UC SANTA BARBARA North Campus Open Space Restoration Project

NCOS NEWS *August 2022*

Western snowy plover chick on the slough shore - July 22nd, 2022.

UPDATES

Snowy Plovers at NCOS

The threatened Western Snowy Plover faces many challenges when attempting to successfully reproduce. One of those challenges is a shortage of safe, suitable nesting habitat, much of which has disappeared or is under threat from human development, recreation, and sea-level rise. An important aspect of the NCOS restoration project is the extension of the available breeding habitat for snowy plovers and each year we've been hopeful this small shorebird would successfully nest in the upper reaches of the slough.

In 2018 we had evidence of breeding, while in 2019 nesting occurred but the eggs were predated by skunks. In 2020 two chicks were born but were predated soon after and we had no breeding evidence in 2021. However this year, on June 30, two tiny snowy plover chicks with two parents were seen foraging along the shore in the southeastern salt marsh of NCOS. These tiny chicks grew up fast and were seen in

southeastern saltmarsh area for approximately four weeks until they fledged.

The first snowy plover chicks of the year were seen on June 30, 2022 in the southeastern saltmarsh.

Western snowy plover chicks leave the nest just hours after hatching - June 30, 2022.

Getting closer to fledging! Approximately 3 week old chicks in the early morning near Venoco bridge - July 22, 2022.

Chicks foraging in the slough near Venoco bridge - July 22, 2022.

Successfully fledged! A fledged chick in the eastern saltmarsh near Dilling's Link - August 4, 2022.

Continuing this exciting turn of events from years past, two more snowy plover chicks hatched on July 19th. This pair began foraging in exposed mudflats in the western saltmarsh area and are now just over three weeks old. They were most recently seen in the central salt marsh area and will likely be fledging sometime next week. The photo set below shows this pair.


2 chicks hatched
July 19, 2022
2 chicks first seen
June 30, 2022
Univ of
Californi
Santa
Barbara

Four day old snowy plover chick in the western saltmarsh, July 22, 2022.

This 10 day old chick's natural camouflage helps it blend in with salt crust in the western saltmarsh - July 29, 2022.

Snowy plover chick in the central salt marsh - August 4, 2022.

Snakes of NCOS

We wanted to take a moment to appreciate and review the snakes that live in our natural areas. While the number can vary, our best guess from records indicate we have 5 species present, although a few others reside just outside of campus lands. The first is our familiar and wonderful gophersnakes. There are actually five species of gophersnakes in California, our local one being the San Diego gophersnake (*Pituophis cantifer annectens).* Gophersnakes are harmless animals that mainly prey on rodents such as mice and rats.

Up next are our regal and beautiful California kingsnakes (*Lampropeltis californiae).* The genus *Lampropeltis* means "shiny skin" and the species name denotes that they are from California, although they exist outside of California's borders as well. They feed on rodents, lizards, and other snakes, even rattlesnakes, and are harmless and beneficial. They are typically banded but across their range display a wide degree of morphological variations including aberrant, striped, and further forms consisting of different color variations of black to brown and white to cream.

