Friday, April 28, 2017

Session 1: Marine Coastal Ecology Symposium

Location: HSS 105

Session Chair: Bengt Allen, California State University, Long Beach

1 8:00  ENVIRONMENTAL CONTROLS OF BLACK ABALONE BODY TEMPERATURE DETERMINE RISKS OF THERMAL STRESS AND DISEASE
B.J. Allen1, E.A. Duncan1, L.P. Miller2, 3, and M.W. Denny3. 1Department of Biological Sciences, California State University, Long Beach, 2Department of Biological Sciences, San Jose State University, 3Hopkins Marine Station, Stanford University

2 8:20  LARGE-SCALE IMPACTS OF SEA STAR WASTING DISEASE AND RECENT RECRUITMENT PATTERNS FOR PISASTER OCHRACEUS
C.M. Miner1, L. Gilbane2, and P.T. Raimondi1. 1University of California Santa Cruz, 2Bureau of Ocean Energy Management

3 8:40  LONG-TERM POPULATION FLUCTUATIONS IN THE INTERTIDAL SEASTAR (PISASTER OCHRACEOUS) ALONG THE PALOS VERDES PENINSULA, CALIFORNIA
J.K. Passarelli1, B. J. Allen2, S.E. Lawrenz-Miller1, and A.C. Miller2. 1Cabrillo Marine Aquarium, 2Department of Biological Sciences, California State University, Long Beach

4 9:00  ROCKY INTERTIDAL ECOSYSTEMS IN URBANIZED SOUTHERN CALIFORNIA: EFFECTS AND MANAGEMENT OF HUMAN VISITATION
J.R. Smith. Department of Biological Science, California State Polytechnic University, Pomona

5 9:20  BREAK

6 10:00  COMPARISON OF FISHES AND INVERTEBRATES LIVING IN THE VICINITY OF ENERGIZED AND UNENERGIZED SUBMARINE POWER CABLES AND NATURAL SEA FLOOR OFF SOUTHERN CALIFORNIA
M.M. Nishimoto. Marine Science Institute, University of California, Santa Barbara

7 10:20  PHYSIOLOGY, FUNCTIONING, AND FEEDBACKS: IMPACTS OF CLIMATE CHANGE ON CALIFORNIA’S COASTS
C. Sorte. Department of Ecology and Evolutionary Biology, University of California, Irvine
10:40 BREAK

11:00 Plenary Session: HSS 105
Dr. Sharon Walker, Dept. of Chemical and Environmental Engineering, University of California, Riverside
"Environmental Implications of Nanotechnology: A Wastewater Case Study"

12:15 – 1:30 LUNCH BREAK
Friday, April 28, 2017

Session 2: Tropical Ecosystems Symposium

Session Chair: Shana Goffredi, Occidental College

Location: HSS 263

8 8:00  THE INFLUENCE OF UV RADIATION ON TROPICAL DART FROG BEHAVIOR
L.B. Kats and G. Bucciarelli. Pepperdine University

9 8:20  LEAF HYDRAULIC CONDUCTANCE AND RESILIENCE FOR EPIPHYTES IN MOIST TROPICAL FORESTS
G.B. North, E.B. Brinton, M.G. Browne, M.G. Gillman, and T.L. Kho. Department of Biology, Occidental College

10 8:40  DRONES AS A QUANTITATIVE TOOL FOR THE STUDY OF ECOLOGICAL DYNAMICS IN A NEOTROPICAL PREMONTANE THORN WOODLAND
V.D. Carmona-Galindo. Biology Department, Loyola Marymount University

11 9:00  SEEING THE FOREST FOR THE TREES: USING PUBLICLY AVAILABLE LONG TERM DATA SETS TO TEACH QUANTITATIVE METHODS IN TROPICAL FOREST ECOLOGY
E. Braker¹, D.B. Clark², and D.A. Clark². ¹Department of Biology, Occidental College. ²Department of Biology and Whitney R. Harris World Ecology Center, University of Missouri

9:20  BREAK

12 9:40  FISHES MEET THE TREES: FRUIT-EATING AND SEED DISPERSAL LINK AQUATIC AND TERRESTRIAL ECOSYSTEMS
M.H. Horn. Department of Biological Science, California State University, Fullerton

13 10:00  CRYPTIC CORAL REEF PREDATORS: MORPHOLOGICAL SPECIALIZATIONS BROADEN THE DIET OF MANTIS SHRIMP
M.S. deVries¹, B.C. Stock¹, and J.H. Christy². ¹Scripps Institution of Oceanography, Marine Biology Research Division, University of California, San Diego. ²Naos Marine Laboratories, Smithsonian Tropical Research Institute, Balboa, Ancón, Panama City

14 10:20  ABUNDANCE AND DISTRIBUTION OF THE FISH-HUNTING CONE SNAIL SPECIES CONUS CATUS ON INTERTIDAL BENCHES
J.R. Schulz and J. Preble. Department of Biology, Occidental College

10:40  BREAK
11:00  Plenary Session: HSS 105
      Dr. Sharon Walker, Dept. of Chemical and Environmental Engineering, University of California, Riverside
      "Environmental Implications of Nanotechnology: A Wastewater Case Study"

12:15 – 1:30   LUNCH BREAK
Southern California Academy of Sciences 2017 Session Schedule

Friday, April 28, 2017

Session 3: Parasitology Symposium  Location: HSS 106

Session Chair: Ralph Appy, Cabrillo Marine Aquarium

15*P 8:40  EXPLORING NEW TRANSMISSION PATHWAYS OF TOXOPLASMOSIS IN MARINE ENVIRONMENTS: HOW VIRULENT IS THE TACHYZOITE STAGE DURING EXPOSURE TO SEAWATER CONDITIONS?
H. Gause, V. Valencia, and D.A. Pace. Department of Biological Sciences, California State University, Long Beach

16*P 9:00  CHARACTERIZATION OF A PUTATIVE CALCIUM-BINDING PROTEIN IN THE HUMAN PARASITE TOXOPLASMA GONDII
I. Meepe, D. Sandoval Olmos, and D.A. Pace. Department of Biological Sciences, California State University, Long Beach

9:20  BREAK

17*P 9:40  THE CRITICAL ROLE OF K+/H+ EXCHANGE IN PH REGULATION AND INVASION IN THE HUMAN PARASITE, TOXOPLASMA GONDII
V.G. Valencia, H.E. Gause, C. Monahan, E. Cuevas, and D.A. Pace. Department of Biological Sciences, California State University, Long Beach

18*P 10:00  STRESSORS INFLUENCING METACYCLOGENESIS IN TRYPANOSOMA CRUZI
H. Lynch, D. Arroyo, N. Dave, and V. Jimenez. Center for Applied Biotechnology Studies and Department of Biological Science, Natural Sciences and Mathematics, California State University, Fullerton

19*P 10:20  ROLE OF A CALCIUM ACTIVATED POTASSIUM CHANNEL IN TRYPANOSOMA CRUZI PHYSIOLOGY AND INFECTIVITY
C. Skorka, M. Boktor, and V. Jimenez. Center for Applied Biotechnology Studies and Department of Biological Science, College of Natural Sciences and Mathematics, California State University, Fullerton

10:40 – 11:00  BREAK

11:00  Plenary Session: HSS 105
Dr. Sharon Walker, Dept. of Chemical and Environmental Engineering, University of California, Riverside
"Environmental Implications of Nanotechnology: A Wastewater Case Study"

12:15 – 1:30  LUNCH BREAK
Southern California Academy of Sciences 2017 Session Schedule

Friday, April 28, 2017

Session 1: Contributed Papers, Conservation

Session Chair: TBA

20* 1:30 TO LIVE AND DIE IN LA: CONSERVATION OF THE WESTERN GRAY SQUIRREL IN GRIFFITH PARK THROUGH GENETIC ANALYSIS
C. DeMarco1, A. Aguilar1, E. Torres1, D. Cooper2, and A. Muchlinski1. 1Department of Biological Sciences, 2Cooper Ecological Monitoring, Inc.

21* 1:45 KELP FOREST RESTORATION OFF OF THE PALOS VERDES PENINSULA
P.H. House1, T.K. Ford1, D.J. Pondella, II2, J.T. Claisse3, H. Burdick1, J.P. Williams3, and A.A. Barilotti1. 1The Bay Foundation, 2Vantuna Research Group, Occidental College. 3California State Polytechnic University, Pomona

22* 2:00 HISTORICAL BIOGEOGRAPHY OF THE STREPTANTHUS HOWELLI ALLIANCE
Nick Jensen. Claremont Graduate University

23*F 2:15 EXPLOITATION INTENSITY PREDICTS MPA EFFECTS ON TARGETED FISHES
E. Jaco and M.A. Steele. California State University, Northridge

24* 2:30 ASSESSING ARCHIPELAGO WOLVES: RISK AND VIABILITY IN A FRAGMENTED LANDSCAPE
H. Monteleone. California State University, Fullerton

25 2:45 MARINE DEBRIS OF THE NORTH PACIFIC GYRE LEADING TO ENDOCRINE DISRUPTION ON MYCTOPHIDS
J.A. Rodriguez and J.A. Reyes. Pacific Coast Environmental Conservancy

26* 3:00 SUSTAINABLE WHALE-WATCHING FOR THE PHILIPPINES: A BIOECONOMIC MODEL OF THE SPINNER DOLPHIN (STENELLA LONGIROSTRIS)
A.S. Santos1, B. Riegl1, D.W. Kerstetter1, M.H. Horn2, and L.V. Aragones3. 1Halmos College of Natural Sciences and Oceanography, Nova Southeastern University. 2Department of Biological Science, California State, University, Fullerton. 3Institute of Environmental Science and Meteorology, College of Science, University of the Philippines, Diliman

3:15 – 3:45 BREAK

Session 1, continued: Contributed Papers, Physiology

Session Chair: TBA
27 3:45 ENDOCRINE DISRUPTION SCREENING OF CALIFORNIA HALIBUT, PARALICHTHYS CALIFORNICUS, IN LOCAL SOUTHERN CALIFORNIA ENVIRONMENTS
N.J. Brahmbhatt¹, J.A. Reyes², and J.A. Rodriguez², ¹Endocrinology Lab, Department of Biology, California State University, Long Beach. ²Pacific Coast Environmental Conservancy

28*F 4:00 SEXUAL DIMORPHISM OF THE URINARY BLADDERS IN BLUE ROCKFISH (SEBASTES MYSTINUS)
H. Jamal and K.L. Forsgren. Department of Biological Science, California State University, Fullerton

29*F 4:15 EVALUATING THE EFFECTS OF TEMPERATURE ON THE METABOLIC RATE OF THE BLUEBANDED GOBY (LYTHRYPNUS DALLI)
R. Rangel and D. Johnson. Department of Biological Sciences, California State University, Long Beach

30* 4:30 ENERGETICS OF LARVAL PHENOTYPIC PLASTICITY IN THE SAND DOLLAR, DENDRATER EXCENTRICUS
A.J. Rendleman, J.A. Rodriguez, A. Ohanian, and D.A. Pace. Department of Biological Sciences, California State University, Long Beach

31 4:45 CHEMICAL POLLUTION ALTERING ENDOCRINE PHYSIOLOGY IN LOCAL FLATFISH, PARALICHTHYS CALIFORNICUS, OF SOUTHERN CALIFORNIA
J.A. Rodriguez and J.A. Reyes. Pacific Coast Environmental Conservancy

32*F 5:00 AMONG-POPULATION VARIATION IN DIET OF BLACK PERCH EMBIOTOCA JACKSONI
B.S. Stirling and D.W. Johnson. Department of Biological Sciences, California State University, Long Beach

33* 5:15 RELATION OF FOOD SOURCE AVAILABILITY AT HUNTINGTON STATE BEACH TO THE CALIFORNIA LEAST TERN (STERNULA ANTILLARUM BROWN) DIET
C.C. Coria and C.R. Whitcraft. Department of Biological Sciences, California State University, Long Beach

5:30 – 8:00 POSTER SESSION
Friday, April 28, 2017

Session 2: Contributed Papers, Marine Fish Ecology

Location: HSS 263

Session Chair: TBA

34* 1:30  DIEL MOVEMENTS AND FINE SCALE ACTIVITY PATTERNS OF THE CA HORN SHARK, *HETERODONTUS FRANCISC* E.N. Meese and C.G. Lowe. California State University, Long Beach

35 1:45  CONTRIBUTIONS OF GRAZERS TO NITROGEN RECYCLING IN TIDE POOLS: NOT ALL SPECIES ARE EXCRETING EQUALLY G. Bernatchez, J.M. Oates, and M.E.S. Bracken. University of California, Irvine

36*F 2:00  WILL CALIFORNIA GRUNION LARVAE ADAPT TO OCEAN ACIDIFICATION? A. Tasoff and D. Johnson. California State University, Long Beach

37*F 2:15  LONG-TERM TRENDS IN ROCKFISH (*SEBASTES SPP.*.) POPULATIONS AT TWO SITES IN SOUTHERN SANTA MONICA BAY S.E. Ashey, C.M. Williams, M.J. Robart, and D.J. Pondella, II. Vantuna Research Group, Department of Biology, Occidental College

38*F 2:30  TOP-DOWN VERSUS BOTTOM-UP PROCESSES IN A PROTECTED EELGRASS BED (*ZOSTERA MARINA*) AT SANTA CATALINA ISLAND R.P. Dauksis and M.A. Steele. California State University, Northridge

39* 2:45  THE EFFECTS OF PHLOROTANNIN CONCENTRATIONS OF BROWN SEAWEEDS (PHAEOPHYCEAE) ON THE FEEDING RATES OF THE BLACK SEA HARE, *APLYSIA VACCARIA* D.M. McHaskell and J.R. Smith. Department of Biological Sciences, California State Polytechnic University, Pomona

40*F 3:00  EFFECTS OF EL NIÑO ON ANCHOVY AND TOPSMELT POPULATIONS IN SAN DIEGO BAY M.M. Roethler, J.P. Williams, and D.J. Pondella, II. Vantuna Research Group, Department of Biology, Occidental College

3:15 – 3:45  BREAK

Session 2: Contributed Papers, Habitat / Ecosystem Change

Location: HSS 263

Session Chair: TBA

LONGITUDINAL TEMPERATURE PROFILE OF THE LOS ANGELES RIVER
J. Mongolo, N. Trusso, R. Dagit, A. Aguilar, and S. Drill. ¹Resource Conservation District of the Santa Monica Mountains Topanga, ²Department of Biological Sciences, California State University, Los Angeles, ³University of California Cooperative Extension, Ventura

CHARACTERIZING THE CHANGE IN CDOM FLUORESCENCE DUE TO RIVER RESTORATION WITH THE USE OF PARAFAC MODEL
D.J. Parsons, N. Mladenov, A. Kinoshita, and D. Lipson. ¹Water Innovation and Reuse Lab, San Diego State University, ²Kinoshita Research Group, San Diego State University, ³Department of Biology, San Diego State University

PRELIMINARY EXPLORATION OF METHANE FLUX FROM THE SOUTH BAY SALT POND RESTORATION PROJECT

EFFECTS OF EELGRASS RESTORATION ON INSHORE SEDIMENT STABILIZATION IN THE NEWPORT BACK BAY, CA
J.D. Smith, S.K. Briley, J.A. Sohm, and D.W. Ginsburg. ¹Environmental Studies Program, University of Southern California, ²Orange County Coastkeeper

EVALUATING BASELINE BIRD COMMUNITY AFTER BEACH RESTORATION
K. Alvarez, A. Garcia, J.H. Dorsey, and K. Johnston. ¹Environmental Science Program, Loyola Marymount University, ²Santa Monica Bay Foundation

DIVERSITY EFFECTS IN A LONG TERM STUDY OF A COASTAL WETLAND
K.J. Gonzalez, M. Fitzgerald, J.L. Funk, C. Whitcraft, and B.J. Allen. ¹Department of Biological Sciences, California State University, Long Beach, ²School of Earth and Environmental Sciences, Chapman University

5:30 – 8:00 POSTER SESSION
Southern California Academy of Sciences 2017 Session Schedule

Friday, April 28, 2017

Session 3: Parasitology Symposium, continued

Session Chair: Ralph Appy, Cabrillo Marine Aquarium

**Location:** HSS 106

48 1:30 LIFE CYCLE OF *RHINEBOTHRIUM UROBATIDIUM* (CESTODA: RHINEBOTHROIDEA) A PARASITE OF THE ROUND STINGRAY, *UROBATS HALLERI* (MYLIOBATOIDEA)

**R.G. Appy** Cabrillo Marine Aquarium

49 1:45 IS THE ASIAN BURROWING SHRIMP, *UPOGEBIA MAJOR*, FOLLOWING ITS BOPYRID ISOPOD PARASITE TO SOUTHERN CALIFORNIA?

