

**ANNUAL MEETING
SOUTHERN CALIFORNIA
ACADEMY OF SCIENCES**

May 4 and 5, 2001



California State University
Los Angeles

Dear Colleagues,

On behalf of the Southern California Academy of Sciences (SCAS) Board of Directors and our sponsoring, endorsing, invited and supporting organizations, I invite you to join us for our Annual Meeting at California State University, Los Angeles on May 4th and 5th 2001.

As you are undoubtedly aware the Academy has a strong commitment to the research progress of the Southern California scientific community. To promote that progress the Center for Environmental Analysis – Centers of Research Excellence in Science and Technology (CEA-CREST) and the Southern California Chapter of the Wildlife Society are meeting jointly with SCAS this year. This collaboration, which includes nine symposia, is by far the most diverse meeting we have had in recent years. We are proud of both the breadth and depth of this year's meeting and believe you will be very pleased with the program.

One of the Academy's goals is to promote fellowship among scientists. Along these lines, I would like to invite everybody to the plenary talks by Dr. Alan Mearns and Dr. Blake Gumprecht as well as the Friday and Saturday evening wine and cheese socials. Friday's social will be centered on our poster session and the student awards for best posters will be announced. Similarly, at the Saturday social the student awards for best oral presentations will also be given. Also on Saturday, the Southern California Junior Academy of Sciences (SCJAS) will be giving their presentations. I would hope that everyone would take some time to encourage our young scientists.

Since 1891, SCAS has been an important force in the Southern California scientific community. This meeting embodies that long history of support for the science in Southern California. I sincerely hope you will enjoy yourselves. On behalf of the Board of Directors, I would like to thank you for your participation in the 2001 Annual Meeting.

Sincerely,



Daniel J. Pondella, II
President
Southern California Academy of Sciences

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| | |
|--|-----------------------------------|
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| | |
|----------------------------|-------------------------|
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Future SCAS Annual Meetings:

| | | |
|------|---|-----------------|
| 2002 | Claremont McKenna College | May 31 & June 1 |
| 2003 | California State University, Northridge | |

Student Awards

Undergraduate or graduate students working towards a degree who elect to participate are eligible for best paper or poster awards in several categories. The categories are:

1. Ecology and Evolution
2. Fishery Biology
3. Molecular Biology and Physiology
4. Physical Science

The American Institute of Fishery Research Biologists will present an award for the Best Student Paper in Fishery Biology. The Southern California Academy of Sciences will present the other awards.

Student competing for an award are indicated by an * next to the time of their presentation.

Acknowledgements

The Southern California Academy of Sciences wishes to acknowledge the following organizations and people for their support of the 2001 Annual Meeting.

- ◆ College of Natural and Social Sciences, California State University, Los Angeles
- ◆ Department of Biology and Microbiology, California State University, Los Angeles
- ◆ Office of Graduate Studies and Research, California State University, Los Angeles
- ◆ Port of Los Angeles
- ◆ Martha and Richard Schwartz
- ◆ Wrigley Institute for Environmental Studies

SCAS 2001 SESSION SCHEDULE

Friday Morning, May 4

*Location: Los Angeles Room A
Student Union – 3rd Floor*

Symposium: Nutrient Dynamics in Marine and Estuarine Environments

CHAIR: Dr. Krista Kamer, Southern California Coastal Water Research Project

| <u>Time</u> | <u>No.</u> | <u>Paper</u> |
|---------------|------------|--|
| 8:00 – 8:20 | 1 | REVISING OUR VIEW OF THE OCEANIC NITROGEN CYCLE <u>Douglas G. Capone</u> , University of Southern California, Los Angeles |
| 8:20 - 8:40 | 2 | NUTRIENT DYNAMICS IN COASTAL UPWELLING SYSTEMS OF THE COAST OF CALIFORNIA, <u>F.P. Wilkerson</u> and R.C. Dugdale, Romberg Tiburon Center, San Francisco State University |
| 8:40 – 9:00 | 3 | SILICON, NITROGEN, IRON AND LIGHT: WHAT REALLY CONTROLS DIATOM PRODUCTION? <u>R.M Kudela</u> , University of California Santa Cruz |
| 9:00–9:20 | 4 | DETERMINING THE RELATIVE IMPORTANCE OF TERRESTRIAL AND OCEANIC SOURCES OF NUTRIENTS TO ESTUARIES ALONG THE WEST COAST OF THE US <u>P. Fong</u> , K.E. Boyer, and A.R. Armitage. UCLA, Department of Organismic Biology, Ecology, and Evolution, Los Angeles, CA, 90095 |
| 9:20–9:40 | 5 | NUTRIENT EXCHANGE BETWEEN CARPINTERIA SALT MARSH NATURE PARK AND AN ADJOINING TIDAL CHANNEL <u>H. M. Page</u> and J. E. Dugan. Marine Science Institute, University of California, Santa Barbara, CA 93106. |
| 9:40–10:00 | 6 | DO ESTUARINE SEDIMENTS CONTRIBUTE TO MACROALGAL GROWTH? DIRECT EXPERIMENTAL EVIDENCE FROM A BIOASSAY <u>K. Kamer</u> and K. Schiff. Southern California Coastal Water Research Project |
| 10:00-10:20* | 7 | NUTRIENT INTERACTIONS BETWEEN MACROALGAE AND EMERGENT VASCULAR PLANTS IN SOUTHERN CALIFORNIA ESTUARIES. (EE) <u>K. E. Boyer</u> and P. Fong. Department of Organismic Biology, Ecology, and Evolution, University of California, Los Angeles, 90095. |
| 10:20-10:40 | 8 | ESTABLISHING BACKGROUND CONCENTRATIONS FOR NUTRIENTS IN A SANTA MONICA MOUNTAINS WATERSHED <u>S. Birosik</u> , California Regional Water Quality Control Board, Los Angeles Region, 320 W. 4 th Street, Suite 200, Los Angeles, CA, 90013. |
| 10:40 -11:00 | | BREAK |
| 11:00 - 12:00 | | PLENARY SPEAKER –Mr. Alan J. Mearns, Senior Staff Scientist Hazardous Materials Response Division National Oceanic and Atmospheric Administration Seattle, Washington <i>Where are the Fish? Sanity and Other Factors in Marine and Aquatic Resource Management in Southern California</i> STUDENT UNION, 3 RD FLOOR - LOS ANGELES ROOMS A & B |

SCAS 2001 SESSION SCHEDULE

Friday Morning, May 4

*Location: Alhambra Room A
Student Union – 3rd Floor*

Symposium: Spatially Explicit Ecology

CHAIR: Dr. Carlos Robles, CEA-CREST Director, California State University, Los Angeles

| <u>Time</u> | <u>No.</u> | <u>Paper</u> |
|---------------|------------|--|
| 8:15 – 8:35 | | INTRODUCTION – Dr. Carlos Robles, CEA-CREST Director, California State University, Los Angeles |
| 8:40 – 9:00 | 9 | SPATIAL INTERACTIONS IN PLANT ECOLOGY: DATA COLLECTION, DATA ANALYSIS, AND MATHEMATICAL MODELING. <u>D.H. Deutschman</u> , San Diego State University, Department of Biology, San Diego, CA. |
| 9:05 – 9:25 | 10 | EXPLORING THE SENSITIVITY OF AN ENDANGERED SPECIES TO CHANGES IN DEMOGRAPHY AND HABITAT USING AN INDIVIDUAL-BASED MODEL FOR THE CAPE SABLE SEASIDE SPARROW (<i>AMMODRAMUS MARITIMUS MIRABILIS</i>) Elder, Bret, and <u>M. Philip Nott</u> . Department of Environmental Studies, University of California, Santa Cruz and Institute for Bird Populations, Point Reyes Station, CA |
| 9:30 – 9:50 | 11 | MODELING IN CONTINUOUS SPACE AND TIME: WHEN BEING DISCRETE JUST ISN'T ENOUGH <u>Doug Donalson</u> , Department of Biological Sciences, California State University, Los Angeles, CA |
| 9:55 – 10:15 | 12 | UNDERSTANDING THE INFLUENCE OF OCEANOGRAPHIC FORCING ON MUSSEL BED DYNAMICS: SIGNATURES OF LOCAL INTERACTIONS <u>Frederic Guichard</u> , Department of Ecology and Evolutionary Biology, Princeton University, Princeton, New Jersey |
| 10:20–10:40 | 13 | ANALYZING THE EFFECTS OF MECHANISMS GOVERNING RECRUITMENT, PREDATION, AND GROWTH ON PATTERN FORMATION IN MUSSEL BEDS <u>R.A. Desharnais</u> , D.D. Donalson, and C.D. Robles. California State University, Los Angeles, Department of Biological Sciences, Los Angeles, CA |
| 10:40 –11:00 | | BREAK |
| 11:00 - 12:00 | | PLENARY SPEAKER –Mr. Alan J. Mearns, Senior Staff Scientist Hazardous Materials Response Division National Oceanic and Atmospheric Administration Seattle, Washington <i>Where are the Fish? Sanity and Other Factors in Marine and Aquatic Resource Management in Southern California</i> STUDENT UNION, 3 RD FLOOR - LOS ANGELES ROOMS A & B |

Afternoon

| Time | No. | Paper |
|-------------|-----|--|
| 1:20 – 1:40 | 14 | <p><i>PISASTER-MYTILUS</i> INTERACTIONS IN THE ROCKY INTERTIDAL: SPATIALLY-EXPLICIT SIMULATION MODELS OF <i>PISASTER</i> FORAGING</p> <p>Harold P. Batchelder, College of Oceanic and Atmospheric Sciences, 104 Ocean Admin Bldg, Oregon State University, Corvallis, OR</p> |
| 1:45 – 2:05 | 15 | <p>MOVEMENTS OF INDIVIDUALS OF THE KEYSTONE PREDATOR <i>PISASTER OCHRACEUS</i> OVER INTERTIDAL LANDSCAPES WITH VARYING WAVE EXPOSURES AND PREY DISTRIBUTIONS.</p> <p>¹ C. D. Robles, ¹R., Paillet, and ²J. Shima. ¹Department of Biological Sciences, California State University at Los Angeles; ²Department of Ecology, Evolution and Marine Biology, University of California at Santa Barbara</p> |
| 2:10 – 2:30 | 16 | <p>DIEL MOVEMENT PATTERNS OF THE HAWAIIAN STINGRAY (<i>DASYATIS LATA</i>) IN KANEOHE BAY, HAWAII.</p> <p>D. Cartamil, J. Vaudo, C. Lowe, B. Wetherbee, and K. Holland. California State University, Long Beach, Biology Department, Long Beach, CA 90840 (DC, JV, and CL). NOAA/NMFS/NEFSC, Narragansett, RI 02882 (BW). Hawaii Institute of Marine Biology, Kaneohe, HI 96744 (KH).</p> |
| 2:35 – 2:50 | 17 | <p>ESTIMATING THE IMPACT OF MULTIPLE PREDATORS ON BENTHIC PREY POPULATIONS.</p> <p>C. D. Garza, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA</p> |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 3:40 | 18 | <p>USING AN EIGHTEEN-YEAR PHOTOGRAPHIC RECORD TO QUANTIFY CHANGES IN MUSSEL ABUNDANCE AND DISTRIBUTION ON BIRD ROCK, CATALINA ISLAND, SOUTHERN CALIFORNIA.</p> <p>D. Blakeway and C. D. Robles, Department of Biological Sciences, California State University Los Angeles, CA 90032</p> |
| 3:45 – 4:00 | | Discussion - Evaluation Of Different Modeling Approaches |
| 4:05 – 4:25 | | Discussion - Coevolution Of Models And Field Studies |
| 4:30 - 4:50 | | Discussion - Modeling The Mussel Bed Problem In The So Cal Bight. |
| 5:00 – 5:15 | | SCAS MEMBERS MEETING – MAXWELL THEATER, STUDENT UNION, 2ND FLOOR |
| 5:00 – 7:00 | | POSTER SESSION – WINE AND CHEESE RECEPTION ALUMNI LOUNGE, STUDENT UNION, 2ND FLOOR |