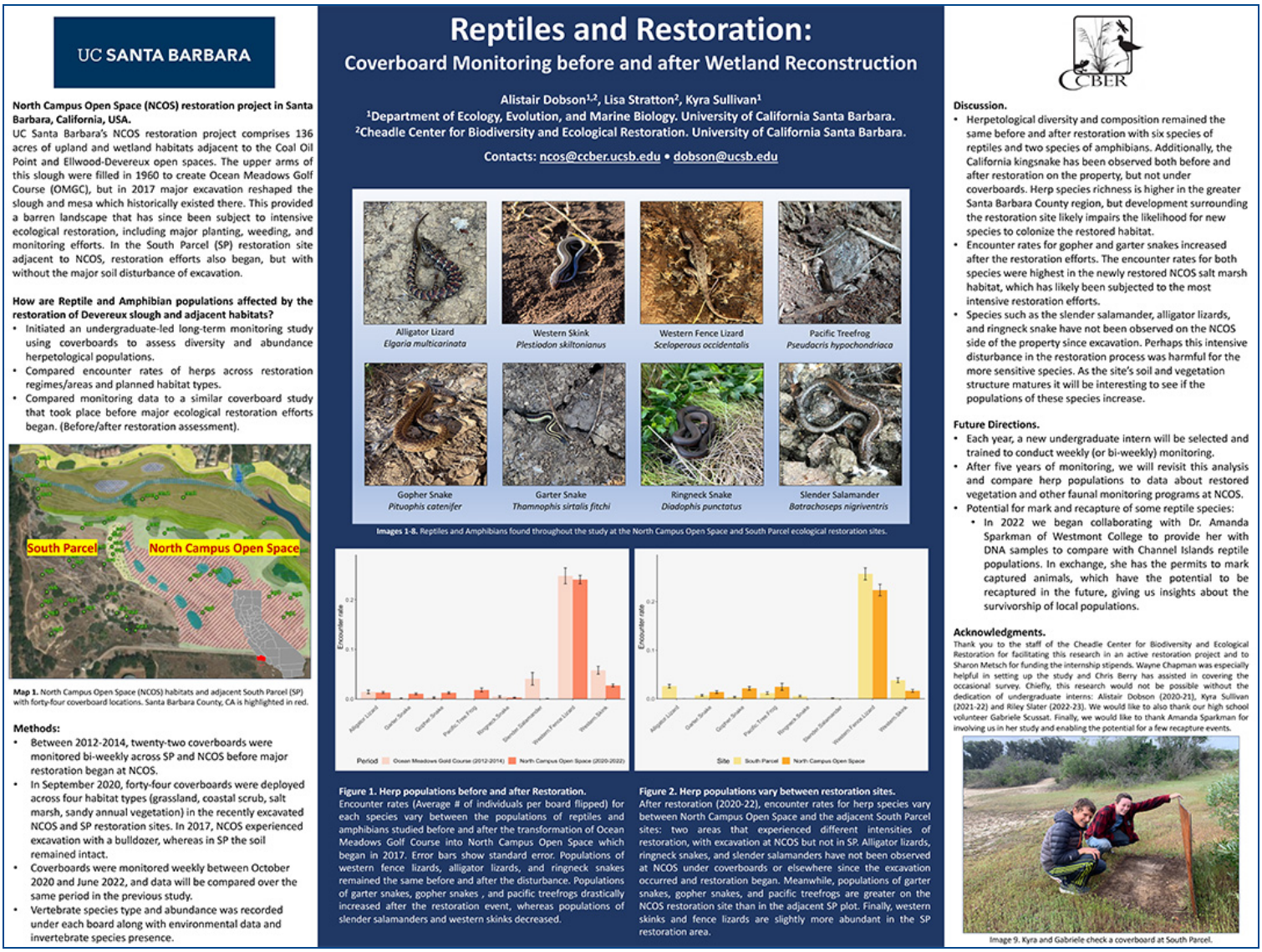
Can you name all these snakes? Left: King Snake, Right from top down: Ringneck, Gopher and Garter Snake. Photos by Connie Weinsoff, Susan Cook, and Wayne Chapman.

Next up are our gartersnakes, of which we have two difficult-to-tell-apart species. Gartersnakes are a very diverse and wide-ranging genus, and are the most northerly-occurring snakes in North America. Locally occurring are both the common or valley gartersnake (*Thamnophis sirtalis fitchii),* and the western terrestrial, or valley gartersnake (*Thamnophis elegans terrestris).* These are sometimes very difficult to tell apart - one method is to count the upper labial scales as there is usually 8 on *elegans* and 7 on *sirtalis.* These harmless snakes feed largely on frogs, fish, and insects and favor our frog-producing wetlands and adjacent uplands.

Lastly is the elusive and diminutive ring-necked snake, another snake with many species and subspecies occurring in North America. Our local animal is the Monterey ring-necked snake (*Diadophis punctatus vandenburgii).* Easily our smallest snake, adults average just 11-16 inches in length. These are usually

olive-colored, interrupted by a bright orange ring around the neck with a belly colored the same brilliant orange. They feed on insects, worms, and slender salamanders. All of these snakes are decreasing on campus as they have many natural predators, and are now faced with increasing additional threats such as development, use of plastic bird netting, severe drought, and all-too-common vehicle strikes, to name a few. Please watch the road closely, and let us know if you see any of our local serpents! Bonus question: can anyone name the three species of snakes that occur just outside of campus, but generally are not found here?

