

West Hills Community College District
 Citizen and Undergraduate Science Project
 Western Native Trout Initiative

Abstract

West Hills Community College District (WHCCD), a rural, comprehensive community college district serving 3,464 square miles of California's western Central Valley, earned a Western Native Trout Initiative (WNTI) small grant in 2019. The award of this grant built upon the success of a WNTI funded field research project in 2017 that led WHCCD Biology students to Heenan Lake (550-mile roundtrip) to study the ecology and habitat of the Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*). Funding in 2019 brought students to Mill Creek, a tributary to the Smith River (1,136-mile roundtrip) fourteen miles south of the Oregon border to study the ecology and habitat of the coastal cutthroat trout (*Oncorhynchus clarkii clarkii*). This trip occurred on October 19th, 20th, and 21st, 2019. WHCCD leaned on and strengthened partnerships with the California Department of Fish and Wildlife Native Fishes Conservation and Management Department to ensure the trip was a success. In the field, students collected the following data: the potential of hydrogen (pH), dissolved oxygen (DO), ammonium (NH₄⁺), surface temperature (°C), total dissolved solids (TDS), and chloride (Cl⁻). Data was collected at predetermined locations to identify if anthropogenic activity (e.g., a traffic bridge, a footpath) adversely affected the water quality of Mill Creek and the coastal cutthroat trout. On-site, students concluded that automobile traffic over a bridge has slight adverse effects on water quality but otherwise found no additional disruption of quality throughout the watershed that could be attributed to human activity. Educational attainment of the project was captured using student pre- and post-surveys; positive trends were identified through increased interest in STEM, awareness of coastal cutthroat trout, understanding of habitat supporting native trout in the west, and human impact on the environment. Ultimately, the partnership of WNTI and WHCCD provided lasting impacts for students who, otherwise, would not have opportunities to learn in-field research techniques, travel the state, and identify STEM as a valid and fulfilling career choice.

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Planning and Partnerships

This undergraduate research trip was planned and established as a collaborative effort with WHCCD staff, faculty, and outside agencies and resources. Representing WHCCD's educational offering were Dr. Atif El Naggas as lead research faculty and Jeff Wanderer, Biology faculty at West Hills College Coalinga. Support was delivered from the WHCCD Grants Office to work out logistics and manage collaboration between parties. In preparation for this trip, WHCCD partnered with numerous agencies and experts in the field to provide robust information, ensuring a valuable trip for students. Senior Environmental Scientist for the California Department of Fish and Wildlife's Native Fishes Conservation and Management department, Jeff Weaver, collaborated with WHCCD to identify a location for testing and opportunities to learn about coastal cutthroat trout. With Jeff's assistance, WHCCD identified the Mill Creek tributary to the Smith River and vetted test locations listed on the maps provided below (Research Plan and Data Collection).

Staff closely monitored extended weather forecasts to identify a window in October that would be free of rain and freezing weather. Once dates were identified, WHCCD made preparations for hotels and van rentals, secured scientific instruments to be used in the field, began paperwork for student meal stipends, and promoted the trip via flyers on campus and throughout the community.

Mr. Weaver connected WHCCD with Justin Garwood of the California Department of Fish and Wildlife's Anadromous Fisheries Resource. Mr. Garwood agreed to meet students during the drive north to Crescent City to give a presentation titled *Coastal Cutthroat Trout in California: Population Monitoring, Status, and Management*, on 10/19/20 at 7 pm at the CDFW office in Arcata, Ca. However, inclement weather slowed the group's journey north considerably. Originally estimated to be a 9 hour trip from Coalinga to Crescent City, rain pushed the arrival in Arcata from 7 pm until 9 pm. Given the presentation was to last an hour, WHCCD and CDFW decided to continue directly to Crescent City for arrival by 10 pm, rather than 11 pm, to ensure students got adequate rest for the following day of field research.