SCAS 2001 SESSION SCHEDULE

Friday Morning, May 4

*Location: Alhambra Room B
Student Union – 3rd Floor*

Symposium: Scaling and Ecosystem Processes

CHAIR: Dr. John Gamon, California State University, Los Angeles

| Time | No. | Paper |
|---------------|-----|---|
| 8:15 – 8:35 | | INTRODUCTION – John Gamon, California State University, Los Angeles |
| 8:40 – 9:00 | 19 | MULTI-SCALE SAMPLING OF BIOSPHERE-ATMOSPHERE CARBON FLUXES IN ARCTIC AND CHAPARRAL ECOSYSTEMS John A. Gamon ^{1,3} , Stan Houston ^{1,3} , Dan Sims ¹ , Fred Huemmrich ^{3,4} , Walt Oechel ² , Hyojun Kwon ² , Rommel Zulueta ² , Pablo Bryant ² , Steven Hastings ² , Joseph Verfaillie Jr. ² ¹ California State University, Los Angeles, CA, ² San Diego State University, San Diego, CA, ³ Desert Research Institute, Reno, NE, ⁴ University of Maryland, Baltimore, MD |
| 9:05 – 9:25 | 20 | WAVELET ANALYSIS OF SPATIAL PATTERNS IN THE REFLECTANCE INDICES OF CHAPARRAL STANDS F. Rahman and J. A. Gamon, Ecology and Natural Resources Dept., Rutgers University, New Brunswick, NJ |
| 9:30 – 9:50 | 21 | STATISTICAL AND PHYSICAL METHODS IN REMOTE SENSING FOR LINKING LEAF AND CANOPY LEVELS: FORWARD AND INVERSE MODELLING P.J. Zarco-Tejada, Center for Spatial Technologies and Remote Sensing (CSTARS), Department of Land, Air and Water Resources (LAWR), University of California, Davis, CA |
| 9:55 – 10:15 | 22 | CORRELATION BETWEEN SATELLITE BASED LAND COVER TYPES AND AIRBORNE MEASUREMENTS OF CO ₂ , LATENT HEAT, AND SENSIBLE HEAT FLUXES IN THE BOREAL FOREST OF CANADA Segun O. Ogunjemiyo ¹ , Dar A. Roberts ¹ and Peter Schuepp ² , ¹ Department of Geography, University of California, Santa Barbara, CA 93106; ² Department of Natural Resource Sciences, McGill University, Ste-Anne-De-Bellevue, Quebec, H9X 3V9, Canada |
| 10:20 – 10:40 | 23 | SCALING CARBON FLUX MEASUREMENTS TO THE REGIONAL LEVEL IN SOUTHERN CALIFORNIA AND BAJA CALIFORNIA Walter C. Oechel ¹ , R. Zulueta ¹ , J. Verfaillie Jr. ¹ , Hyojung Kwon ¹ , S. J. Hastings ¹ , A. Hope ² , D. Stow ² , S. Brooks ² , Larry Miller ⁴ , Arturo Muhlia ⁴ , ¹ Global Change Research Group, San Diego State University, San Diego, CA., ² Department of Geology, San Diego State University, San Diego, CA., ³ ATDD NOAA Oak Ridge, TN, ⁴ CIBNOR, La Paz, BCS, Mexico |
| 10:40 – 11:00 | | BREAK |

11:00 - 12:00 PLENARY SPEAKER –Mr. Alan J. Mearns, Senior Staff Scientist
 Hazardous Materials Response Division
 National Oceanic and Atmospheric Administration
 Seattle, Washington
*Where are the Fish? Sanity and Other Factors in Marine and Aquatic
 Resource Management in Southern California*
 STUDENT UNION, 3RD FLOOR - LOS ANGELES ROOMS A & B

Afternoon

| Time | No. | Paper |
|-------------|-----|---|
| 1:20 – 1:40 | 24 | SCALING FLUXES OF CARBON, WATER AND ENERGY FROM LEAVES TO CANOPY DIMENSIONS: ADVENTURES IN THE FIELD AND ON THE COMPUTER <u>Dennis Baldocchi</u> , Department of Environmental Science, University of California, Berkeley |
| 1:45 – 2:05 | 25 | SCALING ECOSYSTEM PROCESSES USING COMPUTER MODELS AND REMOTE SENSING - THE BGC EXAMPLE <u>Lars L. Pierce</u> , Institute of Earth Systems Science & Policy, California State University, Monterey Bay, 100 Campus Center, Seaside CA |
| 2:10 – 2:30 | 26 | PHYSIOLOGICAL CONTROL OF CARBON AND WATER FLUXES IN FORESTS AND ORCHARDS, ITS VARIABILITY AND CONSEQUENCES <u>Vincent P.Gutschick*</u> , <u>Connie J. Maxwell*</u> , <u>Mario Montes-Helu*,†</u> , <u>Felicia Najera*</u> , <u>Erik Jackson*</u> , <u>Ernesto Catalan*</u> , <u>Ernesto Frias*</u> , <u>Erika Mortenson*</u> , and <u>Alonzo Soto*</u> -*Dept. of Biology, MSC 3AF, New Mexico State University, P.O.Box 3001, Las Cruces, NM; †Dept. of Biology, Northern Arizona University, Flagstaff, AZ |
| 2:35 – 2:50 | 27 | THE CONTRIBUTION OF EL NINO TO VARIABILITY IN THE GLOBAL CARBON CYCLE AND $\delta^{13}C$ <u>Jim Randerson</u> , California Institute of Technology, Divisions of Engineering and Applied Science and Geological and Planetary Sciences, Pasadena, CA. |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 3:40 | | Discussion – Ecosystem Carbon Flux: Integrating Time And Space: Part 1 – Eddy Covariance (Temporal Domain) |
| 3:45 – 4:00 | | Discussion – Part 2: Remote Sensing (Spatial Domain) |
| 4:05 – 4:25 | | Discussion – Part 3: Models (Integrative Tools) |
| 4:30 - 4:50 | | Discussion – Part 4: Informatics (Integrative Data Systems). |
| 5:00 – 5:15 | | SCAS MEMBERS MEETING – MAXWELL THEATER, STUDENT UNION, 2ND FLOOR |
| 5:00 – 7:00 | | POSTER SESSION – WINE AND CHEESE RECEPTION ALUMNI LOUNGE, STUDENT UNION, 2ND FLOOR |

SCAS 2001 SESSION SCHEDULE

Friday Morning, May 4

Location: Maxwell Theater
Student Union, 2nd Floor

Symposium: Dealing with Contaminated Runoff

CHAIR: Dr. John Dorsey, City of Los Angeles

| Time | No. | Paper |
|---------------|-----|---|
| 8:30 – 8:40 | | INTRODUCTION, John Dorsey, City of Los Angeles Stormwater Management |
| 8:40 - 9:00 | 28 | AN OVERVIEW OF STORMWATER QUALITY IN LOS ANGELES COUNTY Bill DePoto, P.E., Watershed Management Division, Los Angeles County Public Works, Alhambra, CA |
| 9:00 – 9:20 | 29 | DISPERSION OF FECAL BACTERIA DISCHARGED FROM FRESHWATER OUTLETS INTO THE NEARSHORE ENVIRONMENT OF SANTA MONICA BAY M. Taggart, Heal the Bay, Santa Monica, CA |
| 9:20 – 9:40 | 30 | NEARSHORE DISPERSION OF COASTAL CONTAMINANTS: PROCESSES, SCALES, AND IMPACTS Burton H. Jones, Department of Biological Sciences, University of Southern California, Los Angeles, CA 90089-0371 |
| 9:40 – 10:00 | 31 | DEGRADATION OF INDICATOR BACTERIA AND COLIPHAGE IN SANTA MONICA BAY SEAWATER R. T. Noble. Southern California Coastal Water Research Project, Westminster, CA, Lee, I. M., Environmental Monitoring Division, City of Los Angeles, Playa del Rey, CA |
| 10:00 – 10:20 | 32 | RANKING OF SANTA MONICA BAY STORM DRAINS AS CANDIDATES FOR LOW-FLOW DIVERSION OF DRY-WEATHER URBAN RUNOFF FROM THE CITY OF LOS ANGELES M.E. Mullin. City of Los Angeles, Stormwater Management Division, 650 South Spring Street, Los Angeles, CA |
| 10:20 – 10:40 | 33 | MUNICIPAL SPENDING ON RUN-OFF CONTROL IN LOS ANGELES AND ORANGE COUNTY Tina Cummins. Coastal Community Research, University of Southern California, Wrigley Institute for Environmental Studies, Los Angeles, CA |
| 10:40 – 11:00 | | BREAK |
| 11:00 - 12:00 | | PLENARY SPEAKER – Mr. Alan J. Mearns, Senior Staff Scientist Hazardous Materials Response Division National Oceanic and Atmospheric Administration Seattle, Washington <i>Where are the Fish? Sanity and Other Factors in Marine and Aquatic Resource Management in Southern California</i> STUDENT UNION, 3RD FLOOR – LOS ANGELES ROOMS A & B |

Afternoon

| Time | No. | Paper |
|-------------|-----|---|
| 1:20 – 1:40 | 34 | STORMWATER BEST MANAGEMENT PRACTICES <u>Michael K. Stenstrom</u> , Civil and Environmental Engineering Department, UCLA, Los Angeles, CA |
| 1:40 – 2:00 | 35 | RESIDENTIAL BEST MANAGEMENT PRACTICES: SIMPLE STRATEGIES FOR SUSTAINABILITY <u>Rebecca Drayse</u> , T.R.E.E.S. Project, TreePeople, Beverly Hills, CA |
| 2:00 – 2:20 | 36 | THE CITY OF LOS ANGELES' BEST MANAGEMENT PRACTICES (BMPs) PROGRAM TO CONTROL POLLUTANTS IN URBAN RUNOFF. <u>G.L.Moore</u> , City of Los Angeles, Stormwater Management Division, 650 S. Spring St., Los Angeles, CA |
| 2:20 – 2:40 | 37 | URBAN RUNOFF: FROM WASTE TO RESOURCE <u>Neal Shapiro</u> , Urban Runoff Management Coordinator, City of Santa Monica, 200 Santa Monica Pier, Santa Monica, CA 90401 |
| 2:40 – 3:00 | 38 | BMP'S NOW AND FUTURE <u>Eric W.Strecker</u> , GeoSyntec Consultants, 838 SW First Avenue, Suite 430, Portland, OR 97204, estrecker@geosyntec.com . |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 3:40 | 39 | HOLISTIC APPROACH TO BMPs <u>M. Walker</u> , Larry Walker Associates, Inc., 509 4 th St., Davis, CA 95616 |
| 5:00 – 5:15 | | SCAS MEMBERS MEETING MAXWELL THEATER, STUDENT UNION, 2ND FLOOR |
| 5:00 – 7:00 | | POSTER SESSION – WINE AND CHEESE RECEPTION ALUMNI LOUNGE, STUDENT UNION, 2 ND FLOOR |

SCAS 2001 SESSION SCHEDULE

Friday Afternoon, May 4

Location: Biological Sciences, Room 144

Symposium: Neuronal Degeneration, Growth and Repair Throughout the Lifespan

CHAIR: Dr. Amelia Russo-Neustadt, California State University, Los Angeles

| Time | No. | Paper |
|--------------|-----|--|
| 12:30 – 1:10 | 40 | NEUROPROTECTIVE ACTIONS OF ESTROGEN AND TESTOSTERONE <u>Christian Pike</u> , Andrus Gerontology Center, University of Southern California |
| 1:10 – 1:50 | 41 | MOLECULAR AND CELLULAR MECHANISMS OF LEARNING AND MEMORY: FROM THE LAB TO THE CLINIC <u>Alcino Silva</u> , Departments of Neurobiology, Psychiatry and Psychology, University of California Los Angeles |
| 1:50 – 2:30 | 42 | NEUROTROPHIC EFFECTS OF ESTROGEN ON THE CHOLINERGIC BASAL FOREBRAIN <u>Sonsoles de Lacalle</u> , Department of Biology and Microbiology, California State University, Los Angeles |
| 2:30 – 3:10 | 43 | NEUROTROPHIC FACTORS AND ACTIVITY DEPENDENT MODIFICATION OF THE BRAIN <u>J. Patrick Kesslak</u> , Institute for Brain Aging and Dementia and Department of Neurology, University of California, Irvine |
| 3:10 – 3:50 | 44 | INDUCTION OF THE NEURAL CREST <u>Marianne Bronner-Fraser</u> , Albert Billings Ruddock Professor of Biology Division of Biology, California Institute of Technology |
| 3:50 – 4:30 | 45 | THE REGULATION OF BRAIN DERIVED NEUROTROPHIC FACTOR THROUGHOUT THE LIFESPAN <u>Amelia Russo-Neustadt</u> , Department of Biology and Microbiology, California State University, Los Angeles |
| 4:30 – 5:10 | 46 | ASTROCYTE ROLES IN NEURAL INJURY, DEGENERATION AND REPAIR, ANALYZED IN TRANSGENIC MICE <u>Michael V. Sofroniew</u> , Department of Neurobiology, University of California, Los Angeles |
| 5:00 – 5:15 | | SCAS MEMBERS MEETING – MAXWELL THEATER, STUDENT UNION, 2 ND FLOOR |
| 5:00 – 7:00 | | POSTER SESSION – WINE AND CHEESE RECEPTION ALUMNI LOUNGE, STUDENT UNION, 2 ND FLOOR |

