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## 106th Annual Meeting Abstracts

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# 106<sup>TH</sup> ANNUAL MEETING

*SOUTHERN CALIFORNIA ACADEMY OF SCIENCES*

May 3–4, 2013



*California State University, Long Beach*

*Long Beach, CA*

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## FRIDAY ABSTRACTS IN PROGRAM ORDER

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1. **HABITAT SELECTION AND UTILIZATION OF THE WHITE CROAKER (*GENYONEMUS LINEATUS*) IN THE LOS ANGELES AND LONG BEACH HARBORS**

**B.J. Ahr**, M.R. Farris, and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA, 90840.

Sediment contamination within the Los Angeles-Long Beach Harbors has been an environmental concern since pollutants entered the harbors through historical wastewater discharge. Contaminants such as DDT and PCBs are of particular concern in the harbors as it negatively affects marine organisms and can be harmful to humans if consumed. White croaker (*Genyonemus lineatus*) are a sentinel fish species for contamination because of their susceptibility to pollutants and their direct interaction with contaminated sediments through their benthic foraging behavior. Acoustic telemetry was utilized to determine fine and coarse scale movements of white croaker within the LA-LB Harbors in order to determine habitat preference and utilization. Benthic infauna data (provided by the ports) was coupled with fish movement data. Preliminary data suggests prey density is not the sole driver for habitat selection for white croaker. White croaker spent relatively equal amounts of time in each one of the four prey density categories (ranging from lowest to highest concentrations in the harbors). White croakers spent 20% in the highest tier (47.5–59 benthic individuals/0.1 m<sup>2</sup>) and spent the most time (32%) in the second highest tier (35.9–47.4 benthic individuals/0.1 m<sup>2</sup>) of benthic infauna. White croaker exhibit a diet shift in depth distribution, occupying deeper depths and a wider range of depths during the day than during the night. This study will continue to investigate the relationship of white croaker movements and prey density and depth. This study will also continue to determine which abiotic and biotic factors are drivers for white croaker habitat selection.

2. **MOVEMENT PATTERNS AND BEHAVIOR OF WHITE CROAKER (*GENYONEMUS LINEATUS*) IN THE LOS ANGELES AND LONG BEACH HARBORS**

**M.R. Farris**, B.J. Ahr, and C.G. Lowe. California State University, Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

Acoustic telemetry techniques were used to study both the fine scale and coarse scale movements of white croaker (*Genyonemus lineatus*) in the Los Angeles (LA) and Long Beach (LB) Harbors. Understanding the movements of *G. lineatus* in the Harbors is of particular importance due to the fact that it is commonly caught by recreational and subsistence anglers, and is highly contaminated with organochlorine pollutants in this region. Individual *G. lineatus* tagged for coarse scale tracking within the inner Harbors ( $n = 49$ ) exhibited greater site fidelity than those tagged in the outer Harbors ( $n = 50$ ), and the highest degree of connectivity was observed between directly adjacent regions of the Harbors. Individual *G. lineatus* tagged for fine scale tracking ( $n = 18$ ) exhibited an average daily area use of  $156533 \text{ m}^2 \pm 229865 \text{ m}^2$  ( $\pm$ SD); average daily area use in the outer Harbors ( $264735 \text{ m}^2 \pm 319920 \text{ m}^2$ ) was significantly greater than in the inner Harbors ( $75382 \text{ m}^2 \pm 54424 \text{ m}^2$ ) ( $p = 0.019$ ). Data from this study indicate that an area in the inner LA Harbor, known as the Consolidated Slip, may be an area of particular importance to *G. lineatus* within the Harbors as individuals tagged in this area exhibit higher site fidelity than fish in other areas of the Harbors. This is noteworthy as the Consolidated Slip is also known to contain the highest concentrations of organochlorine pollutants in sediments within the Harbors.

3. **SITE FIDELITY, HOME RANGE, AND SPAWNING MIGRATION OF BARRED SAND BASS (*PARALABRAX NEBULIFER*) ON THE PALOS VERDES SHELF**

**G.N. Teesdale**, B. Wolfe, and C.G. Lowe. California State University Long Beach, Department of Biological Sciences, Long Beach, CA 90840.

Barred sand bass (*Paralabrax nebulifer*, “BSB”) are an important gamefish in southern California, commonly targeted during summer spawning aggregations. Understanding the timing of individual

migrations to these aggregations is essential for effective management of this species. Acoustic transmitters were surgically implanted in 55 BSB on the Palos Verdes Shelf near Los Angeles County Sanitation District's (LACSD) Whites Point outfall. A passive acoustic receiver array of 42 VR2W receivers combined with vessel deployment of 10 mobile receivers monitored the movements of tagged fish from July 2010–October 2012. Coarse scale detections (individual receiver) of BSB demonstrated a high degree of non-spawning season site fidelity (65.8% of days at liberty (September–May)) to specific inshore areas (20 m to 40 m). Fine scale trilaterated positions rendered from multiple receiver detections were used to calculate kernel utilization distributions (KUDs). Overall areas (95% KUDs) averaged  $(29,187 \pm 5,559 \text{ m}^2)$  and core areas (50% KUDs) averaged  $(2,834 \pm 392 \text{ m}^2)$ . GIS analysis revealed that BSB exhibit high affinity to rocky ballast along outfall pipes and adjacent areas of natural rocky reef while making brief forays into surrounding habitats. Spawning migration was documented through periods of absence from PV and subsequent detections in the Huntington Flats area (late-May through late-September) up to 29.9 km from the array. These results are consistent with short-term acoustic studies documenting small home ranges in close proximity to ecotones and long-term traditional tag-recapture studies documenting general distance and direction of migrations. This is the first study to determine the long-term site fidelity and timing of spawning related migrations of BSB.

#### 4. PRELIMINARY TRENDS: RESPONSES OF FISHING EFFORT AND BOATING TO NEWLY ESTABLISHED MPAS ALONG THE MAINLAND COAST OF SOUTHERN CALIFORNIA

T.K. Ford. Santa Monica Bay Restoration Commission, Center for Santa Monica Bay Studies, Loyola Marymount University, Los Angeles, CA, 90045.

Aerial Surveys of the mainland coast of southern California from Point Conception to the U.S. Mexican border were initiated in 2008. The surveys use light aircraft to fly-over all vessels encountered within California State Waters, (from the coast out to three miles). The observers in the aircraft record the location, and define the type and activity of the vessels when encountered using a georeferenced database in a computer onboard the aircraft. Using this methodology we are able to collect an accurate, fishery independent, fine spatial scale dataset on recreational and commercial fishing activities, as well as other vessels, from kayaks to oil tankers (margin of error  $\pm 188$  meters). Preliminary results suggest: higher rates of noncompliance within the recreational fishing community than commercial sectors. Fishing vessels are not displaying compaction in response to the new MPAs. Commercial fishing effort has shifted away from the boundaries of the new MPAs rather than closer, "fishing the line". For boating more generally preliminary trends suggest: a reduction in boat activity during the spring of 2012 compared to previous years. A consistent spatial trend has been a significantly higher density of boats operating off the mainland coast of San Diego, Orange and southern Los Angeles Counties compared to northern Los Angeles, Ventura and Santa Barbara Counties.

#### 5. STATUS AND TRENDS IN THE SOUTHERN CALIFORNIA SPINY LOBSTER FISHERY AND POPULATION: 1980–2011

E.F. Miller. MBC Applied Environmental Sciences, 3000 Red Hill, Costa Mesa, CA 92626.

The California spiny lobster (*Panulirus interruptus*) fishery in southern California ranked amongst the most economically important fisheries in California. An analysis of commercial harvest data confirms that the fishery was indeed landing near-record catches in recent years. The commercial catch per trap pulled declined 15%/year in years after the introduction of a new rigid-style hoop net in the recreational fishery. Fishery-independent data sourced from power plant marine life monitoring recorded increased California spiny lobster abundance after 1989 with evidence of increased larval settlement in 1989. This coincided with a documented oceanographic regime shift in the Pacific Ocean. Power plant abundance indices derived for lobsters one year away from recruiting into the fishery as well as young-of-the-year each significantly predicted the commercial harvest at index-appropriate temporal lags, i.e. one year for next year's fishery recruits. Predictability of both indices was apparently reduced in years since the introduction of the new rigid hoop net in the recreational fishery. The population data confirms that, at this point, the fishery appears healthy but warns of the collapse that may occur if oceanographic conditions shift to a new

regime less favorable to California spiny lobster than present conditions. These analyses also indicate the urgency of monitoring the recreational fishery harvest.

**6. KELP AND SHALLOW ROCK ECOSYSTEMS: MPA BASELINE DATA COLLECTION FOR THE SOUTH COAST REGION (2011–2012); AN OVERVIEW**

**L.A. Zahn**, J.T. Claisse, J.P. Williams, C.M. Williams, and D.J. Pondella, II. Vantuna Research Group, Occidental College, Department of Biology, Los Angeles, CA, 90041.

Data collection for the Kelp and Shallow Rock Ecosystems assessment of the South Coast MPA Baseline Monitoring Program was completed in 2012. The overall goal of this project was to describe the ecological condition of rocky reefs inside and outside of the new reserve boundaries. Data was collected using standardized CRANE methodology on scuba, assessing the abundance and distribution of fish, macroalgae and conspicuous invertebrates, reef characteristics including benthic cover and relief, and size structure data of all fish and selected invertebrate species (e.g., *Strongylocentrotus* spp.), throughout different depth zones of each site (inner, middle, outer, and deep). In total, 119 sites were surveyed in 2011 and 117 in 2012, assessing the ecological conditions inside and outside of 36 MPAs. Density and size structure of all the indicator or ‘focal’ species (as defined by the South Coast MPA Monitoring plan) were measured, which included giant kelp (*Macrocystis pyrifera*), kelp bass (*Paralabrax clathratus*), kelp and olive rockfishes, (*Sebastes* spp.), red and purple urchins (*Strongylocentrotus* spp.), spiny lobster (*Panulirus interruptus*), and abalones (*Haliotis* spp.), among many others. We plan to integrate the data with existing long-term datasets from the region to give the best picture of the status of these reefs at MPA implementation. Assessing the abundance and spatial distribution of these focal species region-wide, and integrating site-specific environmental data (e.g., sea surface temperature, reef substrate and relief) will help with the development of ecosystem indicators and provide information for future monitoring protocols.

**7. THE CONSEQUENCES OF FISHING-INDUCED CHANGES IN PREDATOR SIZE FOR PREDATOR-PREY INTERACTIONS**

**R.L. Selden**, S.D. Gaines, and R.R. Warner. Ecology, Evolution and Marine Biology, University of California, Santa Barbara.

Even without selecting for large fish, the added mortality of fishing means fewer fish make it to larger sizes, leading to distributions shifted towards smaller individuals. The consequences of these shifts for single-species management have long been recognized. Because body size limits the sizes of prey a predator can eat, truncated size distributions may cause equally dramatic changes in predator-prey interactions. As a result, multispecies models based on biomass alone, without considering changes in size distributions, may over- or under-estimate predation rates. The potential trophic effects have largely been ignored when managing these fisheries, but will be critical to fulfilling the mandate for multispecies management. I developed a size-structured predator-prey model to evaluate how fisheries-induced changes in predator size distributions affect prey population dynamics. I parameterized this model within California kelp forests using observations of size-specific predation of California sheephead (*Semicossyphus pulcher*) on urchins (*Strongylocentrotus* spp.). When predation success varied with predator size, and predators were size-selective, shifts in size distributions toward smaller predator sizes decreased overall prey mortality rates, with disproportionate reductions for larger prey, and increased prey densities. These patterns suggest changes in predator size structure will lead to previously unexpected changes in prey size structure and abundance.

**8. FISH PRODUCTION OF THE OIL PLATFORMS OFF THE COAST OF CALIFORNIA**

**J.T. Claisse**<sup>1</sup>, D.J. Pondella, II<sup>1</sup>, M. Love<sup>2</sup>, L.A. Zahn<sup>1</sup>, C.M. Williams<sup>1</sup>, and A.S. Bull<sup>3</sup>. <sup>1</sup>Vantuna Research Group, Department of Biology, Occidental College, Los Angeles, CA, 90041; <sup>2</sup>Marine

Science Institute, University of California, Santa Barbara, CA 93106; <sup>3</sup>Pacific Region, Environmental Sciences Section, Bureau of Ocean Energy Management, Camarillo, CA, 93010.

To investigate the conservation and fisheries value of active and decommissioned oil platforms, standing stock biomass and production of fishes on oil platforms (and natural rocky reefs for comparison) off of southern California, USA were modeled using fisheries independent empirically-collected submersible and scuba survey data. All platforms and natural reefs included in the study were surveyed for at least 5 years. Standing stock biomass estimates incorporated depth-specific fish density and size structure with published weight-length relationships. Production of these fishes was then modeled over one year using von Bertalanffy growth function parameters and size-based species-specific estimates of natural mortality. Reproductive potential was also evaluated between platforms and natural reefs for species with published size-fecundity relationships (or other size-based measures of reproductive potential). Fish production estimates for oil platforms were high, often one to two orders of magnitude greater than rocky-reefs in the region. Per unit area of seafloor, oil platform fish populations also have significantly greater reproductive potential relative to those on rocky reefs. These results indicate that the potential contribution of oil platform habitat to biological resources in this region is substantial.

#### 9. U.S. WEST COAST SEA TURTLE CONSERVATION AND MANAGEMENT

**C.C. Fahy** and R.A. LeRoux. National Marine Fisheries Service, Southwest Region (Long Beach, CA, 90802) and Southwest Fisheries Science Center (La Jolla, CA, 92037).

Sea turtles found in the marine environment are managed under the jurisdiction of NOAA's National Marine Fisheries Service. The highly migratory nature of sea turtles presents a challenge for NMFS in recovering these endangered and threatened species, particularly since many of the threats to their survival, including impacts on nesting beaches or preferred foraging areas, are located in areas outside U.S. jurisdiction, including the high seas. Four sea turtle species inhabit waters off the U.S. west coast, including leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), and green turtle (*Chelonia mydas*). Stranding records, fisheries bycatch data, and observations at sea provide valuable information on the seasonality and potentially important habitat for sea turtles off the west coast. In addition, analyses of life history data, genetics and satellite telemetry, including correlation with oceanographic and physical features, have refined our understanding of the origin of these turtles, important habitat, and their status regionally (e.g. North Pacific Ocean). Threats to sea turtles off the U.S. west coast include: fisheries interactions, boat collisions, power plant entrainments, marine debris, and illness, including a phenomena well known off the U.S. east coast termed "cold stunning." Domestic and international collaborative efforts have made positive strides in recovering sea turtle populations in the Pacific Ocean; however, major threats remain and the U.S. continues to serve as a leader in exploring solutions to reducing or mitigating these impacts.

#### 10. TARGETING SWORDFISH DEEP DURING THE DAY TO REDUCE BYCATCH

**H. Dewar**, S. Kohin, S. Stohs, and H. Gjertsen. Fisheries Resources Division, Southwest Fisheries Science Center NMFS, NOAA 8604 La Jolla Shore Dr. La Jolla, CA 92037.

In recent years the management of Pacific swordfish (*Xiphias gladius*) fisheries have been shaped by concerns about bycatch of protected species rather than the sustainability of the target catch. An example comes from the California Drift gillnet fishery that targets swordfish off the U.S. West Coast. Due to concerns about leatherback sea turtle (*Dermochelys coriacea*) and marine mammal bycatch a series of gear modifications and time-area closures have been implemented. As a consequence, the fishing fleet and catch levels have declined dramatically with significant economic impacts. The diminishing landings may come at a greater cost in terms of bycatch if imports increase and foreign fisheries are not as tightly regulated. One way to reduce bycatch while allowing fishing is to take advantage of habitat separation between target and bycatch species. The habitat of swordfish and leatherbacks are separated vertically during the day; swordfish - deep, leatherbacks - shallow. This project examines the feasibility of targeting swordfish at depth using a deep-set longline and uses tagging technology to better characterize habitat separation. Two research cruises have been conducted targeting swordfish deep during the day. Working with fishermen,



methods were developed to suspend the hooks below 200 m. Catch data were recorded on all sets. Catch are dominated by blue sharks (*Prionace glauca*) and opah (*Lampris* sp.) with few swordfish caught. There were no interactions with marine mammals or turtles. Additional efforts are planned for the fall of 2013.

#### 11. EVALUATING POPULATION GENETIC STRUCTURE OF STRIPED MARLIN IN THE PACIFIC OCEAN

C.M. Purcell<sup>1,2</sup> and S. Edmonds<sup>2</sup>. <sup>1</sup>Southwest Fisheries Science Center, NOAA Fisheries, 8901 La Jolla Shores Dr., La Jolla, CA 92037-1508; <sup>2</sup>University of Southern California, Department of Biological Sciences, Los Angeles, CA 90089-0371.

Spatial genetic structure in the highly migratory striped marlin (*Kajikia audax*) was examined using nuclear (microsatellite) and mitochondrial (control region sequences) DNA markers. A multi-year concurrent sampling scheme was employed to collect tissue from 7 locations representative of the species' range in the Pacific: Japan, Hawaii, Southern California, Mexico, Central America, New Zealand and Australia. Mature and immature specimens were analyzed separately to evaluate life-stage specific population structure and movements. Microsatellite and sequence results revealed small, but significant overall spatial subdivision ( $F_{ST} = 0.0145$  and  $K_{ST} = 0.06995$ , respectively). Pair-wise microsatellite analyses ( $n = 1199$ ) revealed 4 groups: 1) Japan/Immature Hawaii/Southern California 2) Mature Hawaii 3) Mexico/Central America and 4) Australia/New Zealand. Mitochondrial sequence analysis ( $n = 451$ ) showed similar patterns; however, no significant differentiation was found between groups 1 and 2. Accounting for both spatial and temporal variation is crucial when interpreting genetic information for use in management strategies for striped marlin and other fisheries; therefore, temporal variation was also assessed in this study. Microsatellite data were used to calculate an unbiased estimate of temporal variance,  $F_s'$ , which was corrected for overlapping generations. The magnitude of genetic drift ranged widely between consecutive age-classes, but did not alter the spatial patterns previously detected. This enhanced resolution of geographic genetic structure is important for understanding the complex migration patterns in this species. Moreover, the consistency among independent genetic studies on striped marlin provides strong support for management of at least 3 clearly delineated Pacific stocks.

#### 12. RECENT ANALYSIS OF THE CALIFORNIA SEA CUCUMBER FISHERY

C. Mireles and D. Stein. California Department of Fish and Wildlife, 1933 Cliff Dr. Suite 9, Santa Barbara, CA, 93109.

In 2011, the California sea cucumber fishery reached a record high ex-vessel value of \$3.4 million. This was double that of the previous record set in 2008 of \$1.7 million. This dramatic increase in value has been primarily driven by increasing demands from foreign markets in China and Korea, with domestic markets also on the rise. The dive fishery targets the shallower occurring warty sea cucumber (*Parastichopus parvimensis*) while the trawl fishery targets the deeper giant red sea cucumber (*P. californicus*). Recent analysis of dive and trawl logs, have provided important information that we can use to better understand daily fishing behavior and how it has changed as this fishery has evolved. The results from independent monitoring groups have shown both decreasing and increasing densities of warty sea cucumber. The Department is currently evaluating these independent data sets as they relate to the commercial landing and log databases to determine if they can be used to better understand fishery trends. In addition, we have begun to monitor both inside and outside established MPAs to determine how distributions of warty sea cucumbers may be influenced seasonally. This understanding will be important in exploring the role that MPAs play as a fisheries conservation tool for sea cucumbers, and in assessing the various options that can be used to best manage this growing fishery.

#### 13. STATUS OF THE FISHERIES - COASTAL PELAGIC SPECIES

E.A. Hellmers. California Department of Fish and Wildlife, Marine Region, San Diego, CA, 92123.

Populations of coastal pelagic species have long provided an important resource for the west coast of the U.S. In 1999 the Federal Coastal Pelagic Species Fishery Management Plan (CPS FMP) was adopted with

the intent to prevent over-fishing while managing an increasing harvest capacity and maximizing yield. Under the FMP, take of all krill species is prohibited. Northern anchovy (*Engraulis mordax*) and jack mackerel (*Trachurus symmetricus*) are considered monitored species, while management of market squid, *Doryteuthis (Loligo) opalescens* is deferred to the State under the Department's Market Squid Fishery Management Plan. Populations of Pacific sardine (*Sardinops sagax*) and Pacific mackerel (*Scomber japonicas*) are actively managed under the CPS FMP. For managed species, annual stock assessments are conducted, upon which the Pacific Fishery Management Council bases harvest guidelines (HG) for the following season. One of the largest fisheries in California, commercial sardine fishery catches were constrained by the HG in 2008 for the first time since the population was declared recovered in 1999. For the next four years, annual HG's had a restrictive trend due to declines in biomass estimates. In 2012, the HG was increased but not met, due to several possible factors. With a recent decline in the stock biomass estimates, the harvest guideline for Pacific sardine has again been reduced for the 2013 season from the previous year.

#### 14. CALIFORNIA SHEEPHEAD (*SEMICOSSYPHUS PULCHER*) FISHERY REVIEW

K.A. Loke-Smith and C.F. Valle. California Department of Fish and Wildlife, 4665 Lampson Ave., Suite C, Los Alamitos, CA, 90720.

California sheephead (*Semicossyphus pulcher*) are protogynous, temperate reef fish that are targeted by size-selective recreational and commercial fisheries. Driven by the emergence of a trap fishery supplying the live fish market, the commercial sheephead fishery boomed in the 1990s when average annual landings for the decade were 106 metric tons; a 10-fold increase from average annual landings for the previous decade. In the early 2000s, regulatory actions including implementing minimum size limits and seasonal closures, and restricting access to the commercial fishery contributed to a decrease in landings. In 2001, optimum yield was determined and total allowable catch (TAC) was set to approximately half that of recent catches. Since 2005, commercial landings have been near or below the TAC set in 2001. Research has shown biological plasticity in sheephead in response to fishing and/or environmental factors. In some populations, sheephead reached first maturity and changed sex at smaller sizes, and sex ratios ranging from 1:1 to 15:1 (female:male) were reported. Recent studies also showed sheephead from some populations changed sex during the spawning season thereby forgoing spawning for some portion of the season. Changing sex during the spawning season suggests the reproductive potential of sheephead populations may be diminished where it occurs. In addition, spatial differences in population size structure show there is variable efficacy of the current minimum size limits across the sheephead's range. Although regulatory actions since the most recent boom have affected landings, modeling data from a recent study suggests that other regulations may increase fishery yield.

#### 15. THE EFFECTS OF FISHING AND THE ENVIRONMENT ON THE LONG-TERM SUSTAINABILITY OF THE BARRED SAND BASS AND KELP BASS FISHERY IN SOUTHERN CALIFORNIA

E.T. Jarvis, H.L. Gliniak, and C.F. Valle. California Department of Fish & Wildlife, 4665 Lampson Ave., Suite C, Los Alamitos, CA, 90720.

Unlike several boom-and-bust fisheries in other parts of the world, the recreational *Paralabrax* spp. (kelp bass/sand bass) fishery in southern California has endured several warm and cool oceanographic phases and nearly a century of increasing anthropogenic impacts. We examined regulatory changes and fishery-dependent and -independent data to investigate historical influences on the fishery and causes of dramatic catch declines in recent years. Our results reveal a complex relationship between harvest rules, fishery recruitment, kelp, ocean regimes, and fishing. Recent trends in larval abundance and lengths of harvested fish suggest population recruitment failure occurred during the last oceanographic regime shift coincident with peak exploitation. We believe this contributed to poor fishery recruitment, declines in catch-per-unit-effort, and a depressed population since the mid-2000s. Although long-standing regulations and periods of optimal environmental conditions appeared to have sustained the fishery, we recommend an adaptive management approach to mitigate the effects of fishing during unfavorable ocean conditions.

16. **PROCEDURES AND SUCCSESSES OF THE NMFS TUNA TRACKING AND VERIFICATION PROGRAM**

**B.R. Rogers**, U.S. Army Corps of Engineers. Former National Marine Fisheries Service, Southwest Region, Long Beach, CA, 90802.

Since 2000, the National Marine Fisheries Service (NMFS) in Long Beach has implemented the National Oceanic and Atmospheric Administration's national Tuna Tracking and Verification Program (TTVP), reviewing and verifying imported and domestic tuna in the United States. Along with tracing tuna by harvest information, the TTVP verifies the status of dolphin-safe tuna claims, and oversees use of dolphin-safe tuna labels on consumer products. The dolphin-safe tuna label, designated in 1990, was the first label of its kind and remains an important tool for consumers who wish to know whether or not dolphins were seriously injured or killed during tuna harvest. Despite this long-standing history of tuna tracking by NMFS, this is the first formal description of the TTVP's internal review process for verifying dolphin-safe tuna.

17. **DOLPHIN-SAFE TUNA LABELING IN THE UNITED STATES: WHERE DID IT COME FROM? WHAT DOES IT MEAN?**

**B. Jacobson**, NOAA, National Marine Fisheries Service, Southwest Region, Sustainable Fisheries Department, Long Beach, CA, 90802.

Dolphin-safe logos are found on the vast majority of the tuna cans or pouches in U.S. retail markets. Tuna fishing practices, the role of fishery observers, U.S. statutes and regulations, and current issues are examined by the National Marine Fisheries Service, along with the impact these have had on dolphin-safe tuna labeling today. A review of the dolphin-safe program will be addressed.

18. **PROTEOMIC CHARACTERISTICS OF THE REPRODUCTIVE STAGES OF THE POLYCHAETOUS ANNELID *NEANTHES ARENACEODENTATA***

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*Neanthes arenaceodentata* is the southern California member of the *Neanthes acuminata* complex. All the species in this complex are morphologically identical and have the same reproductive characteristics. Same sexes fight and opposite sexes lie side by side until egg laying. The female dies after laying eggs, and the male fertilizes the eggs and incubates the embryos for 3–4 weeks. The male can reproduce up to 9 times. Since this method of reproduction is unusual in polychaetes, the objective of this research was to determine if there is any set of proteins which influences this method of reproduction. Two-dimensional gel electrophoresis was used to identify differences between male and females proteins before and after reproduction. A total of 145 protein and 81 phosphoprotein spots were detected of which 36 proteins and 19 phosphoproteins were identified. The protein pattern was similar before and after fertilization in the male. Females lose about 75% of their weight following egg laying and are unable to resume feeding and either die or is eaten by the male. The protein structure is very different in the female as a result of spawning. There was a 44% and 16% decrease in the number of detected proteins and phosphoproteins in spent females, respectively. Identified proteins were actin-binding molecules involved in many cellular pathways regulated by multiple regulatory binding proteins and their modifications. Further, the down-regulation of muscle proteins and expression of specific set of actin isoforms after spawning suggested their regulatory role during reproductive period in *Neanthes* worms.

19. **TEMPERATURE-MEDIATED VARIATION IN LARVAL TRAITS OF A SEASONALLY CLOSED ESTUARY SPECIALIST FISH: HOW MUCH DOES LATITUDE MATTER?**

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Variations in the environment have been found to strongly influence the life history of many marine organisms that occur across with large latitudinal gradients. Species such as the endangered tidewater goby (*Eucyclogobius newberryi*) persist in estuaries along the California coast that are highly seasonally variable. This habitat preference may predispose them to local extirpation. This study investigates variations in the early life history of *E. newberryi* in relation to temperature trends found in ten estuaries spanning approximately eight degrees of latitude. Hourly temperature recordings were taken from July–October of 2011 using ibutton thermocron data loggers. Newly settled individuals were collected in order to determine how habitat variations affect pelagic larval duration (PLD), size at settlement, and post-settlement growth rates. Estuaries inhabited by *E. newberryi* showed high variability in temperature with no latitudinal trend, likely due to factors such as estuary size, amount of freshwater input, and duration of seasonal closure. Variations in all life history traits were found between high and low temperature sites. Fish that experienced colder temperatures had a longer PLD, slower post-settlement growth rates, and were larger at settlement.

## 20. BEHAVIOR OF JUVENILE WHITE SHARKS IN SOUTHERN CALIFORNIA

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The Southern California Bight is a known nursery for white shark (*Carcharodon carcharias*) of the eastern Pacific. Although birthing location is still unknown, young-of-the-year sharks (YOY) (< 1.75 cm TL) are incidentally caught in commercial gillnet fisheries and along coastal piers during summer and early fall months. Satellite and acoustic tagging data of YOY sharks caught in southern California during the summer indicate that sharks spend a majority of their time in coastal waters (< 200 m depth) then migrate south into Mexican waters during winter months when water temperatures go below 15.5°C. Some individuals have been shown to migrate back to southern California waters the following summer. Telemetry data indicate that YOY shark use approximately 600 km<sup>2</sup> during summer months. Areas showing the highest degrees of activity include Ventura Flats, Santa Monica Bay, Huntington Flats, and off Dana Point.

## 21. A TIME-CALIBRATED PHYLOGENY OF NORTH PACIFIC BAY GOBIES: ADAPTIVE CONVERGENCE, ECOLOGICAL DIVERSIFICATION, AND RELICTUAL ENDEMISM IN THE GULF OF CALIFORNIA

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North Pacific bay gobies inhabit bays, beaches, and estuaries of temperate Asia and North America, but are absent from the northernmost latitudes of the central Pacific. Morphological characters have conventionally subdivided the clade into two informal groups – an elongate infaunal *Astrabe* group, and a deeper-bodied *Chasmichthys* group – each with a disjunct East-West (amphi-) Pacific distribution. A multi-locus phylogeny reveals basal divergence of the tree coincident with a dramatic global cooling event at the Eocene/Oligocene transition, with no evidence of subsequent trans-Pacific migration. These results suggest that several morphological characters previously used to define the *Astrabe* and *Chasmichthys* groups have arisen independently on both sides of the Pacific, revealing convergence of ecologically adaptive characters within a geographically divided clade. Inferences of vicariance via biogeographic events are used to time-calibrate this phylogeny. Divergence time estimates are used to compare and contrast potential mechanisms of bay goby diversification on either side of the Pacific. Speciation in the West Pacific has been driven largely by interstitial colonization of gravel beaches of varying grain size, and by invasion of freshwater streams around the Sea of Japan. In the East Pacific, diversification appears to be related to an intense upwelling regime combined with isolation in large Miocene-era embayments on the coast of California. Divergence times also provide strong evidence for relictual endemism in the Gulf of California, as speciation of three out of four Gulf-endemic gobies substantially predates tectonic formation of the Gulf itself.

