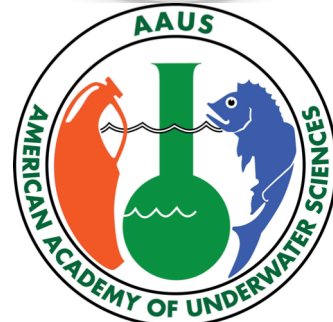




2019 OWUSS AAUS SCIENTIFIC DIVING INTERNSHIP REPORT

Kyra Jean Cipolla, Somers Intern



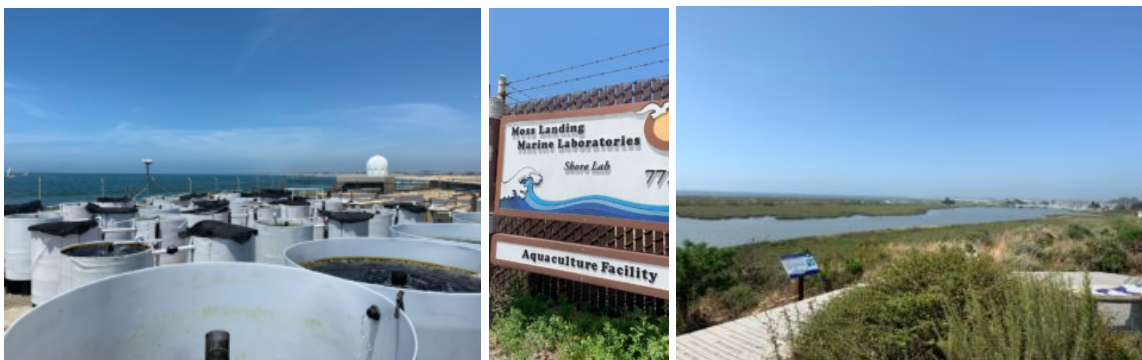
Introduction

When I first got the email that I was selected to be the 2019 Our World-Underwater Scholarship Society Somers Internship with AAUS, I was filled with happiness, excitement, pride, and nervousness. I had no idea what to expect since the internship details were unknown. On the website, location, date, and internship host were not there and I was fully aware of that when I applied since the internship changes hosts every year. My professional goal for the summer of 2019 was to be able to continue my diving education by utilizing the AAUS training, gain in-water training, and become comfortable and confident in the associated coursework no matter the location or time. And that is exactly what I did plus more! I definitely grew more as a person, researcher, and diver. Before this internship, I have had about thirty dives that were mostly in the Caribbean. In general, I have only dove with bigger groups, in clear warm water, and wearing only a swim suit and maybe a 3mm wetsuit. This internship was an immersive experience where almost everything I did was new and exciting but by the end of the summer, I felt very prepared and I cultivated diving and life skills in various ways.

Acquainting Myself to Moss Landing

First, I want to detail what I learned from my living accommodations and travel experiences during the internship while in Moss Landing. Before this internship, I had only lived with other people either at home or my school. I have always been surrounded by people in all my living situations and have had my own vehicle or used public transit widely. However, during the internship, I lived on a sailboat by myself and had limited modes of transport. At first, this was difficult for me since the sailboat I was living on was in an isolated area of Moss Landing and on a highway. There was a short walk to Moss Landing Marine Laboratories and

Marine Operations, however I had to walk along a busy highway. I quickly met and made connections with people nearby, mostly students and staff at MLML, exchanging rides for help on research projects. I'm normally an introvert but these exchanges allowed me to branch out and learn more about people's academic path and their career while gaining research experience. The sailboat was a completely new experience for me. It was wonderful experiencing life on a boat because of the beautiful water on the Elkhorn Slough, local people, and the animals (seabirds, sea otters, and sea lions). It was also the best option due to the dynamic nature of the internship. In total, I spent approximately 4-5 weeks in Moss Landing. The first week I was there, after the trip to Mexico, and after the trip to Catalina. While in Moss Landing, in the first week, I situated myself to the quiet area and the marine labs.



Tanks for seaweed at MLML Aquaculture Facility, Aquaculture Fac., View from Moss Landing Marine Labs

Research At Moss Landing

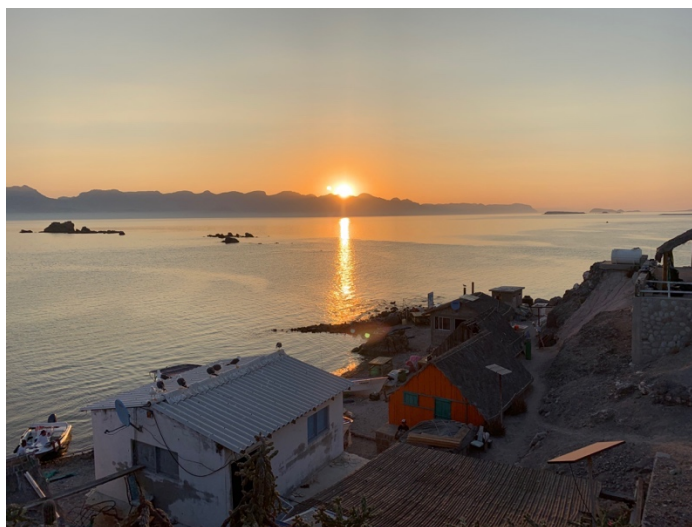
I also volunteered at the Moss Landing Marine Labs Aquaculture facility for a graduate student that worked there. The student, Dan Gossard, was part of the phycology lab (studying the distribution and life cycle of *Pyropia nereocystis*) and was working with the seaweed that grew in the facility that they actually sell to chefs. I weighed dulse seaweed, emptied a tank, and cleaned it out. The location was very refreshing since I could see the beach and ocean only 20

