



2019 ANNUAL MEETING CSUN: SCHEDULE AT A GLANCE

Main Events: CSU Northridge, University Student Union (USU) East

FRIDAY May 4, 2018				
Time	Symposium Tujunga Room	Symposium Altadena Room		
8:20-9:40	Desert Sciences	*Rocky Reefs		
9:40-9:55	Break			
9:55-10:55	Desert Sciences	Rocky Reefs		
10:55-11:15	Break			
11:15-11:45	SCAS President's Address & Awards Presentation Location: Lake View Terrace Room			
11:45-12:45	Plenary Speaker: Dr. Don Prothero <i>Reality Check: How Science Deniers Threaten Our Future</i> Location: Lake View Terrace Room			
12:45-2:00	Lunch			
Time	Symposium Tujunga Room	Contributed Papers Altadena Room	Contributed Papers Van Nuys Room	Contributed Papers Panorama City
2:00-3:15	Terrestrial Ecology	Parasitology	Ecosystems, Habitats & Climate Change	Physiology
3:15-3:35	Break			
3:35-5:05	Terrestrial Ecology	Parasitology	Ecosystems, Habitats & Climate Change	Community Ecology
5:15-7:30	Poster Session Location: Orange Grove Bistro			

*Rocky Reefs Symposium starts at 8:40 AM

Friday, May 3, 2019 Plenary Speaker

REALITY CHECK: HOW SCIENCE DENIERS THREATEN OUR FUTURE

Professor Donald R. Prothero, Ph.D.*

Modern civilization and even human survival would not be possible without significant advances in science and medicine, yet even in the most developed countries there are people who deny the evidence of science when it conflicts with their religious or political agendas. Modern science deniers often have the same psychological factors and motivations, and typically employ the same tactics to deny reality, often using "the Holocaust Denier's playbook". In this lecture, we will examine some of the most serious forms of science denialism, from climate deniers to creationists to anti-vaxxers, why they resist the discoveries of science yet embrace the latest technology and medicine, and what it means for our future.

*Professor Prothero is a geologist, paleontologist and author with a research focus on mammalian paleontology and magnetostratigraphy. He has authored and edited more than 30 books and over 250 scientific papers, including five geology textbooks. For 27 years he was a member of the faculty at Occidental College, and he previously taught at California Institute of Technology, Knox College, Vassar College and Columbia University where he led many undergraduate paleontological and geological field trips. Dr. Prothero is currently a research associate in vertebrate paleontology at the Natural History Museum of Los Angeles County.

SYMPOSIA SESSIONS: 8:20 – 9:40 AM

FRIDAY, MAY 3 8:20 – 9:40 AM		
Time	Symposium Tujunga Room Desert Sciences Chair: D. Sandquist CSU Desert Studies Consortium	Symposium Altadena Room Rocky Reefs Chair: M. Adreani CSU Northridge
8:20	Sandquist D, CSU Desert Studies Consortium. An introduction to the Desert Studies Consortium	
8:40	1. Knott, J. CSU Fullerton. Historic erosion patterns and replicate photography in death valley and the Mojave Desert	7. Allen, L. CSU Northridge. The song of <i>Stereolepis</i>
9:00	2. Hibbs, B. CSU Los Angeles. Time series data resolves issues of imported water recharge in Coachella Valley, California	8. Estrada, A. CSU Northridge. Abalone (<i>Haliotis</i> spp.) recruitment at Santa Catalina Island
9:20	3. Holk, G. CSU Long Beach. The petrologic and hydrothermal evolution of the coastal batholith of Peru: insights from oxygen isotopes	9. Claisse, J. CSU Pomona. Fish assemblages and reproductive output potential around California oil and gas platforms and natural reefs
9:40	Break	

SYMPOSIA SESSIONS: 9:55 AM – 12:45 PM

FRIDAY, MAY 3 9:55 AM – 12:45 PM		
Time	Symposium Tujunga Room Desert Sciences Chair: D. Sandquist CSU Desert Studies Consortium	Symposium Altadena Room Rocky Reefs Chair: M. Adreani CSU Northridge
9:55	4. Melchiorre, E. CSU San Bernardino. Determination of drought resiliency for endangered fish habitat using undergraduate experiential field learning, CSU Desert Studies Center, Zzyzx, California	10. Nava, E. CSU Northridge. The effects of marine protected areas on fish foraging behavior
10:15	5. § Mills, C. Claremont Graduate University. A vascular flora of the Nopah Range, Inyo County, California	11. Steele, M. CSU Northridge. Rapid response of kelp bass <i>Paralabrax clathratus</i> size to changes in fishing regulations
10:35	6. Yoder, J. CSU Northridge. Learning and coevolution in plant-pollinator mutualism	12. §, £ Scafidi, K. CSU Northridge. The effects of an invasive alga <i>Sargassum horneri</i> on the trophic dynamics of temperate rocky reefs
10:55	Break	
11:15	SCAS President's Address & Awards Presentation Location: Lake View Terrace Room	
11:45	Plenary Speaker: Dr. Don Prothero <i>Reality Check: How Science Deniers Threaten Our Future</i> Location: Lake View Terrace Room	
12:45	Lunch Break	

Symbols denote student award categories: § for SCAS and £ for AIFRB

ORAL PRESENTATIONS: 2:00 – 3:15 PM

Friday, May 3 2:00 – 3:15 PM				
Time	Symposium Tujunga Room	Contributed Papers Altadena Room	Contributed Papers Van Nuys Room	Contributed Papers Panorama City
	Terrestrial Ecology Chair: E. Questad Cal Poly Pomona	Parasitology Chair: R. Hechinger UC San Diego, SIO	Ecosystems, Habitats & Climate Change Chair: A. Bull UC Santa Barbara, MSI	Physiology Chair: TBA
2:00	13. Meyer, W. Pomona College. Introduction to the emerging Southern California undergraduate terrestrial ecological research network	24. §, † Cuevas, E. CSU Long Beach. Quantifying extracellular tachyzoite survival and invasion-capability under a wide range of environmental conditions in the human parasite, <i>Toxoplasma gondii</i>	32. Steele, C. CSU Channel Islands. Increased organic carbon inputs to Southern California beaches following the 2017 Thomas and 2018 Woolsey fires	43. Pandori, L. UC Irvine. Risky business: vulnerability of California mussels to warming varies across life stages and habitats
2:15	14. Martinez, D. CSU Fullerton. Consumption of free-roaming cats by coyotes in Southern California	25. §, † Nguyen, K. CSU Fullerton. Characterization of TbtMscS, a mechanosensitive channel in <i>Trypanosoma brucei</i>	33. Vo, K. CSU Long Beach. Effects of mammalian aposematic pattern and color contrast variation on predator avoidance learning	44. §, £ Pouv, A. CSU Long Beach. Using the aerobic enzyme, citrate synthase, to infer biogeographic dispersal potential and physiological state in echinoid larvae
2:30	15. Yamauchi, J. CSU Northridge. How does ontogeny affect changes in the gut microbiome of the American bullfrog?	26. §, † Gomez, D. CSU Fullerton. New cysteine protease inhibitors with effect against <i>Trypanosoma cruzi</i>	34. Chabot, C.L. CSU Northridge. Functional diversity of permafrost communities distributed across space and time	45. §, £ Rutledge, K. UC Los Angeles. Killing them softly: ontogeny of jaw mechanics and stiffness in mollusk-feeding freshwater stingrays
2:45	16. Lewis-Smith, B. Occidental College. The flight of the bumble bee: tracking species distribution declines across Southern California	27. §, † Hernandez, R. UC San Diego, SIO. Commencing evasive maneuvers: California killifish move, dart, and scratch more during trematode parasite exposure and attack	35. § Britt, G. Loyola Marymount University. Plant bioaccumulation analysis of heavy metals in Southern California bioswale	46. §, £ Ellis, K. CSU Long Beach. The effects of larval culturing density on development and physiology of the echinoid echinoderm, <i>Dendraster excentricus</i>
3:00	17. Burke, C. CSU Fullerton. Bait-station use by non-target wildlife as a route of exposure of urban carnivores to rodenticides	28. Mora, A. UC Riverside. Evidence for a love potion parasite: trematode parasites increase male fiddler crab sexual display rates	36. Gelpi, C. Catalina Marine Society. First results from the Catalina dynamic ocean chemistry program	47. § Brisson, C. CSU Northridge. Interactions between bacteria and coral microalgal symbionts

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ORAL PRESENTATIONS: 3:35 – 5:05 PM

Friday, May 3 3:35 – 5:05 PM				
Time	Symposium Tujunga Room	Contributed Papers Altadena Room	Contributed Papers Van Nuys Room	Contributed Papers Panorama City
	Terrestrial Ecology Chair: E. Questad Cal Poly Pomona	Parasitology Chair: R. Hechinger UC San Diego, SIO	Ecosystems, Habitats & Climate Change Chair: A. Bull UC Santa Barbara, MSI	Community Ecology Chair: E. Reed E Read & Associates
3:35	18. § Singh, M. Scripps College. Role of soil microbial communities in <i>Artemisia californica</i> reestablishment	29. Appy, R. Cabrillo Marine Aquarium. Transmission of the nematode <i>Vasorhabdochona cablei</i> (Rhabdoconidae) from the longjaw mudsucker <i>Gillichthys mirabilis</i>	37. Wallingford, P. UC Irvine. Impacts of <i>Mexacanthina lugubris</i> , the dark unicorn in Southern California intertidal communities	48. Spies, B. UC Los Angeles. Status, habitat impacts, and metapopulation management of the tidewater goby <i>Eucyclogobius newberryi</i> : a federally endangered California coastal endemic
3:50	19. Davies, C. Occidental College. The importance of California buckwheat <i>Eriogonum fasciculatum</i> as a resource for native bees in Southern California	30. Buth, D. UC Los Angeles. Acquisition of macroparasites by young-of-the-year arrow gobies <i>Clevelandia ios</i>	38. § Haas, A. CSU Long Beach. Modeling effects of ocean acidification on predator-prey dynamics in the rocky intertidal zone	49. Obaza, A. Paua Marine Research Group. Spatial distribution and fish community structure of open coast eelgrass <i>Zostera</i> spp.
4:05	20. § Jolly, A. CSU Los Angeles. Plasticity to drought of the leaf hydraulic system in four species of the California coastal sage scrub	31. Hopper, J. USC. Beyond parasites in food webs: Effects of a parasitoid in the marine microbial loop	39. § Martinez, S. & Tafoya, D. CSU Dominguez Hills. Floral visitors of non-native milkweed species within an urban environment	50. §, £ Jarvis, G. CSU Northridge. Evaluating the effects of predation risk on prey reproduction in a temperate reef fish
4:20	21. § Madunich, K. Pomona College. The effect of herbivores on California sage scrub recovery following a fire	Southern California Society of Parasitologists 2019 Business Meeting	40. § Dickson, M. CSU Northridge. Getting comfortable in your own skin: A test of climate-linked variation in integument ultrastructure among introduced populations of Mediterranean house geckos	51. §, £ Satterfield, D. CSU Long Beach. Behavioral variation and local adaptation to predation risk in populations of black surfperch <i>Embiotoca jacksoni</i>
4:35	22. § Lauman, S. CSU Pomona. Propagule pressure and functional traits: utilizing invasion mechanisms to promote restoration	Southern California Society of Parasitologists 2019 Business Meeting	41. English, J. CSU Los Angeles. Microclimate amelioration and environmental gradients in Los Angeles	52. §, £ Chubak, B. CSU Northridge. Evaluating the importance of reef-based resources for reproduction in a temperate reef fish, <i>Semicossyphus pulcher</i>

4:50	23. Zailaa, J. CSU Los Angeles. Functional traits relate to growth and mortality in lowland tropical forests in Central Panama	Southern California Society of Parasitologists 2019 Business Meeting	42. Namwamba, J. Southern University. Using solar energy to distill water and lower cooking and viscoelastic food dehydration energy, while mitigating green house gases emission	53. §, £ Meyer, A. CSU Northridge. Assessment of the population structure of the shovelnose guitarfish <i>Pseudobatos productus</i> from Southern California to Baja California Sur
5:15	Poster Session: Orange Grove Bistro			

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POSTER SESSION: 5:15 – 7:30 PM

- 54. THE EFFECTS OF NATURAL LIGHT ON THE ACTIVITY AND FORAGING BEHAVIOR ON THE PACIFIC KANGAROO RAT *DIPODOMYS AGILIS***
§ **K.E. Berry** and P. Stapp. Department of Biological Sciences, California State University, Fullerton.
- 55. COMMUNITY COMPOSITION OF LICHEN IN JOSHUA TREE NATIONAL PARK**
§ **C.Z. Gust**¹, C.B. Scott² and E. Braker¹. ¹Department of Biology, Occidental College, ²Department of Computer Science, University of California, Irvine.
- 56. IMPACTS OF INVASIVE ANNUALS ON SOIL CARBON AND NITROGEN STORAGE IN SOUTHERN CALIFORNIA DEPEND ON THE IDENTITY OF THE INVADER**
§ **L.A. Hartz**¹, T. Caspi¹, A.E. Soto Villa², J.A. Loesberg¹, C.R. Robins¹, and W.M. Meyer III².
¹W.M. Keck Science Department, Claremont McKenna, Pitzer, and Scripps Colleges, ²Department of Biology, Pomona College.
- 57. CONSUMPTION OF RAT CARCASSES AS A PATHWAY FOR RODENTICIDE EXPOSURE OF WILDLIFE IN SUBURBAN ORANGE COUNTY**
§ **B. Lotts** and P. Stapp. Department of Biological Science, California State University, Fullerton.
- 58. ANTICOAGULANT RODENTICIDE EXPOSURE IN COYOTES IN SOUTHERN CALIFORNIA**
§ **A.M. Mc Kenzie**¹, N.M. Quinn² and P. Stapp¹. ¹Department of Biological Sciences, California State University, Fullerton, Fullerton, ²South Coast Research and Extension Center, UC Agriculture and Natural Resources, Irvine.
- 59. DO COYOTES EAT MESOCARNIVORES IN SOUTHERN CALIFORNIA? A MOLECULAR GENETIC ANALYSIS**
§ **J.M. Shedden**¹, N.M. Quinn² and P. Stapp¹. ¹Department of Biological Sciences, California State University, Fullerton, ²South Coast Research and Extension Center, University of California Cooperative Extension, Irvine.
- 60. FUNCTION OF HYPEROSTOSES IN THE PTERYGIOPHORES OF THE OARFISH *REGALECUS RUSSELLII***
‡ **W. Wan**¹ and E.W. Misty Paig-Tran². ¹Walnut High School, ²Department of Biological Sciences, California State University, Fullerton.
- 61. SUBSTRATE AGE AND AEOLIAN EFFECTS ON PLANT PRODUCTIVITY AMONG THREE ALLUVIAL FANS, ZZYZX, CA**
R. Cochoit², S.S. Jhaj¹, E. Lee¹, C. Flores¹, K. Rodriguez², J. Garcia³, D.R. Sandquist² and J.M. Garrison⁴. ¹Department of Geological Sciences, California State University, Fullerton, ²Department of Biological Science, California State University, Fullerton, ³Department of Biology, California State University, Dominguez Hills, ⁴Department of Geosciences and Environment, California State University, Los Angeles.
- 62. RIPARIAN HEALTH AS A FUNCTION OF MACROINVERTEBRATE SENSITIVITY TO EUTROPHICATION**
§, £ **Y. Guracha**, E. Manvelyan, J.M. Parkinson, J. Blatti and R. Di Fiori. Department of Biology, Pasadena City College.
- 63. NICHE SEGREGATION AMONG ARMADILLOS IN THE SOUTHERN PANTANAL**
J.M. Esparza. Department of Biology, California State University, Northridge.

- 64. BIOMASS, DISTRIBUTION, AND DYNAMICS OF MESOZOOPLANKTON IN THE CALIFORNIA CURRENT SYSTEM**
 ‡ **P. Kim**¹, J. Guet² and D. Bianchi². ¹North Hollywood High School, ²Department of Atmospheric and Oceanic Sciences, University of California, Los Angeles.
- 65. OXIDATIVE STRESS RESPONSE IN THE SEASIDE SPARROW (*AMMOSPIZA MARITIMA*) FOLLOWING THE DEEPWATER HORIZON OIL SPILL**
 § **A. Angel** and A. Bonisoli-Alquati. California State Polytechnic University, Pomona.
- 66. HOW DOES URBAN POLLUTION AFFECT AGING AND OXIDATIVE STRESS IN THE CALIFORNIA TOWHEE *MELOZONE CRISSALIS* IN SOUTHERN CALIFORNIA?**
 § **A. Dant** and A. Bonisoli-Alquati. California State Polytechnic University, Pomona.
- 67. A META-ANALYSIS OF PERFLUOROOCTANE SULFONATE (PFOS) CONCENTRATIONS IN BIRDS AROUND THE WORLD**
 § **R. Flamenco** and A. Bonisoli-Alquati. California State Polytechnic University, Pomona.
- 68. FUNCTIONAL TRAITS OF INVASIVE AND NATIVE ANNUAL PLANTS IN CALIFORNIA COASTAL SAGE SCRUB**
 § **T.N. Edwards**, S.T. Lauman and E.J. Questad. California State Polytechnic University, Pomona.
- 69. NUTRIENT LEVEL DISTRIBUTION IN BALLONA WETLANDS SALTWATER MARSH‡**
A. Mukhey¹ and J. Dorsey². ¹Harvard-Westlake School, ²Loyola Marymount University.
- 70. EXPLORING MECHANOSENSATION -DEPENDENT FUNCTIONS IN *TRYPANOSOMA CRUZI* USING RNA-SEQ**
 §, † **J. Fonbuena**, M. Feldman, M. Tiwari and V. Jimenez. Center for Applied Biotechnology Studies and Department of Biological Sciences, California State University, Fullerton.
- 71. POCKETONCO: A NOVEL CORE-ML BASED APP FOR THE DIAGNOSIS AND PROGNOSIS OF COLORECTAL, BREAST, AND SKIN CANCER USING MULTILAYERED CONVOLUTIONAL NEURAL NETWORK ALGORITHMS**
S. Zhang and P. Cui. Portola High School, Irvine.
- 72. EFFECTS OF UVB RADIATION ON AMPHIBIAN GROWTH AND DEVELOPMENT: A META-ANALYSIS**
D. Wheeler and A. Bonisoli-Alquati. Department of Biology, California State Polytechnic University, Pomona.
- 73. CULTIVATED VERSUS NATIVE SOYBEAN: REVEALING DIFFERING SMALL RNA EXPRESSION PATTERNS**
E.A. Woods and Y. Hanzawa. Department of Biology, California State University, Northridge.
- 74. CITIZEN SCIENCE RELIABILITY, REPEATABILITY AND RESILIENCY: AN ANALYSIS OF WATER QUALITY DATA COLLECTED FROM MALIBU LAGOON STATE BEACH**
A. Kahler¹, R. Dagit¹, M. Grubbs², K. Johnston² and K. Kazmirchuk¹. ¹Resource Conservation District of the Santa Monica Mountains, ²The Bay Foundation.
- 75. NEST SITE CHARACTERISTICS OF THE CALIFORNIA LEAST TERN *STERNULA ANTILLARUM BROWNI***
D.P. Boehmer, A.T. Martinez and C.R. Whitcraft. Department of Biological Sciences, California State University, Long Beach.

- 76. KNOWLEDGE AS POWER: THE ROLE OF MICROSTATE INFORMATION IN THE DETERMINATION OF AVAILABLE FREE ENERGY**
 ‡ S. Buckley-Bonanno¹ and A. Nassar^{1,2}. ¹Harvard-Westlake School, ²Department of Physics and Astronomy, University of California, Los Angeles.
- 77. THE EFFECTS OF URBANIZATION ON TEMPERATURE AND HUMIDITY VARIATION IN BATRACHOSEPS NIGRIVENTRIS MICROHABITATS**
M.G. Forsline¹, J.L. Blickley² and A.J. Zellmer¹. ¹Department of Biology, Occidental College, ²Natural Sciences Division, Pasadena City College.
- 78. INVESTIGATING THE EFFECTS OF LAND-BASED POLLUTION ON CORAL THERMAL TOLERANCE IN A BRANCHING CORAL SPECIES**
 § D.M. Becker and N.J. Silbiger. Department of Biology, California State University, Northridge.
- 79. WATER CONVEYANCE IN SOME CALIFORNIA MISSION WATERWORKS: CONSTRUCTION AND CAPACITY**
L.A. Ritterbush. Department of Geology & Earth and Environmental Sciences, Cal Lutheran University.
- 80. ANTHROPOGENIC DISTURBANCE OF ROCKY INTERTIDAL COMMUNITIES FROM VISITORS TURNING OVER INTERTIDAL ROCKS**
 § M.A. Jeffus and J.R. Smith. California State Polytechnic University, Pomona.
- 81. INVESTIGATING THE POTENTIAL FOR COEVOLUTIONARY RESCUE IN A MODEL CNIDARIAN-DINOFLAGELLATE SYMBIOSIS**
 § J. Moffat and C. terHorst. Department of Biology, California State University, Northridge.
- 82. IDENTIFYING PATTERNS OF GENE FLOW IN BLAINVILLE'S HORNED LIZARDS *PHRYNOSOMA BLAINVILLII* IN AN URBAN LANDSCAPE**
S.M. Wenner¹, K.S. Delaney² and J.M. Robertson¹. ¹Department of Biology, California State University, Northridge. ²Santa Monica Mountains National Recreation Area, National Park Service.
- 84. A DECADE OF HUMAN AND WILDLIFE USE OF CORRIDORS IN ORANGE COUNTY, CALIFORNIA**
 § H. Heesch, L.L.M. Pandori and C.J.B. Sorte. Department of Ecology and Evolutionary Biology, University of California, Irvine.
- 85. ANALYZING THE ADAPTIVE IMMUNE REPERTOIRE DIVERSITY AND MICROBIOMES OF AFRICAN INDIVIDUALS**
 ‡ E. Wesel¹, R. Ayyala¹, J. Castellanos¹, S. Mangul^{2,3} and E. Eskin^{2,3}. ¹Harvard Westlake School, BIG Summer Program, ²Department of Computer Sciences, UCLA, ³Department of Human Genetics, UCLA.
- 86. EFFECT OF DENSITY ON GROWTH AND SURVIVAL OF JUVENILE WOODLICE, *ARMADILLIDIUM VULGARE***
 § A.L. Alani, C.J. Harris and B.J. Ripley. Grossmont College, El Cajon.
- 87. EFFECTS OF BAYCRETE TEXTURE AND TIDAL ELEVATION ON RECRUITMENT OF NATIVE *OSTREA LURIDA* AND NONINDIGENOUS *BALANUS AMPHITRITE* IN SAN DIEGO BAY, CA**
 ‡ S. Li¹, B. Perog² and D.C. Zacherl². ¹Walnut High School, ²Department of Biological Science, California State University, Fullerton.

- 88. DETERMINING THE ROLE OF LINKER REGION PHOSPHORYLATION IN POLYPYRIMIDINE TRACT BINDING PROTEIN 2 NEURONAL SPLICING REGULATION**
 § D. Madory, E. Hitch, S. Gonzalez, and N. Keppetipola. Santa Ana College.
- 89. CHANGES IN GROUNDWATER QUALITY AND FLOW AT ZZYZX, CALIFORNIA**
 § L.X. Zuñiga, B.J. Hibbs, D. Stone and S. Tovar. Department of Geosciences and Environment, California State University, Los Angeles.
- 90. IMPACT OF SUBMERGED AQUATIC VEGETATION *ZOSTERA MARINA* AND *RUPPIA MARITIMA* ON HABITAT PARAMETERS AND MACROINVERTEBRATE COMMUNITY COMPOSITION WITHIN AN URBANIZED COASTAL LAGOON**
 § N.J. Da Silva and C.R. Whitcraft. California State University, Long Beach.
- 91. BASKING PATTERNS AND SPATIAL DISTRIBUTION OF NATIVE AND NONNATIVE TURTLES WITHIN AN URBANIZED WATERWAY IN ORANGE COUNTY, CALIFORNIA**
 ‡ M. Skibsted¹ and G.B. Pauly². ¹Santa Margarita Catholic High School, ²Natural History Museum, Los Angeles.
- 92. PLANT GROWTH PROMOTING POTENTIAL OF *BACILLUS SP.* AND *PAENIBACILLUS POLYMYXA***
 § R. Parker and M. Lum. Department of Biology, Loyola Marymount University.
- 93. DEFINING THE MECHANISM BY WHICH ALCOHOL-MEDIATED NANOG TOGETHER WITH THE PRC2 SUPPRESS OXPHOS WHICH GENERATE CHEMO-RESISTANT TIC'S**
 ‡ J. Archila¹, Mentors D. Yeh² and K. Machida². ¹Bravo Medical Magnet High School & USC STAR Program, ²USC Department of Molecular Microbiology and Immunology.
- 94. MORPHOLOGICAL ASYMMETRY AS AN INDICATOR OF STRESS IN *N. LEPIDA* AND *O. TORRIDUS*, MORPHOLOGICAL CHANGES IN RESPONSE TO POLLUTION IN INYO COUNTY**
 § M. Laiolo, J. Galvez, C. Dauw and W. Binder. Department of Biology, Loyola Marymount University.
- 95. HABITAT USE AND Q10 OF NATIVE AND NONNATIVE GOBIES IN A FRAGMENTED WETLAND HABITAT**
 § C. Van Grootheest and C.R. Whitcraft. Department of Biological Sciences, California State University, Long Beach.
- 96. THE RICH TAPHONOMIC HISTORY OF THE LATE PLEISTOCENE AT RANCHO LA BREA**
 § E. Pitcher, N. Noriega, J. Cohen and W. Binder. Loyola Marymount University.
- 97. AN INTEGRATED MICROFLUIDIC SYSTEM FOR BLOOD PLASMA SEPARATION AND DISEASE DIAGNOSTICS**
 ‡ S. Liu¹ and N. Garg². ¹Arcadia High School, ²University of California, Irvine.
- 98. THE CYTOKINE RESPONSE OF MICE CHALLENGED WITH EQUINE BACTERIAL PATHOGEN *CORYNEBACTERIUM PSEUDOTUBERCULOSIS***
 § D.R. Coleman¹, R. Pollock¹ and K. Mollinder². Department of Biology, Occidental College.
- 99. ONTOGENETIC DISTRIBUTION OF LATE PLEISTOCENE MEGAFUNA AT RANCHO LA BREA**
 § M. Morado, A. Yager, J. Cohen and W. Binder. Loyola Marymount University.

