The Southern California Marine Institute

Annual Report
2018-2019

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Mission

The mission of the Southern California Marine Institute (SCMI) is to foster marine research and education, focusing on urban impacts of the greater Los Angeles region on the coastal ocean. We seek to improve scientific understanding and the development of solutions that will enable coastal waters and watersheds to thrive, adapt and become resilient to ongoing environmental stressors.

Who We Are

SCMI is a consortium representing a strategic alliance of 23 major universities, colleges, and foundations in Southern California. This includes nine universities from the California State University system representing the Ocean Studies Institute: Channel Islands, Dominguez Hills, Fullerton, Long Beach, Los Angeles, Northridge, Pomona, San Bernardino, and San Marcos. SCMI also comprises the combined marine resources of the University of Southern California, Wrigley Institute for Environmental Studies, University of California Los Angeles, Occidental College, Los Angeles Community College District, The Bay Foundation, and NOAA National Marine Fisheries Service West Coast Region.

The consortium structure of SCMI allows us to engage in specialized marine research that would not otherwise be possible through independent organizations, and to maximize the use of resources as well as collaborate on projects. SCMI is located in the heart of the Port of Los Angeles on Terminal Island. Our facility is a full functioning marine research institute equipped with offices, laboratories, classrooms, a seawater filtration system, machine and wood shops, and a warehouse. There is ample docking space for small boats from various universities and organizations, as well as the research vessel R/V Yellowfin.

Director's Message

We have had another great year at SCMI. It seems that SCMI is more vibrant than ever; boats are coming and going every day, research in the labs and aquaria is going full speed and tons of students are receiving their boating and diving safety training. Unfortunately, this year marked multiple boating accidents and the most serious marine accident in recent history, which reinforced our commitment to leading the scientific community in boating and diving safety. As we have learned, compliance is not enough, that's why SCMI supported by the Ocean Studies Institute of the California State University instituted its MOTC boating safety program and now leads the Southern California research, academic and resource agencies in this endeavor. Along these lines, our scientific diving program is continuing to increase enabling us to facilitate a diverse array of research programs in a safe and practical manner.

The research programs being facilitated by SCMI have many highlights, but I think everyone's favorite was Dr. Larry Allen's giant seabass. Everybody loved to see, feed, get splashed by and take pictures of these magnificent creatures. With the oversight of the SCMI staff, not only was Larry able to achieve his research goals of documenting their sound production, but also, they spawned all summer and the juveniles are still swimming around at Cabrillo Marine Aquarium and the Aquarium of the Pacific. The fish will be tagged by Dr. Chris Lowe's Shark Lab and released to be tracked as the move up and down our coastline. This is just a huge win all the way around and emblematic of the potential SCMI holds. Doing research that cuts across campuses and institutes is what we are all about.

Our next big project is the Palos Verdes Restoration Reef being constructed next summer. This $6,700,000 restoration project supported by NOAA and the California Coastal Conservancy is being constructed next summer is the first of its kind in California. SCMI is the lease holder and completed all of the permitting for this restoration reef. This project has embedded into it replicated design elements that will allow decades of critical research to be conducted as well as restoring an enormous amount of lost habitat. Multiple investigators have already shown interest in this project and this is another example of how SCMI fosters collaboration across campuses and agencies.

Basically, if there is something you need done, we're here to help. I hope to see you on Terminal Island in 2020.