SCAS 2001 SESSION SCHEDULE

Friday Afternoon, May 4

*Location: Los Angeles Room A
Student Union - 3rd Floor*

Symposium: The Virtual Ocean

CO-CHAIRS: Dr. Judith Doino Lemus, University of Southern California and Dr. M. James Allen, Southern California Coastal Water Research Project

| <u>Time</u> | <u>No.</u> | <u>Paper</u> |
|-------------|------------|--|
| 1:20 – 1:40 | 47 | APPLICATION OF MULTIMEDIA GIS, ACOUSTIC REMOTE SENSING AND 3D VISUALIZATION FOR MARINE HABITAT MAPPING AND ECOSYSTEM-BASED MANAGEMENT <u>R. G. Kvitck</u> , Seafloor Mapping Lab, California State University Monterey Bay, CA |
| 1:40 – 2:00 | 48 | MORPHOLOGY OF THE SEAFLOOR OFFSHORE OF LOS ANGELES <u>R.G. Bohannon</u> , United States Geological Survey |
| 2:00 – 2:20 | 49 | GIS AND VISUALIZATION TECHNIQUES FOR ECOSYSTEM MANAGEMENT IN A MARINE SANCTUARY <u>Ben Waltenberger</u> , NOAA/Channel Islands National Marine Sanctuary, Santa Barbara, CA |
| 2:20 – 2:40 | 50 | ACOUSTIC MAPPING OF SQUID AND ROCKFISH NEARSHORE HABITAT OFF SANTA ROSA ISLAND, CALIFORNIA <u>Guy R. Cochrane</u> , USGS, MS-999, Menlo Park, CA |
| 2:40 – 3:00 | 51 | AN INTERACTIVE INFORMATION SYSTEM FOR SANTA MONICA BAY D. A. Kiefer, V. M. Tsonotos and <u>S. P. Ogle</u> , Wrigley Institute for Marine Studies, University of Southern California, Los Angeles, CA |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 3:40 | 52 | MARINE RESOURCES OF THE SANTA MONICA BAY <u>S. Strand</u> ¹ , <u>J. Topel</u> ² , R. DeShazo ² , K. Martin ¹ 1) Department of Life Sciences, University of California, Los Angeles, CA; 2) Santa Monica Bay Restoration Project, Los Angeles CA |
| 3:40 – 4:00 | 53 | THE SUSTAINABLE SEAS EXPEDITIONS: A FIVE YEAR PROGRAM OF EXPLORATION AND EDUCATION <u>F. M Cava</u> , The Sustainable Seas Expeditions, 735 State Street, Suite 617, Santa Barbara, CA |
| 5:00 – 5:15 | | SCAS MEMBERS MEETING – MAXWELL THEATER, STUDENT UNION, 2 ND FLOOR |
| 5:00 – 7:00 | | POSTER SESSION – WINE AND CHEESE RECEPTION ALUMNI LOUNGE, STUDENT UNION, 2 ND FLOOR |

SCAS 2001 POSTER SESSION

Friday Afternoon, May 4

Location: Alumni Lounge,
Student Union, 2nd Floor

- | No. | Paper |
|-------|---|
| P1 | AN ADDITION TO THE PETRIFIED WOOD FLORA FROM THE EOCENE WAGON BED FORMATION OF WYOMING. <u>Sabrina S. Thakur</u> , Jennifer H. Jones, Jay H. Jones Department of Biology, University of La Verne, 1950 Third St., La Verne, CA 91750. |
| P2 * | IDENTIFYING HIGHLY DIVERGENT GENES FROM <i>TETRAHYMENA</i> (MBP) <u>Louis Lee</u> and Anne Tran, Brunk Research Group, UCLA Department of Organismic Biology, Ecology and Evolution, Los Angeles, CA 90095 |
| P3 * | BURST SWIMMING PERFORMANCE IN LARVAL AND POST-METAMORPHIC WHITE SEA BASS (<i>TRACTOSCION NOBILIS</i>) (FB) <u>S.L. Cole</u> and K.A. Dickson. California State University, Fullerton. Department of Biological Science, Fullerton, CA 92831 |
| P4 * | DETECTING AGE OF SOUTHERN CALIFORNIA CHAPARRAL STANDS WITH SPECTRAL REFLECTANCE (EE) <u>Schmidts, M.</u> , D.A. Sims, B.R. Zutta, H.-L. Qiu, J.A. Gamon, California State University, Los Angeles, CA, USA 90032-8524 |
| P5 | ESTIMATION OF VEGETATION WATER CONTENT AND BIOMASS USING WATER ABSORPTION FEATURES IN SPECTRAL REFLECTANCE. <u>Sims, D.A.</u> and J.A. Gamon., California State University, Los Angeles, CA, 90032, USA |
| P6 * | COMPARATIVE ULTRASTRUCTURE OF THE INTESTINAL EPITHELIUM IN THREE RELATED SPECIES OF SILVERSIDE FISHES WITH DIFFERENT DIETS (FB) <u>C. T. Freeman</u> , A. Gawlicka and M. H. Horn, Department of Biological Science, California State University, Fullerton, Fullerton CA 92834 |
| P7 | DETERMING OPTIMAL AVIRIS WAVELENGTHS FOR THE IDENTIFICATION OF BOREAL FOREST LAND COVER TYPES <u>David A. Fuentes</u> ¹ , John. A. Gamon ^{1,2} , Hong-lie Qiu ^{1,3} , Dar A. Roberts ⁴ Center for Environmental Analysis (CEA-CREST) ¹ , Dept. of Biology and Microbiology ² , Dept. of Geography and Urban Analysis ³ , California State University, Los Angeles, CA, 90032; Department of Geography, University of California, Santa Barbara, CA, 93106 ⁴ |
| P8 * | MONITORING NITRATE AND ORTHOPHOSPHATE CONCENTRATIONS OF AN ORANGE COUNTY NURSERY DURING STORM EVENTS (PS) C. P. Sevilla, B. J. Hibbs and <u>James Walker</u> . Center for Environmental Analysis-Centers for Research Excellence in Science and Technology, California State University, Los Angeles, Los Angeles, CA, 90032. |
| P9 * | PHOTOSYNTHESIS AND PIGMENTS OF ARCTIC TUNDRA SPECIES LINKED TO REMOTE SENSING (EE) <u>Houston, S.</u> ¹ , J.A. Gamon ^{1,2} , K.F. Huemmrich ³ ¹ California State University at Los Angeles, ² Desert Research Institute, ³ University of Maryland, NASA GSFC |
| P10 * | LINKING BIODIVERSITY AND SPECTRAL REFLECTANCE IN SOUTHERN CALIFORNIA CHAPARRAL AND COASTAL SAGE SCRUB (EE) <u>Brian R. Zutta</u> , Miriam J. Schmidts, Daniel A. Sims, John A. Gamon. California State University, Los Angeles |

- P11 * OCCURENCE OF *GYRODACTYLUS PERFORATUS* (MONOGENEA) ON ITS FISH HOST (*CLEVELANDIA IOS*) FROM BODEGA BAY AND TOMALES BAY, CALIFORNIA (FB)
M. P. Walberg, E. Diamant, and K. Wong. Department of Organismic Biology, Ecology and Evolution, University of California (UCLA), Los Angeles, California 90095-1606
- P12 * CHARACTERIZATION OF MHC CLASS I LOCI IN THE ISLAND FOX (*UROCYON LITTORALIS*) (EE)
A. Selaya, A. Aguilar, G. Roemer, and R. Wayne. Department of Organismic Biology, Ecology & Evolution, University of California Los Angeles, Los Angeles, CA, 90095
- P13 * CART - A ROBOTIC SYSTEM FOR ENVIRONMENTAL SAMPLING (PS)
John Babilonia, Phil Clark, Nigel Harris, Dr. John Gamon, Dr. Lih-Min Hsia
California State University, Los Angeles, CA. 90032
- P14 * STAND-SCALED CARBON AND WATER VAPOR FLUX MEASURING BY CO₂ LT CHAMBERS IN SOUTHERN CALIFORNIA CHAPARRAL (EE)
Yufu Cheng, Walter Oechel, Steve Hastings, Jon Major, Pablo Bryant and Joe Verfaillie
Global Change Research Group, San Diego State University, San Diego, CA92182
- P15 * PHYSICAL ACTIVITY, ANTIDEPRESSANT TREATMENT, AND BDNF EXPRESSION IN THE AGING BRAIN (MBP)
Antonio Garza, Amelia Russo-Neustadt, M.D., Ph.D. Department of Biological Sciences, California State University, Los Angeles, CA 90032
- P16 * NORADRENERGIC ACTIVATION MAY PARTICIPATE IN THE ELEVATION OF BDNF mRNA OCCURRING WITH GENERAL PHYSICAL ACTIVITY (MBP)
Celithelma Garcia, Amelia Russo-Neustadt M.D., Ph.D., Department of Biological Sciences, California State University, Los Angeles, CA. 90032
- P17 * GEOLOGIC MAPPING OF ARAM CHAOS, MARS: A POSSIBLE HARBOR FOR EARLY MARTIAN LIFE (PS)
E. Noreen. California State University Los Angeles, Department of Geological Sciences, Los Angeles, CA 90032
- P18 ESTIMATING GROUNDWATER CONSUMPTION FROM IRRIGATED FIELDS USING REMOTE SENSING DATA
Hong-Lie Qiu and Bob Kirby, Department of Geography and Urban Studies, California State University Los Angeles, 5151 State University Drive, Los Angeles California 90032
- P19 * FOURIER TRANSFORM INFRARED (FTIR) STUDIES OF HETEROGENEOUS REACTIONS BETWEEN GASEOUS POLLUTANTS IN THE ATMOSPHERE AND NITRIC ACID (HNO₃) ON SILICA SURFACES AS A FUNCTION OF THE TYPE OF SURFACE AND RELATIVE HUMIDITY (RH).(PS)
A.M. Rivera-Figueroa, M. Mochida and B.J. Finlayson-Pitts. University of California, Irvine. Department of Chemistry, Irvine, CA, 92697-2025
- P20 SOURCES OF EXCESS NUTRIENTS IN THE SAN DIEGO CREEK WATERSHED
Eric Chavez and Gary Desselle. Center for Environmental Analysis, California State University, Los Angeles, CA. 90032
- P21 * NEUROTROPHIC EFFECTS OF ESTROGEN ON THE CHOLINERGIC BASAL FOREBRAIN (MBP)
Reymundo Dominguez, Cathy Jalali, Sonsoles De Lacalle. Department of Biological Sciences, California State University, Los Angeles

SCAS 2001 SESSION SCHEDULE

Saturday Morning, May 5

*Location: Los Angeles Room A
Student Union, 3rd Floor*

Symposium: Marine Ecology of Rocky Reefs and Areas of Special Biological Significance

