CSU MONTEREY BAY
PRESENTS

FALL
UNDERGRADUATE RESEARCH, SCHOLARSHIP, AND CREATIVE ACTIVITY
COMPETITION

Thursday, November 14, 2024

University Center Living Room

2:30 to 6:00pm

Hosted By

Undergraduate Research Opportunities Center

Cal State Monterey Bay
Undergraduate Research Opportunities Center

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WELCOME

Created in 2015 by CSUMB faculty and staff, the *Fall Undergraduate Research, Scholarship, and Creative Activity Competition* is designed to highlight scholarly work at California State University, Monterey Bay. Modeled after the *CSU Student Research Competition*, students, under the guidance of one or more faculty members within their department, or multiple departments for interdisciplinary projects, are eligible to submit a project to be considered for the competition.

All presenters, especially winning presenters, will be encouraged to apply for the statewide CSU Student Research Competition, held each spring to promote and recognize outstanding student accomplishments throughout the 23 campuses of the CSU system.

Please scan QR code to learn more about the CSU Student Research Competition.

COMPETITION OVERVIEW AND FORMAT

Each fall, CSUMB students are selected to present their work orally at the *Fall Research, Scholarship, and Creative Activity Competition*. Presenters give a 10-minute oral presentation followed by a brief Q&A (questions and answers) period. Judges ask questions *first* and if time remains, the audience is invited to ask questions.

Judges will be looking for the following criteria in each of the 10 presentations:

- Clarity of Purpose of the Research
- Appropriateness of Methodology
- Quality of Analysis and/or Interpretation
- Ability to Present the Research or Creative Activity
- Organization of the Presented Materials
- Ability to Handle Questions
- Value of Research or Creative Activity to the Discipline

Based on the recommendations of the judges, prizes will be awarded to the first, second, and third-place presenters.

1st Place: $250
2nd Place: $150
3rd Place: $100

UROC IMPACTS

DISSEMINATION

- 1,300+ student research presentations at one of UROC's campus-wide research events since 2015.
- 1000+ presentations at national conferences funded by UROC since 2015.
- UROC students have presented in all 50 states and have published widely in peer reviewed journals.
- 90+ student delegates have represented CSUMB at the CSU Student Research Competition.

RESEARCH IN THE CLASSROOM

- 11,000+ students have participated in a Course-based Undergraduate Research Experiences (CUREs) at CSUMB since 2018.
- Over 75 faculty across the disciplines have developed CUREs.

$4.6 MILLION SCHOLARSHIPS AND FELLOWSHIPS

Awarded to support graduate study:

- 37 NSF Graduate Research Fellowship Program (GRFP)
- 1 Ford Foundation Fellowship
- 12 Goldwater Scholar Scholarships

CSU Awards

- 23 Sally Casanova Pre-doctoral Scholars
- 4 CSU Trustee Awards for Outstanding Achievement

$20 MILLION IN EXTERNAL GRANTS

Support for student programming, research scholarships, research materials, and student conference travel.

- Department of Ed (HSI-STEM, Ronald E. McNair)
- NSF (Louis Stokes Alliance for Minority Participation, LSAMP; IUSE)
- USDA
- Apple
- Chevron
- Koret Foundation

PARTICIPANTS

82% of UROC participants have been from traditionally undeserved groups including:

- 45% First-generation in college
- 44% Pell Grant recipients
- 42% Traditionally underrepresented minority
- 41% Transfer students.

Graduation Outcomes of UROC Participants

- 83% of all UROC students graduate within 4 years!
- 85% of Hispanic, low-income transfer STEM students graduate within 3 years or less!
- 100% of UROC transfer students graduate within 3 years!
- 100% of UROC Hispanic, low-income students (first year) graduate within 6 years!

GRADUATE DEGREE ATTAINMENT

- More than 20% of UROC alumnae have graduate degrees.
- ~50% of McNair alumnae have graduate degrees.
- 120 UROC alumnae have earned graduate degrees to date.