feet away. I actually ended up diving off that beach about three months later for the AAUS course. I was also able to have my checkout dive at Breakwater before I left for Mexico. This was my first time diving in cold water and shore diving so this was a very new and interesting experience for me. My wonderful instructor, Sloane Lofy, is also a grad student at MLML who studies kelp in the Phycology Lab. I was using spare gear that MLML had so the suit did not fit me perfectly. This was also my first time wearing a hood and I felt very restricted and a bit overly cramped. Now I am aware of different diving situations and that owning my own gear makes a huge, positive difference (which I will explain in the Catalina section of this report). Fortunately, it was a good checkout dive at Breakwater once I got used to the water and the gear/equipment. Then my first field experience in Mexico began 5 days after I arrived in California.

Mexico Research Trip

From June 8th to the 22nd, I went to Mexico to help on research projects focused on sea turtles, manta rays, and fish within a protected area. Myself, Diana, and her family flew from San Jose to Tijuana to La Paz. We stayed in La Paz for two days and then we left for El Pardito, a small rock island. The crew on this research trip consisted of a few faculty and their graduate students from University of California Santa Cruz, a graduate student from University of California San Diego, a turtle researcher from Costa Rica, an assisting researcher from Mexico, and myself. The faculty from UCSC were Donald Croll (Professor) and Kelly Zilliacus (Data Analyst and Lab Manager) who have been to the island countless times. Luli Martinez, Ph.D. candidate under Dr. Croll whose project titled, “Effectiveness of spatial strategies for the conservation of large pelagic vertebrates: Locally Managed Protected Areas as a strategy for the

conservation of hawksbill turtles in the Gulf of California,” was the main project I assisted with while on El Pardito. To find out what exactly the turtles are consuming, our team identified and collected 100 samples (approximately 10 of each species) of sponges, tunicates, and vegetation within the mangroves via snorkel. Dorota Szuta, a former Master’s student from the benthic ecology lab at Moss Landing Marine Labs, showed us the invertebrates and vegetation we needed to collect (and taught me a few knots!).



View from the top of El Pardito.

After collection the goal was to run isotope analysis on all the samples so we had to dry them out. We made small boats out of aluminum foil for cleaned samples to dry in the sun. This project took up the first few days and the student from UCSD, Kara Reynolds, was in charge of the samples. She is a Master’s student under Dr. Carolyn Kurle and is studying the foraging ecology of a population of hawksbill turtles in the Sea of Cortez using stable isotope analysis. I also connected with Melissa Cronin, a Ph.D. candidate in the Conservation Action Lab at UC Santa Cruz studying Ecology and Evolutionary Biology. Her research focuses on mapping and mitigating marine fisheries bycatch, mainly looking at manta and devil ray bycatch in industrial fisheries. Another researcher involved in the manta project is Nerea Lezama Ochoa, the project

leader of Save our Seas Foundation who aims to reduce unintentional mobulid by-catch in the eastern Pacific Ocean by researching them in El Pardito and other areas. I got to watch these two inspiring ladies drive a drone over water near the island and Estero to monitor mantas and their population size. Daniel Arauz Naranjo, a National Geographic Explorer and manages a sea turtle project at Costa Rica's Rescue Center for Endangered Marine Species (CREMA), where he catches, tags, and monitors sea turtles in foraging grounds in Costa Rica. He also coordinates a sustainable fisheries project, working with local fishermen to promote science and conservation. Andrea Paz Lacavex is a recent graduate at Facultad de Ciencias Marinas, in Universidad Autónoma de Baja California.



Kyra Jean and Andrea Paz after a successful fish survey!

Myself, Daniel, Andrea, and Kara worked together on dive and snorkel days to finish fish transects along sandy areas and along mangroves within the Estero. We learned different species of grunt, snapper, stingray, parrotfish, wrasse, damselfish, and more for the fish surveys. I have done fish surveys in the past but at 40 feet in clear water. These fish surveys happened by the mangroves so in 4 feet of murky water. When there were too many fish we had to use Diana's 'Snapshot' method. The 'Snapshot' method is where you take a mental screenshot of the school

of fish in the front of you and then recorded the number and size of those fish. It was very pleasant to learn a new method of sampling and use it correctly only an hour later.