**J.W. Chapman**¹, R.A. Breitenstein¹, and M.F. McGowan². ¹Department of Fisheries and Wildlife, Hatfield Marine Science Center, Oregon State University, ²Maristics, Berkeley

50 2:00 DISTRIBUTION OF TWO HOST-SPECIFIC PARASITES OF THE LONGJAW MUDSUCKER, *GILLICHTHYS MIRABILIS*, IN SOUTHERN CALIFORNIA WETLANDS; A TALE OF ISOLATION, EXTERMINATION AND LOCALIZED RECOLINIZATION

**R.G. Appy**, Cabrillo Marine Aquarium

2:15 SCSP Business Meeting

3:15 – 3:45 BREAK

3:45 END OF SESSION

5:30 – 8:00 POSTER SESSION
Southern California Academy of Sciences 2017 Session Schedule

Friday, April 28, 2017: 5:30 – 8:00 PM

Poster Session

Location: Quad Walkway

51* EFFECTS OF INVASIVE PLANTS IN CALIFORNIA WETLANDS
A. Arenas, C. Whitcraft, T. Asef, and R. Wigginton. Department of Biological Sciences, California State University, Long Beach

53* STUDY OF NATURAL CERAMIC GLAZES BY INFRARED MICROSCOPY
W.Z. Rowlands1, R. Fleck2, and J.M. Landry3. 1Department of Environmental Science, 2Department of Art and Art History, Loyola Marymount University

55* DIET AND VENOM ONTOGENY IN INSULAR AND HIGH-ALTITUDE POPULATIONS OF THE SOUTHERN PACIFIC RATTLESNAKE (CROTALUS HELLERI)
Z.D. Travis, E.C.K. Gren, W. Kellen, G. Fox, C. Person, and W.K. Hayes. Department of Earth and Biological Sciences, School of Medicine, Loma Linda University

57* LEAF WATER RELATIONS OF A WIDESPREAD TANK BROMELIAD
M.G. Gillman, M.G. Browne, J.R. Palumbo, and G.B. North. Department of Biology, Occidental College

59 AN INVENTORY OF OCEANIC UPWELLINGS WITHIN THE SOUTHERN CALIFORNIA BIGHT WITH CORRELATIONS BETWEEN GEOGRAPHICAL SITES TO DETERMINE STRENGTH AND ORIGIN
C.G. Rodgers1, C.G. Gelpi1, and D.Y. Kim2. 1Catalina Marine Society, 2Wrigley Institute for Environmental Studies, University of Southern California

61* MODELING TEMPERATURE VARIATION USING DRONES TO INFORM TROPICAL FOREST MANAGEMENT STRATEGIES
J. Lugo, M. Dix, R. Bremer, R. Sanders, and V.D. Carmona-Galindo. Loyola Marymount University

63* LOW RATES OF WATER LOSS THROUGH LEAF SURFACES OF A TROPICAL RAINFOREST EPIPHYTE, GUZMANIA MONOSTACHIA
E.Z. Wang1, V.A. Fung2, and G.B. North1. 1Departments of Biology and 2Biochemistry, Occidental College

65* GROWTH OF DEPTH CYCLED MACROCYSTIS PYRIFERA: A NOVEL METHOD FOR INCREASING BIOCRUDE PRODUCTION IN OPEN-OCEAN ECOSYSTEMS
J. Sturges, P. Hines, D.W. Ginsburg, and D.Y. Kim. 1USC Wrigley Institute of Environmental Studies, University of Southern California

67* RECOLONIZATION OF INVERTEBRATES IN SEDIMENT AUGMENTATION
A.T. Martinez, K. McAtee, and C.R. Whitcraft. Department of Biological Sciences, California State University, Long Beach
**HOP TOPIC: THE EFFECTS OF GENISTEIN, A PHYTOESTROGEN IN BEER BREWERY WASTEWATER, ON THE REPRODUCTIVE PHYSIOLOGY OF ZEBRAFISH (DANIO RERIO)**

S.D. Schkoda\(^1\), G.C. Struckhoff\(^2\), and K.L. Forsgren\(^3\). \(^1\)Department of Biological Science and \(^3\)Civil and Environmental Engineering, California State University, Fullerton

**HABITAT PREFERENCE OF THE CALIFORNIA STATE MARINE FISH**

G.S. Coogan, D.J. Pondella, II, C.M. Williams, and J.P. Williams. Vantuna Research Group, Department of Biology, Occidental College

**VALIDATING FORMULAS FOR WIND-BLOWN SAND TRANSPORT**

S.L. Sinclair\(^4\), K. Johnston\(^5\), E.G. Strauss\(^1\) and M. Grubbs\(^2\). \(^1\)Department of Civil Engineering and Environmental Science, Loyola Marymount University. \(^2\)The Bay Foundation

**ANALYSIS OF MICRO-PLASTICS FOUND IN GREAT LAKES SEDIMENTS**

S.L. Sinclair\(^1\), J.M. Landry\(^2\), E.G. Strauss\(^3\), and W.J. Edwards\(^4\). \(^1\)Departments of Civil Engineering and Environmental Science, \(^2\)Chemistry and Biochemistry, and \(^3\)Biology, Loyola Marymount University. \(^4\)Department of Arts and Sciences, Niagara University

**GREENHOUSE GAS FLUXES FROM A SEDIMENT AUGMENTATION PROJECT AT SEAL BEACH NATIONAL WILDLIFE REFUGE**


**CHARACTERIZATION OF KELP WRACK ALONG THE SANTA MONICA BAY**

M. McPherson and H. Kearns. Loyola Marymount University

**LANDSCAPE GENOMICS OF THE VERNAL POOL TADPOLE SHRIMP (LEPIDURUS PACKARDI)**

S.K. Garza, A. Aguilar, and G. Perez. Department of Biological Sciences, California State University, Los Angeles

**NEKTON UTILIZATION OF CREATED AND NATURAL INVERTIDAL CRASSOSTREA VIRGINICA REEFS**

K. Rutledge, T. Alphin, and M. Posey. University of North Carolina, Wilmington Benthic Ecology Lab, University of California, Los Angeles, Ichthyology Lab

**RECOVERY OF CORALLINE ALGAL TURFS AND ASSOCIATED MEIOFAUNAL COMMUNITIES IN A SOUTHERN CALIFORNIA ROCKY INVERTIDAL ECOSYSTEM**

S.T. Agler and J.R. Smith. Biological Sciences Department, California State Polytechnic University, Pomona

**A PRELIMINARY INVESTIGATION: COMPARATIVE MORPHOLOGY OF ROCKFISH GENITAL PAPILLA**

B. Sadighi, C. Garia, J. Javier, and K.L. Forsgren. Department of Biological Science, California State University, Fullerton
A DESCRIPTIVE REPORT OF THE REPRODUCTIVE MORPHOLOGY OF MALE BLACK PERCH (*EMBIOTOCA JACKSONI*)
E. Bond, A. Barraza, and K.L. Forsgren. Department of Biological Science, California State University, Fullerton

MICROBIAL CONTRIBUTIONS TO ORGANIC MATTER OPTICAL PROPERTIES IN ALVARADO CREEK DURING A STORM EVENT
L. Mendoza, N. Mladenov, and D. Parsons. Department of Civil, Construction, and Environmental Engineering, San Diego State University

THE GUT MICROBIOME OF TROPICAL *CEPHALOLEIA* BEETLES: INTERACTION BETWEEN DIET, PATHOGENS, AND INVASIVE PLANT SPECIES
C.L. Blankenchip and S.K. Goffredi. Department of Biology, Occidental College

A ROLE FOR LIPOPROTENE LIPASE IN REGULATION OF INSULIN SIGNALING
C. Robinson and J. Medh. Department of Chemistry and Biochemistry, California State University, Northridge

GENERATING THE FIRST-EVER DNA BARCODE SEQUENCES FOR COASTAL FREE-LIVING POLYCLAD FLATWORM SPECIES OF CALIFORNIA
K. Nannini and D.J. Eernisse. Department of Biological Science, California State University, Fullerton

DISTRIBUTION OF HATCHING GLAND CELLS IN THE CALIFORNIA GRUNION, *LEURESTHES TENUIS*
C.A. Rosales and K. Dickson. Department of Biology, California State University, Fullerton

AQUAPORIN EXPRESSION IN LEAVES OF A TANK BROMELIAD UNDER WET, DRY, AND REWETTED CONDITIONS
T.L. Kho, E.B. Brinton, and G.B. North. Department of Biology, Occidental College

EFFECTS OF IN VITRO SUPPLEMENTATION OF GRANULOMAS WITH L-GSH AND NAC ON IMMUNE RESPONSE DURING INFECTION WITH BCG AND MYCOBACTERIUM TUBERCULOSIS
H. Islamoglu, R. Cao, G. Teskey, M. Guiterrez, O. Salaiz, J.K. Chan, and V. Venketaraman. 1Department of Biological Sciences, California State Polytechnic University. 2Graduate College of Biomedical Sciences, Western University of Health Sciences. 3Department of Basic Medical Sciences, College of Osteopathic Medicine of the Pacific, Western University of Health Sciences

COMPARING THE EXPRESSION OF GENES INVOLVED IN CARBOHYDRATE METABOLISM IN WILD-TYPE AND LPL-KNOCK-DOWN MUSCLES CELLS
M. Ramos Correa and J. Medh. Department of Chemistry and Biochemistry, California State University, Northridge
DETERMINING TEMPERATURE-PERFORMANCE OF THE AEROBIC ENZYME, CITRATE SYNTHASE, AS A WAY OF PREDICTING THERMAL HABITAT RANGE IN FOUR SPECIES OF ECHINODERM LARVAE
A. Ohanian, J. Alfaro, A. Pouv, T. McCormick, B. Chang, A. Ellison, T. Tran, D. Schmitz, A.J. Rendleman, and D.A. Pace. Department of Biological Sciences, California State University, Long Beach

DEVELOPMENT OF THE ABILITY TO ELEVATE RED MUSCLE TEMPERATURE IN THE PACIFIC BLUEFIN TUNA
Y.R. Bholat and K.A. Dickson. Department of Biological Science, California State University, Fullerton

MOLECULAR STUDIES ON THE GUT MICROBIOME OF THE BLOOD-FEEDING MARINE ISOPODS, ELTHUSA SPP.
J. DeRogatis and Shana Goffredi. Department of Biology, Occidental College

PLANT DEVELOPMENTAL STRATEGIES BEGIN AT GERMINATION: FUNCTIONAL TRAITS, PLASTICITY, AND SURVIVAL IN THE FIRST FOUR DAYS OF PLANT LIFE
S.E. Wanous, J.E. Larson, and J.L. Funk. Schmid College of Science and Technology, Chapman University. Department of Ecology and Evolutionary Biology and Institute of Arctic and Alpine Research, University of Colorado, Boulder

NUT PREFERENCES IN FORAGING LARUS CALIFORNICUS
A.M Lau and W. Binder. Department of Biology, Loyola Marymount University

MICROBIOME AND MORPHOLOGICAL STUDIES ON THE GUT OF A TROPICAL FOREST FLIGHTLESS GRASSHOPPER, MICROTYLOPTERYX HEBARDI
ORAL ABSTRACTS IN PROGRAM ORDER

1 ENVIRONMENTAL CONTROLS OF BLACK ABALONE BODY TEMPERATURE DETERMINE RISKS OF THERMAL STRESS AND DISEASE

B.J. Allen¹, E.A. Duncan¹, L.P. Miller²,³, and M.W. Denny³. ¹Department of Biological Sciences, California State University, Long Beach, ²Department of Biological Sciences, San Jose State University, ³Hopkins Marine Station, Stanford University

Black abalone (Haliotis cracherodii) populations in southern California exhibited dramatic declines in recent decades due to overharvesting and the emergence of withering syndrome (WS), a disease caused by a Rickettsiales-like organism (RLO). Prevalence of WS-RLO among abalone has been linked to higher body temperature ($T_b$) variability during aerial exposure at low tide. We coupled a species-specific biophysical model with long-term meteorological records from Hopkins Marine Station (HMS) in Pacific Grove, CA, USA, to generate information about environmental and topographic controls of abalone $T_b$, allowing us to quantify how relative risk of thermal stress and WS-RLO infection varied with location on shore. Generally, black abalone were predicted to experience wider daily temperature ranges (DTRs) and higher maximum daily $T_b$s with increasing shore height on southwest facing, 45° sloped rock surfaces. Spatial patterns of WS-RLO infection risk were similar to those of high temperature stress only at the lowest shore height; risk of infection by WS-RLO was uniformly high for abalone located higher on shore and mostly independent of orientation. Abalone at HMS were predicted to experience high $T_b$s most frequently during winter, primarily due to low tides characterized by long midday exposures. Even so, with the exception of summer, high abalone $T_b$s were observed throughout the year with key environmental factors combining in different characteristic ways. Mechanistic approaches such as heat budget modeling enhance our ability to quantify physiological risk to individuals, compare ecological conditions across broad spatial scales, and successfully predict consequences of changing environmental conditions through time.

2 LARGE-SCALE IMPACTS OF SEA STAR WASTING DISEASE AND RECENT RECRUITMENT PATTERNS FOR PISASTER OCHRACEUS

C.M. Miner¹, L. Gilbane², and P.T. Raimondi¹. ¹University of California, Santa Cruz, ²Bureau of Ocean Energy Management

Massive declines of the ochre star, Pisaster ochraceus, were documented throughout most of the species’ range by the Multi-Agency Rocky Intertidal Network (MARINe), a long-term monitoring program with sites stretching from Alaska to southern California. Declines began in late 2013, due to an ongoing epidemic termed “sea star wasting disease” (SSWD). Although the cause of SSWD is not yet fully known, an associated virus has been identified, and environmental stressors are suspected contributors. Quantitative MARINe surveys spanning 16 years revealed unprecedented declines of P. ochraceus in 2014 and 2015, years when seawater temperature was abnormally warm. Population declines, combined with recent recruitment pulses at several sites, have resulted in significant shifts in the population size structure of P. ochraceus in many regions. Recruitment patterns from Alaska to southern California suggests higher recruitment in the north (except Alaska), with markedly lower levels in the south. This pattern was evident both pre- and post-SSWD, and has significant implications for recovery. Juvenile survivorship has thus far been higher than reported by other researchers, and lends support that populations may recover; however, low levels of SSWD-symptomatic stars are still present throughout the impacted range, thus long-term survival of recruits, and subsequent recovery, is unclear.
LONG-TERM POPULATION FLUCTUATIONS IN THE INTERTIDAL SEASTAR (*PISASTER OCHRACEOUS*) ALONG THE PALOS VERDES PENINSULA, CALIFORNIA

J.K. Passarelli¹, B. J. Allen², S.E. Lawrenz-Miller¹, and A.C. Miller². ¹Cabrillo Marine Aquarium, ²Department of Biological Sciences, California State University, Long Beach

Intertidal populations of the ochre seastar, *Pisaster ochraceous*, have been monitored annually at three sites on the Palos Verdes Peninsula since 1975. Seastar densities have fluctuated dramatically over the past 40+ years, but appear to be decoupled from local factors such as annual upwelling intensity or cumulative hours exposed during low tide. Instead, seastar population abundances and recruitment were significantly correlated with multiple regional climate indices that include the Multivariate ENSO Index (MEI), Pacific Decadal Oscillation (PDO), and North Pacific Gyre Oscillation (NPGO). In the late 1970s, this species was severely impacted by a densovirus-associated wasting disease first observed several years prior to the extreme 1982-1983 El Niño event; PVP populations did not recover to earlier densities until the late 1980s. A similar die-off was recorded in 2013, again preceding the 2015-2016 record-setting El Niño event by several years. Based on our previous observations, we predict that it will take approximately a decade for PVP seastars to recover from the latest mass mortality.

ROCKY INTERTIDAL ECOSYSTEMS IN URBANIZED SOUTHERN CALIFORNIA: EFFECTS AND MANAGEMENT OF HUMAN VISITATION

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In heavily urbanized coastal regions, such southern California, rocky intertidal ecosystems are subjected to a high number of human visitors who frequent the rocky shore for education, recreation, and harvesting purposes. The collecting, trampling, handling, and rock turning activities of these visitors negatively impact numerous intertidal flora and fauna, such declines in abundance, reductions in fitness or reproductive output, and alterations of the size and age structure of susceptible organisms. For example, the California Sea Mussel exhibits lowered abundances and a shift in size of individuals in the population towards smaller mussels at the most frequented sites. Experimental studies suggest trampling and collecting of mussels can cause direct losses, as well as indirect losses through the weakening of mussel attachment strengths within beds, causing further loss to wave activity. To protect rocky intertidal organisms from visitation impacts, stretches of the coastline have been designated as Marine Protected Areas (MPAs) where collecting is prohibited. However, rocky intertidal MPAs have been suggested to be ineffective as compliance has been low and other activities, such as trampling and handling, are not well regulated under MPA designation. To supplement MPA regulations, local collaboratives, such as the Orange County Marine Protected Area Council, have enacted supplemental management strategies to conserve intertidal habitats, such as education/outreach programs, signage, increased enforcement, and a mobile touch tank. Studies of these management strategies have suggested they are effective in reducing many of the detrimental activities of visitors, yet increasing numbers and subsequent trampling remains difficult to manage.