Instagram: uroc_csumb
Facebook: UROC @ CSU Monterey Bay

Rev. 4/5/2024

PROGRAM

Opening Remarks | 2:30 - 2:35 p.m.
Dr. John Banks, UROC Director

Abraham Porras-Vargas | 2:35 – 2:50 p.m.
Creeping, Charging, and Cessant Hillslopes: Investigating Environmental Controls on Earthflow Occurrence and Activity Near Hollister, CA

Mahlon L. Rosenberg | 2:52 – 3:07 p.m.
Impact of Coastal Upwelling on *Sebastes carnatus* Growth via Expression of Insulin-like Growth Factor-1 (IGF-1)

Mariah Moreno | 3:09 – 3:24 p.m.
Identify Overreporting on the Personality Inventory for the Diagnostic and Statistical Manual for Mental Disorders (PID-5) Brief Form

Hailey Christian & Paola Cabezas | 3:26 – 3:41 p.m.
Modeling TSC Dependent LAM Using *Drosophila* Muscle Precursor Cells

Break | 3:41 – 3:51 p.m.

Sofia Barajas | 3:51 – 4:06 p.m.
La Niña Vs. El Niño: How Hypoxic Events Affect the Reproductive Output of Gopher Rockfish (*Sebastes carnatus*)

Audrey Longan | 4:08 – 4:23 p.m.
The Effects of an Increase in Fine Sediment from Wildfire on Filter-feeding Stream Benthic Macroinvertebrates

Sameer Dingore | 4:25 – 4:40 p.m.
Curated Dataset for Benchmarking of RNA Base-Pairing Annotations Tools

Break | 4:40 – 4:50 p.m.

Sam A. Minard | 4:50 – 5:05 p.m.
The Interaction of Political Views and Extreme Weather in Shaping Climate Change Concern

Ty Takahashi & Kaitlyn Alvarez | 5:07 – 5:22 p.m.
Sandy Beach Habitat Variability of Pismo Clam (*Tivela stultorum*) Populations within Monterey Bay

Skye Cardoza | 5:24 – 5:39 p.m.
Demystifying Stress: A Model to Identify and Quantify Stress in Captive Southern Sea Otters, *Enhydra lutris nereis*

Break | 5:39 – 5:50 p.m.

Awards and Closing Remarks | 5:50 – 6:00 p.m.
Dr. Andrew Lawson, Provost and Vice President of Academic Affairs

JUDGES

Cindy Juntunen, Ph.D.
Associate Provost
Dean of Graduate Studies and Research
Office of Graduate Studies and Research
California State University, Monterey Bay

Dr. Cindy Juntunen is Associate Provost for Research and Dean of Graduate Studies at California State University, Monterey Bay. She was faculty in the Counseling Psychology PhD program at the University of North Dakota from 1994-2016, and then served as Dean of Education & Human Development at UND until August, 2023. Her research interests are in vocational psychology, ethics, and rural behavioral health. She served as PI on several federal mental health training grants, emphasizing interprofessional practice in rural communities. She also oversaw the SAMHSA-funded Mountain Plains Addiction Technology Transfer Center from 2021-2023.

Erin Ramirez, Ph.D.
Associate Professor
Department of Education & Leadership
California State University, Monterey Bay

Dr. Erin M. Ramirez is an Associate Professor in the Department of Education and Leadership, and Principal Investigator of 2 US Department of Education grants: Project POPPY and the ROOTS Project. Previously Dr. Ramirez was an Adjunct Professor and Graduate Research Assistant at George Mason University where she received the Adjunct Faculty Teaching Excellence Award (the first ever recipient in the College of Education & Human Development). Dr. Ramirez earned her PhD in Teacher and Teacher Education with an emphasis in Research Methodologies at George Mason University in 2016. Before teaching at Mason, Erin was a high school English and Journalism teacher. Her research interests include: teacher self-efficacy, content-area literacy, secondary literacy instruction, student reading achievement, teacher education, and research methods. Dr. Ramirez looks to pass on her love of research and teaching by mentoring graduate students through their research projects and has served as an advisor & methodologist on 56 (and counting) masters theses at CSUMB and a research methodologist on a PhD dissertation in 2019 at George Mason.