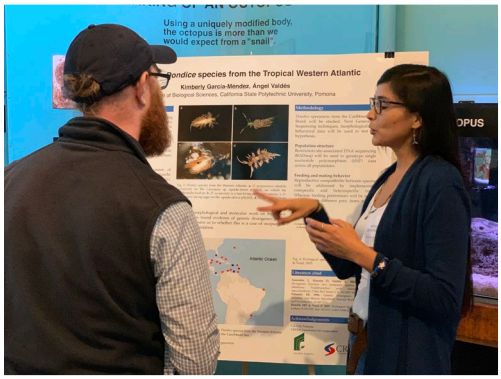
Introduction

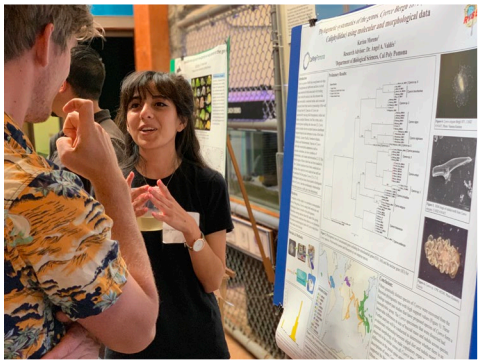
The Southern California Marine Institute (SCMI) has had an exciting and successful year. The year started off strong with a busy research season over the summer. SCMI assisted in research collaborations with University of California Los Angeles and the Los Angles Natural History Museum on an eDNA study. SCMI had another great batch of volunteer interns assisting SCMI staff with a wide range of projects from water quality to animal husbandry. SCMI's interns ranged from recent university graduates looking to gain valuable work experience for high school students researching degree options. This year again saw a successful CSU Marine Biology Semester on Catalina Island with 5 CSU participating and 17 students attending. Ocean Studies Institute had successful annual symposium that showcased exciting research from the 9 CSU campuses in our consortium. The Bay Foundation's Abalone lab build was completed and now housing white, green, and red abalone. The R/V Yellowfin was booked solid with educational cruises supporting over 1800 students and researchers. SCMI assisted with some exciting research this year including CSUN's Dr. Larry Allen's Giant Sea Bass Study which saw seven successful spawning producing 700 babies. SCMI finished permitting the Palos Verdes Restoration Reef with funding from the California State Coastal Conservancy and NOAA.

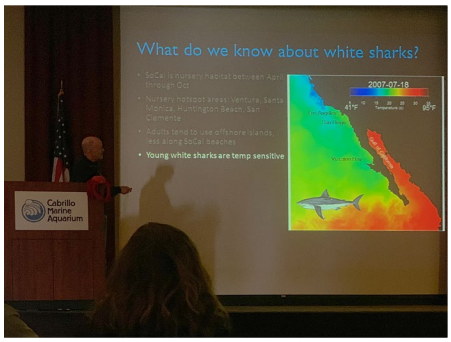
What's New?

OSI Research Symposium

The Ocean Studies Institute held its first annual Research Symposium at Cabrillo Marine Aquarium on April 19, 2019. The Symposium was a great success with 10 OSI faculty members presenting their ongoing research and 12 OSI graduate and undergraduates students presenting posters of their research from over 6 of OSI member campuses. The full day event brought together over 50 distinguished marine science researchers from many disciplines, students and the public. Simulating presentations covered topic such as; white sharks off California, deep learning based on data augmentation, biofilm detection, rocky intertidal habitats, Giant Sea Bass songs, and fish assemblages around oil platforms.







Service Goals

Facility Improvements

This Year SCMI has worked hard to meet the service goal to provide and grow the facility for our member institutions to carry out their educational and research activities. SCMI purchased a new CTD for research and educational cruises. The YSI DSSpro CTD is handheld with 20 meters of cable, a handheld readout and measures pH, dissolved oxygen, conductivity, turbidity, temperature, depth and barometric pressure. It also has a GPS and is capable of logging data as well. The unit has already been on several classes and contracts and has proved to be a fine little workhorse when something smaller and shallower than the SeaBird CTD is needed.

SCMI also refurbished our supply of Niskin bottles that were used in research contracts with the Los Angeles Natural History Museum and UCLA eDNA surveys.

SCMI also saw improvements in our building with repairs to the parking lot and hallway floors. Asbestos tile flooring in the hallways was removed and the floors were refinished.

The Bay Foundation Abalone Lab

The Bay Foundation (TBF) joined SCMI as its first non-academic member in late 2015. Joining the SCMI team provides TBF convenient access to the local rocky reefs where they can manage and monitor their kelp forest and abalone restoration projects.