Reptiles and Restoration



UCSB graduate Alistair Dobson recently presented this poster Reptiles and Restoration: Coverboard Monitoring before and after Wetland Reconstruction**.** This project used 44 coverboards to sample snakes, lizards, mice and insects throughout different habitats in a systematic way. The project was led by several undergraduates at UCSB, including Kyra Sullivan, who were funded by the Sharon Metsch RAMMP (Research and Monitoring Mentorship Program) intern fund. In addition, local high-school student Gabriele assisted with surveys and used data from the project for his own science poster last year.

Ventura Marsh Milk-vetch

The population of Ventura marsh milk-vetch at NCOS is currently the largest in the world.

The population of flowering Ventura marsh milk-vetch (*Astragalus pycnostachyus* var*. lanosissimus*) at NCOS has increased from 500 individuals in 2021 to 1,300 in 2022! This is great news for the state and federally listed endangered plant that has historically grown along the south and central coast of California. Ventura marsh milk-vetch is actually more tolerant of variable conditions than initially anticipated in terms of soil type and moisture as it has been planted in 5 distinct areas at NCOS. The Cheadle Center was recently awarded a USFWS grant to further study the habitat requirements of the species and look for additional possible locations for the plant.

FEATURE STORY

Environmental DNA: Assessing this new technology for documenting biodiversity

UCSB student Mckenzie Goetz filters water through 1 um filter to obtain an eDNA sample.

EDNA is a method of extracting and identifying fragments of DNA from sources that might otherwise be very time consuming to sample. It is a relatively new method of capturing the presence of organisms that might otherwise be missed. The Cheadle Center is now getting results from an eDNA assessment funded by Steve Senesac and the Associated Students Coastal Fund designed to assess how valuable this tool might be for understanding biodiversity at North Campus Open Space. The primary source of DNA was derived from sampling water in the estuary and wetlands to capture genetic signals from plants, algae, vertebrates, invertebrates, fungi and bacteria. Other assessments included submitting samples of guano from shorebirds and ground up burrowing owl pellets to learn more about their diets; from bee pollen to understand plant/pollinator relationships, and samples of soil from different depths and amendments to understand how compost and biochar might influence microbial communities and, ultimately, soil function. This story covers initial results from data delivered from filtering water samples at various parts of Devereux Slough and NCOS wetlands. This feature story is continued on page 20.

VOLUNTEER OPPORTUNITIES

"Second Saturdays" at NCOS

This month: August 13, 9-12

Please RSVP to ncos@ccber.ucsb.edu

Help us restore and create NCOS with plants and more! Meet at 6969 Whittier Drive at 9am. Bring water, sunscreen, and wear a hat, clothes and shoes that are suitable for outdoor work.

Thursdays -

CCBER Greenhouse Associates

Come help transplant seedlings of native plants with the CCBER team from 9:00 - 12:00. To join, please send an email to ncos@ccber.ucsb.edu.

Nature Guide Tour

This month: August 20, 9:30 -11

Come take a walk around NCOS and learn about native plants and animals with a trained Nature Guide.

COMMUNITY FORUM & PHOTOS

We are interested in any observations of wildlife activity on NCOS, as well as plants and landscapes. Please send your observations, with or without photos, to ncos@ccber.ucsb.edu. Thank you!

In the first half of the 20th century, Anna's Hummingbirds bred only in Northern Baja California and Southern California. The planting of exotic flowering trees provided nectar and nesting sites allowing them to greatly expand their range. Photo by Karen Lunsford.

Allen's Hummingbirds breed in a narrow strip of coastal forest, scrub, and chaparral from sea level to around 1,000 feet elevation along the West Coast. Photo by Karen Lunsford.

Red-necked phalaropes breed in lakes, bogs, and marshes in the Arctic tundra or tundra-forest boundary. Photo by Jeremiah Bender

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For more information on the
North Campus Open Space Restoration Project, Click here**, or email** ncos@ccber.ucsb.edu

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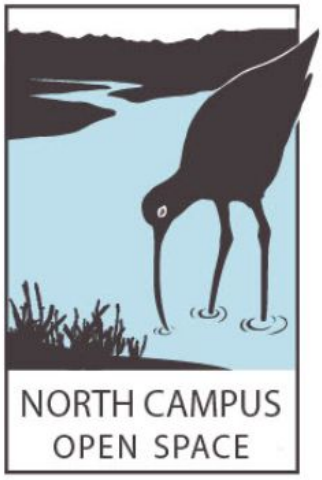


CCBER
CHEADLE CENTER FOR BIODIVERSITY
& ECOLOGICAL RESTORATION

Environmental DNA: Assessing this new technology for documenting biodiversity

What is Environmental DNA (eDNA)?