Cortez Stingray cruising along the bottom of the sand

This trip was very exciting for me since this was my first time in Mexico. Diana and the whole crew made me feel welcome. Out of the entire group, myself, Daniel, Andrea, and Kara were the only new members and we all became very close through working together on the various projects. I dove a handful of times for the turtle project and the fish sampling project. For example, Diana Steller and I dived to put in receivers for the turtle tagging project. As I discussed in my blog, this was my first dive in Mexico and my first time working underwater with a receiver. The dive consisted of finding the GPS point of the old receiver, dropping cinder blocks with chains attached, descending to attach the receiver to the cinder block. For the second receiver, we used a screw anchor which involved kneeling on the sand and twisting a metal bar into the sand in order to attach the receiver. This was very engaging for me since I have never really done physical work like that underwater. I've done 3D models on reefs and other transects but that only involved slowly hovering, recording data, and measuring things. The receiver dive included moving items, tying things, and trying not to lose my dive buddy. I felt a strong sense

of teamwork with Diana and we effectively communicated for the placement of the receiver. It was really great to practice communication without a slate on the first receiver dive. For example, there was an inconvenient knot in the rope that held the concrete block and Diana went to untie it but instead I made her aware that I could lift the block while she moved the rope out of the way- in order to save time. This was a simple interaction but a great example of problem solving that made me feel pleased and accomplished. Working with my hands underwater to complete a task made me feel very capable as a diver. I was nervous at first since it was my first dive with Diana as well as my first dive in low visibility. My past dive experience has been in mostly clear water so it took me some time to get used to. Some of the blame of the low visibility was the Sargassum, which I learned from Diana and Kelly. During the dive, I thought of the Sargassum that has been decimating areas in the Caribbean.



El Paredito, Mexico

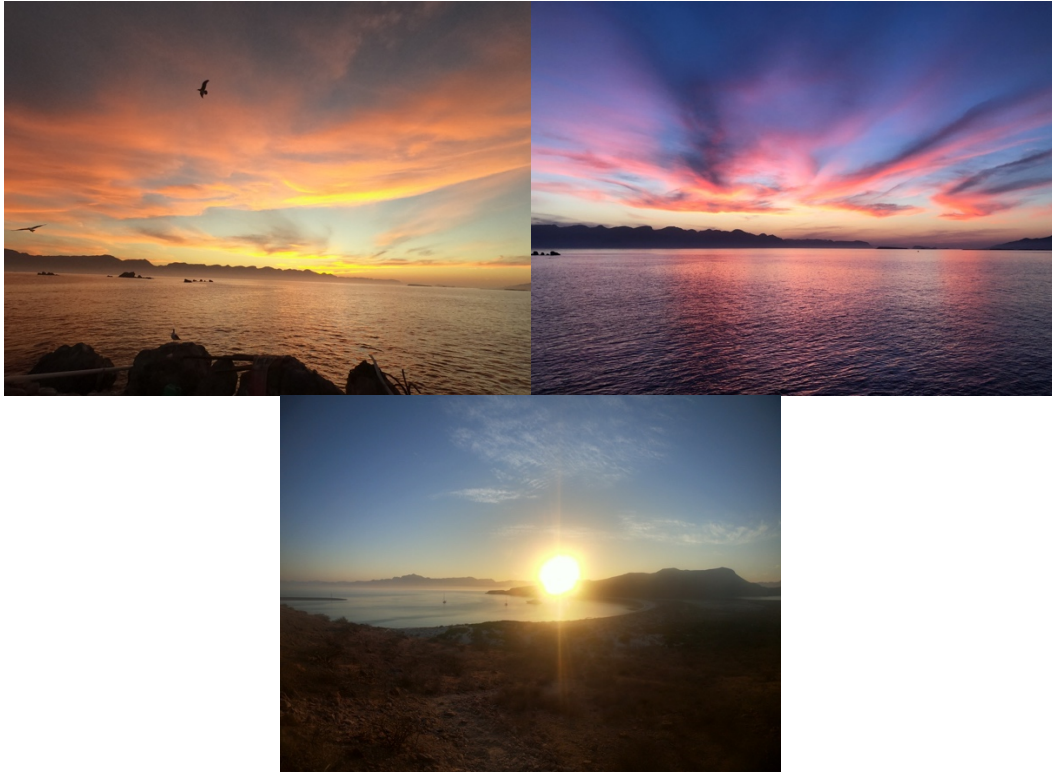
Another dive-related part of the project was diving for turtle fecal matter during the Mexico trip. Years ago, Diana and her past graduate student, Dorota, found feces from a turtle that had green specks of algae, tunicate, and other benthic life. Although rare, it is the perfect opportunity to find out what these turtles consume. Then I and others ended up with our faces a foot above the sand scanning for turtle poop. There have been 13 poops total found in the past

and after about three dives we, unfortunately, found none. Dorota and I found a false one which we tried to collect. We carefully had to place it in a plastic bag where it eventually dissolved and we realized it wasn't the golden poop. This experience, although technically a failure in the books, was very exciting since it was my first dive experience where I was actively searching and collecting something. While we tried to collect the "poop" underwater, we had to do things that terrestrial biologists don't have to even think about. One person had to carefully put the bag slightly under the "poop" while the other gently nudged it into the bag without having it fall apart. All while not stirring up the sediment and blinding us entirely.