In early 2019, SCMI and TBF completed an expansion project to more than double their current abalone rearing facility. This second lab space contains six 170-gallon tanks to hold broodstock abalone and four larval settling troughs for juvenile rearing. The new lab is dedicated to red and green abalone, while the other has been retrofitted for white abalone propagation. Since being added to the NMFS ESA permit held by the Bodega Marine Lab, TBF has received 2,000 endangered white abalone. These will be outplanted to the Palos Verdes Peninsula in October 2019 in the hopes of restoring wild populations.

Figure 1. A one year old *Haliotis rufescens* (red abalone) from the spawn on 9/15/2017.

OSI AAUS Research Dive/Boating Program

Dive Operations: We currently have 111 Scientific Divers on our roster. 76 logged dives totaling 2729 dives for fiscal 2018/19. Three AAUS Scientific Diver courses were offered – one during the Winter and two during the Summer. A total of twenty new divers received training, and cohorts were comprised of candidates from CSUN, CSULB, CSUF, NOAA, and Occidental College. We anticipate offering three AAUS Scientific Diver courses in 2020. We've purchased an inventory of six DAN hard cases with combination O2 & First Aid kits available for checkout for dive and vessel operations. CSU has placed new, system-wide Risk Management and EH&S staff, tasked with reviewing and implementing consistency in policies and procedures for all campuses. To that end, they reached out to all of the DSOs to form an affinity group which will meet on an ongoing basis to help consolidate policies and procedures. Related to this, a number of questions have arisen regarding the recent fatality of a UCSC research diver, and the Conception incident. Both incidents are under investigation and pending publication of the final reports we will review relevant training and safety policies and procedures.

Boat Operations: We conducted three, five-day, Motorboat Operator Training Courses (MOTC) for non-experienced boat operators during the 2019 Spring Break a total of twelve participants. In conjunction with our AAUS Scientific Diver courses, we offered one five-day MOTC during the month of July for six participants – the second course, scheduled for August, was canceled due to lack of applicants. Cohorts were comprised of candidates from CSU/OSI, CPP, and Occidental College. During 2020, five-day courses will again be offered during Spring Break, and in conjunction with our Summer AAUS Scientific Diver courses. Over the past year we've continued to build our inventory of PFDs, exposure suits and safety gear required to teach the course.

Educational Goals

CSU Marine Biology Semester on Catalina Island

The CSU Marine Biology Semester on Catalina was hosted by CSU Northridge this semester. The semester continues to be a unique opportunity for CSU students to experience hands-on marine biology and guide them to careers in marine science. There was a total of 17 students this semester from 5 different CSUs. The semester was taught by CSUN professors: Dr. Larry Allen, Dr. Robert Carpenter, Dr. Peter Edmunds, and Dr. Mark Steele.