Environmental DNA (eDNA) is a method of extracting and identifying fragments of DNA from sources that might otherwise be very time consuming to sample. It is a relatively new method of capturing the presence of organisms that might otherwise be missed. The Cheadle Center is now getting results from an eDNA assessment funded by Steve Senesac and the Associated Students Coastal Fund designed to assess how valuable this tool might be for understanding biodiversity at North Campus Open Space. The primary source of DNA was derived from sampling water in the estuary and wetlands to capture genetic signals from plants, algae, vertebrates, invertebrates, fungi and bacteria. Other assessments included submitting samples of guano from shorebirds and ground up burrowing owl pellets to learn more about their diets; from bee pollen to understand plant/pollinator relationships, and samples of soil from different depths and amendments to understand how compost and biochar might influence microbial communities and, ultimately, soil function. This story covers initial results from data delivered from filtering water samples at various parts of Devereux Slough and NCOS wetlands.

UCSB students Lauren Stiles, Mckenzie Goetz and Sam Daley prepare to gather an eDNA sample near Phelps Bridge at NCOS.

UCSB students Sam Daley and Mckenzie Goetz measure dissolved oxygen, salinity, and temperature.

How we collect eDNA?

There are many ways to process eDNA. For our purpose we filter 60-360 mL of water through a 1 um (micron) filter and send it to a third party lab called Jonah Ventures. Once the samples arrive at Jonah Ventures they are sequenced and compared to data bases known as “libraries” of known DNA sequences. We have been collecting aquatic eDNA samples over the last 8 months from the sites where we currently conduct aquatic invertebrate sampling, and we plan to continue sampling for the remainder of the year. Once we have a full year of data we can analyze how the wetland flora and fauna changes throughout the year, compare to aquatic sampling and sorting results, and further examine how salinity and dissolved oxygen might affect the organisms in the water.

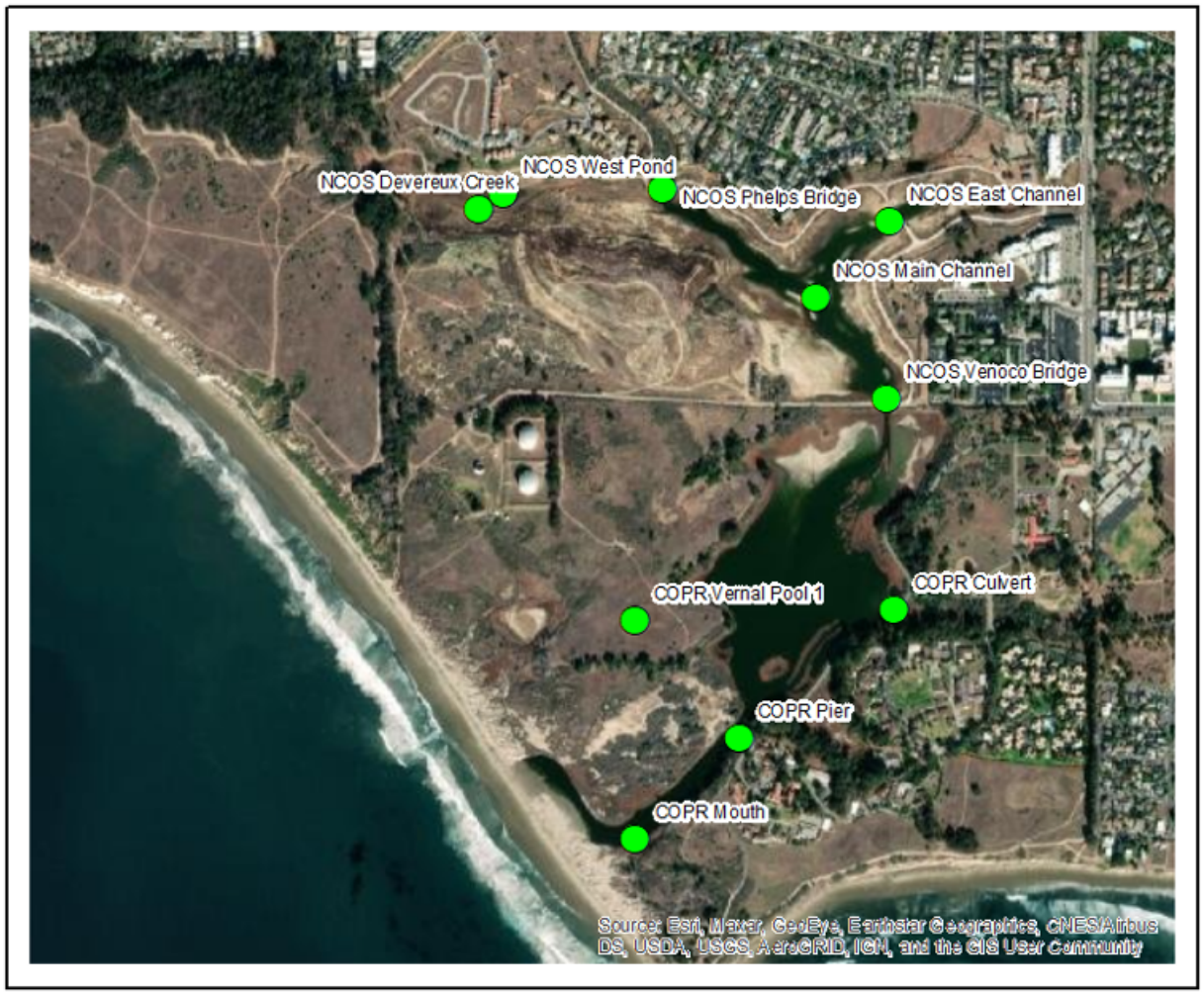
UCSB student Mckenzie Goetz filters water through 1 um filter - left shows clear filter and right shows filter with eDNA sample present.