Kyra Jean, navigating with a GPS (Photo: Dorota Szuta)

Luckily while we were there, we went as a group to hike, explore, and watch the full moonrise at a nearby island. The views were breathtaking and I felt very grateful to have fun carefree experiences that allowed me to enjoy the local area (marine and terrestrial). After the 10-day trip, we spent two days in La Paz. Some of us visited the La Paz Serpentarium where we got to see snakes, birds, alligators, foxes, and feed some guinea pigs and rabbits. I enjoyed this a lot since I got to learn about the terrestrial animals in Mexico.



Compilation of sunsets in Mexico

In-between Research Trips

After the trip to Mexico, I had two weeks in Moss Landing to learn about dive safety and maintenance from Shelby Penn, a Masters student at MLML in the Phycology lab. She taught me how to fill tanks, how to use and maintain the Moss Landing compressor, how to tumble tanks, and the details of visual inspections of scuba tanks.



Shelby Penn (Assistant DSO) & tumbling tanks.

I also got to help Diana with cataloging old rhodoliths collected from various places in Mexico and California. I constructed a table of associated Echinoderms found in rhodoliths. This little project has the potential to turn into a small paper that I can work on to submit to a journal - which I will continue to work on after the internship ends. I also got to show children what I was doing and this was a surprising and exciting chance for science communication/education that I wasn't expecting to do during the internship.

Santa Catalina Island Trip

On July 14th, myself, Diana, and Charnelle Wickliff (a Master's student at Moss Landing) left to go on our second research trip of the summer to Santa Catalina Island. The team was a mix of graduate students and undergraduates from different universities. From Moss Landing were Charnelle Wickliff who is studying seastar wasting syndrome impacts on coastal habitat composition and June Shrestha, seeking to answer the question of, "How do human activities—such as fishing and subsequent establishment of marine reserves—affect nutrient cycles via fish pee?". I got to learn a lot about the science behind these projects as well as how they integrate

scientific diving into their research. From San Diego State University, Scott Gabara (PhD candidate and past Master's student of Diana) studies latitudinal variation in urchin barren dynamics. In the past, he has used stable isotopes to trace energy flow in kelp forests and rhodolith beds systems off Santa Catalina Island. Also from SDSU was Darrin Ambat who was examining the effects of pH on the trophic interactions between purple urchins and California Sheephead. Dr. Matthew Edwards runs the Kelp Ecology lab at SDSU and his research focuses on patterns of variation in giant kelp (*Macrocystis pyrifera*) forests at multiple spatial and temporal scales throughout the species' geographic range in the Northeast Pacific Ocean along with how opportunistic marine algae maintain populations in spatially and temporally heterogeneous environments. Although not all of the projects/research topics that were described were incorporated into this research trip, it is important to note how all these people with different backgrounds and skillsets came together to work on projects together on Catalina.



Amazing lab work by the entire group.



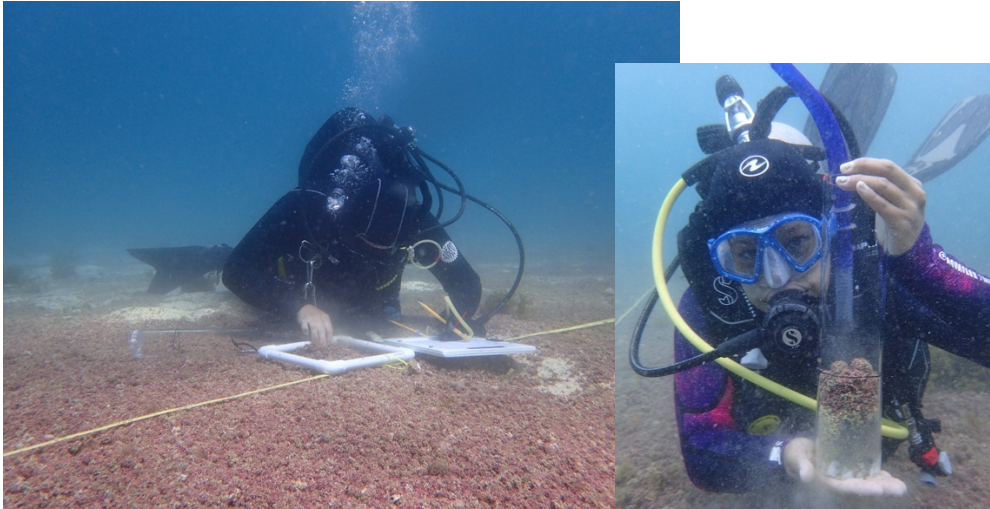
Although we did not have the best visibility, we were the best dive team.