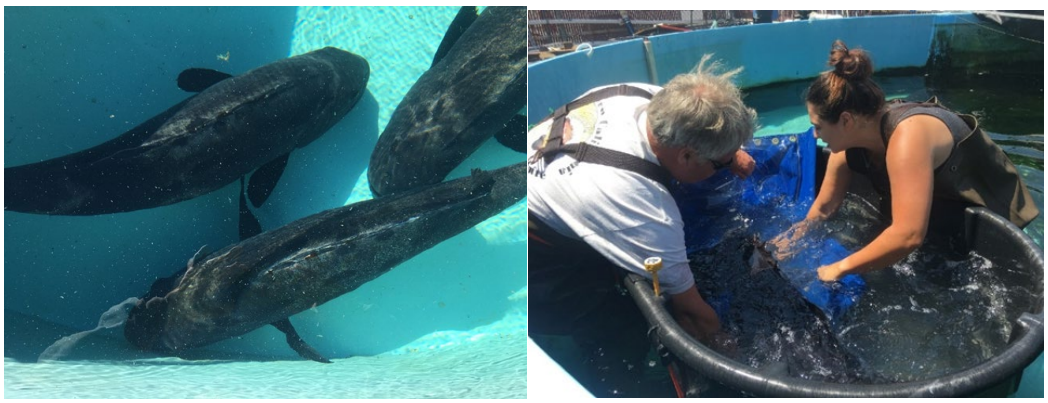

CSU Marine Biology Semester on Catalina Fall 2018			
University	**# Students**	**Professors**	**Courses**
CSU Fullerton	1	Dr. Larry Allen	Marine Phycology
CSU Long Beach	10	Dr. Robert Carpenter	Invertebrate Zoology
CSU Northridge	4	Dr. Peter Edmunds	Ecology of Marine Fishes
Cal Poly Pomona	1	Dr. Mark Steele	Directed Research
CSU San Francisco	1		
Total # Students	**17**		
Total # Schools	**5**		

Demonstration Yellowfin Cruises

Our Yellowfin demonstration cruises have continued to be a valuable resource for students to experience hands on marine science. With the help of our Captain, Vessel Engineer, and the on-board Demonstration Techs we can give classes experience using real-world equipment and techniques such as VanVeen grabs, plankton tows, biological dredges, otter trawls, and our new handheld CTD. Demonstration cruises on the R/V Yellowfin supported over 1800 students from Southern California colleges and universities.

Research Goals

SCMI has provided vessel support, equipment, and expertise to researchers from member and non-member institutions. This year SCMI has assisted researchers from University of Southern California, Occidental College, University California Los Angeles, California State University, Northridge, Long Beach, and Los Angeles, NOAA, Ports of Los Angeles, Woods Environmental & Infrastructure Solutions, and Los Angeles Natural History Museum.



Giant Sea Bass Acoustic Study

Dr. Larry Allen's Giant Sea Bass Acoustic study is still on going at SCMI. The three Giant Sea Bass are thriving in the tanks at SCMI and in June 2018, began to court and make sounds. Initially, Dr. Allen and his students completed the acoustic monitoring of the captive Giant Sea Bass through two breeding seasons (partial summer of 2017 and all of 2018). After hundreds of recording sessions with both the handheld TASCAM hydrophone and Soundtrap underwater hydrophones, only "booms" recorded, presumably from the male Giant Sea Bass SOK-3 (aka "Maxie"). In short, these "booms" and concert bass drums have very similar acoustic profiles ranging from 30 to 90 Hz in max frequencies.

However, on May 28, 2019, the captive giants began spawning in the tank at SCMI. We have since had seven successful spawns with the fertilized eggs collected and distributed to rearing facilities at both the Long Beach Aquarium of the Pacific and the Cabrillo Marine Aquarium. The staffs at both aquaria have, to date, successfully reared about 700 juvenile Giant Sea Bass through the settlement stage. Rearing baby Giants to this size has never been accomplished before, by anyone. We are now in the process of signing a Letter of Agreement with the California Department of Fish and Wildlife to release these YOY into the known nursery areas (e.g. head of Redondo Canyon).

More important to the acoustic study, the fish began producing a new type of sound during spawning events. The male GSB (SOK-3) produced an abrupt "snare drum" sound during the evenings of each spawn (Fig.1). The acoustic frequency characteristics were similar to the known "booms" (Fig. 2), but at very high repetitive rate.