ECOLOGICAL SIGNIFICANCE OF THE OUTER BANKS OF THE SOUTHERN CALIFORNIA BIGHT

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We analyzed and inventoried the biological resources on and around Gareth Ridge, Cherry Bank, Tanner Bank and Cortes Bank contained within a 6,639 km² area of the outer continental borderlands of the Southern California Bight. These offshore banks lie at the divergence of the California Current and the Southern California Counter Current, major sources of production in the bight. Based upon this unique
geology and physical oceanography, it is not surprising that the outer banks of the Southern California Bight have long been acknowledged as distinctive and productive habitats. As an example, they maintain populations of endangered and protected species such as white abalone (*Haliotis sorenseni*), Cowcod (*Sebastes levis*), and purple hydrocoral (*Stylaster californicus*), and a variety of marine mammals, birds and turtles. This production also supports extensive commercial and recreational fishing activities. We analyzed fishing block data for these fisheries from 1980-2009. Commercial fishers reported 55,530 metric tons during this period. Recreational Commercial Passenger Fishing Vessels reported 1,578.855 fishes and invertebrates caught. While recreational fishers targeted pelagic species, they landed primarily benthic taxa. Conversely, commercial fishing of high value pelagics, were a significant and increasing proportion of the overall catch of these taxa in the Southern California Bight. All ecological and fishing information from this region indicates that these offshore banks constitute a significant amount of production in the bight and are critical and unique habitats.

6 COMPARISON OF FISHES AND INVERTEBRATES LIVING IN THE VICINITY OF ENERGIZED AND UNENERGIZED SUBMARINE POWER CABLES AND NATURAL SEA FLOOR OFF SOUTHERN CALIFORNIA

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An important component of any offshore renewable energy generation facilities is the network of power cables laid on the seafloor. Concerns have been raised over the potential ecological impacts of in situ power cables given that laboratory experiments show EMF can affect the behavior of some marine animals. Off southern California, we conducted surveys of marine fishes and invertebrates living around energized and unenergized submarine power transmission cables and nearby sea floor during 2012–2014 at depths between 76 and 213 m. EMF, measured as the magnetic field strength, dissipated to background levels about one meter from the cable. Overall, we found no differences between the fish and invertebrate communities along the energized and unenergized cables. As expected, the fish and invertebrate assemblages of the natural soft sediment habitat differed from both cable habitats. Total fish densities and a number of invertebrate species were significantly higher around cables than over natural habitat. Differences are likely reflective of the hard substratum and habitat complexity afforded by the cables. Given the rapidity with which EMF produced by the energized cables diminished and the lack of response to EMF by the fishes and invertebrates in this study, cable burial in the study region would not appear necessary strictly for biological reasons.

7 PHYSIOLOGY, FUNCTIONING, AND FEEDBACKS: IMPACTS OF CLIMATE CHANGE ON CALIFORNIA’S COASTS

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The Earth’s biological systems will be exposed to continuing and accelerating increases in CO2 levels and temperature as we move further into the Anthropocene. Predicting the outcomes of these global changes requires an understanding of direct impacts, interactions, and feedbacks within natural ecosystems. My previous work has shown that climate change can favor some species over others (including invasive over native species) and that impacts can propagate upwards to impact community and ecosystem level processes (including biodiversity and productivity). In this talk, I present findings from in situ measurements and manipulations of CO2 and temperature in California’s rocky intertidal systems, which address responses and feedbacks between multiple levels of biological organization. Results of both observational and experimental studies indicate the ability of the organisms themselves (e.g., invertebrates and algae) to modify the thermal environment and seawater chemistry. Thus, coastal marine species are not just responding to climate change, they are driving the extent of local changes.
8 THE INFLUENCE OF UV RADIATION ON TROPICAL DART FROG BEHAVIOR

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Declines of tropical amphibian populations are well documented. However, certain species appear to be more persistent, especially those in the Dendrobatidae family. Over the last two decades, we have studied two species of Dendrobatid frogs and examined the role of ultraviolet (UV) radiation in influencing their behavior. Most amphibians are nocturnal, but Dendrobatids are diurnal, making them more prone to UV radiation and potentially more likely to alter behavior in response to elevated UV. To test these hypotheses, we have made long-term field observations, conducted field experiments, and manipulated UV exposure levels to understand the extent to which UV influences behavior. Our results suggest that even minor increases in UV radiation influence where adult male dart frogs choose to vocalize and that UV is one of many environmental variables that significantly influences site selection. While we do not have direct evidence that UV sensitivity helps sustain population levels, our data suggest these species may be well prepared to behaviorally adapt to increasing UV radiation from ozone depletion which has been recorded across Central America rainforests.

9 LEAF HYDRAULIC CONDUCTANCE AND RESILIENCE FOR EPIPHYTES IN MOIST TROPICAL FORESTS

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Despite large annual totals for rainfall in lowland tropical forests, plants that grow as epiphytes in the canopy can experience wide variations in water availability and are likely to face even greater variability due to global warming. Several water-conserving adaptations occur in a number of tropical epiphytes, including CAM photosynthesis, absorptive leaf surfaces, and water-storing leaf bases (tanks). In addition, tropical epiphytes including ferns, cacti, orchids, and bromeliads not only persist through desiccating conditions but also recover quickly when rainfall returns. We investigated a wide-ranging species of tank bromeliad, Guzmania monostachia, to determine how water movement through its leaves, or its leaf hydraulic conductance, varied in response to wet, dry, and rewetted conditions, both in the rainforest and in greenhouses in Costa Rica and in southern California. Withholding water for 14 d from plants reduced their leaf hydraulic conductance by about 40%, a reduction that was driven largely by changes in leaf tissues outside the vasculature. This decrease was at the low end of drought-induced reductions in leaf hydraulic conductance reported for other species from moist and xeric habitats, perhaps reflecting anatomical traits in G. monostachia that protect against water loss. Within 4 d after tanks were refilled with water, initial values of hydraulic conductance were restored or exceeded, in concert with an increase in gene expression of aquaporins, proteins involved in transporting water across membranes. The ability of G. monostachia to resume water uptake relatively rapidly after a dry period matches or even exceeds that of many other rainforest epiphytes.

10 DRONES AS A QUANTITATIVE TOOL FOR THE STUDY OF ECOLOGICAL DYNAMICS IN A NEOTROPICAL PREMONTANE THORN WOODLAND

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The early adoption of drones (or unmanned aerial vehicles) in ecological studies has had tremendous success with qualitative research applications, such as for monitoring endangered species habitat. The quantitative application of inexpensive commercial drones to evaluate ecological landscapes and model forest dynamics has great potential to inform the forest management strategies in-real-time as well as integrate environmental justice issues in conservation biology. We employ digital-image analyses of distortion-corrected imagery captured with the convex lens of a Parrot-Bebop drone in order to quantitatively inform the reforestation management strategies of a high-elevation (2,500 m.a.s.l.) Oak-Pine forest in the western Sierra Madre of Mexico. Image polygon measurements and pixel hue intensities
are used to measure elements at the landscape-level (e.g. patch size, shape, position, pixel diversity of the canopy, etc.) that are correlated with dynamics at the population-level (e.g. seedling density, cohort structure, herbivory, etc.). The resulting empirical models allow for the use of drone imagery to quickly infer canopy openness, variability of understory temperatures, seedling density, forest structure, and gall-infestation levels. We are working with natural area managers in Aguascalientes, México, to use drones to monitor cattle grazing frequency and intensity so as to incorporate the intermediate disturbance hypothesis into an inclusive forest-conservation management strategy that also empowers local communities sustainably.

11 SEEING THE FOREST FOR THE TREES: USING PUBLICLY AVAILABLE LONG TERM DATA SETS TO TEACH QUANTITATIVE METHODS IN TROPICAL FOREST ECOLOGY

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We used long-term, publicly available, variable-rich data generated by research conducted at La Selva Biological Station of Organization for Tropical Studies to develop classroom-ready modules for teaching ecology concepts at the undergraduate level. These data sets constitute a unique resource for students to investigate the role of climate, disturbance and edaphic factors on performance of tropical trees. The first module addresses the question of trade-offs between growth and survival in tropical rain forest trees. This data set includes survivorship, growth, and microhabitat for 4027 individuals from established seedling to canopy-level individuals over a 33-yr span. In the exercise we developed, students learn how to extract the necessary data from a larger data set to answer new questions. In this exercise, students test several published findings from a shorter-term version of the data set and place the findings in a newer conceptual framework about tropical tree growth and regeneration, and the ways that changing climate may affect tree growth, performance, and carbon flow in tropical rain forests. The approach of using large data sets is broadly applicable to teaching a variety of concepts in environmental science

12 FISHES MEET THE TREES: FRUIT-EATING AND SEED DISPERSAL LINK AQUATIC AND TERRESTRIAL ECOSYSTEMS

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Fruit-eating by fishes represents an ancient fish-plant interaction, stretching back to the late Cretaceous, if not much earlier, and may antedate modern bird and mammal frugivory. Some frugivorous fish species act as seed predators, but numerous species pass viable seeds through their digestive tracts and thus can function as seed dispersers. Of the more than 275 known fruit- and seed-eating species, most occur in tropical ecosystems, and they mainly represent characiform (pacus, piranhas) and siluriform (catfishes) lineages. Even though frugivorous species occur in all six biogeographic regions, the highest diversity is found in the Neotropical region. More than 560 species of fruits and seeds have been recorded in the diets of about 150 fish species in this region, with many of the plant species apparently adapted for fish seed-dispersal. Fishes are recognized as important seed dispersers that can influence plant-recruitment patterns and regional biodiversity in floodplain habitats and riparian forests. The highly mobile, large-sized and long-lived species are the most effective seed dispersers, yet they are the species most subject to overfishing. Two of the largest species, the tambaqui (Colossoma macropomum) and the pacu (Piaractus mesopotamicus), are both heavily fished and their populations greatly diminished. Deep losses of the best seed dispersers call for urgent conservation and management actions to maintain plant recruitment and diversity in floodplain and riparian ecosystems. Much remains to be known about fish-plant interactions, including the relative contributions of vertebrate seed dispersers, identification of seeds in fish diets and the migratory movements of frugivorous fish species.
CRYPTIC CORAL REEF PREDATORS: MORPHOLOGICAL SPECIALIZATIONS BROADEN THE DIET OF MANTIS SHRIMP

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A foundational observation in animal ecology is that species with specialized feeding morphology consume specific prey types. Mantis shrimp (Stomatopoda: Crustacea) are ubiquitous predators in tropical coral reefs and are often hailed as having highly specialized feeding morphology. Their modified feeding appendages are either elongate spear-like appendages (spearers) used to ambush soft-bodied evasive prey, or hammer-like appendages (smashers) that produce extremely high forces used to break hard-shelled prey. Despite long-standing hypotheses about correlations between feeding morphology and ecology, basic knowledge about strike mechanics and diet remains unknown in most mantis shrimp species. We integrated biomechanics, animal behavior, and stable isotope ecology to examine the relationship between diet and morphology in a Caribbean coral reef flat smasher, as well as a spearer and a smasher species that co-occur in the coral reef flats of French Polynesia. Unexpectedly, in all three of these species, we found that soft-bodied prey, primarily fish but also worms and snapping shrimp, comprised large proportions of the diets, in addition to clams, crabs, hermit crabs, and snails. Thus, counter to expectation, the specialized feeding appendages of both spearers and smashers correspond to a broad diet of hard-shelled and soft-bodied prey, regardless of morphology. Mantis shrimp are also the major diet item of common reef animals. Given that they are very abundant and consumed by a diversity of larger predators, while also consuming different prey themselves, mantis shrimp are likely an important link in coral reef food webs.

ABUNDANCE AND DISTRIBUTION OF THE FISH-HUNTING CONE SNAIL SPECIES CONUS CATUS ON INTERTIDAL BENCHES

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Conus catus is a fish-hunting marine gastropod distributed broadly across the tropical Indo-Pacific. C. catus utilizes a novel family of neuroexcitatory peptides to rapidly paralyze fish prey and has one of the most potent venoms on mammals of any cone snail. Despite their biomedical importance, little is known about the abundance and distribution of fish-hunting cone snail species like C. catus within their coastal marine habitats. We have established a multi-year program to survey C. catus and conspecific cone snails on shallow water marine benches in the Hawaiian Islands using geographic information system (GIS) approaches. Location data was improved by correction to site-specific anchor points allowing for consistent, detailed mapping of cone snails in the field. C. catus co-occur with congeners in daytime refugia, negating a unique distribution linked to feeding behavior. While capable of extensive daily movements on the bench, C. catus occupy their marine bench habitats for extended periods. Surprisingly, C. catus was the most abundant of all the larger Conus species. This is in marked contrast to the typical abundances of the worm-hunting, snail-hunting and fish-hunting feeding guilds, with fish-hunters being the least abundant species. The GIS approaches developed here can be applied to site-specific distributions of cone snail, and other species, in a variety of shallow-water marine habitats, leading to an increased understanding and conservation of these valuable marine resources.
15*P EXPLORING NEW TRANSMISSION PATHWAYS OF TOXOPLASMOSIS IN MARINE ENVIRONMENTS: HOW VIRULENT IS THE TACHYZOITE STAGE DURING EXPOSURE TO SEAWATER CONDITIONS?

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The spread of Toxoplasma gondii, a terrestrial, apicomplexan parasite, to marine habitats has led to adverse effects, including lethal encephalitis in California Sea Otters. To our knowledge, the role the tachyzoite lytic form plays in marine transmission has never been studied. The transition from intracellular to extracellular conditions during the lytic cycle is indicative that T. gondii tachyzoites possess robust ion homeostatic mechanisms. We hypothesize that tachyzoites can maintain survivability and virulence when exposed to seawater conditions and thus represent a significant transmission route to marine organisms. Survivability of T. gondii tachyzoites was measured using Giemsa Staining and a “Live/Dead” fluorescent stain. Both experiments independently confirmed that tachyzoites were able to survive in seawater at comparable levels to control treatments in physiological buffers. Virulence and invasion ability of T. gondii tachyzoites in seawater was measured by assessing various aspects of their invasion-linked traits (ILTs). The ability to extend the conoid invasion machinery was similar for parasites exposed to seawater and control conditions. However, the efficiency of host cell invasion while exposed to seawater conditions was severely limited in comparison to control parasites. Preliminary data indicated that the activation of other ILTs, including microneme secretion and motility, showed similar limitations in seawater conditions. Despite these results, the high survivability of T. gondii tachyzoites after exposure to seawater allows for the possibility of infection through ingestion. These results indicate that tachyzoites are more robust than previously assumed and their role in the transmission of toxoplasmosis to California marine environments should be re-considered.

16*P CHARACTERIZATION OF A PUTATIVE CALCIUM-BINDING PROTEIN IN THE HUMAN PARASITE TOXOPLASMA GONDII

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Toxoplasma gondii is an Apicomplexan obligate intracellular parasite which produces the disease toxoplasmosis and is related to the malaria parasite Plasmodium falciparum. The dependence of T. gondii on calcium (Ca2+) during invasion processes has previously been established, yet the molecular mechanisms by which T. gondii regulates Ca2+ remain unknown. This study seeks to explore the role of a putative Calcium Binding Protein (CBP1) as a mechanism for regulating calcium flux during invasion, replication and egress during the bloodstream infectious tachyzoite stages of T. gondii. CBP1 has been shown to localize to the Plant-like Vacuole (PLV), an important site of protein maturation and calcium storage. Importantly, intracellular calcium regulation in over-expressing mutants of CBP1 (using the ratiometric calcium probe, FURA2-AM) was disrupted when compared to the RH parental wildtype strain. A knockout (KO) vector to CBP1 was designed by PCR amplification of the 5’ and 3’ Untranslated Regions (UTRs), containing the drug selectable marker CAT (chloramphenicol acetyl transferase) in place of the gene and a YFP tag. The vector was confirmed through restriction enzyme digest and used to transfect the wildtype RH strain and the Ku80 strain defective for non-homologous end joining (ensuring greater efficiency of homologous recombination). Full characterization of CBP1 through analysis of knockout mutants will elucidate the role this protein plays in calcium regulation and downstream invasion-linked traits, which may be useful as a drug target for diminishing parasite virulence.
THE CRITICAL ROLE OF K+/H+ EXCHANGE IN pH REGULATION AND INVASION IN THE HUMAN PARASITE, TOXOPLASMA GONDII

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Toxoplasma gondii is an obligate, intracellular parasite that infects 1/3 of the global population. T. gondii has the ability to contend with extreme changes in ionic conditions as it transits from outside to inside host cells during the lytic cycle. We hypothesize that invasion-linked traits (ILTs) of the parasite are regulated through environmental sensing of extra-parasitic ionic conditions. This sensing likely also serves as a homeostatic mechanism for maintenance of intracellular ionic conditions during the lytic cycle. We tested our hypothesis by measuring intracellular pH regulation and the secretion of an invasion protein (MIC2) under acidic and neutral pH conditions with the removal of Na+ and/or K+. Intracellular pH experiments using BCECF-AM showed that parasites were able to regulate their pH across all neutral, ionic conditions tested, however, in acidic conditions, there was a greater loss in regulation when K+ was removed. When K+ was added back, pH regulation was re-established. MIC2 assays showed reduced secretion when parasites were exposed to acidic conditions, but as with the intracellular pH experiments, the loss was much greater when K+ was removed. These data indicate the existence of a K+/H+ exchange mechanism that is critical for both pH homeostasis and host cell invasion, thereby supporting our hypothesis. Interestingly, there is no genetic evidence for a K+/H+ exchanger in T. gondii. Further elucidation, both physiological and genetic, of this exchange pathway will be critical for understanding ion permeation pathways and their potential as drug targets for treating Apicomplexan infections.