22. **A COMPARISON OF THE FREQUENCY OF MULTIPLE PATERNITY BETWEEN TWO POPULATIONS OF THE BROWN SMOOTHOUND SHARK, *MUSTELUS HENLEI***

**C.L. Chabot**, University of California, Los Angeles, Department of Ecology and Evolutionary Biology, Los Angeles, CA, 90095.

Multiple paternity was recently observed in a population of the brown smoothhound shark (*Mustelus henlei*) from Las Barrancas, Baja California Sur, Mexico with litters demonstrating the greatest percentage of multiple paternity for any shark species (0.93 of litters and an average number of sires = 2.3). To determine if this frequency is consistent elsewhere in the species' range, 4 polymorphic microsatellite loci were used to determine the frequency of multiple paternity in 18 litters of *M. henlei* from Santa Catalina Island, CA sampled in 2004, 2008, and 2012. Overall, multiple paternity was detected in 0.22 of litters with an average of 1.3 sires per litter. Multiple paternity varied among sampling periods with 2004 demonstrating multiple sires for 0.4 of sampled litters (n = 10) and 2008/2012 demonstrating a total lack of multiply sired litters (n = 8). Although multiple paternity was detected in this study, the frequency of occurrence is lower than that observed in the Mexican population. Based on these findings, investigators should take location into consideration when assessing the existence of multiple paternity in future studies of elasmobranch species.

23. **A COMPARATIVE STUDY OF GENETIC DIVERSITIES AMONG EXPLOITED FLATFISHES OF THE CALIFORNIA SLOPE WITH EMPHASIS ON DOVER SOLE (*MICROSTOMUS PACIFICUS*)**

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Dover sole (*Microstomus pacificus*) is a commercially important, slope dwelling flatfish of the northeast coast of the Pacific Ocean. Its genetic diversity is low relative to another commercially important flatfish, Pacific sanddab (*Citharichthys sordidus*). To provide a possible explanation, Dover sole nucleotide diversity and average pairwise differences are being compared to Pacific and longfin sanddab (*Citharichthys xanhostigma*), slender sole (*Lyopsetta exilis*), and the diamond turbot (*Hypsopsetta guttulata*) at Palos Verdes, Monterey, and Eureka, California. The rubynose brotula (*Cataetyx rubrirostris*), a non-flatfish, is being used as an outlier at Palos Verdes. Data from cytochrome oxidase subunit 1 (COI) sequences in Genbank (652 base pairs) suggested a trend where nucleotide diversity and average pairwise differences decrease with increasing depth. The shallow Pacific sanddab has an average pairwise difference of  $1.65 \pm 1.04$  (mean  $\pm$  standard deviation), while the deep slender and Dover sole have average pairwise differences of  $1.20 \pm 0.82$  and  $0.98 \pm 0.71$ , respectively. Preliminary mitochondrial DNA control region data from specimens collected off Palos Verdes, using the highly variable 5' domain, matches the COI sequences' depth trend. The shallow diamond turbot and longfin sanddab have an average pairwise difference of  $15.98 \pm 7.80$  and  $9.38 \pm 4.64$  (respectively), whereas the deeper dwelling Dover sole, slender sole, and rubynose brotula (overlapping depth ranges) have lower average pairwise differences of  $3.67 \pm 2.33$ ,  $4.28 \pm 2.24$ , and  $4.35 \pm 2.31$ , respectively. These preliminary data suggest that the low genetic diversity of Dover sole may be related to the depth it inhabits.

24. **BAY GOBIES IN CALIFORNIA AND THE GULF OF CALIFORNIA – PHYLOGENY, SPECIATION PROCESS, CRYPTIC TAXA, ANTHROPOGENIC IMPACTS AND RESTORATION CONFLICTS**

**D.K. Jacobs**, R. Ellingson, G. Dolby, and C.C. Swift. Ecology & Evolutionary Biology Dept. UCLA, Los Angeles, CA, 90095.

The primarily estuarine North Pacific "bay gobies" include approximately 17 eastern Pacific temperate and subtropical species. Diversity is high on the California Coast and higher still in the Gulf of California. These species prefer discrete types of estuarine habitat. The federally endangered tidewater goby (*Eucyclogobius newberryi*) is exclusive to the coast of California and strongly prefers seasonally closing habitat. Our recent work demonstrates that species within the group are phylogenetically subdivided East/West across the Pacific not on Ecological distinction relating to infaunality and blindness as had been previously argued. We also document that gobies endemic to the Gulf of California actually evolved prior

to the tectonic formation of the Gulf, and that other subdivision within goby species may be a product of isolation of estuarine habitat at glacial low-stand. Moreover habitat specificity influences dispersal, genetic structure and endangerment. Cryptic diversity is evident including within the Gulf of California including the recently resurrected *Gillichthys detrusus* from the Colorado Delta. More generally a greater concern should be exhibited regarding local genetic variation relative to management action on the West Coast.

**25. USING THE ROUND STINGRAY (*UROBATUS HALLERI*) AS A MODEL OF MATERNAL TRANSFER IN ELASMOBRANCHS**

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Maternal offloading is one route by which animals may bioaccumulate persistent organic pollutants, such as DDT and PCBs. However, this process has not been well documented in elasmobranch fishes, despite the important roles they play in maintaining communities. The round stingray (*Urobatis halleri*) represents a good model to examine maternal offloading processes due to their high local abundance and use of contaminated nearshore systems. Ovulating and near-term pregnant female stingrays were sampled from several local estuaries in southern California and organic contaminants were measured in the ova and embryonic tissues and compared to levels measured in corresponding female livers to determine route of and extent of transfer. Total organic contaminant loads measured in ovulated ova were significantly lower than levels measured in embryos ( $132.84 \pm 58.23$  ng/ova versus  $438.66 \pm 301.64$  ng/embryo;  $t_{25} = -3.9$ ,  $p < 0.001$ ), indicating females have the ability to transfer contaminants throughout pregnancy. In addition, contaminant loads measured in pups showed a positive relationship with female contaminant concentrations ( $F_{1,67} = 21.51$ ,  $p < 0.001$ ). While females were demonstrated to maternally transfer contaminants, they offloaded relatively low percentages of their total contaminant loads ( $1.5 \pm 1.7\%$ ) compared to other species. Therefore, variation in reproductive modes utilized by elasmobranchs will likely influence the extent to which females may maternally offload contaminants.

**26. REGIONAL TAXONOMIC STANDARDIZATION AND INTERCALIBRATION: HOW TO ACHIEVE IT? THE GOALS AND ROLE OF SCAMIT**

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California has some of the strictest environmental regulations in the US. The Southern California Bight has four major POTW's, three large ports, coastal bays and harbors, and open ocean which require marine environmental studies to insure their protection. As a result, there is a great amount of benthic sampling in coastal and ocean environments. That means taxonomic work! There are many government laboratories (municipal, county, state) and private consulting companies involved in producing benthic invertebrate community data (identification and abundance). A need for standardization and intercalibration of taxonomic name usage between Southern California laboratories was recognized and the Taxonomic Standardization Program was established by the Southern California Coastal Water Research Project in 1973. The demise of that program led to the formation of the Southern California Association of Marine Invertebrate Taxonomists (SCAMIT) in 1982. From the outset, the goal of SCAMIT was "promoting the study of marine invertebrate taxonomy in Southern California and developing a regionally standardized taxonomy". To accomplish this, SCAMIT provides a regular monthly forum to address problems in taxonomy, organizes taxonomic workshops, and hosts a discussion email list server. In addition, SCAMIT hosts a website, produces taxonomic aids, maintains a regional species list, and provides members with access to publication grant funds. A web based taxonomic database combining several information sources is in development. The organization's activities contribute to the scientific value of the many surveys of marine benthic invertebrate communities conducted in Southern California by assuring standardized taxonomy and compatibility between various taxonomic data sets.

**27. THE SCAMIT TAXONOMIC DATABASE PROJECT: THE VISION AND THE REALITY**

**C.A. Brantley**. Ocean Monitoring and Research Group, County Sanitation Districts of Los Angeles, Marine Biology Lab, Carson, CA 90745.

In 2004 after a decade of successful use of SCAMIT's Taxonomic Species List of soft bottom invertebrates, an idea for an internet based version of the list was proposed by members. At this time



SCAMIT already had an established website ([www.scamit.org](http://www.scamit.org)). For more than eight years it was only used to post current newsletters, meeting announcements, and membership forms. This new database was envisioned as an on-line version of the taxa list that would provide scientific users with historical, bibliographical, and ecological data in addition to taxonomic descriptive information for each individual invertebrate species. The database could also provide community assessment tools and calculations for taxa specific indices greatly needed for state mandated sediment quality objectives. The database would then become a central clearinghouse for all SCAMIT's past products such as newsletters, taxonomic keys, voucher sheets, character tables, and digital images. All these useful resources could be linked thru a dynamic species page for each taxa name. This would allow working taxonomists and benthic ecologists instant access to information long kept in notebooks, binders and even brains. The realities of available volunteer time, support money, and lack of computer database skills created many stumbling blocks. Progress has been slowly made over the last nine years with the help of many partnerships. The taxonomic database is still a work in progress but the basic backbone and species pages are currently ready for public display, use and input.

**28. BIODIVERSITY SURVEY SPECIES NAMES: CAN THEY BE TRUSTED?**

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Accurate specimen identification is the foundation of biodiversity surveys, environmental monitoring, and ecological studies. It is usually assumed that the long lists of names contained within publications are reliable but that's not always the case. Comparison of the polychaete names reported in several recent studies and actual specimens shows that experience matters when it comes to providing trustworthy data. Species lists compiled in university labs by students & non-specialist researchers, monitoring agencies, and consulting companies often contain mistakes. The time required to process the specimens and the level of identification (whether to family, genus, or species) varies according to the quality of the taxonomist as well. Molecular data may give misleading results if not paired with accurate morphological identifications. Good taxonomy results from a combination of factors: 1) education & experience, 2) access to literature, 3) communication between researchers, and 4) access to vouchers & museum specimens. The Southern California Association of Marine Invertebrate Taxonomists (SCAMIT), which promotes all four factors, is an outstanding example of regional cooperation resulting in a high level of competence & standardization in California and beyond.

**29. THE ROLE OF SAFIT IN THE CALBRATIVE STANDARDIZATION OF FRESHWATER INVERTEBRATE TAXONOMY IN THE SOUTHWESTERN UNITED STATES**

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The implementation of the Clean Water Act by the EPA in 1972 has heavily influenced the way we monitor our waterways throughout the United States. The initial steps toward assessing freshwater stream health were strictly focused on water chemistry and toxicity. In time, it was recognized that to truly assess stream condition, direct measures of instream biological communities were necessary, and thus bioassessment monitoring began. With the inclusion of benthic macroinvertebrate (BMI) communities in bioassessments, it became necessary for many governments, consulting agencies, and citizen monitoring groups to hire freshwater invertebrate taxonomists. To ensure accurate assessments of stream condition it was necessary to standardize the taxonomic naming conventions of BMIs, which in turn, resulted in the formation of the Southwestern Association of Freshwater Invertebrate Taxonomists (SAFIT). The mission of SAFIT is "to promote a better understanding of the taxonomy and systematics of macroinvertebrates in support of assessment of biotic condition in inland aquatic ecosystems of the southwest United States. Fundamental to this mission is the standardization of identification and reporting of taxa." SAFIT accomplishes this task by fostering scientific research, training and professional development of the environmental sciences pertaining to freshwater invertebrates through annual

meetings, hosting webinars and workshops on problematic taxa, and has produced a standard taxonomic effort (STE) database to standardize all the taxonomic data collected by various sources throughout the southwestern United States.

### 30. WHAT IS SCAITE?

**J. Kalman Passarelli**<sup>1</sup>, B. Power<sup>2</sup>, and D. Diehl<sup>3</sup>. <sup>1</sup>Cabrillo Marine Aquarium, San Pedro, CA 90731; <sup>2</sup>Ocean Monitoring and Research Group, County Sanitation Districts of Los Angeles County, Carson, CA 90745; <sup>3</sup>Southern California Coastal Water Research Project, Costa Mesa, CA 92626.

SCAITE (Southern California Association of Ichthyological Taxonomists and Ecologists) formed in 2010 and began meeting regularly in 2011. This southern California based SCAMIT-like-fish-group consists of ichthyologists from sanitation districts, academia, museums and aquariums, and governmental agencies. We meet four times a year (typically March/April, June, September, and December) at either Cabrillo Marine Aquarium (CMA) in San Pedro or Southern California Coastal Water Research Project (SCCWRP) in Costa Mesa. Past meetings have focused on specific fish groups, such as rockfishes, syngnathids, and cottids, and typically include a guest speaker, a questions and answer session, and hands-on identification with specimens. This year's meetings will focus on the upcoming Southern California Bight 2013 Regional Monitoring Program. A LISTSERV has been created, has close to 100 scientists, and is constantly growing. Please visit our website at <http://scaite.org/> for more information and details about upcoming meetings.

### 31. SIMPLIFYING THE COMPLEX, PART 1 - MOLECULAR APPROACHES TO DISSECTING THE *LEPTOCHELIA* COMPLEX

**K.A. Beauchamp**<sup>1</sup>, D.B. Cadien<sup>2</sup>, R.M. Duggan<sup>3</sup>, and E.M. Pilgrim<sup>4</sup>. <sup>1</sup>City of San Diego Marine Biology Laboratory, Public Utilities Department, San Diego, CA 92101; <sup>2</sup>Marine Biology Laboratory, County Sanitation Districts of Los Angeles County, Carson, CA 90745; <sup>3</sup>Oceanside Biology Laboratory, City and County of San Francisco Department of Water, Power and Sewer, San Francisco, CA 94132; <sup>4</sup>E.M. Pilgrim, Ecological Exposure Research Division, U.S. Environmental Protection Agency, Cincinnati, OH 45268.

Crustaceans of the order Tanaidacea are abundant in soft bottom habitats in the Northeastern Pacific Ocean and measures of species diversity within this group are ecologically significant to ocean monitoring programs. Identification of species within the family Leptocheliidae is problematic due to their small size (2–5 mm) and unresolved species concepts. For example, although *Leptochelia dubia* has been identified worldwide the cosmopolitan distribution of this species is questionable. Specimens identified as *L. dubia* are common in our samples along the California coast; however, limitations of current taxonomy only allow classification to a species complex level that may include several different species. In this study, we use a combination of traditional taxonomic procedures and molecular techniques to explore the systematic relationships of species in the genus *Leptochelia* and related taxa. Specimens of *L. dubia* Cmplx were collected from benthic samples at three sites: San Francisco Bay, San Diego Bay, and offshore of San Diego and Los Angeles. Phylogenetic analyses using the mitochondrial COI gene on the morphologically identified specimens will be presented and compared with GenBank sequences of *Leptochelia* species and other taxa in the family Leptocheliidae from the Atlantic Ocean. In the future, we plan to add the nuclear Histone 3 gene and 28S rDNA to the molecular analyses and include specimens from additional sites along the Northeastern Pacific and other geographic regions.

### 32. SIMPLIFYING THE COMPLEX, PART 2 – MORPHOLOGICAL APPROACHES TO DISSECTING THE *LEPTOCHELIA* COMPLEX

**D.B. Cadien**. Ocean Monitoring & Research Group, County Sanitation Districts of Los Angeles County, Carson, CA. 90745.

Small, white, eyed tanaids (order: Tanaidacea) of the genus *Leptochelia* have been variously identified over the years in our waters, mostly as *Leptochelia dubia*. They are currently viewed as representatives of



an unresolved complex of taxa, which probably does not even include the nominal *L. dubia*. Recent advances in recognition of separatory criteria for females of this genus developed by others are applied here in an attempt to resolve individual taxa in the *L. dubia* complex locally, determine their number and distribution, and test methods for their separation. The same materials described here morphologically are also being analyzed using molecular methods by Katherine Beauchamp, Eric Pilgrim, and other collaborators. Methods will be described and preliminary results presented. The ability to identify females within this genus, long speciated on characters of adult males, should further adoption of a more gender neutral taxonomy within a group known for complex life cycles and highly skewed sex ratios.

### 33. ASSESSMENT OF DEEP BENTHIC HABITATS OFF SAN DIEGO, CALIFORNIA: PRELIMINARY RESULTS AND THE ROLE OF SCAMIT

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The City of San Diego conducts one of the most extensive benthic monitoring programs in the world, regularly collecting ~240 samples/year from nearly 100 sites at mostly continental shelf depths (< 200 m). Consequently, soft-bottom benthic conditions along the San Diego mainland shelf are fairly well understood. In contrast, less is known about conditions in deeper continental slope waters. The City began to address this issue about 10 years ago as part of its enhanced ocean monitoring objectives by adding sites located between 200–1000 m depths to its regional monitoring efforts. These efforts have been subsequently combined into a long-term Deep Benthic Habitat Assessment Study with the Scripps Institution of Oceanography. A total of 79 quantitative 0.1 m<sup>2</sup> grabs sampled to date (2003–2012) captured 7381 individuals, representing about 500 species. Diversity is highly variable at these sites, with species richness ranging between 8–126 taxa/grab. Macrofaunal abundance also varies considerably, ranging between 10–412 animals/grab. Polychaete worms account for about 57% of the animals, molluscs 22%, crustaceans 12%, and echinoderms 7%. Preliminary classification analysis results discriminate between at least nine ecologically-relevant groups occurring at slope depths off San Diego, which appear to separate primarily along depth and sediment type gradients similar to that seen at shallower shelf depths. Details of these deep assemblages will be discussed along with comparisons to sediment quality and other factors. The role of SCAMIT as an important QA component of this study and other local and regional programs throughout the Southern California Bight will also be discussed.

### 34. BENTHIC MACROFAUNAL COMMUNITY CONDITION IN THE SOUTHERN CALIFORNIA BIGHT, 1994–2008

**J.A. Ranasinghe**<sup>1</sup>, K.C. Schiff<sup>1</sup>, C.A. Brantley<sup>2</sup>, L.L. Lovell<sup>2</sup>, D.B. Cadien<sup>2</sup>, T.K. Mikel<sup>3</sup>, R.G. Velarde<sup>4</sup>, S. Holt<sup>5</sup>, and S.C. Johnson<sup>3</sup>. <sup>1</sup>Southern California Coastal Water Research Project, Costa Mesa, CA 92626; <sup>2</sup>County Sanitation Districts of Los Angeles County, Carson, CA 90745; <sup>3</sup>Aquatic Bioassay and Consulting Laboratories, Inc., Ventura, CA 93001; <sup>4</sup>City of San Diego Marine Biology Laboratory, San Diego, CA 92101; <sup>5</sup>Weston Solutions, Pacific Division, Carlsbad, CA 92010.

To evaluate whether the extent and magnitude of altered benthic macrofaunal communities in Southern California vary among habitats and over time, samples were collected using spatially random designs and assessed at 1,111 sites in 1994, 1998, 2003 and 2008, with 382 sites sampled in 2008. Extensive quality assurance and quality control measures were implemented. Benthic community condition was assessed on a four category scale and the area in each category was estimated. Habitats for which assessment tools do not yet exist were not assessed, including slopes and basins (>200m deep), the shallowest areas (< 10 m deep) of the inner shelf, and brackish water embayments with salinity < 27 psu. Overall, benthic macrofauna in Southern California were in good condition during 2008, with 99.7% of the area in reference condition or deviating only marginally. There was no evidence of disturbance on the island shelf or the mainland shelf. In contrast, embayment macrofaunal communities were more frequently disturbed with slightly over 12% of the area supporting clearly disturbed benthos, most often in estuaries (59.0%) and marinas (37.4%). Regional benthic community condition did not change substantially between 1994

and 2008 with less than 4% of the area supporting disturbed benthos and no consistent pattern of change at sites that were sampled during more than one survey. Southern California benthic condition evaluations may be improved by extending the depth and salinity ranges of assessment tools, improving trend detection methods, and improving understanding of mechanisms of impact in estuaries.

**35. IT SAVES TIME, BUT CAN WE COUNT ON IT? - FIELD TESTS OF THE TRAWL WEIGHT/COUNT METHOD**

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For many years local agencies have used a convenient shortcut in evaluating large trawl catches of invertebrates. Using weight/count, assumptions are made about representativeness of a counted subsample, which is separately weighted. The proportion of the total weight of the organism is then used as a multiplier of the exact count to estimate the count of the total catch. The method was a replacement for generic "class" methods used in earlier periods, where effort was truncated by use of 25+, 50+, 200+, etc. These assumptions were recently tested with a variety of different species from several different depths, substrates, and populations to evaluate potential sources of variability in application of the procedure, and to assess the confidence with which the results can be interpreted. This is a step towards providing a defensible methodology for use in SWAMP compatible quality assurance plans for marine trawls.

**36. CHANGES IN INVERTEBRATE COMMUNITY DIVERSITY AND ABUNDANCE AS A FUNCTION OF OLYMPIA OYSTER (*OSTREA LURIDA*) RESTORATION TECHNIQUES**

**K.M. Walker**<sup>1</sup>, A. Cisneros<sup>1</sup>, S.R. Crossen<sup>1</sup>, A. Moreno<sup>1</sup>, C. Waterston<sup>1</sup>, C.R. Whitcraft<sup>2</sup>, and D.C. Zacherl<sup>1</sup>. <sup>1</sup>California State University Fullerton, Department of Biological Science, Fullerton, CA, 92831; <sup>2</sup>California State University Long Beach, Biological Sciences, Long Beach, CA, 90840.

The potential role of the Olympia oyster (*Ostrea lurida*) as an ecosystem engineer has not been explored, so little is understood about whether any ecosystem services will be produced by ongoing restoration efforts for the West Coast's only native oyster species. Further, the effectiveness of different techniques for restoring Olympia oyster beds has not been systematically evaluated. The most common technique is augmenting available structured habitat by adding dead shell onto mudflats and allowing remnant oysters to seed the shell with spat. Shell has been added at varying thicknesses, either consolidated in bags or simply placed loose onto the mudflat. We explored the effects of different combinations of Olympia oyster restoration techniques (varying the thickness of constructed shell beds using loose versus bagged oyster shell) on abundance and diversity of epifaunal and infaunal invertebrates. Twenty-five oyster beds were established in Newport Bay, California in June 2010. Five beds were not augmented with any shell and were used as control plots. The other twenty beds were randomly assigned to be constructed using dead oyster shell at thicknesses of 12 cm or 4 cm using shell bagged in jute or loose shell (n=5 replicates per treatment). Preliminary analyses indicate that the bagging of shell had no effect on abundance or diversity of epifauna. However, bed thickness did have an effect; 12 cm-thick beds supported higher community diversity and invertebrate abundance compared to controls while 4 cm-thick beds had intermediate values. Results could inform future restoration efforts for this species and establish *O. lurida* as an ecosystem engineer.

**37. EXAMINATION OF SOUTHERN CALIFORNIA DROUGHT USING TREE RINGS, AND COMPARISON WITH THE AGGREGATE DROUGHT INDEX (ADI) AND THE STANDARDIZED PRECIPITATION INDEX (SPI)**

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Severe droughts have been recorded and have great impacts in Southern California. Tree rings have ability to record drought in a wide variety of climate. In this research, we used tree rings from Bigcone Douglas-fir (*Pseudotsuga macrocarpa*) in the San Bernardino and San Jacinto Mountains to assess drought in the Santa Ana and San Jacinto River basins, respectively. The tree-ring data were detrended and standardized

using the computer software program ARSTAN (Cook, 1985) to build two master chronologies. The chronologies extend back to 1745 in the San Bernardino Mountains and 1375 in the San Jacinto Mountains. The tree-ring chronologies were compared with two drought indices: the Aggregate Drought Index (ADI) (Keyantash and Dracup, 2004), the Standardized Precipitation Index (SPI) (McKee, Doesken, & Kleist, 1993). Both the ADI and the SPI can describe drought conditions for multiple timescales (e.g., 3-, 6-, 12-, 24- month, etc.), and in this research, the two drought indices are compared with tree rings, and each other, over multiple time scales. A comparison of the three drought indicators during the modern era showed significant drought history in Southern California, especially 1947–50, 1959–63, 1987–92, 1998–03, and 2007–09. The ADI had stronger correlations with both tree-ring chronologies than the SPI (at multiple timescales). The ADI correlations were strongest ( $r \approx 0.70$ ) during the end of summer in both basins. Based on the agreement, the tree ring records used to reconstruct ADI values back to 1375.

**38. DECLINE TO NEAR EXTINCTION OF THE ENDANGERED SCOTTS VALLEY POLYGONUM (*POLYGONUM HICKMANII*) (FAMILY: POLYGONACEAE)**

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Scotts Valley polygonum (*Polygonum hickmanii*) (Family: Polygonaceae) is a narrow endemic plant restricted to a specialized habitat (exposed bedrock in annual grassland) in Santa Cruz County, California. The species was named in 1995 and subsequently listed as endangered under the U.S. Endangered Species Act and California Endangered Species Act in 2003 and 2005, respectively. One population with two occurrences exists on three properties in a recently urbanized area in vicinity of the city of Scotts Valley with a geographic range of 0.03 km<sup>2</sup>. The species persisted as 128 plants in 2012, having declined from 604 plants in 2003 and 1,612 plants in 1998. The primary threats to *P. hickmanii* are habitat alteration due to adjacent land uses and developments, and invasive species and thatch. Cessation of grazing and possibly fire suppression have likely contributed to the increasing presence of invasive species and accumulation of thatch. Intensive management will be necessary for *P. hickmanii* to survive. Unless management is implemented as a matter of urgency, the species will likely disappear within just a few years.

**39. QUANTIFICATION OF WATER UPTAKE FROM PULSED INPUT VIA DISTURBED AND UNDISTURBED CHANNELS ON A DESERT BAJADA**

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Sap-flow gauges were used on creosote bush (*Larrea tridentata*) to provide automated and efficient long-term measurements after simulating rain events (pulses) at three sites on the foot of the Providence Mountains in the Mojave Desert: an upslope channel with natural flow (active channel), a channel below a road with interrupted flow (inactive channel), and an upslope area without a channel (simulated channel). Plants within 3 meters of the active channel had a 20% sap-flow increase showing a maximum peak 16 days after pulse; whereas plants from inactive channel had a 45% sap-flow increase with a maximum peak 8 days after pulse. For plants in the simulated channel, only plants within 1 meter responded to pulse with a 20% sap-flow increase and a maximum peak 15 days after pulse. Plants located further than 3 meters from a channel did not respond to the pulses in any of the three sites. As opposed to expected results, plants located within 3 meters of the inactive channel did respond to the water pulse, and surprisingly showed higher percent increases in sap-flow, however, these values did not persist as in the case observed in the active and the simulated channels. It is not clear why plants near channels that have been cut off from significant flow for greater than 100 years would have a more pronounced pulse response.

**40. THE IMPACT OF AGE AND MATE QUALITY ON RESOURCE ALLOCATION IN THE HOUSE CRICKET *ACHETA DOMESTICUS***

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Organisms are faced with a tradeoff between allocating resources to somatic maintenance or reproduction. The balance of this trade off may be impacted by the quality of an individual's mate and

age at first reproduction. However, few studies have examined how mate quality and age impact reproductive decisions. Reproductive allocation varies with age, mating status and mate quality. Two hypotheses try to explain how mate attractiveness affects reproductive allocation. Reproductive compensation (RC) predicts a female will allocate more resources towards reproduction when her mate is unattractive. Differential allocation (DA) predicts females will allocate more resources when her mate is attractive. We sought to determine which strategy of reproductive allocation is used by house crickets (*Acheta domesticus*), how it varies with age and if females have higher fitness when young and mated to an unattractive male, or older and mated to an attractive male. Older females lay fewer eggs than young females. Regardless of age, female house crickets mated to unattractive males have higher initial rates of egg production compared to females mated to attractive males. Hatching rates don't vary with female age or male attractiveness. However, fertilization rates were highest in young females mated with attractive males and lowest for old females mated with attractive males suggesting attractive males may vary their reproductive investment in response to female age but unattractive males do not. Clearly, house crickets do not strictly adhere to either DA or RC and both male and female strategies vary depending on the context.

**41. MATE GUARDING AND SPERMATOPHORE REMOVAL IN THE HOUSE CRICKET  
*ACHETA DOMESTICUS***

**E.S. Peralta** and S.E. Walker. Department of Biological Science, California State University, Fullerton, 800 N. State College Blvd., Fullerton, CA 92831.

Numerous studies have examined sexual selection prior to mating. However, aspects of sexual selection after mating are not as well understood. In orthopterans, males will continue to compete after mating through various behaviors that presumably increase the number offspring sired. I assessed the post-mating behaviors of the house cricket (*Acheta domesticus*) under varying conditions that should impact male and female behavior. After a focal pair mated, it was put into one of five treatment types. In three of the treatments, an additional male was added that was larger, smaller, or the same size as the focal male. One treatment had no males added and the other had the focal male removed. Aggressive behaviors by the focal male and time until spermatophore removal were measured. I hypothesized that males will mate guard more and that females will remove spermatophores faster in the presence of additional males. There was no difference in the number of stridulations, aggressive calls, mandible flares, or grapples among males in all treatment types indicating that intruder size did not affect aggression levels. However, males spent significantly more time mate guarding females when no additional males were present. Females removed spermatophores significantly faster when no males were added and the focal male was removed. These results indicate that mated males do not require competitors to induce mate guarding and that their presence deters spermatophore removal by females

**42. UNCOVERING A FOSSORIAL SPECIES: HOME RANGE AND HABITAT PREFERENCE  
OF THE WESTERN SPADEFOOT (*SPEA HAMMONDII*) IN ORANGE COUNTY  
PROTECTED AREAS**

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The western spadefoot (*Spea hammondi*) is a small, burrowing amphibian that inhabits arid ecosystems in California and Baja California. The species lives underground during the dry season and emerges only after a certain amount of rainfall to make its way to vernal pools for breeding. It is extirpated from most of its range in southern California, with only a few populations remaining in coastal Orange County, western Riverside County and inland San Diego County. Given that little is known of its biology and that both its terrestrial and aquatic habitats are imperiled in California, the spadefoot is recognized as a species of special concern by the U. S. Fish and Wildlife Service and California Department of Fish and Wildlife, a sensitive species by the Bureau of Land Management and a species of interest by the County of Orange Natural Community Conservation Plan. In response to the need to learn more about the ecology of this cryptic species, we used 11 months of telemetry data for 15 spadefoot to characterize the movement and habitat use for these animals. We found that spadefoot moved a maximum of 262 m away from the

breeding pools. Their aestivation sites were between 10 m and 90 m from the breeding sites (mean=46 m). Preliminary analysis of the spadefoot home range suggests that they cover from 24 m<sup>2</sup> to 6.5 km<sup>2</sup>. From field observations, the spadefoot do not seem to show a habitat preference for burrowing sites, but the data have yet to be analyzed.