How are we using eDNA?

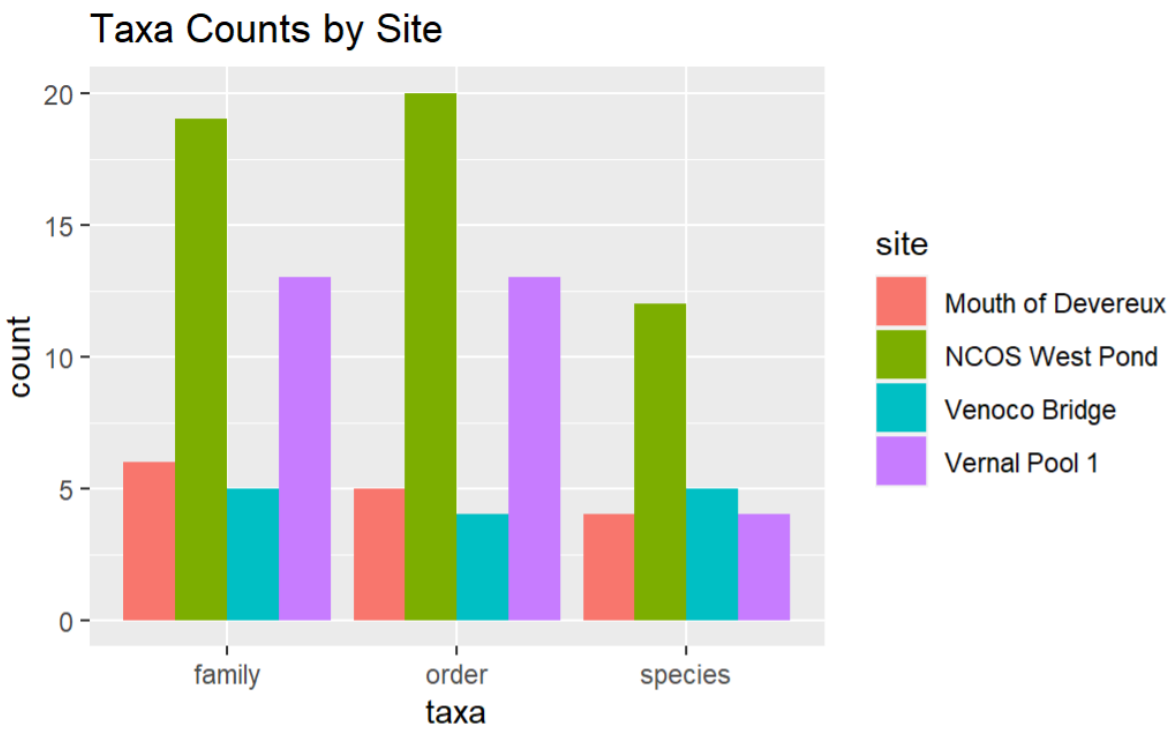
eDNA is useful because it can process a lot more data much quickly and with potentially more precision than hand sorting. eDNA can also identify organisms like bacteria, fungi and single cell algae that can be difficult and expensive to identify in the lab. For example, a UCSB student recently completed a project sampling the macro algae at NCOS, but microalgae, also known as phytoplankton, require a very expensive microscope setup and a high degree of expertise, and therefore was not included in the assessment. EDNA is used to fill in those gaps. Also, since DNA flows freely in the water, eDNA is also able to capture the entire water column. Our hand sampling methods for aquatic invertebrates and fishes typically only focus on one portion or depth of the