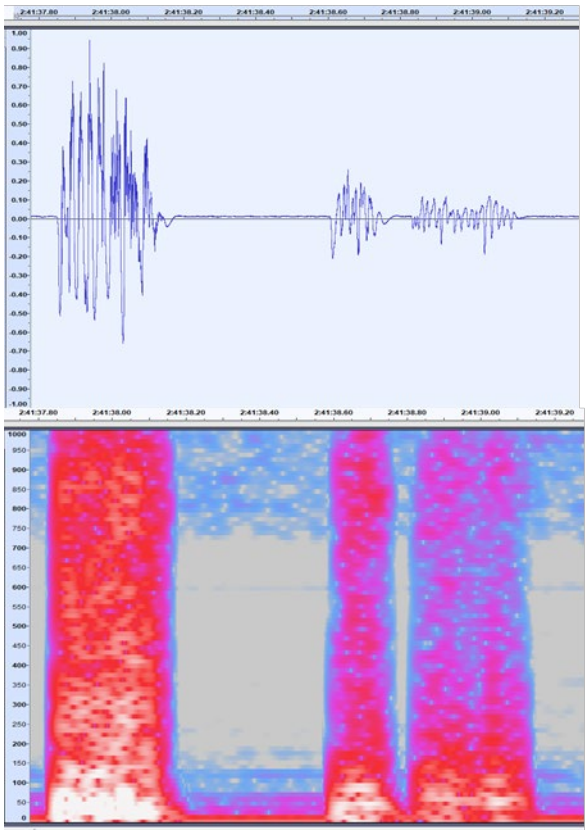


Fig. 1

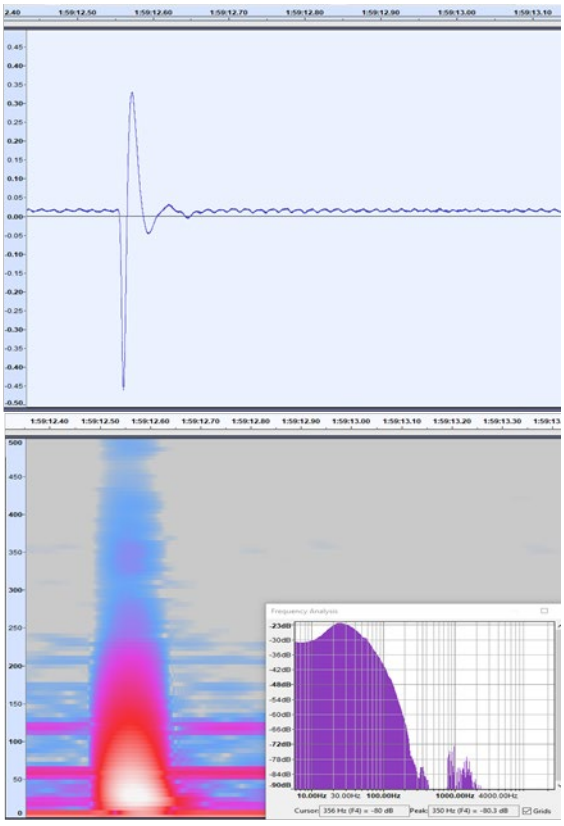


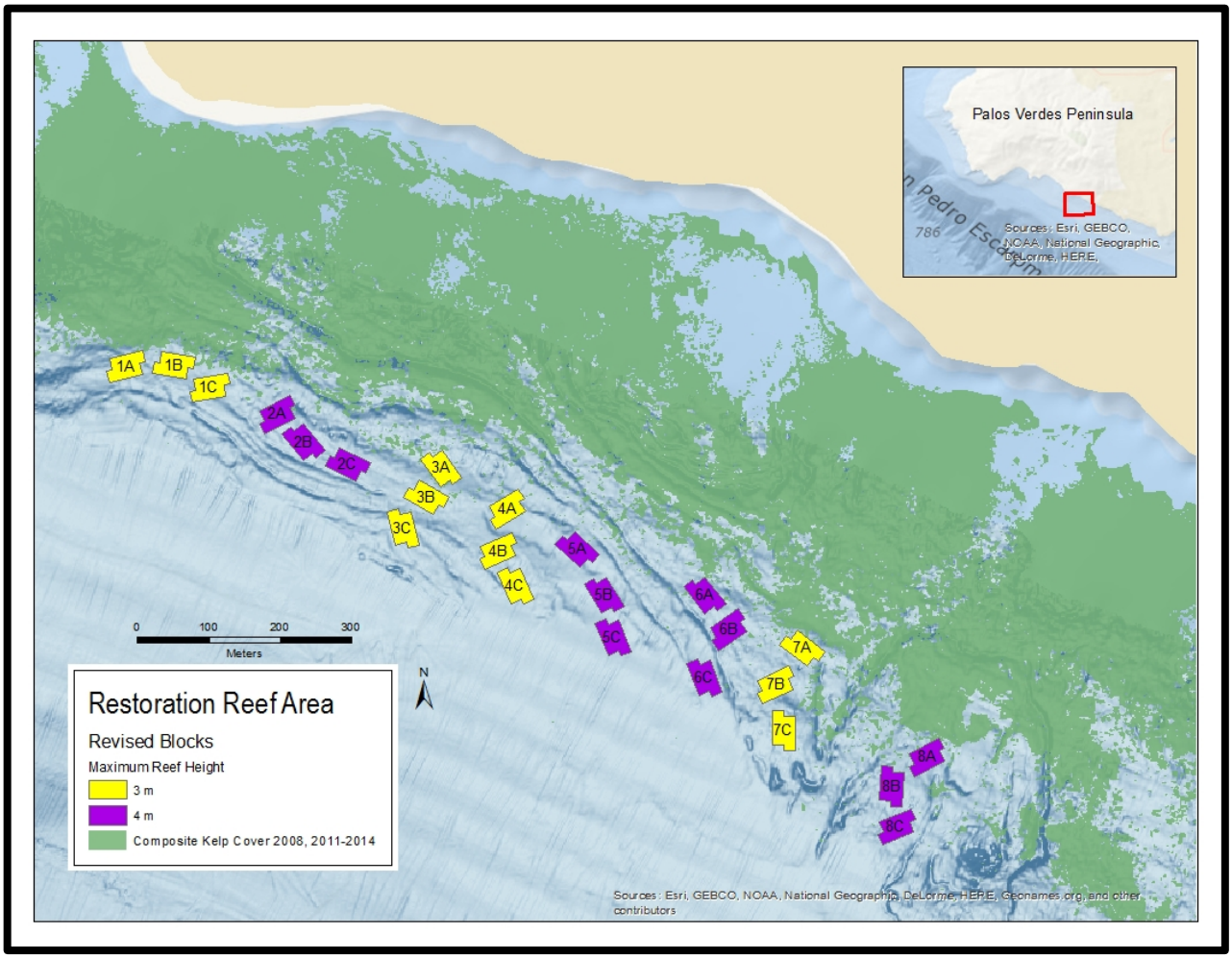
Fig. 2

The information gathered by this study will allow Dr. Allen to complete the description of the courtship and mating behaviors of this ecologically and economically important species. Finally, both the "boom" and "snare drum" sounds will aid greatly in the indentification of spawning areas for Giant Sea Bass throughout their current range.

Palos Verdes Restoration Reef

SCMI working with the Vantuna Research Group at Occidental College has permitted and is the lease holder for the construction of the first offshore restoration rocky reef in California's history (Figure 1). The project will be constructed next summer on the Palos Verdes Peninsula. The peninsula has suffered from historic anthropogenic stressors that have resulted in significant and well documented losses and of rocky-reef and kelp bed habitat. This loss of habitat and associated ecosystem services has reduced socioeconomic benefits to the region. This project will restore critical habitat for important fish and invertebrate fishery species that have been impacted from historical watershed

mismanagement. Stretches of the rocky reefs and kelp forests that surround the Palos Verdes Peninsula in Los Angeles County have been impacted from chronic sedimentation that are at least partially the result of human caused landslides and urban runoff over the past 70 years. While many of the sources of the sedimentation have been ameliorated, over 200 acres of reef habitat have been lost to sedimentation, continued reef scour and burial. However, some smaller areas of reef along this coastline that are naturally high relief (extend vertically up from the seafloor) remain some of the most productive in southern California for commercially and recreationally important fish and invertebrates. This restoration project will use a peer reviewed published design based on the best available science that mimics the productive characteristics of these existing natural reefs to restore the productivity of these sediment impacted areas by creating high relief quarry rock reef modules that will extend up from the seafloor above the moving sediment.