#### 43. VENOM VARIATION AMONG SOUTHERN CALIFORNIA SCORPIONS

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Most groups of venomous animals exhibit substantial variation in venom composition. Variation may exist among taxonomic groups, among geographically delineated populations, among individuals within a population, and sometimes between the sexes and ontogenetically within individuals. Most of our knowledge regarding venom variation derives from extensive literature on snakes. In contrast, only a few studies have examined scorpions. In this study, we sought to characterize venom variation among several genera of Southern California scorpions, including *Hadrurus*, *Smeringurus*, and *Paruroctonus/Vaejovis* (identities to be confirmed). Using high-pressure liquid chromatography (HPLC), we found that each of these genera exhibit distinctive and very complex venom profiles, with numerous peptides and proteins. Mass spectrometry (LC-MS/MS) identification of proteins yielded limited hits, underscoring the tremendous potential of scorpion venoms for bioprospecting. We also found distinctive venoms between the two species of *Hadrurus* and two species of *Smeringurus* examined. We will also present results from our analyses of geographic and intersexual variation in venom. These studies form the basis of more in-depth studies of venom variation that will compare the relative influences of phylogenetic distance, geographic distance, habitat differences, and dietary differences.

#### 44.\* TEMPORAL AND SPATIAL VARIATION OF THE INTESTINAL INFRACOMMUNITY OF ALLIGATOR MISSISSIPPIENSIS

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Ecological stochasticity over evolutionary space and time contributes to the patterns illustrated in host parasitism, reflecting the current state of the environment, and the biodiversity and abundance of intermediate and definite hosts. During the 2009–2011 annual American Alligator (*Alligator mississippiensis*) harvest in Louisiana, the intestinal parasite infracommunity was examined to identify correlations of abiotic and biotic factors influencing parasitism between host size, sex, location and year. A total of 10,421 parasites were collected from 104 infected alligator specimens (96%). A significant difference of parasitism was found between sex ( $p=0.02$ ) and harvest years ( $p=0.04$ ). Sex was found to be the best predictor for parasite aggregation (overdispersion coefficient: 1.6964). Although no significant difference was found among geographic locations, variation in intensity and prevalence among geographic zones may be explained by anthropogenic alteration of the environment, such as agriculture and mining, and annual climactic factors, such as hurricanes.

#### 45. A TEMPORAL PERSPECTIVE ON THE DISTRIBUTION OF METACERCARIAL CYSTS OF *CRASSIPHIALA BULBOGLOSSA* (DIGENEA) ON FISHES OF THE HEADWATERS OF THE EMBARRAS RIVER, ILLINOIS

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Fishes of the headwaters region of the Embarras River, Champaign County, Illinois, were surveyed in 1973 (Hinson et al., 1976) for the distribution of metacercarial cysts of the digenetic trematode *Crassiphiala bulboglossa*. The fish hosts were resampled in 1992 and 2011. The preferred fish host species remained similar across this 38 year period. However, the degree to which the hosts were parasitized, as

measured by prevalence and mean intensity, varied greatly. The relevance of such measurements of host-parasite interaction may have considerable temporal limitations.

46. **PARASITE PREVALENCE AND INTENSITY IN RELATION TO HOST MIGRATION: A CASE STUDY OF ATLANTIC COD (*GADUS MORHUA*) PARASITES IN THE NORTHWESTERN ATLANTIC**

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Because parasites rely to a large extent on host ecology to perpetuate themselves, it follows that information on the host can be obtained by studying their parasite fauna. While this concept has resulted in numerous studies on the use of parasites to delineate fish stocks and fish migratory patterns there are relatively few studies that examine shifts in parasite recruitment relative to known seasonal movements of its fish host. Data for the present study was collected in 1974 and 1975 in Passamaquoddy Bay, Bay of Fundy, Canada, by examining 517 Atlantic cod (*Gadus morhua*) caught by otter trawl on a monthly basis. Of the 44 parasite species found in cod during the study, ten species were enumerated and classified as to their state of maturity. Results indicate that patterns of parasite prevalence and intensity were not always consistent with parasite recruitment; e.g., in some cases, parasite numbers increased without any evident juvenile parasite recruitment. This suggests that changes in the prevalence and intensity in some parasites is related to host movement and not to parasite recruitment or death. Due to presence of intermediate hosts and other factors, parasites of cod have localized areas/foci of infection and cod moving through these areas become subtly labeled as to their recent past localities.

47. **THE IDENTIFICATION, PATHOLOGY AND TREATMENT OF *NEOBENEDENIA*, A CAPSALID MONOGENEAN, IN A CLOSED SYSTEM AQUARIUM**

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Monogenean infestations are a common occurrence in captive settings. These infestations can be very difficult to contain once on exhibit because of invertebrates and algae who do not tolerate the treatment options. In this study, the infestation of the capsalid monogenean, *Neobenedenia* is thought to have been introduced through live kelp from the ocean. While a monogenean infestation is considered chronic and rarely a fatal problem, this ecto-parasite can do serious damage to its host – the most concerning of which is to the eyes. The monogeneans will attach to the cornea - causing ulcerations, scarring, edema and infection which can lead to blindness. Monogeneans can also cause infections of the epidermis - which can lead to secondary opportunistic parasite infections, septicemia and death. For control of monogeneans, we regularly identify fish we know to have high infestations and put them a freshwater bath for 4-8 minutes. After treatment, we frequently move fish into a parasite free environment to allow healing and recovery. This is not ideal for wide-spread control, but individually helps fish prone to monogenean related skin and eye problems. Hydro-vacuuming the substrate regularly will also aide in removing monogenean eggs before they hatch. Another widely used treatment option is the use of the drug Praziquantel. Praziquantel can be administered as a bath, a prolonged immersion, an intramuscular injection or it can be given orally. We continue to document what species of fish are parasitized by *Neobenedenia* and investigate with different parasite control and management strategies.

48. **GROSS PATHOLOGY OF SOME METAZOAN PARASITES OF PINNIPEDS IN SOUTHERN CALIFORNIA**

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Between 2000 and 2012, 1593 California sea lions (*Zalophus californianus*), 500 Northern elephant seals, (*Mirounga angustirostris*) and 184 harbor seals (*Phoca vitulina*) were found live-stranded on Orange County beaches were admitted to Pacific Marine Mammal Center for evaluation and rehabilitation. All animals were given a fecal parasite examination on intake and additionally, when they died or were euthanized were given a full parasite organ examination. All animals were found infested with one or more



metazoan parasites. Photographic depictions of parasite anatomy and the pathology associated with infestation by *Otostrongylus circumlitis*, *Parafilaroides decorous*, *Contracaecum osculatum* (Nematoda), *Diphyllobothrium pacificum* (Cestoda), *Corynosoma* sp. (Acanthocephala) and/or *Orthohalarachne diminuata* (Arachnida) are presented. With the exception of *Otostrongylus* sp. and *Parafilaroides* sp., these parasites were not found to be primary causes of morbidity or mortality.

**49. *GYRODACTYLUS LEPTORHYNCHI* (MONOGENEA) ON BAY PIPEFISH (*SYGNATHUS LEPTORHYNCHUS*) AT THE CABRILLO AQUARIUM**

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In October 2011, bay pipefish (*Sygnathus leptorhynchus*) on display at the Cabrillo Aquarium became heavily infected with a previously undescribed species of *Gyrodactylus*. *Gyrodactylus leptorhynchus* (Cone et al. 2013) is the sixth species of *Gyrodactylus* found on pipefish and can be distinguished morphologically by the shape of the marginal hook sickle. DNA sequence data also distinguishes *G. leptorhynchus* from other previously sequenced *Gyrodactylus* species and within the genus, it is a member of a basal lineage that has radiated among coastal syngnathid, anguillid and gobiid fishes throughout the Atlantic Ocean and some adjacent waters. One to three, *G. leptorhynchus* were present on 63% of pipefish collected at Inner Cabrillo Beach and it was also found on pipefish in British Columbia. In the wild, *G. leptorhynchus* is found predominantly on the dorsal fins and anterior body surfaces. In more heavily infected captive fish, worms can be found in other parts of the body, including the male brood pouch. In captivity, young fish became infected at birth or shortly thereafter. Hyperviviparity and close proximity of pipefish held in captivity without treatment, likely result in an increase in parasite numbers within a short time, even at ambient temperatures. Worms can be removed from pipefish with serial treatment of topical anthelmintic chemicals.

**51. SEASONAL CHANGE IN PREVALENCE, INTENSITY AND ABUNDANCE OF SYMBIOTIC COPEPODS ON *NEOTRYPAEA* SPP. IN SOUTHERN CALIFORNIA MUDFLATS**

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Little is known about symbiotic copepods on crustacean hosts, in particular copepods belonging to the family Clausidiidae. In order to better understand the biology of these symbiotic copepods on their hosts, we collected symbiotic copepods on two species of ghost shrimp, *Neotrypaea californiensis* and *Neotrypaea gigas* from two southern California mudflats (Cabrillo Salt Marsh and Santa Ana River mouth). In total, 182 *N. gigas* and 67 *N. californiensis* were collected and 423 and 225 copepods were removed, respectively. So far we have determined the prevalence of copepods at Cabrillo is similar to Santa Ana River for both host species (59.6% and 52.3% for *N. gigas* and 54.8% and 52.8% *N. californiensis*, respectively). The mean intensity of copepods on *N. gigas* at Cabrillo was 5.38 and 8.59 for *N. californiensis*. Mean intensity for *N. gigas* was 2.65 and it was 4.16 for *N. californiensis* at the Santa Ana River mouth. In addition, fluctuations in prevalence and mean intensity of copepods have been observed throughout the season. By assessing the distribution of copepods on *N. californiensis* and *N. gigas*, this study aims to resolve what species of symbiotic copepods occur on southern California ghost shrimp and improve what is known about the life history of symbiotic copepods in the family Clausidiidae.

**52. PREVALENCE OF BOPYRID PARASITES (ISOPODA: BOPYRIDAE) ON TWO SPECIES OF CRANGONID SHRIMP IN SOUTHERN CALIFORNIA**

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All known species of adult bopyrid isopods (Family Bopyridae) parasitize decapod crustaceans and occur either on the abdomen or within the branchial chamber of their host. Samples of crangonid bay shrimp

(*Crangon nigromaculata* and *Crangon nigricauda*) were collected from 2009 to 2012 at five locations in southern California (Mandalay Generating Station in Ventura, Inner Cabrillo Beach in San Pedro, Los Angeles/Long Beach Harbor in Los Angeles, Huntington Beach Generating Station in Huntington Beach, and San Onofre Nuclear Generating Station in San Clemente) and were inspected for bopyrid parasites. A total of 2,264 *C. nigromaculata* and 2,172 *C. nigricauda* were collected and locality, carapace length, weight, sex, reproductive status, and parasite location (left or right branchial chamber) were recorded for each shrimp. Of the total shrimp, 293 *C. nigromaculata* and zero *C. nigricauda* were infected with the bopyrid isopod *Argeia pugettensis*. Infection of *A. pugettensis* on *C. nigricauda* has been reported in other localities; however, none were seen infected in this study. Total parasite prevalence on *C. nigromaculata* was 13% and varied by season and locality. Frequency of location in the right or left branchial chamber seems to be random and no shrimp had multiple parasites. No infected female shrimp were brooding, and non-infected brooding females of comparable size were collected in the same sample. Some crustacean host species have been reported to have the ability to reproduce while parasitized by bopyrids. Our results, however, suggest that *Argeia pugettensis* is likely a parasitic castrator of the bay shrimp *Crangon nigromaculata*.

53. **DETERMINING ACCEPTABLE ERROR THRESHOLD OF BIOMETRIC FINGERPRINT SECURITY**

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Biometric security is an emerging and popular solution for many security needs that would otherwise require less secure forms of identification (e.g., passwords, ID cards, PIN numbers). The fingerprint is a convenient solution that is non-reputable as well as unique to each person. When implementing this type of security it is vital that the system be balanced in its ability to not let unauthorized people have access (false positives) but also does not inconvenience legitimate users by rejecting their fingerprints (false negatives). The objective of this research is to establish the threshold of false positives versus false negatives relative to the level of security that is needed as well as the number of users of the system. The first process is using the NFIQ (NIST Fingerprint Image Quality) standard as a variable scale of quality standards. After asserting that the raw image is up to standards, you must set the allowed minutiae percentage error. As the percentage error value increases the number of false positives increases and the number of false negatives decreases, making them inversely proportional. Establishing an acceptable error threshold is highly dependent on the use of the security system. Highly sensitive information should have a very low error percentage making the information more secure, while systems with high amount of users should have a lower percentage error as to not inconvenience the thousands of people who will use this system every day. This research will increase our ease of access as well as our system/information security with biometric data.

54. **THE RELATIONSHIP BETWEEN TIME PERSPECTIVE AND SPEEDED NEUROPSYCHOLOGICAL TEST PERFORMANCE**

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Differences in neuropsychological test performance among ethnic groups have been documented, and attempts have been made to deconstruct the "race" concept into the language and cultural variables that can help explain these performance differences. The present study explored the concept of time perspective, a cultural factor that may help explain performance differences, particularly on timed neuropsychological tests. It was predicted that Caucasians will outperform Latino/Hispanic participants on timed tests of neuropsychological functioning, and that these differences will be accounted for, at least partially by time perspective. Participants were neurologically and psychologically healthy undergraduate students divided into two groups based on self-reported ethnicity (Caucasian, n=11; Hispanic/Latino, n=39). All participants were administered a comprehensive neuropsychological test battery including a timed measure of processing speed (i.e., the Symbol Digit Modality Test oral and written forms; SDMT) and the Zimbardo Time Perspective Inventory. Independent samples t-test revealed significant performance differences by ethnic group with Caucasians outscoring Hispanic/Latino students on the SDMT-oral form.



There were no significant differences found between Caucasians and Hispanics with respect to time perspective, and time perspective was not significantly correlated with SDMT performance nor did it significantly predict SDMT performance in either group. Results are discussed in light of the current literature and study limitations. Future studies should concentrate on using multivariate methods of data analysis with large representative samples, as well as including measures of acculturation, a variable that likely interacts with time perspective to explain group performance differences.

#### 55. CITY OF NUMBERS: THE UNITS OVER FIELDS OF PRIME ORDER

**A. Hoffman.** CSUDH Department of Mathematics, Dominguez Hills, Carson, CA 90747.

All numbers can be divided into composite and prime numbers, and every prime number is connected with fields and their corresponding finite units. Since these finite units are used in abstract algebra, number theory, and cryptography, their behavior and nature are of significant interest in mathematics. The goal of this presentation is to give a visual representation of the structure of finite units, and to use these visual models to give us an intuition of the behavior of modular exponentiation. This intuition can help us understand existing theorems in number theory and abstract algebra, and hopefully allow us to come up with new theorems. The presentation will cover the slow approach to constructing diagrams of the units, and discuss some of the immediate consequences that we can conclude from this approach. From there we will use this information to find quadratic roots algorithmically, and use the quadratic algorithm to generate the structure quickly. The presentation will then use diagrams to give visual representations of theorems in number theory and hopefully abstract algebra. Thus the structure of units as visually represented will make a useful tool in teaching. The final part of the presentation will look forward on plausible application and categorical approaches of different types of prime, based on the behavior of their units. We will also look at the structure of units to form a solution for discrete logarithms, one of the most important unanswered questions in cryptography.

#### 56. THE CSUDH HADRONIC STRUCTURE LABORATORY

**E. Banuelos-Casillas** and J. Price. California State University, Dominguez Hills, Department of Physics, 1000 E. Victoria Street, Carson, CA 90747.

Modern nuclear physics is not possible without extensive use of computers. Two of the main uses of computers are detector simulation and data analysis, both of which require the highest speeds possible. The amount of data used in a modern physics experiment can exceed 100 Terabytes, and understanding the behavior of the detector requires the simulation of approximately the same amount of data. This is not possible in a reasonable time frame with a single computer, which has led to the development of computer clusters. Both data analysis and event simulation scale linearly with the number of computers sharing the load, so large clusters are very useful for this purpose. A Beowulf cluster uses many identical computers, all connected to each other, performing a task in unison. At the CSUDH Hadronic Structure Laboratory (HadLab), we have built 37-node Beowulf-like computer cluster. All the computers in the HadLab cluster are recycled, mostly from computer labs on campus, to reduce the overall cost of the cluster. HadLab uses two administrative nodes: a "head" node, which controls the overall behavior of the cluster, and a "server" node, which houses a 15-Terabyte disk array, which holds the data used by the cluster; the rest of the computers are used for the calculations done by the cluster. This talk will discuss the motivation, design, and use of the HadLab cluster, and will describe the plans for its future expansion.

#### 57. THE PLANNED SEARCH FOR FREE NEUTRON-ANTI-NEUTRON TRANSFORMATION USING THE NNBARX EXPERIMENT AT FERMILAB AND HOW IT RELATES TO BOUND NEUTRON OSCILLATIONS AT SUPER-KAMIOKANDE AND ELSEWHERE

**J. Venegas.** CSU Dominguez Hills, Department of Physics, Carson, CA, 90747.

In this presentation I will describe the role of CSUDH and present initial planning results on a new experiment at Fermilab called nbarX that will use *neutrons* from a 1 MW cold spallation source near the Fermilab main accelerator ring which is being upgraded. This project will eventually probe theories of grand unification of the fundamental forces, the stability of matter, and how *Baryons* were created in the

early stages of the big bang, at levels of sensitivity to the *baryon* lifetime that will be 100–10000 higher than what is currently available and will rule out or confirm leading theories of grand unification in which *neutrons* and other *fermions* are equally mixed with their antiparticles and can transform to each other in Right-Left symmetric theories such as *SO(10)*. We at CSUDH will be directly collaborating with the University of Tennessee Knoxville, University of Indiana Bloomington, North Carolina State University, Fermilab and Los Alamos National Laboratory on detector R & D for *nnbarX* and will be also working with a few other institutions in the US and in other countries.

#### 58. DOES THE DWARF PLANET PLUTO HAVE AN INTERNAL OCEAN?

**K.D. Trego**, Center for Oceanic Planetology, La Jolla, CA 92037.

The dwarf planet Pluto is large enough to have an internal ocean result of internal heating. The NASA New Horizons mission to Pluto will image the dwarf planet's surface in 2015 and there may be evidence of an internal ocean on Pluto's surface such as resurfacing events. Pluto is a captured dwarf planet from the Kuiper Belt. The Neptune moon Triton has a similar origin as Pluto being a Kuiper Belt dwarf planet captured in a retrograde orbit around Neptune. Triton may have an internal ocean 20 km below its surface result of internal heating and external tidal forces of Neptune. Some other dwarf planets in the Kuiper Belt are large enough to have internal oceans result of internal heating.

#### 59. ICE COVERED OCEANS ON MARS

**K.D. Trego**, Center for Oceanic Planetology, La Jolla, CA 92037.

It is now proposed that Mars has always had an atmosphere with enough carbon dioxide which would never allow the presence of liquid water on the planet's surface for any significant amount of time. Proposed oceans defined by two different sets of shorelines in the Vastitas Borealis northern hemisphere basin comprise the oceans called Oceanus Borealis. Aquifers exposed by slumping regolith released water to the surface. Water associated with volcanism, particularly in the Tharsis Volcanic Province, was brought to the surface. Fracture patterns associated with planetesimal craters in the Vastitas Borealis also released water to the surface. Cryovolcanism would melt subsurface and surface ice to add water to the surface. The water in the Vastitas Borealis basin would freeze not allowing liquid water oceans to form. The continued flow of liquid water to the surface through planetesimal crater fracture zones under a significant layer of ice cover would allow ice covered oceans to form in the Vastitas Borealis if a significant heat source existed to maintain it. That heat source would most likely be volcanism associated with the Tharsis Volcanic Province. A similar environment on Earth would be ice covered lakes in Antarctica.

#### 60. RESTORATION OF CALIFORNIA SAGE SCRUB: RECLAMATION OF GROUND COVER FROM EXOTIC GRASSLAND

**C.M. Rodrigue**, P. Laris, L. Avelar Portillo, S. Brennan, J. Diminutto, M. Mills, P. Nesbit, A. Santana, C. Tabag, C. Vaughan, and S. Winslow. Department of Geography, California State University, Long Beach, CA 90840-1101.

Coastal sage scrub and interior sage scrub has markedly declined in Southern California in the face of construction, plowing, clearing for grazing, changes in fire régimes, and air pollution. Dwindling to an estimated 10–15% of its previous range, a number of endangered animals species are threatened with loss of habitat. A common type conversion is to exotic-dominated annual grassland, which is often strikingly able to maintain its dominance long past the disturbance that originally led to its replacement of CSS. Concerted efforts to restore CSS have often been disappointing, as grass and associated exotics reclaim restoration sites. That said, there are a number of places where CSS has been able to encroach back onto grasslands on its own. Understanding the reasons for CSS self-restoration is critical for the success of landscape restoration programs. Geography at CSULB has been conducting research in areas of persistently stable boundaries between CSS and grassland and in areas where CSS is expanding into grassland. Our work evaluates hypotheses given in the literature for the loss of CSS and the persistence of grassland: fire frequency, grazing history, plowing history, nitrogen fertilization from air pollution,

edaphic factors, slope and aspect, and geological substrates. Field sites have included the western Santa Monica Mountains and the Palos Verdes Peninsula. Papers in this session report progress on these tests, including the fall 2012 fieldwork done by a biogeography seminar.

**61. CHARACTERIZING BIOPHYSICAL DIFFERENCES BETWEEN SHIFTING AND FIXED CSS-GRASSLAND BOUNDARIES**

**K. Engelberg** and P. Laris. California State University, Long Beach, Department of Geography, Long Beach, CA 90840.

California coastal sage scrub (CSS) has experienced significant decline in the last century, with only ten percent of its original land cover remaining. Exotic annual grassland often takes its place, but only temporarily in many cases. In order to understand why and how CSS rebounds, this study compares CSS-grassland boundaries that have shifted significantly over the last 60 years to those that have remained fixed. Shifting boundaries represent significant CSS regrowth, as shrub species move into previously homogenous grassland. We used field transects to compare topographic, edaphic, and species cover characteristics of shifting and fixed boundaries. Results indicate that shifting boundaries tended to have CSS upslope from grass, be more sandy and less silty, have large ecotones, and contain more species associated with pure CSS, while stable boundaries included more traditionally chaparral species. These findings may help guide land managers in their choice of exotic grassland to be restored to native CSS.

**62. GEOLOGY, SUBSTRATE AND CSS RECOVERY IN LA JOLLA VALLEY, VENTURA COUNTY, CALIFORNIA**

**S. Winslow** and P. Nesbit. California State University, Long Beach, Department of Geography, Long Beach, CA, 90840.

Coastal sage scrub (CSS) is a unique and highly threatened vegetation community in California with an estimated 90 percent of the former biomass lost to development, agriculture, and invasion of exotic plant species. Although many hypotheses exist, the primary conditions and mechanisms that govern the success of CSS recovery are still poorly understood. The purpose of this paper is to explore whether any recognizable associations exist between the geologic substrate and stable CSS/grassland boundaries within the La Jolla Valley. The study area is composed predominantly of older (late Pleistocene-age) alluvial materials which overlie shale and sandstone units of the lower Topanga Formation. Scattered outcrops of intrusive volcanic rock (diabase basalt) also occur around the valley perimeter. Erosion of these geologic units and subsequent redeposition of the eroded material on the valley floor has resulted in the development of a soil profile of variable thickness and composition depending on the parent material. We will analyze the relationship between CSS boundaries over several decades compared with the underlying geologic substrate. We expect to find that CSS is mostly prevalent on geologically youthful and rocky soils while grassland is limited to substrates associated with deeper soils, high clay content, and low permeability. Although both CSS and grasslands are abundantly represented on all geological substrates occurring in La Jolla Valley (Engelberg, 2011), the association between local geologic substrate and dominant species assemblage is considered as one possible controlling factor with respect to CSS recovery.

**63. IS THERE FUNGUS AMONG US: PRESENCE AND ABSENCE OF MYCORRHIZÆ FUNGUS IN CALIFORNIA SAGE SCRUB**

**M. Mills**. California State University, Long Beach, Department of Geography, Long Beach California, 90840.

Restoration and conservation efforts of critically threatened California Sage Scrub (CSS) habitats in Southern California have struggled with the prevalence of non-native grasses and the inability, in some cases, of CSS to reestablish once anthropogenic disturbances have been removed. One hypothesis suggests that CSS is not recovering due to the degraded state of the mutualistic relationship between arbuscular mycorrhizæ and native species. Most non-native grasses in California are not reliant on mycorrhizal mutualism. Their presence significantly affects soil dynamics and may reduce or eliminate mycorrhizal

populations. Anthropogenic soil disturbances, such as tilling, also significantly affect mycorrhizae populations. Furthermore, studies demonstrate species of mycorrhizal fungi recognize specific host plants and will not form infection structures with inappropriate hosts. This study investigates whether there is a difference in presence of mycorrhizae in exotic grass, native CSS and mechanically disturbed vs. undisturbed sites. Root balls from sites where both natives and non-natives occur, and from both disturbed and undisturbed sites, were collected to compare mycorrhizal presence. The samples were stained with 5% ink diluted in vinegar (5% acetic acid) and examined under a dissecting microscope to determine and census mycorrhizae fungus presence.

**64. EFFECTS OF HERBIVORY ON CSS RECOVERY IN LA JOLLA VALLEY, CALIFORNIA**

S.G. Brennan, C.R. Vaughan, and C.M. Tabag. California State University Long Beach, Department of Geography, Long Beach, CA 90840.

Coastal Sage Scrub (CSS) has recovered immensely in the La Jolla Valley over the last century. Large areas once dominated by nonnative grassland have been repopulated with CSS; however, certain locations in the valley remain persistently covered by grassland. One of these areas, nicknamed the 'Moose' for its shape, is the focus of this research and has maintained a relatively stable boundary between CSS and grassland over the last two decades. Numerous factors can contribute to CSS recovery – edaphic conditions, precipitation, disturbance history, and herbivory. The vertebrate herbivores in the La Jolla Valley include mice, rabbits, and deer that feed on grasses and CSS saplings. The purpose of this research is to analyze the effects of herbivory on CSS expansion in the La Jolla Valley. Using field data that measures changes in CSS sapling height and grass plot height over a two month period, this research will be able to draw insight on the effects, if any, that herbivore foraging has on CSS expansion into the 'Moose' area of the La Jolla Valley. Specifically, our research measures the amount of CSS and grassland vegetation that is consumed by herbivores along the boundary and whether their foraging habits facilitate or hinder CSS recovery. Implications of this research are aimed at informing CSS restoration strategies to account for the impacts of herbivory.

**65. COASTAL SAGE SCRUB AND THE SUCCESSIONAL INFLUENCE OF BACCHARIS PILULARIS**

S. Brennan and P. Laris. California State University Long Beach, Department of Geography 1250 Bellflower Blvd, Long Beach, CA 90840.

Large areas of California Sage Scrub (CSS) have been type-converted to exotic annual grasslands. Concerted efforts to actively restore CSS can be expensive and have often been disappointing, as grasses reclaim restoration sites. While much research has focused on active strategies to restore degraded CSS landscapes, less research has focused on more passive strategies. This is surprising given that there are a number of places where CSS has to encroached back into grassland areas once the agent of disturbance has been removed. Understanding the reasons for CSS self-restoration is critical for the success of landscape restoration programs. This study examines cases of CSS recovery in the Santa Monica Mountains National Recreation Area (SMMNRA). We focus on *Baccharis pilularis* (coyote brush), a known seral CSS species with successional qualities that can be advantageous for habitat restoration in Southern California. Combining the spatial location of coyote brush stands with known shifts in CSS boundaries; we were able to assess levels of biodiversity in the wake of shifting boundaries. Preliminary results suggest that biodiversity has increased where coyote brush expands into nonnative grasslands. Implications of this research demonstrate that coyote brush can be used as an effective tool in the passive restoration of CSS.

**66. THE ADVANCEMENT OF NATIVE SHRUBS INTO NON-NATIVE GRASSLANDS IN LA JOLLA VALLEY CA**

J. Dean. California State University, Department of Geography, Long Beach, CA 90840-1101.

The current state of the Coastal Sage Scrub (CSS) plant community is poor. Only 10–15 percent of the original habitat remains and is highly degraded due to landscape fragmentation and invasion of annual grasses. As a result, restoration efforts are underway to recover lost habitat. La Jolla Valley in the Santa Monica Mountains represents an area where type conversion from CSS to grasses occurred due to cattle

grazing. Grazing ended in the 1970s. Since this time, CSS has advanced into the grasslands in some areas while, in others, grasses have remained dominant. This study examines advancing and stagnant boundaries of CSS, as determined by analysis of historical aerial images taken from 1947 to 2010, applying raster map algebra to calculate the amount of CSS lost and gained. It integrates this imagery with the fire history of Pt. Mugu State Park. Transects were taken perpendicular to these boundaries, collecting species presence and ground coverage. These were then subjected to non-parametric statistical analysis to determine if there is a significant relationship between distance to boundary and species present in the two types of CSS-grassland boundaries and between distance to boundary and maturity of individuals as measured by height. Preliminary analysis suggests that advancing species are not representative of the surrounding CSS habitat, indicating that certain CSS species are better able to colonize grassy areas.