- 100. OCEAN'S EIGHT: EXAMINING CORAL RECRUITMENT PATTERNS ON JAMAICAN REEFS FROM 2012-2019**
§ S.R. Thiagarajan and A.D. Stubler. Department of Biology, Occidental College.
- 101. CHARACTERIZING THE PLANT GROWTH PROMOTING PROPERTIES OF *STREPTOMYCES* SP. 13GDEB02N**
§ G. Di Franco and M. Lum. Department of Biology, Loyola Marymount University.
- 102. TOPANGA: A LUCIFERASE-BASED ASSAY FOR THE DETECTION OF CHIMERIC ANTIGEN RECEPTORS**
‡ A. Morales, R. Gopalakrishnn, H. Matta, S. Choi, V. Natarajan, A. Jeronimo and P.M. Chaudhary. Bravo Medical Magnet High School & USC STAR Program, Norris Cancer Center, University of Southern California.
- 103. THE REPRODUCTIVE MORPHOLOGY OF MALE SURFPERCHES (EMBIOTOCIDAE; TELEOSTEI)**
§, £ E.C. Bond and K.L. Forsgren. California State University, Fullerton.
- 104. PARASITES OF CYPRINIFORM FISHES OF THE SANTA CLARA RIVER**
§, † M.D. Murray. Department of Ecology and Evolutionary Biology, UCLA.
- 105. EFFECT OF TEMPERATURE ON EMBRYONIC TO LARVAL DEVELOPMENT OF SAND DOLLARS, *DENDRASTER EXCENTRICUS***
‡ J. Lee, D.A. Pace and A. Carrillo. California Academy of Science and Math, California State University, Long Beach, Cabrillo Marine Aquarium, San Pedro.
- 106. PHYTOPLANKTON ASSEMBLAGE COMPOSITION AT WHITE POINT HYDROTHERMAL VENT**
G.A. Peters. Cabrillo Marine Aquarium, San Pedro.
- 107. ALIGNMENT OF INTERSTS IN THE JOSHUA TREE – YUCCA MOTH POLLINATION MUTUALISM**
A. Dang and J.B. Yoder. Department of Biology, California State University, Northridge.
- 108. UTILIZING ENDO-PORTER TO DELIVER MORPHOLINO ANTI-SENSE OLIGONUCLEOTIDES INTO ISOLATED SKELETOGENIC CELLS OF *LYTECHINUS PICTUS***
§ H. Rattu Mandias and B.T. Livingston. Department of Biological Sciences, College of Natural Sciences & Mathematics, California State University of Long Beach.
- 109. LOCAL-SCALE ENVIRONMENTAL HISTORY INFLUENCES THE RESPONSE OF ALASKAN TIDE POOL SPECIES TO INCREASED TEMPERATURE**
§ R. Rangel and C. Sorte. Department of Ecology and Evolutionary Biology, University of California, Irvine.
- 110. CALPAINS 8 AND 9 ARE EXPRESSED IN THE MURINE INTESTINES AND REGULATED BY *wnt3a* IN COLON CANCER CELLS.**
‡ A. Beshimova¹, B. Nakamura² and L. Shao². ¹Bravo Medical Magnet High School & USC STAR Program, ²Department of Medicine, Division of Gastroenterology and Liver Diseases, USC Keck School of Medicine.

111. UNDERSTANDING THE CAUSES AND CUMULATIVE CONSEQUENCES OF RARITY ON *ENCELIA DENSIFOLIA* AND *E. RAVENII*

§ **A. Hernandez**¹, C.T. DiVittorio², A.B. Roddy³, F. Zapata⁴ and S. Singhal¹. ¹Department of Biology, CSU Dominguez Hills, ²Tru-Breed Technologies, Oakland, ³School of Forestry and Environmental Studies, Yale University, ⁴Department of Ecology & Evolutionary Biology, UCLA.

112. MARKING TERRESTRIAL ISOPODS FOR RECAPTURE: NOT AS EASY AS YOU MIGHT THINK

§ **M. Nguyen**^{1,2}, S. Al Azzawi¹ and B. Ripley¹. ¹Grossmont College, ²University of California, San Diego.

113. COMPARING PHYSICAL CHARACTERISTICS AMONG EELGRASS BEDS *ZOSTERA PACIFICA* AND A PROPOSED TRANSLOCATION SITE IN SANTA MONICA BAY, CA

§ **J.A. Burns**¹, P.H. House² and K.K. Johnston¹. ¹Coastal Research Institute, Loyola Marymount University, ²The Bay Foundation.

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‡ **Y. Cho** and A. Carrillo. Palos Verdes Peninsula High School, Cabrillo Marine Aquarium.

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‡ **J. Heo**^{1,2} and O. Otim^{2,3}. ¹Burbank High School, ²TEAMS Research Institute, Los Angeles, ³Environmental Monitoring Division, City of Los Angeles.

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- 137. DETERMINING SPECIES STATUS OF THE SANTA ANA SPECKLED DACE, *RHINICHTHYS OSCULUS*: CONGRUENCE AMONG NUCLEAR AND MITOCHONDRIAL GENETIC MARKERS**
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§ **E. Reyes**¹, J.R. Knott¹ and A.L. Garcia². ¹Department of Geological Sciences, California State University, Fullerton, ²Mojave Water Agency, Apple Valley, CA.

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ORAL ABSTRACTS IN PROGRAM ORDER

1. HISTORIC EROSION PATTERNS AND REPLICATE PHOTOGRAPHY IN DEATH VALLEY AND THE MOJAVE DESERT

J.R. Knott¹, A.L. Garcia² and L.J. Thomas¹. ¹Department of Geological Sciences, California State University, Fullerton, ²Mojave Water Agency, Apple Valley, CA.

Repeat photographs of U.S. Geological Survey historical photographs in the Mojave Desert area date as far back as 1900. The most common landscape change is the improvement and installation of roads and other conveniences in highly trafficked areas. In tourist areas, such as Furnace Creek Ranch, Death Valley, invasive tamarisks and palm trees replace native vegetation. Mine spoils and road construction are common landscape and vegetation disturbances as well. Precarious vertical slopes, spires and natural bridges in the hyper-arid area remain relatively unchanged down to the individual rock scale. Mushroom Rock is the most dynamic landscape element in Death Valley. Compared to photographs over 110 years ago, Mushroom Rock has lost significant mass along with erosion of the ground around the pedestal. Slope decline related to high foot traffic is the likely cause of the surrounding ground. Fault scarp decline is visible along the Black Mountains fault zone results in accumulation of material at the toe, which is likely related to debris placed at the toe raising local base level. By 1960, erosion had removed 27% of the uphill berm along the dirt road from Furnace Creek to Badwater. By 2011, erosion had destroyed over 97% of the berm, which shows that most of the alluvial fan surface was active over the 50-year interval. South of Death Valley at Silver (dry) Lake, replicate photography shows loss of creosote bushes surrounding the playa. These observations illustrate the relative landscape and human impacts on the semi-arid to hyper-arid landscape and vegetation.

2. TIME SERIES DATA RESOLVES ISSUES OF IMPORTED WATER RECHARGE IN COACHELLA VALLEY, CALIFORNIA

B. Hibbs. Department of Geosciences and Environment, California State University, Los Angeles. The Coachella Canal was completed in 1948 to divert water from the Colorado River for use in Imperial Valley. The unlined canal recharged local aquifers, and wetlands expanded. Before and after canal lining in 2006, we collected samples from spring and well locations at Dos Palmas Preserve for comparison to canal and native groundwater sources. Analysis of stable isotopes identifies distinct groups of water: the first was comprised of nearly pure canal water with $\delta^{18}\text{O}$ ranging from -11.3 to -11.9 and $\delta^2\text{H}$ ranging from -84 to -95; the second consisted of nearly pure native groundwater with $\delta^{18}\text{O}$ ranging from -7.3 to -8.7 and $\delta^2\text{H}$ ranging from -59.5 to -71; and a third group was made of a mixture of canal and native groundwater with $\delta^{18}\text{O}$ ranging from -8.7 to -11.1 and $\delta^2\text{H}$ ranging from -80 to -91. Most of the waters at the preserve are derived from Colorado River-fed canal water. Tritium and Carbon-14 support these interpretations. With the lining of the canal, flow at the wetlands has decreased. After canal lining a wetland mitigation project used artificial recharge to try to maintain adequate flow at springs. Artificial recharge is no more than 10-15% of the canal leakage that occurred before the canal was lined. A previous study in the late 1980s suggested that the San Andreas Springs at Dos Palmas Preserve was not connected to canal recharge, based on lack of tritium in flows. Regulators used this information to make plans for wetland mitigation. By 2003, our sampling showed that flow at San Andreas Spring was almost pure canal water, with bomb tritium detected. Canal water had not arrived in the late 1980s but had arrived by 2003. Our study points to the limitations of interpretations based on sampling in a moment in time, when a major retrofit to a groundwater basin is completed.

3. THE PETROLOGIC AND HYDROTHERMAL EVOLUTION OF THE COASTAL BATHOLITH OF PERU: INSIGHTS FROM OXYGEN ISOTOPES.

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The Cretaceous-Paleocene Coastal Batholith of Peru formed during the subduction of the Farallon plate under South America as part of the ongoing Andean Orogeny. This >2000 km-long batholith was emplaced at crustal depths <5 km, making it highly susceptible to alteration by hydrothermal systems involving surface-derived water, including seawater and meteoric-hydrothermal water. We present oxygen isotope data from numerous gabbro, K-rich monzonite granodiorite, tonalite, and granite plutons of this 184 to 58 Ma batholith that intruded into Precambrian gneiss at the Arequipa segment in the south and into a Jurassic-Cretaceous volcano-sedimentary basin at the Lima segment in the north. The excellent exposures provided by the extremely arid conditions of the northernmost Atacama Desert make this an excellent location for the study of interactions between magmas and shallow crustal rocks. Mineral $\delta^{18}\text{O}$ values from >60 samples indicate variable magma sources and document hydrothermal alteration. Equilibrium quartz, plagioclase, hornblende, and biotite $\delta^{18}\text{O}$ values at $T > 550^\circ\text{C}$ indicate the preservation of primary magmatic values for most rocks. Most plutons produced quartz and plagioclase $\delta^{18}\text{O}$ values (<9‰) that indicate a mantle magma source. Higher $\delta^{18}\text{O}$ values that suggest significant crustal contamination are observed at only a few plutons within the Arequipa segment, consistent with published $^{87}\text{Sr}/^{86}\text{Sr}_{\text{initial}}$ values for such rocks. Perthitic and “sieve” textures in K-feldspar and zoned plagioclase indicate shallow emplacement and fractional crystallization. Alteration minerals include sericite, epidote, chlorite, and actinolite. Non-equilibrium hornblende and biotite $\delta^{18}\text{O}$ values from the older plutons indicate infiltration of seawater in the north and meteoric-hydrothermal water in the south.

4. DETERMINATION OF DROUGHT RESILIENCY FOR ENDANGERED FISH HABITAT USING UNDERGRADUATE EXPERIENTIAL FIELD LEARNING, CSU DESERT STUDIES CENTER, ZZYZX, CALIFORNIA

E.B. Melchiorre, C.E. Skjerve, K.R. VonSydow, H.M. Shields, B.H. Seymour, H.C. Haddock, L.J. Gomez, F. Ashley, K.M. Amezcua and M.H. Aldawoud. Department of Geology, California State University, San Bernardino.

Undergraduate course-based field research has extended our knowledge of how geology contributes to survivability of the endangered Mojave Tui Chub (*Gila bicolor mohavensis*) at the CSU Desert Studies Center located at Zzyzx, CA. Using active experiential learning techniques in a field environment, field hydrology students deployed a 3m (9ft) research blimp with sub-meter GPS and stereographic image capture to create a 0.1m (12 in) resolution 3D topographic model of the site. Students populated this model with water table elevations at monitor wells and the spring which hosts the Mojave Chub, using GPS-enabled field tablet computers. Students also digitally collected hundreds of structural measurements on fractures and karst in the limestone hill, which separates the Mojave Chub spring from its presumed source in the Soda Spring aquifer. Contour maps of fracture density, average fracture length, and fracture orientations revealed a zone of fracture density up to 6 times the local bedrock average, directly connecting the Soda Spring aquifer with Mojave Chub spring. Karst was determined to be an insignificant control on fluid flow through the limestone hill. Given the fracture-regulated flow between a large aquifer and the small spring hosting the endangered fish, it is suggested that this species benefits from a significant degree of drought resiliency. This knowledge may inform future studies which aim to identify and rank drought resiliency at other species-critical spring sites in the Mojave Desert.

5. A VASCULAR FLORA OF THE NOPAH RANGE, INYO COUNTY, CALIFORNIA

§ **Carolyn Mills**^{1,2}. ¹Department of Botany, Claremont Graduate University, ²Rancho Santa Ana Botanic Garden, Claremont, CA.

The Nopah Range in southeastern Inyo County, California is a botanically diverse mid-elevation sky island located in the northern Mojave Desert just west of the California-Nevada border. This range has seen very little botanical documentation away from roadsides; however, its calcareous substrates have the potential to yield exciting discoveries including rare and endemic species, range extensions, and new species records for California. The study area is approximately 240 km² (93 mi²) and is located at the intersection of two major floristic provinces, the Mojave and Great Basin deserts. Data collection for this study began in October 2018 and will continue through November 2020. This presentation will review the botanical collection history for the study area and present preliminary findings including previously

undocumented populations of rare plant taxa such as *Agave utahensis* var. *eborispina* (ivory spined agave), *Arctomecon merriamii* (white bear poppy) and *Salvia funerea* (Death Valley Sage).

6. LEARNING AND COEVOLUTION IN PLANT-POLLINATOR MUTUALISM

J.B. Yoder. Department of Biology, California State University, Northridge.

Extensive evolutionary theory and empirical research have focused on plant-pollinator coevolution and on pollinators' learning to discriminate among plants that offer different rewards, but how pollinator learning might interact with plant-pollinator coevolution remains largely unexamined. Learning should reduce the need for a "pre-programmed" response to plant signals, which could weaken the strength of plant-pollinator coevolution; but it may also reduce the success of deceptive plants that mimic rewarding ones without offering rewards, thus strengthening natural selection exerted by pollinator preferences. I present a population genetic model of plant-pollinator coevolution in which pollinators are able to learn associations between floral signals and rewards, and compare this model to an equivalent one in which pollinators do not learn. This allows me to identify how, specifically, pollinator learning may alter coevolution in this interaction, and in other mutualistic associations. These results have significant implications for wild and domesticated pollinators' ability to adapt to plant communities altered by climate change and human introduction of nonnative species.

7. THE SONG OF STEREOLEPIS

L.G. Allen and E. Ladin. Department of Biology, California State University, Northridge.

To investigate sound production of Giant Sea Bass, we captured (under CDFW SCP permit) three, mature Giants (40-50 kg) and placed them into captivity in a 5,000 l tank at the Southern California Marine Institute's Fish Harbor Laboratory facility in the summer of 2017. One male and two females remained isolated from other fish species and any sounds produced were continuously recorded using underwater hydrophones (Soundtrap 202: Ocean Instruments^{NZ}) during the breeding seasons (June-August) of both 2017 and 2018. After analysis of hundreds of 6-min recording sessions, only low frequency "Booms" were recorded. The male Giant Sea Bass SOK-3 (aka, Maxie) presumably produced these sounds. We have now characterized the frequencies and amplitude these "Boom" sounds in detail. In short, these "Booms" and concert bass drums have very similar acoustic profiles ranging from 30 to 90 Hz in max frequencies. Necropsies of beached specimens have also revealed the sound producing mechanism associated with the swim bladders of male Giant Sea Bass. The characterization of these "booms" should allow us to identify spawning aggregations of Giant Sea Bass throughout their range based solely on sound in the future.

8. ABALONE (*HALIOTIS SPP.*) RECRUITMENT AT SANTA CATALINA ISLAND

A.C. Estrada and M.A. Steele. California State University, Northridge.

After 22 years of fishery closure, California abalone populations have been slow to recover or are not recovering at all due to limited reproduction and recruitment failure. Regular and substantial recruitment is necessary for recovery, but recruitment has not been well studied. Recently, green abalone (*Haliotis fulgens*) have been showing signs of population recovery at sites at Santa Catalina Island, yet a full assessment of population recovery and recruitment has not been possible due to limited data on spawning and recruitment. We quantified the density of recently settled abalone at 2 sites at Santa Catalina Island, California, from May-September 2017 to measure recruitment rates and identify key habitats. Abalone recruitment was greatest at shallow depths (<8 m) but occurred at all depths sampled (2-12 m). Recruitment differed between the two sites and was lower during mid-summer than during early or late summer. How the recruitment rates measured compare to historical rates is unknown because this is the first study to examine recruitment of abalone in southern California. For efficiency, future monitoring of abalone recruitment could focus on depths and seasonal periods shown by this study to have the highest recruitment, providing key information to resource managers.

9. FISH ASSEMBLAGES AND REPRODUCTIVE OUTPUT POTENTIAL AROUND CALIFORNIA OIL AND GAS PLATFORMS AND NATURAL REEFS

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Fish assemblage surveys were conducted annually from 1995 to 2013 around oil and gas platforms and natural rocky reefs off the coast of southern California. Every site was not sampled each year, but overall the data set included the fish assemblages associated with 23 platforms and 70 natural reef sites. Both depth and habitat type had significant effects on fish community structure. A clear depth gradient in the fish assemblages across all habitat types is evident in ordination analyses. The influence of habitat is primarily due to clear separation between fish assemblages in platform midwater habitats (fish observed within 2 m of platform crossbeams at various depths throughout the water column) from those in all other seafloor habitat types (i.e., natural reefs, platform bases and platform associated shell mounds). The distribution of young-of-the-year fishes suggests platform habitats serve a nursery function. Further, patterns in fish size-structure and species-specific densities demonstrate how fishes distribute themselves across a depth gradient on platform structures, while they tend to co-occur in natural rocky reef habitats with more limited vertical relief. We identified 17 fish species (15 rockfishes *Sebastes spp.*) that have potential reproductive outputs (eggs m⁻²) on individual petroleum platforms that were tens to hundreds of times their average potential reproductive output on natural reefs in the study area. While the reproductive potential for almost all focal species was zero at the majority of surveyed sites, the highest reproductive output values were observed on platform habitats for all but two of the focal species.

10. THE EFFECTS OF MARINE PROTECTED AREAS ON FISH FORAGING BEHAVIOR

E. Nava and M.A. Steele. California State University, Northridge.

Marine protected areas (MPAs) are used to allow organisms and habitats to recover from anthropogenic impacts such as overfishing, which has significantly diminished populations of many exploited marine species. MPAs typically have higher biomass of harvested species within them than is found outside of them, which may result in resource limitation and intraspecific competition for resources among them. I evaluated whether a species known to have higher biomass in MPAs, California sheephead (*Semicossyphus pulcher*), is prey limited within them. In each of six different MPAs, I conducted foraging observations, to test whether foraging behavior of sheephead differed inside versus outside of MPAs; verified that biomass of sheephead was higher in the MPAs studied than in nearby areas open to fishing; and tested the prediction that prey density would be lower in MPAs than outside them. Underwater visual transects by scuba divers provided data on fish biomass and prey density. Foraging observations by divers quantified fish foraging behavior (foraging rate and time spent searching). Biomass of sheephead was higher within MPAs than outside and biomass was higher in older MPAs than younger ones. Prey densities differed inside vs. outside MPAs and correlated with sheephead biomass. Sheephead exhibited different foraging behavior inside versus outside MPAs, with longer searching periods for food and a higher foraging rate within MPAs. These data suggest that sheephead might be resource limited within MPAs, implying that as populations of harvested species rebuild within MPAs, they may become food limited.

11. RAPID RESPONSE OF KELP BASS *PARALABRAX CLATHRATUS* SIZE TO CHANGES IN FISHING REGULATIONS

M.A. Steele and M.S. Adreani. Department of Biology, California State University, Northridge

The speed and extent to which harvested populations respond to changes in management are often not well documented, particularly in marine systems. We evaluated how the size of the kelp bass (*Paralabrax clathratus*) responded to a change in the minimum size limit. This species is a popular target of an intense sport fishery (though it cannot be fished commercially) along the coast of southern California. In response to concerns about the status of the population, in April 2013, the minimum size

limit for this species was raised to 14 inches (35.6 cm) after being 12 inches (30.5 cm) for decades. The bag limit was also reduced from 10 to 5 fish per day. We sampled adult kelp bass from 2009 through 2018 at three large reefs along the coast between Oceanside and Dana Point, which all receive high fishing pressure. Over the period prior to the new size limit (2009-2012) adult kelp bass were similar in size among years, averaging 28 cm in total length (TL) and 287 g in weight. From 2013-2015, size increased and then was fairly stable through 2018, with kelp bass averaging 12% longer (31.5 cm TL) and 45% heavier (417 g). Thus, this change in fishing regulations appeared to have a fairly rapid and large impact on the size of this heavily exploited fish.

12. THE EFFECTS OF AN INVASIVE ALGA, *SARGASSUM HORNERI*, ON THE TROPHIC DYNAMICS OF TEMPERATE ROCKY REEFS

§, £ K.C. Scafidi and M.A. Steele. Department of Biology, California State University, Northridge.

Invasive species can alter habitats dramatically when they thrive in foreign conditions. *Sargassum horneri* is an invasive alga from the northwestern Pacific that is flourishing in the waters off Santa Catalina Island, California. However, the effect of this alga's presence on higher trophic levels is not clear. This study quantified the foraging rates of three common reef fishes (*Halichoeres semicinctus*, *Hypsypops rubicundus*, and *Semicossyphus pulcher*) and the abundance of small invertebrate epifauna the fish prey upon associated with understory algae, including *S. horneri*. Foraging observations were made via SCUBA at six sites along the leeward side of Santa Catalina Island. Three of the most abundant native algae (*Zonaria farlowii*, *Dictyopteris undulata*, and *Sargassum palmeri*) and *S. horneri* were collected at all six sites. Fishes foraged at higher rates among the native, *S. palmeri*, than the invasive *S. horneri*, even at sites with low algal diversity, and epifaunal abundance was greater on the native algae. Our results suggest that the invasive *S. horneri* negatively impacts the foraging of fishes, perhaps due to the low abundance of epifauna inhabiting this alga. These results suggest that the increasing prevalence of *S. horneri* on rocky reefs in Southern California and Baja California may impact higher trophic levels in invaded ecosystems.

13. INTRODUCTION TO THE EMERGING SOUTHERN CALIFORNIA UNDERGRADUATE TERRESTRIAL ECOLOGICAL RESEARCH NETWORK (SCUTER-NET)

W.M. Meyer III. Department of Biology, Pomona College.

While undergraduates are conducting important research on many of the urgent and unprecedented environmental challenges our society is currently facing (e.g., global climate change, habitat destruction, introduced species, biodiversity loss, and increased addition of nutrients and toxins), their work is often being conducted over small time and spatial scales, limiting its exposure and scope. Additionally, undergraduates are often isolated from other undergraduates at different institutions and the broader scientific community, working in the silo of the faculty mentor's lab. In this presentation, I will introduce an emerging network of southern California ecologists (Southern California Undergraduate Ecological Network) that aims to eliminate these logistical barriers by providing novel interdisciplinary training in research collaboration and authentic inquiry-based research experiences to a diverse group of undergraduates across regional institutions. We envision this network will be transformative in two important ways: (1) undergraduates will experience the joys and challenges of collaborating, which is critical to conservation research, and (2) the scope of the research questions undergraduates can ask will be broadened so that the data they collect will be regionally important.

14. CONSUMPTION OF FREE-ROAMING CATS BY COYOTES IN SOUTHERN CALIFORNIA

D. Martinez¹, N.M. Quinn² and P. Stapp¹. ¹Department of Biological Science, California State University, Fullerton, ²University of California South Coast Research and Extension Center, Irvine.

Coyotes (*Canis latrans*) are among the most successful carnivores in urban and suburban environments, which have increasingly led to conflicts between coyotes and people in southern California. One possible contributor to high coyote population densities and human-coyote encounters is the abundance of free-

roaming domestic cats (*Felis catus*) subsidized by backyard feeding and trap-neuter-release (TNR) programs. To determine if coyotes are attracted to and regularly eat free-roaming cats, we identified prey items in stomachs of road-killed coyotes and coyotes purposely killed as nuisance animals. We hypothesized that consumption of cats would be directly related to cat abundance, as measured by the density of TNR colonies and other landscape factors associated with urbanization. To date we have processed 311 coyote stomachs, 80% (250) of which had identifiable contents. Of these 250 stomachs, 27% (67) contained anthropogenic items and 71% (178) contained mammalian prey that could be identified to at least the ordinal level. Of the latter, 51% consumed rodents, 27% ate rabbits, and only 8% ate wild mesocarnivores. Cat remains were found in 20% of these stomachs and 11% of all stomachs examined. We are currently mapping locations of TNR colonies to determine if coyotes that ate cats were collected near these locations and to identify landscape characteristics associated with consumption of cats and other anthropogenic foods, as well as the locations of TNR colonies. When completed, our results will improve understanding of the role of TNR colonies as a possible attractant to coyotes that increase human-coyote conflicts.

15. HOW DOES ONTOGENY AFFECT CHANGES IN THE GUT MICROBIOME OF THE AMERICAN BULLFROG?

J.M. Yamauchi, G.E. Flores and R.E. Espinoza. Department of Biology, California State University, Northridge.

An organism's gut microbiome changes over the course of its life as a function of age, diet, and environmental factors, but species with complex lifecycles have been scarcely studied in this regard. For example, we would expect dramatic changes in the microbiome of a frog as it undergoes the profound changes associated with metamorphosis. Transforming tadpoles experience not only changes in their appearance, but also results in a complete remodeling of their digestive tracts during the shift from an herbivorous to a carnivorous diet. Our project aims to characterize changes in the microbial community living in the guts of American Bullfrogs (*Rana catesbeiana*) as they develop and undergo metamorphosis. We collected wild tadpoles and frogs representing most developmental stages, sampled their dissected guts for microbes, and extracted the DNA from these microbial communities. Next, we purified, amplified, and sequenced the microbial DNA, and identified operational taxonomic units, which will allow us to determine how ontogeny affects changes in the gut microbiome. Preliminary data ($n = 4$ adults) indicate that *Cetobacterium* is the dominant bacterial genus, suggesting these bacteria play an as-yet unknown role in frog health. Our study is the first to characterize changes in the gut microbiome of a wild vertebrate with a complex life cycle over the course of its entire life. As such, it will provide insight into the interactions among development, ontogenetic shifts in diet, and microbial community ecology over the course of the radical transformation experienced by these animals with complex lifecycles.

16. THE FLIGHT OF THE BUMBLE BEE: TRACKING SPECIES DISTRIBUTION DECLINES ACROSS SOUTHERN CALIFORNIA

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Wild and domesticated bumble bees (*Bombus*) provide essential pollination services for native plants and agricultural crops and therefore hold high ecological and economic value. Convincing evidence indicates global bumble bee declines, with confirmation of recent extensive range reductions across North America. These declines are induced by land use change, introduced pathogens, and climate change. Unfortunately, there remain large gaps in data pertaining to specific species and geographic regions. Better understanding species distribution shifts is important for agriculture and conservation efforts. Here I accessed natural history collections, community science databases (GBIF), and conducted field surveys to compare current and historical species distribution models (SDM) of five Southern Californian bumble bee species: *B. californicus*, *B. crotchii*, *B. melanopygus*, *B. sonorus*, and *B. vosnesenskii*. These species were selected based upon relative abundance and projected range shift intensity within Southern California. Statistical analysis using the software R Studio supports the occurrence of range reductions within each target species with large scale declines in the Eastern Sierra Mountains.

17. BAIT-STATION USE BY NON-TARGET WILDLIFE AS A ROUTE OF EXPOSURE OF URBAN CARNIVORES TO RODENTICIDES

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Anticoagulant rodenticides (ARs) are placed in tamper-resistant bait stations to control urban commensal rodent populations. Native rodents can be exposed to ARs directly, through consumption of AR baits, whereas scavengers and carnivores, such as coyotes, can be exposed indirectly by eating AR-laden prey. The extent to which native wildlife visit AR bait stations, however, is unclear. We used Reconyx trail cameras to monitor use of commercial bait stations in 90 residential yards in Orange County, California. Two stations, baited but with no ARs, were monitored continuously in each yard for ~30 consecutive days during the dry and wet seasons. One bait station was placed on the ground, whereas the other was elevated 1.5-2 m. Based on dry-season results, most yards (84%) were visited by at least one wild mammal species (range = 0-6), with more activity at ground cameras. Wild mesocarnivores were recorded at ground cameras in 52% of yards, with Virginia opossums and raccoons being the most common species (38%, 30%). Striped skunks were rarely detected in yards (4%). Native rodents, including ground squirrels, deer mice and woodrats, were only detected in 13% of yards. Larger carnivores were present at least once in 10% of all yards, with coyotes and bobcats present in 6% and 8% of yards, respectively. These results will be combined with wet-season results to examine the relative importance of local, yard-scale environmental features versus mapped, landscape-scale measurements of urbanization and land use as predictors of risk of rodenticide exposure of native wildlife.