STRESSORS INFLUENCING METACYCLOGENESIS IN TRYPANOSOMA CRUZI

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Chagas disease is a neglected tropical disease with no current FDA approved treatments and is caused by the protozoan parasite Trypanosoma cruzi. In order to complete its life cycle, T. cruzi propagates between insect vector and mammalian host and differentiates into four main life stages. Previous studies have shown that Trypanosoma cruzi has robust adaptive homeostatic mechanisms that allow the parasite to survive harsh environmental challenges, including fluctuations in pH, temperature, osmolarity and nutrient availability. While some factors that influence differentiation in T. cruzi have been described, the exact molecular mechanisms that allow the parasite to sense environmental changes and trigger differentiation are unknown. Studies on other closely related trypanosomes have revealed evidence of social motility and quorum sensing within parasite populations, suggesting that similar mechanisms may be utilized by T. cruzi. When T. cruzi was plated on semi-solid agarose plates and exposed to different variables such as pH, cell density, parasite strain, and agarose concentration, we observed the rapid induction of metacyclogenesis from non-infective to infective forms. In addition, social motility behaviors were seen after several hours of incubation, a trait that has been largely uncharacterized in Trypanosoma cruzi. Our studies suggest that surface recognition and social motility are important factors that influence metacyclogenesis in T. cruzi. We have also developed a new methodology for obtaining higher percentage of infective forms. Understanding the mechanisms that govern metacyclogenesis could help to identify new therapeutic targets that might lead to eradication of Chagas disease.
Chagas Disease is a parasitic infection caused by the protozoan Trypanosoma cruzi. Due to large variability of nutrient availability, osmolarity, ionic concentrations and pH throughout the parasite’s life cycle, the ability to adapt and respond to such changing conditions determine the survival and successful transmission of T. cruzi. We propose that different types of channels integrate a homeostatic network that allows the parasite to detect and respond to these external changes. Combining molecular, cellular and electrophysiological approaches we are characterizing the expression and function of a putative calcium-activated potassium channel (TcCaKC). TcCaKC was expressed in Xenopus laevis oocytes by microinjection of cRNA to characterize the biophysical properties of the channel by two-electrode voltage clamp. Oocytes expressing TcCaKC and exposed to voltage pulses show a significant increase in inward current after addition of calcium ionophore ionomyocin. Similar responses were elicited after raising intracellular calcium by pre-incubation with SERCA pump inhibitor thapsigargin. These responses can be abolished by introduction of calcium chelator EGTA. Through homologous recombination, knockout parasites were generated deleting one or two alleles of TcCaKC gene. Through fluorometric measurements with calcium indicator Fluo-4, membrane potential indicator DisBac2(3), and intracellular pH probe BCECF, we have found that epimastigote forms lacking TcCaKC gene had abnormalities regulating calcium levels, intracellular pH, and membrane potential. Knockout parasites show a significant decrease in production of infective forms and intracellular replication, pointing to an important role of TcCaKC in infectivity. Our results indicate that TcCAKC is a potassium channel that contributes to homeostatic regulation of important physiological processes.

20* TO LIVE AND DIE IN LA: CONSERVATION OF THE WESTERN GRAY SQUIRREL IN GRIFFITH PARK THROUGH GENETIC ANALYSIS

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While there is an increasing trend of population reductions of the Western gray squirrel (WGS) in California, no genetic research had been done to assess the extent of this loss. Griffith Park (GP) is a large urban park in Los Angeles, which is home to a small population of WGSs that is presumably isolated from the larger contiguous population in the Santa Monica Mountains (SMMs) and other local populations near GP. The park and surrounding areas have factors responsible for local population contractions including habitat fragmentation, potential competition with the Eastern fox squirrel (Sciurus niger), and other anthropogenic disturbances, which pose a risk for local extinction. In order to assess the WGS population for conservation purposes, genetic diversity was estimated for the population in Griffith Park. Non-invasive sampling was conducted at three sample sites in GP to collect hair from which DNA was extracted. Twelve microsatellite loci and the mtDNA control region were used to characterize the genetic diversity of WGS in GP. Metrics included gene flow, population structure, bottleneck events, allelic richness, and relatedness. Diversity estimates for WGSs in GP were compared to diversity estimates for two other WGS populations, SMM and Bonelli Park (BP). Microsatellite results indicated low levels of genetic variation within GP, high relatedness, and elevated genetic differentiation among subpopulations. Nuclear DNA and mtDNA analyses suggested that GP is isolated from both SMM and BP. Overall, results revealed that WGSs in GP are vulnerable to extinction and confirmed the need for its management.
KELP FOREST RESTORATION OFF OF THE PALOS VERDES PENINSULA

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Approximately 61.5 hectares of rocky reef habitat have persisted as urchin barrens on the Palos Verdes shelf for the past 60 years. Active management of this rocky reef complex, to restore the giant kelp (\textit{Macrocystis pyrifera}) community to the reef was started in July 2013, via the reduction of purple sea urchin (\textit{Strongylocentrotus purpuratus}). Presently, over 16 hectares of rocky reef have been restored via in situ culling; reducing purple sea urchin densities from 36/m\textsuperscript{2} to 2/m\textsuperscript{2}. Additional monitoring includes; giant kelp density and biomass, sea urchin gonad indices, species richness, and fish biomass. The monitoring is designed to quantify the changes in structure, function, productivity and richness as a result of the reduction in urchin density. Our results suggest significant progress towards the restoration of a stable and productive rocky reef ecosystem.

HISTORICAL BIOGEOGRAPHY OF THE \textit{STREPTANTHUS HOWELLI} ALLIANCE

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\textit{Streptanthus} (jewelflowers, Brassicaceae) is almost entirely restricted to western North America and has served as a model system for understanding rarity and edaphic specialization. Thirty of 35 recognized \textit{Streptanthus} in California are listed as rare by the California Native Plant Society. Recent phylogenetic research has shed light on evolutionary relationships in the genus, but the \textit{Streptanthus howelli} Alliance (SH), a clade of 10 perennial taxa ranging across the western U.S., has not been thoroughly sampled. Using genome-wide sequencing (RADseq), I produced a well-resolved phylogeny of the SH. Using this phylogeny, I am in the process of analyzing historical biogeographic patterns and the evolution of morphological traits. This research will result in taxonomic clarification and shed light on biogeographical and evolutionary patterns within Southern California and beyond. These taxonomic changes and data collected in the field threats will help to identify species that are in need of increased conservation attention, two of which are new to science, and will be described in the course of my research.

EXPLOITATION INTENSITY PREDICTS MPA EFFECTS ON TARGETED FISHES

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Fishing often targets the largest individuals in a population, resulting in negative impacts such as, smaller body sizes, younger maturation, and decreased productivity. Marine Protected Areas (MPAs) can be effective tools in marine resource management that combat the effects of fishing on ecosystems. In 2012, 52 MPAs were established to counter over exploitation in Southern California, which has high levels of fishing pressure. The goal of this study was to determine if the level of exploitation prior to MPA implementation predicted differences among MPAs in their effects, particularly changes on fish body size, among MPAs. We conducted diver-operated stereo-video transects in seven different MPAs to determine differences in fish body size between each MPA and a nearby comparison area. We used California Recreational Fisheries Survey data to determine levels of fishing pressure in the vicinity of each MPA prior to its protection. We found that species targeted in fisheries were significantly larger in MPAs than in unprotected comparison areas, but that the difference in size inside versus outside the MPA varied among sites. Preliminary results suggest that levels of exploitation prior to MPA protection predict differences in the MPA effect on body size: areas with less intense fishing pressure showed greater differences in fish size inside versus outside of MPAs than areas with higher fishing pressure. The success of an MPA relies on proper placement, and a sound understanding of how fishing pressure and other spatial factors influence the efficacy of MPAs can aid in better-informed use of ecosystem-based management.
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The endemic Alexander Archipelago Wolf (*Canis lupus ligoni*) inhabits the fragmented island landscape of Southeast Alaska, also home to the Tongass National Forest. Isolated predator-prey communities may be influenced by spatial features throughout a given landscape, destabilizing population dynamics. This geographic and genetic fragmentation is further impacted by the re-emergence of the timber industry on several large islands in the archipelago that target old growth stands. Timber harvest expansion detrimentally impacts the home range of the wolves’ main prey source, the Sitka Black-Tailed deer (*Odocoileus hemionus sitkensis*). Consistent patterns in telemetry and feces data indicates that home range of the deer is positively correlated to stable wolf pack size throughout the year, and individual wolf range is inversely related to available low-elevation old growth winter habitat for the deer. Analysis of telemetry data and long term wolf-deer population models indicate that the re-initiation of large scale timber harvest, including the recent US Forest Service funded Big Thorne Deal, has had a detrimental impact on productivity and mortality for both species. The expansion of roadways and clear cutting tracts has decreased the wolf population on several key islands by as much as 75%, and has led to several deer population collapses. While short term regulatory shifts in road access and timber selection are significant, the stability of old growth stands for sustained deer carrying capacity is the most important factor for long term wolf pack maintenance. Several forest management plans are suggested, including silviculture of second-growth stands and alternatives to clear cutting.

J.A. Rodriguez and J.A. Reyes. Pacific Coast Environmental Conservancy

Our Earth consists of four oceans that inhabit marine life, but five seas of plastic pollution, which are known as gyres. Of these five gyres, the North Pacific Gyre of the Pacific Ocean is the largest, consisting of 100 million tons of garbage. The area that the North Pacific Gyre covers supports thousands of fish species, the myctophid being one of them. Myctophids make roughly 50-60 percent of the ocean’s fish-mass and serve as food for other top predators, such as tuna, mahi mahi, and squid. Not only are these fish most likely to mistakenly eat many items that linger around the gyre, but the degradation of many plastic items, plastic being the number one form of debris in this gyre, release many chemicals such as polychlorinated biphenyls (PCBs) and DDTs, which are known to cause endocrine disruption. This contributes to these findings by measuring plasma concentrations of triiodothyronine (T3), thyroxine (T4) and cortisol. Our results showed that debris exposure in Myctophids resulted in disrupted stress and developmental systems; fish exhibited lower T3 levels and Cortisol levels in gyre sites compared to a farfield site. Results also showed an impacted proteome from fish within the gyre sites compared to the farfield site. These findings suggest that the pollution found in these gyre locations are indeed causing an effect on marine wildlife living amongst it and is possibly being passed along the food chain. Future studies will focus on potential impacts to top predators, including humans, as a result of bioaccumulation.
We report here the first bioeconomic model designed to optimize whale-watching effort for sustaining a spinner dolphin (*Stenella longirostris*) population in the Philippines. The model is based on the maximum sustainable yield (MSY) concept. Whale-watching can negatively impact the behavior, habitat use and life history of cetaceans. To sustain a population under whale-watching, operators still need to make a profit. We investigated the bioeconomics of unrestricted whale-watching in one of the more popular whale-watching cities of the Philippines. We evaluated annual cost and revenue of operators and modeled a population of spinner dolphin under different levels of whale-watching effort. For the years 1995–2013, 12 of the 16 vessels lost an average of $4,000/yr. Sensitivity analysis showed that operators lost money when depreciation rate was set as low as 1%. Under current effort (n=16 vessels), the dolphin population is predicted to decrease by 94% in 25 years. Under high levels of effort, more cetaceans are exposed to vessels and fail to reproduce. Our model showed that since operations began, the abundance of spinner dolphin fell below the MSY as effort increased. We recommend a fixed number of permits, in which all operators cooperate to limit vessels out on the ocean. Even with as few as 4 vessels, the population declines. However, if effort is reduced to 3 vessels/day, our model predicts that the population will increase by 75% in 27 years. Our results indicate that the spinner dolphin population is overexploited by current whale watching and can be expected to decline.

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**ENDOCRINE DISRUPTION SCREENING OF CALIFORNIA HALIBUT, *PARALICHTHYS CALIFORNICUS*, IN LOCAL SOUTHERN CALIFORNIA ENVIRONMENTS**

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California Halibut, *Paralichthys californicus*, is a crucial fish in recreation, sport fishing, and aquaculture, which directly results in human consumption, so to determine the impacts on wild populations and how that may potentially correlate to aquaculture systems, a preliminary study was conducted on blood samples of fish from a reference and impacted location. A total of 8 samples were taken from the Orange County (Newport Beach) area, organisms caught from the west coast of Catalina Island were used to represent the more pristine location (reference point). A series of assays were conducted on these samples; cortisol, thyroxine (T4), and triiodothyronine (T3) levels were compared between the two locations. The samples collected from Catalina were expected to have a higher ratio of T3 relative to T4 (as is seen in healthy animals) and higher cortisol levels. The results indicated that the Catalina samples showed expected results, while the Orange County samples displayed a lower ratio of T3 to T4 as well as a smaller average of cortisol due to inflicted stress. This supports the conclusion that the organisms were under greater stress in the impacted location due to a larger human population (human activity), and the results highlight their inability to combat the environment. The results conclude that California Halibut, *Paralichthys californicus*, exhibit a disrupted endocrine system due to a highly impacted environment. Future studies will look at proteomic analysis of these samples, as well as, whether similar impacts are seen in aquaculture systems.
Rockfish are one of the most popular recreational fisheries in California. In some rockfish species, the male displays an elaborate courtship dance prior to copulation. It has been proposed that male rockfish may be releasing pheromones into the water near potential mates via urine, thus pheromones may play a role in female mate selection. The aim of our study is to describe the differences in urinary bladder morphology between male and female blue rockfish (*Sebastes mystinus*) to test this hypothesis. Blue rockfish were collected via hook and line off the coast of Santa Barbara from November 2016 – March 2017. Urinary bladders were dissected from adult fish, weighed, and processed for paraffin histological analysis. Male urinary bladders weighed significantly more than female urinary bladders (p < 0.031). A urinary bladder somatic index (UBI) was calculated (urinary bladder weight /bodyweight x 100%), in which male UBI was significantly greater than females (p = 0.0019). Histological examination revealed that the female urinary bladder largely consists of organized transitional epithelium, whereas the male urinary bladder had a thicker, transverse epithelium. The morphological differences between the urinary bladders of male and female blue rockfish may be indicative of a specialized urinary bladder capable of producing and secreting pheromones. Other male fishes (e.g., *Pseudoplesiops* spp.) have urinary bladders with thickened epithelia and have been shown to secrete pheromones. Our research will contribute to our understanding of rockfish reproduction and provide insight into the possibility that blue rockfish may utilize a pheromone in mate selection.

As ocean temperatures steadily rise, marine species will be exposed to more extreme diel and seasonal fluctuations. These overall temperature increases may expose sedentary reef species like the Bluebanded Goby (*Lythrypnus dalli*) to temperatures that are near or over their physiological optimum. Understanding how the metabolic rates of sedentary species respond to increasing temperature may help predict whether natural populations will be able to acclimate to increasing ocean temperatures. However, relatively little is known about basic metabolic rates of Southern California reef fishes with limited movement. Using respirometry, we estimated resting oxygen consumption (VO$_2$) and calculated metabolic rates (MR) at three different temperatures (13°C, 16°C, and 20°C) for 43 *L. dalli* individuals of varying sizes. As predicted VO$_2$ and MR significantly increased with temperature and mass. Mass-specific metabolic rates were moderately sensitive to temperature change. The Q$_{10}$ value across the range of experimental temperatures was 2.99. When compared to other teleost species (Q$_{10}$ = 1.68 to 2.40), *L. dalli* has a relatively high sensitivity to temperature change. Thermal fluctuations likely play a significant role in the ecology of these gobies and continued increases in seawater temperature will either necessitate an increase in consumption or drive costly trade-offs between metabolism and processes such as growth and reproduction.

Connectivity among benthic marine invertebrate populations relies on development of planktonic larval cohorts. Echinoderm larvae exhibit phenotypic plasticity, where development of long arms in low-food conditions is considered advantageous for improved algal particle capture. Conversely, larvae in abundant nutrients redirect growth to post-larval structures and develop quickly. This study seeks to understand the
physiological consequences of this morphological plasticity in the sand dollar *Dendraster excentricus* by comparing larvae developing in low and high algal concentrations (1,000 and 10,000 algal cells ml⁻¹, respectively). Three independent spawns were implemented to track ingestion, metabolism, and growth rates (protein and lipid) during development. Resulting phenotypes demonstrated morphological divergence, where high-fed larvae grew smaller arms relative to stomach size (a remaining post-metamorphic feature) compared to low-fed larvae. Physiological data were converted to energetic units (mJ) to determine assimilation and growth efficiencies. After 30 days, cumulative low-fed algal ingestion was equivalent to 22 mJ compared to 229 mJ in high-fed larvae. While total energy ingested reflected the 10-fold difference in feeding concentration, partitioning of energy between growth and metabolism was significantly different. Low-fed larvae proportionally allocated more energy to metabolism while high-fed allocated more toward growth. This resulted in similar assimilation efficiencies of low- and high-fed larvae (~50%), but different net growth (50 and 64%, respectively) and protein growth efficiencies (23 and 44%, respectively). Understanding the energetic demands and growth capacities of these contrasting phenotypes is important for defining response-mechanisms available to these critical life-stages in rapidly changing marine conditions.