CO-CHAIRS: Mr. Robert Grove, Southern California Edison and Mr. Dan Pondella, Occidental College

| <u>Time</u> | <u>No.</u> | <u>Paper</u> |
|---------------|------------|---|
| 9:00-9:20 | 54 | VISITOR IMPACTS ON ROCKY SHORES: ARE SOUTHERN CALIFORNIA'S MARINE PROTECTED AREAS PROTECTING COASTAL RESOURCES? <u>S. N. Murray</u> . Department of Biological Science, California State University, Fullerton, CA |
| 9:20-9:40 | 55 | SEASONAL OCCURRENCE AND SPECIES RICHNESS OF THE AVIFAUNA ON THE LONG BEACH BREAKWATER: A MAN-MADE SURROGATE HABITAT. . J.W. Johnson and R.A. Schallmann. Naval Weapons Station Seal Beach, Seal Beach, CA, 90740; CSU Long Beach, Department of Biological Sciences, Long Beach, CA |
| 9:40-10:00 | 56 | FACTORS AFFECTING FISH DIVERSITY ON A TEMPERATE REEF III: THE FISH ASSEMBLAGE OF PALOS VERDES POINT, 1974-2000 <u>D. J. Pondella, II.</u> and J. S. Stephens, Jr. Vantuna Research Group, Occidental College, Moore Laboratory of Zoology, 1600 Campus Rd. Los Angeles, CA |
| 10:00-10:20 | 57 | YOU'VE GOT TO KNOW WHERE THEY GO: HOME RANGE AND SPILLOVER POTENTIAL OF KELP BASS (<i>Paralabrax clathratus</i>) IN BIG FISHERMAN'S COVE MARINE RESERVE, SANTA CATALINA ISLAND, CALIFORNIA. <u>D.T. Topping</u> , C.G. Lowe, C.L. Snellen, Y.P. Papastamatiou, D.P. Cartamil, and G. Moss. Dept. of Biological Sciences, California State University Long Beach, 1250 Bellflower Blvd., Long Beach, CA |
| 10:20-10:40 | 58 | CALIFORNIA'S MARINE RESERVES ARE BEING COMPLETELY REORGANIZED, STARTING WITH THE NORTHERN CHANNEL ISLANDS. <u>I. Tetreault-Beers</u> . Member of the Master Plan Team for the Marine Life Protection Act. UCLA Environmental Health Sciences, Los Angeles, CA |
| 10:40 - 11:00 | | BREAK |
| 11:00 - 12:00 | | PLENARY SPEAKER -Dr. Blake Gumprecht, Department of Geography University of Oklahoma <i>The Los Angeles River, Its Life, Death, and Possible Rebirth</i> BIOLOGICAL SCIENCES ROOM 144 |

Afternoon

| Time | No. | Paper |
|-------------|-----|---|
| 1:20 - 1:40 | 59 | AN OVERVIEW OF LONG-TERM CHANGES IN INTERTIDAL AND SUBTIDAL ALGAL ASSEMBLAGES NEAR THE DIABLO CANYON POWER PLANT <u>S. Kimura</u> , Tenera Environmental, San Luis Obispo, CA |
| 1:40 - 2:00 | 60 | HABITAT DESIGN AND RESULTS FOR A KELP (<i>MACROCYSTIS PYRIFERA</i>) RESTORATION PROJECT OFF TAJIGUAS, SANTA BARBARA COUNTY <u>D. C. Barilotti</u> , San Diego State University and D. C. Lees, Littoral Ecological and Environmental Services |
| 2:00 - 2:20 | 61 | BEHAVIOR OF INTRODUCED ROCKS AND PRE-EXISTING SAND FOLLOWING CONSTRUCTION OF SUBTIDAL ARTIFICIAL KELP HABITAT. D. C. Lees, Littoral Ecological & Environmental Services and D. C. Barilotti, San Diego State University |
| 2:20 - 2:40 | 62 | OVERVIEW OF SONG ARTIFICIAL KELP REEF MONITORING PROGRAM – MONITORING PLAN AND SUMMARY OF THE PHYSICAL ATTRIBUTES OF REEF. <u>D. Huang</u> and D. Malone, California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009 |
| 2:40 – 3:00 | 63 | PATTERNS OF SURVIVORSHIP AND RECRUITMENT OF MACROCYSTIS PYRIFERA AT THE SONGS ARTIFICIAL KELP REEF. <u>J. Bunch</u> , California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009 |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 3:40 | 64 | PATTERNS OF INITIAL BENTHIC COMMUNITY DEVELOPMENT AT THE SONGS ARTIFICIAL KELP REEF. <u>D. Toole</u> , California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009 |
| 3:40 – 4:00 | 65 | A COMPARISON OF THE FISH ASSEMBLAGES AT THE SONGS ARTIFICIAL KELP REEF AND AT OTHER NATURAL AND ARTIFICIAL REEFS IN SOUTHERN CALIFORNIA. <u>D. Gates</u> , California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009 |
| 5:00 – 7:00 | | WINE AND CHEESE RECEPTION – PROGRAM AREA, STUDENT UNION – 2 ND FLOOR |

SCAS 2001 SESSION SCHEDULE

Saturday Morning, May 5

*Location: Maxwell Theater
Student Union – 2nd Floor*

Symposium: Puente-Chino Hills Wildlife Corridor and Wildlife Corridors in the Los Angeles Basin

CHAIR: Dr. Daniel Guthrie, Claremont Colleges

| Time | No. | Paper |
|---------------|-----|---|
| 9:00 - 10:00 | 66 | SAVING OPEN SPACE. THE PUENTE-CHINO HILLS WILDLIFE CORRIDOR. HILLS FOR EVERYONE (A 45-minute Video Presentation) William S. Kowalik and Jill Anne Kowalik. Producers, La Habra Heights, CA 90631. |
| 10:00 – 10:20 | 67 | CORRIDORS TO OBLIVION: STRATEGIES FOR PROTECTING HABITAT IN URBAN SETTINGS D.A. Guthrie, Joint Science Department, Claremont McKenna, Scripps and Pitzer Colleges. |
| 10:20 – 10:40 | 68 | PRESERVING AND RESTORING THE COAL CANYON BIOLOGICAL CORRIDOR Geary W. Hund, California Department of Parks and Recreation, Inland Empire District |
| 10:40 – 11:00 | | BREAK |
| 11:00 - 12:00 | | PLENARY SPEAKER –Dr. Blake Gumprecht, Department of Geography University of Oklahoma <i>The Los Angeles River, Its Life, Death and Possible Rebirth</i> BIOLOGICAL SCIENCES ROOM 144 |

Afternoon

| Time | No. | Paper |
|---------------|-----|--|
| 1:20 – 1:40 | 69 | CHARACTERISTICS OF VEGETATION IN THE PUENTE HILL/CHINO HILL CORRIDOR C. Swift and J. Henderson, Whittier College, Department of Biology and Keck Image Processing Laboratory, Whittier, CA |
| 1:40 – 2:00 | 70 | BIRD CONSERVATION PRIORITIES IN THE PUENTE-CHINO HILLS Daniel S. Cooper, The Audubon Center, 6042 Monte Vista St., Los Angeles, CA |
| 2:00 – 2:20 * | 71 | MANAGEMENT CONSIDERATIONS OF WILDLIFE CORRIDORS FOR COASTAL CACTUS WREN POPULATIONS IN SOUTHERN CALIFORNIA (EE) C.W. Solek, Biological Sciences Department, California State Polytechnic University, Pomona, CA |
| 2:20 – 2:40 | 72 | PRELIMINARY RESULTS OF RESERVE-WIDE MONITORING OF CALIFORNIA GNATCATCHERS IN THE NATURE RESERVE OF ORANGE COUNTY. R. A. Hamilton. Nature Reserve of Orange County, 34 Rivo Alto Canal, Long Beach, CA |

- 2:40 – 3:00 73 DISTRIBUTION, RELATIVE ABUNDANCE, AND ROADWAY UNDERPASS RESPONSES OF MAMMALS THROUGHOUT THE PUENTE-CHINO HILLS
C.D. Haas, U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center, San Diego Field Station, San Diego, CA, and K.R. Crooks, Department of Wildlife Ecology, University of Wisconsin, Madison, WI.
- 3:00 – 3:20 BREAK
- 3:20 – 3:40 * 74 HOME RANGE USE, BEHAVIOR, AND MORTALITY OF COYOTES (*CANIS LATRANS*) AND BOBCATS (*FELIS RUFUS*) IN RELATION TO ROADWAYS AND UNDERPASSES IN SOUTHERN CALIFORNIA (EE)
L.M. Lyren¹ and K.R. Crooks². ¹United States Geological Survey, Biological Resources Division, Western Ecological Research Center, San Diego Field Station, San Diego, CA and ²University of Wisconsin-Madison, Department of Wildlife Ecology, Madison, WI.
- 3:40 – 4:00 75 BIO-HOTSPOTS: REGIONAL CONSERVATION PLANNING IN SOUTHERN CALIFORNIA.
E.D. Stein. PCR Services Corporation, One Venture, Suite 150, Irvine, CA 92618
- 5:00 – 7:00 WINE AND CHEESE RECEPTION – PROGRAM AREA
STUDENT UNION – 2ND FLOOR

SCAS 2001 SESSION SCHEDULE

Saturday Morning, May 5

*Location: Alhambra Room A
Student Union – 3rd Floor*

Symposium: Environmental Chemistry

CHAIR: Dr. Barry Hibbs, California State University, Los Angeles

| Time | No. | Paper |
|---------------|-----|---|
| 8:00 – 8:10 | | INTRODUCTION – Barry Hibbs, Ph.D., Professor of Chemistry & Biochemistry, California State University, Los Angeles |
| 8:15 – 8:35 | 76 | CO-PARTITIONING OF LEAD WITH MTBE INTO WATER: IMPLICATIONS FOR MTBE – SOURCE CORRELATIONS. D. Barron and <u>R.W. Hurst</u> . Department of Geological Sciences, California State University, Los Angeles, Los Angeles, CA. |
| 8:40 – 9:00 | 77 | PHYSICAL-CHEMICAL CHARACTERIZATION OF WEST COAST MANUFACTURED GAS PLANT (MGP) SOILS <u>T.C. Harmon</u> , G.A. Burks and M. Hosseini, Department of Civil & Environmental Engineering, University of California, Los Angeles CA |
| 9:05 – 9:25 * | 78 | HEAL THE BAY'S MALIBU CREEK STREAM TEAM (PS) <u>Matthew Horns</u> . Heal the Bay, Santa Monica, CA |
| 9:30 – 9:50 * | 79 | DISCHARGE OF POLLUTED GROUNDWATER INTO MALIBU CREEK AND LAGOON RESULTING FROM SEPTIC SYSTEM LOADING AND STREAM AQUIFER INTERACTIONS (PS) <u>R.D. Vergets</u> , Department of Geological Sciences, California State University Los Angeles, Los Angeles, CA |
| 9:55 – 10:15 | 80 | LAND USE CHANGE AS A CAUSE OF TRACE METAL CONTAMINATION OF A SHALLOW AQUIFER, ORANGE COUNTY, CALIFORNIA <u>B.J. Hibbs</u> and M. Lee., Department of Geological Sciences, California State University, Los Angeles, Los Angeles, CA |
| 10:20 – 10:40 | 81 | ISOTOPIC EVALUATION OF SOURCES AND MIXING RELATIONS FOR RECENTLY RECHARGED GROUNDWATERS, NORTHERN ORANGE COUNTY, CALIFORNIA <u>D. Clemens-Knott</u> , G.T. Yoshiba and J.H. Foster, Department of Geological Sciences, California State University Fullerton, M.L. Davisson and G.B. Hudson, Lawrence Livermore National Laboratory, CA. |
| 10:40 - 11:00 | | BREAK |
| 11:00 - 12:00 | | PLENARY SPEAKER –Dr. Blake Gumprecht, Department of Geography University of Oklahoma <i>The Los Angeles River, Its Life, Death and Possible Rebirth</i> BIOLOGICAL SCIENCES ROOM 144 |