18. ROLE OF SOIL MICROBIAL COMMUNITIES IN *ARTEMISIA CALIFORNICA* REESTABLISHMENT

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Significant portions of the endangered California sage scrub ecosystem are being type converted to invasive grasslands and mustardlands. Because changes in plant community composition can alter soil microbiomes, which can differentially influence germination and growth of different plant species, understanding how soil microbial communities influence plant growth can provide key insights to improve sage scrub restoration efforts. In this study, germination and growth rates were examined for *Artemisia californica* (native shrub species), *Bromus madritensis* (non-native grass species) and *Brassica nigra* (non-native mustard) grown in sterilized and unsterilized soil from sage scrub, invasive grass and invasive mustard habitats. We found that sterilization significantly improved growth rates of *B. madritensis*, and both growth and germination rates of *B. nigra* regardless of soil origin. For *A. californica*, growth rate improved with sterilization in soil from invasive grass and mustard habitats, but there was no difference in sterilized and unsterilized sage scrub soil. Results highlight that soil microbiomes in invaded areas may hamper *A. californica* restoration. However, once sage scrub is established soil microbiomes may act to resist the establishment of common invaders.

19. THE IMPORTANCE OF CALIFORNIA BUCKWHEAT *ERIOGONUM FASCICULATUM* AS A RESOURCE FOR NATIVE BEES IN SOUTHERN CALIFORNIA

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Native bees provide important ecological services by pollinating flowering plants. This study has three main components relating to native bee diversity visiting *Eriogonum fasciculatum* (Polygonaceae), a shrub native to Southern California. In 2017, we collected data on bee species visiting six native summer-flowering shrubs: California buckwheat (*Eriogonum fasciculatum*), toyon (*Heteromeles arbutifolia*), Cleveland sage (*Salvia clevelandii*), white sage (*Salvia apiana*), laurel sumac (*Malosma laurina*), and giant buckwheat (*Eriogonum giganteum*). 34 bee species were found of which 9 species visited >1 shrub species and 3 species visited all plant species, showing complex relationships. In summer 2018, we focused on bee visitors to *E. fasciculatum* because it is widespread and used in restoration. Buckwheat was sampled in restored sites located on roadside cuts and compared with nearby natural sites throughout

Los Angeles County. 26 different native bee species were found, 18 visiting natural sites and 9 visiting restoration sites. Non-native honey bees (*Apis mellifera*) were found to be the most abundant species at all sites. Finally, this study used machine learning to create species distribution models (SDM). SDMs were created for the five highest occurring native bee species and *E. fasciculatum*. The models predicted the five bee species, and buckwheat, to have similar ranges, with higher likelihood of presence in the coastal areas and lower likelihood of presence in the Central Valley. Future studies should be done to increase understanding of native bee diversity and community compositions differences with hopes to advise restoration efforts in urban areas and improve native populations.

20. PLASTICITY TO DROUGHT OF THE LEAF HYDRAULIC SYSTEM IN FOUR SPECIES OF THE CALIFORNIA COASTAL SAGE SCRUB

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Droughts have increased in incidence and severity in many regions of the globe and understanding how species and ecosystems will respond is of timely importance. Coastal California has been labelled as a potential “hotspot” for climate change by global and regional climate models, predicting an increase in temperature of up to 2°C, along with increase in drought severity in the next 50 years. We studied four California coastal scrub species (*Artemisia californica*, *Salvia mellifera*, *Ericameria palmeri* and *Eriogonum fasciculatum*), which we grew under three different water regimes (“wet”: 160% of native precipitation, “dry”: 40% of native precipitation and “control” representing 100% of native precipitation). We investigated the differences across treatments in physiological traits such as leaf hydraulic conductance (K_{leaf}) and its vulnerability to dehydration, stomatal conductance, along with differences in structural traits (leaf morphology, stomatal density and midrib vein length per area). We found overall little to no plastic responses in physiological and structural traits across species. We discuss these results in the context of climate change.

21. EFFECT OF HERBIVORES ON CALIFORNIA SAGE SCRUB RECOVERY FOLLOWING A FIRE

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Increasing fire frequency in the California Sage Scrub (CSS) ecosystem is a primary driver of type conversion of CSS to non-native grasslands. While competition has historically been considered the most important mechanism structuring post-fire plant communities in CSS, existing knowledge on the effects of herbivory on plant succession is limited. Recovery of native shrubs due to herbivore preference for annuals may be favored in the spring, but recent studies show significant mortality of native shrub seedlings is associated with herbivory in the late summer and early fall. Additionally, we have found that the removal of non-native annuals has a positive effect on native annuals but not on native shrubs. As such, a better understanding of herbivory effects in post-disturbance recovery is crucial to constructing effective post-fire restoration efforts for CSS. To study the effects of herbivory on shrub recovery, we have set up six experimental plots that exclude herbivores and six adjacent control plots that allow herbivores access to plants in a CSS habitat that burned in 2017 at the Bernard Field Station in Claremont, California. We are currently in the second year of data collection and will be presenting our most up-to-date results at the conference.

22. PROPAGULE PRESSURE AND FUNCTIONAL TRAITS: UTILIZING INVASION MECHANISMS TO PROMOTE RESTORATION

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The supply of invader propagules (propagule pressure) is related to levels of community invasibility and serves as a strong predictor of invasion success, as increased levels of propagule pressure may overcome high invasion resistance. The role of propagule pressure in invasion success is affected by the traits of

both the arriving and resident species in an environment. Whether the principle of propagule pressure can be applied in the context of restoring invaded habitats has been studied minimally. In this study, a gradient of native propagule pressure using 13 native annual species was applied to plots dominated by invasive species. Species emergence, reduction of bare ground cover, and vegetative cover were all monitored. All native and invasive species used in this study were grown to full maturity in both a greenhouse and field monoculture plots for functional trait measurements. Throughout the growing season, bare ground cover declined quickest in plots with the highest native propagule pressure. Native species abundance increased with increasing native propagule pressure. Additionally, the abundance of invasive species was reduced at increased levels of propagule pressure. These early results indicate that increased native propagule pressures are capable of reducing the cover of invasive species through competition for space. The relationship between increased propagule pressure and density dependent effects, as well as the functional trait differences between native and invasive species remains to be explored in this study.

23. FUNCTIONAL TRAITS RELATE TO GROWTH AND MORTALITY IN LOWLAND TROPICAL FORESTS IN CENTRAL PANAMA

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Understanding forest dynamics is vital for predicting climate change induced shifts in species composition in natural ecosystems. Plant functional traits have been linked with climate response and can inform on a species' capacity to withstand drought. The objective of this study is to relate functional traits from 20 species growing in Central Panama with climate variables from their natural ranges and explore their physiological response to drought stress to elucidate what factors play a role in plant growth and mortality. We hypothesize: (1) higher growth rates and lower mortality rates will coincide with better adaptability to drought; (2) canopy species will exhibit a higher maximal leaf hydraulic conductance (K_{max}) as a consequence of their dryer and more irradiant microhabitat. We collected data from three individuals of each species on Barro Colorado Island (BCI) in Central Panama. We constructed leaf hydraulic conductance (K_{leaf}) vulnerability curves to drought using the evaporative flux method (EFM), measured morphological and physiological traits such as leaf mass per area (LMA), wood density (WD), and leaf osmotic potential at turgor loss point (π_{tlp}), and extracted mean annual precipitation (MAP), mean annual temperature (MAT), potential evapotranspiration (PET), and aridity index (AI) from the Global Biodiversity Information Facility. To investigate climate effects on species growth and mortality, we included data on tree growth and mortality rates from a long-term ecological monitoring site (50 ha plot) at BCI. The implications of this study are important for attempts to predict the effect of climate change on species compositions in tropical ecosystems.

24. QUANTIFYING EXTRACELLULAR TACHYZOITE SURVIVAL AND INVASION-CAPABILITY UNDER A WIDE RANGE OF ENVIRONMENTAL CONDITIONS IN THE HUMAN PARASITE *TOXOPLASMA GONDII*

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Toxoplasma gondii is an obligate intracellular parasite. During acute infection the parasite (aka tachyzoite) transitions in and out of host cells in what is called the lytic cycle. Despite its importance, quantitative measures of tachyzoite survivability have not been undertaken with respect to different extracellular ionic conditions, temperature, and time outside of a host cell. The present study examined the survivability of two strains of *T. gondii* with differences in virulence: PRU (less virulent) and RH (more virulent). Survivability in conditions that mimicked serum, gastric juices (pepsin, pH=2), and full-strength seawater (34 ppt, 16°C) were assessed using four different techniques: 1) Giemsa staining to determine invasion efficiency, 2) plaque assays, 3) live/dead fluorescent staining and 4) conoid extrusion assays. For all conditions, the more virulent RH strain had more robust survival and invasion capability

than the less virulent PRU strain. RH tachyzoites had 65% survivorship after 48 hours in serum-like conditions, with ~10% being invasion-capable. In gastric conditions, a small, but significant, fraction (~2%) of RH parasites survived for up to 30 minutes and were invasion-capable. A small fraction of RH strain parasites were also able to survive in seawater for 6 hours and subsequently invade and replicate within host cells. This study quantitatively documents the robustness of extracellular parasite survival in several different ionic conditions for varying lengths of time. Importantly, it demonstrates that it is possible for the tachyzoite stage to be ingested and survive transit through the digestive system and subsequently establish a productive infection.

25. CHARACTERIZATION OF TbMscS, A MECHANOSENSITIVE CHANNEL IN *TRYPANOSOMA BRUCEI*.

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African Trypanosomiasis an infectious disease transmitted by the tsetse fly is caused by the parasite *Trypanosoma brucei*. This illness devastates human and livestock populations in sub-Saharan Africa. Early symptoms of infection are non-specific and include fever and musculoskeletal pain. Left untreated, trypanosomiasis invariably leads to coma and death. Although a few treatments exist, their specificity to the subspecies and clinical stage of the infection narrows their efficacy. Current therapies are toxic and difficult to administer calling for developing more effective and accessible treatments. A potential drug target is the small conductance mechanosensitive channel (TbMscS), a bacterial-like channel expressed in the parasites but absent in mammalian hosts. Mechanosensitive channels participate in the osmoregulation and virulence of *T. cruzi*. Topology models indicated the protein has three transmembrane domains, similar to the *E. coli* channel. Immunofluorescence analysis indicates the channel is concentrated in the flagellar attachment zone both in bloodstream and procyclic forms of the parasite. Downregulation of the expression by RNAi in procyclics does not affect the growth but significantly decrease the ability of the to maintain their normal volume under hyperosmotic conditions. In contrast, downregulation in bloodstream forms, by single allelic deletion, caused a significant decrease in growth. In both life stages, complete ablation of the gene is lethal, suggesting the essentiality of the protein. Our work indicates that TbMscS is important for cell survival, growth and osmotic regulation, reinforcing the hypothesis that these channels can be exploited as potential drug targets against *T. brucei* and other protozoan pathogens.

26. NEW CYSTEINE PROTEASE INHIBITORS WITH EFFECT AGAINST *TRYPANOSOMA CRUZI*

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Chagas disease, a neglected tropical disease, is caused by the protozoan parasite *Trypanosoma cruzi*. Endemic in Latin America is spreading to other parts of the world. The estimated number of Chagas disease cases in the U.S. ranges from 300,000 to 1 million. The only available drugs are benznidazole and nifurtimox. Both cause severe adverse side effects in patients and achieve only 8% curing rate in the chronic phase of the disease. It is urgent to develop new drugs with higher efficacy, better safety profiles and fewer secondary effects. Cruzipain, a cysteine-protease, has been extensively studied in *T. cruzi* and is necessary for the cell invasion, parasite metabolism and proteolysis of host tissue, as well as evasion of the host immune system. Several cysteine-protease inhibitors that target cruzipain have been developed, however, their lack of specificity and low efficacy compared to current treatments has limited their clinical use. Based on the existing cysteine-protease inhibitors' structure, novel chemical derivatives have been developed to test their ability to induce cytostatic and cytotoxic effects in Y strain parasites. Epimastigotes expressing a reporter gene were used to screen novel chemical derivatives. The prescreening of 72 compounds in a cell-growth inhibition assay identified compounds TN3p8, TN3p92, and TN3p96 as active against the parasites, with a faster killing profile than benznidazole. These substituted chalcones and epoxides are currently used as lead structures to develop a series of derivatives with cysteine-protease inhibitor activity. Our efforts are focused in finding drugs with high specificity and selectivity against *T. cruzi* and other protozoan parasites.

27. COMMENCING EVASIVE MANEUVERS: CALIFORNIA KILLIFISH MOVE, DART, AND SCRATCH MORE DURING TREMATODE PARASITE EXPOSURE AND ATTACK

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With the ubiquity of parasites, many hosts have been selected to decrease parasite infection success by using behavioral forms of defense such as avoidance of infected habitats/conspecifics, grooming, grouping, altering swimming behavior, or even self-inducing behavioral fevers. California killifish, *Fundulus parvipinnis* – common to Southern and Baja California estuaries – are typically exposed to several trematode species that use them as 2nd intermediate hosts. We know that at least one of these trematodes substantially impacts killifish fitness. We also know that it is likely that killifish can perceive the trematodes' infectious propagules (cercariae). However, we do not know whether the killifish employ behavioral defenses to reduce exposure. We experimentally exposed lab-reared killifish originating from two San Diego estuaries to two of these trematode species: *Euhaplorchis californiensis* – which infects the killifish brain and manipulates host behavior to increase predation rates – and Small Cyathocotylid, which infects connective and muscle tissues. To assess killifish behavioral response to exposure, we quantified several behaviors (activity, number and type of potential defensive behaviors, group size, and vertical position in the water column) before exposure, during disturbance (as a control), and during exposure. Our results showed that killifish exposed to both trematode species increase mean activity and the number of several potential defensive behaviors. Conversely, neither group size nor vertical position was influenced by parasite exposure. Hence, not only do these parasites adaptively manipulate host behavior after infection, but they also alter host behavior by hosts employing behavioral forms of defense, with implications for host social and ecological interactions.

28. EVIDENCE FOR A LOVE POTION PARASITE: TREMATODE PARASITES INCREASE MALE FIDDLER CRAB SEXUAL DISPLAY RATES

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To facilitate transmission to predatory final hosts, trophically transmitted parasites often adaptively increase the risky behaviors of their intermediate hosts. Many hosts have sexual displays that are conspicuous and risky, and these displays may be prime targets for parasite enhancement. Although the existence of such “love potion” parasites has been previously hypothesized, little is known about its actual occurrence. Here, we tested the hypothesis that a trophically transmitted trematode (*Probolocoryphe uca*) acts as a “love potion parasite” in California fiddler crabs (*Uca crenulata*), by virtue of increasing male crab waving, which is a conspicuous, risky sexual display. We also evaluated two competing hypotheses that could also explain higher courtship rates in parasitized males: the “sexy susceptible male hypothesis”, whereby increasing display rates increases infection susceptibility, and the “reproductive compensation hypothesis”, whereby increased display rates represent increased reproductive effort given infection reduces life expectancy. We found that experimentally infected crabs exhibited higher predation rates than controls in a field mesocosm. Further, naturally infected males harboring more parasites displayed more frequently than did males with fewer parasites. Males that waved more were not more susceptible to infection, rejecting the sexy susceptible male hypothesis. Additionally, infected males did not suffer greater background mortality or have lower body condition indices compared to uninfected males, providing evidence against reproductive compensation. Hence, to our knowledge, this is the first study to provide substantial evidence for a love potion parasite, one that enhances a host sexual signal for increased transmission success.

29. TRANSMISSION OF THE NEMATODE, *VASORHABDOCHONA CABLEI* (RHABDOCONIDAE) FROM THE LONGJAW MUDSUCKER, *GILLICHTHYS MIRABILIS*

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The nematode, *Vasorhabdochona cablei*, Martin and Zam, 1967 is a parasite of longjaw mudsuckers in tidal wetlands of the Eastern Pacific, confirmed from Morro Bay in California to Scammon's Lagoon in Baja California, Mexico. *Vasorhabdochona* is a monotypic genus and one of the few rhabdodconids living in a marine/estuarine habitat. Larvae (juveniles) resembling *V. cablei* were found in the shorecrabs *Pachygrapsus crassipes* and *Hemigrapsus oregonensis*. Adult male and female worms, which are present in the bile ducts of mudsuckers, release larvated and unlarvated eggs into the intestine. Eggs containing first stage larvae were fed to shorecrabs, *P. crassipes*, where they migrate into muscle tissues throughout the body and undergo two molts to become third-stage larvae. Third-stage larvae removed from crabs and injected into mudsuckers *per os* were present in the pancreatic ducts within one hour of infection where they proceeded to molt twice to become adult worms. Female worms were gravid and releasing eggs by 30 days post infection. Pancreatic ducts become distended by *V. cablei* and infected areas contain melanin deposits. *V. cablei* was found to live for at least one year in the pancreatic ducts.

30. ACQUISITION OF MACROPARASITES BY YOUNG-OF-THE-YEAR ARROW GOBIES *CLEVELANDIA IOS*

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Fishes acquire their parasites over their lifetimes. How soon does this acquisition begin? 225 young-of-the-year (YOY) Arrow Gobies (*Clevelandia ios*) were obtained by seine on 8 November 2018 from the Cabrillo Beach Salt Marsh as part of the Cabrillo Beach Survey operation. These potential hosts were examined for macroparasites using a modified gut wash procedure. These small fishes (ca. 26 mm standard length) were in turn parasitized by small parasites, most at larval or juvenile stages. Four species of parasites including a nematode, an isopod, a cestode and a monogene were harvested. The larval cestodes had the highest abundance, prevalence, and mean intensity compared to the other parasites and were present in an "overdispersed" pattern of distribution. The endoparasites (pleuroceroid cestodes and larval nematodes) may stay with the host for its lifetime. The ectoparasites (juvenile isopods and adult monogenes) may opt to leave for other, larger hosts at a later date.

31. BEYOND PARASITES IN FOOD WEBS: EFFECTS OF A PARASITOID IN THE MARINE MICROBIAL LOOP

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Recent oceanic and coastal surveys have revealed that unicellular, eukaryotic, parasitic interactions are highly prevalent in interaction networks of marine plankton communities. This has profound implications as parasitism has the potential to negatively impact host populations and dramatically alter the flow of energy in planktonic food webs. Here, we examine the parasitoid-host dynamics between a generalist marine parasitoid, *Parvilucifera sinerae* (Perkinsea: Perkinsida), and one of its hosts, *Lingulodinium polyedra* (Dinoflagellata: Gonyaulacales), and the trophic importance of parasitism in the marine microbial loop. We conducted laboratory time-course experiments comparing parasitized and non-parasitized (control) cultures to quantify: 1) the effects of the parasitoid on host mortality and population growth rates, 2) the growth efficiencies of the parasitoid, and 3) the production of dissolved and particulate organic carbon during host lysis. Both the control and parasitized treatments initially consisted of 1,000 host cells ml⁻¹, with the addition of 20,000 parasitoid zoospores per ml in the parasitized treatment. After 72 hours, parasite prevalence reached >90% and the population growth of the host declined at a rate of -0.65 compared to a positive growth rate of 0.01 in the control. Parasitoid-mediated host death results in loss of organic carbon to respiration and the production of non-living particulate and dissolved organic matter, as well as thousands of parasitoid zoospores (free-living stage) that can serve as prey in the marine food web. This study provides insight on the trophic importance of parasites in marine food webs and in the broader context of ecosystem functions.

32. INCREASED ORGANIC CARBON INPUTS TO SOUTHERN CALIFORNIA BEACHES FOLLOWING THE 2017 THOMAS AND 2018 WOOLSEY FIRES

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Large fires have become a frequent occurrence on the Southern California coast. In burn scar areas, charred vegetation and hydrophobic soils combined with seasonal, intense rainfall leads to erosion and mobilization of sediments and organic debris. This material can be transported through coastal watersheds, as catastrophic mud flows or storm discharges from area streams, enter the littoral zone and be deposited along the coast. Littoral drift subsequently transports sediments and organic debris downcoast. The accumulation of organic debris, or wrack, from marine (e.g. kelp) or terrestrial (e.g. leaf litter and wood) sources is an important supratidal component of sandy beach ecosystems. Wrack is habitat and food source for a number of invertebrate infauna including amphipods, isopods and insects. We characterized inputs of organic woody debris to seventeen beaches on the Southern California coast between Carpinteria and Malibu following the 2017 Thomas and 2018 Woolsey fires. Two surface sediment samples were collected from each beach in 2017, preceding the fires, then directly after the fires, and again following the first subsequent rainfall events. We determined percent organic carbon (POC) present in each sediment sample. We found that there was an elevated amount of organic carbon in beach sediment after the first major rains following a fire and that POC was higher on beaches closer to stream inputs of debris flows. Characterizing POC in beach sediment following fire and rain events is crucial in creating a broader understanding of how fires affect coastal ecosystems.

33. EFFECTS OF MAMMALIAN APOSEMATIC PATTERN AND COLOR CONTRAST VARIATION ON PREDATOR AVOIDANCE LEARNING

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Aposematic coloration makes prey defenses easier for predators to learn and remember, and thus plays an important role in reducing mistaken attacks. Coyotes (*Canis latrans*) are potential predators of the striped skunk (*Mephitis mephitis*) but are highly vulnerable to the latter's noxious defenses. To determine how contrast intensity and pattern structure influence avoidance learning in canid predators, we have installed camera traps along transects in local wetland and forested environments to observe wild coyote avoidance behavior in response to artificial prey models that vary in color contrast intensity and pattern structure. Differences in the latency to approach/interact with the models will be compared with respect to the contrast intensity and pattern structure of the model. Past research shows that captive coyotes can easily learn to avoid attacking black and white prey models and can generalize this avoidance to models with more white (high contrast) but not to models with more black (low or no contrast). Preliminary findings suggest that coyote subjects demonstrate greater latency to attack all black and white (maximum contrast) models, regardless of pattern structure, compared to the black and gray (minimal contrast) model.

34. FUNCTIONAL DIVERSITY OF PERMAFROST COMMUNITIES DISTRIBUTED ACROSS SPACE AND TIME

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Permafrost, ground frozen for more than two years, presents challenges to microbial survival due to oligotrophic conditions, subzero temperatures, variable water availability, and fluctuations in salinity. In response, microbial communities can shift in both composition and function as the environment changes. To explore the functional diversity of permafrost communities both globally and temporally, emulsion PCR was used to create 92 metagenomic sequencing libraries from Alaskan (USA) and Siberian (Russia) samples. Sequencing data from these libraries were combined with publicly available permafrost sequence data from Alaska, Canada, and Siberia resulting in a combined dataset of 102 metagenomes spanning a period of time ranging from 5,000 to >100,000 years before present. Preliminary data suggest that variation in carbon, nitrogen, water concentration, and pH may be driving functional diversity.

35. PLANT BIOACCUMULATION ANALYSIS OF HEAVY METALS IN SOUTHERN CALIFORNIA BIOSWALE

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Heavy metals have been identified as a significant source of pollution in the Los Angeles River, classifying it as an impaired water body for its high levels of copper, lead, and zinc. The Culver City Rain Garden is a large-scale bioswale constructed to mitigate nearby commercial source pollution from runoff. Recent research from 2017 calculated retention rates of 92-95% of the three metals of concern based on stormwater loading data. A second study analyzing metal distribution within soil at various depths found that most metals were concentrated within the top 20 cm of surface soil. This study aims to characterize heavy metal distribution within the surface media of the bioswale and determine concentrations of metals in several species of plants. Collections of native plants were based on their abundance and location in the garden. Multiple root and shoot samples were collected from each individual plant as well as samples of surrounding soil and overlying leaf debris. Samples were prepared for Inductively Coupled Plasma/Mass Spectrometer (ICP/MS) analysis of heavy metal concentrations according to a modified version of EPA method 3050B. All three metals were detected in all samples. Results indicate concentrations for zinc were highest across all species, with copper and lead having significantly higher concentrations in the root and soil samples than the shoots or leaf debris. Average *Juncus patens* concentrations of all three metals were significantly higher in comparison to *Carex praegracilis*. These findings will be used to inform adaptive management decisions for the garden.

36. FIRST RESULTS FROM THE CATALINA DYNAMIC OCEAN CHEMISTRY PROGRAM **C.G. Gelpi**. Catalina Marine Society.

Natural variations in ocean pH may influence how marine fauna tolerate increasingly acidifying waters. The Catalina Dynamic Ocean Chemistry (CDOC) program is designed to investigate natural variations at Santa Catalina Island. Measurements of various ocean chemical parameters, including pH, were made at 18.3 m depth from a surface buoy near Two Harbors. There were 4 deployments, each being approximately 3 weeks in duration. We find that during regimes of strong stratification and internal waves (i.e., summer conditions), pH is modulated significantly at internal wave frequencies and is highly correlated with temperature. The pH depth gradient is computed from these data. Strong episodic upwelling events occurring in less stratified conditions (i.e., winter conditions) are also attended by more acidic water. We find the largest change in pH for either summer or winter conditions to be greater than 0.1 pH unit.

37. IMPACTS OF *MEXACANTHINA LUGUBRIS*, THE DARK UNICORN IN SOUTHERN CALIFORNIA INTERTIDAL COMMUNITIES

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The effects of climate-driven range shifts are well documented, but the impacts of range-shifting species on native communities are relatively unknown. In Southern California, the dark unicorn whelk *Mexacanthina lugubris* has been shifting northward from its native range in Baja California, Mexico, which could lead to increased competition with endemic whelks and increased predation on shared prey species. To determine the potential impacts of *Mexacanthina* in local intertidal communities, we surveyed 10 sites in southern California over the course of a year. At each site, we recorded densities and distributions of both native and range-shifting whelks, as well prey abundance and habitat type. We also conducted a competitive interaction experiment and thermotolerance trials with *Mexacanthina* and native whelks to assess competitive ability and predict how future climate warming could alter species' distributions. We found that *Mexacanthina* was able to utilize space higher in the intertidal compared to local competitors and was often more abundant than native species in areas where establishment occurred more recently. Feeding experiments showed that native whelks and *Mexacanthina*. Understanding the potential for competition with local species can help determine how expanding species may impact communities, and whether these impacts could increase under future climate change.

38. MODELING EFFECTS OF OCEAN ACIDIFICATION ON PREDATOR-PREY DYNAMICS IN THE ROCKY INTERTIDAL ZONE

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Increasing concentrations of atmospheric CO₂ are resulting in a decrease in the pH of seawater, so-called ocean acidification (OA). Previous experiments have shown that mussels raised in low pH seawater are typically smaller, have thinner and weaker shells, and exhibit poor physiological condition compared to those living under ambient conditions. In contrast, calcifying predatory crabs have exhibited mixed responses – negative, neutral, or positive – depending upon the species and life stage considered. If crabs get larger and stronger as mussels become smaller and weaker, the predator-prey relationship between the two taxa could be dramatically altered against mussels. We have developed a mechanistic model parameterized with data from the field and lab to predict effects of OA and crab predation on mussel population growth and persistence. Mussel population fitness, as a function of projected reproductive output, can then be compared among models representing different combinations of OA and predation risk. We evaluated the effects of changes in mussel shell thickness and growth rate, and changes in crab carapace size, claw strength, and feeding and foraging behavior on mussel population performance. Scenarios in which the greatest negative impact involved limitations on the ability of mussels to reach a predation-resistant size also resulted in decreases in mussel growth rate and/or increases in crab size. We are currently testing our predictions with manipulative experiments done under controlled conditions in the laboratory.