Arlene Haffa, Ph.D.
Professor
Department of Applied Environmental Science
California State University, Monterey Bay

Dr. Arlene L. Maki Haffa is a Professor in the Department of Biology and Chemistry. Her research Laboratory of Agricultural Biogeochemistry studies how on-farm management practices impact greenhouse gas emissions, soil health, and crop yield. She is currently serving as the Chair of the Academic Senate.

Gail Newel, M.D., M.P.H.
Community Judge
Retired Health Officer at County of Santa Cruz

Dr. Newel is a physician with decades of experience in clinical medicine and public health. She recently retired from her role as Health Officer for the County of Santa Cruz. She attended UC Berkeley for undergraduate work and UC Irvine for medical school before returning home to Central California to the UC San Francisco-Fresno obstetrics and gynecology residency program. Her strong interest in public health led her back to UC Berkeley for her Master in Public Health degree.

Dr. Newel worked in clinical practice for over 30 years in a variety of settings – in private practice, at Kaiser Permanente, as clinical faculty, and in public health. During that time, she maintained a clinical faculty status with the UCSF training program. She served as Fresno County's first MCAH Medical Director at the Department of Public Health, then as Health Officer in San Benito County. She began working as Santa Cruz County's Health Officer in July 2019. Dr. Newel has served on many regional, state and national working groups on public health issues. She is currently the President of the Health Officers Association of California. In addition, she serves on the Board of Directors of the Diversity Center of Santa Cruz. Her areas of special interest include public policy and advocacy for health equity, family health, opioid use disorder, reproductive rights and LGBTQ wellness.

Jill Yamashita, Ph.D.
Professor
Department of Psychology
California State University, Monterey Bay

Dr. Jill Yamashita is a Professor of Psychology and has been at CSUMB since 2009. Dr. Yamashita studies false memory, face recognition and eyewitness memory. She leads a Memory and Perception research lab with undergraduate students studying cognitive psychology. She graduated from the University of Nevada, Reno in 2003 with a PhD in Experimental Psychology.

David MacFarlane, Ph.D.
Professor
Department of Forestry
Michigan State University

Dr. David W. MacFarlane is a Professor of Forestry at Michigan State University (MSU). His Forest Measurements and Modeling Lab at MSU focuses both on developing novel methods of measuring trees and forests and developing new approaches to model forest processes. He has over two decades of experience researching methods to scale local measurements of trees and forests to regional scales and modeling growth and yield. He has led or has played an important role in several projects over the last ten years which have focused on improving the US and Brazilian national forest carbon inventories to better measure forest influences on climate change. He also develops biologically-motivated models of tree structure and function and the role of forests in providing ecological services to enhance human well-being. Dr. MacFarlane's research has had a broad impact through the formation of strong partnerships with local (Ingham County), state (Michigan Department of Natural Resources (DNR), Michigan FFA), regional (Southeast Michigan RC&D)(Great Lakes Stem Profile Modeling Project: Ontario, MI, MN, WI) and federal (USDA Forest Service, US DOE) agencies. These partnerships have enabled him to lend his biometric expertise to solve emerging technical problems associated with quantifying forest resources. He also has significant international experience teaching and researching forests and forestry in places like Kenya, Costa Rica and most recently Mexico.

PRESENTERS

Creeping, Charging, and Cessant Hillslopes: Investigating Environmental Controls on Earthflow Occurrence and Activity Near Hollister, CA

Abraham Porras-Vargas, Manuel Villa Alvarado, Ellery Charleton, Douglas Smith Ph.D., & James Guilinger Ph.D.