wetland. For example, each year we work with permitted biologists to survey the estuary for fish. This assessment has not recently recorded the Pacific staghorn sculpin *(Leptocottus armatus*) in the slough, but it was detected in the eDNA sample. Staghorn sculpin is a benthic fish and perhaps the seining methods used in the survey were not able to capture that portion of the slough effectively. Similarly, another fish that was detected in the eDNA, mullet (*Mugil Cephalus*) are known to be particularly elusive and have not been captured by the seining method.

UCSB students Lauren Stiles and Mckenzie Goetz putting a preservative into the e-DNA sample they collected.



Map of sampling sites. All sites are sampled for eDNA as well as aquatic invertebrates to be sorted by hand.



eDNA results at 4 of our sampling locations, data shows that DNA can be as specific as species, but more often can only identify organisms to a lower classification. We can see that sites with lower salinity (Vernal Pool and West Pond) have more DNA than sites with higher salinity (Mouth and Venoco Bridge). Credit: Chris Kratcha.

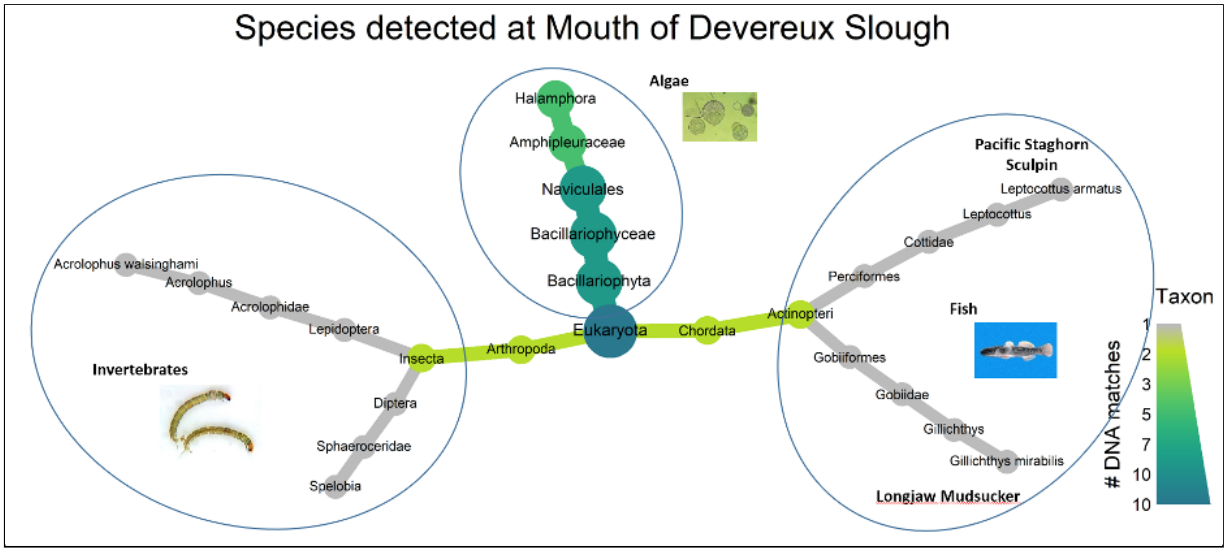
Preliminary results

eDNA is a new technology and since it has some limitations it is important that we combine the results with local knowledge. Even though we collect samples with precaution such as wearing gloves, samples can be subject to cross contamination. One sample at West Pond came back with one result of Atlantic salmon (*Salmo salar*). We are looking more into the reasoning for this, but this shows that it is important to analyze eDNA results with caution. We can be more confident about results where the sequence is read multiple times (shown with darker branches in the taxonomic tree figures below). As for local knowledge, we know that pacific staghorn sculpin and mullet are both commonly found in estuaries of California. The Pacific staghorn sculpin was found in 2 different locations. While both of these observations increase our confidence that these species exist in our wetlands, only a visual observation by someone with identification expertise could verify the presence with 100% confidence. This supports that eDNA has its place - to indicate species that likely exist and inform local field staff what to look out for - but is not intended to replace local sampling.