39. FLORAL VISITORS OF NON-NATIVE MILKWEED SPECIES WITHIN AN URBAN ENVIRONMENT

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Overall, a decline in pollinators has been identified in recent years. There are numerous explanations behind this decline that have been recognized by scientists such as, global climate change and habitat conversion. Ultimately, the decline threatens the future of agricultural and ecosystem productivity. Urban gardens are of ecological importance as they may provide refuge for pollinators. This research aims to understand the role non-native plant species play within an urban setting. We focused on a non-native milkweed species, *Asclepias curassavica*, since milkweeds are often planted to increase the populations of monarch butterflies. Many different insects visit milkweed species, but there have been no studies done on *A. curassavica* within California, so it is unclear how this species is affecting local insects. Throughout the season, visits by the common honey bee *Apis mellifera* (also an invasive species) were observed on a near daily basis. The second most common species, though much less frequent, was the monarch butterfly, *Danaus plexippus*. The total number of visits was found to decrease slightly throughout the day implying visitor activity might be higher earlier in the day. We found a significant difference between the average number of umbels visited by honeybees and monarchs. Similarly, we found a significant difference between the average number of flowers visited by honeybees and monarchs. In addition, we found a significant difference between the average duration of the visit by honeybees and monarchs. We are continuing our observations throughout the year to get a full picture of the diversity of floral visitors.

40. GETTING COMFORTABLE IN YOUR OWN SKIN: A TEST OF CLIMATE-LINKED VARIATION IN INTEGUMENT ULTRASTRUCTURE AMONG INTRODUCED POPULATIONS OF MEDITERRANEAN HOUSE GECKOS

§ **M.M. Dickson**¹, A.M. Bauer² and R.E. Espinoza¹. ¹Department of Biology, California State University, Northridge, ²Department of Biology, Villanova University.

Invasive species often serve as natural experiments allowing us to observe how species respond to novel environments and leading to a better understanding of the process of adaptation over short timescales. Mediterranean House Geckos (*Hemidactylus turcicus*) first established in southern Florida ~100 years ago. Since then, they have colonized 24 states across a diversity of climates in the US. Our previous

studies found that lab-acclimated geckos from distinct climates (desert, Mediterranean, subtropical, and continental) exhibit adaptive differences in physiology. Specifically, at high body temperatures, geckos from hot, dry climates have rates of evaporative water loss (EWL) almost half that of populations from humid climates. Most EWL occurs cutaneously via diffusion through the integument; however, no one has quantified how structures within the epidermis respond to climatic variation. Three distinct layers in the reptile epidermis are hypothesized to retard EWL: the alpha and beta layers, which are composed of corneous keratin, and the lipid-rich mesos layer. We compared the ultrastructure of the superficial epidermis (via SEM) and the subsurface cellular layers (via TEM) among gecko populations representing two extreme climates (desert and subtropical) to identify the mechanism(s) contributing to EWL variation in this widespread invasive reptile. We hypothesized that geckos from drier climates would have (1) larger scales to reduce exposure of the epidermis and (2) more cell layers to increase the thickness of their epidermis, particularly between scales where the skin is exposed.

41. MICROCLIMATE AMELIORATION AND ENVIRONMENTAL GRADIENTS IN LOS ANGELES

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Due to many implications of urbanization, biological communities in urban ecosystems look drastically different than nearby rural ecosystems. Urban ecosystems are more strongly affected by habitat fragmentation, urban heat island effects, disturbance, and nitrogen deposition than their rural counterparts. These changes can drive declines in species diversity in most taxa, resulting in low levels of biodiversity in urban cores. However, in many locations moderate urbanization has shown to increase species diversity. Here we explore how urbanization in Los Angeles county affects biodiversity and species composition in grasslands along an urban to rural gradient. Secondly, this work explores urban heat islands in more detail. Past research has shown how urban heat islands affect plant communities, but there has been little work examining how urban heat islands affect plant-plant interactions. This study identifies and quantifies microclimate amelioration (facilitation) and resource availability (competition) in urban grasslands by sampling vegetation and collecting environmental data across Los Angeles County. We measure soil moisture, vapor pressure deficit at ground level, and light availability to address how microclimate amelioration is stronger in cities, where macroclimate conditions are hotter on average, than in rural environments where macroclimate conditions are cooler on average. We found that at the hottest points during our sampling period, microclimate amelioration from vegetation was over 5°C cooler than ambient site temperatures. These results show that the interactions between plants function differently across urban gradients.

42. USING SOLAR ENERGY TO DISTILL WATER AND LOWER COOKING AND VISCOELASTIC FOOD DEHYDRATION ENERGY, WHILE MITIGATING GREEN HOUSE GASES EMISSION

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As the global human population increases, natural resources such as trees, water and ecosystems are impacted negatively by corresponding energy consumption and demand. In most developing countries, wood and plant biomass serve as the primary sources of energy. In developed countries human population growth has led to increase in consumption of electricity. The increase in biomass use and electricity consumption has contributed to increase in atmospheric carbon dioxide. Use of noncombustible renewable energy for boiling water, distilling water, cooking and other processes can significantly lower the rate of production of greenhouse gases and their corresponding contribution to climate change. Here, we review the design and operation of a solar water boiler and air heater coupled to a viscoelastic food dryer. The food dehydrator was designed, constructed and experiments carried out at Southern University. Models of the economic and ecologic benefits with respect to boiler capacity, for operating this equipment to dehydrate potatoes were developed.

43. RISKY BUSINESS: VULNERABILITY OF CALIFORNIA MUSSELS TO WARMING VARIES ACROSS LIFE STAGES AND HABITATS

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Predicting the vulnerability of marine invertebrates to climate warming can be difficult, especially for species with multiple life stages. Different life stages of marine invertebrates may have different vulnerability to thermal stress due to varying physiological ability to tolerate environmental stress (sensitivity, a function of prior selection and acclimation events) and experience unequal levels of environmental stress due to differences in habitat use (exposure). We studied intertidal California mussels (*Mytilus californianus*) at two sites in southern California to test the hypotheses that habitat use differs across life stages of marine invertebrates and differences in thermal tolerance occur due to environmental filtering. Across four habitats (solitary, aggregate, shelter and tidepool), we documented the distribution and thermal thresholds of juvenile and adult mussels across habitats, and the thermal conditions they are exposed to. Thermal conditions and occupancy differed across habitats while thermal tolerance differed between life stages but not habitats. In sum, juveniles had lower thermal limits than adults and were more likely to experience conditions that exceeded these limits, making them most vulnerable to extreme heat events. Our results highlight the importance of considering multiple life stages and habitats to predict the effects of climate change on intertidal invertebrates.

44. USING THE AEROBIC ENZYME, CITRATE SYNTHASE, TO INFER BIOGEOGRAPHIC DISPERSAL POTENTIAL AND PHYSIOLOGICAL STATE IN ECHINOID LARVAE

§, £ **A. Pouy**, A. Ohanian and D.A. Pace. Department of Biological Sciences, California State University Long Beach.

Temperature is a determinant of biogeographic distribution in animals due to its influence on biochemical processes. This study aimed to: 1) determine if habitat ranges of adult echinoids are linked to temperature sensitivity of metabolic enzymes during the larval stage, and 2) assess if *in vivo* aerobic metabolism is tightly linked to *in vitro* enzyme capacity in echinoid larvae. The thermal performance of the regulatory Krebs Cycle enzyme, citrate synthase (CS), was determined in three echinoid larvae with the following thermal habitat ranges: *Dendraster excentricus* (2-28°C), *Strongylocentrotus purpuratus* (2-24°C) and *Strongylocentrotus fragilis* (0-10°C). Over a temperature range of 5-30°C, *D. excentricus* had consistently high Q_{10} values and displayed no discrete change in the Arrhenius activation energy. Both *S. fragilis* and *S. purpuratus* displayed an Arrhenius breakpoint and a peak in temperature sensitivity at 15°C. A strong correlation between aerobic respiration and total CS activity was observed for all three species, indicating that total CS activity is a useful indicator of physiological state. Interestingly, the Strongylocentrotid species had a similar relationship between total CS activity and respiration despite the significant differences in their thermal habitat preferences. In comparison, larvae of *D. excentricus* displayed a 3-fold higher level of change in respiration per unit of CS activity. These results suggest that differences in aerobic performance may be largely driven by phylogeny rather than thermal habitat range. This information is important for understanding the potential biochemical underpinnings of biogeographic distributions and using enzymatic information to infer physiological state in marine larvae.

45. KILLING THEM SOFTLY: ONTOGENY OF JAW MECHANICS AND STIFFNESS IN MOLLUSK-FEEDING FRESHWATER STINGRAYS

§, £ **K.M. Rutledge**^{1,2}, A.P. Summers¹ and M.A. Kolmann^{1,3,4}. ¹Friday Harbor Laboratories, University of Washington, ²Department of Ecology and Evolutionary Biology, University of California Los Angeles, ³George Washington University, ⁴Department of Ichthyology, Royal Ontario Museum.

Durophagous predators consume hard-shelled prey typically by crushing the mineralized exoskeleton. This is energetically costly due to the bite forces, handling times, and the stresses inflicted on the predator's skeleton. As such, it is not uncommon for durophagous taxa to display an ontogenetic shift from softer to harder prey items, implying that it is relatively difficult for smaller animals to consume shelled prey. Batoid fishes have independently evolved durophagy multiple times, despite the challenges

associated with crushing prey harder than their own cartilaginous skeleton. *Potamotrygon leopoldi* is a durophagous freshwater ray endemic to the Xingu River in Brazil, with jaw morphology superficially similar to its distant durophagous marine relatives, eagle rays. We examined the arrangement of the jaw materials of *P. leopoldi* to resist bending (2^{nd} moment of area) and jaw mineralization over ontogeny using computed tomography (CT) scanning. We found that the jaws of *P. leopoldi* do not resist bending nearly as well as other durophagous elasmobranchs and possess a skeleton that is stiffest nearest the jaw joints rather than beneath the dentition. While jaw stiffness has similar material distribution over ontogeny, mineralization of the jaws under the teeth increases. Neonate rays have very low jaw stiffness and poor mineralization, suggesting that *P. leopoldi* may not feed on hard-shelled prey early in life. These differences in the shape, stiffness and mineralization of the jaws of *P. leopoldi* compared to its durophagous relatives show there are several solutions to the problem of crushing shelled prey with a compliant skeleton.

46. THE EFFECTS OF LARVAL CULTURING DENSITY ON DEVELOPMENT AND PHYSIOLOGY OF THE ECHINOID ECHINODERM *DENDRASTER EXCENTRICUS*

§, £ **K. Ellis**, B. Pernet and D.A. Pace. Department of Biological Sciences, California State University.

Echinoderm larvae are model organisms used in many areas of research. Interpretations of experimental results can be confounded by culture conditions used to rear larvae. The objective of this study was to quantify effects of culture density on larval development and physiology. Larvae of the Pacific sand dollar, *Dendroaster excentricus*, were reared at densities of 0.1, 0.25, 0.5, 1.0 and 5.0 larvae ml^{-1} and fed *Rhodomonas* sp. at 10,000 cells ml^{-1} . Morphological measurements and determinations of total protein growth were made at 11 days post-fertilization (DPF), and the percentage of competent larvae was subsequently assessed daily. Larvae grown at densities $\leq 1.0 \text{ ml}^{-1}$ exhibited no significant differences in larval arm growth and had protein biomass of $\sim 2,300 \text{ ng ind}^{-1}$. Larvae grown at densities of 5 ml^{-1} had similar arm lengths, but significantly lower amounts of protein biomass and less rudiment development. Notably, larvae reared at densities of $\leq 1.0 \text{ ml}^{-1}$ were metamorphically competent at 14-16 DPF, while those reared at 5 individuals ml^{-1} did not reach competency until 26 DPF. Our data support the use of cultures stocked at densities of ≤ 1 individual ml^{-1} when studying the development and physiology of echinoid larvae. The optimization of experimental culturing conditions is critical to exploring the mechanistic factors that underlie the development of larval forms.

47. INTERACTIONS BETWEEN BACTERIA AND CORAL MICROALGAL SYMBIONTS

§ **C.A. Brisson** and C.P. terHorst. Department of Biology, California State University, Northridge.

Bacterial communities alter their environment, which may change the dynamics of interactions between other organisms. The mutualism between corals and their associated photosynthetic, microalgal symbionts may be facilitated by a bacterial consortium. Previously we showed physiological variation between different genotypes of *Breviolum antillogorgium* (f. *Symbiodiniaceae*), an obligate octocoral symbiont. My study aimed to discern the extent to which dissimilarities in the associated bacterial communities drive these differences. Four isolated *B. antillogorgium* genotypes were lab cultured over many generations; the associated bacterial communities that persisted were collected via filtration. Microalgae were inoculated with either their own bacterial community or the community from the other 3 genotypes. We measured algal growth rate, respiration, photosynthesis, photosynthetic efficiency, and nitrogen concentration. Analyses of the 16S region showed that microalgal genotypes support different bacterial communities. The effects of bacteria on the photosynthetic and respiration rates of *B. antillogorgium* were dependent on the algal genotype from which the bacterial communities were sourced. Photosynthetic rates were higher in cultures with a greater concentration of *Rhodobacterales*. We found no significant effects on nitrogen, quantum yield, or growth rate between genotypes. Pending analyses will identify patterns between bacterial community identity and measured traits. Future work will include analyses of specific bacterial functional groups such as photosynthetic bacteria and nitrogen fixers, and their effect on *B. antillogorgium* physiology under normal and thermal stress environments.

48. STATUS, HABITAT IMPACTS, AND METAPOPOPULATION MANAGEMENT OF THE TIDEWATER GOBY *EUCYCLOGOBIUS NEWBERRYI*: A FEDERALLY ENDANGERED CALIFORNIA COASTAL ENDEMIC

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The federally endangered tidewater goby (*Eucyclogobius newberryi*) is currently in review for reclassification, despite the shortage of thorough population surveys needed to conduct the appropriate metapopulation viability analysis (MVA) listed in the USFWS Recovery Plan for reclassification. Given the recent extreme and volatile weather patterns that have occurred in California over the past few years, ranging from severe drought to record rains, many coastal estuaries and lagoons where the tidewater goby occurs continue to be heavily impacted and degraded. Therefore, we conducted annual population surveys (2014, 2015, 2017, and 2018) in >100 estuaries to assess the current health and status of the tidewater goby in five of the six Recovery Units, spanning from Bodega Bay to San Diego, CA. This massive effort, supported by USFWS, has provided a robust and comprehensive presence/absence dataset needed to develop the basic framework for our range wide MVA model. Surveys also revealed a high degree of endangerment of this species, mainly in Southern California due to habitat desiccation and the presence of invasive species. Endangerment is especially high in the Southern Recovery Unit of San Diego County. This unit has been recently described as a separate, and unequivocally endangered, distinct species in the genus *Eucyclogobius* that is currently being managed as *E. newberryi*. Therefore, we feel reclassification of the tidewater goby should not be done until the appropriate metapopulation viability analyses are completed, and individual management plans are in place.

49. SPATIAL DISTRIBUTION AND FISH COMMUNITY STRUCTURE OF OPEN COAST EELGRASS *ZOSTERA* SPP.

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Eelgrasses (*Zostera* spp.) are a suite of marine flowering plants found in coastal estuaries and shallow subtidal regions worldwide that create fish habitat and provide other ecosystem services. While numerous studies have focused on the ecological role of eelgrasses in estuarine habitats, little is known about *Zostera* along open coast environments. To address this knowledge gap, the structural complexity, spatial distribution and fish community composition of coastal eelgrasses (*Zostera marina* and *Z. pacifica*) were quantified across 19 different beds located off Santa Catalina Island and the mainland coast. Eelgrass beds surveyed off the windward side of Catalina and along the mainland coast were primarily comprised of *Z. pacifica*, while beds off the lee side of the island were dominated by *Z. marina*. Five eelgrass beds on the eastern, leeward side of Catalina have disappeared since their last known survey (~15 years ago), while those on the western leeward and windward sides have either expanded or not substantially changed in size. Community composition differed across each of the two different eelgrass species and length of fishes in *Z. marina* was often below the length at maturity while those in *Z. pacifica* were greater in size. These results suggest *Z. marina* functions as a nursery habitat while *Z. pacifica* may be similar to nearby reef or kelp habitats. This work is an important step in defining the ecological role of *Zostera* among the network of coastal habitats in the Southern California Bight.

50. EVALUATING THE EFFECTS OF PREDATION RISK ON PREY REPRODUCTION IN A TEMPERATE REEF FISH

§, £ **G.C. Jarvis** and M.A. Steele. Department of Biology, California State University, Northridge.

Predators can impact prey fitness through their lethal (e.g. density-mediated) and sublethal (e.g. trait-mediated) effects. Of the field studies that examine sublethal effects of predators on reproduction in marine fishes, most are correlative. To determine whether risk directly affects fitness in nature, we tested the effects of sublethal predation on reproductive output and behavior in the bluebanded goby, *Lythrypnus dalli*, over month-long trials. Similar initial populations of gobies were established on artificial reefs and predator exclusion cages were used to manipulate access of predators to prey. Total egg production was

similar among all risk treatments after one month, but gobies were observed 24% less frequently in high-risk treatments during density surveys throughout the trials. Equal recollections of gobies at the end of the trials suggest that changes in the density of gobies among treatments were caused by sublethal effects of predators rather than by lethal predation itself. These results indicate that bluebanded gobies can maintain reproductive output despite increased hiding behavior in high-risk environments. This study highlights the importance of evaluating direct responses of prey to accurately evaluate mechanisms associated with sublethal predation in nature.

51. BEHAVIORAL VARIATION AND LOCAL ADAPTATION TO PREDATION RISK IN POPULATIONS OF BLACK SURFPERCH *EMBIOTOCA JACKSONI*

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Although behaviors can be flexible, behavioral tendencies (e.g., reactivity) may be heritable, and it is possible that behavioral tendencies evolve via natural selection. For example, in high-risk environments, individuals that exhibit greater vigilance and/or reactivity may be better at avoiding predators and thus have a fitness advantage over less vigilant individuals. In low-risk environments, vigilance/reativity may be a disadvantage for fitness if it results in fewer opportunities to feed. Marine fish often behave differently in high- and low-risk environments, but it is not clear whether such differences in behavior are innate or learned. We tested natural spatial variation in reactivity in black surfperch (*Embiotoca jacksoni*) from high- and low-risk populations. In field surveys, surfperch in high-risk locations had larger Flight Initiation Distances than surfperch in relatively low-risk locations. In a test of whether these behavioral differences are inherited, we collected pregnant fish from a high-risk population (Santa Catalina Island) and a low-risk population (Palos Verdes). In this “common garden” experiment, we compared the behavioral responses of lab-born offspring to risk in a novel environment. Fish from the high-risk population exhibited higher swimming velocities, and spent less time sheltering than fish from the low-risk population. Our results reveal significantly more reactivity in our high-risk population both in the field and in lab born naïve offspring. These results suggest behaviors related to predator evasion can be inherited rather than learned.

52. EVALUATING THE IMPORTANCE OF REEF-BASED RESOURCES FOR REPRODUCTION IN A TEMPERATE REEF FISH, *SEMICOSSYPHUS PULCHER*

§, £ **B.R. Chubak** and M.A. Steele. Department of Biology, California State University, Northridge.

California sheephead are among the most ecologically important fish on temperate reefs in California and Mexico, yet little is known about their reproductive ecology. Environmental factors can affect reproductive success in fish populations in a variety of ways, including by affecting diet. The goal of this study was to determine if any differences in reproduction among populations of California sheephead (*Semicossyphus pulcher*) were related to differences in diets among them. We measured the prey availability, diet composition, and batch fecundity of California sheephead on three large reefs within the Southern California Bight. Reproductive output, diet, and prey availability all differed between years, implying that variation in prey availability affected diet, which affected reproductive output. Understanding how changes to kelp forest habitat impact reproductive output can aid in future management efforts of economically and ecologically important species of fish.

53. ASSESSMENT OF THE POPULATION STRUCTURE OF THE SHOVELNOSE GUITARFISH, *PSEUDOBATOS PRODUCTUS*, FROM SOUTHERN CALIFORNIA TO BAJA CALIFORNIA SUR

§, £ **A. Meyer**, C.L. Chabot and L.G. Allen. Department of Biology, California State University, Northridge.

The Shovelnose Guitarfish *Pseudobatos productus* (Ayres 1854) is a benthic elasmobranch that lives in shallow waters from Monterey Bay, California to the Gulf of California, Mexico, and is targeted by fisheries throughout Baja California and the Gulf of California. In many cases, localized fishing pressure

can lead to a loss of genetic diversity, a reduction in effective population size, and local extinction. The most recent IUCN assessment of *P. productus* lists the species as Near Threatened with a decreasing population trend and a continuing decline in the number of mature individuals. This study sought to assess the genetic diversity and connectivity of *P. productus* from San Pedro, CA to Guerrero Negro, Baja California Sur, MX. Genetic diversity and connectivity were assessed using the complete mitochondrial control region as well as genomic SNP data produced by RAD-seq. Both markers show evidence of high levels of connectivity from southern California to northern Baja California Sur, indicating admixture across international boundaries. Mitochondrial DNA evidence supports higher levels of population structure while genomic SNP data supports panmixia between localities. This may be indicative of sex-specific movement patterns, with higher levels of male-mediated geneflow between localities. Based on these data, *P. productus* should be managed as a bi-national species with sex-based restrictions as males contribute more to genetic admixture than females.

POSTER ABSTRACTS IN PROGRAM ORDER

54. THE EFFECTS OF NATURAL LIGHT ON THE ACTIVITY AND FORAGING BEHAVIOR ON THE PACIFIC KANGAROO RAT *DIPODOMYS AGILIS*

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Natural light can increase the actual or perceived risk of predation for nocturnal rodents. I used live-trapping and seed tray experiments with digital cameras to investigate the effects of varying levels of natural light on the activity and behavior of the Pacific kangaroo rat, *Dipodomys agilis*, in coastal sage scrub at the Bernard Field Station in Claremont, California. I hypothesized that kangaroo rats are sensitive to natural light and would forage longer, removing more seeds on dark, new-moon nights than on bright, full-moon nights. I expected that kangaroo rats would be less active on bright nights and would use shrub microhabitats more than open on these bright nights. I live-trapped for two consecutive nights followed by two nights of foraging experiments; both performed in open and shrub microhabitats during new and full-moon phases. Kangaroo rats were captured most frequently in open microhabitats during both new and full-moon nights, but these differences were not significant, likely because of variable shrub cover between study areas. Kangaroo rats are the primary foragers at these stations and preliminary results show no obvious preference for open or shrub trays during the new and full-moon. Small mammals including woodrats, deer mice, and desert cottontails also entered the trays, with some foraging alongside kangaroo rats. Preliminary analysis shows slightly lower rates of seed removal on full-moon nights and higher seed removal overall on the second night. Even with increased natural light, kangaroo rats showed little preference for shrub cover and instead located food anywhere it was available.

55. COMMUNITY COMPOSITION OF LICHEN IN JOSHUA TREE NATIONAL PARK

§ **C.Z. Gust**¹, C.B. Scott² and E. Braker¹. ¹Department of Biology, Occidental College, ²Department of Computer Science, University of California, Irvine.

Lichens make up an important yet understudied component of terrestrial ecosystems, particularly in the desert ecosystems of Southern California. Individual lichen species are uniquely sensitive to environmental conditions, and act as ecological indicators. A diverse array of crustose lichens can be found in Joshua Tree National Park (JTNP), but their ecology and interactions are not well understood. To contribute to the understanding of lichen in JTNP, we determined the community composition of lichens on boulders in Cottonwood Springs, JTNP. Many of the species in the park grow in contact on the same rock surface, suggesting that the lichens may be interacting in some way. We took photos of boulder surfaces using quadrat sampling and then used a Convolutional Neural Network (a machine learning model specialized for image analysis) to identify lichen species and quantify spatial patterns. The patterns of interaction are then analyzed based upon the variance of abiotic factors such as sun exposure and location of the rock substrate.

56. IMPACTS OF INVASIVE ANNUALS ON SOIL CARBON AND NITROGEN STORAGE IN SOUTHERN CALIFORNIA DEPEND ON THE IDENTITY OF THE INVADER

§ **L.A. Hartz**¹, T. Caspi¹, A.E. Soto Villa², J.A. Loesberg¹, C.R. Robins¹, and W.M. Meyer III². ¹W.M. Keck Science Department, Claremont McKenna, Pitzer, and Scripps Colleges, ²Department of Biology, Pomona College.

Non-native plant invasions can alter nutrient cycling processes and contribute to global climate change. In southern California, California sage scrub (hereafter sage scrub), a native shrub-dominated habitat type in lowland areas, has decreased to <10 % of its original distribution. Post-disturbance type-conversion to non-native annual grassland, and increasingly to mustard-dominated invasive forbland, is a key contributor to sage scrub loss. To better understand how type-conversion by common invasive annuals impacts carbon (C) and nitrogen (N) storage in surface soils, we examined how the invader's identity (non-native grasses, *Bromus* spp.; and non-native forbs, *Brassica nigra*), microbial concentrations, and soil properties influence soil nutrient storage in adjacent native and invasive habitat types at nine sites along a coast to inland gradient. Sage scrub soils stored more C and N than non-native grasslands,

whereas non-native forblands had nutrient storage similar to or higher than sage scrub. We calculate that $>940 \text{ t C km}^{-2}$ and $>60 \text{ t N km}^{-2}$ are lost when sage scrub converts to grass-dominated habitat, demonstrating that grass invasions are significant regional contributors to greenhouse gas emissions. We found that sites with greater total C and N storage were associated with high cation exchange capacities and bacterial concentrations. Non-native grassland habitat type was a predictor of lower total C, and soil pH, which was greatest in invasive habitats, was a predictor of lower total N. Our results provide evidence that efforts to restore and conserve sage scrub enhance nutrient storage, a key ecosystem service reducing atmospheric CO_2 concentrations.

57. CONSUMPTION OF RAT CARCASSES AS A PATHWAY FOR RODENTICIDE EXPOSURE OF WILDLIFE IN SUBURBAN ORANGE COUNTY

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Second Generation Anticoagulant Rodenticides (SGARs) are commercial rodenticides that target populations of commensal rats and mice in urban settings. The high toxicity and effectiveness of SGARs has led to their widespread use; however, there are significant concerns about the exposure of non-target wildlife species. Non-target species consume toxic bait directly or, indirectly, by scavenging SGAR-killed prey (secondary exposure). To investigate opportunities for secondary exposure, we used remote cameras to quantify the fates of rat carcasses placed in residential backyards in suburban Orange County, California. Rats were purchased from a commercial pet-food vendor and were not exposed to SGARs. In winter and spring 2019 one carcass was placed in each of 20 yards and monitored continuously for at least 5 days using a Reconyx PC800 camera. We also recorded characteristics of yards (e.g., yard area, vegetation cover and presence of barriers) to explain the variation in carcass removal rates between yards. Preliminary results indicate that approximately 80% of rat carcasses were discovered within 5 days, with some removed within a single day. Digital images from cameras revealed that Virginia opossums *Didelphis virginiana* and coyotes *Canis latrans* removed and consumed rats. When completed, our results will improve our understanding of the routes by which native carnivores and scavengers are exposed to rodenticides.