The main project that I assisted on was led by Diana Steller and Matthew Edwards who are co-principal investigators on the project titled, “Minimizing disturbance impacts by California vessel mooring systems on living rhodolith benthos in Catalina MPAs: an experimental assessment.” The project objectives are: “to identify and experimentally evaluate potential vessel mooring systems that may reduce impacts to rhodolith beds and other sensitive Catalina Island benthic habitats; to identify a suite of efficient field metrics to rigorously monitor integrity and recovery of rhodolith habitats; and to assess productivity and ecosystem functioning of rhodolith beds in order to evaluate restoration potential for recovery of impacted habitat.” (Steller & Edwards, SeaGrant). USC Wrigley Marine Science Center, located on Big Fishermen’s Cove, is a state-of-the-art research center and teaching facility on Catalina Island that we used to store samples, sort specimens and samples, and conduct experiments.

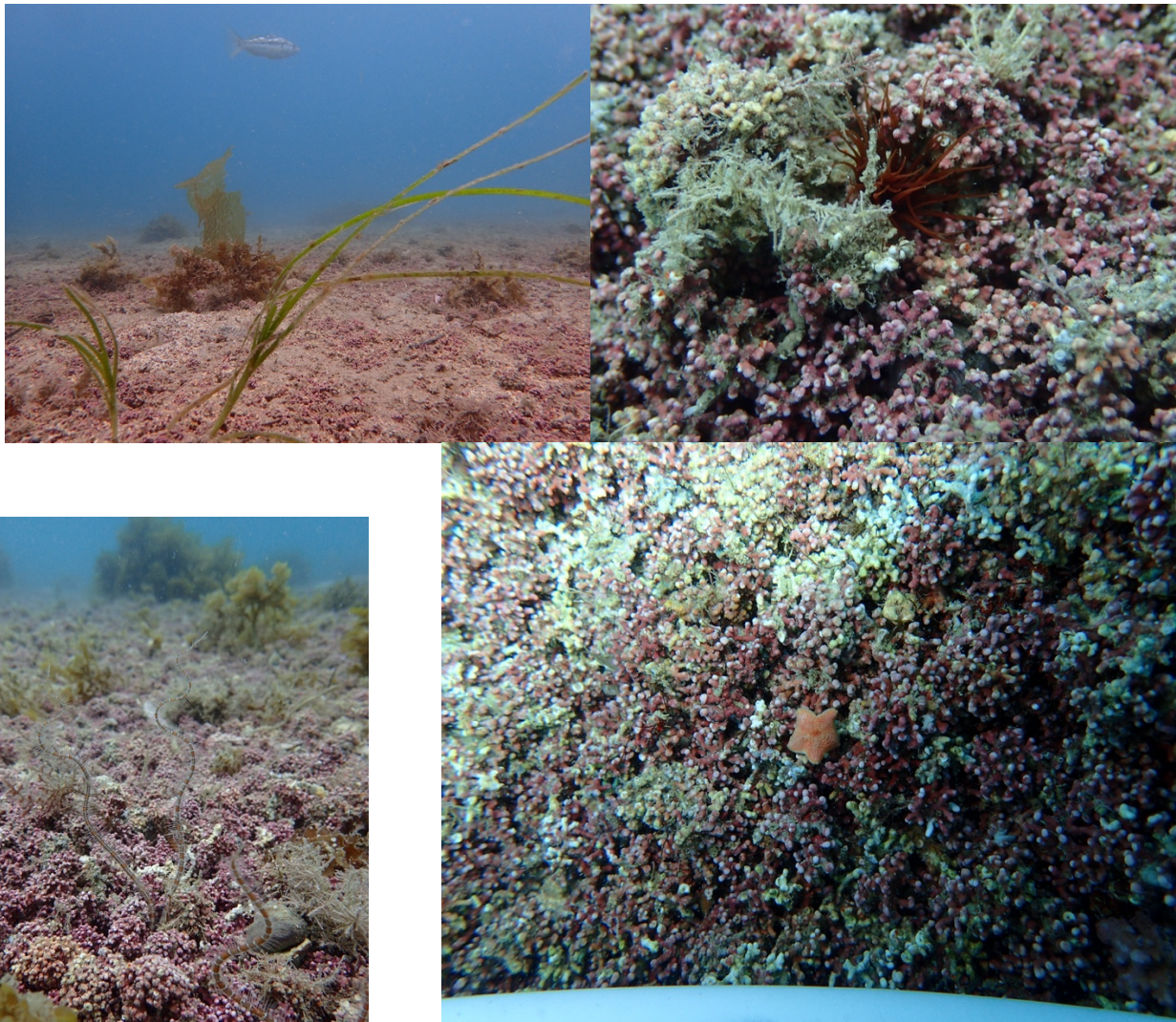


USC Wrigley Marine Science Center (Photo: USC)