### 31 CHEMICAL POLLUTION ALTERING ENDOCRINE PHYSIOLOGY IN LOCAL FLATFISH, *PARALICHTHYS CALIFORNICUS*, OF SOUTHERN CALIFORNIA

**J.A. Rodriguez** and J.A. Reyes. Pacific Coast Environmental Conservancy

In recent years, populations in coastal regions, such as in the Southern California Bight, have been rapidly increasing. With such an increase in population, there has also been an increase in pollution, consequently an increase in chemical pollutants in marine environments that are capable of endocrine disruption. Little is known on the extent of which these existing pollutants are affecting marine organisms. In order to measure the degree of impact such chemical pollutants may possibly have on marine organisms, thyroid and cortisol hormone concentrations were measured along with Proteomic analysis in *Paralichthys californicus*, California halibut, of Alamitos Bay (impacted site) and Catalina Island (reference site). Plasma concentrations of triiodothyronine (T₃) and cortisol were significantly lower in fish sampled in Alamitos Bay than those sampled in Catalina Island. Thyroxine (T₄) levels were then significantly higher in fish sampled in Alamitos Bay than those in Catalina Island. Our study has targeted *P. californicus* for it has increasingly become a top choice in commercial fisheries, and thus human consumption. With higher levels of T₄ hormone (inactive) present in the plasma of the samples in the impacted site, suggests that there is a poor expression of deiodinase in the system. With lower levels of T₃ hormone (active) present, this indicates that there is poor expression of vital proteins and signals throughout the body. This information provides insight on whether or not the consumption of these local flatfishes can possibly affect organisms found on the higher end of the food chain.

### 32*F AMONG-POPULATION VARIATION IN DIET OF BLACK PERCH *EMBIOTOCA JACKSONI*

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By studying the diet of an animal, we may better understand fundamental aspects of its ecology such as competitive potential, niche width, and the functional role it plays within its community. Diets may vary naturally among populations, but inferences about diets may depend on the methods used to measure them. We used two complementary methods, stomach content and stable isotope analysis to quantify the diet of five separate populations of Black Perch (*Embiotoeca jacksoni*) throughout the Southern California Bight (n = 154 total fish). Stomach content analysis describes short-term diet and directly observes what each individual consumed prior to capture, while stable isotopes (δ¹³C and δ¹⁵N) describe long-term diet. Niche width for each population was described by the total area of stomach content and isotope space occupied by the population. Competitive potential was measured by calculating the mean distances between fish in isotope and diet space. Stomach content and isotope analyses both indicated significant,
among-population variation in diets. Mean distance among individual fish differed among populations (ANOVA; \( F_{4,149} = 5.29, P < 0.001 \)). These results suggest that niche width and competitive potential may differ among populations of Black Perch in southern California. Furthermore, stomach contents suggest that some populations are composed of groups of specialists, which may have consequences on long-term resilience of populations.

33*  RELATION OF FOOD SOURCE AVAILABILITY AT HUNTINGTON STATE BEACH TO THE CALIFORNIA LEAST TERN (STERNULA ANTILLARUM BROWNI) DIET

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The California Least Tern (Sternula antillarum browni) is a federally endangered bird due to habitat loss and predation. Food availability, often reduced as habitats are lost or degraded, impacts nesting success and fledgling survival. Our study focused on the Huntington State Beach tern preserve and how food availability affects the diet of California Least Terns. The Huntington State Beach tern preserve has access to both the Pacific Ocean (marine habitat) and the Santa Ana River (tidal riverine habitat). Seines were conducted at both habitats during the mating, chick, and fledgling stages of the California Least Tern mating season. We determined that fish abundance, species richness, and community composition did not differ between habitats but topsmelt was the most abundant food source in both locations. Additionally, we found that topsmelt were significantly smaller during the chick and fledgling stages than during the mating stage. Further, using behavioral observations, we determined that more foraging was completed in the marine habitat rather than the tidal riverine habitat. Preliminary guano analysis data also suggest that Atherinopsidae is the predominant diet source. This study shed light on food availability in differing habitats and locational foraging preference as it relates to the overall health and survival of the endangered California Least Tern at this colony.

34*F  DIEL MOVEMENTS AND FINE SCALE ACTIVITY PATTERNS OF THE CA HORN SHARK, HETERODONTUS FRANCISCI

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Because water temperature influences internal body temperatures of ectothermic sharks, it is considered the key environmental variable to directly influence their physiology (e.g., metabolism, appetite) and behavior (e.g., movement patterns, feeding rates). This project uses active acoustic telemetry and accelerometer data loggers (ADLs) to quantify diel movements and fine-scale activity rates of horn sharks (Heterodontus francisci) as they move through a heterogeneous thermal environment. At Catalina Island, nine horn sharks (1.8 to 3.5 kg) were fitted with custom tag packages that include an acoustic transmitter (Vemco V9-6L) and an ADL (Cefas G6a), which records 3D body acceleration, depth, and temperature. Each shark was continuously tracked for 24 h. After being tagged, individuals tended to rest in shallower, warmer water during the day. Diel movement spaces ranged from 1,140 m² to 44,440 m², with the majority of movement activities occurring at night. During the nighttime activity periods, horn sharks experience up to a 10°C difference while traversing deeper (>30 m habitat). The proportions of time horn sharks spent active relative to depths and temperatures were modeled to determine how they use heterogeneous environments on a reef. Differences by size and sex were additionally examined to determine what mechanisms influence horn shark activity. Quantifying horn shark movements and activity across heterogeneous environments will allow us to quantify their energetic landscape and to predict how changing ocean temperatures may affect the distribution and behavior of this kelp forest associated species.
CONTRIBUTIONS OF GRAZERS TO NITROGEN RECYCLING IN TIDE POOLS: NOT ALL SPECIES ARE EXCRETING EQUALLY

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Bottom-up processes play important roles in shaping the dynamics of ecological communities. For example, nutrient availability can affect the diversity and abundance of primary producers. An important local-scale source of nutrients is the metabolic by-products of consumers. Here, we evaluated ammonium excretion rates of four groups of intertidal invertebrates, turban snails (Chlorostoma spp.), chitons (Nuttalina fluxa and Cyanoplax hartwegii), limpets (Lottia spp.), and littorine snails (Littorina scutulata), and considered whether overall excretion rates could be predicted based on abundance or biomass. We found substantial differences in the per-biomass excretion rates of the grazers, which spanned three orders of magnitude. Turban snails contributed the most nitrogen on a per-gram basis (11.4 ± 7.6 µmol hr⁻¹ g⁻¹ [mean ± SD]), followed by chitons (8.3 ± 2.2 µmol hr⁻¹ g⁻¹), littorine snails (2.7 ± 2.0 µmol hr⁻¹ g⁻¹), and limpets (0.5 ± 0.1 µmol hr⁻¹ g⁻¹). We combined these data with surveys of grazers in tide pools to predict the contribution of each group to overall in situ nutrient recycling rates. Whereas turban snails contributed the most (~59%) to ammonium excretion in tide pools, littorine snails also made substantial contributions (~34%) due to their high abundances. Although chitons had a relatively high excretion rate, they were uncommon and contributed little to overall nutrients (~4%). Limpets contributed little (~2%) to overall ammonium fluxes. Excretion rates were not predicted by total grazer biomass in tide pools, demonstrating the need for species-specific measurements in order to calculate the contributions of different grazer species to nitrogen recycling.

WILL CALIFORNIA GRUNION LARVAE ADAPT TO OCEAN ACIDIFICATION?

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A decline in the pH of seawater can reduce survival and growth during the larval stages of many marine species. However, if populations have the genetic capacity to adapt and increase their tolerance to low pH, then such genetic changes may offset the harmful effects of ocean acidification. We used a breeding experiment to measure the genetic variance for low pH tolerance in a nearshore forage-fish: the California grunion (Leuresthes tenuis). We raised families of grunion larvae across an experimental pH gradient and measured their mortality rates over a 14-day interval during the early larval stage. Our results indicated that low pH significantly decreased the survival rates of grunion larvae overall. However, families varied widely with respect to pH tolerance, and many families had similar mortality rates in high and low pH treatments. Quantitative genetic analyses indicated that pH tolerance has a substantial genetic basis and that maternal effects on pH tolerance were also appreciable. These results suggest that populations of California grunion may adapt relatively quickly to long-term changes in ocean pH.

LONG-TERM TRENDS IN ROCKFISH (SEBASTES SPP.) POPULATIONS AT TWO SITES IN SOUTHERN SANTA MONICA BAY

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The Vantuna Research Group has been monitoring fish populations at King Harbor, Redondo Beach and Rocky Point, Palos Verdes for over 40 years. Quarterly, divers swim transects along the bottom for 5 minutes on 3 m isobaths at each of the seven stations, which vary in depth from 4 m to 16 m. Over a mean of 45 transects per quarter, the divers record all fish encountered, separated by life history stage (adult, sub-adult, juvenile). At the two sites, 11 distinct species of rockfish (Sebastes spp.) were recorded and between 2 and 8 species were observed each year. Rockfish are an economically important genus for both the commercial and sport fishing industries in California. They are species known to inhabit cool temperate waters, and the area surveyed is South of the preferred habitat for most shallow-dwelling members of the genus. La Niña events are characterized by cooler than average sea surface temperatures.
in southern California and preliminary data indicates that higher rockfish abundance during those years. Furthermore, El Niño events are characterized by warmer than average sea surface temperatures and fewer rockfish species were encountered during and following the strong El Niño events of 1982-83, 1987-88, and 1997-98.

38°F  TOP-DOWN VERSUS BOTTOM-UP PROCESSES IN A PROTECTED EELGRASS BED (ZOSTERA MARINA) AT SANTA CATALINA ISLAND

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Seagrass beds provide critical nursery habitats for many economically important juvenile fishes and invertebrates. Unfortunately they have been in decline globally, and by as much as 90% in southern California due to intensive coastal development. Little is known about the trophic effects of top-level fish predators or their relative interactive effect with bottom-up processes such as eutrophication. We performed two caging experiments during two summers in a marine reserve on Santa Catalina Island, which has low human impact and essentially no terrestrial nutrient input. The first experiment, in 2015, used two different mesh sizes exclude and assess the role of different fishes. The second experiment, in 2016, had an orthogonal design with crossed treatments of predator exclusions and nutrient additions. Invertebrate diversity, epiphytic algal biomass, and eelgrass blade height were compared among treatments in each experiment. In the first experiment, eelgrass blade elongation averaged of 20 cm greater in predator exclusion cages than control treatments over the course of the two-month experiment. In the second experiment, in contrast to the first, blade height decreased in all treatments over the course of the experiment. Although there were differences in the experimental design and layout of the two experiments, the contrasting results between years highlights a need for more long-term studies of the basic ecology of this ecosystem.

39*  THE EFFECTS OF PHLOROTANNIN CONCENTRATIONS OF BROWN SEAWEEDS (PHAEOPHYCEAE) ON THE FEEDING RATES OF THE BLACK SEA HARE, APLYSIA VACCARIA

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In marine ecosystems, herbivory plays a vital role in ecosystem function and can drive seaweed community structure. In response to herbivory, some seaweeds produce chemical defenses to deter consumption, such as the production of phlorotannins by brown algae (Phaeophyceae). Phlorotannins are a phenol-based chemical deterrent and these secondary metabolites have been found to reduce herbivory by decreasing seaweed palatability. The black sea hare, Aplysia vaccaria, is one of the largest marine herbivorous gastropods in our coastal ecosystems. It is a voracious grazer, reaching 14 kg within its 1-year life span, and consumes primarily, if not exclusively, brown algae. While phlorotannin concentrations have been previously shown to reduce consumption in some herbivores, little research has been conducted with large herbivores exhibiting high consumption rates, such as A. vaccaria. The phlorotannin concentration of a series of brown seaweeds from shallow-waters off the southern California coast was determined using a standard Folin-Ciocalteau method. As found in other regions, the kelps tended to have a lower amount of phlorotannins whereas Fucoids tended to have a higher amount. In controlled laboratory feeding experiments we determined consumption rates of A. vaccaria for multiple taxa of brown algae. We examined the relationship between feeding rates and phlorotannin concentrations and found that there was not a significant relationship, although a slight trend is observed. Currently, we are continuing feeding experiments with additional phaeophycean taxa.
**40°F  EFFECTS OF EL NIÑO ON ANCHOVY AND TOPSMELT POPULATIONS IN SAN DIEGO BAY**

**M.M. Roethler, J.P. Williams, and D.J. Pondella, II. Vantuna Research Group, Department of Biology, Occidental College**

The unusually warm waters occurring during El Niño can lead to significant changes in fish assemblages. The most recent El Niño (2015-2016) is one of the strongest ever recorded. This project examines the changes in abundance, biomass, and size of three anchovy species (Northern Anchovy, *Engraulis mordax*; Deepbody Anchovy, *Anchoa compressa*, and Slough Anchovy, *Anchoa delicatissima*) and Topsmelt, *Atherinops affinis*, in San Diego Bay from 1995-2016, focusing on the El Niño events from 1997-1998 and 2015-2016. While Northern Anchovies have been studied extensively during El Niño events, the response of the other three species is relatively unstudied. It was hypothesized that all species would experience significant decreases in abundance, biomass, and size during El Niño events, particularly Northern Anchovies. However, no species experienced such a decline. Moreover, Northern and Deepbody Anchovy size significantly increased during El Niño events. Temperature was nearly universally an important factor in predicting the abundance and biomass of all four fish species. Salinity and time of year were also important factors. While fish community structure shifted significantly during the 1997-1998 El Niño, the same was not true for the 2015-2016 El Niño. The difference in response of the fish communities can potentially be attributed to the shift in the Pacific Decadal Oscillation to a cool phase following the 1997-1998 El Niño. The non-significant reaction of Anchovy and Topsmelt populations in San Diego Bay to El Niño demonstrates that estuarine fish populations may be less affected than their pelagic counterparts by large-scale oceanographic events.

**41*  WATER INFILTRATION AND POLLUTANT REMOVAL EFFICIENCIES IN THE BALLONA CREEK RAIN GARDEN**

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The Ballona Creek Rain Garden, located in Culver City, CA, is an engineered biofiltration system designed to capture runoff flowing from 11.1 acres of industrial/commercial property. The garden measures 300 by 3 m in dimension (900 m²) and is designed to capture runoff from a 0.75-inch storm via five inlets. When filled, runoff overflows into Ballona Creek from two outlets. The goal of this study was to determine the efficiency of the garden to infiltrate runoff and retain pollutants. Flows were measured at all inlets and outlets using 90° V-notch weirs outfitted with Hobo water level sensors to produce hydrographs. Concentrations of pollutants (total suspended solids, metals (copper, zinc, and lead), fecal indicator bacteria (*E. coli*, enterococci), polyaromatic hydrocarbons, and petroleum and diesel hydrocarbons) were measured at all flowing inlets/outlets two to three times per storm depending on its duration. The summation of load method was used to calculate the mass of contaminants entering and leaving the garden for each storm event, and their percent capture in the garden. On average, 89% of the runoff was retained in the garden with 100% for the smaller storms <1-in, and 75% for the largest storm of 3.1-in where 3,915 m³ of runoff was infiltrated. Initial results for pollutant loading and retention indicated that the average percent retentions were in the 80-90% range for most pollutants and the 70% range for PAHs and diesel hydrocarbons. These mean values probably will remain similar when results are received for samples now being processed.
LONGITUDINAL TEMPERATURE PROFILE OF THE LOS ANGELES RIVER

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A pilot study to develop a longitudinal temperature profile of the Los Angeles River deployed continuously recording temperature loggers in 13 sites throughout the main stem and tributaries between June and October 2016. The river was divided into six zones based on channel conditions (soft bottom, concrete); main stem sites were distributed throughout all zones; and tributary sites were located just above their confluence with the main stem. Locations were selected to reflect representative conditions of water depth and canopy cover. Water temperature was recorded at 30 minute intervals, generating maximum, mean and minimum monthly and seasonal temperatures at each site. Seasonal maximum temperatures ranged between 21-34°C, mean temperatures between 16-26°C and minimum temperatures between 13-25°C. No clear pattern of temperature from the headwaters to the ocean emerged, although diurnal differences between soft bottom and concrete channel reaches were observed. Overall, temperatures were too warm to support re-introduction of native fish species but currently support reproducing populations of several generalist non-native fish species dominated by tilapia and carp. Temperature mitigation throughout the river, but especially in the proposed restoration area will be needed if native fish species are to become re-established in the Los Angeles River. Albeit limited in scope, the present study establishes a baseline profile of summer/fall temperatures in the Los Angeles River, to which future conditions may be compared.

CHARACTERIZING THE CHANGE IN CDOM FLUORESCENCE DUE TO RIVER RESTORATION WITH THE USE OF PARAFAC MODEL

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This study identifies how the composition of chromophoric dissolved organic matter (CDOM) changes in Alvarado Creek due to river restoration using fluoresce spectroscopy and the PARAFAC model. In 2016, the San Diego River Conservancy supported the removal of non-native vegetation from Alvarado Creek, a tributary to the San Diego River. Such a change in the watershed provided a unique opportunity to explore the relationships of CDOM composition, land use, and water quality in an urban ecosystem. Both spatial and temporal samples were collected in Alvarado Creek, representing stream conditions pre, mid, and post restoration. Fluorescent components of each sample were determined using the fluorescence excitation-emission matrix (EEM) and characterized using the PARAFAC model. Preliminary analysis using the PARAFAC model has identified three unique fluorescent components in Alvarado Creek samples. There also appears to be a correlation between tryptophan like components and pathogenic bacterial loadings. Complimentary data, including the analysis of pathogenic bacteria, dissolved organic carbon, total nitrogen, and anion concentrations, has provided additional lines of evidence regarding water quality. PARAFAC modeling when compared to this complimentary data will help explain greater fluorescence patterns and broader implications on water quality.