**67. PASSIVE RESTORATION OF CALIFORNIA SAGE SCRUB?: WHAT HISTORICAL ECOLOGY CAN TELL US**

**P. Laris.** Department of Geography, California State University, Long Beach 90840.

Large areas of California Sage Scrub (CSS) have been type-converted to exotic annual grasslands as a result of past disturbance regimes. Even once these disturbances have been removed, many areas of CSS do not recover. Concerted efforts to actively restore CSS can be expensive and results have sometimes been disappointing. While much research has focused on active strategies to restore degraded CSS landscapes, less research has focused on more passive strategies. This is surprising given that there are a number of places where CSS has recolonized grassland areas following release from disturbances such as grazing or disking. Understanding the reasons for CSS self-restoration is critical for the success of landscape restoration programs. In an effort to understand the factors that regulate re-colonization, our research compares and contrasts areas that have recovered without active efforts with those that have not. Drawing on natural experimental results from multiple sites in the Santa Monica Mountains our work examines the role of disturbance intensity and type, topography and soil texture, vegetation boundaries and species type to determine the factors most associated with passive restoration of CSS stands. The findings will be of use to land managers as well as restoration ecologists planning long-term projects.

**POSTER SESSION ABSTRACTS IN PROGRAM ORDER**

**68. ARSENIC IN THE MAINSTREAM: A CONCERN IN FOOD SAFETY**

**S. Mantravadi.** California State University Los Angeles, CA 90032.

Arsenic is a naturally occurring heavy metal that is present in air, ground water, and now reported to be present in the food we consume. The presence of arsenic in apple/pear juice, and rice, has implications on the drinking water treatment, crops, the availability of healthy food, and the subsequent ill effects on health from such arsenic exposure. Consumers are concerned of increased levels of Arsenic in the various brands of rice and rice products, such as infant rice cereal, breakfast cereal, rice cakes, and rice beverages. This study will address the significance of the recent discovery of arsenic in rice by the Food and Drug Administration (FDA).

**69. ACRYLAMIDE: A POTENTIAL INDICATOR OF THE OBESITY EPIDEMIC?**

**S. Mantravadi.** California State University Los Angeles, CA 90032.

Acrylamide is known for its use in the coagulation stage of wastewater treatment (Environmental Protection Agency, n.d.). However, it is also used in industrial and agricultural applications. In 1992, close to 100 million tons of Acrylamide was produced in the United States (Mannsville, 1993). Acrylamide is also a chemical intermediate in several cooking procedures, such as frying and boiling coffee. Over the past 30 years, the childhood obesity rate has tripled – now seventeen percent of children are obese (Centers for Disease Control, n.d.). Acrylamide is present in many of the unhealthy foods that children eat – such as French fries and potato chips (National Cancer Institute, n.d.). This paper will address the issue of

increased Acrylamide levels in target food products over the years. Dose response curves will be used to analyze the resulting negative health effects.

**70. SUSTAINABLE SEAFOOD AVAILABILITY AND AWARENESS DEPENDS UPON THE PREDOMINANT LANGUAGE OF THE ESTABLISHMENT'S CUSTOMERS/PURVEYORS**

G. Ramirez, J. Arroyo, and S.S. Anderson. Environmental Science and Resource Management Program and Pacific Institute for Restoration Ecology, CSU Channel Islands, Camarillo, CA 93012.

The word "sustainable" has been appropriated and adapted to fit many different audiences, both scientific and non-scientific. We hypothesized that much of the general public would be unfamiliar with this increasingly amorphous word and concept and see little relationship to their food systems. We explored knowledge of seafood sustainability in two different linguistic communities (English- and Spanish-speakers) via point-of-sale surveys of seafood items, seafood-related customer inquiries, and purveyor knowledge at markets and restaurants in Santa Barbara, Ventura, and Los Angeles Counties. Establishments in Anglo-dominant neighborhoods were surveyed in English (n = 30) while those in Hispanic-dominant neighborhoods were surveyed in Spanish (n = 25) beginning in fall of 2012. Information about seafood and overall awareness of seafood sustainability strongly depended upon an establishment's dominant language. Spanish-speaking establishments proffered less info (species, source, harvest method) about seafood, had employees with little awareness seafood sustainability (e.g. 25% of English-speaking fishmongers have heard of MSC, Seafood Watch, etc. compared to 0% of Spanish-speakers), and were frequented by customers with little apparent interest in issues related to seafood sustainability (19.4% of English speakers ask about an item's source vs. 1.8% of Spanish speakers in our restaurants). This illuminates a dramatic void in educational efforts to promote healthy and sustainable seafood options. We believe dramatic gains in public awareness/understanding of these issues may be achieved with a greater outreach to and engagement with non-English speaking seafood consumers and sellers across Southern California.

**71. HOLOCENE OYSTER ASSEMBLAGE OF NEWPORT BAY, CALIFORNIA: UNDERSTANDING THE PAST TO HELP RESTORE THE FUTURE**

K.K. Vreeland and N. Bonuso. California State University, Fullerton, Department of Geological Sciences, Fullerton, CA, 92834.

Oysters have played a significant role in the ecology throughout Orange County's geologic history, but there has been a vast decline in the diversity and abundance within the region. Current restoration projects aim to reestablish the only native oyster, the Olympia oyster (*Ostrea lurida*) back into its southern California habitat. Fished to near-extinction in the 1930s, then further damaged by sulfite pollution from paper mills, *Ostrea lurida's* species habitat once stretched from Alaska to Baja, Mexico. The modern history of oysters has been well documented by biologists, however the paleontological history of oysters is less well known and many questions remain unanswered such as: Was *Ostrea lurida* always the only native oyster or did multiple oyster species live here? What other organisms thrived as a result of the oysters' reefal hard ground? How did the thickness of oyster beds vary through geological time? Did ocean environments play a role in community structure through time and if so, how? Results reveal highly diverse and abundant oyster communities were present in Newport Bay approximately 10,000 years ago. Future research includes analyzing specimens housed at the John D. Cooper Paleontological Curation Center, which holds a vast collection of Orange County fossils, allowing us to build a database that tracks diversity and depositional environments through space and time. This research will aid ongoing restoration projects throughout southern California by providing a long-term perspective of community change through time.

**72. HIGH-RESOLUTION EARTHQUAKE FAULT KINEMATICS OF THE SAN PEDRO BASIN FAULTS, CALIFORNIA CONTINENTAL BORDERLAND**

E. Mohammadebrahim and G.W. Simila. California State University of Northridge, 18111 Nordhoff Street Northridge, CA 91330.



The San Pedro Basin Fault (SPBF) is potentially an earthquake hazardous fault, especially if it is continuous with other faults to the south in the Inner Borderland, such as the San Diego Trough fault (SDTF), or if significant slip transfer occurs across a gap between the faults. About half of the Inner Borderland slip of 6–8 mm/yr is taken up by the Palos Verdes fault (PVF); the SPBF appears to be the most likely avenue for the other half. The SPBF terminates to the south in an area of complex faulting and folding between Santa Catalina Island and Lasuen Knoll. This region is a transition zone between the SDTF and Coronado Bank fault (CBF) to the south, and the SPBF and PVF to the north (Legg et al., 2004). Exactly how slip is transferred and partitioned across this zone is not well known, but it is critical to assessing earthquake potential on these regional faults, which are located near a major port and population center (Conrad et al., 2009; 2010). In this project proposes to accurately map the seismicity and associated kinematics (motions) for San Pedro Basin fault and interactions with the Avalon Knoll-San Diego Trough faults in the San Pedro Basin region in the California Continental Borderland. I started my analysis with relocating events using Southern California Seismic Network SCSN data. I relocated 29 events in the tie period of August 2010 to September 2011. Most of the events are low magnitude and are between  $1M_w$ – $3M_w$ . I used Hypoinverse2000 software. For the events located offshore, we had acceptable errors (RMS<0.34) in most of the cases. Our horizontal errors and also the depth values are not accurate in most of the cases which is predictable because I didn't have S waves. The events were located in the area surrounded with interaction of PVF and SPBF and Santa Monica Fault. This result will be revised by adding data from 2010–11 NSF-funded Project Albacore ocean bottom seismographs (OBS).

### 73. POST-STATION FIRE DEBRIS FLOW ANALYSIS IN THE SAN GABRIEL MOUNTAINS

M.P. Ahlstrom and R.V. Heermance. California State University Northridge, Department of Geological Sciences, 18111 Nordhoff Street, Northridge, CA 91330.

Debris flows are a source of substantial erosion in mountainous areas; consequently, their occurrence, spatial density, and characteristics provide essential data for understanding erosion rates and volumes. The 2009 Station Fire in the San Gabriel Mountains burned an area of 649.75 km<sup>2</sup>, and destabilized slopes setting them up for subsequent debris flows. GIS mapping of burn area post-fire debris flows, combined with field mapping, allowed the calculation of flow area and volume calculations and their spatial density. Most debris flows initiated from burned, previously undisturbed, upper channel hill slopes averaging 28° with a spatial density of one flow/two km<sup>2</sup>. Total flow material deposited is 715,071 m<sup>3</sup> and affected 2.5% of the total burn area. The relationship between each debris flow area affected and the volume deposited in each flow reveals a positive linear correlation, suggesting that as the area affected by a debris flow increases, so does the depositional volume of the flow. Assuming a 30 year recurrence of fires and subsequent debris flows, these flows account for  $0.12 \pm 0.03$  mm/yr of erosion within the burn area. This erosion rate accounts for 7.5–13.3% of the total erosion rate in the San Gabriel Mountains, according to the erosion rate of 0.9–1.6 mm/yr (Lavé and Burbank, 2004). This new data demonstrates that debris flows are efficient in causing significant erosion compared to typical erosion processes, provides an empirical dataset for future debris flow hazard analysis, and provides a quantitative assessment of post-fire erosion rates in the San Gabriel Mountains.

### 74. MONITORING SURFGRASS AND SARGASSUM DENISTY IN A MARINE PROTECTED AREA OFF SANTA CATALINA ISLAND

M.A. Felberg, W.R. Whitcombe, and D.W. Ginsburg. University of Southern California, Environmental Studies Program, Los Angeles, CA, 90089.

Big Fisherman's Cove off Santa Catalina Island is listed as part of the Blue Cavern State Marine Conservation Area under the California Marine Life Protection Act. It is a designated no take zone and provides habitat for numerous invertebrate and fish species. Surprisingly, little is known about the spatial patterns and variability of algal communities found living in this area – despite its designation as a no-take marine reserve nearly 25 years ago. This study aimed to examine the ecosystem health of the Big Fisherman's Cove area in regards to key foundation and invasive species, as well as to continue to develop a long-term monitoring system for future data collection. Two different species of algae, Pacific surfgrass *Phyllospadix* sp. and the invasive brown seaweed *Sargassum* sp., were regularly monitored underwater

using SCUBA. Over a 1.5-year sampling period, we recorded a strong correlation among the density of surfgrass and Sargassum with monthly changes in ocean temperature. Mean density amongst both algal species was highest during the summer months (July–September) when mean water temperatures reached their peak (~70°F). These data will provide a better understanding of the characteristics and stability of algal communities within Big Fisherman’s Cove, as well as provide important information about the ecosystem health of the Blue Cavern State Marine Conservation Area at large.

#### 75. THE CALIFORNIA NATURALIST PROGRAM

S.L. Drill<sup>1</sup>, A. Merenlender<sup>2</sup>, and B. Gamble<sup>2</sup>. <sup>1</sup>UC Cooperative Extension, 700 W. Main St., Alhambra, CA 91801; <sup>2</sup>UC Hopland Research and Extension Center, 4070 University Road, Hopland, CA 95449.

California Naturalist is a new statewide program developed by the University of California Cooperative Extension to create a committed corps of volunteer naturalists and citizen scientists trained and ready to take an active role in natural resource conservation, education, and restoration. Throughout the country, Master Naturalist programs and citizen science projects have both been shown to increase volunteers’ ecological knowledge, understanding of science and/or environment-related behaviors. In California, we provide training for adults to be environmental stewards through an adaptable curriculum that can be as easily applied in the inner city as in the less populated rural counties, by tribes, colleges, natural resource agencies and nature centers. We utilize a core science curriculum called the California Naturalist Handbook, recently published by UC Press, that addresses basic natural history of California as well as classical and modern techniques for recording naturalist observations. We are currently developing advanced training modules in subjects such as estuarine, beach, and near-shore systems, regional modules for specific bioregions, and urban ecology. Additionally the program includes hands-on learning, communication training, and community service to engage adults in interactive learning and provide them with scientific literacy and critical thinking skills. We will report on courses running throughout the State as well as our efforts to couple these courses with citizen science projects and enhance diversity within the program.

#### 76. CATALINA ISLAND ECOLOGY, RESTORATION, AND MANAGEMENT

J.M. Bogda, D.W. Ginsburg, and L.E. Collins. University of Southern California, Environmental Studies Program, Los Angeles, CA, 90089.

For two years a summer undergraduate internship program focusing on the natural history and management of Catalina Island has run as a joint effort between the USC Environmental Studies Program, the Catalina Island Conservancy, and the USC Wrigley Institute for Environmental Studies. One of the primary goals of this program is to provide an experiential learning opportunity for students enrolled in the Environmental Studies Program. In Summer 2012, four student interns worked on the maintenance of the Deer Valley trail adjacent to the WIES campus on Catalina Island. Students eradicated invasive plants, set up a long-term monitoring project to examine the spread of invasive fennel, established an interactive plant field guide, and provided overall maintenance of the trail itself. Initial assessments of soil chemistry also were recorded, measuring total carbon, organic carbon, and nitrogen, as well as soil pH texture. Soil chemistry measurements were made along the trail to compare areas highly modified by invasive plants (i.e., fennel monoculture) and areas occupied by native plant communities. In addition to conducting research projects in the laboratory and field, student-learning outcomes included analyzing data, writing research blogs and reports, and providing outreach activities to members of the Catalina community.

#### 77. THE NEW FRONTIER OF WATER QUALITY REGULATION: BALLONA CREEK TMDLS

N. Kinsey, J.A. Fawcett, and D.W. Ginsburg. University of Southern California, Environmental Studies Program, Los Angeles, CA, 90089.

In 1999 the Environmental Protection Agency entered into a consent decree with the National Resource Defense Council that represented two local non-profits the Santa Monica Bay Keeper, present day Los



Angeles Water Keeper, and the Heal the Bay Organization. This consent decree required that Total Maximum Daily Loads be established for the Los Angeles Region within 13 years. The original problem faced was that section 303d of the Clean Water Act which requires the establishment of TMDLs for impaired water bodies was not being enforced in the Los Angeles Region by the Los Angeles Regional Water Quality Control Board. One of the waterways that was found to be impaired and required the establishment of TMDLs was Ballona Creek. As of spring 2012 four TMDL's had been established for Ballona Creek including: trash, toxic chemicals, metals and bacteria. The main findings of this legislative review were legal standing of TMDLs, the pollution mitigation requirements for the TMDL programs, a timeline of when reduced levels of pollution must be met, and the methodologies that were being implemented by stakeholders to address the pollution.

**78. CONSERVATION OF RIPARIAN AND UPLAND DIVERSITY IN CALIFORNIA CHAPARRAL**

M.G. Narog and J.L. Rechel. USDA Forest Service, Pacific Southwest Research Station, Riverside, CA 92507.

Chaparral is but one vegetation type comprising the fauna and flora of southern California's high concentration of biological diversity. This globally important Mediterranean biome has a temperate climate with hot dry summers and mild, wet winters. Chaparral is characterized by summer drought-tolerant plants to which fire is a common natural and anthropogenic disturbance. Surveys were made to evaluate ecosystem resilience to disturbance. Species assemblages were assessed across sites to identify chaparral conservation value. Three distinctive datasets of chaparral and associated oak woodland habitat were synthesized from study sites located in southern California's Cajon Pass, San Dimas Experimental Forest, and San Jacinto Mountains. Each site recently burned and shares similar conservation issues such as urban infringement, post-fire erosion, and vegetation control practices. Data collected includes plant and avian community structure and diversity on 199 plots from 1997–2012. We compared diversity metrics among study sites to estimate number of species under the existing habitat categories. Avian species richness ranged from 31 to 142 and plant species richness ranged from 8 to 23. Average avian richness increased and leveled off at 1,000 ha. Plant richness values increased in smaller areas and leveled off at about 50 ha. Initial results indicate larger areas had greater diversity. Burned sites generally had greater species diversity than unburned, but this varied by site characteristics. These estimates show a consistent relationship between diversity metrics and chaparral area. This underscores the importance of habitat size and species associations when protecting valuable resources.

**79. BENTHIC INFAUNAL INVERTEBRATE COMPARISON BETWEEN RECENT AND ESTABLISHED WETLAND RESTORATIONS**

B.R. Pagan and C.R. Whitcraft. California State University Long Beach, Department of Biology, Long Beach, CA, 90840.

Restoration efforts for Long Beach's Colorado Lagoon were completed in August 2012 and consisted of dredging to remove contamination, resloping and revegetation. Samples of benthic infaunal invertebrates were taken 6 month after the completion of dredging to create a baseline of the invertebrate community structure in the Lagoon. This criterion can serve as an indicator of habitat restoration progress. Preliminary data indicate that the early invertebrate community at Colorado Lagoon is dominated by insect larvae and lacking deposit feeders, such as oligochaetes. Mimicking restoration trajectory in other regional wetlands, these data indicate a less mature wetland than our reference site, a 10-year-old restoration at Los Cerritos Wetlands located in Seal Beach. Such data and analysis can be used to determine how Colorado Lagoon is developing post-restoration.

**80. ENVIRONMENTAL AND COMMERCIAL BENEFITS OF CARBON SEQUESTRATION BY *ENCELLA CALIFORNICA* AND *SALVIA LEUCOPHYLLA***

R. Dokko, Palos Verdes Peninsula H./S.Mentord A. Dalkey, PVPLC and R. Sharifi, UCLA.

Because global climate change is a widespread concern, studies that reduce the emissions of CO<sub>2</sub> and other greenhouse gases through plant carbon sequestration are of great interest. Plants are major reservoirs of atmospheric carbon and CO<sub>2</sub> levels fluctuate with their photosynthetic patterns. Carbon sequestration refers to the storage of CO<sub>2</sub> into reservoirs, and describes a method to delay global warming effects and slow the accumulation of greenhouse gases. Specifically, this study quantifies the biomass dry weight of two common drought-deciduous species, *Salvia leucophylla* and *Encelia californica*. These species are part of an ongoing coastal sage scrub CO<sub>2</sub> sequestration study also involving *Eriogonum cinereum* and *Rhus integrifolia*. Two methods were used to collect *S. leucophylla* and *E. californica* samples. In Method 1, 12.5–50% of the subject was harvested and dried, and canopy measurements were recorded. Method 2 also required field measurements in addition to subsample samplings from each which was later used to calculate the biomass. (*Encelia californica* was collected using only method 1.) Using regression analysis, the results showed that *S. leucophylla* showed a strong correlation in its biomass and canopy dimension relationships. The correlation between the biomass and the surface area was  $y = 58.386x^2 - 217.64x + 698.28$  and the correlation between the biomass and volume was  $y = 173.25x^2 + 120.59x + 467.93$ . The correlation between biomass and surface area for *E. californica* was  $y = 149.86e^{1.5926x}$  and the correlation between biomass and volume was  $y = 121e^{0.4317x}$ . These equations will be utilized to calculate the amount of CO<sub>2</sub> sequestered using only canopy measurements, which will then aid planting efforts to maintain the natural balance of carbon between Earth and the atmosphere.

#### 81. THE EFFECTS OF SEA LEVEL RISE ON THE DECOMPOSING COMMUNITIES OF A RESTORED SOUTHERN CALIFORNIA SALT MARSH

**N. McLain**, C. Whitcraft, and J. Dillon. CSU Long Beach, Department of Biological Sciences, 1250 Bellflower Blvd, Long Beach, CA 90840.

Salt marshes are valuable, interconnected ecosystems that provide many key ecological services. They are sites of major nutrient cycling and a habitat for a diverse set of organisms. Southern California wetlands are shrinking due to anthropogenic factors and future sea level rise will exacerbate these effects. Increased inundation will likely disrupt or hinder key salt marsh functions. The decomposer community is one key functional group that is susceptible to increased inundation. Their role of releasing sequestered carbon and nutrients back into the ecosystem may be impacted. This community is composed of invertebrates, fungi, and bacteria. Each group has an important role in recycling nutrients and breaking down organic substrates. A marsh organ containing native *Spartina foliosa* and sediments has been deployed to simulate sea level rise. It is a wooden structure that holds 3 rows of PVC pipe at different elevations. The PVC pipes contain sediments and *Spartina* with the lowest row receiving maximum inundation. Traditional invertebrate taxonomic classification and molecular microbial community fingerprinting techniques will be used to determine the specific impacts of increased inundation on salt marsh decomposer community structure. Impacts on decomposition function will be assessed via litter bag experiments and sulfate reduction rate assays. I hypothesize that rates of plant litter decomposition and sulfate reduction will decrease and the decomposer communities' diversity and community composition will change, becoming less diverse. The data from this study will assist wetland management and restoration efforts to protect wetlands from impacts of sea level rise.

#### 82. IMPACTS OF INVASIVE *TAMARIX* AND ITS HYBRIDS ON INFAUNA AT SAN DIEGUITO LAGOON

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*Tamarix* spp., introduced from Eurasia and Africa to North America in the 1800s, is one of the most invasive species in the United States. Its impacts are well-known in riparian and desert ecosystems. Yet, little is known about how *Tamarix* affect salt marshes. Our primary objective was to determine the impact of genetically diverse *Tamarix* on the infaunal macroinvertebrate community in a Southern California salt marsh. This study was conducted in San Dieguito Lagoon, a salt marsh located in north San Diego County, CA. Infaunal invertebrate samples were collected in a paired design under *Tamarix* canopies (both pure and hybrid species) and under non-tamarisk canopies. This study found higher infauna diversity under non-tamarisk than under *Tamarix* spp. and higher infauna diversity under hybrid *Tamarix*

than pure *Tamarix chinensis*. The presence of *Tamarix* spp. altered invertebrate community composition in the marsh microhabitat, increasing the abundance of an isopod *Littorophiloscia richardsonae* (90% of total composition) relative to non-tamarisk canopies (39% of total composition). These discoveries suggest that removal of pure *Tamarix* should be prioritized over removal of hybrid *Tamarix* in salt marshes for restoration strategies. Further studies still need to be conducted on the driving mechanisms behind the observed differences in the infaunal community.

**83. MAPPING PLANT RESPONSES TO CHANNEL-WATER INPUT IN A DISTURBED MOJAVE ALLUVIAL FAN**

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Water is a precious resource in the harsh climate of the Mojave Desert. Complex networks of alluvial drainage channels (washes) guide rainwater down from desert mountains, providing water to plants throughout desert bajadas. However, roads, railroads, and other anthropogenic features cut across the natural landscape, creating barriers to the even distribution of water to plants from the alluvial channels. In addition, railroad culverts consolidate and channel large amounts of water from upslope, creating large channels down-slope from the railroad. Such changes in water distribution can potentially alter the biotic community structure of the area immediately surrounding these channels, with plants near the channel edges growing larger due to more water availability than plants growing away from the channel margins. The physiological responses of plants at various distances around both anthropogenically impacted and non-impacted washes were examined by measuring the pre-dawn water potential, stomatal conductance, and sap flow of *Larrea tridentata* individuals at three alluvial channels in the Mojave National Preserve. In this study, land survey-grade GPS devices were used to accurately map the positions of the sampled plants as well as the study channel margins. Using the geospatial analysis technique of kriging, the measured physiological responses were used to interpolate water potential, stomatal conductance, and sap flow values of un-sampled plants around the study area channels. This method can be used to predict plant responses across the alluvial fan landscape based on channel distribution and their disturbance.

**84. DEVELOPING A SEED COLLECTION METHOD FOR LONG TERM STORAGE, AND TESTING VIABILITY OF THE FEDERALLY ENDANGERED PLANT *ERIASTRUM DENSIFOLIUM* SPP. *SANCTORUM***

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The Santa Ana River Woolly Star (*Eriastrum densifolium* spp. *sanctorum*), is a federally-listed endangered plant species native to the Santa Ana River floodplain in Redlands, CA. A major cause for its protection is the lack of occasional flooding from the Santa Ana River due to regional flood control measures. The woolly star has a very specific habitat preference for sand deposits near rivers that experience occasional flooding. This habitat type is very limited and only supports very small populations of woolly stars. The goals of this project were to develop a consistent seed collection protocol and to collect seeds for long term storage and woolly star habitat mitigation. Seeds were collected from four field sites and filtered through a series of sieves (No. 14 and No. 25 standard soil sieves) to minimize the debris retained, and maximize seeds recovered within a sample. Seed-to-mass regressions were created by weighing subsamples across increments of ~0.1–0.2 g (up to 0.9 g) and manually counting the number of visibly normal seeds within each sample. These regressions were used to estimate the amount of potentially viable seeds collected for each site. Weekly collections from September 13–November 4, 2012 amassed ~57,000 seeds. Across sites there was some variability among regressions that was not clearly understood, suggesting that more testing may be necessary. Germination of collected seeds ranged from 47% to 79% across all sites with an average of 62%.

**85. BROOD SEX RATIO AND NEST SUCCESS BASED ON DNA ANALYSIS AND TAIL-FEATHER PATTERN IN COSTA'S HUMMINGBIRD (*CALYPTE COSTAE*) IN THE SONORAN DESERT**

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Nest success may be affected by brood sex ratio. Adult Costa's Hummingbird (*Calypte costae*) females are larger than males, but males display sex-specific plumage and behaviors, namely singing and diving, that increase developmental costs and are expensive to maintain. If one sex demanded more resources to fledge than the other the brood sex-ratio might have had an influence on overall nest success. The two chicks might use resources differently (females for body mass, males for developing expensive behaviors); however, the amount of resources required from the parent might be the same. Therefore, I hypothesized that brood sex ratios will not affect nest success because one sex is not necessarily more expensive to rear than the other. Sex of the chicks was determined in two ways: by tail feather pattern and by DNA analysis. I collected chick feathers for DNA analysis to test the hypothesis. The DNA analysis was also used to verify the accuracy of the tail-feather pattern to determine the individual sex of chicks. Brood sex ratios for 26 nests (52 individuals) were successfully determined from feather samples through genetic techniques from DNA. Brood sex ratios were not related to nest success, which supported my hypothesis. This study is the first on Costa's Hummingbird to use genetics to sex individuals and sequence a gene region on the sex chromosomes. This study is also the first to use tail feather patterns to sex individuals for Costa's Hummingbird, and the first to verify this method using genetic analysis.

**86. COLONY DYNAMICS OF ELEGANT TERN (*THALASSEUS ELEGANS*) IN THE SOUTHERN CALIFORNIA BIGHT IN RELATION TO OCEANOGRAPHIC CONDITIONS AND DISTURBANCE EVENTS**

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Coastal seabirds are prey generalists known to be influenced by oceanographic conditions related to productivity and affected by various kinds of disturbance. The Elegant Tern, the most abundant seabird in southern California, nests at three locations yet is recognized as a single population in the region. Numbers of nesting pairs provide the first measure of reproductive success, and they fluctuate dramatically for this tern within and among years at the three sites. Recently (2003–2012), nest numbers have ranged from <100–20,000 at the San Diego Salt Works, 300–10,000 at the Bolsa Chica Ecological Reserve, and 0–11,000 at Los Angeles Harbor. What are the forces driving these marked fluctuations? We know that conditions related to temperature and productivity vary within the region, and that disturbance events, which can cause colonies to abandon a site, also vary among the nesting locations. To address our question, we are first assessing oceanographic conditions in the region for 2003–2012 using chlorophyll *a*, sea surface temperature (SST), upwelling intensity, and the Oceanic Niño Index (ONI), a measure of El Niño Southern Oscillation events. Secondly, we are developing an index to quantify the impacts of disturbance, either from human or predator activity. We expect Elegant Terns to be attracted to conditions that increase prey availability, including high chlorophyll, low SST, strong upwelling, and low ONI values. We also expect that disturbance can cause this tern to abandon a site during a given season. Our study should help tease apart the factors driving these striking fluctuations in nest numbers.

**87. COMPARISON OF DIETS AND DIETARY SAMPLING METHODS FOR NESTING CALIFORNIA LEAST TERNS (*STERNULA ANTILLARUM BROWNI*) AT PURISIMA POINT ON THE CENTRAL CALIFORNIA COAST AND ALAMEDA POINT IN SAN FRANCISCO BAY**

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The relationship between diet and reproductive success is important for assessing the status and predicting the future for a recovering endangered species. Accurate dietary data are crucial for assessing this relationship. However, the diet of the California least tern (*Sternula antillarum browni*), a state and federally endangered species, has not been studied extensively. For the dietary assessments that have been completed on this nearshore seabird, multiple techniques have been variously used, making it difficult to compare diets among nesting colonies. To help alleviate these shortcomings, we are comparing CLTE diets over the last decade at two colonies, Purisima Point (37° N, 122° W), Vandenberg Air Force Base, on the central California coast, and Alameda Point (34° N, 120° W) about 300 km distant in San Francisco Bay. We are analyzing diets from the first site using fecal samples and dropped fish for 2001–2012 and fecal samples, regurgitated pellets and dropped fish from the second site for 2000–2012. Preliminary results show that, as expected, birds at Purisima Point feed mostly on subtidal and nearshore fishes while the birds

at Alameda Point feed mostly on bay/estuarine and nearshore fishes. We have also found that dropped fish and fecal samples often show different proportions of fish families present in the diet. This study should contribute to a greater understanding of dietary assessment methods for CLTE and of differences in food habits of CLTE nesting at coastal and estuarine sites.

**88. DIETARY AND STABLE ISOTOPE ANALYSES REVEAL THE ROLE OF A CRYPTIC PREY IN THE ELEGANT TERN (*THALASSEUS ELEGANS*) FOOD WEB IN SOUTHERN CALIFORNIA WATERS**

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Species composition of dropped fish collected at Elegant Tern (*Thalasseus elegans*) colonies in southern California shifted from mainly northern anchovy (*Engraulis mordax*) in the 1990s to >60% kelp pipefish (*Syngnathus californiensis*) in 2011. This change was unexpected as ELTE is an open-water forager, and the pipefish is cryptic in kelp. In response, we tested two hypotheses at the Los Angeles Harbor nesting colony in 2012: 1) Kelp pipefish are incorporated into the ELTE diet given the many past deliveries of pipefish; 2) Kelp pipefish feed in a plankton vs. kelp food chain, leaving them vulnerable to predation by the tern. We identified ELTE prey deliveries and determined  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  isotope values for ELTE and its prey—northern anchovy, kelp pipefish, market squid (*Loligo opalescens*), and California grunion (*Leuresthes tenuis*). Direct observations revealed that the ELTE chick diet comprised 8% kelp pipefish and 61% northern anchovy even though dropped fish still comprised mostly pipefish. All prey were found to have similar  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  signatures, except that California grunion was significantly enriched in  $\delta^{15}\text{N}$  compared to anchovy and pipefish, indicating it feeds at a higher trophic level. Given that anchovy, grunion and squid feed in the plankton, common  $\delta^{13}\text{C}$  values suggest that pipefish do also. The similarity of prey isotope values, however, hinders using mixing models to determine relative contributions of prey species to the ELTE diet. Increased prey sampling may resolve this issue as it appears that pipefish and grunion are enriched in  $\delta^{13}\text{C}$  compared to anchovy and squid.