Afternoon

- 1:20 – 1:40 82 THE ROLE OF GROUNDWATER IN GEOLOGIC HAZARDS
W. Richard Laton, Department of Geological Sciences, California State University, Fullerton, CA.
- 1:45 – 2:05 83 CAN THE SALTON SEA BE DESALTED: A COST BENEFIT ANALYSIS
Ivan P. Colburn, Department of Geological Sciences, California State University, Los Angeles, Los Angeles, CA.
- 2:10 – 2:30 84 LIVING ON THE EDGE: CHLORIDE, BROMIDE AND NITRATE ION REACTIVITY AT THE AIR-WATER INTERFACE.
K.L. Foster, California State University, Los Angeles, Department of Chemistry and Biochemistry, Los Angeles, CA 90032.
- 2:35 – 2:50 85 FOURIER TRANSFORM INFRARED (FTIR) STUDIES OF HETEROGENEOUS REACTIONS BETWEEN GASEOUS POLLUTANTS IN THE ATMOSPHERE AND NITRIC ACID (HNO₃) ON SILICA SURFACES AS A FUNCTION OF THE TYPE OF SURFACE AND RELATIVE HUMIDITY (RH).
A.M. Rivera-Figueroa, M. Mochida And B.J. Finlayson-Pitts. University Of California, Irvine. Department Of Chemistry, Irvine, CA.
- 3:00 – 3:20 BREAK
- 3:20 – 3:40 * 86 MONITORING AMBIENT GAS PHASE POLLUTANTS ON A FINE SPATIAL SCALE IN EAST LOS ANGELES (PS)
Charlene Acdan Chin, Daisy Mah, and Scott L. Nickolaisen, Department of Chemistry & Biochemistry, California State University, Los Angeles, CA.
- 3:45 – 4:05 87 PARTICULATE AIR POLLUTION SAMPLING AND ANALYSES: A STUDY OF VARIABILITY WITHIN A SUBURBAN EAST LOS ANGELES NEIGHBORHOOD
S. LaDochy, J. Faliti, M. Luna, and J. Rivero, California State University, Los Angeles, Department of Geography & Urban Analysis; and F. Zhou, Y. Garcia, I. Madu, California State University, Los Angeles, Department of Chemistry and Biochemistry
- 4:10 – 4:30 88 TEMPORAL AND SPATIAL DIFFERENCES IN PASSIVE MONITOR NITRITE OXIDATION RELATIONSHIPS WITH AVERAGE HOURLY AMBIENT OZONE CONCENTRATIONS.
Michael Arbaugh, Andrzej Bytnerowicz, Haiganoush Preisler, Rocio Alonso, Susan Schilling Riverside Fire Laboratory, USDA-Forest Service, 4955 Canyon Crest Dr., Riverside, CA
- 5:00 – 7:00 WINE AND CHEESE RECEPTION – PROGRAM AREA,
STUDENT UNION – 2ND FLOOR

SCAS 2001 SESSION SCHEDULE

Saturday Morning, May 5

Location: Biological Sciences Room 334

Contributed Papers: Fish Biology- Ecology, Evolution, Physiology

CHAIR: Dr. Kathryn Dickson, California State University, Fullerton

| <u>Time</u> | <u>No.</u> | <u>Paper</u> |
|-----------------|------------|---|
| 8:00 – 8:20 * | 89 | GETTING A BEAD ON FISH LENGTH: USING UNDERWATER VIDEO AND LASER SIGHTS TO DETERMINE LENGTHS OF KELP BASS (<i>Paralabrax clathratus</i>) IN THE FIELD (FB) <u>S. Snider</u> and <u>C.G. Lowe</u> . Dept. of Biological Sciences, CSU Long Beach, 1250 Bellflower Blvd., Long Beach CA |
| 8:20 - 8:40 * | 90 | PARASITES ON FISHES IN SANTA MONICA BAY, AN AREA INFLUENCED BY A MAJOR WASTEWATER OUTFALL (FB) <u>J. Kalman</u> . California State University, Long Beach; Department of Biological Sciences; 1250 Bellflower Blvd.; Long Beach, CA |
| 8:40 – 9:00 * | 91 | THE ORIGIN OF PRE- AND POST-ROTENONE TREATMENT LAKE DAVIS NORHTERN PIKE (<i>ESOX LUCIUS</i>) (FB) <u>A. Aguilar</u> and <u>R. K. Wayne</u> . Department of Organismic Biology, Ecology & Evolution, University of California Los Angeles, Los Angeles, CA |
| 9:00 – 9:20 * | 92 | ENDOCRINE RESPONSE TO STRESS IN THE JACK MACKEREL: POTENTIAL RELATIONSHIP TO GROWTH (FB) <u>Maelanie M. Galima</u> and <u>Kevin M. Kelley</u> . Endocrinology Laboratory, Department of Biological Sciences, California State University Long Beach, CA |
| 9:20 – 9:40 * | 93 | THE EFFECT OF REPRODUCTIVE MODE AND HABITAT PREFERENCE ON THE GENETIC STRUCTURE OF SEVERAL EASTERN PACIFIC ESTUARINE FISHES (FB) <u>K.D Louie</u> , <u>K.P. Koepfli</u> , and <u>D. K. Jacobs</u> . Department of Organismic Biology, Ecology and Evolution, University of California, Los Angeles, CA |
| 9:40 – 10:00 | 94 | TEMPORAL STABILITY IN THE FALL SEASON PARASITIC INTERACTION OF THE CYMOTHOID ISOPOD <i>LIRONECA CALIFORNIA</i> ON THE SHINER PERCH (<i>CYMATOGASTER AGGREGATA</i>) IN BODEGA BAY, CALIFORNIA <u>D. G. Buth</u> , <u>M. Barlow</u> , <u>B. Hajduczek</u> , <u>S. Johnson</u> , and <u>V. M. Morris</u> . Department of Organismic Biology, Ecology, and Evolution, University of California (UCLA), Los Angeles, CA |
| 10:00 – 10:20 * | 95 | TEMPERATURE EFFECTS ON THE FEEDING BIOLOGY OF THREE SEAWEED-EATING SPECIES OF <i>TEGULA</i> (TROCHIDAE; GASTROPODA) FROM CENTRAL AND SOUTHERN CALIFORNIA (EE) <u>Everett Yee</u> and <u>S. Murray</u> , California State University, Fullerton, Department of Biological Science, Fullerton, CA |
| 10:20 – 10:40 * | 96 | BEHAVIORAL TIME-BUDGET STUDY OF THE YELLOW TANG, <i>ZEBRASOMA FLAVESCENS</i> IN AN ARTIFICIAL AND NATURAL REEF ENVIRONMENT (EE) <u>Kim Anthony</u> and <u>C.G. Lowe</u> . Dept. of Biological Sciences, CSU Long Beach, 1250Bellflower Blvd., Long Beach CA |
| 10:40 – 11:00 | | BREAK |

11:00 - 12:00

PLENARY SPEAKER –Dr. Blake Gumprecht, Department of Geography
University of Oklahoma
The Los Angeles River, Its Life Death and Possible Rebirth
BIOLOGICAL SCIENCES ROOM 144

Afternoon

Contributed Papers: Ecology/Evolution

CHAIR: Dr. Kathryn Dickson, California State University, Fullerton

| Time | No. | Paper |
|---------------|-----|--|
| 1:20 – 1:40 * | 97 | ROUTINE AND STANDARD METABOLIC RATES OF THE ROUND STINGRAY (<i>Urolophus halleri</i>) (MBP) <u>T.D. Royal</u> and C.G. Lowe. Dept. of Biological Sciences, CSU Long Beach, 1250 Bellflower Blvd., Long Beach CA |
| 1:40 – 2:00 * | 98 | THE IMPACT OF NATIVE PREDATORS ON AN INVASIVE WHELK: SEA OTTERS AND SEASHELLS BY THE SEASHORE. (EE) <u>S. I. Lonhart</u> . Department of Ecology and Evolutionary Biology, UC Santa Cruz, CA |
| 2:00 – 2:20 | 99 | A COMPARISON OF PLASTIC AND PLANKTON IN THE NORTH PACIFIC CENTRAL GYRE <u>C.J. Moore</u> , Algalita Marine Research Foundation, 345 Bay Shore Avenue, Long Beach, CA. Shelly Moore, M.K. Leecaster, and S.B. Weisberg, Southern California Coastal Water Research Project, 7171 Fenwick Lane, Westminster, CA |
| 2:20 – 2:40 * | 100 | THE PALEOECOLOGY OF LATE PLEISTOCENE FRESHWATER OSTRACODES RECOVERED FROM SEDIMENTS IN THE CHINO BASIN, SOUTHERN CALIFORNIA. (EE) <u>James J. Steinmetz</u> . University of Southern California, Rossier School of Education, Los Angeles, Ca |
| 2:40 – 3:00 * | 101 | LONG-TERM CHANGES IN THE ROCKY INTERTIDAL FLORA ALONG THE PALOS VERDES PENINSULA (LOS ANGELES COUNTY).(EE) <u>Amanda Gerrard</u> and Steve Murray. Department of Biological Science, California State University, Fullerton, CA |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 3:40 | 102 | INVASIVE MARINE CHLOROPHYTE, <i>CAULERPA TAXIFOLIA</i> , DISCOVERED AT TWO SOUTHERN CALIFORNIA SITES <u>R.A. Woodfield</u> and K.W. Merkel. Merkel & Associates, Inc., 5434 Ruffin Rd., San Diego, CA |
| 3:40 – 4:00 | 103 | A PALEOCLIMATIC ASSESSMENT OF THE MIDDLE TO UPPER EOCENE OF CENTRAL WYOMING BASED ON A FOSSIL WOOD ASSEMBLAGE. <u>Jennifer H. Jones</u> , Jay H. Jones Department of Biology, University of La Verne, 1950 Third St., La Verne, CA |

- 4:00 – 4:20 104 THE LACK OF RELATIONSHIPS BETWEEN NUTRIENTS AND ALGAE COVERAGE IN MALIBU CREEK AND LAGOON
Earl Byron 1, and Randal Orton 2, 1.CH2M HILL, 2485 Natomas Park Dr., Suite 600, Sacramento, CA., 2. Las Virgenes Municipal Water District, 4232 Las Virgenes Rd., Calabasas, CA
- 4:20 – 4:40 105 INSULAR POPULATION DYNAMICS OF DEER MICE (*PEROMYSCUS MANICULATUS SUBSP.*) ON SANTA BARBARA AND SAN MIGUEL ISLANDS: INTRINSIC POPULATION RESPONSES TO EXTREME DENSITIES.
C.A. Schwemm and T.J. Coonan. Channel Islands National Park, National Park Service, Ventura, CA
- 4:40 – 5:00 106 THE UNPUBLISHED WORK OF YUK-MAAN LEUNG ON THE ECTOSYMBIOTIC CILIATED PROTOZOA OF THE NEBALIIDS.
T.P. Smith¹ and J.L. Mohr². ¹2901 Midwick Dr., Alhambra, CA 91803, ²University of Southern California, Department of Biological Sciences, Los Angeles, CA 90007
- 5:00 – 7:00 WINE AND CHEESE RECEPTION – PROGRAM AREA,
STUDENT UNION – 2ND FLOOR

SCAS 2001 SESSION SCHEDULE

Saturday Morning, May 5

Location: Biological Sciences Room 244

Southern California Junior Academy of Sciences

CHAIR: Ms. Gloria Takahashi, La Habra High School

| Time | No. | Paper |
|--------------|-----|--|
| 8:00 - 8:15 | | INTRODUCTION to SCJAS and Research Training Program Ms. Martha Schwartz and Mr. Richard Scharz, SCAS Board Members |
| 8:15 - 8:30 | 107 | NONLINEAR CIRCUIT WITH OSCILLATING IMPEDANCE <u>J. Manasson</u> and V. A. Manasson, Marlborough School, Los Angeles, CA 90004 |
| 8:30 - 8:45 | 108 | THE GREEN TEA POLYPHENOL, EPIGALLOCATECHIN GALLATE, INDUCES APOPTOSIS IN MALIGNANT CELLS. Sarah Appleman, Phage Biotechnology Corporation, Tustin, CA |
| 8:45 - 9:00 | 109 | IMMUNE RESPONSE OF NEONATAL RHESUS MACAQUES TO RECOMBINANT SIMIAN IMMUNODEFICIENCY VIRUS USING ENZYME LINKED IMMUNOSORBENT ASSAY <u>Christel S. Miller</u> ¹ and <u>Shabbir Ahmad</u> ² , California Academy of Mathematics and Science, Carson, CA 90747 ¹ , International Laboratory of Molecular Biology for Tropical Disease Agents, Department of Veterinary Pathology, School of Veterinary Medicine, University of California, Davis, Davis, CA 95616 ² |
| 9:00 - 9:15 | 110 | A HIGH-RESOLUTION PALEOMAGNETIC SECULAR VARIATION RECORD FROM THE EQUATORIAL WEST PACIFIC OCEAN SPANNING THE LAST 65,000 YEARS <u>A.P. Chen</u> and S. Lund. University of Southern California, Department of Earth Sciences, Los Angeles, CA. |
| 9:15 - 9:30 | 111 | CLOSE SOLUTIONS OF VECTOR EQUATIONS WITH COMPUTER C++ IMPLEMENTATION THAT ALBERT EINSTEIN DID NOT FINISH. <u>Richard (Chao-Kuo) Lin</u> , 833 Market Street, #300, San Francisco, CA |
| 9:30 - 9:45 | | BREAK |
| 9:45 - 10:00 | 112 | UNIFIED APPROACH TO SOLVING QUADRATICS AND CUBIC EQUATIONS WITH PRATICAL USAGE IN SCIENCE AND MATHEMATICS. <u>Steven Zhao</u> , Olympia Institution, 833 Market Street, Room 301, San Francisco, CA. |
| 10:00-10:15 | 113 | THE COMPETITION OF NATIVE CALIFORNIA SEA MUSSELS (<i>MYTILUS CALIFORNIANUS</i>) AND NON-NATIVE JAPANESE OYSTERS (<i>CRASSOSTREA GIGAS</i>) FOR NUTRIENTS AND HABITAT <u>K.M. McCully</u> and L. Chilton, Cabrillo Marine Aquarium, San Pedro, CA 90731 |
| 10:35-10:30 | 114 | THE SYSTEM DYNAMICS OF ALTERNATIVE FUEL VEHICLES <u>Leslie E. Kao</u> , Palos Verdes Peninsula High School, Rolling Hills Estates, CA Mentors: Dr. K. Merryfield and Dr. J. Hou, California State University at Long Beach, Department of Mathematics, Department of Economics, Long Beach, CA |