Right on the day we arrived at Two Harbors (Big Fishermen's Cove) on the 15th, I dove with the Survey Team at Emerald Bay. The Survey Team consisted of Diana, Scott, and June. In total, we went to 6 study sites around Catalina and conducted benthic surveys inside and outside rhodolith beds. June conducted fish surveys and Scott would lay out the transect, identify the benthic substrate, count and identify the associated organisms on top of the rhodoliths within each 1m² quadrat. Diana and I would work with Scott on the same transect and use a 25 cm x 25 cm quadrat for substrate percent cover and we dug to collect organisms like snails, sea stars, urchins, and other small creatures. We also obtained sediment cores to collect live and dead rhodoliths to do size frequencies (where we took abundance in each size class and measured the volume).

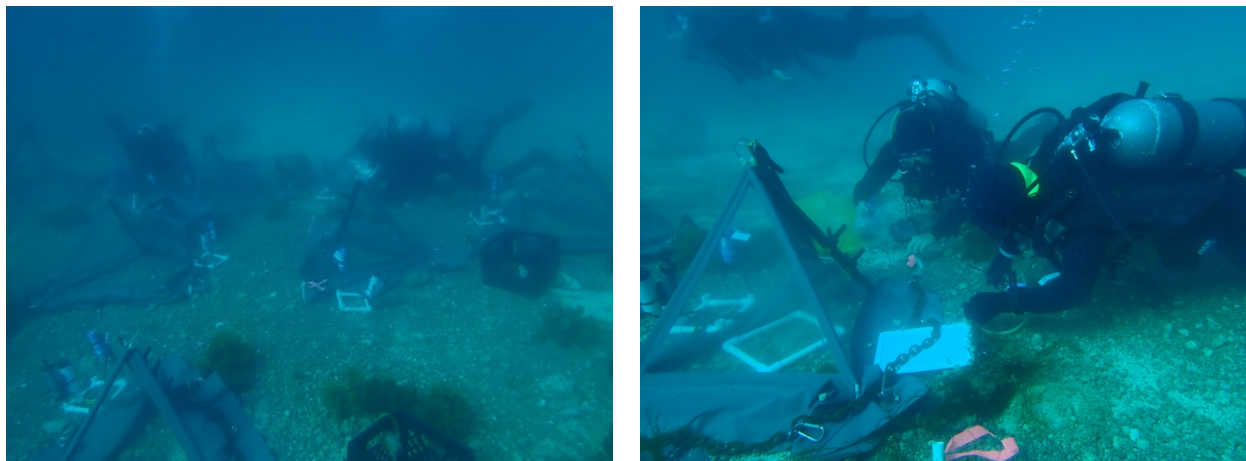


Scottie surveying the rhodolith bed using a quadrat & Kyra Jean with a core.



Rhodolith beds and associated organisms including anemones, brittle stars, and a sea star.

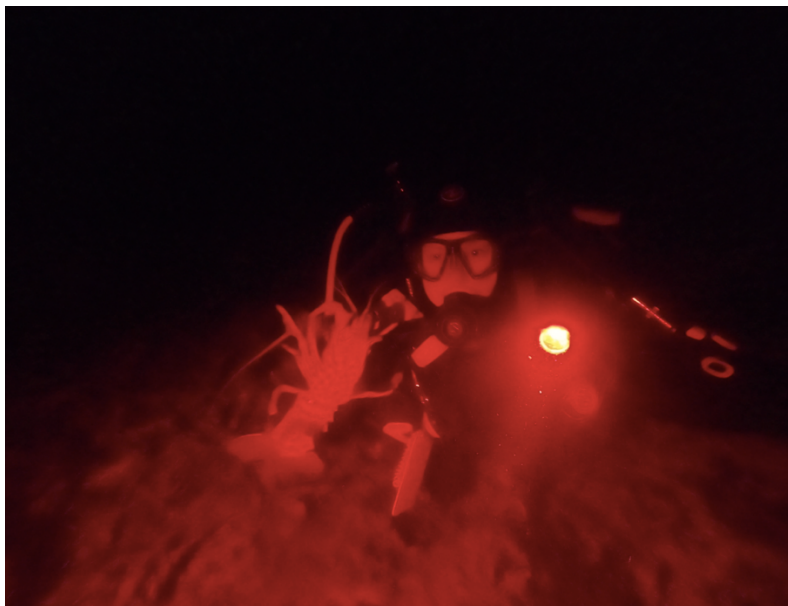
The second part of this project utilized underwater chambers. In total, 10 chambers were deployed, some located within rhodolith beds and some on top of crushed rhodolith/sand habitat. Inside the chambers were sensors that took measurements of water quality. During chamber surveys, benthic details and cores are taken as well. An additional part of the chamber experiment involved crushing of the rhodoliths with chains to mimic the crushing action of mooring chains. A Tupperware, a rigid cylinder, and a spoon were used to collect live rhodoliths in order to bring them back to the lab to find size-frequency for samples within and outside rhodolith beds. Although I spent most of my dive time assisting in the first part of the rhodolith project, I assisted in collected size frequency within the chambers as well as deployment and retrieval of the chambers at two sites. For the first time, I lifted heavy chains underwater and actually had to take a fin off to hobble it over to secure a chamber. I've never done heavy work like that on a research dive so it was a very unique diving experience for me.