**89. DETERMINING THE EFFECTS OF ANTHROPOGENICALLY-ALTERED WATER TEMPERATURES ON THE MOVEMENT PATTERNS AND HABITAT SELECTION OF THE EASTERN PACIFIC GREEN SEA TURTLE (*CHELONIA MYDAS*) WITHIN ITS MOST NORTHERN RANGE**

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Anthropogenic temperature change along the coastline can affect the distribution and movements of marine species. The endangered green sea turtle (*Chelonia mydas*) is known to utilize coastal habitats as a juvenile and during breeding and foraging periods as an adult. Due to their ectothermic qualities, juvenile green sea turtle (GST) distribution is influenced by water temperature; therefore, anthropogenic influence of coastal thermal conditions may affect GST behavior. Eastern Pacific GSTs have been observed at its most northern limits in southern California particularly within the San Gabriel River and Anaheim Bay Estuary. Due to the warm water effluent from coastal power plants along the river and the shallow ponds within the estuary I hypothesized that the San Gabriel River acts as thermal refugia year round and Anaheim Bay Estuary only during the warmer months, enabling individuals to occupy its most northern range to forage. To date eight GSTs have been tagged and passively monitored using acoustic telemetry. All immature individuals tagged in the river have remained in the river over periods spanning two seasons, while turtles tagged in the estuary have moved into the river once temperatures dropped below 15°C. Water temperatures within the river fluctuate up to 20°C within a month, a temperature swing that should directly affect GST movements. One individual has been tracked for two 24 hr periods within the river, displaying diurnal patterns where at night it would stay in one spot and during the day it would foraging in different parts of the river.

90. **DETERMINANTS OF BOT FLY INFESTATION IN THIRTEEN-LINED GROUND SQUIRRELS IN COLORADO SHORTGRASS STEPPE**

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Larvae of parasitic flies grow inside and feed upon tissues of wildlife species and therefore depend upon healthy hosts. Bot fly (*Cuterebra* sp.) larvae were discovered on thirteen-lined ground squirrels (*Ictidomys tridecemlineatus*) during long-term monitoring studies in northern Colorado. Although bot flies are common parasites of small mammals, there are no records of infestation of this squirrel species and the species of bot fly is unknown. We examined prevalence and load of bot flies in ground squirrels trapped in shrub and grassland habitats in spring and summer between 1999–2011, with the aim of determining host characteristics and environmental factors that influence bot fly infestation. We also investigated possible effects of prescribed fires in grasslands on prevalence. Infested squirrels were rarely found on shrub sites and during spring trapping. Across all summers, average prevalence of infestation in grasslands was 9.8%, although prevalence was especially high in 2008 (25.4%). Infested squirrels had 1–7 bots, with 44% having only 1 larva. Infestation did not vary greatly with host sex, age or weight. Prevalence was much higher (33%) in burned sites the first year after a fire, and remained consistently higher on burned grassland sites than on unburned sites trapped the same years. Our results suggest that fires may alter the environment in ways that increase the susceptibility of squirrels to infestation, or increase fly populations or the ability of flies to find and infest hosts. In the future we hope to identify the bot fly species using molecular genetics analysis.

91. **POPULATION GENETIC STRUCTURE OF NORTHERN GRASSHOPPER MICE (*ONYCHOMYS LEUCOGASTER*), IN RELATION TO PRAIRIE DOGS AND PLAGUE**

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At the Pawnee National Grasslands (PNG) of northern Colorado, high densities of northern grasshopper mice, *Onychomys leucogaster*, are often associated with colonies of black-tailed prairie dogs, *Cynomys ludovicianus*. Prairie dogs suffer massive population die-offs as a result of plague, an introduced disease caused by the bacterium *Yersinia pestis* and spread by fleas. Grasshopper mice share burrows and fleas with prairie dogs, but they are more resistant to plague mortality and suffer less marked population declines. The population genetic structure of prairie dogs is well-understood, but it is not clear if the association between prairie dogs and these wide-ranging mice is reflected in gene flow of mice, or if plague outbreaks on prairie dog colonies influence the population genetic structure of grasshopper mice. To determine the effects of spatial landscape features, such as prairie dog colonies, and episodic mortality events, such as plague outbreaks, on the genetic structure and diversity of grasshopper mouse populations, we extracted DNA from 600 individuals collected on and off colonies between 2004–2011, including sites that suffered plague. We screened samples using 2 types of hyper-variable molecular markers: one mitochondrial gene, *cytochrome oxidase subunit I (COI)*, and 11 nuclear microsatellite loci. Preliminary results from 40 *COI* sequences from 2004 showed some population genetic differentiation between eastern and western subunits of the PNG, indicating a potential isolation-by-distance pattern. Additional analyses of microsatellite data, combined with GIS information on landscape features, will be required to identify pockets of genetic diversity and the effects of plague on population differentiation.

92. **IMPACTS OF THE INTRODUCED EASTERN FOX SQUIRREL ON THE BEHAVIOR OF THE NATIVE WESTERN GRAY SQUIRREL**

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The eastern fox squirrel (*Sciurus niger*), has been introduced to Los Angeles and many other areas within California. Over time, the fox squirrel has expanded its geographic range and has displaced the native western gray squirrel, (*Sciurus griseus*), in many urban/suburban habitats. The western gray squirrel



is considered to be a specialized feeder and highly arboreal while the eastern fox squirrel is a generalist feeder and more adaptable animal. Observations were conducted to compare the behaviors of the gray squirrel among habitats where they exist alone to those where they coexist with the fox squirrel. In addition, the behaviors of the two species were compared in habitats where they coexist. Observations on location, eating, foraging, grooming, and communication were recorded. Each individual animal was observed for a total of 15 minutes and behaviors were recorded at 15-second intervals. Significant differences in behavior were observed in aspects of location, foraging, and eating. Ongoing and future portions of this study include continued behavioral observations, litter counts, natural food preferences, and predator-risk assessments.

**93. FORAGING BEHAVIOR OF KANGAROO RATS AT SEED TRAYS REVEALED BY GIVING-UP DENSITIES AND REMOTE CAMERAS**

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Behavioral ecologists often use indirect approaches to understand foraging decisions of nocturnal, secretive animals such as rodents. Many researchers have measured rates of seed removal by rodents in seed trays to estimate giving-up densities (GUDs), but few studies have documented the number and species of individuals visiting trays, the number of visits, and the amount of time spent foraging and between visits. We studied foraging behavior of the desert kangaroo rat (*Dipodomys deserti*) in seed trays in the Mojave Desert, California, in June 2012. Reconyx PC800 cameras were used to quantify how GUDs were affected by the amount of seed provided (2, 4, 8, or 16 g millet) and by the number and duration of visits. We successfully recorded 17 foraging trials, during which only 1 individual was observed in a given tray at a time. Except at the lowest initial density (2 g), *D. deserti* removed >70% of seeds and GUDs were relatively constant, i.e. usually <2.5 g, underscoring *D. deserti*'s efficient foraging abilities. The number and frequency of visits were affected by variation in initial seed densities: *D. deserti* made more visits more often to richer patches. Higher seed densities also resulted in lower nightly GUDs and longer first visits to a tray. Although we could not identify individuals, such information could verify that all foraging at tray was done by a single individual. Our results demonstrate that information available from remote cameras can complement traditional approaches to understand the mechanistic basis of foraging of small mammals.

**94. PATTERNS OF ACTIVITY AND DIVERSITY OF BATS AT THE URBAN-WILDLAND INTERFACE IN SOUTHERN CALIFORNIA**

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Habitat loss and fragmentation pose a significant threat to bat populations. Urbanization can decrease roosting sites and foraging habitat for many species in southern California; however, the factors that allow some species to persist in cities and suburban areas, while others decline, are unclear. We used acoustic detectors (Pettersson D240X) to record bat echolocation calls at 4 sites in the eastern San Gabriel Valley that differed in their local site characteristics and the degree of urbanization of the surrounding landscape. Each site was sampled for 10 nights between March and August 2012. Using Sonobat software to identify 6,448 calls, we detected 8 bat species. Activity of the 4 most common species differed among sites: *Tadarida brasiliensis* was recorded at all sites but was the most active species at 2 golf courses, *Myotis yumanensis* was most common species at a large regional park, and *Eptesicus fuscus* and *Lasiurus cinereus* were the most common species at an ecological reserve. Although the reserve had the least bat activity and lowest mean species richness (based on calls), it had the highest species richness after adjusting for the number of calls. Community composition differed significantly between the sites except for the golf courses, which were not different from one another. Our results suggest that bats are abundant in areas of southern California where suitable roosting and foraging habitats are available. Understanding how bats are affected by the loss and fragmentation of natural habitats will aid in regional bat conservation efforts.

95. **SUBSTRATE ATTRIBUTES DETERMINE GAIT IN A TERRESTRIAL GASTROPOD**

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Some terrestrial gastropods are able to move using two gaits: adhesive crawling, where the entire foot is coupled to the substrate by mucus and the snail leaves a continuous mucus trail, and loping, where regions of the foot arch above the substrate and the snail leaves a discontinuous mucus trail. Some previous researchers have suggested that loping is only used as a means of escaping predators rapidly. We found that in the pulmonate *Cornu aspersum*, gait choice is determined in part by attributes of the substrate: snails moved using adhesive crawling on dry acrylic or glass substrates, but loped on dry concrete or wood. Loping snails did not move more rapidly than snails moving by adhesive crawling. Snails loping on concrete secreted a greater volume of pedal mucus per area of substrate contacted than those moving by adhesive crawling on acrylic. Because loping snails contact a smaller area of substrate per distance travelled than do snails using adhesive crawling, loping may help conserve mucus when moving on porous, absorbent substrates like concrete. Additional studies are needed to understand gait choice by terrestrial gastropods in natural habitats and the effects of factors such as body hydration and atmospheric humidity on locomotory behavior.

96. **IF ONLY WE COULD LIVE APART: COSTS OF COHABITATION AND MULTIPLE MATES IN THE HOUSE CRICKET (*ACHETA DOMESTICUS*)**

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Males can maximize reproductive success by fertilizing multiple females; however, for many species, a female can have all of her eggs fertilized during a single mating event. Nonetheless, polyandry (females mating with multiple males) is a common mating strategy that can yield several benefits. For example, females could gain resources from nuptial gifts, increase the genetic quality of offspring by mating with a second male, and replenish sperm. However, there may also be fitness costs associated with multiple mating or cohabitation (e.g., toxic sperm and harassment). In house crickets (*Acheta domesticus*) females do not receive nuptial gifts, but will mate multiply and males produce chemicals that influence female reproduction. To investigate costs and benefits of polyandry, we experimentally manipulated the mating system (polyandry and monogamy) and whether a female was cohabiting with a male using a fully factorial design. We measured female longevity and fecundity. We found no significant effect of multiple mates on female longevity and fecundity. However, there were significant reductions in female lifespan and fecundity when females were cohabiting with males. Male house crickets produce prostaglandins that impact egg-laying in females. To mimic multiple mating, we singly or repeatedly exposed females to Prostaglandin E2 (PGE2). Fecundity increased with increasing dose of PGE2 but lifespan was not impacted. Repeated exposure to PGE2 had no impact on female fecundity or lifespan. Our data indicate that the physical and behavioral interactions between males and females may more costly than repeated exposure of a female to spermatophores of a male.

97. **DEVELOPMENT OF *MEGASELLA SCALARIS* (DIPTERA: PHORIDAE) AS A MODEL ORGANISM FOR CIRCADIAN RHYTHM EXPERIMENTS**

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Urban biodiversity is understudied despite its importance to the majority of humans living on Earth. Species of the fly genus *Drosophila* are a key model organism in the laboratory and are becoming important in field environmental studies. Preliminary data show that flies in the family Phoridae also appear suitable as laboratory organisms. *Megaselia's* diversity and ease of rearing in a laboratory environment would permit evolutionary genetic study of multi-species changes across an urban to non-urban environmental span. To be able to effectively use phorid flies as a model organism, rearing these flies must be improved so that they are as easy to raise as *D. melanogaster*. In this experiment, *Megaselia*

*scalaris* was raised on a ration based on that used for *Drosophila* and rearing temperatures of 22°C and 26°C. At the lower temperature, it took the flies an average of 26.3 days to reach sexual maturity, while at 26°C, the developmental time was reduced to 25.8 days. Preliminary circadian cycle investigations showed similarities to *Drosophila melanogaster* in 12-hour light and dark phases, with higher activity during light phases. Future experiments should test the effects of various rations and broader temperature ranges on developmental rates. The effects of urban light pollution on activity can also be measured to further explore how urban light pollution affects genetic and species diversity. Finally, gene sequencing could compare known circadian genes across phorid species and between *Megaselia* and *Drosophila*.

**98. IMPACT OF A RESTORED OLYMPIA OYSTER BED ON EELGRASS (*ZOSTERA MARINA*) PRODUCTION AND ECOSYSTEM FUNCTION**

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Interest in restoring the Olympia oyster, *Ostrea lurida*, has in part been motivated by recovering potential ecosystem services provided by oysters, including increased habitat complexity and improved water clarity. The potential impact of these ecosystem services on another valuable and coexisting species, eelgrass *Zostera marina*, is unclear. We hypothesize that oyster beds may increase light available to eelgrass, ameliorating a major seagrass growth limitation, through oyster filter feeding behavior and by decreasing the epiphytic load on eelgrass blades, via habitat creation for epiphytic grazers. We are investigating these mechanisms by monitoring an existing eelgrass bed before and after the construction of a restored Olympia oyster bed in Alamitos Bay, Long Beach, CA. We are monitoring changes in eelgrass production (shoot density and biomass), epiphytic load (epiphyte area covered and biomass), epifaunal grazer diversity, and light availability. Two additional eelgrass beds in the bay will serve as reference sites. After 6 months, turion density among all eelgrass beds shows similar seasonal declines, with the greatest decline observed at one of the reference sites. A longer time series and data on other monitored factors may yet reveal significant trends in oyster impact on eelgrass. Understanding the broad impacts of restoration of the Olympia oyster is critical to evaluate the success of ecological restoration. Furthermore, understanding the relationship between *O. lurida* and *Z. marina* is critically important in future restoration design for both species.

**99. EVALUATING NATURAL HISTORY MUSEUM COLLECTIONS: WHAT CAN THEY TELL US ABOUT ENDANGERED FAIRY SHRIMP BIOGEOGRAPHY?**

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For nearly two decades all voucher specimens of the two California federally-listed fairy shrimp species, *Branchinecta sandiegonensis* and *Branchinecta lynchi* (Crustacea: Branchiopoda), have been deposited by California Fish and Wildlife mandate at one of two official depositories: the California Academy of Sciences and the Natural History Museum of Los Angeles County. Until now there has been little or no effort to use these tens of thousands of samples to assess geographical distributions for these two freshwater crustaceans. The main difficulties preventing the use of these collections have been the unstandardized preservation methods and preservatives used, and a lack of digitized collecting data pertaining to the samples. This makes it impossible to efficiently determine where collections were made or what preservatives had been used (formalin, acetone, isopropyl or ethyl alcohol, or other preservative). Without digitized records, searching the massive collections has been prohibitive. Our work has focused on improving this collection's usefulness in three ways. First, we digitized the collection data of approximately 5,000 samples, making the resulting data available on the web, and thereby exposing the collection to researchers. Second, the potential for molecular genetic analysis of the current collection was checked by extracting DNA and performing PCR amplifications for mitochondrial genes on a spot sampling from across the taxa. Third, by working with Fish and Wildlife Services, the collection and preservation protocols for all future collections of these endangered (and other non-endangered) species have been improved and standardized.

**100. MORPHOLOGICAL CHARACTERIZATION OF SOUTHERN CALIFORNIA PIPEFISH (FAMILY SYNGNATHIDAE)**

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Many teleost fish populations, such as the pipefishes (family Syngnathidae) are dependent upon seagrass beds for all or part of their life cycle. Due to similarities in appearance, pipefishes are extremely difficult to identify and differentiate between species. It has been hypothesized that due to climate change and warming water conditions, more southern pipefish species are expanding their range further north into southern California waters. While some work on pipefishes has been conducted, a clear and accurate picture of local pipefish populations is needed. The objectives of this study are to: 1) survey California seagrass beds to gain an understanding of species presence and distribution, and 2) establish morphological characteristics to accurately identify and differentiate between different pipefish species. Our hypothesis is that external morphological characteristics and measurements can be utilized to aid in positive identification of pipefish species. Preliminary data on three pipefish species (bay pipefish, *Syngnathus leptorhynchus*; kelp pipefish, *Syngnathus californiensis*; and snubnose pipefish, *Cosmocampus arctus*) indicates that the head-length to snout-width ratio is significantly different ( $p < 0.0001$ ) between species. Additionally, the bay pipefish has two dark spots at the base of the operculum and the snubnose pipefish has an unusually truncated snout. In order to conclusively characterize pipefish species in southern California, future work will focus on developing molecular fingerprints that can be matched to the unique characteristics of each pipefish species. Accurate and reliable data will be used to create an updated dichotomous key that can be easily utilized by fisheries and field biologists.

**101. POPULATION CONNECTIVITY OF THE BROWN SMOOTHFOUND SHARK (*MUSTELUS HENLEI*) IN THE NORTHEASTERN PACIFIC AND THE GULF OF CALIFORNIA**

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To determine the effects of the prominent biogeographic and phylogeographic barriers of the northeastern Pacific (Point Conception, the Los Angeles Region, and the Peninsula of Baja California) on the population connectivity of the temperate brown smoothhound shark, *Mustelus henlei* (Triakidae), data from the mitochondrial control region (mtCR) and six nuclear microsatellite markers were used to measure gene flow among sample localities from throughout the range of the species (San Francisco Bay, CA, Santa Barbara, CA, Santa Catalina Island, CA, Punta Lobos, Baja California Sur, and the northern Gulf of California). Microsatellite data demonstrated significant contemporary gene flow among all localities with mtCR sequence data detecting significant structure between both San Francisco Bay and Santa Catalina Island and all other localities. Based on these results, female philopatry to the known nursery of San Francisco Bay may have been detected as well as the identification of a putative nursery at Santa Catalina Island. Furthermore, the barriers of the northeastern Pacific seem to have little effect on the contemporary population connectivity of *M. henlei*.

**102. PRELIMINARY BATCH FECUNDITY ESTIMATE FOR BARRED SAND BASS, A SERIAL SPAWNER WITH INDETERMINATE FECUNDITY IN SOUTHERN CALIFORNIA**

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Reliable batch fecundity estimates are essential for calculating total annual fecundity; however, previous batch fecundity studies on barred sand bass (*Paralabrax nebulifer*) contained small sample sizes. We collected barred sand bass throughout the 2011 spawning season (June–August) and into September. Batch fecundity was calculated using the hydrated oocyte method, where the number of hydrated oocytes was counted per 0.10 g of whole-mounted ovarian tissue and multiplied by ovary mass. Active or imminent spawning females were identified by the presence of hydrated oocytes and post-ovulatory follicles (POFs) in histological cross-sections of ovaries from 208 females. Ovaries were categorized by POF age (Day0 =

< 4 hr, Day1 = 4–24 hr, Day2 = > 24 hr), but only females with Day2 POFs ( $n = 46$ ) were used for obtaining a batch fecundity size relationship. Based on the preliminary model predicted from a subset of females with Day2 POFs ( $n = 18$ ), hydrated oocyte counts of females with Day0 ( $n = 6$ ) and/or Day1 ( $n = 13$ ) POFs underestimated batch fecundity by an average 26 and 20%, respectively. Batch fecundity was linearly related to ovary mass ( $y = 1107x + 5147.5$ ,  $R^2 = 0.93$ ) and the relationship with fish standard length (mm) was best described by the power function,  $y = 0.0086x^{2.8028}$ ,  $R^2 = 0.72$ . None of the females collected in September met the criteria for estimating batch fecundity. Our results provide a more robust estimate of batch fecundity for barred sand bass and highlight the importance of aging POFs, as results may otherwise underestimate fecundity.

**103. SEASONAL, GEOGRAPHIC, AND ONTOGENETIC FEEDING ECOLOGY OF EASTERN PACIFIC ANGEL SHARKS**

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Angel sharks are primarily benthic dwelling sharks found mainly in temperate and sub-tropical parts of the Atlantic and Pacific Oceans. Their primary method of capturing prey is by ambushing anything small enough to be swallowed by rapidly lunging from a sedentary position on the sea floor. In the eastern North Pacific angel sharks are thought to be generalists predators that exhibit geographic variation in their diet compositions in different environments across their range. In the Southern California Bight blacksmith (*Chromis punctipinnis*) are the most prevalent prey and in the Southern Gulf of California jack mackerel (*Decapterus macrosoma*) are the most prevalent prey item. Curiously, no significant ontogenetic shifts in diet have been previously documented, which would suggest that the sharks might exhibit a local preference for a particular species. In this study the stomach contents of 71 angel sharks from across the Pacific Ocean and the Gulf of California surrounding the Baja California peninsula were examined and used to describe patterns of seasonal, geographic, and ontogenetic feeding habits of these sharks across their range.

**104. IMPROVED ESTIMATE OF SPAWNING FRACTION FOR BARRED SAND BASS, AN AGGREGATIVE SPAWNER IN SOUTHERN CALIFORNIA**

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The previous spawning fraction estimate for barred sand bass (*Paralabrax nebulifer*) was based on a two-week sampling period in July. To determine if spawning fraction varies across the entire spawning season, we quantified ovarian activity using histological cross-sections from 208 barred sand bass collected on the San Pedro Shelf from June–September 2011. The presence of postovulatory follicles (POFs), hydrated oocytes, and atretic follicles was recorded for each ovarian cross-section. We calculated spawning fraction using the POF method to determine the proportion of mature females with POFs < 24 hr old. Spawning fraction varied by month ( $X^2$  (3, N=208) = 23.1,  $p < 0.001$ ) and was highest in July and August (mean =  $0.13 \pm 0.14$  95% CI). No difference in spawning fraction was noted between July and August; however, the incidence of recently spawned fish (i.e., females with POFs < 4 hr) was significantly higher in July ( $X^2$  (1, N = 166) = 6.75,  $p = 0.009$ ) compared to August. The proportion of nonspawners (i.e., no POFs) varied monthly ( $X^2$  (3, N=208) = 89.9,  $p < 0.001$ ) and was significantly higher in June and September (mean =  $0.71 \pm 0.13$  95% CI) compared to July and August (mean =  $0.15 \pm 0.05$  95% CI). The end of the spawning season coincided with a high proportion (0.89) of females exhibiting follicular atresia in September. Our results highlight the importance of sampling throughout the spawning season to avoid over/underestimating the total number of spawning events per female per year.

**105. VARIANCE IN AGGRESSION LEVEL IN AMONG SPECIES AND BETWEEN SPECIES PAIRINGS OF POLYCHAETOUS ANNELIDS IN THE *NEANTHES ACUMINATA* COMPLEX**

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The *Neanthes acuminata* complex consists of four morphologically identical species: *Neanthes acuminata* from the Atlantic coast of the United States, *Neanthes arenaceodentata* from the Pacific coast of the U.S., Hawaii, and Mexico, *Neanthes caudata* from Portugal, and *Neanthes cricognatha* from India, the Philippines, and Hong Kong. Previous studies demonstrated that *N. caudata* showed aggression towards individuals from *N. arenaceodentata* populations. This investigation paired individuals of five cultured populations from the *N. arenaceodentata* group (Venice Beach, Los Angeles Harbor, San Gabriel River, Alamitos Bay, and Newport Beach) to determine aggression levels within this species. *N. caudata* specimens from Portugal were also compared with these five populations. No aggression was observed between males and females within a population (ex. LA Harbor male with LA Harbor female), low levels of aggression were observed in pairs between *N. arenaceodentata* populations (ex. Venice male with Newport female), and high levels of aggression were observed in pairs between species (*N. arenaceodentata* versus *N. caudata* from Portugal). Aggression was defined as one worm killing the other, while nonaggression was defined as the female surviving to lay eggs. Previously, it was found that intersexual aggression is rare within the *N. acuminata* complex. Increased aggression levels may be indicative of premating isolation that has developed between the two species, and is starting to develop between the five populations from Southern California.

**106. MIXTURE EFFECTS OF DES AND HPTE ON CELL VIABILITY AND DIFFERENTIATION OF EMBRYONIC C57BL/6 THYMOCYTES**

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Endocrine disrupting chemicals (EDCs) are chemicals that affect a developing organism by mimicking or interfering with hormones that are produced in the body. EDCs can be found in the environment in several forms such as medications and pesticides. Due to the various EDCs present in the environment, people have the potential to come in contact with a mix of EDCs at various concentrations. Despite this information, most experiments looking at EDC effects are done on only individual toxicants. Very few studies have done experiments on exposure to a mix of EDCs at low dose concentrations. A low dose mixture experiment is more realistic to the exposure experienced on a daily basis. To address the question of the effect of exposure to mixtures we selected two well-known toxicants. Diethylstilbestrol (DES) was a medication prescribed to pregnant women to help prevent miscarriages and other pregnancy related complications. However, the medication was shown to have adversely affected the offspring of those women who took it during their pregnancy. Methoxychlor was a pesticide used in agriculture, and once in the body, it is metabolized to a more toxic form, HPTE (2,2-bis-(p-hydroxyphenyl)-1,1,1-trichloroethane). DES and HPTE have been examined at high concentrations and have shown negative effects on developing thymocytes. Using an in-vitro assay, our research lab attempted to observe the effects of a mix of a range of doses (50 pico-, nano- and micromolar concentrations) of DES and HPTE on maturation and differentiation of embryonic C57BL/6 thymocytes. Interestingly, we have found that when the thymocytes were exposed to a mix of DES and HPTE, the cells decreased in number at micromolar concentrations but there was no significant decrease at the nano- and picomolar concentrations.

**107. DIFFERENTIAL EXPRESSION OF SFSWAP PROTEIN IN THE DEVELOPING MALE AND FEMALE MOUSE CORTEX AND HIPPOCAMPUS**

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The cerebral cortex and hippocampus are important for cognitive function and social behavior, many of which show sex differences. Meanwhile, many neurological diseases and mental disorders linked to the dysfunction within the cortex and hippocampus have displayed gender differences in prevalence and symptomatology. Although the molecular mechanisms underlying these differences between the sexes remain unclear, with the growing list of neurological diseases associated with splicing defects, we speculate that alternative splicing might play an important role in sex-specific regulation and disruption of the cortex and hippocampal function. We have recently shown that during early development, mRNA levels of splicing factor suppressor of white apricot (*Sfswap*) in the male mouse cortex and hippocampus were



higher than the females 7 and 21 days after birth. Thus, we hypothesize that the sex difference in *Sfswap* transcript is preserved at the protein level. To test our hypothesis, we measured protein levels of *Sfswap* in the mouse cortex on the day of birth (PN0) and 7 (PN7) and 14 (PN14) days after birth using immunoblotting with the antibody against *Sfswap* protein. We observed that the antibody detected two *Sfswap* protein bands, at 105 kDa and 115 kDa. While our preliminary data did not show significant sex difference on *Sfswap* protein levels, there seems to be a trend that *Sfswap* expression in the male cortex and hippocampus increases on PN0 and PN14. We are currently increasing the sample size to ensure if the masculine increase in *Sfswap* expression occurs in the mouse cortex and hippocampus during development.

**108. GENETIC POPULATION STRUCTURE OF THE OLYMPIA OYSTER (*OSTREA LURIDA*) IN SOUTHERN CALIFORNIA**

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Although oyster restoration projects are ongoing along the west coast of the USA, restoration managers have no information regarding range-wide genetic structure of the Olympia oyster (*Ostrea lurida*) and therefore cannot include this information when designing restoration projects in order to allocate time, money, and resources appropriately. We aim to provide baseline genetic diversity and structure estimates for the historically impacted native Olympia oyster populations in southern California by using non-coding mtDNA and microsatellite genetic markers. We will test for detectable genetic structure among remnant southern California populations and combine our microsatellite data with unpublished data from central California to Washington in order to examine nearly range-wide genetic structure. We hypothesize that southern California populations will have some genetic structure and that genetic similarity will reflect geographic proximity, the pattern for an isolation by distance model. Genomic DNA was prepared from adult Olympia oysters (n=50 per site) collected at eight sites in southern California from Mugu Lagoon to Tijuana Estuary. We will estimate haplotype or nucleotide diversity, and  $F_{ST}$  or related estimates in order to assess within and among site variation. Baseline data from this study will fill a gap in the literature concerning the population genetics of especially southern California estuarine species where restoration of Olympia oysters can serve as a model for the restoration of other native estuarine species.

**109. GPR30: A POTENTIAL RECEPTOR FOR ENDOCRINE DISRUPTORS**

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Many people live their lives unaware that they are unavoidably exposed to harmful chemicals called endocrine disrupting chemicals (EDCs). EDCs are believed to disrupt the function of the endocrine and immune systems by mimicking estrogen. Studies have shown that endocrine disruptors affect our immune system negatively by interfering with thymocyte development and by inducing apoptosis, but the mechanism is yet to be discovered. EDC exposures can cause immune dysfunctions (including autoimmune diseases), learning disabilities, disorders, developmental deformations, and effects on overall growth and development. The goal of this project was to find out if EDCs use the nonclassical receptor G protein coupled receptor 30 (GPR30) to promote cell death in thymocytes. To address our question, we observed the effects of the GPR30 agonist, G1, on the cells at different concentrations, 2nM, 20 nM, 200 nM, and 2000 nM, and compared the effects with diethylstilbestrol, (DES a positive control) at a 25 $\mu$ M concentration. G1 has a high affinity for binding to the GPR30 receptor. If the effects of G1 and DES on thymocytes are similar, our findings would support that a common mechanism is being used by G1 and DES. Our results showed that G1 at a 2000nM concentration had similar effects as the 25 $\mu$ M DES concentration, which suggests that the endocrine disruptors may be using the GPR30 receptor. By figuring out the receptor to which these chemicals bind, other research can find a way to block this receptor to inhibit the effects of these EDCs on the immune system.