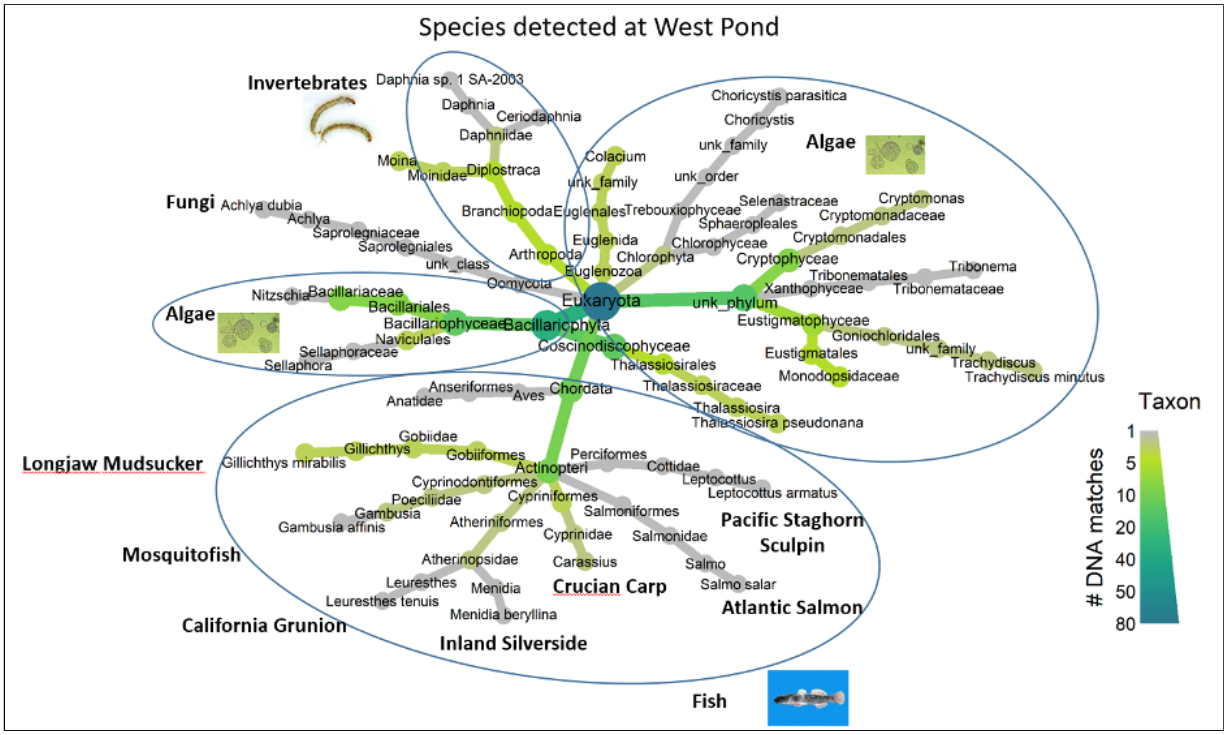
Another instance where hand sampling results differed from eDNA results is the single instance of Daphnia and lack of copepod and ostracod identification in the eDNA. Our hand sorting methods indicate that Daphnia is one of our most common zooplankton species. The lack of daphnia and other macroinvertebrate DNA is likely due to the fact that macroinvertebrates shed less DNA than other species such as algae. This could be improved by running the macroinvertebrate DNA with more "libraries". Interestingly, one of the questions we wanted to answer was whether eDNA could be a substitute for the much more time-consuming process of hand sampling, sorting and identifying aquatic organisms, but the diversity from the eDNA was significantly lower than that derived from manual monitoring. We are working with Jonah Ventures to better understand why the eDNA does not capture the signal from aquatic invertebrates. A higher value of the eDNA may be to understand the ecological context of the manually sampled aquatic invertebrates from the data on otherwise elusive fish, as well as difficult to identify phytoplankton and microbes.