| Time | No | Paper |
|--------------|-----|--|
| 10:30-10:45 | 115 | MAGNETIZATION OF MATERIALS USED IN CONSTRUCTION OF CRYOSTATS AT LOW TEMPERATURES <i>John Xia</i> , Torrance High School, Torrance, CA 90501. Hans M. Bozler, Department of Physics and Astronomy, University of Southern California, Los Angeles, CA 90089-0484 |
| 10:45-11:00 | | BREAK TO PLENARY |
| 11:00-12:00 | | PLENARY SPEAKER –Dr. Blake Gumbrecht, Department of Geography University of Oklahoma <i>The Los Angeles River: Its Life, Death and Possible Rebirth</i> BIOLOGICAL SCIENCES ROOM 144 |
| 12:00 – 1:15 | | LUNCH – BIOLOGICAL SCIENCES, ROOM 268 THE JR. ACADEMY OF SCIENCES LUNCHEON IS SPONSORED BY MARTHA AND RICHARD SCHWARTZ |

Afternoon

| Time | No | Paper |
|-------------|----|---|
| 1:30 – 1:45 | | INSIGHT INTO THE INTEL SCIENCE TALENT COMPETITION Christel Miller and Amy Chen |
| 1:45 – 2:00 | | REFLECTIONS OF THE AMERICAN JUNIOR ACADEMY OF SCIENCES MEETING IN SAN FRANCISCO, CALIFORNIA - FEBRUARY 2001 Christel Miller and other participants |
| 2:00 – 3:00 | | ATTEND SCAS SESSIONS |
| 3:00 – 3:20 | | BREAK |
| 3:20 – 5:00 | | ATTEND SCAS SESSIONS |
| 5:00 – 7:00 | | WINE AND CHEESE RECEPTION – PROGRAM AREA, STUDENT UNION – 2 ND FLOOR |

ABSTRACTS

1. REVISING OUR VIEW OF THE OCEANIC NITROGEN CYCLE

Douglas G. Capone, Wrigley Institute for Environmental Studies and Department of Biological Sciences, University of Southern California, Los Angeles, CA 90089-0371

A revolution in our understanding of the marine nitrogen cycle and the role of microorganisms in it is currently underway. It had generally been thought that nitrogen is the most common nutrient limiting primary production by phytoplankton through much of the world's upper ocean, that the main source of inorganic nitrogen is the large reserves of nitrogen (as nitrate) in the deep ocean, and that microbial N₂ fixation is of relatively minor import in the seas at large and in the global marine N balance. Recent observations in biological oceanography, molecular ecology, geochemistry and paleoecology now prompt us to review and radically revise our view of the quantitative importance of this process in the N cycle of the present, as well as the past, ocean. Moreover, the simple view that there are only a few key N₂ fixers in the sea is being challenged as new studies unveil a much broader suite of potential diazotrophs resident in the oceans. Importantly, marine N₂ fixation has been proposed as one of the key components in a suite of interactions and feedbacks between the oceans and atmospheric CO₂. Developing an understanding of the controls on marine N₂ fixation has taken on more immediate importance.

2. NUTRIENT DYNAMICS IN COASTAL UPWELLING SYSTEMS OF THE COAST OF CALIFORNIA

F.P. Wilkerson and R.C. Dugdale, Romberg Tiburon Center, San Francisco State University, Tiburon, CA 94920.

Eastern boundary coastal upwelling systems are important areas of biological production where the flux of nutrients from depth to the euphotic zone results in enhanced primary production. The quality of new and primary production and the composition and size structure of the phytoplankton assemblage are major determinants of the quantity of productivity that occurs. Data from the upwelling areas off Monterey Bay (near Año Nuevo) and Bodega Bay, California will be used to describe the response of phytoplankton to upwelled nitrate and silicate. In both areas, strong wind driven upwelling provides abundant nutrients resulting in high concentrations of phytoplankton (and associated productivity) reaching bloom conditions that are typically dominated by the larger phytoplankton, such as diatoms. Off Bodega Bay, along the shelf, chlorophyll concentration reached 30 ug/l and was composed mostly of a diatom (*Chaetoceros* sp.). In comparison, off-shore, chlorophyll concentrations were low and the population was dominated by smaller, flagellated phytoplankton. Nutrient uptake measured using the stable isotope ¹⁵N show that in both upwelling areas that the larger phytoplankton dominate nitrate uptake (i.e. new production) and as the productivity cycle develops, are responsible for nutrient draw down that takes between 2-5 days.

3. SILICON, NITROGEN, IRON AND LIGHT: WHAT REALLY CONTROLS DIATOM PRODUCTION

R.M Kudela. University of California Santa Cruz, Ocean Sciences Department, Santa Cruz, CA, 90564.

Of all the potentially limiting nutrients in the ocean, only Si selects specifically against one type of phytoplankton when it becomes limiting. Diatoms have an absolute Si requirement for growth and other marine autotrophs do not, such that Si limitation affects only diatoms. It is somewhat surprising, then, that we know so little about how silicon regulates diatom growth and indirectly shapes ecosystem structure through species selection. Silicon has largely been ignored in recent years, as oceanographers focused on the role of other macro-nutrients such as nitrogen, micro-nutrients such as iron, and non-siliceous organisms such as autotrophic bacteria and the role of the microbial web. Recent technological advances have allowed us to re-examine the role of silicon in controlling diatom production, with some surprising results. This presentation

will focus on the interactions between Si metabolism and photosynthesis, and how this affects our understanding of local harmful algal bloom dynamics and global HNLC regions.

4. DETERMINING THE RELATIVE IMPORTANCE OF TERRESTRIAL AND OCEANIC SOURCES OF NUTRIENTS TO ESTUARIES ALONG THE WEST COAST OF THE U.S.

P. Fong, K.E. Boyer, and A.R. Armitage. UCLA, Department of Organismic Biology, Ecology, and Evolution, Los Angeles, CA, 90095

Macroalgae were collected along a latitudinal gradient inside bays and estuaries to determine if the nitrogen (N) and phosphorus (P) content of their tissues as well as their $^{15}\text{N}/^{14}\text{N}$ isotopic ratios reflected differences in nutrient availability and source. Collections were conducted in two summers (1998 - 99) and sites ranged from the US/Mexican border to Puget Sound, WA. Species that were abundant across as many of the sites as possible were used for comparisons; collections included *Ulva expansa*, *Porphyra perforata*, *Enteromorpha intestinalis*, and *Gracilaria* spp. Each of these algae are opportunistic, fast-growing, cosmopolitan, and have the ability to take up and store nutrients rapidly; thus, they are capable of recording nutrient supply in their tissues over a time scale of days to weeks compared to water column sampling that only provides a snap-shot in time. Tissue N and P content of all species varied along the latitudinal gradient, with higher nutrients in algae collected farthest north and decreasing with latitude. In addition, isotopic ratios indicated that estuaries in Southern and Central California have significant influxes of terrestrial nutrients. The importance of terrestrial nutrients declined with increasing latitude while the importance of advection of upwelled oceanic water into estuaries increased. We conclude that the tissue N and P content of macroalgae may provide useful insight into nutrient availability and sources in coastal marine systems. Furthermore, cosmopolitan species may be especially useful in comparing nutrient regime over large latitudinal and habitat ranges.

5. NUTRIENT EXCHANGE BETWEEN CARPINTERIA SALT MARSH NATURE PARK AND AN ADJOINING TIDAL CHANNEL

H. M. Page and J. E. Dugan. Marine Science Institute, University of California, Santa Barbara, CA 93106.

One of the often-cited values of coastal wetlands is their potential role in the improvement of water quality through the conversion or assimilation of nutrients delivered in watershed runoff. Carpinteria Salt Marsh Nature Park is a 15 acre, 3.5 year old restored tidal wetland at the eastern end of a larger 230 acre natural marsh. Tidal exchange in the Nature Park occurs through two culverts that connect to a creek draining a watershed occupied by agricultural and urban development. That controlled flow of tidal waters into and out of the wetland provides an opportunity to estimate nutrient exchange between the wetland and adjoining channel waters. To explore whether the Nature Park is a source or sink of nutrients, we measured water levels, flow rates, salinities, and nutrient concentrations in tidal waters entering and leaving the restoration site through the culverts during selected tide cycles. Salinities of flood waters ranged from 5 to 34‰. Nitrate-N concentrations in tidal waters were typically highest during flood tides and following rainfall events (~700 μm) and were inversely related to salinity. Flow rates and nutrient concentrations varied between culverts; waters entering the upstream culvert typically had lower salinity and higher nutrient concentrations than the downstream culvert. Comparisons of nutrient concentrations as a function of salinity for ebb and flood waters indicated that the wetland was often a sink for inorganic nitrogen although this pattern was not consistently evident. Stable nitrogen isotope analysis of algae and vegetation will provide insights on where nutrient uptake may occur.

6. DO ESTUARINE SEDIMENTS CONTRIBUTE TO MACROALGAL GROWTH? DIRECT EXPERIMENTAL EVIDENCE FROM A BIOASSAY

K. Kamer and K. Schiff. Southern California Coastal Water Research Project, Westminster, CA, 92683; P. Fong and R. L. Kennison. Department of Organismic Biology, Ecology and Evolution, University of California, Los Angeles, Los Angeles, CA, 90095.

Upper Newport Bay, Orange County, CA, is one of the largest estuaries in southern California and is subject to high nutrient inputs from surrounding urbanization. UNB also suffers seasonal macroalgal blooms comprised of the green macroalgae *Enteromorpha intestinalis* and *Ulva expansa*. Data previously collected in UNB suggests that seasonal inputs of nitrogen via San Diego Creek were stored in the sediments and then used by the algae during summer blooms. We conducted a bioassay using sediments, algae, and water from three areas in UNB to determine if sediment nutrients directly contribute to growth and nutrient content of *E. intestinalis*. We hypothesized that growth and the amount of nitrogen contained in algal tissue would be higher in algae in the presence of estuarine sediments than in controls (experimental units containing inert sand). Results of this experiment and implications to nutrient loading to the system will be discussed. Nutrient fluxes from the benthos may have significant impacts on magnitude and duration of macroalgal blooms.

7. NUTRIENT INTERACTIONS BETWEEN MACROALGAE AND EMERGENT VASCULAR PLANTS IN SOUTHERN CALIFORNIA ESTUARIES.

K. E. Bover and P. Fong. Department of Organismic Biology, Ecology, and Evolution, University of California, Los Angeles, 90095.