PRELIMINARY EXPLORATION OF METHANE FLUX FROM THE SOUTH BAY SALT POND RESTORATION PROJECT


Coastal wetland ecosystems are incredibly valuable environments due, in part, to their ability to sequester and store carbon over long periods of time. There is a growing interest among coastal managers to capitalize on this carbon storage capacity to drive restoration and conservation efforts in the context of
emerging carbon markets. The South Bay Salt Pond Restoration Project (SBSPRP) is the largest tidal wetland restoration effort on the West Coast, launched in 2004 with an objective to restore 15,100 acres of industrial salt ponds in the south of the San Francisco Bay. While wetlands are extremely efficient carbon sinks, they also have the ability to produce and emit greenhouse gases like methane. If the SBSPRP systems are releasing methane into the atmosphere, it will influence the design of possible restorations efforts to maximize carbon storage. In order to monitor the production of methane in the SBSPRP, we deployed floating and fixed chambers in salt ponds undergoing various management regimes and an associated tidal marsh. To date, samples have been collected in November 2016, January 2017, and March 2017. Our results suggest that some ponds are releasing significant amounts of methane, but only during some portions of the year, indicating that methane fluxes may be subject to seasonal variability. We will continue to explore the seasonal dynamics that may drive methane fluxes from the SBSPRP to better understand the role that these coastal ecosystems play within global climate change.

45* EFFECTS OF EELGRASS RESTORATION ON INSHORE SEDIMENT STABILIZATION IN THE NEWPORT BACK BAY, CA

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Rising sea levels make the management of coastal erosion a priority for urban areas. Additionally, as vital coastal ecosystems are declining, future coastal protection strategies should aim to both mitigate erosion and restore native habitat. Current methods to prevent erosion can have devastating impacts on local communities and ecology, often creating greater damage to coastal areas than the erosion they mitigate. We investigated the effects of seagrass restoration in the Newport Back Bay on in-shore sediment. Samples at +0.5m MLLW (mean lower low water) were collected bi-monthly at both restored and control locations. Grain size and organic carbon were analyzed to measure sediment stabilization and deposition of fine-grained particles. After two months, initial findings suggest that eelgrass restoration resulted in increased deposition of finer sediment particles in-shore, a sign of decreased erosion from wave and current energy. On average, fine-grained particles increased 5.1% and sand particles decreased 6.4%. Additionally, sites with restored eelgrass experienced reductions in organic carbon content by 0.14%, potentially as a result of increased retention of organic carbon in the beds themselves. Data collection is ongoing, but these initial findings suggest that restored eelgrass beds provide significant protection from erosion to in-shore sediments. This research could inform sea level rise adaptation strategies that promote the use of native ecology in coastal urban infrastructure. It is important that further research of alternative coastal infrastructure such as living shorelines be incorporated into decisions about climate adaptation because of their efficiency, affordability, and layered benefits.

46* EVALUATING BASELINE BIRD COMMUNITY AFTER BEACH RESTORATION

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Sand dunes provide various ecosystem services including providing habitats for native species, managing sand transport, and serving as a buffer against tides, storms, and sea level rise (SLR). Southern California coastal beaches have been heavily impacted by extensive mechanical grooming (raking) to remove trash. Grooming also removes vegetation and alters geomorphic processes that form dunes. As a result, Southern California coasts have experienced a significant decrease in native wildlife biodiversity and in resilience to SLR. The Bay Foundation implemented a restoration project in December 2016 on three acres of Santa Monica State Beach with two primary objectives: to restore a native beach habitat that has undergone extensive grooming and to allow the formation of small dunes to increase coastal resilience. To monitor the effectiveness of restoration efforts for the bird community, avifauna presence and behavior surveys were conducted on low tides 8 times from February to April 2017. Avifauna are evaluated as indicators of an ecosystem’s health because they respond quickly to changes in the environment. Bird communities were surveyed at the restoration site and at two adjacent groomed and
unseeded sites, located approximately 200 meters north and south of the restoration site. Bird counts were evaluated over time, between the three sites, and against human use data. Preliminary results suggest a variety of shorebirds and gulls using the restoration area, including the notable new addition of the threatened Western Snowy Plover (*Charadrius alexandrinus*), which previously had not been seen on that portion of Santa Monica Beach.

47* DIVERSITY EFFECTS IN A LONG TERM STUDY OF A COASTAL WETLAND

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The loss of as much as 90% of coastal wetlands in California over the past century has motivated research aimed at understanding the effects of such habitat decline. In particular, the loss of key ecosystem functions is thought to be due to observed reductions in species diversity. Studies of biodiversity-ecosystem function (BEF) are abundant in terrestrial ecosystems, yet very few focus on marine ecosystems, especially in the context of restoration. To address this knowledge gap, we manipulated salt marsh plant diversity in a large-scale field experiment of an urban coastal wetland in Long Beach, CA, and monitored productivity in the experimental plots after the first and third year of restoration. To monitor overall diversity effects, we partitioned them into complementarity and selection. Complementarity results from species exhibiting higher performance capacity on average in mixtures compared to in monocultures, whereas selection occurs when species that perform best in monocultures also do best in mixtures, relative to other species. After one year, we observed a significant positive effect of plant diversity on productivity due primarily to selection effects, consistent with results of other short-term studies. However, by the third year, complementarity replaced selection as the main driver of biodiversity effects. These results indicate that short-term experiments may underestimate and misidentify the mechanisms that drive diversity effects as plant communities mature, which is an important consideration when making decisions about the restoration of marine ecosystems because it influences their success.


R.G. Appy Cabrillo Marine Aquarium

During studies on fish and macroinvertebrate parasites of Anaheim Bay, larval tapeworms resembling *Rhinebothrium urobatidium* (Young, 1955) were found in the gall bladder of a number of small benthic fish species. *R. urobatidium* is one of the most abundant parasites of the round stingray, *Urobatis halleri*, which is a common ray in Anaheim Bay. The purpose of this study is to describe the morphogenesis of *R. urobatidium* and confirm the identity of the larval tapeworms found in the gall bladder of fishes in southern California. Eggs of *R. urobatidium* were taken from *U. halleri* collected in Anaheim Bay and Two Harbors, Catalina Island, and fed to the tidepool copepod, *Tigriopus californicus*, held at 21°C. Hexacanth larvae penetrated the digestive tract, became quiescent in the hemocoel of the copepod and developed into larva with a single apical sucker. Infected copepods were fed to arrow gobies, *Clevelandia ios*, where larvae were initially found among the intestinal villi, and subsequently migrated up the bile duct into the gall bladder and developed into juvenile worms with four loculated bothridia. Larvae were morphologically identical to those found in the gall bladder of fish collected in Anaheim Bay. While there are numerous reports of larval stages of members of the Rhinebothrioidea from various invertebrate and fish intermediate hosts, this is the first experimental transmission of a member of this Order.
49 IS THE ASIAN BURROWING SHRIMP, UPOGEBIA MAJOR, FOLLOWING ITS BOPYRID ISOPOD PARASITE TO SOUTHERN CALIFORNIA?

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Establishment of the Asian burrowing mud shrimp, Upogebia major, in San Francisco Bay, Drakes Estero and Bodega Harbor, California amplifies a present threat to congeneric native species from its coevolved Asian bopyrid isopod parasite, Orthione griffenis. High incidences of effective castration by O. griffenis are associated with the collapses or extinctions of most populations of the native mud shrimp, Upogebia pugettensis, from Morro Bay, California to British Columbia. O. griffenis presently occurs in southern California and may have arrived in the eastern Pacific without a native host. No Asian Upogebia were known in North America prior to the discovery of U. major in San Francisco Bay in 2010 and thus, O. griffenis may have been limited previously when severe declines of intensely infested native Upogebia species occurred. The spread of U. major to southern California will provide a persistent alternative host for O. griffenis and thus, will threaten native southern California Upogebia species by direct competition and by increasing the abundances and persistence of O. griffenis.

50 DISTRIBUTION OF TWO HOST-SPECIFIC PARASITES OF THE LONGJAW MUDSUCKER, GILLICHTHYS MIRABILIS, IN SOUTHERN CALIFORNIA WETLANDS; A TALE OF ISOLATION, EXTIRPATION AND LOCALIZED RECOLINIZATION

R.G. Appy, Cabrillo Marine Aquarium

Distribution of two host-specific parasites of the longjaw mudsucker, Gillichthys mirabilis, was examined in 15 Southern California wetlands from Mugu Lagoon to Tijuana Estuary. Transmission of Vasorhabdachona cablei (Nematoda), and Microsentis wardae (Acanthocephala) is through a single intermediate host, shorecrabs and ostracods, respectively. Only two wetlands, Anaheim Bay and Sweetwater Marsh contained both parasite species. One or both of these parasites were absent from all of the other wetlands. Both parasites were absent from mudsuckers in Bolsa Chica, Batiquitos, San Elijo and San Dieguito lagoons, despite the presence of intermediate hosts at these localities. The presence or absence of these parasites in each wetland appears to be a result of the geologic and anthropogenic history of each wetland, the differential susceptibility of each parasite life cycle to disruption, and physical barriers to dispersal of parasitized hosts from one wetland to another. Because adult mudsuckers and the intermediate hosts of these parasites have very small home ranges, there is little likelihood either V. cablei or M. wardae will ever recolonize wetlands from which they have been extirpated, especially where wetlands are separated by open coast. M. wardae apparently can reestablish in new/restored wetlands when adjacent/near to a refugium for this parasite.
POSTER ABSTRACTS IN PROGRAM ORDER

51* EFFECTS OF INVASIVE PLANTS IN CALIFORNIA WETLANDS

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Wetlands are important ecosystems that provide habitat and human services such as filtering water, providing buffers during storms, and reducing erosion. Despite this recognized importance, about 90% of wetlands have been lost in California. Of the remaining wetlands, many are degraded by human activities, including the spread of invasive species. Some of the worst wetland invaders are invasive plant species. In California, three examples of such invaders are Tamarix spp. Limonium ramosissimum, and Lepidium latifolium. All three invaders differ in structure from the surrounding native wetland species. First, it has been shown that Tamarix reduces the invertebrate community under its canopy compared to non-Tamarix canopies. Removal of this species showed that the invertebrate community has recovered in two years, but that the community overall has been changing over the years. Limonium ramosissimum in the Huntington Wetlands increased soil water content and increased densities of native snails immediately under the plant as compared to areas without L. ramosissimum. Another invasive species Lepidium latifolium was studied in Northern California and was shown to increase invertebrates under its canopy while decreasing species richness compared to non-Lepidium canopies in the upland transition zones, but no significant differences in the other zones of the marsh. With these three species in mind, we can start to see patterns of how structurally different invaders can act as ecosystem engineers in the salt marshes they invade. Studies such as these help prioritize among wetland plant invaders and potentially how to manage the removal of these species.

53* STUDY OF NATURAL CERAMIC GLAZES BY INFRARED MICROSCOPY

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Ceramic glazes are typically composed of common rocks and minerals, which contain silica, a glass former (SiO2), alumina, a stiffener (Al2O3), and a flux, a melting agent. The purpose of this research was to evaluate the composition of specific non-commercial, natural materials in an effort to inform their use in glaze formulations. Raw materials were collected on various outings throughout the vast and richly varied geologic landscape of California. These materials were chosen for analysis because they didn’t behave in predictable or logical ways when fired to 2380° F, in a reduction atmosphere on an iron bearing clay. It was hypothesized that natural materials contain multiple minerals and impurities, which may affect the materials behavior in a glaze recipe. Infrared microscopy (IR) by Attenuated Total Reflectance (ATR) was used to study these materials. The infrared spectra for natural materials were compared to widely used commercial materials and to an infrared spectral library of common materials used in the arts. For some of the materials, distinct particles were observed under a stereomicroscope. Based on the size and color, these particles were sampled separately. The results revealed the natural materials sampled (n=7) were either silicate or carbonate minerals. This information will be used to discuss how material composition may determine glaze qualities.

55* DIET AND VENOM ONTOGENY IN INSULAR AND HIGH-ALTITUDE POPULATIONS OF THE SOUTHERN PACIFIC RATTLESNAKE (CROTALUS HELLERI)

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The Southern Pacific Rattlesnake (Crotalus helleri) exhibits pronounced geographic variation in venom composition. Ontogenetic variation in lethality and enzyme activities has also been documented.
Transition from the more toxic, less proteolytic venom of juveniles to that of adults has been associated with a shift from lizard to rodent prey as the snake grows. In this study, we compared the diet and venom composition of two age classes of *C. helleri* from three populations. Specimens on Santa Catalina Island and the Transverse Range Mountains express proteolytic venom, whereas those in the San Jacinto Mountains possess neurotoxic venom that has been interpreted as paedomorphic—the retention of a juvenile characteristic (highly toxic venom) into adulthood. We hypothesized that 1) if diet influences venom composition, then diet ontogeny will differ substantially between the proteolytic and neurotoxic populations, and 2) that venom of the neurotoxic population will exhibit less ontogenetic change between juvenile and adult snakes than that of the proteolytic population. Stomach and fecal contents revealed that snakes from Santa Catalina Island and the Transverse Range Mountains had similar diets, whereas the San Jacinto snakes consumed a higher proportion of lizards. Reverse-phase high-pressure liquid chromatography (RP-HPLC) chromatograms confirmed that venom composition differed substantially between populations, but snakes in all populations showed fairly substantial changes in venom composition during ontogeny. We conclude that diet has possibly influenced distribution of the two distinct venom phenotypes in this species, and that the concept of venom paedomorphosis needs closer scrutiny.

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57* LEAF WATER RELATIONS OF A WIDESPREAD TANK BROMELIAD

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To investigate how the Neotropical epiphyte *Guzmania monostachia* responds to changes in water availability, leaf hydraulic conductance and leaf water potential were measured throughout an imposed drought. *Guzmania monostachia* occurs in rainforests throughout the Americas and the West Indies. For epiphytes in the rainforest canopy, the availability of light and water can vary greatly. Plants in this study were collected from the forest floor at La Selva Biological Station, Costa Rica, placed in an ambient lab for the duration of the experiment, held without water for 14 days, and rehydrated for 4 days. In addition, five plants in a sunny site in the field were measured under natural drought and after a rainfall. No significant differences in leaf hydraulic conductance were found between the dry, wet, and rehydrated plants in the lab, but the hydraulic conductance for plants in the field was significantly higher after rainfall (P < 0.05, paired t-test). There were significant differences in water potentials of plants kept in the ambient lab between wet and dry tank conditions and between dry and rehydrated conditions. Given the ecological importance of plants of *G. monostachia* and their lack of access to a consistent supply of water, their physiological response to drought can be of use to forest conservation programs and management decisions. Additionally, studying the extent to which this species can handle changes in water availability is becoming increasingly relevant as variations in rainfall in tropical forests are escalating with climate change and deforestation.

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59 AN INVENTORY OF OCEANIC UPWELLINGS WITHIN THE SOUTHERN CALIFORNIA BIGHT WITH CORRELATIONS BETWEEN GEOGRAPHICAL SITES TO DETERMINE STRENGTH AND ORIGIN

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Oceanic upwellings are consistently witnessed, but seldom fully understood as to when and where they originated, making them difficult to accurately predict or categorize. Coastal upwellings are caused by the Ekman transport due to North to South winds moving down the coast, but the Southern California Bight has many islands and channels that diversify the bathymetry making it more difficult to identify and therefore measure these events. The Catalina Marine Society and a collection of researchers from the University of Southern California have installed several thermograph arrays along the Southern Californian coast to regularly collect temperature data. With these data, we will create an inventory of upwelling events at each site. The application of appropriate algorithms with temperature modeled as a function of time and depth will allow the magnitude of each event to be illustrated. Identifying spatial
correlation between sites can provide a means for determining the strength and origin of each event. Maps depicting individual events as well as individual events will be made from these results. This inventory will provide the basis for future research endeavors on the topic of upwellings, including how El Niño, the Santa Ana winds, and other meteorological phenomena can affect these important events.

61* MODELING TEMPERATURE VARIATION USING DRONES TO INFORM TROPICAL FOREST MANAGEMENT STRATEGIES

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Deforestation and forest fragmentation is detrimental to the ecological systems and biodiversity of the area. Unsustainable forest management strategies furthers forest fragmentation and edge effects. In order to address this problem drone imagery was used to get quantitative data on population level dynamics in the high elevation tropical thorn woodland of Western Sierra Madre, in Sierra Fria of La Congoja of Aguascalientes, Mexico. Furthermore, there is little to no information on temperature dynamics in this area of Mexico. Links between population-level and landscape element variables were used to create a preliminary model using drone images to inform reforestation strategies. The model links four variables; canopy area, maximum 12 hour nocturnal temp, variance 12 hour diurnal, and seedling population ($y = 0.00002x + 167.8$). The model is designed to help identify and optimize seedling planting in the Western Sierra Madre. Drone images can be used to optimize planting and highlight the specific areas that may be in need of assistance. Planting trees along the fringe of canopies can help buffer effects and promote seedling growth for more successful reforestation and the decrease of forest fragmentation.