Department of Applied Environmental Science, California State University, Monterey Bay

In tectonically active mountainous regions with weak and clay-rich bedrock and seasonally varying precipitation, earthflows are common occurrences. Such conditions are prevalent along the creeping section of California's San Andreas Fault, which includes our study area south of Hollister, CA. It is well understood that the amount of annual rainfall controls the rate of displacement of a slide, however, the absolute activity of one slide to another can vary significantly. This research aims to use remote sensing, field survey methods, and geospatial software, such as image correlation techniques like IMCORR in order to resolve the degree of influence of geological and environmental variables on landslide movement and sediment delivery to stream networks that lead to this difference in absolute activity. Using repeat LiDAR and drone photogrammetry, volumetric surface changes resulting from slide motion and gullying can be revealed, allowing us to quantify sediment transfer by earthflows to streams. Research on two earthflows in the Hollister Hills SVRA indicates a strong relative correlation between slide motion and extreme wet and dry seasons at the decadal scale, and significant variance in absolute sediment delivery and displacement was observed between the two earthflows, likely due to different drainage structures. Preliminary results from comparing movement vectors generated with IMCORR to physical ground pegs shows promise in IMCORR's ability to quantify earthflow movement, permitting the analysis of more earthflows. By expanding our dataset, we aim to enhance our ability to investigate factors that contribute to variable behavior of earthflows as a whole and their sedimentological connectivity to stream channels.

Impact of Coastal Upwelling on *Sebastes carnatus* Growth via Expression of Insulin-like Growth factor-1 (IGF-1)

Mahlon L. Rosenberg[1], Dailyn Jones[1,2], Matthias Milton[1,2], Scott Hamilton, Ph.D.[2], & Cheryl Logan, Ph.D.[1]

[1]Department of Marine Science, California State University, Monterey Bay
[2]Moss Landing Marine Laboratories, San José State University

Climate change is driving ocean acidification and hypoxia (OAH), intensifying seasonal upwelling along the California coast, and potentially negatively impacting nearshore species. OAH exposure may divert energy from growth and reproduction to environmental stress responses. For example, lower dissolved oxygen and pH levels associated with OAH affect juvenile nearshore rockfishes' (genus *Sebastes*) metabolism and swimming abilities. We studied the impact of upwelling intensity on the growth of adult gopher rockfish (*Sebastes carnatus*) by comparing the expression of an endocrine biomarker for growth, insulin-like growth factor-1 (IGF-1), in fish caught during high and low-intensity upwelling periods. We analyzed IGF-1 levels in 14 fish collected via hook-and-line from January to May 2023 off the coast of central California. Dorsal muscle tissue was dissected within 10 minutes of collection and immediately flash-frozen. Tissue samples were analyzed using an enzyme-linked immunoassay to measure the concentration of IGF-1. A 10-day Coastal Upwelling Transport Index (CUTI) average was calculated for each trip to determine recent upwelling exposure. Trips with a 10-day CUTI average >1 m^2/s were classified as 'high' intensity; values <1 m^2/s were classified as 'low' intensity. We found that IGF-1 levels were higher in the low-intensity upwelling group (Welch's t-test; $t = 5.8091$, $df = 8$, $p < 0.001$), indicating that exposure to upwelling and OAH stressors may negatively impact fish growth. As climate change continues to intensify upwelling, the reduced growth of gopher rockfish may lower reproductive output and lead to the potential decline of an important fishery species.

Identify Overreporting on the Personality Inventory for the Diagnostic and Statistical Manual for Mental Disorders (PID-5) Brief Form

Mariah Moreno, Destiny Renero, & Danielle Burchett, Ph.D.