One interesting finding is that there are a lot of DNA matches for fish and algae species at West pond, a pond filled by rain water and water from Devereux Creek, but otherwise isolated from the larger estuary system (figure 5 and see map). This data confirms that the pond has a unique, separate function in the ecosystem relative to the continuous estuarine wetland. Environmental factors of the pond such as the low salinity and

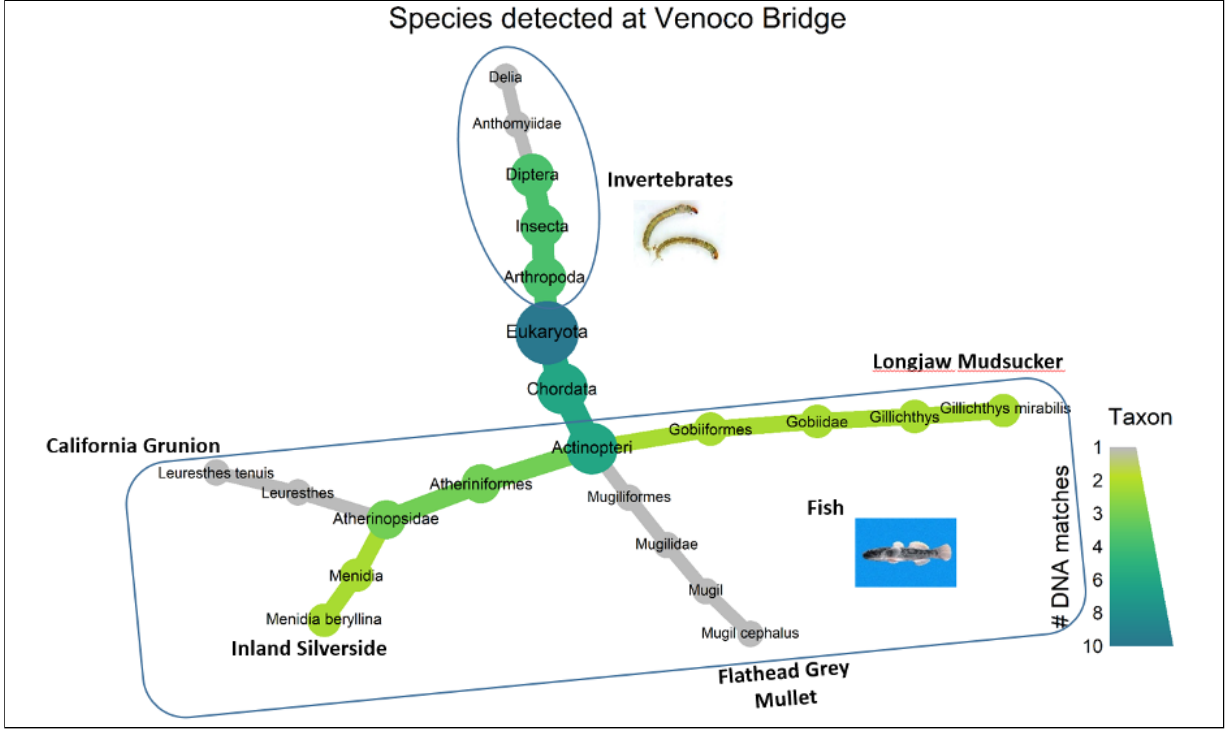
high dissolved oxygen provide a more suitable habitat for many species. The high presence of waterfowl who use this pond indicates that there is an abundant food source.



The Devereux slough mouth is generally saline throughout the year and may have lower biodiversity. Credit: Chris Kratcha.



The western pond is primarily fresh water but dries out in the summer months. Credit: Chris Kratcha.



Venoco bridge has high salinity as water evaporates in the summer months, but is diluted to a lower salinity after heavy storms before the sand berm breaks and introduces seawater. Credit: Chris Kratcha.

Future aspirations

Stay tuned for more results to come on eDNA, we are continuing to learn how we can interpret our data and hope to share more results on our aquatic eDNA results soon! We also plan to share results on the diet reconstruction of bees, burrowing owls and shorebirds as well as data on the microbes living in NCOS soil.

Date:
Thursday, August 11, 2022 - 10:15