Setting up chambers (Photo: Darrin Ambat)

Another project that I assisted with while in Catalina was a project by MLML/CSUMB Master's student, Taylor Eddy. Taylor is studying how spiny lobsters interact with the intertidal habitat and the seasonal variability of these interactions. Specifically, she is looking at how different food resources available in this habitat affects their reproduction and demography (size,

sex, and abundance). To do this, she collects lobsters at high tide in the intertidal and subtidal, records the size, sex, and reproductive status of each lobster, and then removes a leg to get a muscle sample for a diet study. Dillon Dolinar, an undergraduate student at SDSU that has been assisting the rhodolith project for over a year, also assisted on the lobster project. The project required sampling at night, and for the first night dive at Big Fisherman's Cove, I had the role of the "runner" which meant I transported the caught lobsters from the lobster catchers (Dillon and Riley, who is an undergraduate student from CSUMB) to the boat where Taylor and Charnelle would extract a muscle sample. Once they were done, I returned the lobsters to where they were found. For the second night dive at Birdrock, I was a lobster catcher and successfully caught about 10 lobsters by hand! This was my first time using a red light (since lobsters can not see red), catching a live animal, and diving in the intertidal zone of an island. This diving experience had many firsts for me and I had my own dive gear during all of the dives. I felt very comfortable and was able to focus on the dives instead of how cold or claustrophobic I felt as I did during my first dives near Moss Landing.



Kyra Jean with a lobster.

Truthfully, a rhodolith bed is a whole new world. I was intrigued and inspired during the entire research trip at Catalina because of the hidden world within the rhodolith bed and also by the people I worked with. I learned so many diving techniques and got experience handling several data collection instruments (yes, I consider a spoon and Tupperware as research instruments now). Diving in harbors is another experience I can reflect on. Because of heavy boat traffic, communication before, during, and after dives were extra important and I was very aware of dive risks. Diving safe was our main priority as always and navigation skills were utilized every dive, which I fine-tuned by the end of the trip. We ended the Catalina trip a day early, June 28th, since we were efficient data collectors! I was able to attend the 2019 Joint Meeting of Ichthyologists and Herpetologists and present past research. Upon my return, I continued to assist Diana and Shelby prepare for the AAUS Scientific Diving Course.

MLML AAUS Diving Course

On August 5th to the 17th, I participated in life-changing, inspiring, and lively course of my life: the MLML AAUS Scientific Diving Course taught by my internship host, Diana Steller, and her assistant DSO, Shelby Penn. The course passed by in four days but in my head it felt like we were doing a semester's worth of hard work in two weeks.



Group photo of our wonderful AAUS class and Dan Abbott from Reef Check.

The activities that filled a substantial amount of the time for the first week were training and AAUS/NAUI lectures on different topics including equipment, cylinders and regulators, species identification, dive emergency & rescue, diving physics, and diving physiology. After expanding our minds in the classroom by familiarizing ourselves with protocols, we enhanced our dive and snorkel skills in the water. We had our checkout dives at Breakwater Cove (where I had my first cold water dive at the beginning of the internship...full circle!). Then at Hopkins Marine Station we had our first practice on Reef Check CA surveys. Reef Check, a non-profit organization recognized across the globe, helps ensure the long-term sustainability and health of rocky reefs and kelp forests along the coast of California. They monitor rocky reefs inside and outside of California's marine protected areas (MPAs). Reef Check also provides scientific data needed to make knowledgeable decisions for the sustainable management and conservation.

During Reef Chef we learned species identification of fish, abalone, crabs, sea stars, slugs/snails, sea cucumbers, urchins, kelp, and other algae. As a dive team, we conducted four

different surveys: algae, fish, invertebrates, and uniform point contact (UPC) using 30 meter transect tapes. For all measurements during the data collection, we used our “body measurements” for the more accurate measurement. For algae, we counted individuals (only if they met certain length requirements) and recorded number of stipes for two species: Feather boa and Giant kelp in an area of 2 m across the transect. We also had to keep an eye out for algae species that are invasive including *Caulerpa* sp., *Undaria* sp., *Sargassum muticum*, and *Sargassum horneri*.



Up close and personal with Nereocystis luetkeana.

For invertebrates, we counted individuals (of certain lengths) and recorded sizes of abalone. For fish, our instructors and trained volunteers (a few have been involved with RCCA for years and one actually helped start the initial program) counted and sized the fish that they observed in an area 2 m across the transect tape and 2 m off the bottom (30 m x 2 m x 2 m). The goal of UPC is to characterize the habitat so this survey combined cover, substrate, and relief at 30 points along the transect.