In southern California estuaries, macroalgal mats are common due to high nutrient inputs. When underlying layers of algal tissue decompose, nutrients may be recycled within the mat or lost to the sediments or water column. We hypothesized that algal mats occurring in saltmarshes may transfer nutrients to vascular plants through releases to sediments. Of particular interest is whether this effect occurs in nitrogen (N)-deficient soils common at created marshes. Using a flow-through, low-nutrient seawater system and tidal simulator, we investigated whether *Enteromorpha intestinalis* releases N to sandy sediments and if algal density affects this release. We further explored the extent to which algal N becomes available to the saltmarsh plant, *Salicornia virginica*. By first culturing *Enteromorpha* in 15N-enriched seawater, we were able to trace N flows within our experimental saltmarsh system. We found algal biomass to decrease greatly and that loss of N mass was large (up to 66%) and positively related to mat density. The percent of 15N present increased incrementally in soils and *Salicornia* with increasing density of macroalgae. However, the N taken up by *Salicornia* was not enough to increase its tissue N or biomass; the highest mass of algal N loss is equivalent to a single application in our biweekly fertilization of *Salicornia* in a restoration marsh. Low-nutrient seawater in our experiment did not support algal mat growth; however, we suspect that mats in eutrophic systems may both release nutrients from underlying tissues and continue to "bloom", possibly allowing sustained N transfers to saltmarsh plants.

8. ESTABLISHING BACKGROUND CONCENTRATIONS FOR NUTRIENTS IN A SANTA MONICA MOUNTAINS WATERSHED

S. Birosik, California Regional Water Quality Control Board, Los Angeles Region, 320 W. 4th Street, Suite 200, Los Angeles, CA, 90013.

For a variety of reasons, it may become necessary to establish background concentrations for constituents in a watershed. This information may be needed for Total Maximum Daily Load (TMDL) development, to aid in evaluating the health of the watershed, or to serve as the starting point for site-specific water quality objective development where a numeric objective currently does not exist. Watershed-specific information is particularly important for nutrients due to the numerous factors, both natural and anthropogenic, which influence their concentrations, which, in turn, influence crucial water quality parameters such as dissolved oxygen. Of particular interest is the recent publication by USEPA of recommended "ecoregional" nutrient criteria in order to reduce problems associated with excess nutrients. These criteria are suggested baselines which states may use as starting points to identify more precise levels needed to protect beneficial uses on a smaller geographical scale. For the Malibu Creek Watershed, in the Santa Monica Mountains of southern California, a ten-year dataset of nitrate-N and phosphate-P sorted by season or by predominant land use was evaluated using frequency histograms. Comparisons were made with nutrient concentrations in nearby smaller coastal streams. Where these numbers fall in relation to the USEPA recommended criteria will be presented.

9. SPATIAL INTERACTIONS IN PLANT ECOLOGY: DATA COLLECTION, DATA ANALYSIS, AND MATHEMATICAL MODELING.

D.H. Deutschman, San Diego State University, Department of Biology, San Diego, CA 92182.

Recent attention has focused on the role of spatial interactions in mediating important ecological processes from local competition to large-scale biomass storage and carbon flux. Much of the literature appropriate for investigating spatial dynamics exists across a variety of disciplines including statistics, geography, and computer science. It is vital that we investigate the role of space in plant ecology and broaden the understanding and use of these techniques among all ecologists. Observational studies need to be designed to estimate both the spatial and functional signals. Systematic, stratified, and nested sampling designs have different strengths and weaknesses for separating the spatial and non-spatial signals. Similarly, field experiments need to carefully consider the influence of space. Statistical analysis of ecological data must respect the fact that spatial autocorrelations are prevalent and may contaminate traditional general linear models. Finally, mathematical models of ecological processes can be designed to incorporate spatial interactions. Reaction-Diffusion models, cellular automata, and spatially-explicit, individual-based models incorporate spatial processes. I will give several examples of the role of local dispersal and competition in mediating large-scale pattern in plant ecosystems. Examples will be drawn from field projects in California sage-scrub and a simulation model of a hardwood forests from the Northeastern US to show that these concepts are quite general. I argue that understanding spatial interactions is central to many fundamental questions in plant ecology and should be considered in all stages of research from design of the data collection, through data analysis and modeling.

10. EXPLORING THE SENSITIVITY OF AN ENDANGERED SPECIES TO CHANGES IN DEMOGRAPHY AND HABITAT USING AN INDIVIDUAL-BASED MODEL FOR THE CAPE SABLE SEASIDE SPARROW (*AMMODRAMUS MARITIMUS MIRABILIS*)

Elder, Bret, and M. Philip Nott. Department of Environmental Studies, University of California, Santa Cruz, CA 95064 (BE) and Institute for Bird Populations, Point Reyes Station, CA 94956 (MPN)

The Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), a US endangered species, occurs in the isolated short-hydroperiod marl prairies of the Everglades of South Florida. Several sub-populations are threatened by changes in hydrology and subsequent habitat change. In order to explore the effects of a changing landscape on sparrow population dynamics, we constructed a spatially-explicit individual-based Monte Carlo model. The model (SIMSPAR) includes the topography, vegetation and hydrology of sparrow habitat as well as field-derived demographic parameters. We explored the population's sensitivity to behavioral, demographic and landscape level changes. Sparrow populations are highly sensitive to changes in maximum number of clutches, mortality rates, and female dispersal distance. Degradation of sparrow habitat resulted in a greater than proportional decrease in breeding population size and increased the population's coefficient of variation. If habitat was degraded by allowing shrub invasion of higher elevation breeding areas, the population levels declined to a greater extent than if habitat was degraded by other means. Although this population is sensitive to changes in demographic and behavioral parameters, these results highlight the sparrow's sensitivity to habitat quality and the importance of using spatially explicit models to explore a species response to landscape level as well as demographic changes.

11. MODELING IN CONTINUOUS SPACE AND TIME: WHEN BEING DISCRETE JUST ISN'T ENOUGH

Doug Donalson, Department of Biological Sciences, California State University, Los Angeles, CA 90032

Most individual based models are constructed using a discrete time/discrete space engine. While, for many applications, this causes no model artifacts, there can be effects introduced by the fine grain quantization of time and space. In discrete time model, the artifacts can occur two ways. The first is from the assumption that the average behavior during a time interval is equivalent to the starting value of the state variables. The second can occur when the different mechanisms that cause state changes within the time interval are not executed randomly. One artifact that can be introduced in a model using discrete space is what I term

implicit competition. An individual that colonizes a cell, no matter its size, immediately excludes all other individuals from the entire area of the cell. An alternate method for handling space and time in individual based models is the use of continuous time and space. A continuous time engine is also called an event driven schedule and works from the assumption that no two events (or state changes) ever occur simultaneously. Because of this, time can be advanced state change by state change. In a continuous space model, an individual can occupy any coordinate within the spatial arena, as opposed to being constrained to the center of a cell. I give an overview of implementations of a continuous time/continuous space model vs. a discrete time/discrete space model. I then discuss some of the advantages and disadvantages of each type of model.

12. UNDERSTANDING THE INFLUENCE OF OCEANOGRAPHIC FORCING ON MUSSEL BED DYNAMICS: SIGNATURES OF LOCAL INTERACTIONS.

Frederic Guichard, Department of Ecology and Evolutionary Biology, Princeton University, Princeton, New Jersey, 08544.

Predicting macroscopic properties of ecosystems from local interactions is a great challenge for ecologists. I will present a spatially-explicit simulation of mussel disturbance dynamics and compare the results with data from 6 mussel beds along the Oregon coast. The model implements local interactions among nearest-neighbor cells within a lattice, where each cell can be either empty, occupied by a mussel bed, or disturbed. The model then allows local (density-dependent) transition rules for both disturbance and recovery. Mussel beds are disturbed by new disturbances or if at least one neighbor is disturbed. Disturbed cells stabilize within one time step, and empty cells recover as a function of occupied neighbors. Neighborhood effects were validated using artificial gap data showing that occupied neighbors facilitate recovery, and natural mussel bed data showing that new disturbances and new mussel beds have a high connectivity with existing clusters, thus suggesting spreading mechanisms. The model predicts very sharp transitions in mussel abundance along productivity and disturbance gradients. I will describe the basic behavior of the system associated with critical values of parameters and show that for a wide range of parameters, clusters of mussels coexist with gaps, and they have a scale invariant size distribution and a fractal shape. These emerging properties of mussel beds can be observed in field data and be used to characterize oceanographic conditions. These results also provide evidence that macroscopic properties of intertidal communities can emerge from the local interactions between biotic and abiotic processes at the meter scale.

13. ANALYZING THE EFFECTS OF MECHANISMS GOVERNING RECRUITMENT, PREDATION, AND GROWTH ON PATTERN FORMATION IN MUSSEL BEDS

R.A. Desharnais, D.D. Donalson, and C.D. Robles. California State University at Los Angeles, Department of Biological Sciences, Los Angeles, CA, 90032.

The development of theory for benthic marine communities has reached a crisis point. The paradigm that governed the thoughts of many researchers for a generation—and which therefore underlie explanations of such diverse phenomena as intertidal zonation, maintenance of diversity, and stable coexistence of predators and prey—has begun to disintegrate under the force of new observations and experiments. The theories of keystone predation and prey refugia have provided a unified explanation for zonation, the maintenance of diversity, and mechanisms promoting the coexistence of predators and prey. Recent studies reveal the limitations of the paradigm. The keystone and refugia explanations are not universal generalities, but part of a larger set of predator-prey interactions. The new information suggests that theory must consider spatial arrangements of individuals over environmental gradients in ways that may best be expressed in spatially explicit population models. The Stochastic Arena Model (SAM), is a cellular automata model designed to test the strengths of different mechanisms known to effect the population dynamics of intertidal mussel beds. These factors include wave stress, spatial variation in growth, size specific predation risk, spatially varying predation risks, spatially varying recruitment, and neighbor effects on recruitment and predation. We use both qualitative and quantitative spatial analysis techniques to compare and contrast the effects of these mechanisms. We focus on the edges of the mussel bed and how they expand and contract with changing

effects as well as how the spatial structure of the edge changes. We attempt to correlate the model results with field data.

14. *PISASTER-MYTILUS* INTERACTIONS IN THE ROCKY INTERTIDAL: SPATIALLY-EXPLICIT SIMULATION MODELS OF *PISASTER* FORAGING

Harold P. Batchelder, College of Oceanic and Atmospheric Sciences, 104 Ocean Admin Bldg, Oregon State University, Corvallis, OR 97331-5503

Spatially-explicit simulation models of seastars (*Pisaster*) foraging on randomly located mussels in an intertidal environment yield spatial patterns of mussels (*Mytilus*) resembling those observed in real intertidal habitats. The seastars forage using simple movement rules--a random walk with some restrictions placed upon them by tidal height, emergence, and prey handling time. Movement and displacement of the seastars is a function of their size and prey density, size and distribution. Prey handling time and prey attractiveness to attack is a function of the relative size of prey to predator. Simulation results suggest that large, relatively mobile, predators can nearly completely eliminate prey from intertidal habitat, although, by chance alone, a few prey usually escape predation (in these short duration model simulations). The present models use static (imposed) initial prey fields; future simulations will include dynamic prey populations that experience recruitment and growth.

15. MOVEMENTS OF INDIVIDUALS OF THE KEYSTONE PREDATOR *PISASTER OCHRACEUS* OVER INTERTIDAL LANDSCAPES WITH VARYING WAVE EXPOSURES AND PREY DISTRIBUTIONS.

¹ C. D. Robles, ¹R., Paillet, and ²J. Shima. ¹Department of Biological Sciences, California State University at Los Angeles, CA, 90032; ²Department of Ecology, Evolution and Marine Biology, University of California at Santa Barbara, CA 93106.

Theory holds that intertidal predatory invertebrates are comparatively sedentary, and therefore, incapable of moving among local populations within the metapopulation of their prey. Sea stars (*Pisaster ochraceus*) were tagged with passive internal transponders and translocated between sites of contrasting wave exposures and prey distributions (treatments) or within the same site (controls). Subsequent movements were plotted on GIS landscapes. Alongshore movement rates on a given type of site were the same for treatments and controls. Sea stars on wave exposed sites with prey zones extending to low shore levels diffused slowly from the release points. Sea stars on sheltered sites with sparse high zones of prey diffused an order of magnitude faster. At both types of sites, alongshore movements > 10 m/D were not uncommon. It is proposed that differences in sea star movement rates among sites are to some extent both the cause and the effect of varying prey zonation in different hydrodynamic regimes. Such spatially structured dynamics must be considered in benthic predator-prey dynamics.