The restoration reef is designed as set of eight "blocks". Each block contains three modules (A, B, C). Each module consists of a 3 x 2 set of six "piles". The three piles on each side of the module are offset

by 1/2 of the pile width (8 m). Each pile is a 16 m x 16 m square pyramid of quarry rock with an overall height of 1 m, 2 m, 3 m, or 4 m. The blocks will be in two designs, either with a 3 m overall pile height or a 4 m overall pile height. There is a 10 to 20 m wide sand channel between modules and at least 50 m of space between blocks. These distances were chosen due to the previously described 'halo' effect around reef of ~30 m. Reef modules that are separated by < 30 m are more likely to operate as a single reef for many species, while blocks separated by > 30 m operate more independently. In our design criteria reef blocks are spaced at least 50 m apart. By separating the blocks and modules by the appropriate distances we can restore a greater amount of reef perimeter sand-rock ecotone habitat and we can increase the independence of replicate reef blocks. The overall approach is to try to balance scientific study design considerations with maximizing the potential for an effective restoration effort across the range of important species, and kelp forest biodiversity. Major motivations included incorporating heterogeneity throughout the restoration reef design both within (e.g., varying pile heights within blocks) and amongst (e.g., varying block orientation across blocks) the reef blocks.

Not only will this project restore an enormous amount of lost reef habitat, we have embedded into it a repeated statistical design that will allow a variety of research project to be conducted in a replicated manner. As you can imagine, this unique opportunity has sparked a lot of interest. Please contact Dr. Pondella if you have any questions.

Natural History Museum of Los Angeles and UCLA eDNA Study

The Natural History Museum of L.A. County's "Diversity Initiative for the Southern California Ocean" (DISCO) is engaged in a research program to develop "environmental DNA" in the marine environment. Environmental DNA (eDNA) is a newly-emerging technology with enormous potential to enhance our ability to discover and describe marine biodiversity. The core idea is that, since all organisms shed DNA into their environment, samples of seawater contain a summary set of DNA from around where the water was collected. By sequencing selected genes from seawater samples, we can inventory local sea life without having to physically collect, count, and identify individual organisms. DISCO researchers are collaborating with the Port of Los Angeles and the Port of Long Beach to examine how eDNA sampling matches up with conventional trawl sampling of marine fishes and invertebrates. Using Niskin bottles deployed from SCMI's R/V Yellowfin, DISCO researchers took seawater samples along a series of tracks inside the port area. Immediately following the seawater sampling, contract biologists for the Ports took conventional trawls along the same tracks. Comparing the species inventories from the eDNA samples with the species reported from the trawls will yield one of the first parallel comparisons of eDNA and conventional sampling in a marine setting.


Wood Environmental & Infrastructure Solutions, California Least Tern Foraging Study 2019