The proprietor of The Ecological Angler, native trout educator, and guide to WHCCD's ecological science trips, Michael Carl, also provided input to study locations. Mr. Carl was invited to attend the trip and provide an on-site overview to students and citizens at Mill Creek but had a prior engagement on the weekend of the trip and was unable to attend.

Visit to San Francisco and arrival at Mill Creek



Figure 1 - Students in San Francisco

On October 19th, 2019, WHCCD vans departed West Hills College Coalinga bound for Mill Creek near Crescent City. As many of WHCCD's students have not ventured past the Central Valley, often less than 50 miles from their hometown (evidenced in pre- and post-survey results), the group made plans to stop for lunch in San Francisco for two hours. While in San Francisco, students received lunch per-diem and were free to explore the Pier 39 area. Students broke into smaller groups and sight-saw for two hours before returning to the vans. Students enjoyed time in San Francisco, 3 hours north of Coalinga, but still had a 6-hour trip ahead of them. Departing the city, the group began to encounter rain and

thunderstorms, which slowed progress north. Travel was delayed by two hours, forcing the group to miss a scheduled presentation in Arcata, CA, from Mr. Justin Garwood on the coastal cutthroat trout.

The group arrived at Best Western Plus Northwoods in Crescent City, CA, at 10 pm; students were in rooms for the night by 10:30 pm. The next morning, students ate breakfast and loaded into vans to make the 6 mile trip on Howland Hill Road to Test Site 1 at the confluence of the East Fork and West Branch of Mill Creek. Entering into the California Redwoods, students were amazed at the size of the trees, and a new energy propelled the group forward. Off a parking spot on Howland Hills Road, students and faculty dressed in waders, primed scientific equipment, and readied themselves for descent into the Smith River watershed to collect data.