Positivity and smiles before our surveys! Pictured: SJSU student, Chase McCoy.

UPC Data Sheet

SITE _____ Date _____ Diver _____

Volunteer (s) _____ Bully _____

Transsect #1										Transsect #2									
Time	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End			
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
Total must = 30																			

N = sand (<0.5 mm)
 C = rubble (0.5 cm - 15 cm)
 B = Boulder (> 15 cm - 1 m)
 R = Reef (> 1 m)
 O = Other (anthropogenic, etc.)

N = None
 B = Brown kelp forest
 C = Other brown algae (including treasuries and leather leaf)
 O = Other algae
 R = Red algae
 O = Encrusting red algae
 AC = Artificial Corals
 CC = Crustacean Corals
 S = Sponges (including sponges, anemones, sandcastle worm etc)
 M = Mollusks (including snails, shells, whelms, limpets etc)
 BG = Bivalves (including scallops and mussels)

0 = 0 to 15 cm
 1 = 15 to 30 cm
 2 = 30 to 45 cm
 3 = 45 to 60 cm
 4 = 60 to 75 cm
 5 = 75 to 90 cm
 6 = 90 to 105 cm
 7 = 105 to 120 cm
 8 = 120 to 135 cm
 9 = 135 to 150 cm
 10 = 150 to 165 cm
 11 = 165 to 180 cm
 12 = 180 to 195 cm
 13 = 195 to 210 cm
 14 = 210 to 225 cm
 15 = 225 to 240 cm

Max height difference
 in box 0.5 m x 1 m in
 front of point

Reef Check California

Reef Check Data Sheets 3.4.19

UPC data sheet from Reef Check

During the second week of the diving course, we camped and practiced more Reef Check surveys at Big Creek State Marine Reserve in Big Sur, California. Big Creek is a 14.51 square mile MPA that was established September of 2007. In my opinion, this dive site was the perfect place to obtain our AAUS certification. There was an easy beach entry, a freshwater stream nearby to rinse off our equipment, grassy area for our belongings, and super thick kelp to explore in.



Various features of our beloved dive site, Big Creek.

On our last survey day, Dan Abbott from Reef Check came to test us on our species identification skills. Once we were checked off on specific survey groups, we divided into 3 teams with each diver in charge of one specific survey.



Dive Team A. Chase McCoy, Shelby Penn, Kyra Jean Cipolla, Diana Steller, and Mariana Kneppers (left to right).

Although I discussed this in a blog, I have to reiterate it here too. I am thankful for the personal lessons that I have learned over this summer. I couldn't have wished for a better way to end the AAUS/OWUSS internship. This small group of people, of seven wonderful people, have become lifelong friends and dive buddies. By spending time every day with each other for two weeks, we all became very close and helped build one another's skills and experience. Through difficult and hard times, we supported each other well and lifted each other's spirits when we felt low or were uncomfortable. Scuba diving is an activity where you trust your dive buddy with your life. This allowed us to build strong relationships and work together perfectly. We trusted each other to finish surveys as a research team and most importantly, dive safe.

Acknowledgements and Deepest Thanks

Deepest thanks to Diana Steller, without her there is no way I would've obtained four diving certifications, completed Reef Check training, helped on multiple research projects in California and Mexico, and had the time of my life this summer. I've learned many lessons about marine science, diving, and life from Diana. One of the greatest overall personal achievements that I gained this summer was getting the exposure to diving in a cold water environment and Diana was the one who positively pushed me the most. She is a role model to so many students and throughout the summer, all I heard was, "you are so lucky to be her intern," and that couldn't be more true. She is an inspiration for female scientists, student, and divers. I learned how to be strong, smart, organized, and to let emotions free from Diana Steller and I am forever grateful to have gotten to know her through this internship.



Thank you to the people from Moss Landing Marine Labs, San Diego State University, California State University, Monterey Bay, USC Wrigley Institute for Environmental Studies and those who participated in the AAUS Scientific Diving Course for the adventures, shared laughter, and teaching me how to be a better diver, researcher, and person.

Most importantly, I cannot thank the Our-World-Underwater Scholarship Society enough for giving me this opportunity and for the generous financial support. I also am grateful for my connections with the Our-World-Underwater Scholarship Society and The American Academy of Underwater Sciences. Thank you to Katherine Newcomer for the help with my internship preparations, helping me with expense reports, and giving me great advice during the entire internship. Thank you to Ross Whippo for all the help with my blogs. I also greatly appreciate Jenna Walker, Vice President of Internships and Ellie Roberts, Lead Internship Coordinator.

I can't wait to see the success of future Our-World-Underwater Scholarship Society and AAUS interns and to follow in the footsteps of past researchers and scientists. Although this is my final chapter as the OWUSS and AAUS intern, I am looking forward to dive deeper into marine science in the future.