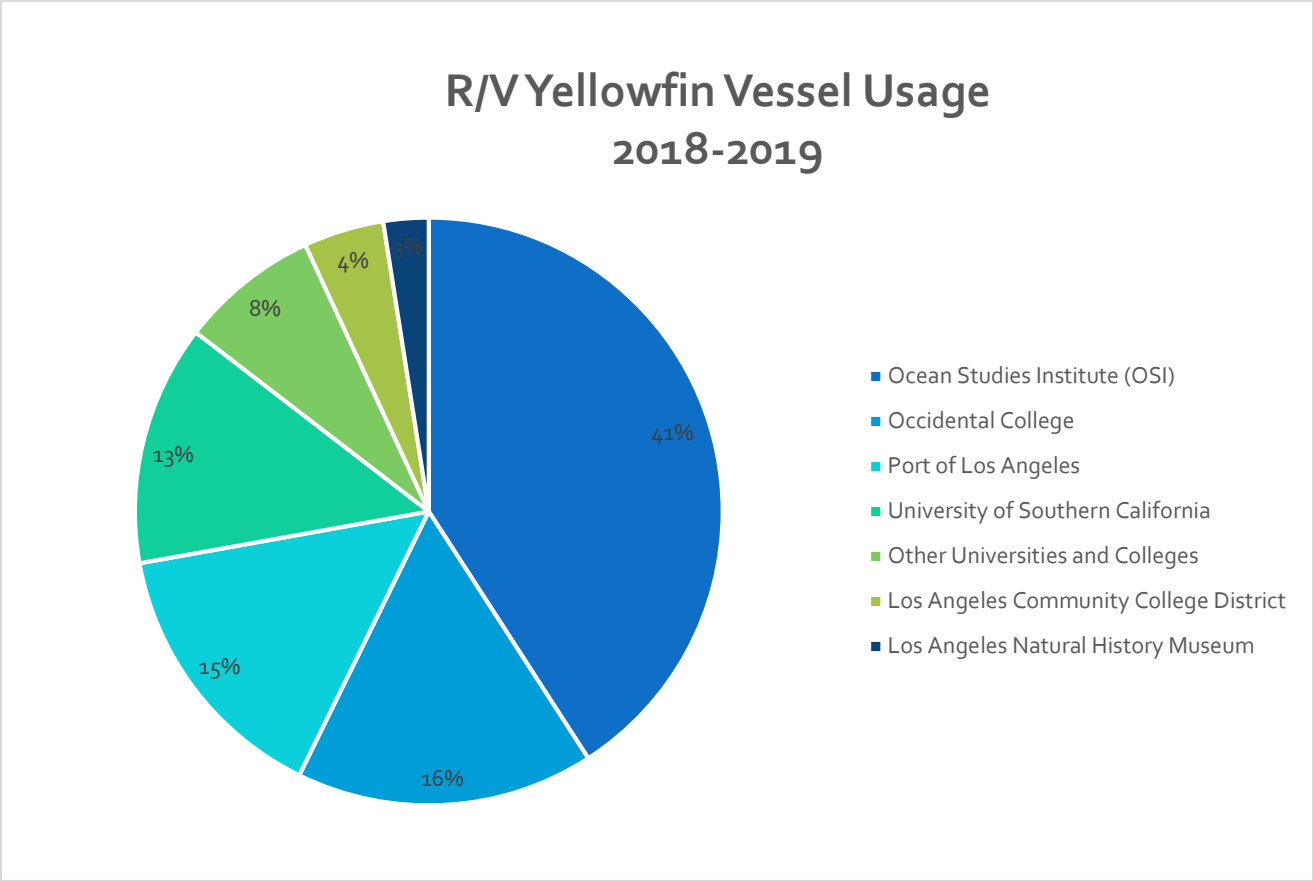
This study focused on observing California Least Tern foraging habits in small vessels through the Port of Los Angeles. The Port would like to better understand nesting success at the Pier 400 nesting site. Beginning in May SCMI staff and Wood's researchers have gone out on the SCMI whaler, Old Blue, and observed the terns at Pier 400 and other locations in the Port. The researchers noted the number of terns and their foraging and flight behavior.

Vessel Use

R/V Yellowfin Usage by Institutions

This year, the R/V Yellowfin logged approximately 724 hours of vessel use. The vessel usage was consistent with last year's hours. The trips consisted of a combination of class laboratories, graduate and university research, and contracted research. SCMI's goal is to continue increasing vessel usage among SCMI member institutions and to broaden vessel usage to other institutions and disciplines.

Institute Name	Total # of Students	Total # of Faculty/Researchers	Total Hours of Vessel Use	Total # of Cruises
Ocean Studies Institute (OSI)	1103	57	296	64
Occidental College	194	29	119	17
Port of Los Angeles	2	29	108	12
University of Southern California	47	32	96	12
Other Universities and Colleges	378	16	56	16
Los Angeles Community College District	136	6	32	6
Los Angeles Natural History Museum	0	15	18	2
Yearly Total	**1860**	**184**	**724**	**129**


R/V Yellowfin Vessel Usage
2018-2019
41%
16%
15%
13%
8%
4%
3%
Ocean Studies Institute (OSI)
Occidental College
Port of Los Angeles
University of Southern California
Other Universities and Colleges
Los Angeles Community College District
Los Angeles Natural History Museum

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