Figure 2 - Students in Redwoods

Research Plan and Data Collection

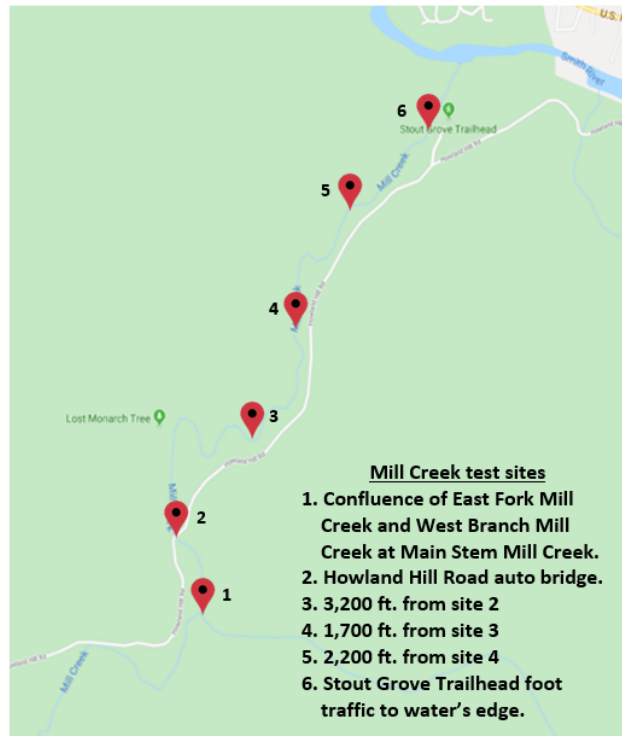


Figure 3 - Data sampling locations on Mill Creek map

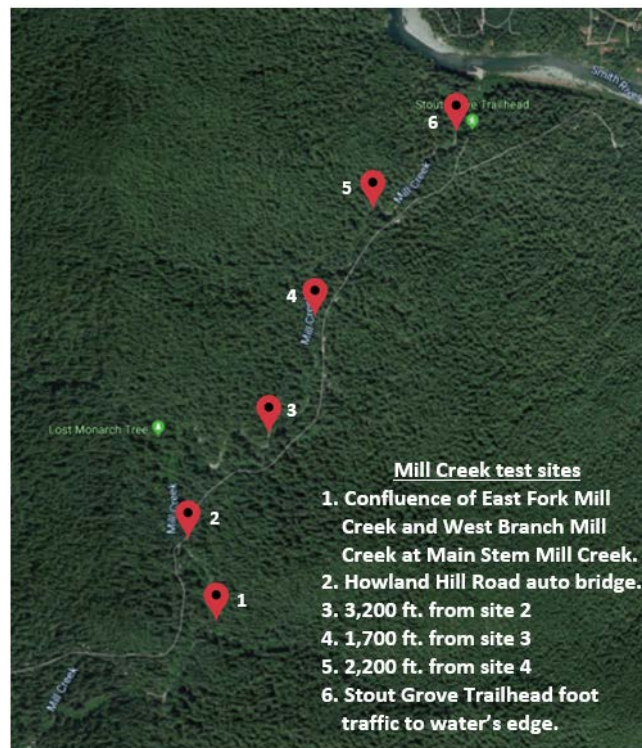


Figure 4 - Data sampling locations on Mill Creek satellite image

At Mill Creek, Biology faculty instructed students to tag data sampling locations with handheld GPS units and cellphones to capture longitude and latitude coordinates at each sampling site. Sites were mapped prior to the trip and captured three main points of interest: 1. the confluence of the East Fork Mill Creek and West Branch Mill Creek as they become Main Stem Mill Creek as a base measurement; 2. Mill Creek beneath the Howland Hill Road bridge where, though light, auto traffic could potentially change creek data measurement from site 1; 3. an accessible location from Howland Hill Road; 4 & 5. locations not easily accessible from Howland Hill Road; 6. a location 1,300 feet down Stout Grove Trailhead where hiking foot traffic was assumed heaviest at Mill Creek before the confluence with the Smith River.

At site 1, students and faculty gathered to discuss the data collection plan utilizing the scientific method and classroom procedures outlined earlier in the semester. At each site, students rotated positions or "jobs," including a sampler, tester, calculator, data logger, coordinate capturer, and observer. Students worked in tandem, taking turns within each role to widen their scientific experience in the field, and hiked between sites in waders. Under the guidance of faculty, students used scientific materials such as scientific calculators, computers, bathyscope, camera, net, seines, and pads of paper.



Figure 5 - Mill Creek; Howland Hill Road bridge in background



Figure 6 - students with Biology faculty

At each location, a student verified the GPS coordinates and the rest of the team tested water samples for the potential of hydrogen (Ph), dissolved oxygen (DO), ammonium (NH_4^+), water surface temperature ($^{\circ}\text{C}$), air temperature ($^{\circ}\text{C}$), total dissolved solids (TDS), and Chloride (Cl^-). Student understanding of these measurements in relation to the health of Mill Creek and coastal cutthroat trout was tested separately through a pre- and post-survey detailed in the Educational Attainment section below. Students gathered data and dialogued

with staff and faculty about the changes in data across sites and inferred potential reasons for data fluctuation as well as how logged changes might affect the coastal cutthroat trout. Ultimately students concluded that the Howland Hill Road bridge (site 2) had negatively impacted water quality at sites 2 and 3 as compared to site 1 (base test). Students and faculty discussed possible causes for the data changes, including concrete, car exhaust, foot traffic, and

others. Ultimately, students concluded that this effect was essentially nullified between sites 4 and 6 (6,336 feet).