Department of Psychology, California State University, Monterey Bay

The Personality Inventory for the Diagnostic and Statistical Manual for Mental Disorders, 5th edition (PID-5; Kruger et al., 2012) has repeatedly found reliable and valid for the measurements of personality dysfunction. Within clinical assessments, it is critical to be as accurate when assessing for personality dysfunction. Some measures of personality dysfunction include overreporting scales, which are helpful to identify invalid responses within the questionnaires. Identifying these invalid responses is crucial for forensic evaluation settings where individuals may distort self-reported information creating compromised results. Previous research, regarding the 220 item Personality Inventory for the Diagnostic and Statistical Manual for Mental Disorders, 5th Edition (PID-5; Krueger et al., 2012) has involved creating and validating an overreporting scale (Sellbom, Dhillon, & Bagby, 2018; see also Dhillon et., 2017), but research is needed to examine whether it is possible to create similar indicators for the 25-item PID-5 Brief Form. The focal point of this study is to identify and create a valid overreporting scale for the 25-item PID-5 Brief Form and then compare its functioning against a well validated overreporting scales on the Minnesota Multiphasic Personality Inventory-3 (Ben-Porath & Tellegen, 2020). Detecting credible responses keeps clinical assessment reliable and valid for examiners and examinees. If it is feasible to identify overreporting on the PID-5 Brief Form, it will be useful tool for future forensic evaluations and research projects. For future works, the collection of well- validated items from the PID-5 Brief Form can be compared to the overreporting measurements used in the MMPI 3 Scale Performance.

Modeling TSC Dependent LAM Using *Drosphilla* Muscle Precursor Cells

Hailey Christian, Jacqueline Schmidt, Hamza Al-Hakim, **Paola Cabezas**, & Frank Macabenta, Ph.D.

Department of Biology and Chemistry, California State University, Monterey Bay

Tuberous sclerosis complex (TSC) and lymphangioleiomyomatosis (LAM) are severe diseases caused by abnormal cell growth. While TSC affects multiple organs, LAM primarily targets the lungs and kidneys in young women. LAM and TSC both result in overgrowth of smooth muscle cells. Both diseases are linked to mutations in the TSC1 and TSC2 genes, first discovered in *drosophila*. Muscle precursor cells that form in the gut (CVM cells) have the same smooth muscle phenotype as TSC and LAM. Our preliminary research shows expression of dominant negative version of gigas specifically in CVM cells results in apparent cell migration defects. We speculate TSC1 and gigas help regulate the collective migration of *drosophila* muscle precursor cells. Our methods include a combination of immunohistochemistry, immunofluorescence staining, and both light and confocal microscopy to assess cell migration, as well as hybridization chain reaction (HCR) assays to determine the expression patterns of the TSC1 and TSC2 genes during *Drosophila* embryogenesis, for which little to no evidence exists. Ultimately, we hope to establish the CVM as a genetically tractable model for TSC, TSC-related LAM, and sporadic LAM. The broader impacts of this research can improve the understanding of the development of TSC and LAM disorders and the pattern of gene expression of TSC 1 and TSC2 genes could improve diagnosis.

La Niña Vs. El Niño: How Hypoxic Events Affect the Reproductive Output of Gopher Rockfish (*Sebastes carnatus*)

Sofia Barajas[1], Samuel Perrello[1,2], Cheryl Logan, Ph.D.[1,2], & Scott Hamilton, Ph.D.[1,2]

[1]*Department of Marine Science, California State University, Monterey Bay*
[2]*Moss Landing Marine Laboratories, San José State University*

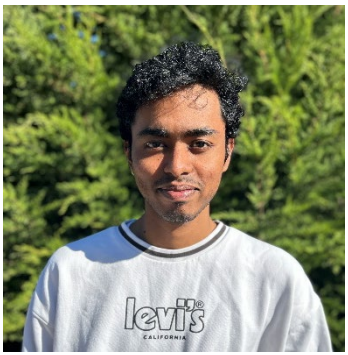
In the California Current Ecosystem (CCE), deep water upwelling creates zones of oxygen-depleted water, known as hypoxic zones. In addition, carbon dioxide (CO2) saturation has increased substantially, leading to ocean acidification. The combined stressors of low oxygen and high CO2 have been shown to alter fish maturation and reproductive output. During El Niño events, warmer water and a relaxation from upwelling occurs in the CCE. We examined the effect of ENSO cycles on Gopher rockfish (*Sebastes carnatus*) reproduction. Rockfish have large brood densities that increase exponentially with age. We predicted that older fish will have greater fecundity and resilience to low oxygen conditions. Larger female fish typically have more stored energy and have far greater reproductive outputs than smaller females, leading us to expect these larger females to be more resilient to changing ocean conditions. To analyze differences within an ENSO cycle, we sampled gopher rockfish from 2023 (La Niña) and 2024 (El Niño), and measured fecundity and developmental stage. Older, larger rockfish gave birth to substantially larger broods across years while individuals caught within the El Niño year produced smaller broods relative to their size and age. If hypoxic waters considerably increase, this could substantially decrease the sustainable yield of rockfish in the future. Yearly revisions are being made constantly to try to sustainably fish rockfish species, and quantifying these environmental conditions is vital for informing future policy making.