**110. NON-CLASSICAL ESTROGEN RECEPTOR GPR30 USAGE BY EMBRYONIC THYMOCYTES OF C57/BL6 MICE WHEN EXPOSED TO HPTE**

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Synthetic organic chemicals, commonly referred to as endocrine disrupting chemicals (EDCs), can be found in the air, food, water, and in common household items. EDCs are known to have disrupting effects on hormones and some EDCs, such as HPTE, have the ability to mimic estrogen and can bind to estrogen receptors on T-cells. HPTE is the demethylated metabolite of the insecticide methoxychlor, and has been shown to have high estrogenic activity. Exposure to HPTE has been linked to disorders affecting the developing immune system with the chief mechanism identified thus far being apoptosis of affected cells. While it is well documented that EDCs are harmful and that they can affect the immune system, the receptors they bind to in order to mediate their effects is still unclear. The purpose of this research was to determine whether or not HPTE utilizes the non-classical estrogen receptor, G-Protein Coupled Receptor 30 (GPR30), to mediate its effects on the developing immune system. Embryonic thymocytes (16–18 days of gestation) were cultured and pre-treated with varying concentrations of the GPR30 antagonist G15, which has a high affinity for GPR30. The thymocytes were then exposed to HPTE. Preliminary results suggest that there is a partial rescue from cell death in cells that were pre-treated with G15 prior to exposure to HPTE.

**111. THE TEMPORAL EXPRESSION OF GENES IMPLICATED IN THE FORMATION OF THE EMBRYONIC SKELETON IN *OPHIOCOMA WENDTII***

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While all adult echinoderms have a skeleton, sea urchins and brittle stars alone express a larval skeleton. The gene regulatory network (GRN) leading from specification of the skeletogenic cell lineage to formation of the mineralized skeletal spicule in sea urchin embryos has been well characterized. The initial genes activated are transcriptional regulators, which begin a cascade of gene regulation culminating in activation of genes encoding the proteins that bind calcium and are integral to the skeleton. Most of the genes implicated in this GRN are also involved in adult skeleton formation in sea urchins as well. We would like to know the extent of conservation of this skeletal GRN between sea urchins and brittle stars. Previous studies have identified homologues of several of the transcription factors that are part of the sea urchin skeletal GRN in the brittle star *Ophiocoma wendtii*. These include Alx1, Dri, Ets1/2, Erg and Gapb. Proteomic approaches have identified transcripts that encode proteins that are occluded in the *Ophiocoma wendtii* skeleton. These include LUPK, 00358, 00266, PO24 and 01464. The purpose of this work is to study the temporal expression of these genes during the development of *O.wendtii* embryos and to compare that to what has been characterized in sea urchins.

**112. THE EFFECT OF DIETHYLSTYLBESTEROL ON THE V $\beta$  AND V $\alpha$  REPERTOIRE OF DEVELOPING THYMOCYTES**

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The T cell receptor (TCR), an integral membrane protein of thymocytes and T cells, is composed of two different chains ( $\alpha$  and  $\beta$ ), each containing a constant (C) and variable (V) region. The V  $\beta$  and V  $\alpha$  subsets on the TCR play a crucial role in immune homeostasis and specificity and protect the body against self-antigens. Absence or dysfunctions of these subsets can be advantageous to pathogens that are introduced into the body and may result in autoimmune diseases. It has been hypothesized that endocrine disrupting chemicals (EDC's) may have an effect on the distribution of T cell receptors in thymocytes that develop in their presence. The primary focus of our research is to elucidate the effects of EDCs on T-cell development. This study attempts to reveal whether EDCs alter expression of specific V  $\beta$  or V  $\alpha$  subsets, which would suggest that a correlation between EDC exposure and autoimmune disease may exist. To address our question embryonic thymocytes were exposed to DES, a known endocrine disrupting chemical, at 50 and 0  $\mu$ M concentrations. Following a two-step *in vitro* differentiation assay, fetal mouse thymocytes were stained with V  $\beta$  and V  $\alpha$  antibodies. Preliminary results suggest that exposure to DES causes a decrease in the V  $\beta$  and V  $\alpha$  positive populations. However, it does so in a non-specific manner.

**113. THE EFFECTS OF DIETHYLSTYLBESTEROL ON MATURATION AND DIFFERENTIATION OF SEX SPECIFIC EMBRYONIC C57BL/6 THYMOCYTES IN ORGAN CULTURE**

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The endocrine system consists of a network of hormone producing glands. Hormones are released in low doses and serve as chemical messengers that regulate many of the body's functions, including the immune system. Endocrine disrupting chemicals (EDCs) are substances, which interfere with endocrine system of the body. These chemicals display hormone like properties or interfere with hormone activity which may disrupt the development of the immune system. Furthermore, it has been demonstrated in studies of neonatal and adult systems that sex is also a variable in the effects of EDCs. Diethylstilbestrol (DES), a synthetic estrogen that serves as a model for other EDCs, was once prescribed during pregnancy to prevent complications. It was later discovered to cause endocrine disruption and reproductive health risks. Along with reproductive effects, there is evidence that developmental exposure to DES can alter the functioning of the immune system. Previous studies in our lab indicate that DES impacts developing thymocytes. It is unclear, however whether DES affects thymocyte development differently in male and female embryos. Therefore, the aim of this study was to determine whether there are sex differences in DES effects on developing embryonic T cells. PCR- amplification of a gene on the Y chromosome was used in sex identification. An *ex vivo* assay was used to examine the development of embryonic thymocytes from C57BL/6 mice embryos at 16 to 18 days of gestation. Our results indicate that DES decreases thymocyte viability to similar levels in both females and males in a dose dependent manner.

### SATURDAY ABSTRACTS IN PROGRAM ORDER

#### 114. THINGS I BET YOU DON'T KNOW ABOUT GRAVEL/COBBLE BEACHES LIKE SAN ONOFRE AND TRESTLES!

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While evaluating effects of beach washing on hardshell clam assemblages living in coarse-grained sediments oiled by the *Exxon Valdez* oil spill in Prince William Sound, we found that these sediments are actually a different class of sediment than the usual sediments observed on beaches. Relationships between particle size and sedimentary properties (*e.g.*, quantities of silt/clay or organics) and biological properties (*e.g.*, abundance, species richness, or biomass) are markedly different in heterogeneous coarse-grained (gravel) sediments than in finer homogeneous sediments (*e.g.*, sand, silt, or mud). It appears heterogeneous sediments have not been previously recognized geologically or biologically in published literature. An important feature of heterogeneous sediments is that the coarse rocks concentrated at the sediment surface can organize to form an "armor" or fabric. Organization, which can be measured photogrammetrically, increases the sediment's resistance to hydrodynamic or biological disruption, increasing stability. Organization appears to be a critical factor in the development of rich infaunal assemblages that can develop in this sediment type. Characterizing animals include hardshell clams, burrowing mussels, and burrowing shrimp and worms. Wet bivalve tissue weights exceeding 7 kg have been observed subtidally in Alaska. Disturbance of organized heterogeneous sediments is accompanied by dramatic long-term delays in recovery of the rich assemblages. Recovery following disturbance may require several decades. Such delays have been observed in Prince William Sound and at Trestles and San Onofre. In this paper, I demonstrate the physical, chemical, and biological relationships characterizing the contrasting sediment classes and provide examples of the infauna and these sediments.

#### 115. LOCAL EXTIRPATIONS AND REGIONAL DECLINES OF ENDEMIC UPPER BEACH FAUNA IN SOUTHERN CALIFORNIA

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The upper intertidal zones of sandy beach ecosystems are increasingly threatened by impacts of human activities, erosion, and climate change. Upper beach zones typically support invertebrates with restricted distributions and dispersal. We hypothesized that disproportionate loss or degradation of these zones in the last century has resulted in declines of upper shore macroinvertebrates in southern California. From a suite of potentially vulnerable endemic upper beach fauna with direct development, low dispersal and late reproduction, we investigated historical changes in distribution and abundance of two intertidal isopod species (*Tylos punctatus* and *Alloniscus perconvexus*). Populations of these isopods have been extirpated at 57% and 64%,

respectively, of historically occupied sites. Numerous local extirpations have caused regional declines and greatly reduced connectivity among populations. Two littoral cells (Santa Barbara, Zuma) currently support 74% of the remaining populations. Abundance has declined and the northern range limit of the southern species, *T. punctatus*, has retreated 31 km south since 1971. These isopods persist primarily on relatively remote, ungrouted, unarmored beaches with restricted vehicle access and minimal management. These predominantly narrow, bluff-backed beaches also support species-rich upper beach assemblages, suggesting these isopods are useful indicators. The high extirpation rates of isopod populations over the last century provide a compelling example of the vulnerability of upper beach invertebrates to coastal urbanization. Sea level rise will exert further pressures on upper beach zones and fauna globally. In the absence of rapid implementation of effective conservation strategies, our results suggest many upper intertidal invertebrate species are at risk.

**116. BURROWING IN BEACH FILL: IMPLICATIONS FOR RECOVERY OF SANDY BEACH ECOSYSTEMS**

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Beach nourishment is often considered an environmentally sound approach to maintaining eroding shorelines, however, the ecological consequences of this practice are poorly understood. Beach fill activities cause intense mortality of beach macroinvertebrates, potentially altering these intertidal communities for months to years. Ecological recovery following fill activities depends on successful recolonization of the entire intertidal community from offsite sources. The use of incompatible fill sediments can impede recolonization of intertidal invertebrates. We hypothesized that both intertidal zone and burrowing mode could influence responses of beach invertebrates to altered sediment texture, and ultimately the potential for colonization and recovery of beaches disturbed by fill projects. We tested these predictions when a dredge disposal project at Goleta Beach, California introduced mismatched fine sediments to all zones of the beach in 2011. Experimental trials in fill material and native beach sand found the fine fill significantly inhibited burrowing of characteristic species from all intertidal zones, including sand crabs, clams, isopods, talitrid amphipods, and worms. For several species, burrowing was completely inhibited in the fill, excluding the animals. We also found burrowing of lower intertidal species was sensitive to sediment mixtures with <10% fines. Burrowing inhibition by mismatched fill sediments exposes beach species to stresses, which could depress recruitment and survival at all intertidal levels. Our results suggest use of incompatible fill sediments creates unsuitable habitat that could significantly delay intertidal community recovery. By reducing the availability of intertidal invertebrate prey, impacts of filling could affect shorebirds and fish and extend beyond the beach itself.

**118. AVIAN PREDATION ON MIDNIGHT SPAWNING RUNS OF THE CALIFORNIA GRUNION (*LEURESTHES TENUIS*)**

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The California Grunion (*Leuresthes tenuis*) synchronizes its spectacular midnight spawning runs with the high semilunar tides of full and new moons. The narrow window of time when tides are right requires potential parents to aggregate *en masse* in appropriate areas at specific times. Tidal cycles are readily predictable and most marine animals are acutely aware of tidal rhythms. Forming aggregations at predictable times in particular places may lead to an increased likelihood of predation for beach spawning fishes. Because *L. tenuis* fully emerge onto sandy beaches while spawning, they are potentially exposed to terrestrial as well as marine predators. It has been suggested that *L. tenuis* spawn only at night as a way to reduce predation on the runs. However, at Malibu Lagoon State Beach, we have observed numerous birds that normally feed diurnally, actively preying upon nocturnal spawning runs of *L. tenuis*. These birds do not regularly feed at high tides or at night, appearing on shore solely on nights when spawning runs are likely to occur, even before the fish begin to run. We hypothesize that the birds have an environmental cue that allows them to predict the timing of the runs to some extent. A nearby beach that hosts equally large spawning runs of *L. tenuis* does not have the same avian predators. We conclude that avian predators predict spawning runs of *L. tenuis* by the tidal heights, are present after full and new moons, and in overcast skies, and are site-specific.

**119. COMMUNITY-BASED SCIENCE AND OUTREACH IN THE CONSERVATION OF SNOWY PLOVERS AND LEAST TERNS IN LOS ANGELES COUNTY, CALIFORNIA**

**S.M. Vigallon** and T.P. Ryan. Los Angeles Audubon, Los Angeles, CA, 90093.

From 2007 through 2012, Los Angeles Audubon collaborated with project biologists, management agencies, recreation facilities, and other local Audubon chapters to address conservation concerns about the western snowy plover (*Charadrius nivosus nivosus*) and the California least tern (*Sternula antillarum browni*) on Los Angeles County beaches. We coordinated volunteers to monitor and restore habitat, and we conducted community outreach activities. The goals of these projects were (1) to greatly increase the data-gathering capacity of projects staffed by only a few biologists; (2) to engage the public in community-based science in the highly urbanized setting of Los Angeles as a way to promote conservation of these coastal species; (3) to engage inner-city public school students in multidisciplinary projects that would provide us with visual media to further promote conservation. Through these projects we have been able engage a broad spectrum of the beach-going public, including inner-city public school children, college students, employees from a major corporation, experienced birders, and local beach communities. Volunteers have contributed thousands of hours to monitoring and habitat restoration; and they have proven highly effective in gathering information on target species' population size, location, and behavior, and threats to target species. Hundreds of public school students have participated in conservation-themed field trips and on-campus activities, producing signage, online galleries, and two public service announcement videos that we have subsequently used to promote conservation of plovers and terns.

**120. CHALLENGES FACED BY THE ENDANGERED CALIFORNIA LEAST TERN AND THREATENED SNOWY PLOVER ON THE URBAN BEACHES OF LOS ANGELES COUNTY, CALIFORNIA**

**T.P. Ryan**<sup>1</sup> and S. Vigallon<sup>2</sup>. <sup>1</sup>Ryan Ecological Consulting, Monrovia, CA 91016; <sup>2</sup>Los Angeles Audubon, Los Angeles, CA 90093.

It is known from historic egg collections that both the California least tern (*Sternula antillarum browni*) and the western snowy plover (*Charadrius alexandrinus nivosus*) nested on the sandy beach and coastal dune habitats along the Coast of Los Angeles County. Coastal development in the early 1900's extirpated the snowy plover as a nesting species, although they now persist in non-breeding flocks. The least tern still nests at two protected and managed colonies near their historic nesting areas. We present results of monitoring efforts that show recent high productivity by the least tern at both colonies. However, both colonies are facing declines, likely due to unknown food resources issues and adaptation by predators to management techniques. Between 10–15% of the population of the western snowy plover uses the urban beaches as winter roosting and foraging areas. We describe efforts underway to protect these important winter roosts. We present monitoring data that indicates recent management efforts are leading to increases in wintering individuals, but no nesting. We discuss lessons learned from management efforts and make recommendations for further protections for both species.

**121. BRINGING BACK THE BEACH: THE DOCKWEILER PLOVER FENCE**

**D.S. Cooper**. Cooper Ecological Monitoring, Inc., 255 Satinwood Ave., Oak Park, CA 91377.

In late 2008, I was hired to monitor the western snowy plover (*Charadrius alexandrinus nivosus*), a Federally-Threatened shorebird, at Dockweiler Beach in Los Angeles County, to prevent their disturbance during pipeline construction and a sand-cleaning operation. While the birds appeared unaffected by this project, they were being constantly disturbed by trucks of various unrelated public agencies, as well as by joggers. This led to my working with Los Angeles County officials and others to place orange cones around the main roosting area in 2009, and to help expedite the construction of fencing around the main roost of the plovers, which was finally completed in early January 2010, despite considerable resistance. Since then, the fence has been rebuilt, and informational signage has been posted, and several dozen plovers continue to use the roost through the winter. Pre-breeding behavior has been noted, and future nesting is possible, as has occurred elsewhere in the region. As importantly,

the fence has allowed for the establishment of a native foredune/coastal strand plant community, which now includes at least one additional sensitive species, the red sand verbena (*Abronia maritima*), a CNPS Rank 4 plant.

**122. FIRST REPORT OF SHEETS OF SOFT FIBRILLAR BONE TISSUES FROM A TRICERATOPS HORN FOSSIL AND REACTION TO THE DISCOVERY**

**M.H. Armitage.** Biology Department, California State University Northridge, 587 Ventu Park Road #304, Thousand Oaks, CA 91320.

During excavation of a fossil site at the Hell Creek Formation, Glendive, Montana in May 2012, the largest *Triceratops horridus* supraorbital horn ever recovered from Glendive was jacketed and transported to CA for microscopic analysis. The horn was discovered to be highly vascular, filled with moist matrix and featured both permineralized and unfossilized material. Subsequent to decalcification with EDTA, soft and hard remains were thin sectioned and examined by light and electron microscopy. Permineralized vascular vessels which remained after decalcification exhibited internal spherical structures consistent with size and shape of blood cells. Soft tissues collected from deep within the horn yielded heavy populations of layers of osteocytes. Osteocytes featured delicate filopodia and internal structures consistent with nuclei and other organelles. Soft sheets of fibrillar bone examined under Scanning Electron microscopy were characterized by groupings of tightly aligned osteocytes, widely connected via filopodia with widths approaching 500nm. Results of this study conform to previous soft tissue studies in ancient materials and strongly suggest that this is endogenous dinosaur tissue. Reaction to this discovery has been mixed.

**123. THE EVOLUTION OF MARINE TURTLES, WITH AN EMPHASIS ON FOSSIL SPECIMENS FROM THE EASTERN PACIFIC**

**J.F. Parham.** John D. Cooper Archaeological and Paleontological Center, Department of Geological Sciences, California State University, Fullerton, CA 92834.

The seven extant species of marine turtles represent the last representatives of a lineage with a long and poorly known history. Although the fossil record of marine turtles extends into the Jurassic (~150 mya), until recently it was not clear whether these earliest sea turtles are part of the same clade or represent an independent evolution of a marine ecology. This uncertainty, combined with a lack of detailed study of some key specimens, has confounded our understanding of the evolutionary history of marine turtles. Recent advances in reconstructing evolutionary relationships of all turtles (marine and non-marine), combined with the discovery of new fossil specimens, are providing a new picture of sea turtle evolution. In particular, specimens from the Miocene (10–15 mya) of the eastern Pacific (California and Peru) reveal unexpected patterns of biogeography and morphological evolution that set the stage for the origins and diversification of the extant species.

**124. AN EDENTULOUS DESMOSTYLUS (ORDER: DESMOSTYLIA) FROM THE LATE MIOCENE OF ORANGE COUNTY, CALIFORNIA**

**G.F. Santos<sup>1</sup>, B.L. Beatty<sup>2</sup>, and J.F. Parham<sup>1</sup>.** <sup>1</sup>John D. Cooper Archaeological and Paleontological Center, California State University Fullerton, Department of Geology, Fullerton, CA, 92834; <sup>2</sup>New York College of Osteopathic Medicine, Northern Boulevard, Old Westbury, NY 11568-8000.

Desmostylians are an extinct group of large, herbivorous marine mammals that inhabited the northern Pacific Rim from the late Oligocene to the late Miocene (~30–7 mya). They are known for their unique bounded columnar molars for which the group is named. Well preserved material of paleoparadoxid and desmostylid desmostylians are known from Orange County, but most material remains undescribed. A new specimen of a nearly complete mandible of the genus *Desmostylus* from the Puente Formation was discovered during the construction of the Eastern Transportation Corridor toll road in 1996. Unlike all other known desmostylians, this specimen is edentulous except for a pair of large, downward-turned tusks. These features may represent characteristics of a new species, or may have developed as a result of advanced age and wear in the individual. Though much of the ontogeny of the *Desmostylia* is still poorly



understood, the comparisons of this specimen to more complete material of *Desmostylus* from other collections could clarify ontogenetic sequences of desmostylians.

125. THE FOSSIL RECORD OF ELEPHANT SEALS (*MIROUNGA*) IN SOUTHERN CALIFORNIA

**M.A. Rivin**, John D. Cooper Archaeological and Paleontological Center, 1141 E. Chestnut Avenue, Santa Ana, California 92701.

Modern elephant seals consist of two species in the genus *Mirounga*. The northern elephant seal (*Mirounga angustirostris*) was intensively hunted during the nineteenth century. Once thought extinct, current populations of northern elephant seals have very successfully rebounded from a single surviving population of very few individuals to over 150,000 today. Despite a strong historical record of northern elephant seals, very few fossil elephant seals have been reported. A new specimen of *Mirounga* sp., a fragment of maxilla consisting of a canine tooth, has been identified from the Palos Verdes Sands Formation in Newport Beach, California, very close to Los Angeles County Museum of Natural History (LACM) locality 1066, which has produced a skull and postcranial material of *Mirounga*. The presence of several individuals of elephant seal, including juveniles, in late Pleistocene deposits of Orange County, could potentially even indicate a breeding population, since elephant seals spend most of their lives at sea. This is in contrast with historical and archaeological records, which do not record *Mirounga* breeding sites in coastal southern California. Previous studies have noted the apparent rarity of northern elephants seals in California in archaeological sites in contrast with their abundance today, and have suggested that Native American predation may have displaced elephant seals in the Holocene. Establishing a baseline of the relative abundance of *Mirounga* prior to human inhabitation in southern California illuminates the adaptability of the northern elephant seal, and may help answer questions about the population density of elephant seals in southern California prior to European hunting.

126. FOSSIL SITES WITHIN THE LA HABRA FORMATION OF RALPH B. CLARK PARK, ORANGE COUNTY, CA

**B.E.M. Watkins**<sup>1</sup>, L.C. Babilonia<sup>2</sup>, and J.F. Parham<sup>1</sup>. <sup>1</sup>John D. Cooper Archaeological and Paleontological Center, Department of Geological Sciences, California State University, Fullerton, CA 92834; <sup>2</sup>Clark Paleontology Museum, Buena Park, CA 90621.

The fossils found in Ralph B. Clark Park (housed at the Clark Park Paleontology Museum) provide an exceptional record of prehistoric life in Southern California. The park is in northern Orange County, on the border of Buena Park and Fullerton. The park includes the southwestern portion of the La Habra Formation, which consists of interbedded mudstones, sandstones, siltstones, pebbly sandstones, and conglomerates that are poorly consolidated. The limited exposure of the La Habra Formation inside the park rests unconformably over the Coyote Hills Formation, and underlays Holocene alluvial deposits. The fauna and unpublished radiocarbon dates suggest the La Habra Formation is in the late Rancholabrean North American Land Mammal Age (240,000-10,000 kya, Late Pleistocene). There are several well-documented sites in the park. Hudson's Hope (LC-40) is the most productive site, with over 60 species including plants, invertebrates, mammals, birds, reptiles, amphibians, and fish. Analysis of the sediments and the fauna suggest the paleoenvironment includes floodplains, open grasslands, woodlands, and braided streams. The relative stratigraphic positions of the fossil sites within the La Habra Formation are unknown. A detailed comparative sedimentary analysis of all fossil sites, a stratigraphic column, geochemical analysis, and a detailed study of the fauna, will give us a better understanding of the age and paleoenvironment of the La Habra Formation.

127. PAST ECOLOGICAL IMPLICATIONS FROM MICROVERTEBRATE REMAINS FROM CAVE OF THE CHIMNEYS (CA-SMI-603), SAN MIGUEL ISLAND, CALIFORNIA

**J.A. Allen**, E.L. Whistler, and R.L. Vellanoweth. Department of Anthropology, California State University, Los Angeles, 5151 State University Dr., Los Angeles, CA 90032.

Cave of the Chimneys (CA-SMI-603) is a rockshelter located on the northeast coast of San Miguel Island. The site is deeply stratified and contains at least seven distinct strata dated to between about 8000

and 1000 Cal BP (1 $\Sigma$ ). Preservation of faunal remains is excellent. Previous archaeological studies have found abundant evidence of human subsistence remains, bone and shell tools, and early Holocene cordage and beads. Temporal chronology and density of subsistence remains support short-term occupation or intermittent human use of the rockshelter giving rise to the question of how microvertebrates accumulated within the deposits. While microvertebrate remains only make up approximately less than 1% of this assemblage (by weight), high MNI (Minimum Number of Individuals) of rodents and reptiles have been identified throughout the strata. Preliminary analysis has yielded species infrequently seen in the archaeological record of San Miguel Island including gopher snake (*Pituophis catenifer*), ornate shrew (*Sorex ornatus*), and the extinct giant island deer mouse (*Peromyscus nesodytes*). Through detailed femoral measurements we see the possible targeting of juvenile rodents for prey by raptors. Measurements were also taken of mandibular tooth row length to address the possibility of an increase or decrease in rodent size through time. This study seeks to contribute to our understanding of past terrestrial environments, shifting ecological baseline, and predator/prey species relationships.

**128. SHELLS, BONES, AND STONES: MIDDLE HOLOCENE MATERIALITY ON SAN NICOLAS ISLAND**

R.F. Murphy, R. Vellanoweth, and M. Evans. Department of Anthropology, California State University, Los Angeles.

In 1959 UCLA archaeologists Sam-Joe Townsend and Fred Reinman excavated 20 burials eroding out of a cemetery on a dune site, CA-SNI-40, on San Nicolas Island. The burials were radiocarbon dated to the middle Holocene. Grave goods associated with the burials include thousands of *Olivella* sp. shell beads, woven water bottles, projectile points, abalone shells, bone tools, pendants, ground stone artifacts, and other constituents. Our recent excavations of the midden at CA-SNI-40, began in 2010. Material linkages identified between the cemetery and the midden grant insights into the daily life and mortuary practices of middle Holocene Channel Islanders.

**129. THE ECOLOGICAL AND DEMOGRAPHIC UNDERPINNINGS OF DIVERGENT PREHISTORIC SETTLEMENT TRAJECTORIES ON SAN CLEMENTE AND SAN NICOLAS ISLANDS**

B.F. Byrd and A.R. Whitaker. Far Western Anthropological Research Group.

San Nicolas and San Clemente islands are relatively remote compared to the northern Channel Islands. Despite their geographical proximity to one another, the history and organization of prehistoric settlement on the two islands are dramatically different in terms of site size, site distribution by topographic region, and the intensity of occupation through time. Comparison of these two robust and well-documented occupation records is possible because of large-scale cultural resource management efforts undertaken by the US Navy to identify and evaluate the significance of archaeological sites. San Nicolas Island is marked by larger sites during all periods and has a fairly even distribution of radiocarbon-dated site components beginning around 6,000 years ago in the Middle Holocene and continuing through the Late Holocene. In contrast, San Clemente has a sparse Early Holocene record (beginning by at least 9,000 years ago) that persists, with a few additions, through the Middle Holocene. During the Late Holocene, however, there is a dramatic increase in dated sites associated with a profusion of small, generalized sites in nearly all topographic and environmental zones. These striking temporal and spatial differences in settlement patterns between the two islands appear to be driven by divergent human adaptive responses to a complex set of ecological and demographic factors. These baseline variables include differences in land mass, topographic and resource diversity, annual rainfall, geological inundation and erosional processes, and the regional orientation of cultural interaction. This talk explores these trends and provides an initial assessment of the underlying causal factors.

**130. ARCHAEOLOGICAL PERSPECTIVES ON ISSUES OF MARINE ECOLOGY ALONG CALIFORNIA'S CENTRAL COAST**

T.L. Jones. Department of Social Sciences, California Polytechnic State University, San Luis Obispo.

The degree to which managers of contemporary California marine environments should or will listen to archaeological interpretations of paleo-ecology is debatable. In many cases, archaeological studies are not sufficiently grounded in empirical evidence to be considered credible by natural scientists, yet alone to provide a basis for management policy. Adding to this challenge along the central coast are archaeological studies that suggest that certain aspects of the marine environment are very different today from what they were in the past, including ocean chemistry, and species richness and diversity. I illustrate this point with discussion of estuarine fisheries, marine mammal populations, and the sea otter-abalone ecological dynamic.

**131. EXPLORING DIFFERENCE IN SIZE OF INTERTIDAL SHELLFISH SPECIES: ANALYZING TWO DISTINCT STRATIGRAPHIC LEVELS FROM CA-SNI-40, SAN NICOLAS ISLAND, CALIFORNIA**

J. Morales, Q.G. Lapeña, and R.L. Vellanoweth. Department of Anthropology, California State University, Los Angeles, CA, 5151 State University Dr. Los Angeles California.

Excavations at a middle Holocene dune site (CA-SNI-40) on the west end of San Nicolas Island revealed two distinct occupation phases. These periods of occupation are characterized by a high density of black abalone (*Haliotis cracherodii*) in the earlier period and an increase in the number of red abalone (*Haliotis rufescens*) in the later. Radiocarbon dates suggest that people initially inhabited the site from 4300-4100 cal. B.P., abandoned it for approximately two centuries, and reoccupied the site around 3900-3700 cal. B.P. Detailed measurements of fragile whole shells were recorded during excavations at CA-SNI-40. This paper will discuss statistical differences between the size of intertidal shellfish species within the two distinct depositional episodes at the site. Granted that human predation can significantly affect local faunal resources, a detailed analysis of this taxon may reveal an anthropogenic effect on the marine resources at San Nicolas Island.

**132. SOURCING ARCHAEOLOGICAL BITUMEN FROM THE CALIFORNIA CHANNEL ISLANDS TO SUBMARINE SEEPS**

K.M. Brown, N.W. Poister, J. Connan, and R.L. Vellanoweth. Department of Anthropology, California State University, Los Angeles, CA, 5151 State University Dr. Los Angeles California.

Asphaltum, often referred to as bitumen, is a naturally occurring form of petroleum used for thousands of years by native Californians for a variety of practical, decorative, and symbolic purposes. Ethnohistoric accounts state that asphaltum from terrestrial seeps was shaped by hand into cakes and traded throughout coastal Southern California and was the only type of asphaltum employed in the manufacture of plank-canoes. While there are no terrestrial seeps on the California Channel Islands, drift asphaltum exuded from submarine seeps can frequently be found washed up on the shore. It remains unclear to what extent prehistoric island populations relied on this drift asphaltum and whether or not they acquired terrestrial asphaltum through trade. This study combines Gas Chromatography/Mass Spectrometry (GC/MS) and liquid chromatography coupled with carbon isotopic analysis in an effort to identify the sources of six archaeological bituminous mixtures from San Nicolas and San Miguel Islands. We compare the archaeological asphaltum to four modern samples collected from marine tarballs and a mainland terrestrial seep. Further, we compare our data to a chemometric database, published by the USGS, in an effort to track our archaeological samples to extant sources. Our results show that prehistoric peoples on the Channel Islands utilized drift asphaltum from submarine seeps in a variety of technological applications throughout the Holocene.