Figure 7 - Student in waders



Figure 8 - Student using bathyscope



Figure 9 - Students wading downstream to site 3



Figure 10 - Data collection

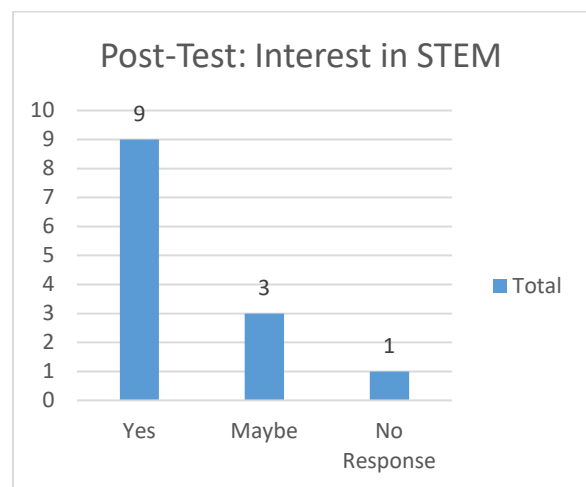
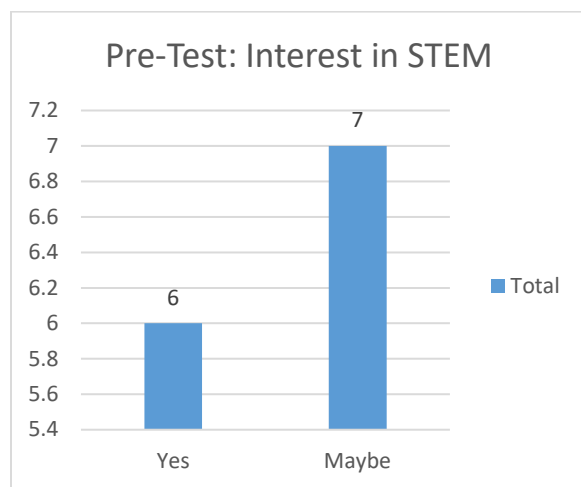
Educational Attainment

At the onset of the trip on 10/19/19, students were given a folder with CalTrout's (2017) publication, *SOS II: Fish in Hot Water*, CDFW's (2017) *An Angler's Guide to the California Heritage Trout Challenge* sections on coastal cutthroat trout (CCT), and information and pictures on CCT from Jeff Weaver, Senior Environmental Specialist for CDFW's Native Fishes Conservation and Management division. As part of this informational packet, students were given a pre-assessment to gauge their interest in science, experience with travel and undergraduate research, and knowledge of the coastal cutthroat trout (CCT) and habitat. At the end of the trip, on 10/21/19, students were given a post-assessment containing the same set of questions to capture increases in experience and knowledge.

Questions on the survey included:

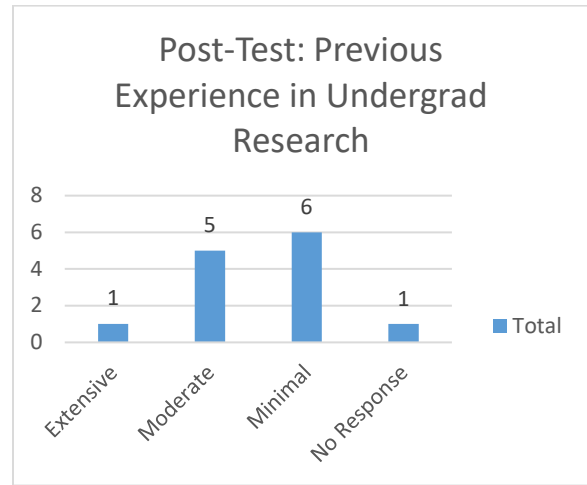
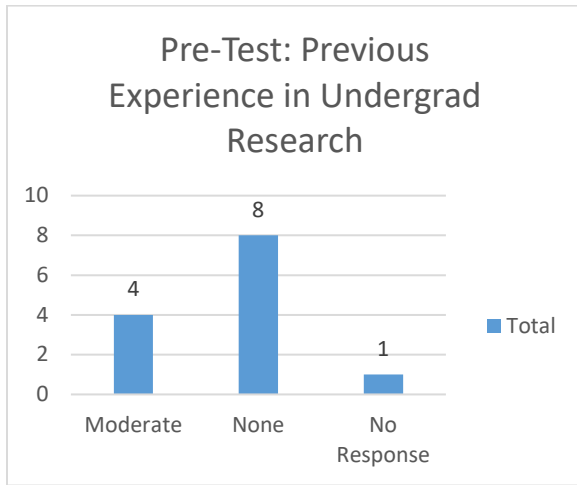
1. What is your major of study?
2. Are you interested in pursuing a STEM major?
3. What is the furthest you've traveled outside of Coalinga/Hometown?
4. What is your experience with undergraduate research?
5. Are you aware of the coastal cutthroat trout?
6. What is the current level of concern of the coastal cutthroat trout?
7. Which range in California is the coastal cutthroat trout native to?
8. Can you explain how the health of Mill Creek affects coastal cutthroat trout?
9. What are three components for "healthy" water to sustain coastal cutthroat trout?
10. What is optimal potential of hydrogen (pH) for coastal cutthroat trout?
11. What is optimal dissolved oxygen (DO) for coastal cutthroat trout?
12. What is the temperature range needed to sustain coastal cutthroat trout?
13. Is a total dissolved solids (TDS) measurement of 1000 mg/l beneficial to aquatic organisms?
14. What are three anthropogenic impacts on coastal cutthroat trout?
15. Would you like more opportunities to participate in undergraduate research experiences?

Below are selected outcomes of the survey measuring educational attainment:

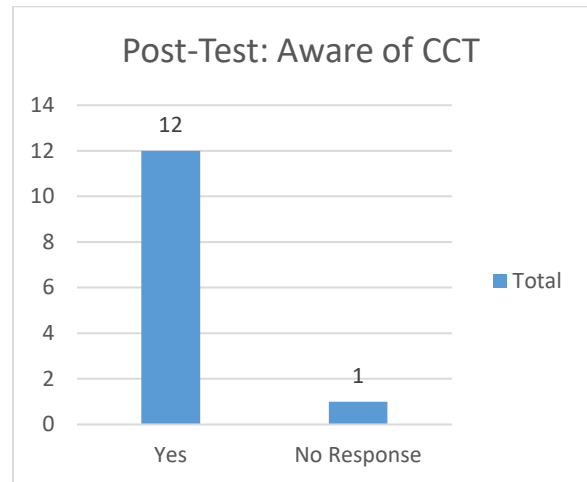
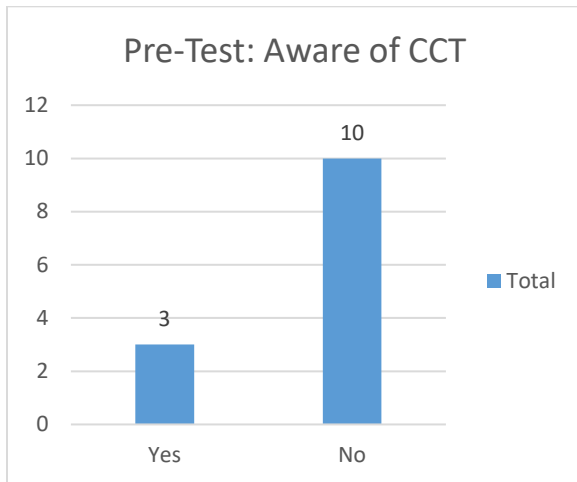


Prior to the research experience, 46% of students expressed an interest in STEM-related fields of study. Following the experiential learning expedition, 69% of students expressed interest in STEM-related fields. The difference suggests that through the experience of faculty-guided undergraduate