63* LOW RATES OF WATER LOSS THROUGH LEAF SURFACES OF A TROPICAL RAINFOREST EPiphyte, GUZMANIA MONOSTACHIA

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Epiphytes in tropical rainforests may experience much rainfall, yet they lack well-developed roots systems in soil. Thus, their supply of water may be limited and variable on a diurnal and/or seasonal basis. Many tropical epiphytes have low stomatal and cuticular conductance (evaporation through the leaf surface) as a strategy to minimize water deficits. To examine the surface conductance of leaves of the wide-ranging tank bromeliad Guzmania monostachia, we measured water loss of detached leaves of greenhouse-grown plants that had previously experienced wet (well watered), dry (14 d without water) and rewet (4 d of rewatering) conditions. Leaves were cut near the base of the blade, the cut surface was sealed with silicon grease, and grease was applied to the upper (adaxial), lower (abaxial), or neither surface (control treatment) to compare rates of water loss by evaporation under lights. Leaves were weighed every 15 min for four hours and then less frequently for several more hours. There was a significant difference in rate of water loss for control leaves and leaves with abaxial grease, which had stomates blocked (ANOVA, P < 0.001), but not between control leaves and those with adaxial grease. The implication is that cuticular conductance limits leaf water loss in G. monostachia, which in addition was among the lowest recorded for leaves of tropical epiphytes and even arid-land species such as chaparral plants and desert species. Chemical removal of wax from leaf discs confirmed that leaf cuticles of G. monostachia are well protected against water loss.

65* GROWTH OF DEPTH CYCLED MACROCYSTIS PYRIFERA: A NOVEL METHOD FOR INCREASING BIOCRUDE PRODUCTION IN OPEN-OCEAN ECOSYSTEMS

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Giant kelp Macrocystis pyrifera is one of the fastest-growing organisms on Earth. This rapid generation of biomass makes kelp one of the most promising sources of biocrude, which can serve as an energy
efficient replacement for traditional crude oil. Under normal conditions, kelp grows in rocky, subtidal habitats, in shallow, nutrient limited waters. However, in this study, *M. pyrifera* will be cultivated in deep (≤200m), offshore waters using a diurnal, depth cycling system in which kelp is translocated between different depths. At night, this method will expose kelp to considerably high nutrient conditions below the thermocline, while, during the day, will allow for increased rates of primary productivity near the surface.

As proof of concept, the effectiveness of the depth cycling method on the growth and condition of *M. pyrifera* will be evaluated in a series of control experiments conducted off Catalina Island in Big Fisherman Cove. Physical rates of kelp growth will be quantified using morphometric parameters and changes in total biomass, whereas indicators of kelp health will be determined using elemental and isotopic analyses of kelp tissues. These findings will help to optimize a novel system for growing kelp in open-ocean environments, which may provide consumers with an economically competitive alternative to fossil fuels.

**67* RECOLONIZATION OF INVERTEBRATES IN SEDIMENT AUGMENTATION**

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Climate change has led to sea levels rising at a rate too quick for most coastal wetlands to adapt. Sediment augmentation, one potential tool to help wetlands adapt to sea level rise, has been used at the Seal Beach National Wildlife Refuge testing whether it is a viable option in conserving coastal wetlands. Sandy sediment was applied to the augmentation sites instead of the muddy sediment that existed at the control site. Preliminary data indicated that invertebrate communities were different between the control and augmentation sites, yet it is unclear whether this is due to sediment type and/or the new higher elevation of the augmented marsh plain. We designed an experiment to test whether sediment type or elevation affected the recolonization rates of invertebrates. Sand from the experimental site and mud from mudflats in the refuge were both collected. Both sediments were defaunated, placed in Ziploc containers (73mm x 73mm x 45mm) with a mesh screen on the bottom, and re-deployed in both the control and experimental sites. Triplicate sand and mud containers were placed at 5 sites within each site type (control, augmentation). One pair of sand and mud containers will be collected at 2, 4, and 8 weeks to see the rate of recolonization by invertebrates. The samples will be sieved (300µm) and sorted to identify the invertebrate community, which will indicate potential factors influencing the success of the sediment augmentation. This experiment will have implications for management strategies of coastal wetlands as sea level continues to rise.

**69*F HOP TOPIC: THE EFFECTS OF GENISTEIN, A PHYTOESTROGEN IN BEER BREWERY WASTEWATER, ON THE REPRODUCTIVE PHYSIOLOGY OF ZEBRAFISH (DANIO RERIO)**

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Beer brewing is a growing industry and is responsible for an estimated $6.8 billion in annual revenue in California. However, for one liter of product, up to 10 liters of wastewater, the excess water and plant matter generated in the brewing process are produced. Generally, beer brewery wastewater enters the local municipal sanitation treatment facility, which treats and discharges wastewater. The plant matter in brewery wastewater contains natural plant compounds (e.g., phytoestrogens), which have the potential to mimic estrogen hormones produced by the vertebrate endocrine system. Thus, phytoestrogens may evoke a similar response to estrogen by binding to the same hormone receptors. Genistein is a commonly measured phytoestrogen in industrial streams. Our hypothesis is that genistein may affect the reproductive physiology of young fish in a dose-dependent manner. Two-week old zebrafish (*Danio rerio*; n=358) were exposed in triplicate to genistein (5, 50, and 500 µg L⁻¹), a positive control (0.1 µg L⁻¹ estradiol 17-β), and a negative solvent control (ethanol) for eight weeks. After the exposure period, fish standard length (mm) and body mass (mg) were measured. Fish exposed to genistein were significantly greater in
standard length (p<0.0001) and weight (p<0.0001) compared to negative and positive control fish. Currently, reproductive tissues (i.e., ovary and testis) are being examined histologically to determine differences in gonadal development. Genistein is an important phytosteroid to study as it may affect developmental reproductive physiology of aquatic organisms and vertebrates. Increased awareness of phytosteroids and the brewing industry will be important as microbreweries grow in popularity and in protection of wildlife.

71*F HABITAT PREFERENCE OF THE CALIFORNIA STATE MARINE FISH

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The Garibaldi, Hypsypops rubicundus, is a marine fish that inhabits shallow rocky reef habitats along the coast of California and Baja Mexico. Due to strict protection to prevent overfishing by the aquarium industry, little scientific research has been performed on the Garibaldi. The Vantuna Research Group (VRG) at Occidental College conducts SCUBA surveys of reefs in the Southern California Bight using fish and Uniform Point Contact (UPC) invertebrate transects. This study looks for patterns of Garibaldi habitat preference for specific habitat characteristics, focusing on substrate type and degree of reef relief. Relief appears to be more of a determining factor in Garibaldi habitat than substrate type. There is no significant interaction between substrate and relief values across depth zones and groups. Total degree of relief and percent composition of boulder substrate are the only statistically significant habitat characteristics of all substrate and relief data. Garibaldi prefer depths in inner and middle depth zones, but few still recruit to outer and deep depth zones. Temperature may also be an important selection criteria, with the most dense sites falling between 15-17°C.

73* VALIDATING FORMULAS FOR WIND-BLOWN SAND TRANSPORT

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The beaches of Santa Monica are iconic to the Los Angeles landscape and as such, are highly valued as a cultural and economic resource. However, the Southern California beach system is highly impacted by erosion and negative consequences associated with non-natural sediment and sand transport (beach grooming). If left to natural processes, it is believed these beaches can buffer the harshest effects of sea level rise and increased storm intensity associated with climate change, protecting urban infrastructure and wildlife. Direct measurement using Modified Wilson and Cooke (MWAC) samplers developed by Goossens (2000), is often used to determine rates of natural system restoration and dune development. However, coastal systems are affected by tidal surges to precipitation, public access and theft, among many uncontrollable factors, that make the long-term use of MWAC samplers challenging in such settings. Therefore, this study compares information from MWAC samplers to the calculation of wind-blow sand transport, which may be preferable when needing actionable information that can be used for policy and maintenance decision-making.

75* ANALYSIS OF MICRO-PLASTICS FOUND IN GREAT LAKES SEDIMENTS

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The Great Lakes are an ecologically unique system containing 90% of the U.S. water supply. The characteristics of each lake, how they interact, and proximity to urban centers create a delicate ecosystem faced with compounding impacts. One such impact is the presence of plastics. Most plastics are not biodegradable and represent the bulk of debris found in marine and lake environments. Plastic debris recovery efforts have focused on those in the size ranges >1mm, as they can be captured by modern
water-purification processes. Those in the smaller size ranges are potentially more dangerous to the food chain due to bioaccumulation. Fewer studies have focused on smaller size ranges. The current study aims to quantify the presence of such smaller microplastics by analyzing samples from three beaches from each of three of the Great Lakes; Superior (the most pristine of the lakes), Michigan, and Erie (the smallest and most polluted). After density separation of the micro-plastics from same samples followed by direct observation under the microscope and using infrared microscopy, the greatest numbers of microplastics observed were in the form of fibers. The presence of pellets, foam pieces, fragments, film and (fishing) line, found in great number in previous studies, were minimal or non-existent in this study. These findings underline the importance of micro-plastic propagation and the challenges we face in removing them from our water systems.

77* GREENHOUSE GAS FLUXES FROM A SEDIMENT AUGMENTATION PROJECT AT SEAL BEACH NATIONAL WILDLIFE REFUGE


Coastal wetland ecosystems efficiently store a vast amount of carbon despite their relatively small areal extent. Emerging carbon markets could capitalize on this carbon sequestration potential to drive wetland restoration and conservation efforts. However, soil carbon storage can be offset by the release of potent greenhouse gases like methane and nitrous oxide. We explored the importance of these greenhouse gas fluxes at the Seal Beach National Wildlife Refuge, which is home to a thin layer sediment augmentation project that added ~10 inches of dredge material to 10 acres of salt marsh to conserve the marsh in the face of projected sea level rise. Samples were collected from the augmentation site (and a control site) before and after the sediment augmentation. Pre-augmentation data from both sites 2 months prior to the project, suggest that the flux of methane and nitrous oxide were minimal. Additional samples collected 3, 5, 7, 8, 9, 10, and 11 months post-augmentation suggest methane and nitrous oxide production do not increase following the thin layer sediment augmentation. Carbon dioxide emissions from the augmentation site were significantly lower than the control site, likely because of decreased plant biomass. Our data may suggest that sediment augmentation is a good candidate for wetland restoration and conservation without any initial offsets to potential soil carbon sequestration. Ongoing work includes sampling the augmentation site throughout its restoration, and exploring porewater chemistry in relation to gas fluxes.

79* CHARACTERIZATION OF KELP WRACK ALONG THE SANTA MONICA BAY

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As climate change continues to cause sea levels to rise, coastal communities will either need to invest heavily in infrastructure, retreat, or become more reliant on their beach’s ecosystem services, mainly plants creating protective sand dunes. In an effort to bring the back the ecosystem services of sand dunes to the beaches in Los Angeles area, The Bay Foundation has set aside three acres on Santa Monica beach that will remain ungroomed and has been seeded with native dune species. An important aspect of this larger study is the characterization of kelp wrack that washes up on the ungroomed beach as these plants serve as an important nutrient source to the beach’s invertebrate community, which in turn serve as a food source for shore birds. Comparing the build up of wrack kelp, terrestrial debris, and trash on ungroomed versus groomed sites will create a picture of how beach grooming affect coastal ecosystems. Two paired sites were selected for study at each of four locations along Santa Monica Bay in order to account for this diversity. Zuma Beach, the Santa Monica restoration site, El Segundo Beach and Torrance Beach will serve as our four sites for investigation. At each site two, 30-m transects were surveyed along the beach berm. From each of these transects, a 50-m transect will extend from the berm to the back of the beach in order to assess the difference in percent coverage of wrack at groomed and ungroomed areas.
81* LANDSCAPE GENOMICS OF THE VERNAL POOL TADPOLE SHRIMP (*LEPIDURUS PACKARDI*)

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The vernal pool tadpole shrimp, *Lepidurus packardi*, is an endangered keystone species that is endemic to California and southern Oregon, which lives in seasonal wetland vernal pool habitats. *L. packardi* have limited dispersal capability, resulting in little to no gene flow between pools. Due to anthropological changes, only 9% of vernal pool habitats remain. Low population size, reduced habitat, and low dispersal capability, have negatively impacted the species and we are concerned with the amount of genetic variation among populations. By studying the genetic composition and patterns among *L. packardi* populations, we will be able to recommend conservation efforts and management strategies which can help this species thrive in the future with the objective of being removed from the endangered species list. Utilizing double-digest restriction-site associated DNA sequencing (ddRADseq) and the bioinformatics pipeline STACKS, we identified single nucleotide polymorphisms from 77 individuals and established which factors contributed to allelic diversity and population structure. Our research identified significant isolation by distance, suggesting there is a significant relationship between geographic distance and genetic differentiation (FST). Additionally, isolation by environment was not found, as environmental distance (estimated from soil properties) was not correlated with FST values. Principle component analysis revealed that pools cluster based on geography. These results suggest that *L. packardi* populations are limited in their dispersal capabilities and that conservation strategies for this species should focus on local scales.

83*F NEKTON UTILIZATION OF CREATED AND NATURAL INTERTIDAL *CRASSOSTREA VIRGINICA* REEFS

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Since the 1970s, eastern oyster restoration efforts have increased. Oyster reefs provide habitat and refuge for organisms, improve water quality, and decrease erosion. Oyster restoration projects aim to construct reefs that function similarly ecologically to their natural counterpart. Therefore, post-creation monitoring of these reefs is crucial in determining their success. However, monitoring is often lacking or focused on harvest size rather than ecosystem services such as nekton utilization. This study examines nekton utilization among created reefs compared to natural reefs in an estuary in North Carolina. The objective was to determine whether the created reefs function similarly to the natural reefs in abundance, species richness, and fish size. Through seine netting and Breder traps, reefs were sampled over a 5-month period. No significant difference was detected among reefs for nekton abundance, species richness and standard length. This is a promising result for future management, indicating the success of restoration efforts of one important ecosystem service.

84* RECOVERY OF CORALLINE ALGAL TURFS AND ASSOCIATED MEIOFAUNAL COMMUNITIES IN A SOUTHERN CALIFORNIA ROCKY INTERTIDAL ECOSYSTEM

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Rocky intertidal ecosystems are subjected to numerous disturbances that can influence community structure. The middle rocky intertidal zone of southern California is often dominated by an articulated coralline/red algal turf which serves as an important microhabitat for invertebrate meiofauna. This community can be subjected to pulse disturbances, such as by sand burial or boulder movement, which
remove the turf community. The goal of this ongoing experiment is to examine the recovery rates of coralline turf, and their associated meiofauna, following a disturbance. In February 2016, plots were cleared of the coralline turf, with the encrusting portion left behind, simulating a typical disturbance event. Recovery of algal composition turf thickness, and associated meiofauna is being determined through comparisons with non-manipulated control plots. To date, recovery of the algal turf has been slower than expected with treatment plots still not fully recovering one year after removal. Relationships between turf and meiofaunal recovery will be examined to determine whether the recovery of meiofauna occurs concurrently with turf recovery or whether one facilitates the recovery of the other. The first phase of this experiment was initiated during the 2015-16 ENSO event; anomalous ocean conditions typically characterize ENSO, including warmer waters with lowered nutrients. To determine whether recovery rates differ during ENSO and non-ENSO periods, a similar effort was initiated in February 2017 with recovery to be compared among sampling periods. The study will increase our knowledge about recovery of important microhabitat forming turfs and associated meiofauna following a disturbance.

A PRELIMINARY INVESTIGATION: COMPARATIVE MORPHOLOGY OF ROCKFISH GENITAL PAPILLA

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Rockfishes are a popular recreational fishery in California; over 8 million rockfishes are caught annually. While recreational fishermen are aware of the genital papilla and often use it as a means to identify species, the morphology and physiological connection to the testis has not been fully described in any species. The objective of our study is to build upon our understanding of rockfish reproduction by characterizing and describing the genital papilla of various species of rockfish. Rockfish species that were collected in southern California for our study include: starry (Sebastes constellatus), squarespot (Sebastes hopkinsi), rosy (Sebastes rosaceus), speckled (Sebastes ovalis), greenstriped (Sebastes elongatus), and blue rockfishes (Sebastes mystinus). Gonadal tissues and genital papilla were dissected, preserved in Bouin’s fixative, and embedded in paraffin wax. Tissues were sectioned using a rotary microtome, stained, and histologically analyzed. We have documented differences in male and female ventral regions of the body; only males have a genital papilla. It appears as though the external morphology (i.e. shape) of the genital papilla is species-specific. We are also mapping the pathway of sperm transfer from the testis to the genital papilla. Our future work includes examining female rockfish to determine if female genitalia match the shape of the male genital papilla, which would confirm a species-specific mating mechanism.