**133. LATE HOLOCENE HUMAN IMPACTS ON MARINE AND TERRESTRIAL FAUNA IN SOUTHERN COASTAL CALIFORNIA: TWO ARCHAEOLOGICAL PROJECTS ON SAN NICOLAS ISLAND AND THE PALOS VERDES PENINSULA**

S.R. James. Department of Anthropology, California State University at Fullerton, P.O. Box 6846, Fullerton, CA 92834-6846.

The Channel Islands off the southern California coast provide a unique opportunity to study prehistoric adaptations in an insular environment, a region sometimes referred to as the North American Galapagos. Although the broad cultural historical outlines of the region have been examined for over a hundred years,

new archaeological data are providing significant information regarding the peopling of the Americas, origins of social complexity, and intensive marine resource utilization. During the past decade, field classes from California State University at Fullerton under the direction of the author have conducted investigations at archaeological sites at the Palos Verdes Peninsula and on San Nicolas Island, including test excavations at one of the deepest sites on the island (CA-SNI-44). Zooarchaeological data from these projects are presented with regard to overexploitation and resource depression of marine mammals, fish, and shellfish populations. The role of domestic dog as a top predator introduced in prehistory on San Nicolas Island and other Channel Islands is also examined. Biologists, conservationists, and other researchers need to consider prehistoric impacts in managing and preserving coastal ecosystems for the future.

**134. MARINE MAMMAL EXPLOITATION AT SITE CA-SNI-44 ON SAN NICOLAS ISLAND DURING THE LATE HOLOCENE: ZOOARCHAEOLOGICAL RESULTS AND INTERSITE COMPARISONS**

**S.R. James** and K. Gonzales. Department of Anthropology, California State University at Fullerton, P.O. Box 6846, Fullerton, CA 92834-6846.

Test excavations at CA-SNI-44 on the Central Plateau of San Nicolas Island in the southern Channel Islands, Ventura County, California, were conducted by field classes from the Department of Anthropology, California State University at Fullerton (CSUF). SNI-44 is one of the deepest shell middens (2.75 meters) thus far excavated on the Central Plateau. A relatively large marine mammal archaeofaunal assemblage was recovered during the excavations. Identified species include sea otter (*Enhydra lutris*), California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), and Guadalupe fur seal (*Arctocephalus townsendi*), as well as undetermined species of whales and dolphins (Cetacean). Sea otter dominates the assemblage in all test units with smaller percentages of the other identified taxa. Aside from presenting the zooarchaeological results of the analysis, intersite comparisons are examined with regard to marine mammals identified from other prehistoric sites on the island. The absence of northern elephant seal (*Mirounga angustirostris*) in the archaeofaunal assemblage from SNI-44 and other late Holocene sites is significant, especially given the abundance of this species today on the island. The results have implications for the modern management of these and other marine mammals in the Channel Islands.

**135. ZOOARCHAEOLOGICAL RESEARCH ON SAN NICOLAS ISLAND: FISH EXPLOITATION AT SITE CA-SNI-44 DURING THE LATE HOLOCENE**

**S.R. James** and J. Vyhmeister. Department of Anthropology, California State University at Fullerton, P.O. Box 6846, Fullerton, CA 92834-6846.

Field classes from the Department of Anthropology, California State University at Fullerton (CSUF) conducted archaeological test excavations at CA-SNI-44, which is located on the Central Plateau of San Nicolas Island in the southern Channel Islands, Ventura County, California. SNI-44 is one of the deepest sites (2.75 meters) thus far excavated on the Central Plateau and provides evidence for short-term seasonal occupations at the site throughout the late Holocene. Although situated about 2 km from the coast, the inhabitants transported large quantities of marine subsistence remains to the site where they were consumed and discarded. Zooarchaeological analyses indicate that California sheephead (*Semicossyphus pulcher*) and rockfishes (*Sebastes* spp.) account for over 85 percent of the identified fishes based on bone counts (NISP). Small amounts of surfperches (Embiotocidae), silversides (Atherinidae), herrings (Clupeidae), white sea bass (*Atractoscion nobilis*), giant kelpfish (*Heterostichus rostratus*), señorita (*Oxyjulis californica*), and lingcod (*Ophiodon elongatus*) are also represented. The prehistoric Nicoleños caught most of these species from nearshore kelp beds and rocky reefs. Analytical results are presented and comparisons with fishes reported from other prehistoric sites on the island are discussed in order to provide patterns of late Holocene fish exploitation.

**136. SETTLEMENT PATTERNS ALONG ALISO CREEK IN ORANGE COUNTY: A REGIONAL PERSPECTIVE**

**M. Wilson-Thuler**. Department of Anthropology, California State University at Fullerton, P.O. Box 6846, Fullerton, CA 92834-6846.

This study will utilize Geographic Information Systems (GIS) to analyze the spatial patterning of 202 archaeological sites along the Aliso Creek Watershed in Orange County, California. The goal of this project is to identify regional patterns in prehistoric coastal southern California during three cultural periods: Millingstone (6000 to 1000 B.C.), Intermediate (1000 B.C. to A.D. 500), and Late Prehistoric (A.D. 500 to 1804). Data collected for this study include recorded sites along the Aliso Creek Watershed derived from Cultural Resource Management (CRM) archaeology, utilizing the unpublished “gray literature” to make contributions to the prehistory of coastal southern California. A secondary goal of this study is to identify patterns in prehistoric settlements as they relate to paleoenvironmental change, specifically drought during the Intermediate and Late Prehistoric periods.

**137. PILOT STUDY OF GC-MS METHYL MERCURY DETERMINATION IN FISH FROM SANTA FE DAM LAKE**

**K. Lustig**, Environmental Science graduate student, California State University Dominguez Hills, Carson, CA, 90747.

In 2009, the San Gabriel River Regional Monitoring Program found elevated levels of mercury in some fish species from the Santa Fe Dam Lake, posing a potential public health risk to individuals consuming these fish. The USEPA method 245.7 was utilized assuming that nearly all mercury found was in the methyl mercury form. The agency again evaluated the mercury contamination at this location with an additional study into finding what percentage of the total mercury measured is methyl mercury. The additional study required my developing a gas chromatography/mass spectrometry method for analyzing organic mercury compounds extracted from fish tissue. This pretreatment method involved tissue digestion, organic solvent extraction, and then derivatization for GC/MS detection. The method was reasonably efficient with methyl mercury recoveries ranging from 55% to 95%, providing a potential alternative that is a convenient and accurate analysis of environmental mercury impacts to the public.

**138. THE GENETIC DIVERSITY AND POPULATION STRUCTURE OF BARRED SAND BASS (*PARALABRAX NEBULIFER*)**

**C.N. Paterson** and L.G. Allen, California State University, Northridge, Department of Biology, Northridge, CA, 91330.

Barred sand bass (commonly, sand bass), *Paralabrax nebulifer*, is part of the largest recreational fishery in Southern California as well as a large artisanal fishery in Mexico. This species ranges from Santa Cruz, California to the southern tip of Baja California, Mexico, but is common only south of Pt. Conception. Sand bass form large spawning aggregation in the summer months of June–August which makes them highly susceptible to overfishing. In the last decade, populations of sand bass in southern California have experienced a severe decline in numbers and subsequently the recreational fishery has been seriously impacted. The population structure and genetic diversity of barred sand bass populations was previously unknown. This study looks at both using the d-loop region of the mitochondrial DNA for populations in California and Mexico. Populations in southern California lack genetic structure, have high levels of genetic diversity and are indicative of panmixia across the region.

**139. REPRODUCTIVE BIOLOGY OF A SEVERELY DEPRESSED SPORTFISH THE BARRED SAND BASS, (*PARALABRAX NEBULIFER*) FROM SOUTHERN CALIFORNIA**

**J. Bautista**, Near shore Marine Fisheries Research Program, California State University Northridge, Northridge, CA 91330.

Years of intense fishing pressure has caused the fishery of the barred sand bass, (*Paralabrax nebulifer*) of Southern California to decline precipitously in the first decade of the 21<sup>st</sup> century. The large aggregations that this species forms during their spawning season have left them vulnerable to fishermen who remove them by the tens of thousands each summer. Specifically this proposed study into the reproductive biology of barred sand bass aims to document the monthly gonado-somatic index (GSI) for both male and female for a full year and determine fecundity for a wide range of female size classes. These parameters can indicate when

spawning is occurring and at what possible magnitude. A total of 699 barred sand bass were collected in 2011 from three sites (San Diego, Santa Monica Bay, Long Beach/Huntington) across Southern California. GSI begins to increase in May, peaks in July, and continues into September. Fecundity increases with size, indicating fecundity is a function of size. Understanding the reproductive cycles and the duration of energy allocation towards reproduction is important for the proper management of this fishery. Historically, barred sand bass have played a prominent role in the recreational fishing industry. Now 53 years since implementation, fishing regulations will undergo change as of March 1, 2013. It will be several years before we can accurately assess any possible change but protecting and properly managing this fishery is a necessity in order to prevent any further decrease in the stocks and the ultimate collapse of the fishery.

**140. IMPACT OF ORGANIC POLLUTANTS ON THE GROWTH AND FECUNDITY OF *PARALABRAX NEBULIFER* (BARRED SAND BASS) FROM SOUTHERN CALIFORNIA**

**B.D. Sanchez** and M.A. Steele. California State University, Northridge, Department of Biology, Northridge, CA, 91330.

Pollution is widespread in marine environments, where pollutants can accumulate in sediments and in the tissues of marine organisms. Many pollutants have carcinogenic and mutagenic properties. Polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and heavy metals can cause physiological stress in fishes by limiting the abilities to acquire resources for growth, reproduction, and survival. Benthic associated species are more impacted by pollutants by their direct and indirect contact with the substrate, especially in areas of high pollutant concentrations, like harbors. This study evaluated the impacts of pollutants on growth and fecundity of a recreationally important coastal marine fish in Southern California. This study was conducted at four sites: two highly polluted sites within harbors and two less polluted sites located outside of harbors. Tissue concentrations of pollutants, growth, physiological condition, and reproductive potential were compared among the sites. There was a significant difference of pollutant type and concentration among sites, with fish in harbors having the highest tissue concentrations. Measures of growth, physiological condition, and reproductive potential did not differ among sites, implying that the concentrations of pollutants in the harbors studied were not high enough to affect these variables. Organic pollutants are still present in the marine environment of Southern California, but this research indicates that the concentrations are too low to significantly impact the growth and reproductive potential of the barred sand bass population.

**141. BIOGEOGRAPHY, CRYPTIC DIVERSITY AND EVOLUTION WITHIN THE SEA SLUG GENUS *PLEUROBRANCHUS* (NOTASPIDEA: PLEUROBRANCHIDAE)**

**J. Goodheart** and Á. Valdés. California State Polytechnic University, Pomona, Department of Biological Sciences, Pomona, CA, 91768.

Opisthobranchs, otherwise known as sea slugs, are a highly diverse group of organisms that play important roles as primary or secondary consumers in marine ecosystems. Opisthobranchs also have biomedical importance both as sources of potential drugs and models for neurological research and are commonly found in a vast array of marine ecosystems. My thesis focuses on the Opisthobranch genus *Pleurobranchus*, characterized by an internal shell and a gill exclusively on the right side of the body. Species in this genus are commonly found worldwide, but there is a substantial amount of confusion regarding the ranges and identification of individual species. Difficulties in phylogenetic reconstruction and identification of pleurobranchids using morphological traits has resulted in complex classification schemes, with several species having disjunct ranges across physical and biogeographic barriers (including the tropical Indo-Pacific, the eastern Pacific and the Atlantic). In addition, a sizeable number of species have been described that supposedly belong to this genus, though morphologically and biogeographically they have strong similarities. Molecular phylogenies will be constructed using the mitochondrial genes Cytochrome Oxidase 1 (CO1) and 16S and the nuclear gene H3 and morphological data for each species will be included to address these issues. Preliminary data indicate discrepancies in the current identification of many species in *Pleurobranchus*, and morphological work still needs to be conducted in order to match the previously described species with our molecular phylogeny.



**142. COMPARING EFFECTS OF PH AND DISSOLVED OXYGEN STRESSORS ON THE DEVELOPMENT OF THE SQUID, *DORYTEUTHIS OPALESCENS***

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The market squid (*Doryteuthis opalescens*) is not only California's largest fishery but also ecologically important to the California Current Ecosystem. Throughout embryogenesis, squid egg capsules are attached to the seafloor where they can be exposed simultaneously to near-hypoxic and  $p\text{CO}_2$  induced low pH environments. To identify the relative impact of each, squid embryos in this study were chronically exposed to each stressor separately for 27 days:  $\text{pH}=7.56$ ,  $p\text{CO}_2=1,350.8 \mu\text{atm}$  and dissolved oxygen (DO)= $83.6 \mu\text{atm}$ . Squid chorions and embryos were analyzed using photo-microscopy, ImageJ<sup>TM</sup> Software (Ver.1.46r), and ANOVA. Results indicate slower growth and yolk consumption under DO stress compared to pH stress. These results suggest that metabolic suppression is more strongly induced in response to the DO stressor. If current patterns of intensified upwelling persist, environmental DO stress will play an increasingly important effect on embryo development in nature. Field work is needed to corroborate these results and physiological research is needed to identify the mechanisms that induce these responses.

**143. MOVEMENTS AND CONNECTIVITY OF ESTUARINE PREDATORY FISHES BETWEEN TWO DISCRETE RESTORED ESTUARIES**

**R.M. Freedman**, C.R. Whitcraft, B.J. Allen, and C.G. Lowe. California State University Long Beach, Department of Biology, Long Beach, CA, 90840.

Restoration has become a popular tactic to increase estuary habitat coverage; however, large gaps between these habitats may pose a problem to their accessibility, connectivity and effectiveness. Using acoustic telemetry, we assessed connectivity potential, habitat preference, and homing behavior of five coastal predator fishes between two restored estuaries. Juvenile California halibut, *Paralichthys californicus* (n=30), spotted bay bass, *Paralabrax maculatofasciatus* (n=9), gray smoothhounds, *Mustelus californicus* (n=30), shovelnose guitarfish, *Rhinobatus productus* (n=6), and leopard sharks, *Triakis semifasciata* (n=5) were caught at Bolsa Chica Full Tidal Basin and Huntington Beach Wetlands, fitted with acoustic transmitters and translocated between study sites (approximately a 10 km distance). All species except *P. maculatofasciatus* have individuals that moved between study sites. For fish that homed back to their estuary of capture, the residence time in the translocation site significantly differed by species; however, the time spent moving between study sites, or homing time, did not. Fishes spent an average of  $14\pm 35$  days homing; however, 66% made the journey in 3 days or less. *Rhinobatus productus*, *T. semifasciata*, *M. californicus*, and *P. californicus* movements are evidence of connectivity between estuaries at this distance and detections of these individuals from receivers in other areas suggest possible connectivity across even larger distances. The translocation residency exhibited by *P. maculatofasciatus* possibly indicates that individuals may remain in the estuary where they first recruit.

**144. THE EFFECTS OF SIMULATED SIZE-SELECTIVE HARVESTING ON A SEX- CHANGING TEMPERATE REEF FISH, *RHINOGOBIOPS NICHOLSII***

**M.J. Schram** and M.A. Steele. California State University, Northridge, Department of Biology, Northridge, CA, 91330.

Environmental pressures and anthropogenic impacts can influence the life history and population ecology of a species. Fishing pressure, both recreational and commercial, is a prominent anthropogenic influence along our coast. Correlative links have been established between harvesting tactics and changes in the life history and population ecology of sex-changing fishes; however, the causal links have not been demonstrated. We used a field experiment to investigate the impacts of size-selective harvesting on the reproduction and growth of a sex-changing fish that is not normally harvested. Artificial reefs were constructed and populated with a standard density and size distribution of blackeye gobies (*Rhinogobiops*

*nicholsii*) which were then manipulated, simulating fishery-style harvesting. Reproductive output and growth were measured over a period of weeks. Size-selective harvesting had no significant effect on the reproductive output or growth of the blackeye goby. This result, however, appeared to be due to unexpectedly high immigration and settlement, which caused population densities and size structures to be similar among treatments. From these results we infer that relatively low intensity size-selective harvesting may not impact reproductive output or growth of protogynous species.

**145. ASSOCIATING GENETICALLY DIVERSE TAMARISK INVADERS WITH THEIR IMPACTS IN A SALT MARSH ECOSYSTEM**

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Invasive tamarisk has many impacts in freshwater systems including increasing soil salinity, decreasing water content, and causing a shift in food web structure. Tamarisk species originally introduced to the U.S. have hybridized and have been documented invading salt marsh systems in San Diego County, California. The main goals of this study were to determine the abiotic and biotic impacts of tamarisk within a salt marsh and among genetic types of tamarisk. Amplified Fragment Length Polymorphism was used to determine genetic identity of each individual salt-marsh invading tamarisk. Abiotic impacts depended on microhabitat, as did tamarisk tree morphology, and infauna community composition. Tamarisk altered abiotic factors in the upland and upstream microhabitats. The tamarisk invasion had the most pervasive biotic impact on the infauna in the marsh microhabitat. 17.8% of trees were hybrids of *Tamarix ramosissima* x *T. chinensis*. The remainder were pure *T. chinensis*. Tamarisk genetic identity did not influence abiotic factors, although invertebrate diversity was lower beneath pure *T. chinensis* than the hybrid. The introduction of hybrid tamarisk was not an *in-situ* hybridization because there were no pure *T. ramosissima* present at the site, rather they were most likely introduced from another site during rain and flood events.

**146. WHO'S ON FIRST?: COMPARISONS OF ABOVE- AND BELOWGROUND PHENOLOGICAL VARIATION AMONG NATIVE AND INVASIVE ANNUALS**

M.R. O'Neill and M.F. Allen. Center for Conservation Biology, University of California, Riverside, CA, 92521.

Phenological variation among coexisting species is an often overlooked and yet critically important factor in community assemblage and invasibility. Those species first to establish exert priority effects – alteration of biotic and abiotic conditions through preemption – influencing the potential for additional species to establish and persist. In annual plant communities seasonal priority effects can result from differences in phenology. Within habitat comparisons have shown that invasive species tend to have earlier growth activity relative to natives. However, the majority of these studies neglect the potential for belowground dynamics to contribute to aboveground observations. In the present study we sought to quantify above- and belowground phenological variation among native and invasive annuals and asked whether these patterns were indicative of priority effects underlying the competitive superiority of invasive species. Phenological state, density and relative growth rates were quantified, and data used to construct life tables for species encountered. Belowground growth dynamics were quantified via an automated mini-rhizotron imaging system. Results obtained thus far are generally consistent with the priority effects hypothesis. As predicted, invasive species displayed greater germination rates earlier in the season while native species germinated later, over a longer period of time. In contrast to expectations however, natives displayed faster relative growth rates and greater survivorship relative to invasives. No differences in root growth rate were detected. The observation of phenological differences above- but not belowground is intriguing. However, observations remain ongoing and this discrepancy may be merely an artifact of limited data.

**147. NATURAL VARIATION AMONG *DROSOPHILA MELANOGASTER* POPULATIONS IN RESPONSE TO *BEAUVERIA BASSIANA* EXPOSURE**

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Pesticides are commonly used as a means of controlling insect populations; however, this widespread use has resulted in the continual progression of resistance in various insect species. Consequently, new methods of pest control are being studied to counteract these developing resistances. Previous research of insect exposure to the fungal pathogen *Beauveria bassiana* suggests that a separate immunological pathway might be used to mediate an insect's resistance to this fungus than to various pesticides. This raises the possibility of using *B. bassiana* as an alternative means of pest control. Additionally, there seems to be a difference in survival rates between populations derived from temperate and tropical climates. Nevertheless, none of these previous studies involved any genetic analysis, when a thorough understanding of the underlying molecular mechanisms involved in pathogenic resistance is necessary. In order to better understand the genetic underpinnings of an insect's fungal resistance, we used *Drosophila melanogaster* as our model organism. We exposed flies from both temperate and tropical populations to the fungus *B. bassiana*, and assayed their mortality rates for 28 days. Whole genome sequences are available for the fly genotypes chosen for this experiment, allowing us to link differences in resistance to their underlying genomic sequences. In agreement with previous studies, our preliminary results show a difference in resistance among temperate and tropical populations, suggesting that there is natural variation for the genes involved. We are currently analyzing the results from our experiments in order to detect possible genomic sequences involved in this differential resistance among populations.

**148. HOW DOES THE EVOLUTIONARY LOSS OF A SEXUAL SIGNAL AFFECT THE AGE STRUCTURE OF FIELD CRICKET POPULATIONS SUBJECT TO AN ACOUSTICALLY ORIENTING PARASITOID FLY?**

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There is considerable interest in the consequences of evolutionary events, especially those that on a contemporary timescale. Such an event occurred in some populations of the Pacific field cricket (*Teleogryllus oceanicus*). Males in certain Hawaiian populations have experienced the evolutionary loss of the wing structures necessary to produce sound, with the loss occurring within 20 generations. As such, these populations now contain two distinct male morphologies: normal-winged males, which are capable of producing mate-attracting songs, and *flatwing* males, which are obligately silent and unable to attract mates via song production. However, flatwing males are protected from lethal parasitism from an acoustically orienting parasitoid fly, *Ormia ochracea*, which may have helped flatwings not only become established but also maintained within a population. We explore how the evolutionary loss of a sexual signal - song - alters the age structure of populations of this species subject to parasitism from *O. ochracea* by aging wild-caught individuals in the field.

**149. CIS-2,5-DIAMINOBICYCLO[2.2.2]OCTANE, A NEW SCAFFOLD FOR ASYMMETRIC CATALYSIS OF THE HENRY REACTION: APPLICATION TO THE SYNTHESIS OF  $\beta$ -ADRENERGIC RECEPTOR BLOCKING AGENTS**

**S. Shaw** and J.D. White. Department of Chemistry, Oregon State University, 153 Gilbert Hall, Corvallis, OR, 97331-4003.

A new chiral tetrahydrosalen ligand (+)-**2** has been designed and synthesized from *cis*-2,5-diaminobicyclo[2.2.2]octane (–)-**1**. The complex generated in situ by the interaction of the ligand with (CuOTf)<sub>2</sub>·C<sub>6</sub>H<sub>5</sub>CH<sub>3</sub> is an efficient catalyst for the asymmetric Henry reaction, producing nitroaldol products in high yield and good stereoselectivity. The Henry reaction catalyzed by this tetrahydrosalen-Cu(I) complex led to syntheses of  $\beta$ -adrenergic blocking agents (*S*)-toliprolol, (*S*)-moprolol and (*S*)-propranolol.

**150. INFECTION WITH THE PROBOLOCORYPHE UCA TREMATODE ASSOCIATED WITH INCREASED COURTSHIP EFFORT BUT NOT CLAW BRIGHTNESS IN THE CALIFORNIA FIDDLER CRAB (UCA CRENULATA)**

**A.B. Mora**<sup>1</sup> and M. Zuk<sup>2</sup>. <sup>1</sup>University of California, Riverside. Department of Biology, Riverside, CA 92521; <sup>2</sup>University of Minnesota, St. Paul; Department of Ecology, Evolution, and Behavior, St. Paul, MN 55108.

The manipulation hypothesis states that parasites are selected to alter host behavior to enhance their transmission and fitness. Altered hosts exhibit increased conspicuous or risky behaviors, often resulting in higher rates of host predation and parasite transmission. While many sexual signals are both conspicuous and risky, little is known about their potential for parasitic manipulation. We hypothesized that parasites increase host sexual signaling to enhance their transmission to predatory final hosts. To quantify parasitic effects on sexual signaling, we measured courtship displays and claw brightness in fiddler crabs (*Uca crenulata*) naturally infected with the *Probolocoryphe uca* trematode. We observed that males harboring more *P. uca* parasites displayed more frequently, but exhibited no differences in claw brightness.

**151. THE RATE AND SPECTRUM OF SPONTANEOUS MUTATIONS IN EXPERIMENTAL POPULATIONS OF THE NEMATODE *CAENORHABDITIS REMANEI***

**M.P. Salomon**<sup>1</sup>, D.G. Ostrow<sup>2</sup>, C. Matsuba<sup>2</sup>, and C.F. Baer<sup>2</sup>. <sup>1</sup>University of Southern California, Molecular and Computational Biology, Los Angeles, CA, 90089; <sup>2</sup>University of Florida, Biology, Gainesville, FL, 32611.

To what degree natural selection has shaped the rate of spontaneous mutations among different taxa remains an important unresolved question in evolutionary biology. While mutation rates are known to vary among and within taxa, the relative importance of natural selection versus non-adaptive processes has yet to be determined. Theory predicts that the strength of natural selection to reduce the deleterious mutation rate should be stronger in asexual and selfing taxa than in outcrossing sexual taxa, leading to an adaptive decrease in mutation rate in the former. Whether this general trend exists in nature is currently unknown. Nematodes in the genus *Caenorhabditis* provide an ideal system to test questions of how mutation rates vary among closely related species with different reproductive strategies. Within the genus the ancestral reproductive state is outcrossing (gonochorism), however self-fertilization (hermaphroditism) has evolved independently several times. Here we present estimates of the rate and spectrum of spontaneous mutations based on whole genome re-sequencing of a set of long-term mutation accumulation lines of the outcrossing species *Caenorhabditis remanei*.

**152. “MALES FIRST OR SECOND?” EXAMINING POSSIBLE MATE COERCION IN THE FIDDLER CRAB *UCA MJOEBERGI***

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Male fiddler crabs such as *Uca mjoebergi* attract mate-searching females by waving an enlarged claw. Upon reaching the male's burrow, the female must decide whether to enter the displaying male's burrow, or move on to another suitor. Typically, the male will 'lead' the female to the burrow entrance and enter the burrow first. However, it has been documented that males will occasionally lead a female to their burrow and then step aside, to allow the female to enter the burrow first. Our observations suggest that females are less likely to enter the burrow when the male doesn't enter first. Males may trap females that enter first, potentially increasing their mating success under some circumstances.

**153. DIVERGENT SPECIES YET RARE LINEAGES: NICHE MODELING OF 20 ENDANGERED CALIFORNIA TAXA AND THEIR CLOSEST RELATIVES – IMPLICATIONS FOR CONSERVATION**

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Species listed as endangered face extinction within their niche. Close relatives of these taxa should occupy similar niches, and thus, share similar risks of extinction. However, few comparative analyses of niche conservatism exist for endangered and threatened taxa across a wide array of taxonomic groups. Using ecological niche modeling (ENM), we evaluated niche overlap in 20 listed species in California and their sisters, together representing plant, snail, amphibian, reptile, bird and mammal lineages. Each pair was modeled in Maxent using extensive museum collections data and 15 topographic and bioclimatic variables.

We employed Schoener's D and background randomization tests in ENM Tools to examine whether niches were more different from one another than expected based on the environmental background available to them. Almost all (31 of 32) pairwise comparisons had niche overlap scores of < 0.5 and niches more dissimilar than similar. Background randomization tests were mixed but with more (14) divergent than convergent (10) pairwise niche comparisons. Most (18 of 26) of the sister taxa are recognized as endangered, threatened or sensitive. Even though the target and sister taxa mostly showed niche divergence, they still constituted rare lineages in most cases. Thus, for conservation purposes our results indicate that close relatives should be evaluated for rarity as part of a management strategy for any endangered species.

**154. NON-TARGET EFFECTS OF INSECTICIDAL CONTROL OF AN AGRICULTURAL INSECT PEST**

**S.L. Davenport**, A.R. Zeilinger, T.R. Pinckard, and M.P. Daugherty. University of California, Riverside, Department of Entomology, Riverside, CA 92521.

The glassy-winged sharpshooter (*Homalodisca vitripennis* Germar) is an exotic agricultural insect pest in southern California. It has had devastating impacts in the wine grape-growing region of Temecula, California where it vectors a bacterial pathogen, *Xylella fastidiosa*. The bacterium blocks movement of plant sap within the xylem, resulting in eventual death of the grapevine. Systemic insecticides (e.g. imidacloprid) have been widely used in the control of *H. vitripennis*, with some success. Vineyards throughout the Temecula Valley vary in their approach to control and management of this pest, with some organic vineyards applying no pesticides of any kind and others applying imidacloprid yearly or only intermittently. Analysis of sticky trap surveys indicates that vineyards applying imidacloprid intermittently (less than once per year) have similarly low densities of *H. vitripennis* present in contrast to high densities of untreated sites. Concomitantly, disease surveys indicate similar low disease prevalence in all intermittent or yearly treated sites. However, foliage tap samples revealed that intermittently and yearly treated vineyards also have similar low species richness and densities of predaceous and parasitoid insects in contrast to the greater predator and parasitoid diversity of untreated vineyards. The results of these combined studies demonstrate that effective control of *H. vitripennis* can be achieved with minimal use of insecticides, and that increased use may actually counteract other methods of control (e.g. predation, parasitism).

**155. PILOT STUDY OF *CAMPYLORHYNCHUS BRUNNEICAPILLUS COUESI* (CACTUS WREN) ON THE PALOS VERDES PENINSULA, CA**

**J.A. McNamara**. California State University Long Beach, Long Beach, CA, 90814.

The coastal cactus wren (*Campylorhynchus brunneicapillus couesi*) is an obligate, endemic species that lives in coastal sage scrub, a unique plant community that expands from Ventura to Baja California. Isolated populations of coastal cactus wrens are extremely threatened due to habitat fragmentation and degradation. This pilot study was conducted on several populations living on two preserves on the Palos Verdes Peninsula (managed by Palos Verdes Peninsula Land Conservancy), Alta Vicente and Three Sisters. The habitat characteristics and behaviors of the cactus wrens were studied. Cactus wrens spent more time in the top portion of all substrates than the middle and lower portions. Male cactus wrens preferred the cactus *Opuntia littoralis* and spent the most time performing self-hygiene behaviors relative to other behaviors. In the middle and lower portion of all substrates, males preferred to spend time on the invasive tree tobacco *Nicotiana glauca* and performed self-hygiene and flight behaviors. Female Cactus Wrens preferred *O. littoralis* at all heights, but did not perform any one type of behavior more than another. Cactus Wrens only utilized two species of plants for nesting, *O. littoralis* and *Cylindropuntia prolifera*. Future conservation efforts should seek to preserve *O. littoralis* and *C. prolifera*, as they are desirable for their height. Removing *N. glauca* from the preserves could interrupt a dynamic structure of the habitat that Cactus Wrens utilize.