58. ANTICOAGULANT RODENTICIDE EXPOSURE IN COYOTES IN SOUTHERN CALIFORNIA

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Anticoagulant rodenticides are baited poisons used to control rodent infestations. Despite application restrictions, rodenticide use can result in accidental poisoning of non-target wildlife, such as carnivores. Coyotes *Canis latrans* are adaptable carnivores that thrive in urban areas and thus are likely to be exposed to anticoagulant rodenticides. However, the extent to which coyotes in southern California are exposed is not clear, and it is not known whether coyotes are exposed to different kinds of rodenticides. We used a liver assay to estimate rodenticide exposure of 186 coyotes collected as nuisance animals and as road-kills in southern California. We also investigated the degree to which coyote age and sex were associated with exposure generally and to specific compounds. Coyotes were exposed to different types of rodenticides, with second-generation anticoagulants bromadiolone and brodifacoum common in coyotes, and some individuals were exposed to multiple compounds (range 0-5). Second-generation anticoagulants are restricted materials and can only be applied by a certified private applicator to control commensal rodents (non-native mice and rats) near buildings. Preliminary analyses revealed no clear differences in exposure between age classes but suggested that males may have higher rates of exposure. Although rodenticide poisoning can cause mortality directly, they may have sub-lethal effects as well, including reduced body condition and increased susceptibility to pathogens and parasites. Further studies should investigate these sub-lethal effects and identify any ecological correlates associated with high exposure to permit a more thorough assessment of the risks of rodenticide exposure in wildlife at the urban-wildland interface.

59. DO COYOTES EAT MESOCARNIVORES IN SOUTHERN CALIFORNIA? A MOLECULAR GENETIC ANALYSIS

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Urban coyotes *Canis latrans* are commonly exposed to rodenticides used to control commensal rodents, but commensal rodents appear to be relatively rare in their diets. An alternative source of rodenticide exposure is through consumption of mesocarnivores that have eaten either toxic bait directly or poisoned rodents or invertebrates. Carcasses of 311 nuisance and road-killed coyotes from suburban and urban areas of southern California were collected from 2016-2018. Stomachs were dissected and those containing suspected mammalian prey (N=179) were homogenized and DNA was extracted. A species accumulation curve was constructed using five replicate extractions of four stomachs known to contain multiple mammalian prey items. Most extractions were performed in two replicates, apart from 33 stomachs containing a very small volume (<0.5 mL) of tissue, for which one extraction was performed. Genus-specific primers (96-440 bp) were designed for domestic cats (*Felis*), opossums (*Didelphis*), raccoons (*Procyon*) and skunks (*Mephitis*), all regionally common species that are consumed by coyotes. PCR was performed for each primer pair and PCR product presence and amplicon lengths were determined by gel electrophoresis. Coyote stomachs containing a PCR product of the appropriate length in at least one replicate were considered to contain that prey item. Cats (28%) and opossums (3%) were detected most frequently, whereas raccoons and skunks were rare (<1%). The extent to which cats and opossums themselves eat poisoned prey remains unknown, although they may be a potential source of exposure for coyotes.

60. FUNCTION OF HYPEROSTOSES IN THE PTERYGIOPHORES OF THE OARFISH *REGALECUS RUSSELLII*

‡ **W. Wan**¹ and E.W. Misty Paig-Tran². ¹Walnut High School, ²Department of Biological Sciences, California State University, Fullerton.

The oarfish *Regalecus russelii* swims via undulation of its dorsal fin with no additional thrust contributed through anguilliform locomotion. Fish greater than 3 meters have distinctive hyperostoses, excessive mineralized bone growths, along their dorsal pterygiophores. Why then do large oarfish consistently develop these hyper-mineralized, structures embedded in poorly mineralized bones? We hypothesize that the hyperostossified components provide a rigid surface for supporting dorsal fin oscillation. We modeled the pterygiophores as beams with a spherical “hyperostosis” embedded within the bone. The spheres were added in one of 3 locations along the bone: 1) at the distal end of the beam, 2) in the center of the beam, and 3) between the center and the distal end of the beam. This allowed us to test whether the position of the hyperostosis affected the strength of the pterygiophore. The models were 3D printed first with resin, to test whether the structural properties of a beam are affected by the addition of hyperostoses and next using calcium carbonate (to imitate bone) to test whether the material of the beam contributes to the overall integrity of the beam. Both models were tested as cantilevered beam tests using an Instron 5942 materials tester. We found that for both tests, the beams broke prior to failure at the hyperostoses. Our findings suggest that the hyperostoses function as increased support for the pterygiophore and are likely the connection point for the uppermost horizontal septa musculature as well as the protractor and retractor muscles that control the dorsal fin.

61. SUBSTRATE AGE AND AEOLIAN EFFECTS ON PLANT PRODUCTIVITY AMONG THREE ALLUVIAL FANS, ZZZX, CA

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Understanding the effects of substrate type on plant productivity is fundamental to identifying drivers of desert ecosystem processes. Alluvial fans near Zzyzx, CA differ primarily in the accumulation of sediment from the Aeolian activity. Perennial plant productivity within and among these fans may result from substrate variation of water infiltration and capture within fans, and variability of Aeolian input across fans. On three alluvial fans, perennial plant productivity and diversity were quantified using nine 50 m line transects and nine 100-m² belt transects on geomorphic surfaces corresponding to three different age classes. Ten randomly selected *Larrea tridentata* were also sampled on each substrate age to quantify plant volumes. The youngest substrates within each fan had the greatest species diversity, largest *L. tridentata* volumes, and highest plant cover. This pattern was expected due to young surfaces having higher water run-on and infiltration. However, across the three fans, differences between each of the substrates were inconsistent. This suggests that pattern shifts may result from differences in Aeolian input across these alluvial fans.

62. RIPARIAN HEALTH AS A FUNCTION OF MACROINVERTEBRATE SENSITIVITY TO EUTROPHICATION

§, £ **Y. Guracha**, E. Manvelyan, J.M. Parkinson, J. Blatti and R. Di Fiori. Department of Biology, Pasadena City College.

Eutrophication from urban runoff disturbs the natural balance of riparian habitats. For example, Echo Park Lake, part of the L.A. River Watershed, receives a nutrient load of about 209 lbs of nitrogen and 32.3 lbs of phosphorus per year, contributing significantly to eutrophication and disruption of the aquatic ecosystem. Macroinvertebrates are ideal bioindicators for measuring the health of freshwater ecosystems due to their relatively long lifetimes, and ubiquitous distribution. They can capture a range of responses to different stressors such as chemical pollutants and nutrients from natural or anthropogenic sources; they can also be sampled and identified in an efficient manner. Macroinvertebrates are extremely biodiverse and serve the important role of energy conduits between autotrophs and heterotrophs and are important for nutrient cycling, processing up to 73% of the riparian leaf litter that enters streams. Macroinvertebrate sensitivity to nutrient fluctuations and primary productivity was used to assess the relative health of the L.A. River watershed. This study focused on agricultural runoff to understand whether nutrient abundance would directly affect the diversity of macroinvertebrates. Macroinvertebrate biodiversity was examined at four different locations along the L.A. River Watershed, ranging from high altitude and low urbanization to low altitude and high urbanization. A pollution tolerance index was used to assess the overall resilience of riparian habitats to eutrophication. Based on preliminary data, we projected healthier sites (less agricultural runoff) would show less ecological resilience, reflected by a less diverse population and altered nutrient cycling.

63. NICHE SEGREGATION AMONG ARMADILLOS IN THE SOUTHERN PANTANAL

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The Pantanal of Brazil is the largest tropical wetland in the world and home to one of the highest diversity of armadillos with five extant sympatric species. All five species are highly specialized diggers with varying diets. I plan to explore how these species of armadillo are partitioning their resources to facilitate coexistence. Due to the expansiveness of the region and diversity of armadillos in South America, there are likely many factors contributing to their coexistence. I will be assessing this question by looking into multiple aspects of their ecology including: space use, activity time, preferred diet, substrate preference, body size, and functional morphology. Although they are fairly diverse, very few field studies have been dedicated to basic ecological characters of this family. These species will benefit from more scientific scrutiny and basic ecology that should ultimately contribute to management decisions regarding their conservation efforts as some of them are considered endangered and/or species of special concern.

64. BIOMASS, DISTRIBUTION, AND DYNAMICS OF MESOZOOPLANKTON IN THE CALIFORNIA CURRENT SYSTEM

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Mesozooplankton play an immense role in the global ocean. They are intricately intertwined in the pelagic food web and are major contributors to oceanic biogeochemical cycling through vertical migrations. However, much is unknown about the quantitative distribution and biomass of mesozooplankton in the ocean. Our limited knowledge impairs the development of global models, used to understand interactions of marine resources with functioning of the earth. In the upwelling system of the California Current System (CCS) and other productive regions throughout the ocean, these models are integral in developing sustainable environmental policy. Here, we assess ecological dynamics of mesozooplankton in the CCS and analyze the accuracy of current simulative models of these dynamics. Using datasets accessed from MARine Ecosystem DATA and the World Ocean Atlas, climatological fluctuations of mesozooplankton biomass, sea surface temperature, chlorophyll levels, salinity, and photosynthetically active radiation in the CCS were standardized and synthesized. These analyses were compared to model output from a coupling of the Regional Ocean Modeling System (ROMS), modeling ocean physics, and Biogeochemical Elemental Cycling (BEC), modeling biogeochemical dynamics. Observational climatologies verified the significance of upwelling dynamics in the CCS. Model outputs underestimated mesozooplankton biomass during upwelling seasons and in regions of coastal upwelling. Regions of overestimation aligned with oligotrophic offshore regions. Compartmental modifications of ROMS-BEC may yield more accurate estimations of observed mesozooplankton dynamics. Especially with increasing perils of anthropogenic climate change, accurate models are essential for development of sustainable fishery management, regulation of wastewater nutrient outfall, and robust global climate policy.

65. OXIDATIVE STRESS RESPONSE IN THE SEASIDE SPARROW *AMMOSPIZA MARITIMA* FOLLOWING THE DEEPWATER HORIZON OIL SPILL

§ **A. Angel** and A. Bonisoli-Alquati. California State Polytechnic University, Pomona.

The Deepwater Horizon (DWH) oil spill introduced massive amounts of oil into the saltmarsh ecosystem of Louisiana. The main toxic components of DWH oil are polycyclic aromatic hydrocarbons (PAHs). PAH metabolites have the capability of reacting with molecular oxygen to create reactive oxygen species (ROS) via a redox cycling reaction. The relatively unstable ROS then react with and cause oxidative damage to organic molecules, which results in more stable reactive oxygen metabolites (ROMs). This oxidative damage therein creates oxidative stress in the organism, if the antioxidant defense system barrier is breached. Our goal is to quantify the oxidative stress response of seaside sparrows (*Ammospiza maritima*) exposed to the DWH oil. We will be measuring serum levels of ROMs and antioxidant barrier strength using commercial kits. We will also be measuring cardiac tissue levels of glutathione (GSH), an endogenous antioxidant that aids in combatting pro-oxidants and mitigates oxidative stress. Finally, we will measure protein carbonyl content, a measure of oxidative damage to proteins, using a protein carbonyl assay. These measurements will tell us the magnitude of oxidative damage to organic molecules within the organisms and whether the antioxidant barriers in exposed birds responded following oil contamination. Additionally, we will quantify the expression of JUN, a proto-oncogene which has been linked to cardiac enlargement and congenital heart anomalies, using qPCR analysis. With these tests, we aim to assess whether contamination from the DWH oil caused a direct toxic effect in the seaside sparrow, with important implications for their fitness.

66. HOW DOES URBAN POLLUTION AFFECT AGING AND OXIDATIVE STRESS IN THE CALIFORNIA TOWHEE *MELOZONE CRISSALIS* IN SOUTHERN CALIFORNIA?

§ **A. Dant** and A. Bonisoli-Alquati. California State Polytechnic University, Pomona.

The rise of urbanization over the last two centuries has led to major changes in the natural environment. Urbanization brought a decline in biodiversity throughout the world through habitat fragmentation and the

production of anthropogenic structures. Urban pollutants in the form of light, noise, and air pollution also have adverse effects on the exposed organisms. In this study, we will be measuring the effect of urban pollutants on the California Towhee *Melospiza crissalis*, a passerine bird commonly found in both natural and urbanized areas in Southern California. California Towhees will be collected in the Santa Monica Mountain Recreation Area, an area with a history of urban development and anthropogenic activity within its boundary. Light and noise pollution in this area will be measured through environmental monitoring equipment and by using preexisting databases from the State of California. Finally, we will utilize molecular techniques to quantify the toxic effects of pollution, by measuring changes in telomere length and oxidative stress in the blood of California Towhees. These results will be used to understand how avian communities respond to the exposure of urban pollutants in Southern California and to determine how to best utilize conservation efforts to protect natural areas threatened by urbanization.

67. A META-ANALYSIS OF PERFLUOROOCCTANE SULFONATE (PFOS) CONCENTRATIONS IN BIRDS AROUND THE WORLD

§ **R. Flamenco** and A. Bonisoli-Alquati. California State Polytechnic University, Pomona.

Per- and poly-fluoroalkyl substances (PFAS) are anthropogenic chemicals used for waterproofing and as surfactants. They are an important group of chemicals for many industries due to their thermal and chemical stability, contributing to their persistence in the environment. PFAS are known to cause developmental, reproductive, and endocrine issues. As Persistent Organic Pollutants (POPs), PFAS bioaccumulate and biomagnify through food webs, posing a threat to wildlife and ecosystems. Yet, we do not know how the concentrations of these substances have been changing in recent decades in the tissues of wild animals. This meta-analysis explores variation in the concentration of a PFAS, perfluorooctane sulfonate (PFOS), in bird species. Birds are reliable sentinels for monitoring the concentrations and risk associated with contaminants, from heavy metals to persistent organic pollutants like PFAS. We collected more than 500 estimates of PFOS concentration in liver, blood and eggs from more than 100 bird species across all continents, to explore taxonomic, geographic and temporal variation in PFOS concentrations. Our results demonstrate a >4.0 fold increase in PFOS concentrations from 1970s to the 2010s. Extensive variation existed in these trends among the different orders of birds included. Future developments of this study will identify the factors affecting variation in PFOS concentrations within and among species, with the expectations of highest PFOS concentrations and associated toxic effects in birds that feed at higher trophic levels.

68. FUNCTIONAL TRAITS OF INVASIVE AND NATIVE ANNUAL PLANTS IN CALIFORNIA COASTAL SAGE SCRUB

§ **T.N. Edwards**, S.T. Lauman and E.J. Questad. California State Polytechnic University, Pomona.

Trait-based ecology provides an important framework for understanding how plant species respond to and affect their environment. When trying to restore invaded systems, such as California coastal sage scrub (CSS), studying plant functional traits gives insight into the mechanisms, which allow invasive plants to dominate the landscape. For example, per capita seed production, or the number of seeds supplied by an individual, is a trait that describes how a species becomes invasive, as those with greater average per capita seed production can disperse more effectively throughout a system. The overall objective of my project is to examine the functional traits of several native and invasive California annual plants to understand community-level invasion patterns in disturbed CSS. Thirteen native and seven invasive species were grown to full maturity in optimal greenhouse conditions and sampled for several functional traits. Preliminary results have identified invasive grasses and a few native forbs as the fastest growers, and thus potential competitors. A goal of this project is to understand how functional traits can improve the success of native species during restoration. The functional profiles of each species will be analyzed to develop candidates for future CSS restoration.

69. NUTRIENT LEVEL DISTRIBUTION IN BALLONA WETLANDS SALTWATER MARSH

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The Ballona Freshwater Marsh (BFM) is a constructed wetland built and managed to treat contaminated runoff from the Playa Vista development, a 1.3-mi² neighborhood comprising residential, commercial and retail components located in the Westside of Los Angeles. A wide variety of ecosystem services are provided by the BFM, the main one being improved water quality. This research focused on assessing one aspect of water quality, nutrient reduction. To assess this variable within the BFM, nutrient levels were sampled at all three inlets where runoff flows into the marsh, and at the outlet where flows are discharged via an outfall into the Ballona Estuary. Three sampling events were conducted during dry weather (winter 2018-spring 2019). Water samples were tested for nitrates (mg NO₃-N) and orthophosphate (mg PO₄³⁻) using Hach Method 8039 and 8048, respectively. Over this period nitrates averaged 0.17 mg l⁻¹ among the three inlets, falling to an average of 0.01 mg l⁻¹ at the outlet. Orthophosphate averaged 0.69 mg l⁻¹ at the inlets, falling to 0.13 mg l⁻¹ at the outlet. These results indicate that the extensive plant life in the marsh system effectively reduces concentrations of nutrients entering the system via contaminated runoff.

70. EXPLORING MECHANOSENSATION -DEPENDENT FUNCTIONS IN *TRYPANOSOMA CRUZI* USING RNA-SEQ

§, † **J. Fonbuena**, M. Feldman, M. Tiwari and V. Jimenez. Center for Applied Biotechnology Studies and Department of Biological Sciences, California State University, Fullerton.

Trypanosoma cruzi is an intracellular protozoan parasite and the etiological agent of Chagas disease. *T. cruzi* propagates from an insect vector to a mammalian host to complete its life cycle. To successfully develop in changing environments, the parasite must be able to detect external conditions and respond accordingly to maintain intracellular homeostasis. In all cell types, mechanosensation is responsible for sensing and responding to changes in pressure, osmolarity and tension of the membrane. In addition, bacterial mechanosensation is associated with virulence-related traits such as biofilm formation and quorum sensing. In *T. cruzi*, we have identified and characterized a mechanosensitive channel (TcMscS) that shares structural and functional features with the small conductance mechanosensitive channel, MscS of *E. coli*. Gene knockout by CRISPR-Cas9 severely reduced the growth of extracellular and intracellular parasites and decreased its ability to respond to osmotic stress. RNA-seq analysis showed differences in the gene expression profiles of TcMscS-KO parasites. Several ion channels, transporters, and flagellar proteins were significantly downregulated. This is consistent with motility and infectivity defects observed in the TcMscS-KOs. Immunofluorescence analysis of paraflagellar rod 2 (PFR2) in wild-type and TcMscS-KO epimastigotes confirmed a reduction in PFR2 expression at protein level and a decrease in the length of the flagella in TcMscS-KO parasites, suggesting a connection between TcMscS and motility. Our results indicate that mechanosensitive-activated channels are part of the physiological responses that allow the parasites to differentiate and effectively infect host cells and could represent a potential drug target against *T. cruzi*.

71. POCKETONCO: A NOVEL CORE-ML BASED APP FOR THE DIAGNOSIS AND PROGNOSIS OF COLORECTAL, BREAST AND SKIN CANCER USING MULTILAYERED CONVOLUTIONAL NEURAL NETWORK ALGORITHMS

S. Zhang and P. Cui. Portola High School, Irvine.

Colorectal, breast, and skin cancer are among the most common and deadly diseases in the United States, according to the American Cancer Society. Despite the pressing need for a fast, accurate and data-driven approach to diagnose and prognose cancer, a current solution does not exist. This project presents PocketOnco, a novel, user-friendly mobile app developed in CoreML and XCode that uses multilayered convolutional neural network algorithms (CNN) to automatically diagnose and prognose colorectal, breast, and skin cancer within seconds through tumor feature segmentation and prediction. Users can either import histopathological tissue images or take an external dermoscopic picture and select crop for the region of interest. Leveraging unique phenotypic features such as nuclear pleomorphism, glandular/tubule formation, mitotic activity, and molecular subtype, the CNN is trained through a dataset

of over 5,000 images to produce an accuracy of 100% for validation for all cancers, identification and diagnosis accuracy of 96%, 78% and 75% and prognosis accuracy of 76%, 97%, and 80% for skin, colon, and breast cancer, respectively. Based on tumor grade and stage, the app then provides potential treatments and clinical trials based on the location of the user. PocketOnco is high speed, low cost, and user-friendly with significantly improved accuracy over the current gold standard. This patent-pending technology pioneers the movement of personalized medicine through a multi-cancer diagnosis-prognosis mobile app, bridging the gap between patients and experts in the field as diagnostics are now available at the touch of users' fingertips in the matter of seconds.

72. EFFECTS OF UVB RADIATION ON AMPHIBIAN GROWTH AND DEVELOPMENT: A META-ANALYSIS

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Amphibians are one of the most threatened group of animals, with 40% of species classified as threatened. Amphibians are in peril from habitat destruction, fragmentation, and disease. There is ongoing debate whether an increase in ultraviolet radiation (UV) is a contributing factor to amphibian population declines. There is concern that with a deterioration of the ozone layer amphibians could be exposed to harmful levels of UV rays. One type of UV radiation, ultraviolet-B (UVB), can harm the DNA of amphibians. Amphibian eggs are also highly susceptible to UVB fluctuation. Multiple studies (including meta-analysis) have been conducted on the effects of UVB on amphibian survivability. These studies leave unanswered questions on the sublethal (i.e., growth and development) impact of UVB on amphibians. The study was conducted to determine whether UVB negatively affects amphibian growth and/or development, and if so, to what degree. Hedges' g was calculated to measure the effect size (i.e., strength of the relationship) between UVB exposure and growth, development time, and the incidence of developmental abnormalities. Daily UVB levels, in the distribution range of each amphibian species, were extracted and used to calculate total UVB dosage. Results indicate that UVB radiation may increase growth and developmental abnormalities. UVB had no effect on amphibians' developmental time. In addition, the results show that higher UVB levels, in the species range, correlated with negative overall effects for growth and developmental abnormalities. Based on these findings, future research and conservation should consider the sublethal effects of UVB when assessing amphibian declines.

73. CULTIVATED VERSUS NATIVE SOYBEAN: REVEALING DIFFERING SMALL RNA EXPRESSION PATTERNS

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Small RNA is non-coding RNA that is able to regulate processes in plants by transcriptional or posttranscriptional silencing of regulatory genes. It is known that small RNA expression can vary between individual plants of the same species, but it is unknown how these small RNA are able to specifically regulate these plants under varying photoperiod conditions. The goal of my work is to identify the differences in small RNA expression between two closely related species: *Glycine soja*, the wild antecedent species of *Glycine max*, the soybean crop we see today. My objectives are to quantify the changes of these small RNA under varying photoperiod conditions and to characterize variations between these species. A small RNA sequencing approach will be used by first, utilizing leaf samples of *Glycine max* and *Glycine soja* that were grown under varying photoperiod conditions, and isolate the total RNA from these samples. Next, I will further isolate the small RNA from the total RNA using a polyacrylamide gel. I will then produce cDNA libraries from these small RNA samples that will be sequenced using an Illumina sequencing machine. Finally, I will quantify the sequenced small RNA and conduct qRT-PCR analysis of known small RNA such as miRNA156 and miRNA172 that regulate the flowering cycle. From these approaches we expect to gather information that will propel the work of small RNA analysis forward to create verifiable standards, and increase our knowledge of how this important crop may fair in different climates around the world.

74. CITIZEN SCIENCE RELIABILITY, REPEATABILITY AND RESILIENCY: AN ANALYSIS OF WATER QUALITY DATA COLLECTED FROM MALIBU LAGOON STATE BEACH

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Citizen science has been used for decades to assist scientists in collecting meaningful data. However, questions remain regarding the validity and resiliency of utilizing these community volunteers to inform scientific studies. The Resource Conservation District of the Santa Monica Mountains examined whether data gathered by citizen scientists was comparable to data collected by professionals in the field. We analyzed water quality data collected by RCDSMM educators and students at Malibu Lagoon State Beach and compared it to the water quality data of the Bay Foundation in Santa Monica. We found statistical differences amongst the two datasets but found that small improvements to protocols could yield a resilient and repeatable citizen science program any environmental organization could easily adopt.

75. NEST SITE CHARACTERISTICS OF THE CALIFORNIA LEAST TERN *STERNULA ANTILLARUM BROWNI*

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The California Least Tern *Sternula antillarum browni* (herein = CLT) is a subspecies of migratory sea bird whose breeding range is along the coast of California and Baja California, between April and September. The CLT is a state and federally protected bird that is threatened by predation, habitat loss and human disturbance. Since receiving its protected status in 1970, the number of CLT breeding pairs and fledglings have recovered, but have started to experience a steady decline in recent years. Successful nesting locations are a vital factor when developing recovery strategies for avian species. This study focuses on factors affecting nesting success including inter-colony dispersal of nests and nest location relative to percent cover of vegetation at a colony within the Seal Beach National Wildlife Refuge (SBNWR). A nearest neighbor analysis of the nest location suggests a trend toward random dispersion, indicating exterritorial social behavior within the colony. I hypothesize that analysis of nest location as it relates to vegetation data will show a positive correlation between percent cover and nest location on the microhabitat scale due to the role of camouflage in the egg and fledgling success. By examining the factors that dictate the CLT preferred nesting conditions, this study can inform resource managers on the best strategies for nest site preparation and management.

76. KNOWLEDGE AS POWER: THE ROLE OF MICROSTATE INFORMATION IN THE DETERMINATION OF AVAILABLE FREE ENERGY

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While it is incontrovertible that the thermodynamic entropy of closed systems increases or remains the same as time passes, the amount of entropy is itself reliant on the available knowledge of the system's state. The very definitions of entropy in thermodynamics share a great deal of mathematical and conceptual parallels with similar ideas in information theory, suggesting the intimate relationship between information and energy in physical systems. Building on the ideas of Landauer's principle, which set a lower theoretical bound on the energy consumption of computation, we consider a generalized Szilard-engine model, that is, a single particle in a confined space, coupled to a heat bath which maintains the system at a constant temperature. For this setup, boundaries may be put on the available phase space, which is physically analogous to such processes as piston compression. The isothermal expansion that follows constitutes work done by the system, resulting in energy extraction from what was previously a system at its maximal entropy state. The act of observation and information acquisition is thus necessarily a thermodynamic event, with the amount of information directly proportional to the increase in entropy, in order to remain consistent with the Second Law of thermodynamics. Fluctuation theorems are also used to show how this relation provides for a gradual rise in the information-processing capacity of systems when such a thermodynamic path is available, with a probability that increases with time, suggesting

future paths of research concerning the emergence of information transfer hierarchies within complex systems of nature.

77. THE EFFECTS OF URBANIZATION ON TEMPERATURE AND HUMIDITY VARIATION IN BATRACHOSEPS NIGRIVENTRIS MICROHABITATS

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Urbanized habitats are one of the most rapidly growing ecosystems globally, exposing an increasing number of organisms to novel environments. Urbanization creates distinct local climates as a result of the heat island phenomenon, which may impact the ability of organisms to survive in urban habitats. These urban habitats consist of many microhabitats; thus, it is important to evaluate whether this variation in urban climate causes any observable differences in the microclimates experienced by organisms. We investigated microclimate variation within microhabitats of *Batrachoseps nigriventris*, a lungless terrestrial salamander that lives across a gradient of urbanization in the Greater Los Angeles area. To test for variation, during the winter season of 2018-2019, we employed iButton data loggers to collect temperature and humidity data every 10 minutes across an approximately 5-week period. We place iButtons at 5 locations along an urban to rural gradient ranging from an urban backyard to a wilderness-adjacent natural habitat. Each location had two microsites, which consisted of two different cover types where *B. nigriventris* are frequently found: logs and rocks. We conducted a time series analysis in order to identify differences in temperature variation across an urbanization gradient and by cover type. Our results demonstrate that temperature changes among microhabitats based on location along the urbanization gradient; some areas experienced significantly different temperature ranges and minimums. We discuss the implications of variation in salamander microclimates for the sustainability of these populations in urban environments.