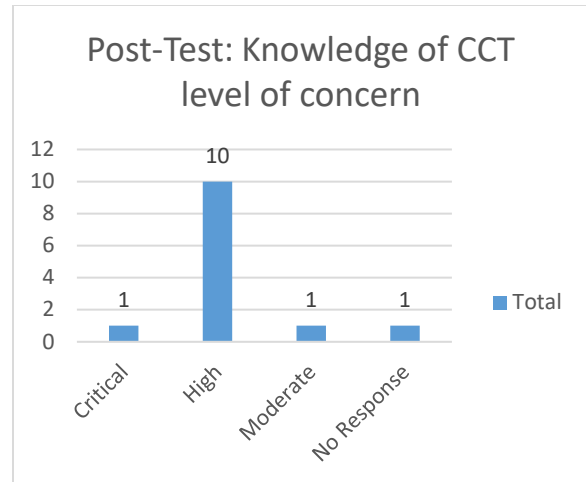
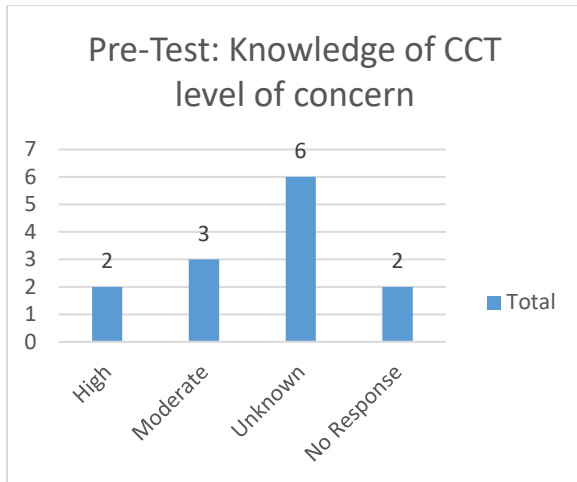
research, students develop a greater interest in STEM fields. Further, it suggests that raising awareness of STEM-related fields is achievable through a 3-day intervention.



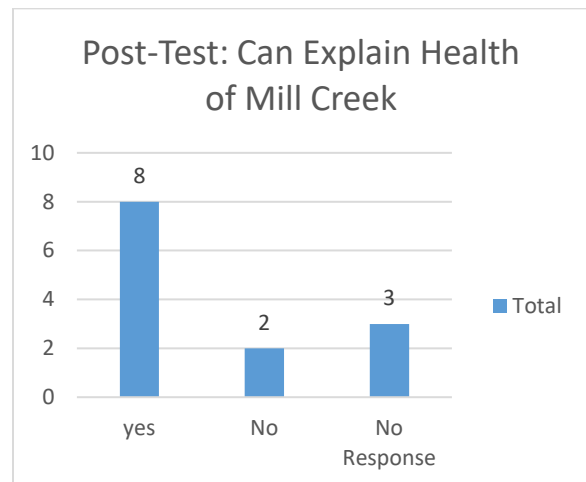
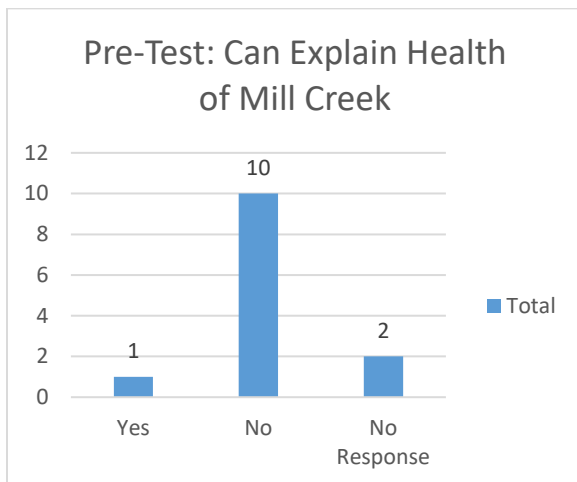
While most WHCCD students are freshman and sophomores in college for the first time, students were asked to self-identify their research experiences with undergraduate education. Prior to the research experience, 61% of respondents indicated they had no previous experience with undergraduate research. After the trip, all responding students indicated they had some level of experience with undergraduate research, 50% of whom rated their experience above "minimal."