**156. HABITAT COMPOSITION AND EXTINCTION RISKS AT SITES OF LONG-TERM COEXISTENCE BETWEEN WESTERN GRAY SQUIRRELS AND EASTERN FOX SQUIRRELS**

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The native western gray squirrel (*Sciurus griseus*) has been extirpated in some of its former range due to habitat fragmentation and the introduction of the invasive eastern fox squirrel (*S. niger*). Particularly in the greater Los Angeles metropolitan area, *S. griseus* populations have declined in urban habitats where *S. niger* has been introduced. A previous study created a Habitat Suitability Model (HSM) to predict the presence or absence of *S. griseus* and *S. niger* within these habitats. My study tested this model by predicting the presence or absence of *S. griseus* and *S. niger* at 11 additional sites. Predictions agree with on-site observations in seven of the 11 sites tested. To further test the presence/absence model I continued a long-term census at a botanical garden in Claremont, California with the prediction of squirrels coexisting. In addition, my study analyzed fine-scale details of habitat structure by creating an abundance-based HSM for long-term coexistence sites. The model shows that species of tree, particularly low percentage of oak trees and high percentage of conifers, have a positive relationship with the relative abundance of *S. griseus*. Each of the six long-term coexistence sites used in the analysis were also analyzed for *S. griseus* extinction risk to determine relative timelines and suitable habitat size for *S. griseus* existence with *S. niger*. The findings were used to make recommendations to habitat managers in southern California, using a landfill and regional park as examples, in the hopes of informing management decisions to maintain populations of *S. griseus*.

#### 157. EFFECTS OF EXERCISE ON BRAIN STIMULATION

**G. Gavilanes**, St. Lucy's Priory High School, Mentor: S. Mejia, University of La Verne.

Aerobic activity is a powerful stimulus for improving mental health and for generating structural changes in the brain. The presence of novel experiences or learning is an especially important component in how these changes are manifest. This experiment relates the distinct time courses of structural brain changes with both aerobic activity. In the experiment, 29 students exercised for an hour before taking various tests that measured cognitive function. Scores were compared with those of students that had not exercised before taking the tests. Most of the students who took the test after the exercise received a higher score than those who did not partake in exercise before the test. Demographic and clinical characteristics of the students were taken into account and are discussed. In addition, rats were tested to further analyze the study. Rats were given voluntary access to individual running wheels attached to their cages and these rats exercised as babies and continued to do so until their mature growth. Another group of male and female rats did not exercise. Behavioral testing (object recognition tests) were administered to both groups of rats. Exercise increased spatial learning and memory in the object recognition tasks in that the exercised rats displayed a decreased latency in locating the hidden platform than the non-exercised rats. The non-exercised rats spent more time exploring the novel objects than the exercised rats in one of the tests. The exercised rats spent significantly less time exploring the most recently encountered object in the task in comparison to the non-exercised controls, therefore showing improved temporal recognition memory. Results of cognitive function tests in both humans and rats indicate that exercise enhances both spatial and recognition memory and therefore exercise can improve learning retention.

#### 158. INVESTIGATING THE LEVELS OF MERCURY CONTAMINATION IN FARMED VS. WILD CAUGHT SALMON

**J. Adan** and D. Gonzalez-Jurado. Manual Arts High School College Preparatory Magnet Los Angeles, CA 90015.

Highly toxic organic forms of the element mercury concentrate in the tissues of many fish. When consumed by humans in the form of methylmercury the element causes a multitude of adverse health effects and is difficult for the body to eliminate. Salmon is generally regarded as a species that accumulates relatively lower mercury levels. In my study I used the analytical chemistry method of gas chromatography to determine the levels of mercury contamination present in samples of both farmed and wild caught salmon from several sources around the world. My results showed that while on average there were not significant differences in mercury contamination between wild caught and farmed salmon, there was great variation in mercury levels within the different types of both wild and farmed salmon samples in my study.



**159. PRODUCING ELECTRIC POWER FROM THE WIND; A STUDY OF WINDMILL BLADE FLOW MECHANICS**

**E.O. Frost.** Chaminade College Preparatory, Mentor: C. Farhat, Aero Astro Engineering.

Electric power generated from the wind can help our society become less dependent upon the production of foreign oil. Windmills of old were made with blades that had a cross-section of a rectangle. These were inexpensive blades sweeping out small circles by today's standards. Windmill rotor blades today have airfoil cross-sections which reduce drag and increase the performance (Hansen, 2000). However, does a flat bottomed airfoil produce more power or the symmetrical airfoil? My hypothesis is that the symmetrical airfoils will outperform the others and the control blades. To test my hypothesis, I created a wind tunnel and wind mill to measure the different blades' power output. The blades were readily available from Flying Foam, Colorado Springs, Colorado, in both 2 and 5 inches from front to back. The length of the blade was 12 inches. The windmill was made out of PVC pipe (Tymos, 2009). To smooth the airflow, I used an array of pre-cut pipes resembling the same used in a 2009 US DOE report (US DOE, 2009). In each series of experiments, I waited for the wind tunnel and air smoother to reach a steady state flow of air. The airflow speed was 11.2 feet per second and 5.8 feet per second. I set the Static Angle of the blades on the rotor and then put the windmill into the airflow. I waited for the rotors to reach steady state and then recorded power data and measured the rotational speed of the rotor with a strobe light. I averaged the observations and graphed the output results. I calculated the net Dynamic Angle of attack for points along the leading edge of the rotors and graphed the ratio of the coefficients for each calculated net Dynamic Angle. My hypothesis was correct as the symmetrical airfoils out performed the flat-bottomed airfoils both when compared with each other and the control blades. At the 11.2 ft/sec wind speed, the 2" symmetrical blade produced 28% more power than the 2" flat-bottomed blade at a 5 degree static angle; 56% more power at a 10 degree static angle. The 2" symmetrical blade also produced twice the power of the 5" symmetrical blade. At the 5.8 ft/sec wind speed, the 2" symmetrical blade produced 11% more power than the 2" flat-bottomed blade at 5 degree static angle; 84% more power than the flat-bottomed blade at a 10 degree static angle. The 2" symmetrical blade power output increased 12.5% at the 10 degree static angle over the 5 degree static angle. The 2" blade produced 23% more power than the 5" symmetrical blade at the 5.8 ft/sec wind speed.

**160. THE EFFECTS OF SEASONAL TEMPERATURES ON SELENIUM CONCENTRATION**

**C.H. Nguyen** and N.T. Trivedi. Huntington Beach H.S.; I. Swift, Supervising Wetlands Biologist for the Irvine Ranch Water District.

The San Joaquin Marsh in Irvine, California has been experiencing a modest – and possibly toxic – buildup of selenium. Selenium is similar to sulfur in its chemical properties, and given an excess of selenium, organisms replace it into their biochemistry. The resultant selenium-containing amino acids produce faulty proteins and enzymes. The bioaccumulation of selenium can result in the deformed embryos of local fowl (such as the mallard and great blue heron), which are secondary consumers in the wetlands' delicate food chain. While this has yet to be the case in the San Joaquin Marsh, the amount of selenium necessary to be a danger has yet to be found. Without knowing this, the IRWD wishes to resolve the issue by removing selenium altogether. In the hopes of understanding selenium's reaction to various temperatures for the purpose of phytoremediation, the selenium in the San Joaquin Marsh's water was measured with an inductively coupled plasma mass spectrometer, and then compared against average seasonal air temperatures in the area. An inverse relationship was found between the two parameters.

**161. THE EFFECT OF VARYING DC-DC CONVERTER CONFIGURATION ON SUPERCAPACITOR OUTPUT EFFICIENCY**

**R. Nguyen.** Palos Verdes Peninsula H.S. Mentor: B. Nguyen, Sigma Test Labs.

My experiment's objective is to improve the ability to extract useful power from supercapacitors by using two different DC-DC converter configurations and determining their power efficiency. First, I decided to use a step up and a step down converter to compare because of their significantly different topology and operation. Two sets of test hardware were constructed, one for each type of converter. Each

set of hardware consisted of a set of supercapacitors, a DC-DC power converter (one step up and one step down), and an LED load that was used in both test set ups. For the step up converter, the initial supercapacitor output voltage of 2.50 volts was “up- converted” to 3.27 volts. The step down converter was run with an initial supercapacitor output voltage of 9.80 volts and “down- converted” to 3.27 volts. In both cases, the converter output was connected across the LED load, and the converter was run for 80 minutes with measurements being taken every minute. For each test run, the voltage and current were measured at the output of the supercapacitor and at the input of the load, which allows the efficiency of the converter to be calculated. The data shows that the power efficiency of the step up converter is initially greater than that of the step down converter by 10–14%. However, towards the end of each run, the step down converter efficiency surpasses that of the step up converter. This observation can potentially be exploited to improve energy efficiency.

**162. ASSESING THE EFFECTS OF MARINE PROTECTED AREAS UPON THE RECREATIONAL LANDINGS OF TARGET SPECIES**

**R.L. Sanders.** Culver City High School; Mentor: D. Gonzalez-Jurado, UCLA.

In the last decade the Marine Life Protection act has established a network of Marine Protected Areas (MPA's) off the Pacific Coast of California. The support of both the commercial and recreational fishing community both enabled the passing of this legislation and continues to ensure the success of the MPAs themselves. The fishing community supposedly benefits from the establishment of MPA's because of the phenomena called the “spillover effect”, that occurs when the fish stocks within an MPA are replenished and subsequently spill over into the non-protected areas. While numerous previous studies worldwide have overwhelmingly shown evidence of the general existence of the spillover effect, baseline data confirming the extent to which this effect occurs for recreationally targeted species has not been gathered. Sometimes protective conditions within a MPA favor an increase in predator populations. If this occurs, the spillover of predators may lead to the trophic cascade of prey populations decreasing in surrounding fishing grounds outside of MPA's. In this study, we sampled across the Southern California Bight Region using methods commonly employed by recreational fishermen and recorded average size of several targeted species relative to distance from the nearest MPA. This data will provide tangible evidence of the most MPA's most relevant impacts to the recreational fishing community.

**163. DETERMINING AND PROFILING THE PREVALENCE OF ANTIBIOTICS- RESISTANT BACTERIA (ARBS) IN THE WATERS OF THE BALLONA WATERSHED**

**A. Lee** and D. Pham. Palos Verdes Peninsula H.S.; Mentor: J. Dorsey, Loyola Marymount University.

Antibiotics have been the foremost means of fighting disease caused by infectious pathogens. However, the overuse of antibiotics has led to the rise of antibiotics-resistant microbes in the environment, posing a public health threat. Recently, a prevalence of bacterial strains with insensitivities to a wide variety of commonly prescribed antibiotics (such as tetracycline and ampicillin) has been found in the Ballona Wetlands. With many different inputs from the urban environment into the wetlands, the bacteria present are put under selective pressure. Though wetlands are supposed to function as means of pollution filtration in the environment, the Ballona Wetlands have experienced severe reduction due to urban pollution and have been less effective in naturally controlling the general bacterial count; thus contributing to the rise of antibiotics-resistance genes (ARGs) which are classified environmental pollutant, and consequently, antibiotics-insensitive bacteria. This investigation addressed the Ballona Wetland's effectiveness in reducing these bacterial counts. Ebb/flood tide, and sediment samples were collected from the Ballona Wetlands. Bacteria was extracted from the samples and plated. A standard replication method was then used to replicate colony growth and the tryptic soy agar plates were then infused with antibiotics. Photos of replica plates were taken and were analyzed and colonies were identified. Then, the bacteria were tested to determine the presence of ABIs using the Kirby-Bauer method. Cumulative frequencies of ABIs of flood, ebb, and sediment samples were compared using the Kolmogorov–Smirnov test. If the wetlands were functioning properly, bacterial counts would be reduced during ebb tide (low tide, higher UV exposure that would eliminate more bacteria.) and that there would

be a significant difference between the ebb and flow tide samples, however it was determined that in most cases the ebb and flood tide's ABI frequencies were nearly identical. It was also expected that the cumulative frequency of ABIs found in sediment would have a very different trend compared to those of the ebb or flow tide samples, yet the trends were very similar. The existence of bacteria resistant to a wide spectrum of antibiotics in the Ballona Wetlands has been confirmed. Additionally, with the exception of one sample collection, the patterns (as in the frequencies in numbers of bacterial isolates/colonies resistant to antibiotics found) of frequencies of ABIs occurring have been consistent. As this research is ongoing, the next steps will involve DNA sequencing of the bacteria through PCR assay to profile and assess the species of prevalent bacteria in order to verify the existence of human pathogens.

#### 164. REDUCING CARBON FOOTPRINT THROUGH INTEGRATION OF LED STREETLIGHTS

A. Wei. Walnut H.S.; Mentor, Dr. Sonner.

Cities throughout the world are still using incandescent and compact fluorescent bulbs for their street lights, unaware of how detrimental they are to the environment and economy. The hypothesis was that although the wattage and lumen output is less amongst the light-emitting diode, or LEDs, it provides a wider spectrum of colors, allowing for less wattage usage and lumen output, but will still provide a similar result relating to the general brightness and color output, if not better, than those of Compact Fluorescent Lights (CFLs) and incandescent bulbs. My goal and mission is to educate the public and city on the implementation of LEDs into city street lights. This phasing in of LEDs will reduce energy consumption, reduce the chance of mercury poisoning among civilians and surrounding landscapes, reduce the amount of mercury that is released into the air through the burning of coal, and increase the environmental benefits. Subjective testing was done using a 23W CFL, a 60W incandescent, a 9W LED, and a 20W LED, comparing the general brightness and color output of the bulbs when shown to a general audience. The audience were not told the wattages of the bulbs prior to the experiment to avoid skewing the data. A positive relationship was found between the usage of less wattage and general brightness and color output.

#### 165. OBSERVATION OF THREATENED CALIFORNIA GNATCATCHER (*POLIOPTILA CALIFORNICA CALIFORNICA*) IN DIFFERENT LOCATIONS OF CALIFORNIA SAGEBRUSH

S. Yong. Palos Verdes Peninsula H.S.; Mentor and Institution: A. Dalkey, PVPLC.

My project was set up to find if the abundance of *Poliioptila californica californica* (California gnatcatcher) would increase along with the growth of *Artemisia californica* (California sagebrush). The purpose of doing this project is to see if the California gnatcatcher, which was once endangered, and now threatened, is able to recover from that title with the help of newly installed California sagebrush. Therefore, I hypothesize that with the growth of newly installed California sagebrush; there will be an increase of California gnatcatchers as well. To increase their chances of survival, I exploited PVPLC's newly installed canopies and measured the canopy's height, and two diameters. To do this, I went on surveys with volunteers of PVPLC to Three Sisters Reserve and collected data from the site which had the habitat of the California gnatcatcher. Also, I have collected data at two sites within Vicente Bluffs as well as Alta Vicente. In addition, to go further into my research, I have utilized the 2008–2013 dataset from the PVPLC- PV/SB Audubon collaborative survey in order to compare my data that I have collected in 2012–2013. Due to the non-normal distributed data, I used the Kruskal-Wallis test to statistically compare the variance of the maturity of Three Sisters Reserve, Vicente Bluffs, and Alta Vicente sites. After completing the test, it was reported that the median values among the three sites were greater than would be expected by chance, therefore there is a statistical significant difference of ( $P < 0.001$ ). To investigate the numerical data of the California gnatcatcher, I have calculated the observational rate for each site. From the calculations, I found that from 2012–2013; Three Sister's Reserve had an observational rate of 1.93%. From the 2012–2013 Vicente Bluffs data, I have found that the observational rate is 1.50%. Lastly, the observational rate for Alta Vicente was 2.2%. Overall, from comparing the three observational rates, the number of California gnatcatchers is greatest in Alta V.

**166. RADIOFREQUENCY IMPEDANCE MATCHING: AN ANALYSIS INTO MATCHING NETWORKS OF SERIES CIRCUITS WITH BOTH KNOWN AND UNKNOWN LOADS USING THE COMBINED L-SECTIONS APPROACH**

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The lack of impedance matching between source and load in a transmitter or receiver system leads to poor efficiency of power transfer and continuous signal reflections. This study presents an optimal design of capacitors, resistors, and air-core inductors along with a set of formulae that guides in the construction of a matching network for cases of known and unknown load impedance at 10 Megahertz. This design can match a known load and an unknown load to their source at radiofrequencies; in this case, the frequency is 10 Megahertz for both known and unknown loads. The network designs presented are based on two combined "L-Type" sections, simplified for noise reduction. This approach has been validated with construction of two networks encased inside anti-electromagnetic interference metal containers of rectangular base size two inches by one inch. The networks were tested with an Agilent Technologies network analyzer and found to comply with the required characteristics at the frequency of 10 Megahertz. Factors such as the number of turns or surface area of the insulated wire used were also analyzed to determine their effect on the two impedance matching networks presented. The design and analysis of these results shed light on the combined "L-Type" section approach as a successful impedance matching network. Factors that impede its success and some transmission line design problems are discussed.

**167. THE EFFECTS OF MAN-MADE STRUCTURES ON WIND PATTERNS**

S.M. Tan and W. Jing. Gabrielino High School; Mentor D. Araya, California Institute of Technology.

The rising number of cities creates urban heat islands which cause uneven distributions of heat between urban and rural areas. One method in which heat is directed away from cities is through wind. Data was collected from 11 locations at the Gabrielino High School campus and was compared with model results obtained from a small-scale model, which demonstrated that urban structures create localized areas with higher wind speed. The taller the building, the stronger the updraft of wind is created over the structure. A difference of 3 meters in height between area B and both areas A and C induced an average increase of 1.5 km/hr in wind speed of the higher area B. When warmer areas are surrounded by cooler denser air, there are surges in velocity. The temperature of the football field causes the wind to increase in velocity by an average of 1.65 km/hr over 119 meters. Therefore, as the temperature difference widens, wind velocity increases as well. General wind direction reflects the effects of local orography on wind flow. On the field, wind normally heads north or northeast due to the placement and elevation of surrounding houses. Another experiment was conducted using Particle Image Velocimetry (PIV) capturing the movement of neutrally buoyant particles moving across steps constructs made to represent the steps of the bleachers. The parallels between the data from PIV and the bleachers are currently being analyzed in hopes of quantifying changes in wind speed. New buildings and cities can also be designed to generate wind flow that maximizes the release of heat and usage of natural energy.

**169. THE EFFECTS OF DIETHYLSTILBESTROL ON MATURATION AND DIFFERENTIATION OF EMBRYONIC C57BL/6 THYMOCYTES IN THE RECOVERY CULTURE**

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Endocrine disrupting chemicals (EDCs) are compounds that mimic or block the normal action of the endocrine system. Some EDCs have been shown to kill thymocytes and alter the development of T cells, potentially harming the immune system. The immune system is a vital organ system, responsible for

protecting the body from foreign objects, pathogens and diseases such as cancer. If the immune system is compromised, the body can be put in harm's way. The current experiment focused on the endocrine disruptor diethylstilbestrol (DES), a synthetic estrogen given to 5–10 million pregnant women with the purpose of reducing pregnancy complications such as miscarriages and premature births. However, consumption of DES during pregnancy resulted in harmful effects in the mothers and their descendants. We have seen in previous experiments that DES decreases the number of embryonic mouse thymocytes, and alters development. We wanted to determine whether there is a difference in endocrine disruptor effects on embryonic thymocytes if they are exposed while being signaled to differentiate versus after being signaled. We hypothesized that the endocrine disruptor effects would be more harmful if the cells were exposed at the same time they were being signaled to differentiate. This experiment utilized an in vitro assay that signaled embryonic thymocytes to differentiate in the presence or absence of nano- and micromolar doses of DES. The data obtained from this experiment showed that the number of living cells was much lower when DES was added during signaling than when it was added after signaling.

**170. LONGEVITY OF SIRTUIN 1 ON LEUKEMIA CELLS**

**C. Diep.** San Gabriel H.S.; Mentor: W.Y. Chen and M.I Roth, City of Hope.

Sirtuin 1 (*sirt1*) is a mammalian protein deacetylase that modifies cellular protein functions by removing an acetyl group from its substrate. Sirt1 is implicated in cancer cell survival and chemo-resistance. Expression in commassie stains and western blots demonstrate that with certain mutations, *sirt1* has lowered in intensity. Sirt1 is traditionally difficult to express in full length human *sirt1*, but mammalian expression of *ku70* using lentivirus vector and *ecoli* expression has determined that it is possible. This study indicates that *sirt1* under the *petduet-1* vector can be inhibited or targeted to advance modern medicine or improve clinical treatment of leukemia.

**171. A COMPARITIVE INVESTIGATION INTO THE DIETARY PATTERNS OF AMERICAN VERSUS JAPANESE-DESCENDED STOMACH CANCER PATIENTS LIVING IN THE UNITED STATES**

**J. Kim.** Beverly Hills High School, 241 Moreno Drive, Beverly Hills, California 90212.

In the absence of curative treatments, the best strategies to manage cancer as a disease focuses on preventative measures and identifying the genetic and environmental causes. In 2009, stomach cancer was the fourth most common type of cancer occurring in humans worldwide. Among the different pre-defined ethnicities of cancer patients, people of Japanese descent annually have one of the three highest stomach cancer rates in the world alternating with nearby Korea and Mongolia. All three of these countries occur from the same part of the world and culturally the human inhabitants share a recent common ancestry with similar dietary habits. Since the initial genesis of stomach cancer is suspected of having strong links to dietary habits These statistics call for data to help elucidate what patterns in cancer diagnosis exist to identify manageable external environmental variables that can be modified (diet, smoking, alcohol consumption, physical activity) and eliminated to prevent cancer development. Here we use a double blind survey of the dietary habits of 150 stomach cancer patients of Japanese American and Japanese ethnicity compared to a control group of stomach cancer patients not of Japanese or East Asian descent to reveal common patterns in diet associated with cancer diagnosis. The results from each group in the survey are compared for statistical significance using Standard's *t*-test.

**172. ASSOCIATION OF CORONARY ARTERY CALCIFICATION WITH THORACIC BONE DENSITY**

**L. Liao.** Palos Verdes High School; Mentor: S. Mao, Los Angeles Biomedical Research Institute.

Osteoporosis and atherosclerosis are major public health problems that often coexist in both genders worldwide. In the past, dual-energy X-ray absorptiometry (DXA) and computer tomography (CT) scanning have been utilized for measuring bone mineral density (BMD) and coronary artery calcification (CAC), respectively. However, quantitative computer tomography (QCT) provides more accurate BMD

measurements based on cardiac CT images, and can thus eliminate additional patient imaging radiation resulting from the use of both DXA and CT scanning. If there is a valid association between CAC and BMD, then cardiac CT will provide an opportunity to evaluate bone health while assessing atherosclerotic risk. This study included 2866 participants who underwent cardiac CT from 2005 to 2008 at the Saint John Cardiovascular Research Center at the Los Angeles Biomedical Research Institute. Participants were free of clinical cardiovascular disease at baseline. Thoracic BMD was measured by QCT 5000. Multivariable regression models were used to relate CAC and BMD. The mean thoracic BMD was significantly greater in men compared to women ( $160.2 \pm 41.8 \text{ mg/cm}^3$  vs.  $159.6 \pm 48.0 \text{ mg/cm}^3$ ). Greater CAC scores were significantly associated with lower thoracic BMD after age, gender, BMI, and race/ethnicity adjustment. CAC and BMD are inversely correlated. Cardiac CT provides an opportunity to evaluate bone health while assessing atherosclerotic risk without additional patient imaging radiation.

### 173. MICRORNA-29 NEGATIVELY REGULATES EXPRESSION OF ONCOGENE TET2

**J. Li.** Glen A. Wilson High School; Mentor: M. Boldin, City of Hope Department of Molecular and Cellular Biology.

MicroRNAs are small, noncoding RNAs that post-transcriptionally regulate gene expression by binding directly to complementary sequences located within the 3' UTRs of target mRNAs, thereby inhibiting their translation. Ten-eleven-translocation 2 (TET2), a gene frequently mutated in myeloid disorders, plays a key role in DNA methylation, a critical process in gene expression and cell differentiation. Mutations in TET2 are known to lead to aberrant changes in DNA methylation patterns that are strongly associated with leukemic transformation and hematopoietic malignancies. In this study, we identified 4 potential binding sites for miR-29 in the 3'UTR of TET2. To confirm the hypothesis that miR-29 directly regulates TET2 expression, the 3'UTR of TET2 containing these sites was cloned downstream of the firefly luciferase gene in the pMIR-REPORT reporter vector. The reporter plasmid was co-transfected with either a miR-29 mimic or a mimic control, and luciferase levels were measured after 48 hours. The luciferase analysis revealed that the reporter's activity was significantly suppressed by the miR-29 mimic, resulting in over a three-fold decrease compared to the control. Thus, our data indicate that miR-29 directly targets TET2, and therefore it may play a role in regulating the development of hematopoietic malignancies.

### 175. EFFECTS OF PRESERVATIVE SOLUTION PH UPON STRUCTURAL DEGRADATION RATES OF PRESERVED NEUROLOGICAL ANIMAL TISSUES

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Scientists and clinicians often preserve brains and other animal nervous tissues to allow for the structure and function of the tissue to be investigated and studied for extended periods after being removed from an organism. At present with the proliferation of genetics, more studies require brains preserved in its intact and natural state. Preserved brains damaged or modified at even the sub-cellular levels usefulness become limited. Historically brains and other animal nervous tissues have been preserved with formaldehyde liquid solutions subsequently stored in alcohol mixtures. Fixing tissues in general using such methods is widely regarded to protect the tissue from decomposition. However, regarding specialized tissues such as brains, the extent to which the preservative solutions themselves may chemically alter the physical structure of the brains stored in them is less documented. In this study we investigated the effect the pH of the alcohol preservative solutions had upon the rates of degradation of sections of lab rat brain tissues. We used spectrophotometer readings to quantify the degree of degradation occurring in brain tissues over time period of a month.

### 176. THE EFFECTS OF HERBICIDES ATRAZINE AND GLYPHOSATE IN INDUCING ADIPOGENESIS IN CULTURED 3T3-L1 PREADIPOCYTES

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Exposure to two commonly used herbicides, atrazine and glyphosate, has been linked to adverse health consequences both humans and animals. Atrazine is used on the majority of U.S.-grown corn crops and is a common water contaminant in the United States. Atrazine exposure has been linked to reproductive problems in wildlife and at least one recent report suggests that rats exposed to atrazine become obese and insulin resistant. Glyphosate (a.k.a. Roundup) is a very commonly used herbicide in agriculture and resistance has been engineered into soybeans, alfalfa, corn, sugar beets, canola, and cotton. About 34% of the US population is obese (BMI  $\geq 30$ ), and previous results in the Blumberg laboratory demonstrated that other agrochemicals can cause fat cell differentiation in culture and increased fat in animals. Therefore, I hypothesized that herbicide exposure might also induce adipogenesis in a cell culture model. I tested this hypothesis by treating 3T3-L1 preadipocytes with multiple doses of each chemical and evaluating the efficacy of the chemical treatment to induce differentiation into fat cells and to up-regulate fat-specific gene expression.

#### 177. CONTROL OF HOMOLOGOUS RECOMBINATION BY *HSRAD52*

**K. Tang.** Glen A. Wilson High School; Mentor: A. Bailis, City of Hope Department of Molecular and Cell Biology.

Loss of genome stability stimulates tumorigenesis. Homologous recombination (HR) promotes genome stability by repairing breaks in DNA. *RAD52* is an HR gene that works with the breast cancer susceptibility genes *BRCA1* and *BRCA2* to maintain genome stability. Mutations that alter its function in HR are likely to stimulate tumor formation. The *RAD52* gene is highly conserved in eukaryotes, such that the human gene (*HsRAD52*) can function in budding yeast, a single-celled eukaryote that is easy to grow, and manipulate at the genetic and molecular levels. Studies in yeast have shown that *RAD52* functions in distinct mechanisms of HR that preferentially conserve, or alter chromosome structure, and that these functions are attributable to different ends of the protein. I propose to use budding yeast to study how the structure of the human *RAD52* protein determines its function in HR, by deleting its C-terminal domain and examining its effect on conservative and non-conservative HR. I will also examine the effects of mutations in *HsRAD52* obtained from cancer patients in order to assess their potential role in disease. With this approach I hope to clarify how *RAD52* controls HR and how this control is involved in tumor suppression.

#### 178. EXPRESSION AND IDENTIFICATION OF N-ACETYLGUCOSAMINE-6- SULFATASE (GNS): A POTENTIAL ERT DRUG FOR SANFILIPPO SYNDROME D

**R. Dokko.** Palos Verdes Peninsula H.S.; Mentor: P. Dickson, Los Angeles Biomedical Institute.

Mucopolysaccharidosis IIID (MPS IIID or Sanfilippo syndrome D) is a genetic lysosomal storage disorder caused by an absent lysosomal enzyme, N-acetyl-glucosamine-6-sulfatase (GNS), which breaks down long sugar chains called glycosaminoglycans (GAGs). The accumulation of these GAGs in the body may cause severe cognitive impairment and skeletal deformity. There is currently no cure for MPS IIID, but an enzyme replacement therapy (ERT) treatment may be one of the potential treatments that may attenuate symptoms for MPS IIID patients. In order to obtain enough enzyme for the ERT, the human *GNS* gene was transfected into Chinese hamster ovary (CHO) cell lines, and the protein was purified from the culture medium. A sulfatase activity assay was used to isolate the highest expressing clones out of 58 original clones, after which, the GNS activity assay was run to confirm the expression of these clones. After the highest expressers were isolated, they were re-cultured and their activities were monitored over two weeks. Then two cell lines of MPS IIID fibroblasts were incubated with the rhGNS CHO cell culture medium and tested for GNS uptake. Nine clones showed the highest sulfatase activity, and when monitored over two weeks, their activities all increased. After the screening with the GNS assay, however, these clones showed minimal GNS activity, suggesting that another CHO cell line needs to be transfected with the human *GNS* gene to acquire greater expression of the enzyme. Because optimization of the GNS assay and confirmation of a functioning GNS protein were achieved, in the future, the GNS produced by the transfected CHO cells may be used in ERT to treat patients with Sanfilippo Syndrome D.