78. INVESTIGATING THE EFFECTS OF LAND-BASED POLLUTION ON CORAL THERMAL TOLERANCE IN A BRANCHING CORAL SPECIES

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Coral reefs, one of the most diverse ecosystems in the world, face increased pressures from global and local scale anthropogenic stressors. Therefore, a better understanding of the ecological ramifications of thermal anomalies and land-based pollution on coral reef ecosystems is necessary. In this study, we used thermal performance curves (TPCs) to quantify the shape of the relationship between different metabolic rates and temperature at high and low pollution sites in Mo'orea, French Polynesia. Specifically, we collected coral fragments of *Pocillopora acuta* and tested their performance (photosynthesis, respiration and calcification) across a range of temperatures (20-36°C) from each site. We also measured key physiological parameters including Chl *a* content, algal endosymbiont densities, ash-free dry weight and surface area for all colonies. We found that low and high pollution sites exhibited differences in algal endosymbiont densities, concentrations of Chl *a* per symbiont, chlorophyll *a* content of coral tissue, and coral tissue biomass (ash-free dry weight) per unit of surface area. Furthermore, we found that corals from low and high pollution sites exhibited differences in their maximum rates of performance and thermal optimum (T_{opt}) for respiration, and calcification rates. There were also differences between overall gross photosynthesis, respiration and calcification rates. These results indicate that local-source pollution influences corals metabolic response to thermal stress and is integral information for coral reef management and can help assist in forecasting future reef functioning.

79. WATER CONVEYANCE IN SOME CALIFORNIA MISSION WATERWORKS: CONSTRUCTION AND CAPACITY

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Remnants of mission waterworks in Ventura and Santa Barbara Counties, together with sparse historical photographs and records, facilitate investigation of flow and capacity and of provenance and competence of construction materials in aqueduct structures. Well-studied and partially reconstructed waterworks of

Santa Barbara were built of sub-quadrate blocks of quarried sandstone. In less well studied extant portions of a Ventura aqueduct proximal to Ventura River and San Antonio Creek, well-rounded oblong pebbles and cobbles dominate; thus, stream beds were likely favored as sources over nearby marine terrace deposits, though both were probably used. Granules and coarse sands in mission-era mortar are compositionally and texturally more heterogenous than their modern equivalents. Although roundedness of larger clasts contributed to erosion of waterworks, heterogeneity of matrix grains may have been advantageous as temper, even given the primitive shell lime production. Zanjias at Santa Barbara and La Purisima (Lompoc) were primarily lined with plates of fissile sandstone, or more rarely with ladrillos. Limited fragments of tall (3 m) portions of the Ventura mission aqueduct were buttressed in a manner evoking Spanish Roman aqueducts of similar scale, reflecting sophisticated design. Some ambiguity besets estimates of maximum capacity for mission aqueducts and zanjias. While some parameters (channel slope, cross-sectional area) can be measured from extant portions of waterworks, others (e.g., channel roughness) may only be bracketed by estimates. Eroded plasters and post-mission slope changes contribute to uncertainty. New discoveries of mission features, and efforts to preserve them, however, improve prospects for more detailed study.

80. ANTHROPOGENIC DISTURBANCE OF ROCKY INTERTIDAL COMMUNITIES FROM VISITORS TURNING OVER INTERTIDAL ROCKS

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Humans visit rocky intertidal ecosystems for a number of different recreational, educational, or subsistence harvesting purposes and engage in a number of detrimental activities, such as collecting, trampling, and rock-turning. While many studies have focused on the resulting negative impact of visitors collecting and trampling on intertidal flora and fauna, the effects of rock-turning have been largely understudied. When visitors turn over rocks during exploration or hunting, they can damage species by: (1) crushing them during the process of rock turn over; and/or (2) by not replacing the rock back into its original location, and thus, exposing organisms to new, unlivable abiotic conditions. To examine the short-term and long-term effects of rock-turning on community composition, we manually turn over tagged rocks of similar sizes in a Newport Beach rocky intertidal habitat. Species composition of the topside and underside of replicate rocks, as well as the substrate underneath the rocks, initially were quantified. After initial sampling, this rock is either returned to its original location and orientation or left overturned. Subsamples of both treatment types were resampled after differing time-lapses over weeks to months to examine length of time for community recovery. The results of this study in progress will help elucidate the impact and recovery rate of the rock-associated community composition from these anthropogenic disturbances. This information can then be utilized in the creation or alteration of new management strategies to further protect the diversity of the coastline from visitor damage.

81. INVESTIGATING THE POTENTIAL FOR COEVOLUTIONARY RESCUE IN A MODEL CNIDARIAN-DINOFLAGELLATE SYMBIOSIS

§ **J. Moffat** and C. terHorst. Department of Biology, California State University, Northridge.

I plan to investigate the potential for evolutionary rescue in the model cnidarian-dinoflagellate symbiosis of the upside-down sea jelly *Cassiopea xamachana* and algal endosymbionts (*Symbiodinium microadriaticum*). Evolutionary rescue is the “rescuing” of a population through selection for resistant individuals who survive and reproduce in a declining population. It has primarily been studied in the absence of interactions with other species. Past research has investigated the potential for one species to be rescued from extinction; however, the role of evolutionary rescue in symbioses, or “coevolutionary rescue”, has been largely unexplored. I will use *Cassiopea xamachana* to investigate how genetic and phenotypic differences of the endosymbiont translate to fitness differences in the host, specifically in how the holobiont responds to thermal stress. Preliminary data has found phenotypic differences between genotypes of *Symbiodinium microadriaticum* in culture when subjected to thermal stress. However, whether these differences translate to differences in host fitness when these same genotypes are in symbiosis is yet unexplored. Finding differential effects of endosymbiont genotypes on host fitness would suggest a potential for coevolutionary rescue of the host through rapid evolution of the endosymbiont.

This work will have implications for the future of similar cnidarian-dinoflagellate symbioses and conservation efforts focused on genetic and evolutionary rescue in the face of global climate change.

82. IDENTIFYING PATTERNS OF GENE FLOW IN BLAINVILLE'S HORNED LIZARDS *PHRYNOSOMA BLAINVILLII* IN AN URBAN LANDSCAPE

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Habitat loss and fragmentation have detrimental effects on genetic diversity and connectivity of populations. In low-ranging species with habitat specificity, natural barriers to gene flow compound these anthropogenic barriers. My study will use principles of landscape genetics to examine populations of Blainville's horned lizards *Phrynosoma blainvillii* in the Santa Monica Mountains. This region occurs within a putative contact zone between evolutionary clades. I will generate a large dataset of SNPs to approximate effective population size, genetic diversity, and population structure. I will examine my genomic data in the context of a Habitat Suitability Analysis to infer patterns of fine-scale gene flow across the landscape. I will also determine the extent of introgression between populations at the putative contact zone. Together, these analyses can be used to determine conservation strategies for populations of horned lizards in this urbanized region.

84. A DECADE OF HUMAN AND WILDLIFE USE OF CORRIDORS IN ORANGE COUNTY, CALIFORNIA

§ **H. Heesch**, L.L.M. Pandori and C.J.B. Sorte. Department of Ecology and Evolutionary Biology, University of California, Irvine.

Wildlife corridors are a landscape component that connects patches of wildlife habitat separated by highways and road systems. Corridors are often proposed to help mitigate the effects of development on natural landscapes. Monitoring the movement of wildlife through these corridors is important because it can give us insights into wildlife foraging behavior, distributions, dispersal patterns, and community interactions. If corridors are not functioning as a successful way for wildlife to travel from patch to patch, the survival of isolated populations are at risk. We assessed the functionality of two wildlife corridors located in Laguna Canyon Wilderness Park (LCWP), located in Orange County, California, by collecting counts of humans and wildlife documented by trail cameras. These trail cameras have been continuously deployed since 2008, and are located alongside the Main Corridor Trail and Stage Coach North Trail which are directly under each of the corridors. We found a significant increase over time in the abundance of humans seen at both corridors. At the Stage Coach North corridor, we observed a significant negative relationship between the wildlife diversity and human use. Between the two corridors, we found a higher species richness at the Main Corridor. Our results highlight the importance of documenting human activity to determining the effectiveness of wildlife corridors.

85. ANALYZING THE ADAPTIVE IMMUNE REPERTOIRE DIVERSITY AND MICROBIOMES OF AFRICAN INDIVIDUALS

‡ **E. Wesel**¹, R. Ayyala¹, J. Castellanos¹, S. Mangul^{2,3} and E. Eskin^{2,3}. ¹Harvard Westlake School, BIG Summer Program, ²Department of Computer Sciences, UCLA, ³Department of Human Genetics, UCLA.

Using an immune repertoire tool, we were able to assemble distinct CDR3 sequences of 130 individuals from eight distinct African tribes and estimate their immune diversity. Upon further analysis using statistical methods, we found a significant difference (p-value = 0.001) between the diversity of T-cell receptor repertoire across African populations. These results support the hypothesis that the African populations have highly diverse T-cell repertoires, which could be influenced by lifestyle. In the future, we plan to focus on analyzing populations of different countries in order to obtain a global perspective of the adaptive immune repertoire diversity.

86. EFFECT OF DENSITY ON GROWTH AND SURVIVAL OF JUVENILE WOODLICE *ARMADILLIDIUM VULGARE*

§ **A.L. Alani**, C.J. Harris and B.J. Ripley. Grossmont College, El Cajon.

The goal of this experiment was to determine whether density effected the growth and survival rate in juvenile *Armadillidium vulgare*, commonly known as woodlice or roly-polies. This was done by randomly assigning individuals into low- and high-density treatments (four versus eight individuals, respectively). Each treatment had half males and half females and the same amounts of food and soil. Length was initially measured and then monitored weekly over a period of eleven weeks. We found that the woodlice had grown an average of $1.4 \text{ mm} \pm 0.2$ (95% CI) but that there was no difference in growth between density treatments. There was no significant difference in survival to week 9 ($z = 0.767$, $p = 0.297$) and only marginally significantly lower survival in the high-density treatment at week 11 ($z = 2.07$, $p = 0.047$). It is possible that time period was not long enough for most individuals to molt (and therefore grow) and some females became pregnant during the experiment so we would like to repeat it with better control of these variables and with a larger density difference between treatments.

87. EFFECTS OF BAYCRETE TEXTURE AND TIDAL ELEVATION ON RECRUITMENT OF NATIVE *OSTREA LURIDA* AND NONINDIGENOUS *BALANUS AMPHITRITE* IN SAN DIEGO BAY, CA

‡ **S. Li**¹, B. Perog² and D.C. Zacherl². ¹Walnut High School, ²Department of Biological Science, California State University, Fullerton.

Globally invasive *Balanus amphitrite* is a common fouling barnacle in harbors worldwide; it is found on many non-living substrates including ships, pilings, and seawalls but can also settle on the shells of living oysters, mussels, and crabs. *B. amphitrite* causes ships to burn more fuel due to increased drag; they can also negatively impact native species that they settle upon. *Ostrea lurida*, the Olympia oyster, is a foundational species native to the North American Pacific coast; it provides habitat for other species and filters the water. Extant Olympia oyster abundances are a fraction of their abundance a century ago. Resource managers are interested in restoring Olympia oysters using baycrete, a concrete mixture incorporating oyster shells, as a base for oyster beds. Baycrete recruits native oysters but may also recruit nonindigenous species. We explored baycrete characteristics that might promote native species recruitment while discouraging nonindigenous species recruitment. From May to September 2018, we deployed replicate baycrete tiles of two textures (rough, smooth) at two tidal elevations (0 m MLLW, +0.6 m MLLW) in San Diego Bay, CA. We used 2-way ANOVA to test whether the difference between native *O. lurida* and nonindigenous *B. amphitrite* percent covers were affected by rugosity and elevation. We detected no significant effect of rugosity on the difference in recruitment between species, but *O. lurida* cover was significantly higher at 0 m MLLW; *B. amphitrite* cover was higher at +0.6 m MLLW. Baycrete deployed at 0 m MLLW will promote native species recruitment without promoting *B. amphitrite*.

88. DETERMINING THE ROLE OF LINKER REGION PHOSPHORYLATION IN POLYPYRIMIDINE TRACT BINDING PROTEIN 2 NEURONAL SPLICING REGULATION

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Polypyrimidine Tract Binding Protein 1 (PTBP1) and its neuronal homolog Polypyrimidine Tract Binding Protein 2 (PTBP2) are two related RNA binding proteins that aid in assembly of the spliceosome. Alternative splicing, a process during gene expression in which a gene codes for multiple proteins, is regulated by these proteins. Aberrant splicing leads to neurodegenerative diseases underscoring the importance of alternative splicing regulation. PTBP1 is expressed in most tissues, while PTBP2 is expressed in neurons, and testis. Interestingly, these proteins, although encoded on separate genes, display similar domain structures and RNA binding properties, as well as a 74% identical amino acid sequence. Previous studies indicate that PTBP1 and PTBP2 are post-translationally modified by addition of phosphate groups in the unstructured N-terminal, linker 1 and linker 2 regions, with PTBP2 being more phosphorylated than PTBP1. Phosphorylation of linker regions can alter

structure and influence inter-RRM interactions. Thus, the hypothesis underlying this study is that phosphorylation of PTBP2 N-terminal and linker regions dictates splicing activity. The goal of this study is to determine the role of phosphorylation in PTBP2 N1 splicing regulation. To do this we will first aim to identify which phosphorylated region(s) are important for PTBP2 N1 splicing regulation by creating PTBP1-PTBP2 chimeras. Chimeras will be generated via two-step PCR and analyzed for splicing repression activity in vivo on the N1 exon. Once we identify a region important for P2 N1 splicing regulation, we aim to determine whether phosphorylation is important by generating alanine mutants and analyzing them for splicing activity.

89. CHANGES IN GROUNDWATER QUALITY AND FLOW AT ZZYZX, CALIFORNIA

§ **L.X. Zuñiga**, B.J. Hibbs, D. Stone and S. Tovar. Department of Geosciences and Environment, California State University, Los Angeles.

Soda Springs is a collection of groundwater seeps and springs along the western shore of Soda Dry Lake at Zzyzx, California. The area is home to the California Desert Studies Center, a field station owned and run by California State University, Fullerton. Prior research at Zzyzx concludes there is an alluvial aquifer that is hydrologically separate from the playa aquifer feeding Soda Lake Playa. The alluvial aquifer appears to be of median groundwater age and has significantly different water composition from the playa aquifer, but not much else is known. These studies were conducted over a decade ago, and since then there has been a period of extreme drought and retrofit of West Pond, a surface water body, to eliminate a saline water sump. Post retrofit, total dissolved solids in West Pond decreased from 21,736 mg l⁻¹ in February 2006 to 2,703 mg l⁻¹ in October 2018. Stable water isotopes show the water in West Pond is now much less evaporated, and there have been comparable decreases in chloride and sulfate as well: from 8,473 mg l⁻¹ to 1,450 mg l⁻¹ Cl and 4,105 mg l⁻¹ to 660 mg l⁻¹ SO₄. We are using this data to trace changes in groundwater chemistry near West Pond with data forthcoming. This study also aims to gain more insight on the source of the heavy flux of groundwater present at Zzyzx, how drought has impacted the aquifer, and investigates if water quality has changed in MC Spring, the last natural habitat of the Mojave tui chub.

90. IMPACT OF SUBMERGED AQUATIC VEGETATION *ZOSTERA MARINA* AND *RUPPIA MARITIMA* ON HABITAT PARAMETERS AND MACROINVERTEBRATE COMMUNITY COMPOSITION WITHIN AN URBANIZED COASTAL LAGOON

§ **N.J. Da Silva** and C.R. Whitcraft. California State University, Long Beach.

Seagrass ecosystems enhance coastal regions and provide a range of important environmental services. Unfortunately, acreage of these ecologically valuable habitats has been dramatically reduced worldwide by anthropogenic disturbances including coastal dredging, development, and urbanization. To combat this loss, local resource managers often promote restoration or mitigation programs, which aim to reestablish degraded or destroyed habitat. This study investigates bed characteristics and macroinvertebrate community structure associated with several seagrass meadows within a highly urbanized but freshly restored coastal lagoon in Southern California. The Colorado Lagoon, located in the city of Long Beach, recently underwent a multi-year renovation, which involved site-wide dredging, bathymetric modifications, and the transplanting of four beds of the eelgrass *Zostera marina* (the historically dominant seagrass in the region). Additionally, a secondary native seagrass, *Ruppia maritima*, colonized several regions of the lagoon through natural dispersal following the completion of restoration activities. We aim to compare abiotic conditions, vegetation characteristics, and macroinvertebrate community composition in the three unique subtidal habitats present within the newly restored lagoon: *R. maritima*, *Z. marina*, and unvegetated bare ground benthos. Preliminary results suggest that the morphology of each seagrass species may influence local macroinvertebrates compared to bare ground, and that differences in each species' growing season, reproductive strategies, and ability to tolerate stress may cause the communities they support to vary both locally and temporally. Understanding how benthic and blade-associated macroinvertebrate communities change in response to the presence and species of local seagrasses will allow for better management and stewardship of California's coastal estuaries.

91. BASKING PATTERNS AND SPATIAL DISTRIBUTION OF NATIVE AND NONNATIVE TURTLES WITHIN AN URBANIZED WATERWAY IN ORANGE COUNTY, CA

‡ **M. Skibsted**¹ and G.B. Pauly². ¹Santa Margarita Catholic High School, ²Natural History Museum, Los Angeles.

The red eared slider turtle (*Trachemys scripta elegans*) has been introduced on six of the seven continents. Invasive populations in California are well documented; however, the impacts these turtles have on native species are not well quantified. It has long been speculated that sliders pose a threat to California's only native freshwater turtle, the western pond turtle (*Emys marmorata*); however, their impact hasn't been formally documented. We observed and recorded red eared slider and western pond turtle prevalence along the 31 km stretch of Aliso Creek, an urbanized waterway located in Aliso Viejo, Orange County, California. We partitioned the creek into 10 separate transects, each roughly three kilometers in length, and monitored these partitions via foot surveys over the course of multiple days. We assessed turtle abundance and basking site usage throughout the waterway. Our first goal was to assess whether red eared sliders were predominately residing along more urbanized sections of Aliso Creek. Our second goal was to assess whether sliders and pond turtles used similar types of basking sites. These results are interpreted with respect to conservation management of pond turtles in urbanized waterways.

92. PLANT GROWTH PROMOTING POTENTIAL OF *BACILLUS* SP. AND *PAENIBACILLUS POLYMYXA*

§ **R. Parker** and M. Lum. Department of Biology, Loyola Marymount University.

Previous studies have shown that *Paenibacillus polymyxa*, a gram-positive facultative anaerobe, can enhance drought tolerance, synthesize plant auxin and cytokinin, suppress pathogens, and enhance soil porosity. *Bacillus sp.*, a gram-positive facultative anaerobe, is also a known plant growth promoting bacterium (PGPB) and reduces severity of disease in the host. Two bacterial isolates from plant roots were characterized and tested for possible PGP properties. Biochemical testing showed both strains positive for nitrogen fixation, cellulase production, and aerobic and anaerobic growth. Bacterial strains also underwent DNA isolation, library preparation, and genome sequencing, leading to their identification as *Bacillus sp.* and *P. polymyxa*. PGPR properties were further tested through various plant growth assays. *Arabidopsis thaliana*, *Zea mays*, and *Trifolium pratense* were inoculated with both strains. Results were variable between the different species of plants, however the overall results indicate both strains have potential for use as bioinoculants for plant growth promotion.

93. DEFINING THE MECHANISM BY WHICH ALCOHOL-MEDIATED NANOG TOGETHER WITH THE PRC2 SUPPRESS OXPHOS WHICH GENERATE CHEMO-RESISTANT TIC'S

‡ **J. Archila**¹, Mentors D. Yeh² and K. Machida². ¹Bravo Medical Magnet High School & USC STAR Program, ²USC Department of Molecular Microbiology and Immunology.

Cancer is the second leading death in the world as liver cancer promotes about 660,000 deaths per year. Liver cancer is caused by environmental factors like alcoholism and obesity. Alcoholism, specifically, causes the protein NANOG to suppress OXPHOS, a metabolic pathway, that induces self-renewal of tumor-initiating cells. NANOG does not cause this suppression by itself as it is induced by the gene suppressor PRC2 Complex. In order to find the minimum required region of binding between the two proteins to prevent their interaction we must generate truncation constructs by both immunoblotting and immunoprecipitation. Our results show that the GST-NANOG interacts with all three components of PRC2 through Carbonyl terminal domain from amino acid 155. By finding this minimum binding region, we can create an in silico 3D model that can undergo drug screening to potentially find a drug that will occupy the molecular groove between the two proteins to prevent interaction allowing normal metabolism and tumor shrinkage.

94. MORPHOLOGICAL ASYMMETRY AS AN INDICATOR OF STRESS IN *NEOTOMA LEPIDA* AND *ONYCHYMOUS TORRIDUS*, MORPHOLOGICAL CHANGES IN RESPONSE TO POLLUTION IN INYO COUNTY

§ **M. Laiolo**, J. Galvez, C. Dauw and W. Binder. Department of Biology, Loyola Marymount University.

Vertebrates develop in a bilaterally symmetrical manner, however it has been suggested that environmental stressors such as anthropogenic pollutants may disrupt this pattern. Pollution exposure may lead to the introduction of fluctuating asymmetries (FA) during development. Moreover, pollutants can make their way into the food chain through plants and are likely to be more concentrated in higher trophic levels. This accumulation of pollutants via diet is predicted to result in higher amounts of FA. By measuring skulls for their degree of bilateral symmetry through calculating distances between landmarks—identifiable sutures on the skull—differences in FA between species can be analyzed. In this study, two variables are examined to better understand the role of PM₁₀ pollutants and trophic level in the formation of two rodent species. PM₁₀ is defined as particles of any substance—i.e. dust, pollen, mold—that are less than 10µm in diameter. Specimens of *Neotoma lepida*, the desert woodrat, and *Onychymous torridus*, the southern grasshopper mouse, with an exposure to higher pollutant levels (those found within an EPA non-attainment site) are compared to specimens from areas with lower levels. Specifically, *N. lepida* living within ~40-mi radius of Owens Lake, CA are compared to those living outside of Inyo County. In addition, rodents from a higher trophic level, *O. torridus*, are compared to the *N. lepida* groups above. We predict *N. lepida* from within Inyo County will have higher amounts of FA compared to those outside, and that *O. torridus* will have higher FA levels compared to all groups of *N. lepida*.

95. HABITAT USE AND Q10 OF NATIVE AND NONNATIVE GOBIES IN A FRAGMENTED WETLAND HABITAT

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Habitat fragmentation in wetland ecosystems can negatively impact flora and fauna by reducing connectivity and increasing vulnerability to invasive species. This study aims to evaluate how fragmentation is influencing the ecology, interactions and connectivity of and between native longjaw mudsucker *Acanthogobius flavimanus* and nonnative yellowfin goby *Gillichthys mirabilis*. These are explored by 1) assessing species distribution and habitat use, 2) evaluating diet overlap as well as species' isotopic niche space between habitat types and 3) comparing physiological tolerances such as temperature sensitivity (Q10) to aid in understanding differential habitat use between species. Habitat types consist of altered, natural, and marsh creek sites. Species' habitat use and distribution are determined by beach seining all habitat types. Species' diet and isotopic overlap are determined through stomach content analyses and stable isotope analyses respectfully. Finally, species' temperature sensitivity is quantified through a metabolic rate experiment at different temperatures using a respirometer. Our preliminary data show that the nonnative goby inhabits the altered habitat while the native goby inhabits the natural and creek habitats. In addition, preliminary stable isotope signatures show similar food signatures among habitats but different signatures of fish among sampling locations and between habitat types. This potentially supports the idea of differential habitat use between the native and nonnative gobies. These results could inform future restoration of the fragmented wetland habitat at the Seal Beach National Wildlife Refuge by suggesting that removal of culverts and conversion of the altered ponds to tidal creeks might reduce the population of the nonnative goby.

96. THE RICH TAPHONOMIC HISTORY OF THE LATE PLEISTOCENE AT RANCHO LA BREA

§ **E. Pitcher**, N. Noriega, J. Cohen and W. Binder. Loyola Marymount University.

The Rancho La Brea tar pits represent a unique window into the environment leading up to the end-Pleistocene megafaunal extinction. It is one of the most fossiliferous sites in North America, preserving thousands of specimens, and presents an opportunity to observe the paleoecology of the Late Pleistocene. At the tar pits there are two major collections: the original Hancock collection and the modern Pit 91

collection. The Hancock collection focused on large, museum-worthy specimens, often excluding smaller and heavily damaged fossils. In contrast, the modern Pit 91 collection records and collects all specimens using modern excavation techniques, so it is imperative to understand any collecting biases between these collections. Taphonomy, the process that an organism undergoes from death to discovery, is important to understand because it provides insight into the local environment at the time of death. By determining the taphonomic processes of the Hancock collection and Pit 91 collection, collecting bias can be quantified to better understand biological differences between these collections. This study compared taphonomic features including abrasion, pit wear, weathering stages, and census data in the sabertooth cat, *Smilodon fatalis*, and the bison, *Bison antiquus*, from Pit 61/67 of the Hancock collection and from the Pit 91 collection. Taphonomic features were similar in both collections, indicating that differences in census data can be attributed to collecting bias. With this data the collecting bias was quantified between the Hancock collection and Pit 91, which will allow for more meaningful paleoecological comparisons between the two collections in the future.

97. AN INTEGRATED MICROFLUIDIC SYSTEM FOR BLOOD PLASMA SEPARATION AND DISEASE DIAGNOSTICS

‡ S. Liu¹ and N. Garg². ¹Arcadia High School, ²University of California, Irvine.

Human blood plasma is critical for disease diagnostics since plasma contains biomarkers associated with many diseases. The current rapid tests (lateral flow strips) are inexpensive and fast but suffer from low accuracy as they rely on colorimetric detection. Fluorescence detection is highly sensitive, but detection of whole blood samples is challenging since blood cells have high autofluorescence. Separation of plasma from blood cells is crucial. The current benchtop standard for blood plasma separation is centrifugation, which suffers from its bulky and expensive design, high consumption of energy, and inability to be integrated with downstream detection. A microfluidic device for plasma separation from whole blood solution was successfully developed. The device was fabricated using soft lithography. It relies on the principle of bubble-induced microstreaming to capture and separate the blood cells from the blood sample, resulting in a pure plasma solution. Bubble-induced microstreaming is created when acoustic energy acts upon an air bubble causing the viscous dissipation of the surrounding liquid in the microchannel. This device successfully demonstrated plasma separation, with a 31.8% yield and 99.9% plasma purity. The plasma was spiked with fluorescent P24 antibody, which was then mixed with 7- μm diameter beads that were conjugated with P24 antigen in an integrated micromixing chamber. The bound proteins were then captured by acoustic microvortexes and detected using a fluorescence microscope. A quantitative analysis system was successfully developed for more accurate readings of fluorescent signal. This device shows a potential of immunoassay-based disease diagnostics with high sensitivity and quantification.

98. THE CYTOKINE RESPONSE OF MICE CHALLENGED WITH EQUINE BACTERIAL PATHOGEN *CORYNEBACTERIUM PSEUDOTUBERCULOSIS*

§ D.R. Coleman¹, R. Pollock¹ and K. Mollinder². Department¹ of Biology, Occidental College.