A DESCRIPTIVE REPORT OF THE REPRODUCTIVE MORPHOLOGY OF MALE BLACK PERCH (EMBIOTOCA JACKSONI)

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Black perch (Embiotoca jacksoni) are a common southern California reef fish that exhibits internal fertilization. During the breeding season, males transfer sperm via a spermatophore (capsule containing spermatozoa) to the female via an intromittent organ during copulation. Relatively little is known about spermatophore development and its relationship with the intromittent organ. The objective of our study was to describe spermatocyte development and spermatophore formation in addition to characterizing the morphology of the black perch intromittent organ. All stages of spermatocyte development were present in males 70–157 mm SL, however spermatophores were only observed in males >90 mm SL. The intromittent organ is housed in a bulbous protrusion that develops on both sides of the anal fin at the anterior end. We hypothesize that the intromittent organ regresses during the non-breeding season and may be testosterone-dependent since histologically the tissue can be observed associated with the anal fin. The copulatory structures of Embiotocid species have not been fully investigated, thus our work contributes to our understanding of the reproductive biology of surfperches and other viviparous species.
Some dissolved organic matter (DOM) can promote bacterial growth, and change a body of water’s ecosystem. This increased growth is more prominent during storm events where urban runoff finds its way to creeks and streams and may ultimately result in additional water quality compliance failures. Fostering pathogens in creeks poses a threat to the well-being of freshwater ecosystems. Of that DOM, there is a portion that is colored, called chromophoric organic matter (CDOM); these components have unique, fluorescent properties that facilitate their identification when they emit radiation in the visible spectrum. Fluorescence spectroscopy has proven to be successful in discriminating between microbial and terrestrial sources of organic matter. Therefore, we hypothesize that a positive correlation exists between bacteria counts and fluorescent DOM during storms when bacterial loads tend to peak. We conducted stormwater sampling at Alvarado Creek on the SDSU campus and used heterotrophic count plates to measure aerobic bacteria. We compared bacterial numbers with a suite of fluorescent components and indices. The data collected is essential in developing a better understanding of the relationship between flushing of watersheds, bacterial populations, including pathogenic bacteria, and refining existing technology for a rapid evaluation of our freshwaters.

THE GUT MICROBIOME OF TROPICAL CEPHALOLEIA BEETLES: INTERACTION BETWEEN DIET, PATHOGENS, AND INVASIVE PLANT SPECIES

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Although interest in symbioses between bacteria and animals is growing, there are few studies on microbes associated with tropical insects, especially regarding herbivore diet breadth. Within the Costa Rican beetle genus Cephaloleia, several are generalists, consuming 9-15 different plants, or specialists consuming 1-4 plant types, and some of each have begun colonizing invasive plants. Through DNA extraction and 16S rRNA gene sequencing, the microbiomes of 6 species of Cephaloleia were determined. Bacteria within the orders Enterobacteriales and Pseudomonadales were most prevalent (observed in 95% of specimens, n=22) and highly abundant (10-26% of recovered ribotypes). Enterobacter (Enterobacteriales) and Acinetobacter (Pseudomonadales) species were isolated in culture and determined to have complementary metabolic capabilities, including digestion of sugars versus lipids and proteins, respectively. While bacterial diversity was not significantly different between feeding strategies (Shannon index values of 1.0-2.5 for generalists and 1.4-2.9 for specialists), a predominance of putative bacterial pathogens (ex: Rickettsiales and Entomoplasmatales) was observed in generalist beetles, suggesting that a generalist feeding lifestyle could put hosts at risk for pathogens. Smaller specimens of C. belti (generalist) had a higher incidence of bacterial pathogens (81%) compared to larger beetles (56%), suggesting a negative fitness correlation with these bacteria. Lastly, bacterial communities for beetles found on invasive plants revealed fewer bacteria from the dominant orders Enterobacteriales and Pseudomonadales (11-24% decrease) and an increase in atypical bacteria such as Brevinema (13% increase). This data shows that dysbiosis in herbivore microbiomes can accompany new interactions with novel invasive plants, and possibly climate change.

A ROLE FOR LIPOPROTENE LIPASE IN REGULATION OF INSULIN SIGNALING

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Our objective is to understand the role of lipoprotein lipase (LPL) in insulin resistance and diabetes. Down-regulation of skeletal muscle LPL was shown to increase insulin sensitivity. LPL may exert its effect by altering the expression of intermediates of the insulin signaling pathway including insulin...
receptor or its substrate, IRS-1. Also, PIK3R1 is known to affect insulin resistance. We compared the transcription of these genes in wild-type and LPL-deficient (LPL-KD) rat skeletal muscle (L6) cells. Cells were grown to 80% confluency in DMEM media containing 10% FBS. Myoblasts were differentiated to myotubes by reducing the FBS to 2%. Thereafter cells were solubilized with TRI reagent, and RNA was isolated. Reverse Transcriptase-Polymerase Chain Reaction was performed using oligoDT primers and PCR was performed using gene-specific primer pairs. Initial results confirmed that LPL is silenced in LPL-KD cells, and that LPL can regulate genes involved in insulin signaling.

95* GENERATING THE FIRST-EVER DNA BARCODE SEQUENCES FOR COASTAL FREE-LIVING POLYCLAD FLATWORM SPECIES OF CALIFORNIA

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Species identification is one of the most important uses of DNA barcoding, allowing researchers to be able to quickly identify a species without the often expensive and time consuming process of consulting a specialist. Some animal groups are very difficult to identify and are currently lacking DNA barcodes for simple species identification. One of these groups are marine free-living polyclad flatworms. This group is found worldwide with over 1000 species classified into 27 families and almost none of these have DNA barcodes available. This is due to the lack of compatibility between the common, universal barcoding primers and the corresponding gene region on polyclads. Newly designed polyclad-specific primers will be tested for successful PCR amplification of the mitochondrial COI gene using DNA extraction from expert-identified museum California polyclad flatworm specimens. Any positive results will be sequenced to obtain the very first (worldwide) DNA barcodes for coastal free-living polyclad flatworms of California. These barcodes will then become available internationally for researchers to utilize by comparing new DNA barcode sequences to reference sequences in a database that will identify the species or possibly lead to the discovery of a brand new species.

97*F DISTRIBUTION OF HATCHING GLAND CELLS IN THE CALIFORNIA GRUNION, LEURESTHES TENUIS

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A local silverside fish, the California grunion (*Leuresthes tenuis*), demonstrates unusual mating behavior where adults spawn on sandy beaches and eggs incubate in the sand. In the developing embryos, epithelial hatching gland cells (HGCs) contain the choriolytic enzyme(s) necessary to digest the eggshell or chorion to allow hatching. HGCs are first visible in the anterior region and appear to migrate in a posterior-lateral direction to their final position along the body of each embryo. We investigated how the HGCs migrate by testing for the involvement of actin and myosin interactions responsible for cell motility in other systems. Embryos at 3-7 days post-fertilization (dpf) were incubated in a JLY mixture of inhibitors (10 \( \mu \text{M} \) Jasplakinolide, 5 \( \mu \text{M} \) Latrunculin B, and 15 \( \mu \text{M} \) Y-27632) in seawater. Embryos were manually removed from the chorion and digital photographs were analyzed with Image J software to quantify the maximum distance along the body where HGCs were present. The HGCs of embryos treated with JLY did not move as far as they did in controls incubated in seawater, but development was also inhibited. Exposure to Jasplakinolide and Y-27532 alone reduced HGC migration and had secondary effects on embryo size and length, whereas exposure to lower concentrations of Latrunculin B produced less inhibition of development. We hope to find a concentration or type of inhibitor that affects HGCs without affecting development, to assess the involvement of actin and myosin in hatching gland cell migration.
The study of aquaporins (AQP) has become an area of interest for cell and molecular biologists, particularly those who study tissues and organs involved in water transport. AQPs are channel proteins responsible for transporting water across cell membranes. Tropical epiphytes known as tank bromeliads lack an absorptive root structure and thus must rely on rainfall stored in their leaf bases (tanks) to supply water for use by the leaves. These epiphytes can withstand periods of desiccation while continuing to carry out photosynthetic processes and maintain metabolic activity. Quantifying the AQP proteins and comparing them among hydrated, dry, and rehydrated leaves may help to understand bromeliad’s responses to drought-like conditions. Two leaf regions were examined, the tank zone and the transition zone—where the leaf changes from absorbing (white) to photosynthesizing (green). Plants of the wide-ranging tank bromeliad of Guzmania monostachia were grown in a greenhouse at Occidental College and were studied in this 10-day dry down and rehydration experiment. The abundance of an aquaporin known to be involved in plant water transport, PIP1, was quantified using quantitative Reverse-Transcriptase Polymerase Chain Reaction (qRT-PCR) and compared among plants before and after a drying period and after rewetting. Although PIP1 expression relative to the housekeeping gene matk in both the tank and transition zone of G. monostachia was higher in leaves that were rehydrated for seven days versus leaves that were rehydrated for only twenty-four hours, results were not significant. A light-induced gene, rbcl, was also quantified using qRT-PCR and showed that both dehydrated and rehydrated (24-h) transition zone leaves had significantly lower rbcL expression than leaves that did not experience drought stress.
is low muscle cells use oxidized glucose for energy. Hence, the down regulation of LPL forces the muscle cells to use glucose for energy and in turn can make the cell more insulin-sensitive. We want to study the effects of LPL levels in L6 rat skeletal muscle cells on insulin activity. We used wild type L6 cells and LPL-deficient (LPL-KD) cells to compare the expression of different genes that play important roles in the metabolic actions of insulin. We used reverse transcriptase polymerase chain reaction and agarose gel electrophoresis to quantify gene expression in these cells. Preliminary gel results confirmed a role for LPL in regulation of genes involved in insulin action.

105°F DETERMINING TEMPERATURE-PERFORMANCE OF THE AEROBIC ENZYME, CITRATE SYNTHASE, AS A WAY OF PREDICTING THERMAL HABITAT RANGE IN FOUR SPECIES OF ECHINODERM LARVAE

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A major reason organisms are limited to their respective habitat ranges is because biological processes are dependent on temperature. One approach in measuring the role temperature plays on biogeographic distribution is to study how they affect enzymatic processes. In the current study we focused on the temperature sensitivity of the critical aerobic respiratory enzyme, citrate synthase (CS), during larval stages of echinoderm development. We hypothesize that temperature sensitivity of CS will correlate with biogeographic distributions of four different echinoid species that are found in Southern California coastal waters: Dendraster excentricus, Strongylocentrotus purpuratus, S. fragilis, and Centrostephanus coronatus. All larvae were reared in similar conditions (fed Rhodomonas sp. at 20,000 cell mL⁻¹ and cultured at 16°C). Larvae were sampled at 10 days post-fertilization and CS reaction rates were determined at a range of temperatures from 0-30°C (5°C intervals). Temperature sensitivity was evaluated through Q₁₀ calculations and determination of enzyme activation energy, this being derived from the Arrhenius equation. Data for D. excentricus shows that CS does not experience an Arrhenius breakpoint throughout the range of temperatures tested, agreeing with its thermal habitat range from 2-28°C. Results for the other species will be discussed in the context of their thermal habitat ranges and contrasted against the results of D. excentricus. It is expected that stenothermic echinoids (e.g., S. fragilis) will exhibit strong thermal preferences and possess a distinct Arrhenius breakpoint. This study will help elucidate key biochemical attributes in shaping biogeographic patterning that results from early life-history experiences.

107°F DEVELOPMENT OF THE ABILITY TO ELEVATE RED MUSCLE TEMPERATURE IN THE PACIFIC BLUEFIN TUNA

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Tunas are able to maintain the temperature of the slow-oxidative (red) muscle (RM) elevated above water temperature, a strategy known as regional endothermy. RM generates metabolic heat continuously as the fish swims, and that heat is retained by counter-current heat exchange within blood vessels that perfuse the RM. As part of a study on how RM endothermy develops as tunas grow, we are quantifying the total amount of RM in juvenile Pacific bluefin tuna (Thunnus orientalis) ranging from 18.4 to 47.5 cm fork length (FL) and 2 to 6 months of age. These fish were collected in August and November 2016 in Japan, frozen, and cut into 2-cm-thick sections using a band saw. Both sides of each section were digitally photographed, and total cross-sectional area of the section and of RM (cm²) were quantified using ImageJ software. The presence and distribution of RM along the body and the total mass (g) of RM in each fish were determined. The maximum %RM occurs at a position along the body of 40-50% FL, a distribution similar to that of yellowfin tuna (Thunnus albacares). The mass of RM increases with fish size, which contributes to development of RM endothermy. Future plans involve histological analysis of the counter-current blood vessels to assess how the capacity to retain heat in the RM changes with fish size.
MOLECULAR STUDIES ON THE GUT MICROBIOME OF THE BLOOD-FEEDING MARINE ISOPODS, ELTHUSA SPP.

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The marine isopod family Cymothoidae includes numerous species with a unique parasitic lifestyle – the exclusive consumption of vertebrate blood. This study focused on characterizing the gut microbiome of Elthusa species, across their various life stages. The gut microbes of these animals are of particular interest because of their blood diet, a single nutrition source deficient in vitamins, which can likely be supplemented by symbiotic microbes in the digestive system. Elthusa vulgaris and E. californica were collected from the California coast in 2016, and were preserved for DNA analysis and microscopy. Since the 2 Elthusa species are often difficult to discern by morphology, the cytochrome c oxidase gene was sequenced from each specimen to genetically differentiate E. vulgaris from E. californica. Bacterial 16S rRNA genes were PCR-amplifiable from the dissected guts of eight adult specimens, two Elthusa hatchlings, and the eggs of two gravid females. Barcode sequencing of the 16S rRNA genes indicated the presence of two predominant bacterial genera; Shewenella and Vibrio (representing 42% and 25% of the recovered sequences, respectively). Interestingly, the preliminary sequence data also suggests a higher microbial diversity for gravid isopods and their eggs (H’ = 2.6 and 2.7, respectively), compared to non-gravid females or males (H’ = 0.7). The presence of gut bacteria was further explored with DAPI staining of digestive tissue sections, providing visual evidence of the bacterial presence lining the gut. We will continue investigating the gut microbiome composition in order to discover the relationship between successful hematophagous organisms and their microbes.

PLANT DEVELOPMENTAL STRATEGIES BEGIN AT GERMINATION: FUNCTIONAL TRAITS, PLASTICITY, AND SURVIVAL IN THE FIRST FOUR DAYS OF PLANT LIFE

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Root, shoot, and leaf trait variation in the first few days following germination could be key factors in determining plant survival under future drought conditions. While studies have examined how adult plants respond to drought, we don’t know what traits make seedlings more fit in drought conditions. As California is expected to become drier with longer periods between rain events over the next 50-100 years, understanding these responses and their connection to future drought survival can inform successful restoration projects. Our study compared root, shoot, and leaf traits of 16 annual grasses and forbs that are native or exotic to California coastal sage scrub systems. We determined relationships in post-germination traits and major trait trade-offs across species. Furthermore, we compared these trait trade-offs between drought condition treatments and species type. Response to drought exposure during germination was thinner root development but higher tissue dry matter content across species. Within these responses, forbs showed stronger responses in altering root depth, leaf and shoot dry matter content, root diameter, germination time, specific leaf area, and shoot elongation rate. Grasses showed stronger responses in altering tissue density, shoot diameter, and specific root length. Additionally, grasses increased root mass ratio and decreased root to shoot length radio under drought while forbs did the exact opposite. These analyses clearly display that seedlings adopt different strategies in response to drought in their first few days. Better understanding these differences can make us more informed in restoration projects in an increasingly drought-affected environment in California.
NUT PREFERENCES IN FORAGING _LARUS CALIFORNICUS_

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*Larus californicus* are coastal-urban gulls that are opportunistic feeders, who forage on a diversity of items. This study aims to determine preferences for foods in terms of handling time and calorie content, specifically looking at nut nutritional preferences, with and without shells. Experiments were undertaken in order to compare nut preferences. Shell presence and size preference were determined individually, and then between nut preferences were compared directly. Nuts in general that were out of the shell were preferred, and nut size was a contributing factor to food preference as well. Further, seagulls had a preference for whole versus quartered nuts, but did not have a significant preference between halved and whole out of the shell nuts. Thus size and shell presence appears to matter for California gull food preferences and the nutritional content of the nut may play a significant role.

MICROBIOME AND MORPHOLOGICAL STUDIES ON THE GUT OF A TROPICAL FOREST FLIGHTLESS GRASSHOPPER, _MICROTOYLOPTERYX HEBARDI_


_Microtylopteryx hebardi_ is a unique flightless tropical grasshopper that displays extreme sex-dependent diet variation; males consume up to 50 different plant species while females limit their diet to only a few plants used for oviposition (Braker 1991; Braker and Chazdon 1993). Males kept in captivity on a low diversity diet (a single plant species) had a lower mean survival time compared to males on a diverse diet of 5 plant types (from 28 days to only 5-20 days; P < 0.0001). Conversely, females showed no significant change in survival on high versus low diversity diets (both 28 days; P = 0.14). In grasshoppers, digestive ceca at the junction between foregut and hindgut, play a key role in digestion and detoxification of plant secondary compounds (Bernays and Chapman 2000). Diet tolerances may therefore be related to sex-dependent differences in ceca physiology or the resident microbiome composition, or both. Morphological examination of _M. hebardi_ ceca showed no difference in volume and surface area between adult males and females. We examined the gut microbiome, with the assumption that beneficial bacteria might also contribute to detoxification and digestive abilities. Four bacterial families dominated the _M. hebardi_ microbiome, including Entrobacteriaceae, Orbaceae, Pseudomonadacea, and Lactobacillaceae. The microbiome composition of the hindgut was most similar to that of the frass, while bacteria in the foregut resembled that of the ceca. Some specimens were highly parasitized by *Spiroplasma* and *Brevinema* bacteria, possibly obscuring the beneficial microbiome. Pending work will compare the microbiomes of male versus female _M. hebardi_. Differences in plant utilization within a single species on insect allow us to test whether bacteria influence nutritional ecology.