The Effects of an Increase in Fine Sediment from Wildfire on Filter-feeding Stream Benthic Macroinvertebrates

Audrey Longan, Skylar Wolfe, Savannah Saldana, & John R. Olson, Ph.D.

Department of Applied Environmental Science, California State University, Monterey Bay

Benthic filter feeders are essential in stream ecosystems as they control nutrient cycling and are excellent indicators of stressors that affect ecosystems. A recent study at Fort Hunter Liggett showed a potential decrease in benthic macroinvertebrate filter feeders among different sites studied. To determine if an increase in fine sediment (<2mm) in streams from recent wildfires has affected the number of filter feeders, we conducted a bioassessment at five sites on Fort Hunter Liggett streams following the California SWAMP protocol. We subsampled these samples, to a total of 600 or more organisms from each site. We identified each taxon's functional feeding groups (FFGs) and then compared both FFG and sediment data from the 5 post-fire sites with an additional 6 sites sampled before the 2020 Dolan/Coleman wildfire, using published data. The results show an increase in substrate (<2mm) has a small to moderate correlation with a decrease in filter feeders. However, there is not a significant increase in substrate when comparing sites from before and after the wildfire. In addition, there was an unexpected overall increase in the proportion of filter feeders after the fire compared to before, which could be due to an increase in nutrients flowing downstream from the burned areas. Overall, the potential for positive impacts on filter feeder populations due to wildfire should be considered in future studies as more research is conducted about wildfires in California, a fire-prone state.



Curated dataset for benchmarking of RNA Base-Pairing Annotations Tools

Sameer Dingore, Shaun Rose, & Shahidul Islam, Ph.D.

School of Computing and Design, California State University, Monterey Bay

Non-coding RNAs (ncRNAs) are regulators in a wide array of cellular processes. Their structural confirmation is a key determinant of biological functionality and is largely dictated by base pairing interactions. These base pairings help form complex three-dimensional structures, so having accurate base pairing annotation tools is crucial to understanding the role of RNA in biological interactions. Misannotated or missing base pair annotations can lead to incorrect structural interpretations and flawed experimental designs, hindering the development of RNA-based therapies. To address these challenges, we evaluated several commonly used computational tools—MCAnnotate, RNAView, ClaRNA, FR3D, and DSSR—that identify base pairs in RNA structures. Our analysis revealed significant discrepancies in the base pair annotations provided by these tools, raising concerns about their reliability. To improve the accuracy of these computational annotations, we developed a curated benchmark dataset based on conserved RNA structural motifs that consistently yield accurate base pairing predictions. This benchmark provides a reliable standard for assessing annotation tools, aiming to enhance our understanding of RNA structures and their roles in biological interactions.

The Interaction of Political Views and Extreme Weather in Shaping Climate Change Concern

Sam A. Minard & Tolga Tezcan, Ph.D.

