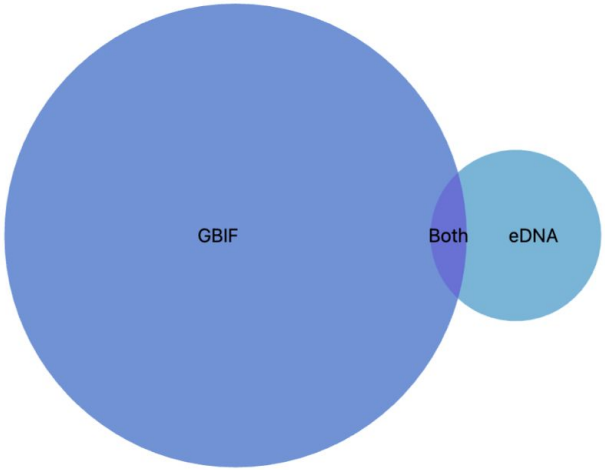
Percentage (%) of eDNA samples indicating presence

eDNA results compared to GBIF data

Species detected by eDNA vs. GBIF

Filters include 339/435 samples: Taxonomic level: Species, Max 25 mismatches, Min 0.003% relative abundance, more...

Primer CO1_Metazoa **Geographic Scale** Local Filters



eDNA 878 GBIF 6,480 Both 116

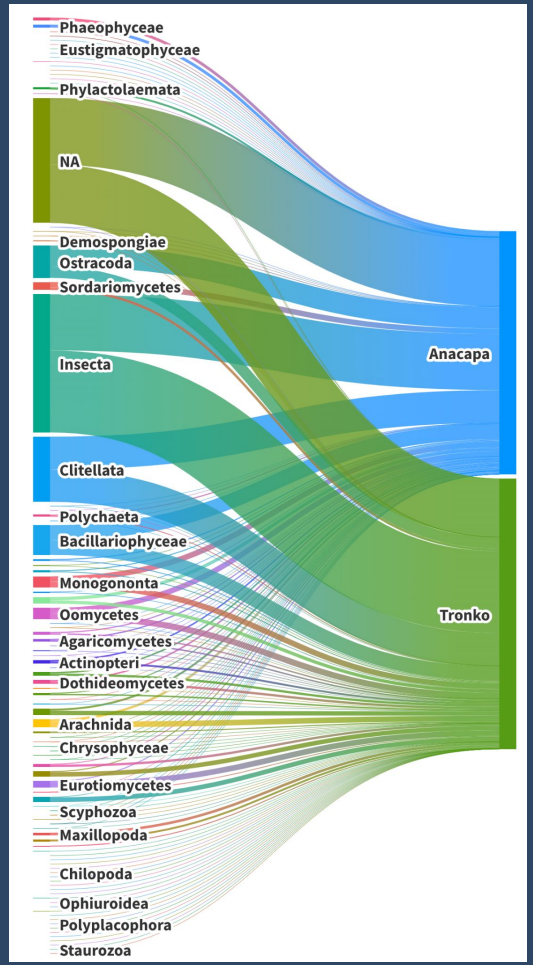
eDNA	GBIF	Both
Corynoneura sp. BOLD:AAN5033	Leuconotopicus albolarvatus	Psychoda alternata
Tetracladium apiense	Phalacrocorax auritus	Canis lupus
Achlya ambisexualis	Calidris mauri	Philodina megalotrocha
Cyclotella cryptica	Strymon melinus	Tetradesmus obliquus
Pythium sp. AL-2010	Pandion haliaetus	Hermetia illucens
Penicillium fellutanum	Setophaga auduboni	Linepithema humile
Micropsectra nigripila	Selasphorus sasin	Dero digitata
Penicillium brevicompactum	Pelecanus occidentalis	Melampsora occidentalis
Phytophthora sp. GHJ-2016a	Pelecanus erythrorhynchos	Physella acuta
Phytophthora bilorbang	Melozone crissalis	Oligotoma nigra
Saccamoeba sp. MSED6	Podilymbus podiceps	Diachus auratus

Benchmarking Results from the LA River

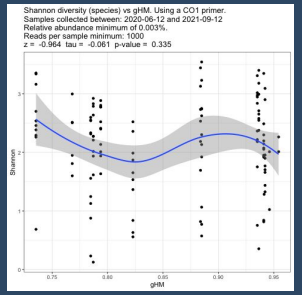
Marker	Taxa assigned with *Anacapa*	Taxa assigned with *Tronko*
16S	1351	11085
CO1	561	2226

Can filter on mismatches to reference

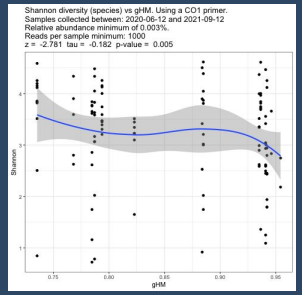
Can filter on relative abundance



Anacapa - Human Impact on CO1 evenness not sig



Tronko - Human Impact on CO1 evenness IS sig



HUGE THANK YOU TO YOU AND THESE ORGANIZATIONS!

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