Corynebacterium pseudotuberculosis is a gram-positive bacteria that infects horses worldwide. One biovar of the bacteria, *C. pseudotuberculosis equi*, infects horses and cattle. This bacterium causes a disease called “pigeon fever” in horses. There are three forms of the infection: external abscesses, internal abscesses and ulcerative lymphangitis. Most horses (~ 90%) are effected by external abscesses and this form of the disease has a low mortality rate (0.8%). However, 8% of the affected horses develop internal infections and these horses have a high mortality rate of 40% There is no current vaccine or diagnostic assay. As the global temperatures are rising, more horses are getting infected beyond the southwestern region of the United States. Our lab foresees that this number will continue to rise due to human behavior. In order to determine the T cell response in immunity and survival I have measured cytokines from previous mouse vaccination and bacterial challenge trials. In these previous trials all mice were immunized with recombinant proteins and challenged with *C. pseudotuberculosis*. Spleen cells from mice that survived two previous trials were harnessed and stimulated with other antigens used for immunizations. The culture supernatants from these cells were tested for the IL-4, IL-17A and IFN- γ

cytokines. Mice exhibited a high response for the pro-inflammatory cytokines IL-17A and IFN- γ . However, the IL-4 cytokine response was low for most mice. We conclude that the IFN- γ and IL-17 cytokines are being produced by a different cell type than the IL-4 cytokines.

99. ONTOGENETIC DISTRIBUTION OF LATE PLEISTOCENE MEGAFUNA AT RANCHO LA BREA

§ **M. Morado**, A. Yager, J. Cohen and W. Binder. Loyola Marymount University.

The asphalt deposits at the Rancho La Brea Tar Pits in Los Angeles, California are one of the largest continued excavations of Late Pleistocene megafauna. This unique site has allowed for continuous recovery of bones of both extinct and extant specimens over the past century. Fossils from the earliest excavations, known as the Hancock collection, were subjected to collecting bias that favored retention of well-preserved specimens, compared to the modern Pit 91 collection, where all specimens were collected. This could have led to lower juvenile counts compared to a higher predicted entrapment rate because of their smaller size and fragility, as they were more likely to break and be discarded. A previous study utilizing the Pit 91 collection found a higher percentage of juvenile entrapment in large herbivores (51%) than in large carnivores (29%). Asphalt deposits from South America indicate a high variation in the entrapment rate of juveniles, with localities ranging from 10% to 55%. Juvenile entrapment rates from the Hancock collection are unknown and allow direct comparisons to Pit 91 and the South American deposits. Pit 61/67 census data of the Hancock collection of the sabertooth cat *Smilodon fatalis* and the antique bison *Bison antiquus* were used to calculate minimum number of individuals. Ontogenetic stage was categorized as adult or juvenile and percent juveniles for each taxon was calculated. We expect that data for La Brea will show no significant variation in ontogenetic distributions and that both deposits will not differ significantly from the South American deposit.

100. OCEAN'S EIGHT: EXAMINING CORAL RECRUITMENT PATTERNS ON JAMAICAN REEFS FROM 2012-2019

§ **S.R. Thiagarajan** and A.D. Stubler. Department of Biology, Occidental College.

As one of the first islands in the Caribbean visited by tourists when commercial air travel began, Jamaica has a prolonged history of human impacts to coral reefs, and has unfortunately been the quintessential example of coral reef demise. Understanding the rate of recovery and resilience in coral populations of Jamaica is critical for both the people of Jamaica who rely on this natural resource and coral reef ecologists. In 2009, three sites were chosen (Dairy Bull, Pear Tree, and Discovery Bay) for a long-term coral recruitment monitoring project. Permanent recruitment tiles were installed on the reef at depths of 8-10m and 15-18m at each site. A total of 180 tiles (60 at each site) are used to monitor annual coral recruitment. Every January, photographs are taken of the tiles and archived for later analysis of percent cover, organism identification, abundance of coral, and coral area. Coral recruitment data from 2012-2019 will be presented, with an emphasis on broad patterns of change over time at the different sites. Quantifying coral abundance and percent cover will help guide governmental conservation priorities and policies for protecting reefs around the island.

101. CHARACTERIZING THE PLANT GROWTH PROMOTING PROPERTIES OF *STREPTOMYCES* SP. 13GDEB02N

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Biofertilizers have been seen as a viable alternative to chemical fertilizers due to their ability to promote plant growth and mitigate pollution events where chemicals would leach into the ground. Biofertilizers are comprised of microorganisms such as fungi and plant growth promoting rhizobacteria (PGPR). PGPRs reside in soil and form commensal relationships with plants through successful colonization of the rhizosphere that allows for increased nutrient availability. Bacterial strain 13GDEB02N was isolated from nodules of *Pisum sativum* (pea). 16S rDNA analysis identified the bacterium as a species of *Streptomyces*. DNA isolation, library preparation, and genome sequencing were also carried out and confirmed that the strain belongs to the genus *Streptomyces*, however the species identification was still unclear. Although

originally isolated from nodules, 13GDEB02N was not able to renodulate pea, suggesting it requires another bacterium to enter the plant. The optimal growth condition for the *Streptomyces* sp. was at 30°C. Biochemical testing showed the strain positive for nitrogen fixation, cellulase production and auxin production, suggesting that 13GDEB02N has plant growth promoting potential. Therefore, the effect of this strain on the growth of *Arabidopsis thaliana*, *Zea mays*, and *Trifolium pratense* was measured. Although the impact on growth was different depending on the plant species analyzed, the overall results show that *Streptomyces* sp. 13GDEB02N is a good candidate to be developed as a biofertilizer.

102. TOPANGA: A LUCIFERASE-BASED ASSAY FOR THE DETECTION OF CHIMERIC ANTIGEN RECEPTORS

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Chimeric Antigen Receptor (CAR) T-Cell therapy is a promising modern discovery, that aims to treat various diseases and malignancies; such as acute lymphoblastic leukemia and lymphoma. Studies have demonstrated that patient's T-cells can be engineered with an antibody's Single Chain Variable Fragment (scFv) to target cancer antigens. This allows the patient's own immune system to detect and combat the desired cancerous cells. As the applications of CAR therapy expands at a rapid rate, the development of a detection method remains lengthy and expensive. This process commonly utilizes flow cytometry, which involves fluorochrome-tagged ligands or antibodies within the CAR's domain. Therefore, our laboratory has developed a quick, specific, and economical assay termed "Topanga Assay" to detect Chimeric Antigen Receptors on T-cells such as those that target CD138, CD33, CD19, CS1 and BCMA. The assay involves the use of recombinant fusion proteins, which consist of an extracellular domain of a CAR target, such as CD19, joined in frame with one of the marine luciferases. The expression is then observed by luminescence measurements after adding Coelenterazine (luciferase substrate). The assay turned out to be a highly specific and cost-efficient form for CAR-T detection compared to anti-idiotype antibody-based and Protein L based assays and does not require the use of a flow cytometer.

103. THE REPRODUCTIVE MORPHOLOGY OF MALE SURFPERCHES (EMBIOTOCIDAE; TELEOSTEI)

§, £ **E.C. Bond** and K.L. Forsgren. California State University, Fullerton.

Surfperches (Embiotocidae) are coastal marine fishes distributed along the eastern Pacific Ocean from Alaska to central Baja California. Surfperch have elaborate courtship behaviors and reproduce via internal fertilization. However, the specific structure used to transfer sperm (genital papilla or flask organ) has not been conclusively determined. In at least seven surfperch species, the fleshy genital papilla, located on the ventral side of the body, has been documented as the mode of sperm transfer. Whereas other research suggests that the flask organs, located on both sides of the anal fin, are involved. Our goal is to better understand male surfperch external reproductive structures in four species: walleye surfperch *Hyperprosopon argenteum*, black perch *Embiotoca jacksoni*, shiner perch *Cymatogaster aggregata*, and dwarf perch *Micrometrus minimus*. We hypothesize that: 1) all surfperches transfer sperm via a genital papilla; and 2) flask organs are involved in reproduction, but not directly involved with sperm transfer. Mature males were collected via beach seine in southern California. Macro/microphotography and paraffin histological techniques were used to examine internal and external reproductive structures. Our research indicates that the testicular efferent ducts of surfperches fuse into a single sperm duct that directly connects to the genital papilla and is the mode of sperm transfer. The flask organs are not connected to testes, and thus not directly involved in sperm transfer. This is the first comparative study on surfperch reproductive anatomy and will increase our understanding of the reproductive biology of viviparous marine species.

104. PARASITES OF CYPRINIFORM FISHES OF THE SANTA CLARA RIVER

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Freshwater fishes in the southwestern United States live in some of the most highly modified habitats in the country. As a result, a relatively small number of native fish species have been impacted by the introduction of nonnative fishes and their parasites. *Catostomus santaanae* (Santa Ana sucker) (n = 35), *C. santaanae* x *C. fumeiventris* F2 hybrids (n = 61), *Pimephales promelas* (fathead minnow) (n = 18), and *Gila orcutti* (arroyo chub) (n = 214) were collected and necropsied in Summer 2017 and 2018. Ten species of macroparasites were collected from these fishes including six native and four nonnative parasites. The most abundant species of native parasite was *Rhabdochona* sp. while the most abundant nonnative parasite was *Lernaea cyprinacae* (anchor worm). The prevalence of *Rhabdochona* sp. was highest in *G. orcutti* (69%) and lowest in *C. santaanae* (5%). The prevalence of *L. cyprinacae* is highest in *G. orcutti* (29%) and lowest in *P. promelas* (5%).

105. EFFECT OF TEMPERATURE ON EMBRYONIC TO LARVAL DEVELOPMENT OF SAND DOLLARS *DENDRASTER EXCENTRICUS*

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Understanding how life responds to changes in temperature is a critical endeavor given the predicted climate changes the planet will experience in the future. The aim of this study was to investigate effects of temperature on early development of sand dollars, *Dendraster excentricus*. It was hypothesized that sand dollars cultured at 21.5°C would develop faster than those reared at 13.5°C, and there would be significant differences in larval morphology. Embryos were grown at their respective temperatures and were monitored every thirty minutes for development. Larval growth metrics were analyzed every two-three days and included post oral arm length (POAL), mid body length (MBL), and stomach length. Embryonic cell division rate was significantly higher at 21.5°C than 13.5°C (ANCOVA Temp x time $p < 0.05$, $p = 0.008$). Larval developmental rate was also significantly faster at 21.5°C, $p = 0.012$. The difference in MBL and the stomach length between the larvae in 13.5°C and 21.5°C increased with time. POAL was longer in high temperature larvae early in development, resulting in a large difference in the POAL:MBL ratio. This difference diminished as larval development progressed. These results are important because with increasing global temperatures, larvae will increase their metabolic rates and abating physical adaptations to this in later stages could adversely impact the survival of these species. These results confirm the necessity for integrative approaches for understanding the true effects of temperature changes on organismal biology.

106. PHYTOPLANKTON ASSEMBLAGE COMPOSITION AT WHITE POINT HYDROTHERMAL VENT

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It is the primary objective of this research to develop a better understanding of the ecophysiological conditions leading to toxic algal blooms. Through water analysis and phytoplankton composition comparisons from three locations in the shallow waters off White Point, CA, this project was designed to discover if nutrients from vent effluence, specifically nitrates and phosphates, as well as increased temperature contributions would create an ideal environment for harmful phytoplankton to proliferate. The hypothesis was a unique signature of phytoplankton would be present in association with an active hydrothermal vent site. The California Department of Public Health (CDPH) Marine Biotxin Monitoring Program supplies volunteers with a 20µm (pore-size) mesh phytoplankton net, data spread sheets, and microscope observation protocols. Using an OMAX digital compound LED microscope, plankton samples were averaged to obtain an accurate representation of relative abundance for each organism observed. All tallied data and water samples were verified by the CDPH Environmental Management Department. Twelve samples were examined during a week in November and abundance compositions were compared between three locations. Patterns were highlighted using data spreadsheets to uncover which organisms were prevalent at each sample location at White Point Beach. An intense elevation in

the relative abundance of Cyanobacteria, as well as *Navicula*, *Cylindrotheca* and *Licmophora* were observed consistently across samples in association with the active hydrothermal vent site. The hypothesis that a unique signature of phytoplankton could be found associated with an active hydrothermal vent site was supported by the results.

107. ALIGNMENT OF INTERSTS IN THE JOSHUA TREE – YUCCA MOTH POLLINATION MUTUALISM

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Natural selection favors organisms that are better at exploiting their resources. Therefore, evolutionary conflict is hidden within mutualistic interactions. In particular, yucca moths *Tegeticula antithetica* lay eggs in flowers of Joshua trees *Yucca jaegeriana* before pollinating them; trees should be selected to minimize seeds lost per pollination event, but moths should maximize eggs laid per pollination effort. Prior studies involving *Y. filamentosa* and its obligate pollinator *T. yuccasella* has shown a high frequency in self-pollen delivery; it is thought that moths transfer lower quality “self” pollen between flowers of the same host plant to minimize effort and predation risk associated with movement between plants. To understand the efforts Joshua tree pollinators put into pollen transfer, we estimated the distance traveled by the moths in a mark-recapture study, using protocols adapted from a prior mark-recapture study involving a different yucca moth species *Tegiticula maculata extranea*. We captured moths in the field, and marked them with “liquid paper” correction fluid. We covered accessible Joshua tree inflorescences with glue traps, then released moths from a central point, and tracked the frequency with which marked moths were trapped, and their distance from the release point. How often moths carry pollen from multiple trees is another crucial factor, and the pollen loads carried by the recaptured moths can be genotyped using microsatellite markers to further explore this question.

108. UTILIZING ENDO-PORTER TO DELIVER MORPHOLINO ANTI-SENSE OLIGONUCLEOTIDES INTO ISOLATED SKELETOGENIC CELLS OF *LYTECHINUS PICTUS*

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Chordata, the phylum that humans belong to, has many genetic similarities with Echinodermata. Through comparative proteomics, a group of proteins that mediate the mineralization of tissue amongst deuterostomes has been identified. Here, our objective was to determine whether or not Endo-Porter reagent is an effective delivery method to transport Morpholino Anti-Sense Oligonucleotides, or MASO, into sea urchin skeletogenic cells. Endo-Porter is a synthetic peptide-based molecule used to transport a substance into the cytosol of a cell without damaging a cell’s membrane. The molecules we want to deliver into the interior of the cell, MASO, are nucleic acid analogs that interfere with the translation of proteins, thus enabling us to eliminate their function through “protein knockdown.” MASO can be detected by utilizing an epifluorescence microscope, which causes the MASO’s fluorescent tag, FITC, to fluoresce. *Lytechinus pictus* cells were dissociated in order to isolate their micromeres, cells that eventually fuse to form the organism’s exoskeleton, at an early developmental stage. Once isolated, micromeres can then be placed in horse serum, which contains growth factors that induce the formation of skeletal rods. The micromeres were placed in varying concentrations of MASO, Endo-Porter, and horse serum. Our results indicated a small amount of fluorescence in the cells, proving that Endo-Porter does indeed successfully facilitate the transportation of MASO into isolated micromeres. We propose that, with future adjustments and more concise results, we can use custom coded MASO to further study skeletal proteins and contribute to research regarding bone disease in human healthcare.

109. LOCAL-SCALE ENVIRONMENTAL HISTORY INFLUENCES THE RESPONSE OF ALASKAN TIDE POOL SPECIES TO INCREASED TEMPERATURE

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In order to anticipate how species will respond to a warming ocean, we need to know the degree to which processes such as metabolic rate depend on thermal history. We measured metabolic rates of hermit crabs *Pagurus hirsutiunculus* and mussels *Mytilus trossulus* with varying thermal histories. Organisms were collected from 9 tide pools in Sitka, Alaska in which we also recorded temperature over the three months prior to metabolic rate assays. Using respirometry, we estimated resting mass-specific oxygen consumption (MO_2) at three different temperatures (10°C, 18°C, and 26°C) for one hermit crab and one mussel from each tide pool. As predicted, MO_2 significantly increased with experimental temperature and mass. We then tested for linear relationships between individual MO_2 slopes and the following environmental parameters: average, variance, maximum, and range of pool temperatures. For both species, there was a relationship between MO_2 slopes and the thermal maximum and range. However, the direction of the relationship differed between species: hermit crab MO_2 increased more rapidly for individuals from cooler pools while mussel MO_2 increased more for individuals from warmer pools. These findings show that thermal environmental history at small scales influences metabolic response to temperature within local populations and that the direction of the response can differ between species.

110. CALPAINS 8 AND 9 ARE EXPRESSED IN THE MURINE INTESTINES AND REGULATED BY *wnt3a* IN COLON CANCER CELLS.

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Calpain-8 and -9 are calcium dependent proteases, predominantly expressed in the stomach. Both proteases are implicated in processes such as cancer development and progression. Upregulation of calpains have been seen in tumors and cancers including gastric cancer, breast, and ovarian cancer suggesting its activity in cancer development. However, their activity in colon cancer is unknown. To investigate a potential role in colon cancer, we have stimulated human colon cancer cell line with WNT3A, Tumor Necrosis Factor alpha (TNF) and both for 24 hours. After WNT stimulation, the relative mRNA expression of calpain-8 and -9 significantly increased, whereas TNF did not affect the expression of calpain-8 and -9. However, when stimulated with both, TNF has suppressed the ability of WNT to upregulate, suggesting an interaction between the two. We also found that calpain-9 to be highly expressed in murine colon through our immunohistochemical analysis. Taken together, our results suggest a possible role for calpains-8 and 9 that warrants further investigation.

111. UNDERSTANDING THE CAUSES AND CUMULATIVE CONSEQUENCES OF RARITY ON *ENCELIA DENSIFOLIA* AND *E. RAVENII*

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Rarity is a term commonly misinterpreted as being uniform in meaning. For instance, the rarity of a species could be caused by multiple factors, including geographic range, habitat specificity and local population size. Two species of the desert plant genus *Encelia* (*Encelia densifolia* and *E. ravenii*) are considered rare because they exist in only a specific habitat. Both *Encelia densifolia* and *E. ravenii* have adapted to living in an incredibly dry, hot, severe environment. *Encelia densifolia* is primarily found in a remote dessert, Sierra de Santa Clara in the Vizcaino Desert, México while *E. ravenii* is limited to a single hillside in the San Felipe Desert in Mexico. We are seeking to understand the causes and cumulative outcomes of rarity on the evolution of the species. To do so, we collected genomic data for 40% and 80% of the known individuals in *E. densifolia* and *E. ravenii*. Through the analysis of these data, we are studying how gene flow, genetic drift, and inbreeding affect genetic diversity within small plant

populations. If one or both species have low genetic diversity, this might hinder their ability to adapt to changing conditions. If they have high levels of gene flow they might be swamped out by hybridizing with other species. The lack of genetic diversity limits the ability of a species to adapt to changing environmental conditions, which provides a possibility for near extinction. Understanding the effects of rarity could thus better assist in the conservation and restoration of the species, as needed.

112. MARKING TERRESTRIAL ISOPODS FOR RECAPTURE: NOT AS EASY AS YOU MIGHT THINK

§ **M. Nguyen**^{1,2}, S. Al Azzawi¹ and B. Ripley¹. ¹Grossmont College, ²University of California, San Diego.

The terrestrial isopod species *Armadillidium vulgare* is native to Europe but has naturalized globally. We were interested in investigating their dispersal ability in a fragmented urban landscape where suitable habitat patches are separated by roads, paths and sidewalks. Mark-recapture methods are commonly used in such studies, however no suitable marking method has been published for these small crustaceans in part because the exoskeleton is regularly molted. A marking method needs to be both effective and safe for the focal species. We piloted multiple marking methods, which included marking the exoskeleton with paint, feeding the isopods with color-dyed food, latex injection, and removing one leg. Preliminary results showed that marking the exoskeleton with paint and leg removal showed promise, thus we performed a replicated controlled experiment testing these two methods. Leg removal was 100% detectable through week six, whereas only 20% of the paint marks were detectable by week four. Both methods also showed significantly higher mortality rates than the control. We concluded that neither method is an appropriate marking method for our mark-recapture study. Therefore, further experiments are planned.

113. COMPARING PHYSICAL CHARACTERISTICS AMONG EELGRASS BEDS *ZOSTERA PACIFICA* AND A PROPOSED TRANSLOCATION SITE IN SANTA MONICA BAY, CA

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Seagrass beds provide numerous ecological benefits ranging from enhancing fisheries, improving water quality, stabilizing sediment, and buffering the effects of ocean acidification. Due to primarily coastal urbanization and runoff, eelgrasses have been suffering globally. This project aims to enhance Santa Monica Bay by increasing offshore eelgrass *Zostera pacifica* at a new experimental translocation site off Dockweiler State Beach from existing eelgrass beds off Malibu, CA. In July and August of 2018, we compared sediment grain size, light intensity, depth and temperature at three existing eelgrass sites (El Matador, Lechuza, and El Pescador) to the proposed enhancement site off Dockweiler. Preliminary results suggest that sediment grain size is most comparable between Dockweiler and El Matador, as both sites consist of close to equal parts of fine and very fine sand. Temperature, light intensity, and depth were also found to be similar among all sites. These preliminary results suggest that the physical and oceanic conditions at the proposed experimental translocation site may be optimal for restoration efforts. As seagrasses are referred to as a “blue carbon” species, successful enhancement of eelgrass within the Bay may provide a localized refuge from ocean acidification.

114. ARE LARVAE OF THE ECHINOID ECHINODERM *DENDRASTER EXCENTRICUS* FOOD-LIMITED IN NEARSHORE WATERS OF SOUTHERN CALIFORNIA?

§ **H. Nguyen**, T. Hoang, D. Hawkins, J. Drechsler and B. Pernet. California State University Long Beach.

The feeding larvae of marine invertebrates may often be food-limited in rates of growth and development, a result with important implications for larval ecology and evolution. The generality of this result is uncertain, however, as studies addressing larval food limitation are few, and conflicting results have been reported. We tested for food limitation in larvae of the sand dollar *Dendraster excentricus* in nearshore waters of southern California in five experiments from 2017-19. In each experiment we compared the form and development rates of larvae reared in natural seawater (NS) to those of larvae reared in natural seawater supplemented with 1000 cells mL⁻¹ *Rhodomonas lens* (NS+); as a control, we also reared larvae

in natural seawater diluted 1:1 with filtered seawater (NS-). Compared to NS+ larvae, larvae reared in NS consistently had slightly higher postoral arm/midline body length ratios (suggesting a phenotypically plastic response to low food) and slightly higher time to 50% metamorphic competence, suggesting subtle food limitation. As expected, larvae reared in NS- showed strong signs of food limitation relative to the other treatments, in both form and time to 50% competence. Our results suggest that even in habitats with relatively high standing stocks of chl a, larvae may routinely experience food limitation.

115. OPTIMIZATION OF A PHOTOSYNTHETIC MICROBIAL FUEL CELL

‡ **Y. Cho** and A. Carrillo. Palos Verdes Peninsula High School, Cabrillo Marine Aquarium.

Renewable energy is a critical field of study, and photosynthetic microbial fuel cells (PMFCs) present a relevant and new area of focus in this field. In PMFCs, electrons produced through anaerobic bacterial respiration are transferred via conductive electrodes and accepted by algae. This flow of electrons produces an electrical current. Chemical mediators, such as methylene blue (MB), are necessary to transport electrons between bacterial/algal cells and electrodes, but are costly and unsustainable. Flavins are naturally-produced molecules, which were found to correspond to greater external electron transport. The purpose of this experiment was to evaluate the novel use of riboflavin as a supplemented mediator. Riboflavin was chosen because of the recent development of mass-production of the substance through biosynthesis. It was hypothesized that if riboflavin was added to PMFCs as a natural mediator, then it would lead to better energy production than MB or mediator-less PMFCs. PMFCs were constructed with *Spirulina platensis* algae and anaerobic bacteria from salt marsh sediment. Then, three sets of trials were conducted, comparing (1) riboflavin and a mediator-less PMFC, (2) riboflavin and MB, and (3) a riboflavin-coated carbon-cloth electrode and a typical PMFC. It was found that PMFCs supplemented with riboflavin were superior to both mediator-less and MB. The riboflavin-coated electrode was also more efficient than the typical PMFC. This project holds important implications for the future of renewable energy by making PMFCs far more accessible and sustainable, and presents a novel method of increasing energy production by PMFCs.

116. THE EFFECT OF FOUNDATION SPECIES LOSS ON ECOSYSTEM FUNCTION IN THE ROCKY INTERTIDAL

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Foundation species are organisms that create shelter, enhance biodiversity, and maintain ecosystem functioning within their environment. Within the rocky intertidal ecosystem, a coastal ecosystem dominated by mussels and macrophytes, foundation species are expected to decrease in abundance with climate warming, ocean acidification, and increased human impact. However, there is a need to better understand how foundation species loss will affect ecosystem functioning through changes in biogeochemical cycling and species interactions, like herbivory. I will study how foundation species loss of mussels and macrophytes affect biogeochemistry, grazing rates of *Tegula funebris* (herbivorous snails) on *Mazzaella flaccida* (iridescent seaweed), and ecosystem function (net ecosystem calcification [NEC] and net ecosystem production [NEP]) via *in situ* tide pool manipulations using a Before-After-Control-Impact (BACI) experimental design. I will measure biogeochemical parameters of temperature, dissolved oxygen, salinity, pH, total alkalinity, and dissolved inorganic nutrients (NH_4^+ , NO_3^- , PO_4^{3-}) in mussel- and macrophyte-dominated tide pools during grazing rate experiments. I will then remove all mussels and macrophytes from their respective pools and measure biogeochemistry, grazing rates, and NEC and NEP again to determine how foundation species loss will impact ecosystem function. The results of my research will anticipate cascading changes in the economic and ecological services that ecosystem function regulates to aid in conservation management policies of our coastal ecosystems.

117. TO METAMORPHOSE OR NOT TO METAMORPHOSE? RELATIVE CONTRIBUTIONS TO POPULATION FITNESS OF METAMORPHIC VERSUS PAEDOMORPHIC SALAMANDERS

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Polyphenism is a case where one genotype may produce multiple phenotypes based on environmental factors. The tiger salamander (*Ambystoma mavortium nebulosum*) shows an example of this case with its two distinct life history pathways, paedomorphs and metamorphs. Metamorphs are seen as 'more fit' in general, with higher survival rates, higher access to food, and more diverse food sources. However, the paedomorphic pathway persists and is often favored, indicating it has some evolutionary benefit. The purpose of this project was to build a population matrix model from a long-term set of mark-recapture data to determine the relative importance of each life history strategy, and to investigate the circumstances which favor paedomorphism over metamorphism. Survival and stage-transition parameters were estimated from data over 25 years of sampling using MARK software. Reproduction parameters were estimated from other existing data. The matrix analysis showed that while growing to maturity as a metamorph would have the most effect on lambda if it were possible, the highest elasticities were to survival for both metamorphs and paedomorphs. The loop analysis showed that 51% of contribution to λ is from the paedomorph loop versus 34% for the metamorph loop. Therefore, although the metamorphs are more successful, there are far fewer of them so the paedomorphs contribute more to population size. Further work will investigate the importance of density-dependence in larval survival and environmental variation on the relative importance of the two morphs on fitness.

118. CLAST PROVENANCE AND DETRITAL ZIRCON DATING OF PLIOCENE FLUVIAL CONGLOMERATE: IMPLICATIONS FOR PALEOHYDROLOGY OF CROOKED CREEK AND DEEP SPRINGS VALLEY, CALIFORNIA

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The paleohydrology of the western Great Basin has long been of interest to geologists and biologists interested in reconstructing dispersal pathways for various biota. Past studies briefly describe a fluvial conglomerate, with an interbedded 3.1 Ma tuff, that crops out on the 270-m-high ridge separating Deep Springs Valley from Eureka Valley. Additional inspection reveals that the fluvial conglomerate contains boulder-to gravel-sized clasts in a sandy matrix interbedded with cross-bedded coarse sandstone. Dominant clast types are sandstone, limestone, quartz monzonite, granite, and basalt. U-Th/Pb dates of 273 detrital zircons separated from the sandstone matrix are dominantly Jurassic (183.6–167.6 Ma), with an average zircon age of 175.33±0.38 Ma that correlates with local plutons. Lesser Triassic and Cretaceous zircon are also present. Six Proterozoic grains are likely derived from Paleozoic metasedimentary sources as they yield U-Th/Pb ages with known North American provenance: ca. 1.1, 1.4, and 1.8 Ga. Zircon ages and clast types can be used to identify the likely drainage basin from which the conglomerate was sourced. Basalt is not found in Wyman Creek drainage, eliminating that drainage. The drainage network of modern Crooked Creek, however, is underlain by Jurassic granodiorite, basalt and Paleozoic sedimentary rocks making it the likely source of the conglomerate. I infer that (a) the conglomerate provenance is to the north-northwest in the White Mountains across Deep Springs Valley, and that (b) post-3.1 Ma uplift along the Deep Springs fault cut off the northwest-to-southeast river flowing in modern Crooked Creek and formed Deep Springs Valley.