Department of Social Sciences and Global Studies, California State University, Monterey Bay

Attitudes about climate change are highly polarized in the United States along partisan lines. Because climate change has long felt distant and intangible, individuals often form their attitudes in response to ideological cues from elites (e.g. politicians) rather than from direct evidence in everyday life. Consequently, political orientation is the dominant predictor of climate change attitudes, but less is known about how direct experiences, such as extreme weather events, affect these attitudes. While several studies have found that extreme weather alone may increase concern in some cases, there is little insight into how political views might moderate the relationship between experience with extreme weather events and climate change concern. This research analyzed data from the 2021 General Social Survey to examine how experience with extreme weather events interacts with political views to influence the level of concern about climate change. Multiple linear regression analysis with interaction terms revealed a statistically significant interaction ($\beta = 0.15$, $p = 0.008$), indicating that the effect of extreme weather experiences on concern about climate change depends on political views. More conservative individuals reported greater concern following extreme weather events, while liberals showed higher concern overall but were less influenced by these experiences. These findings suggest that extreme weather events could be leveraged to increase concern among conservatives, a group that is typically less accepting of climate change. Therefore, climate advocacy groups are encouraged to use messaging that explicitly connects extreme weather events to climate change, particularly in highly conservative areas.

Sandy Beach Habitat Variability of Pismo Clam (*Tivela stultorum*) Populations within Monterey Bay

Ty Takahashi[1], Kaitlyn Alvarez[1], Olivia Beaudoin[1,2], & Alison Haupt, Ph.D.[1]

[1]Department of Marine Science, California State University, Monterey Bay
[2]Moss Landing Marine Laboratories, San José State University

The Pismo clam (*Tivela stultorum*) is a valuable bioturbator and prey for many marine organisms, inhabiting the sandy intertidal and subtidal from Central California to Baja California, Mexico. Unsustainable harvesting practices of commercial and recreational fisheries led to the overexploitation and decline of their population in the 1990s. Despite ongoing sampling efforts in Southern California, where most Pismo clam populations reside, Monterey Bay lacks information on the current status of local populations. During low tide (-1.0 ft or lower), we dug along 30-meter transects, divided into 3-meter sections, where all clams were identified. Corresponding sediment samples were collected and sized using a sieve stack. The beach slope was calculated using a DGPS (Differential Global Positioning System). We produced a map showcasing the location of clams found and analyzed the relationship between sediment grain size, degree of sorting, and beach slope with a multiple logistic regression test to determine the ideal beach morphology for Pismo clams. By exploring the potential habitats in their northernmost range, we can potentially restore the decimated Pismo clam populations. Clams were present in beaches with less-sorted, fine-grain sediment, and a gentle slope.

Demystifying Stress: A Model to Identify and Quantify Stress in Captive Southern Sea Otters, *Enhydra lutris nereis*

Skye Cardoza[1] & Katie Finch[2]

[1]*Department of Marine Science, California State University, Monterey Bay*
[2]*Monterey Bay Aquarium*

The southern sea otter (*Enhydra lutris nereis*) is a keystone species crucial to maintaining kelp forest health and biodiversity, but past mass hunting practices have brought this imperative species nearly to extinction. The Monterey Bay Aquarium is the only institution that captures, rehabilitates, and releases this threatened population in an attempt to re-establish this once-thriving population. Animal welfare assessments are used by husbandry teams to assess the overall well-being of individuals. However, these fail to take into consideration an underrepresented signifier of animal health: stress. This project aimed to create a methodology for how staff can noninvasively identify and quantify stress in captive sea otters. 72 hours of recorded footage was reviewed to identify an otter's time allotment of daily activities at established low, medium, and high stress levels determined by frequency of an individual's pacing behavior. A Stress Identification and Quantification (SIQ) Model was established, and statistically backed definitions eliminated room for subjective error among caretakers when ranking stress. The SIQ Model presents nine behaviors, four indicating physical stress and five indicating psychological stress. These behaviors can be scored from zero to three, and the gathered rankings become one cumulative "stress score." Observed morning activity differed greatly from evening activity, resulting in a protocol to perform SIQ analyses twice daily. Scores recorded over time will allow caretakers to identify patterns in stress frequency. With the implementation of this model, threatened southern sea otters will now be provided with an increased quality of care, benefiting the conservation of this species.

PROGRAM PARTNER RECOGNITIONS

Thank you to all the program partners and funding sources!

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