Prior to the 3-day research experience, only 23% of students were aware of the coastal cutthroat trout (CCT). Following the trip to Mill Creek, most students (92%) reported having an understanding and greater appreciation for the CCT. Improved understanding and appreciation of the CCT also led to gains in understanding of the habitat and metrics that support a healthy and sustainable CCT population. Using information from UC Davis and California Trout's publication, *SOS II: Fish in Hot Water*, students identified additional aspects affecting CCT and provided substantive increases in knowledge illuminating why awareness of the CCT rose.



Prior to the experiential learning trip, only 38% of students expressed knowledge of "concern" of any kind of CCT. This metric tests understanding of risk designation based on Red list classes compiled by the International Union for Conservation of Nature (ICUN). Following the trip, most students (84%) correctly reported a high- to critical-concern of CCT on the Red list.



Prior to the research experience, only 8% of students could explain the health of Mill Creek. Following the expedition, 62% of students reported a confidence explaining the health of Mill Creek and how that health affects the CCT. This suggests through performing the measures and assessment on the potential of hydrogen (pH), dissolved oxygen (DO), ammonium (NH₄⁺), surface temperature (°C), total dissolved solids (TDS), and chloride (Cl⁻) on-site, students were able to synthesize data to actual outcomes relevant to the health and sustainability of the CCT.

Lasting Impacts

At the conclusion of data collection in the late afternoon, students gathered and sat on the banks of Mill Creek as it opens into the Smith River. Students and staff rested, talked, took pictures, ate snacks, and joked for the better part of an hour while the sun fell low in the canyon.



Figure 11 - Gathered at the confluence of Mill Creek and the Smith

While having fun, staff set out to catch a coastal cutthroat trout to bring some concreteness to the data collection. Staff caught and released a number of wild rainbow trout before landing a juvenile coastal cutthroat in a riffle thirty meters above the joining of Mill Creek and the Smith. The cutthroat was netted and placed into a small, natural holding pool, adjacent to the creek.



Figure 12 - Coastal cutthroat trout

Students gathered around the pool, took pictures, and engaged in dialogue about the trout's behavior. The discussion permeated the rest of the trip: 1,085 miles over three days to catch a glimpse of this cutthroat, an attempt to understand a thing beyond our own existence yet so dependent on us now to continue.

Hello, my name is Sandy Serrano, and I am a former West Hills College Coalinga graduate. Last year, in October, my Biology class and other students from the North District Center campus were invited to a trip in Crescent City to do some research. The trip was very fun and filled with amazing experiences. The group of students and I were in charge of finding pH levels, chloride levels and the temperature of the water in different regions of the creek. The goal of our trip was to find out if the coastal cutthroat trout was extinct or if it could live in certain regions near Crescent City.

This experience positively impacted my view on STEM by opening my eyes and giving me a feel of what can be done with science, technology and so much more. Being outdoors and learning about the different equipment that is used to analyze the water in the creek bed was very interesting to me. Prior to the trip, the farthest I had traveled was to Los Angeles, but I had always heard about how beautiful the Oregon border was and I had always wanted to go, so when I was given the opportunity to go on this research trip it was a great way to not only travel but also learn about the coastal cutthroat trout and its living environments.

While analyzing the streams that ran through the creek bed, I was able to find different organisms living in the environment as well. I honestly did not think that the coastal cutthroat was going to be able to live in the environment due to global warming, but it was amazing when we found out that they too can live in those regions. We not only examined the streams, we also found a coastal cutthroat, and the chaperons were able to catch it, so all students were able to see the fish that we were looking for. The trip was an overall great experience, and I would advise students to go on research trips to widen their knowledge.



Figure 13 - Lasting Impacts