119. BIOAVAILABILITY OF EXTRACTABLE ORGANIC MOLECULES IN DISCARDED CIGARATTE FILTERS TO A HYPOTHETICAL AQUATIC ANIMAL

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Large amounts of cigarette butts are discarded on city streets and sidewalks in Los Angeles on a daily basis. Because these improperly discarded cigarette butts ultimately end up in the ocean, I am motivated to research deeper on how these wastes can chemically affect the aquatic life. The significant amount of

cigarette filters thrown away on the ground brought me to this lightbulb moment. I want find more about used cigarette filters and how they affect aquatic animals when smokers throw the filters improperly on the beaches. And yet almost all species of aquatic animals are affected from improperly discarded cigarette filters. In this research, my goal is to collect evidence to help me spread awareness about the excruciating cost of improperly discarded cigarette filters on aquatic animals. I have extracted the chemicals that may affect the aquatic life when the animals consume the filters. I have done this by stimulating the stomach acid environment and soaking the cigarette filters in the acidic solution to determine potential chemicals that will ultimately deteriorate aquatic life. This experiment finds that filters collected from the streets contain a different number of chemicals when compared to used cigarette filters produced in the laboratory. The smoked cigarette filters had more compounds in the unsmoked cigarette filters. This means that the compounds that came from either the cigarette wrapper, or filter wrapper. Alternatively, the extra number of compounds found in used filters might have come from the breakdown of original compounds in unsmoked cigarette by fire during smoking. To further research this idea, glycerol 1,2 – diacetate, a compound used to bond filter fibers together, was injected into a cigarette and the cigarette robotically smoked to produce used filters. The results of this experiment were unexpected because there were fewer compounds in the treated filters than in the non-injected ones. Results also show that a number of compounds found in smoked cigarette filters were derived from the tobacco. Although terminating smoking is nearly impossible, putting a stop to littering of cigarette filters might be a little easier. But I need data to strengthen my position to tell smokers to discard their filters properly.

120. METHOD DEVELOPMENT FOR THE ANALYSIS OF MICROPLASTICS ON SANDY BEACHES

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Microplastics, plastic particles less than 5mm in diameter, are chemicals of concern due to their ubiquitous presence in the environment. They are the result of degrading macroplastics and are potentially harmful to marine life through ingestion. A pilot study was implemented in 2017 to analyze microplastics found in beach sand from the Santa Monica Bay beaches. The previous method yielded a low percent recovery for seeded microplastics and an abundance of sand was carried over from samples. This project was undertaken to improve the process of separating microplastics from sand. Using density separation, a dense heavy liquid was added to the sand sample using a Sediment Microplastic Isolation (SMI) Unit where microplastics would float to the top of the heavy liquid/sand mixture and be separated from the sand sample. The SMI Unit was constructed in-house out of PVC and includes a gate valve that allows the microplastics to be physically separated from the sand sample after the density separation. The resulting solution with isolated microplastics was filtered through two different meshes, dried, analyzed with a stereomicroscope. Infrared Microscopy was used to collect infrared spectra to determine the identity of each microplastic found in each sample. Experiments testing the method's effectiveness yielded a higher percent recovery rate than previously tested. This new method is currently being used for the analysis of microplastics in beach sand from Santa Monica Bay beaches and sediment from the Great Lakes.

121. DELIVERY OF CHEMOTHERAPEUTIC AGENTS VIA HDL NANODISKS CONTAINING APOE3

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Many chemotherapeutic drugs are hydrophobic, and therefore they cannot be directly injected into an aqueous medium, such as the bloodstream. High density lipoprotein (HDL) nanodisks, composed of apolipoprotein E3 N-terminus (apoE3 NT) and 1,2-dimyristoyl-sn-glycero-phosphocholine (DMPC), provide a viable solution to this problem because they bear a nonpolar interior for the transport of hydrophobic drugs. Furthermore, ApoE3 NT has the ability to bind low-density lipoprotein (LDL) receptors that facilitate cellular uptake of lipoproteins via receptor-mediated endocytosis. We propose to

use this feature of apoE3 NT to incorporate hydrophobic chemotherapeutic agents such as paclitaxel (pac) into HDL for eventual uptake into cells. Purified ApoE3 NT was quantitatively analyzed using SDS-PAGE and Nanodrop, revealing that the protein was ~95% pure. Reconstituted HDL nanodisks were quantified using a phospholipid assay and ImageJ. Free paclitaxel was characterized to have an emission peak of ~550 nm. Fluorescence studies suggest Oregon Green 488 Conjugate Paclitaxel (f-pac), a fluorescent analog, was successfully incorporated in reconstituted HDL (rHDL) after a 2 day incubation at room temperature on a shaker. The fluorescence spectra of the incorporated rHDL containing f-pac was shown to be blue-shifted compared to the fluorescence of free paclitaxel. Fluorescent quenching will be conducted in the future to determine where the f-pac is located in or around the rHDL. Afterward, the incorporated rHDL will be tested on MDA breast cancer cells to determine its efficacy compared to regular means of chemotherapy.

122. EVALUATING REVEGETATION TECHNIQUES AT A DEGRADED URBAN WETLAND IN LOS ANGELES, CA

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This research project is evaluating multiple revegetation techniques within a 3-acre restoration area of the Ballona Wetlands Ecological Reserve. Prior to revegetation, phases of the community-based restoration project have included baseline surveys, removal of non-native invasive iceplant (*Carpobrotus* spp.) from the project area, additional invasive plant maintenance and removal, and monitoring over time. Seed surveys were performed to determine where locally-sourced native plants might be viable in the current degraded state of the wetland. GIS polygons were surveyed, and seeds were collected and stored. Research was then conducted on the survivability of plants after dispersal and transplant. This paper evaluates preliminary vegetation monitoring data results, with a focus on comparing revegetation techniques, including hand seeding of native upland species and rhizomal transplants of saltgrass (*Distichlis spicata*) with four different treatments in the wetland habitats. After invasive plants were removed, one area was seeded with erosion mats laid on top. A separate area was allocated to the experimental saltgrass transplant design, which included plots for onsite and offsite transplants, watered and not watered areas, and controls. Preliminary data suggest a shift in the overall plant community within the restoration area from one of a monoculture of invasive iceplant to one with a mix of cover of both native and non-native species. Further research will help resolve questions regarding enhancing plant germination and survivorship for native species. Additional monitoring data will help confirm trends regarding revegetation techniques.

124. EFFECTS OF FIRE ON A BLACKBRUSH AND JOSHUA TREE WOODLAND IN THE MOJAVE DESERT

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Desert organisms are often highly adapted to extreme conditions, however, native desert communities can be slow to recover after major disturbances (e.g., wildfire) and are prone to invasion by non-native grasses. We examined plant community composition of a Mojave Desert Joshua tree woodland recovering from a 2005 fire by comparing adjacent burned and unburned areas in 2018. We hypothesized that fire disturbance would increase abundance of grasses and annuals relative to an unburned area, but decrease perennial species richness and diversity. We quantified the plant community using line transects, 50 m² belt transects, and 0.25 m² quadrats. Cover of non-native grasses did not differ between burned and unburned areas, but percent cover of native grasses was approximately ten times higher in the burned area than the unburned area. There was an average of 5.7 ± 0.6 (mean \pm SE) perennial species in the burned area and 9.0 ± 0.7 in the unburned area. The diversity of perennial plants was higher in the unburned area (mean $H' = 1.742$) than in the burned area (mean $H' = 1.075$). We found an average density of 1.94 ± 0.1 individuals per m² for annual plants in the burned area but none were found in the unburned area. Despite 13 years of recovery, we found that the burned area community composition and cover remained very

different from the unburned area, but that active management may not be necessary to prevent conversion to a non-native grass system.

125. EFFECTS OF IONIZING RADIATION ON HEART RATE, INSTAR DEVELOPMENT, AND SWIMMING BEHAVIOR IN *DAPHNIA PULEX*

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In aquatic ecosystems, the microcrustacean *Daphnia*, is essential in sustaining larger organisms within the aquatic food web and seen as an ideal model organism in ecotoxicology, ecology, and evolutionary biology. Anthropogenic activities in the manufacturing and nuclear industries are responsible for the frequent exposure of aquatic organisms to toxic chemical contaminants. Prolonged exposure to a myriad of contaminants will have a negative effect on the survival of *Daphnia*, and elicit a negative cascade of effects on organisms at higher functional levels. The goal of this study is to explore the behavior and development of *Daphnia pulex* in the presence of low-dose ionizing gamma radiation across two generations. Four groups containing 30 female daphnia from the parent generation are going to be exposed to 0, 10, 100, 1000 mGy of acute gamma radiation. We hypothesize higher irradiation levels can negatively affect not only the cardiac productivity and fertility of the parent generation but also the fertility and survival of subsequent generations. However, we anticipate the offspring to be more negatively affected by irradiated exposure due to the bioaccumulated ionized particles at crucial stages of early development. Once the parent generation has given birth, the heart rate, antennae growth, and instar development of the offspring will be monitored via live imaging analysis. Our results will highlight the impact radioactive toxicants and environmental pollutants have on aquatic model organisms.

126. EVALUATING THE *LABRISOMUS XANTI* POPULATIONS ON SANTA CATALINA ISLAND BY DETERMINING AGE, SIZE RANGES, DENSITIES, AND HABITAT PREFERENCES

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In 2015 a strong El Niño Southern Oscillation event began affecting the NE Pacific Ocean. With an increase in water temperatures, new marine species were able to expand north of native ranges and settle in new habitats. Santa Catalina Island, specifically, became home to many new species of fishes. The first sighting of the species *Labrisomus xanti*, or largemouth blenny, on Santa Catalina was October 2015 and since that time these blennies have been sighted all around the island. To investigate whether the largemouth blennies were established on Catalina, largemouth blennies were counted, sized and their sex was reported at three sites along the island. At each site, transects were placed at depths ranging from 1.5 to 6 m. Substrate type (sand, gravel, cobble, boulders 10-100 cm, bench) was recorded along each of these transects. Observations showed that there are multiple size ranges among sites, depths and sexes of largemouth blennies. Individuals were then collected and aged based on otolith extractions. We found a significant difference in densities among sites and habitat preference was significant based on substrate. These densities, ages and habitat preferences are important observations because if largemouth blennies are established and settling permanently on Catalina Island they may begin competing with native species for territory and resources.

127. CHARACTERIZING SANDY BEACHES OF SANTA MONICA BAY AND EFFECTS OF GROOMING REGIMES ON BEACH ECOSYSTEMS

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Understanding the interaction between management practices and ecological health of sandy beaches allows us to evaluate specific ecosystem services that sandy beaches provide, such as a barrier against storm surge and sea-level rise, and to provide recommendations to maximize those potential services. This study was initiated in 2018 to characterize the beaches of Santa Monica Bay. The first phase of the characterization study created GIS maps showing areas of vegetation, shore type, infrastructure, and areas where grooming (raking) management practices occurred. In summary, along the 82 km of shoreline of

the Bay, 1,077 structures were identified (e.g., parking lots, bathrooms), and approximately 0.135 km² of vegetation was mapped, primarily located along back-beach areas. Sandy shores comprised 62% of the shoreline (38% rocky shores), with 28.5 km of shoreline groomed (56% of sandy shores). The second phase conducted surveys of the effects of grooming on physical and biological characteristics on 9 beaches. Metrics surveyed included vegetation cover, wrack cover, percent organic matter, sand grain size, beach topography, and bird activity. The surveys found higher percent cover of native vegetation, wrack, and percent organic matter in the sand on ungroomed beaches. Additional surveys are being conducted to strengthen the preliminary findings. This study corroborates the concept that nature-based management practices along our coasts may provide additional benefits in the form of ecosystem services.

128. EFFICIENCY OF M13 BACTERIOPHAGE (M13MP18) ON *E. COLI* (ER2738)

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To investigate the potential of bacteriophage *m13mp18* for its prospective use in phage therapy, varying concentrations of phage were combined with *E. coli* ER2738 cultures (cultured in LB overnight) and the optical density was measured. The phage-infected culture was incubated in a laboratory shaker at 37°C and the optical density was measured in intervals of thirty to forty-five minutes using a spectrophotometer at 650 nanometers wavelength. Decreasing rates of optical density, indicative of high potency of M13 phage on *E. coli* ER2738, were observed at the increased concentrations of phage; lessened optical density decreases was also observed at the lower concentrations of phage. These data highlight a negative correlation between optical density and concentration of phage, as expected. The observed results implicate that *m13mp18* has great potential in lysing *E. coli* though further in vitro experiments are needed prior to employment in humans.

129. A BONE TO PICK WITH OSEDAX: ARCOBACTER ON THE TRUNK OF DEEP-SEA WHALEFALL POLYCHAETES

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Osedax, a deep-sea marine polychaete, belongs to a family of worms related to the famous hydrothermal vent worms. Like these other worms, *Osedax* individuals lack a mouth and gut, and instead rely on bacterial symbionts for nutrition, which they house inside cells in a unique green ‘root’ tissue. Until recently, this primary symbiont within the bacterial order Oceanospirillales, was thought to be the only bacteria specifically associated with *Osedax* worms. Past studies have shown other, presumably transient bacteria within the external epithelial groves of the trunk of some *Osedax* species, including *O. roseus* and *O. japonicus*. Although these studies showed the presence of the bacteria through transmission electron microscopy or bulk sequencing of bacterial genes, their identity and prevalence was not determined. Using molecular analysis and fluorescence in situ hybridization microscopy, we have identified this bacteria to be a member of the genus *Arcobacter* (Campylobacteriales). In January 2019, we sampled three different *Osedax* species from 1000m depth in Monterey Canyon, and examined them for the presence of this specific *Arcobacter*. Through 16S rRNA bacterial analysis we have confirmed the presence of *Arcobacter* in at least four species of *Osedax*, including *O. roseus*, *O. packardorum*, *O. talkovici*, and *O. randyi*. We will further examine the ultrastructure of both *O. packardorum* and *O. talkovici* via TEM, in order to observe the location of *Arcobacter* (ex. their possible location within the epithelial cells). Collectively, these results suggest a persistent and close association between *Arcobacter* and *Osedax*, but whether either partner benefits from the interaction is still not known.

130. IMPLICATIONS OF PAIRED OLYMPIA OYSTER *OSTREA LURIDA* AND EELGRASS *ZOSTERA MARINA* RESTORATION ON FISH AND INVERTEBRATE COMMUNITIES OF SOUTHERN CALIFORNIA

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Wetland habitats along California’s coast have greatly decreased over time due to human activities. These valuable ecosystems minimize the effects of erosion, flooding, storms, and pollution. Therefore,

restoration efforts in wetland communities serve to benefit all coastal communities, including humans. Some species found in wetlands are especially important because they are ecosystem engineers, creating habitat for other species. Examples include oysters and seagrasses, which provide shelter to fish and invertebrates and help filter the surrounding water. One solution to restore these habitats is paired oyster and eelgrass bed creation. Although oyster bed restoration promotes ecological diversity, it initially causes disturbance underneath by limiting water flow, potentially leading to reductions in the infaunal invertebrate populations. This experiment aims to offset the reductions by pairing restored native Olympia oyster (*Ostrea lurida*) beds with adjacent native eelgrass (*Zostera marina*). We created these paired plots in Newport Bay, CA and compared pre-, and post-restoration communities with sediment sampling for invertebrates and baited video monitoring for large fish. We hypothesized that overall fish and invertebrate abundance and diversity will increase in and surrounding paired treatments; however, infaunal populations will decrease directly below the oyster beds. Preliminary observations show that fish use both control and restored plots and that community composition is similar. Infaunal invertebrates have higher abundances in the non-oyster plots than below the oyster beds. This project increases understanding of how to restore these valuable ecosystems while also increasing our understanding of the natural history of both key species.

131. CONTRASTING INFLUENCES ON BACTERIAL SYMBIONT ACQUISITION BY CO-OCCURRING DEEP-SEA MUSSELS AND TUBEWORMS

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Relationships between nutritional bacterial symbionts and deep-sea fauna from cold-seep environments, based on sulfide- and methane-fueled autotrophy, are known, but factors influencing symbiont acquisition remain unclear. Host identity and geography can play roles in symbiont acquisition by *Bathymodiolus* mussels and vestimentiferan tubeworms, both of which are known to obtain their symbionts, as larvae, from the surrounding environment. We sampled 3 species of each co-occurring group at 3 seep sites off the coast of Costa Rica (Mound 12, Jaco Scar, and Quepos Seep; depths ranging from 1000-1800 meters). DNA was extracted from their symbiont-bearing tissues, and sequences of the bacterial internal transcribed spacer (ITS) gene were acquired via direct and barcode-amplicon sequencing. Our results show that all 3 mussel species (*B. earlougheri*, *B. billschneideri* and *B. nancyschneideri*) house symbionts that are genetically distinct from each other, despite living nearly side-by-side in the seep habitat, suggesting host-identity is most influential. The dominant symbiont of co-occurring *Escarpia spicata* and two species of *Lamellibrachia* tubeworms, on the other hand, were identical regardless of sampling location, suggesting lack of influence by either factor. Interestingly, worms from Mound 12 showed increased symbiont diversity, suggesting continuous infection throughout their lifespan, possibly related to geography. These findings suggest different influences on the environmental acquisition of symbionts in two invertebrate groups with similar lifestyles. It is not yet known what specific signals are necessary for the initial attraction between host and symbiont, but this new insight may facilitate new ideas for future investigations.

132. CONSTRUCTION OF A CRISPRi LIBRARY AND RNA SEQUENCING FOR THE CHARACTERIZATION OF GENE FUNCTION IN A MINIMAL SYNTHETIC BACTERIUM

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A minimal bacterial cell, JCVI-syn3.0, derived from *Mycoplasma mycoides* has been constructed at the J. Craig Venter Institute. It operates with only 473 genes, of which 149 have unknown function. In order to classify the 149 genes into functional categories, CRISPRi was implemented in the minimal cell. Using CRISPRi, gene expression can be repressed in an inducible manner. With the DNA tools for this mechanism, a genome-wide library for all 473 genes is being created in which each strain has a guide RNA for knocking down a specified gene of interest. Once the library has been completed, RNA sequencing can be conducted in order to produce a genome-scale transcription map. In this process, various methods for rRNA depletion in mycoplasma will be tested. Due to the large number of samples, rRNA depletion to RNAseq library construction will be automated using the epMotion robotic liquid-

handling system. Each library will be sequenced to obtain short sequence reads, followed by their alignment on the reference genome. Each gene will be analyzed for up-regulation and down-regulation by comparing the amount of expression between wild-type and mutant strains. From the transcriptome data, a heatmap can be generated to cluster genes targeted by guide RNA based on functionality as defined by the organism-wide gene expression profiles. RNA sequencing has already been performed for wild-type JCVI-syn3.0 bacterium, giving us reason to believe that the same can be done for the CRISPRi strains being produced. The characterization of knockdown strains is expected to reveal previously unknown mechanisms at the core of cellular life.

133. BACTERIAL ISOLATE EFFECTS ON PROTOZOAN FITNESS WITHIN THE PURPLE PITCHER PLANT *SARRACENIA PURPUREA*

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Within the leaves of the purple pitcher plant, *Sarracenia purpurea*, ciliated protozoans consume a community of bacteria. This system has been used as a model for studying eco-evolutionary dynamics, but to date, the bacterial community has not been well defined. Our objectives are to isolate and identify bacteria from a pitcher plant community then test whether particular bacterial strains affect protist fitness. We will isolate and identify approximately 20 bacterial strains from pitcher plant bacterial communities. Bacterial strains will be isolated and identified by their 16S DNA sequences. Different strains of protists will utilize these bacterial isolates as a food source. To measure and monitor protist fitness we will incorporate protist cell count, size, and biomass. These measurements will be made daily for seven days. The results of this experiment will allow us to create simplified bacterial communities with known strains in future microcosm experiments.

134. IDENTIFYING THE PHYSIOLOGICAL LIMITATIONS TO DISPERSAL AND PERSISTENCE OF AN INVASIVE AMPHIBIAN IN SOUTHERN CALIFORNIA

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Introduced African Clawed Frogs (*Xenopus laevis*) threaten native amphibians across their invasive range. Once imported for use in human pregnancy testing, thousands of these aquatic frogs were released into Southern California waterways following the advent of pharmaceutical tests and quickly spread. *Xenopus* are highly fecund, eat any animal they can swallow, including each other, and are resistant to traditional methods of extermination (poisoning, habitat drying, and prolonged starvation). Yet despite their characterization as an “ideal” invasive species, *Xenopus* have not achieved their anticipated invasive potential in Southern California. In fact, in areas with seemingly viable habitat some populations have gone extinct, while others occur in low abundance. Our goal is to determine which aspects of the biology of *Xenopus* have allowed some populations to persist, while others have failed. We will sample for *Xenopus* throughout Southern California using traditional visual encounter and trapping surveys, as well as environmental DNA (eDNA), to census potential and historic sites. Next, using an inferential approach, we will identify the environmental factors (hydroperiod, water quality etc.), and physiological factors that limit the persistence and dispersal of *Xenopus*. Physiological factors will be determined by lab tests of thermal critical minimum/maximum, desiccation tolerance, and overland locomotor ability in laboratory-acclimated frogs and tadpoles. We hypothesize that a specific suite of variables (distance between viable habits, habitat quality, potential predator presence, etc.) limits *Xenopus* from invading novel sites, and that lab-based physiological tests will provide confirmation of field-based correlations.

135. WORMBEAT: AN INNOVATIVE TOOL TO ENHANCE THE RESOLUTION OF ASSAYS FOR AGING AND DISEASE

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The nematode *C. elegans* is a model organism, commonly used to illustrate and investigate basic cellular mechanisms. Pharyngeal pumping, a feeding behavior, is an established index of “health” in this model organism. Changes in this behavior illustrate functional declines with age, disease and experimental manipulation. Pharyngeal pumping is controlled by a rhythmically active pharyngeal motor neuron (MC), and each pump corresponds to a single synaptically-driven muscle action potential initiated at a single neuromuscular junction. Traditionally, pumping is reported as an occurrence frequency, quantified by counting pump event occurring over an observation period. However, this quantification has limited resolution and fails to distinguish distinct mechanisms influencing the pace and regularity of the MC motor neuron, and/or the fidelity of the neuromuscular junction. We have developed an analysis strategy and algorithm (WormBeat) to distinguish neuromuscular fidelity from MC neuron pace, and to separate random pace variation from directed modulation of the MC neuron. We have validated this strategy using simulated events with known variability, and applied it to electrophysiological recordings of pharyngeal pumping *in vivo*. Our strategy eliminates confounding influences of variation between subjects, enhances resolution of subtle treatment effects, and distinguishes mechanisms acting at the neuromuscular junction from those acting at or above the MC motor neuron.

136. PATTERNS OF GENOTYPIC AND PHENOTYPIC VARIATION IN RED-EYED TREEFROGS

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Linking phenotypic variation to underlying genetic diversity contributes to our understanding of how evolutionary forces affect natural populations. We investigate the genetic structure and evolutionary history of red-eyed treefrogs (*Agalychnis callidryas*) occupying six regions along the Pacific coast of Costa Rica, where a phenotypic cline extends from the north (orange legs) to the south (purple legs), with intermediate color patterns in central regions. We hypothesize that patterns of color variation in intermediate central regions could be explained by the retention of ancestral and/or novel color polymorphism, or by hybridization between divergent populations that meet at secondary contact zones. We used a SNP dataset generated by RAD-sequencing to analyze population genetic structure. Comparison of inter-population ancestry and admixture proportions did not reveal evidence of hybridization at contact zones between color patterns. Instead, we detected a pattern of genetic isolation by distance that is discordant with color boundaries. These incongruent patterns suggest the possibility of selective pressures acting on color pattern along the Pacific Coast. Overall, our data support that color-pattern variation is due to differential retention of polymorphism as opposed to recent introgression.

137. DETERMINING SPECIES STATUS OF THE SANTA ANA SPECKLED DACE *RHINICHTHYS OSCULUS*: CONGRUENCE AMONG NUCLEAR AND MITOCHONDRIAL GENETIC MARKERS

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Rhinichthys osculus, the speckled dace, a freshwater minnow inhabiting watershed tributaries throughout western North America, includes many federally recognized subspecies. The southern California variation, the Santa Ana speckled dace (SASD), having long had state recognition as a unique taxon, has no federal recognition due to lack of complete genetic description. Our study illustrates, through analyses of mitochondrial and nuclear markers, a phylogeographic pattern consistent with the hypothesis that the SASD exhibits sufficient levels of differentiation to be a unique taxon at the species level. Tissue samples were obtained representing three geographically isolated regions of California: Southern, Central Coast,

and Owens Valley. Phylogenetic analyses of 102 individuals on two mitochondrial DNA genes, Cytochrome b and D-loop, and the population genetic analyses of 144 individuals on seven microsatellite loci, were in agreement showing significant differentiation among all three geographic regions, strongly suggesting that the three regions are evolutionarily independent at the species level. To further test this hypothesis we next examined introns within three nuclear DNA genes (*cnot1*, *rps7*, *hrps*). We obtained samples from the Colorado River system and sequenced three introns from 56 individuals among the four geographic regions. To date, analyses of the intron sequence data indicates that the four geographic regions are genetically distinct. The combined analysis of the three sets of genetic markers supports the hypothesis that Santa Ana speckled dace are evolutionarily independent from the other three regions and are most closely related to Colorado River speckled dace.

138. CONDITIONS AND PERSISTENCE OF MCDONALD WELL, BIRD SPRING, AND NORTH BIRD SPRING IN THE MOJAVE DESERT, SAN BERNARDINO COUNTY, CALIFORNIA

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Desert springs are often the sole sources of water and biodiversity across large areas of arid land. Their importance cannot be overlooked in conservation efforts and water resource management because they provide research opportunities for studying evolution and adaptation. We measured discharge, temperature, salinity, conductivity, and pH at three Mojave Desert springs: McDonald Well, Bird Spring, and North Bird Spring from March 2018 to March 2019. McDonald Well is a regional spring with discharge throughout. Lower discharge measurements following significant rain events signify lag time between local precipitation and discharge. Higher salinity and conductivity indicate significant rock-water interaction and a long recharge path. Discharge gradually increasing with steady rainfall implies that discharge is directly related to local precipitation, but not reliant on it. Bird Spring is the least persistent of the three springs. Discharge as drips was observed only once. Salinity and conductivity measurements were fresher than McDonald Well, implying less rock-water interaction and a short recharge path. Thus, Bird Spring discharge is reliant entirely on local precipitation. Discharge from North Bird Spring was observed four times as fracture seepage and drips from the tuff cliff face. Low salinity and conductivity support low rock-water interaction and a short recharge path. Because Bird Spring and North Bird Spring do not see a substantial amount of discharge, restoring the springs to their natural state by the removal of man-made diversion would not harm the environment. McDonald Well restoration would not be harmful because its steady discharge ensures the spring will reestablish itself.