16. DIEL MOVEMENT PATTERNS OF THE HAWAIIAN STINGRAY (*DASYATIS LATA*) IN KANEHOE BAY, HAWAII.

D. Cartamil, J. Vaudo, C. Lowe, B. Wetherbee, and K. Holland. California State University, Long Beach, Biology Department, Long Beach, CA 90840 (DC, JV, and CL). NOAA/NMFS/NEFSC, Narragansett, RI 02882 (BW). Hawaii Institute of Marine Biology, Kaneohe, HI 96744 (KH).

Acoustic telemetry was used to track the movements of seven rays in Kaneohe Bay, Oahu, Hawaii. Rays were tracked continuously over 50 hr periods. Geographical position was determined at 15-minute intervals during tracks, and was analyzed to determine space utilization and rate of movement. Rays were found to utilize significantly larger average activity spaces at night ($0.83 \pm 0.70 \text{ km}^2$) than during daylight hours ($0.12 \pm 0.15 \text{ km}^2$). Rates of movement were also significantly higher at night ($p < 0.001$) than during the day and crepuscular periods. Total mean activity space for rays tracked was 1.32 km^2 , and maximum swimming speed was approximately 1.9 km/hr. *D. lata* and juvenile scalloped hammerhead (*Sphyrna lewini*) pups in

Kaneohe Bay show overlap in habitat use and time of activity; this may indicate competition for food resources.

17. ESTIMATING THE IMPACT OF MULTIPLE PREDATORS ON BENTHIC PREY POPULATIONS.

C. D. Garza, Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA, 93106.

Here I present an experiment in which I examined the absolute and relative impact of two predators, the sea star, *Pisaster ochraceus* and birds over a gradient of increasing prey productivity. In this experiment prey productivity was defined by the intensity of prey settlement and body growth. The absolute effect of each predator on per capita prey survivorship increased in a similar fashion over this gradient. This finding is in agreement with previous studies that suggest the absolute impact of predators should increase as prey productivity increases. The relative impact of each predator did not differ as prey productivity increased. This result is counter to previous studies that suggest the effect of two or more predators on a prey population should diverge, with one of the predators having a disproportionately larger effect (i.e. keystone effect), as prey productivity increases. This suggests that the relative impact of one predator will depend upon what other predator species it is compared to. A Cox proportional hazards model suggests that over the duration of the experiment, spatial location had a relatively larger impact on per capita prey survivorship than predators did. This study also highlights the need to consider how spatial variation in fine local scale abiotic and biotic factors can affect predator-prey dynamics.

18. USING AN EIGHTEEN-YEAR PHOTOGRAPHIC RECORD TO QUANTIFY CHANGES IN MUSSEL ABUNDANCE AND DISTRIBUTION ON BIRD ROCK, CATALINA ISLAND, SOUTHERN CALIFORNIA.

D. Blakeway and C. D. Robles, Department of Biological Sciences, California State University at Los Angeles, CA 90032.

Mussel beds (*Mytilus californianus*) on Bird Rock have been photographed at six-month to two-year intervals since 1983. The photographs contain a potentially valuable record of changes in mussel abundance and distribution. In order to describe those changes quantitatively, the images must be spatially registered to a common projection. This paper describes a method of registering the oblique images to a vertical image using linear transformations. The percentage cover of mussels, and the spatial arrangement of the mussel beds, can be calculated from the registered images. Preliminary results indicate dramatic declines in mussel abundance between 1983 and 1984, and between 1991 and 1992. Mussel beds on the western side of the island have recovered to some extent, but those on the eastern side have not.

19. MULTI-SCALE SAMPLING OF BIOSPHERE-ATMOSPHERE CARBON FLUXES IN ARCTIC AND CHAPARRAL ECOSYSTEMS

John A. Gamon^{1,3}, Stan Houston^{1,3}, Dan Sims¹, Fred Huemmrich^{3,4}, Walt Oechel², Hyojun Kwon², Rommel Zulueta², Pablo Bryant², Steven Hastings², Joseph Verfaillie Jr.² ¹California State University, Los Angeles, CA, ²San Diego State University, San Diego, CA, ³Desert Research Institute, Reno, NE, ⁴University of Maryland, Baltimore, MD

Ongoing efforts to regulate atmospheric carbon dioxide require that we improve our knowledge of biosphere-atmosphere carbon fluxes. To better understand component controls on ecosystem carbon fluxes, we have been sampling hyperspectral (narrow-band) reflectance in conjunction with flux measurements at a range of spatial scales (leaf to landscape). Flux methods include chamber gas exchange and eddy covariance, and optical sampling tools include field spectrometers and an automated, dual-channel spectrometer for tram and aircraft applications. The tram system is an ideal tool for developing and testing models of carbon flux driven by remote sensing because it avoids atmospheric interference and provides spatially distributed optical

sampling matched to the scale of the flux tower footprint. Initial results from the Alaskan North Slope and from Southern California chaparral ecosystems demonstrate the ability of optical sampling to detect temporally dynamic vegetation structural and physiological properties linked to the rate of photosynthetic carbon uptake. In the Arctic, where light and cold temperatures appear to be dominant environmental controls, seasonal patterns of photosynthesis can be largely described by the amount of Absorbed Photosynthetically Active Radiation (APAR), a product of light intensity (PPFD) and the fraction of absorbed light (F_{APAR}). By contrast, chaparral ecosystems of Southern California exhibit periods of striking photosynthetic downregulation during drought or temperature extremes. In evergreen chaparral stands, APAR alone cannot track seasonal patterns of photosynthetic activity, however downregulation is detectable via narrow-band features in reflectance spectra. In both ecosystems, changing photosynthetic activity can be nicely represented using a light-use efficiency model driven entirely by optical measurements. More work is needed to understand the role of respiration and contrasting functional types in influencing the overall carbon balance of these ecosystems.

20. WAVELET ANALYSIS OF SPATIAL PATTERNS IN THE REFLECTANCE INDICES OF CHAPARRAL STANDS

A. F. Rahman and J. A. Gamon, Ecology and Natural Resources Dept., Rutgers University, New Brunswick, NJ 08901-8551

We have investigated the multiple-scale spatial patterns in the chaparral stands of southern California's Santa Monica Mountains. Three physiologically related hyperspectral reflectance indices, namely NDVI (a greenness index), WBI (a water content index), and PRI (a photosynthetic index) were used as indicators of biomass, plant water content, and photosynthetic activity, respectively. Wavelet transforms were used to portray the trends in the non-stationary surface reflectance values along the 100-meter transects. The dominant scales of spatial pattern in the chaparral stands of varying age groups were identified when the wavelet variance was plotted as a function of scale. Use of the position variance along the transects clearly showed the patch/gap structure present in each stand. We also found that wavelet transform compensated the random errors in the transect data. Another advantage of this procedure over other spatial analysis techniques was that it was able to preserve and display the hierarchical information while allowing for pattern decomposition. The results of our research indicate that while the spatial trends in reflectance indices of southern California chaparral follow the stand age, finer scale variations are significantly present in all age groups.

21. STATISTICAL AND PHYSICAL METHODS IN REMOTE SENSING FOR LINKING LEAF AND CANOPY LEVELS: FORWARD AND INVERSE MODELLING

P.J. Zarco-Tejada, Center for Spatial Technologies and Remote Sensing (CSTARS), Department of Land, Air and Water Resources (LAWR), University of California, Davis, Davis, CA 95616- USA

Scaling up leaf-level photon interactions to canopy level for biochemical constituent estimation from remote sensing needs radiative transfer (RT) modeling assumptions. This paper describes different RT approaches for linking leaf and canopy levels for biochemical constituent estimation: i) directly studying the statistical relationships between ground-measured biochemical data and canopy-measured reflectance; ii) applying the leaf-level relationships derived between optical indices and the pigment content directly to canopy-measured reflectance; iii) scaling up the leaf-level relationships based on optical indices related to pigment content through models of canopy reflectance or infinite reflectance (R_{∞}); and iv) inverting the observed canopy reflectance through a canopy reflectance or infinite reflectance model coupled with a leaf model to estimate the optimum pigment content. The four proposed methodologies for scaling up have advantages and disadvantages that are related to the complexity of the modeling approach selected, and the degree of general or local applicability of the methodology in remote sensing. Results show that leaf-level relationships obtained between reflectance indices and biochemistry were scaled up to canopy level through canopy reflectance models using input model parameters related to the canopy structure and viewing geometry at the time of data acquisition. Hyperspectral remote sensing data were used for assessment, and a number of

methods were used for scaling-up, coupling statistical relationships and RT approach (PROSPECT) to Lillestaeter, Hapke, and Yamada & Fujimura infinite reflectance models. Model inversion techniques were used to couple PROSPECT and canopy models such as SAILH, Kuusk, and SPRINT to estimate biochemical constituents without statistical relationships.

22. CORRELATION BETWEEN SATELLITE BASED LAND COVER TYPES AND AIRBORNE MEASUREMENTS OF CO₂, LATENT HEAT, AND SENSIBLE HEAT FLUXES IN THE BOREAL FOREST OF CANADA

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An attempt is made to establish quantitative relationships between the airborne measured fluxes at two heterogeneous grid sites in the boreal forest of Canada, and the cover types within the flux footprint. To this purpose, the satellite observations bands 1 through 5 and 7 of the Landsat TM scene of the study areas were acquired, and were used to produce the land cover classification of the study areas. Using footprint developed from trace gas release experiments in the boreal forest, the fractions of cover types within the footprint were determined, and used in a regression analysis against the observed fluxes. The results showed that, depending on the flux types, as much as 80% to 92% of the variations in the fluxes were explained by the cover types that contributed to them. Model validation using a set of independent data showed high correlations between the observed and predicted estimates. The study provided a first step in extrapolating aeri ally averaged fluxes from local to regional scales, based on land cover characteristics.

23. SCALING CARBON FLUX MEASUREMENTS TO THE REGIONAL LEVEL IN SOUTHERN CALIFORNIA AND BAJA CALIFORNIA

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Long-term eddy covariance measurements, and remote sensing are being coupled with empirical and simulation models to estimate inter- and intra-annual variation in regional carbon fluxes for southern California and Baja California. Calculated fluxes are verified by direct aircraft measurement. Digital images, microclimate, and eddy covariance data are being reported in near real time, and available via the web. Research intensive sites include young and old chaparral stands in San Diego, and a Larrea/Cardon desert site in La Paz. Initial results indicate a differential impact of ENSO events on NEP in young compared to old stands of chaparral in California, and the utility of the SDSU Sky Arrow Environmental Flux Aircraft in remote sensing and measurement of carbon flux in the chaparral environment.

24. SCALING FLUXES OF CARBON, WATER AND ENERGY FROM LEAVES TO CANOPY DIMENSIONS: ADVENTURES IN THE FIELD AND ON THE COMPUTER

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Over a temperate broadleaved forest near Oak Ridge, TN, we have been monitoring meteorological variables since 1981 and we have been measuring fluxes of carbon dioxide, water vapor and energy across the canopy-atmosphere interface since April, 1993. With the availability of new and longer data sets new questions arise about the applicability and accuracy of coupled carbon-water flux models. The new applications of coupled carbon-water flux models need to consider the seasonal dynamics of biology, as well as meteorology. This

feature requires the dynamic adjustment of many model parameters that have been considered static in past applications, such as leaf area index, photosynthetic capacity, basal rates of enzyme kinetics and plant-water relations. The objectives of this talk are to quantify how CO₂, water vapor and energy exchange of a temperate deciduous forest vary across these multiple time scales and how weather, plant structure and physiological capacity impact these fluxes. To conduct this work, we employed an approach that combined stand-level eddy covariance flux measurements and a biophysical model, CANOAK. The eddy covariance flux measurement data are used to validate a biophysical model, CANOAK on annual to multi-year times scales. We then use the model to quantify the impact of weather patterns and changes in plant structure and physiological capacity on annual and decadal scale fluxes of carbon dioxide, water vapor and sensible heat. Specific questions we address include: 1) how well does a biophysical model work over a spectrum of time scales, ranging from hours to years?; 2) how does weather, over a 17 year period, affect inter-annual variability of carbon and water fluxes?; 3) what are the dominant time scales of variance that are associated with the flux densities of carbon dioxide and water vapor over the period of a decade?; and 4) what are the roles of canopy structure, phenology, photosynthetic capacity and turbulence parameterization on annual time scale fluxes?

25. SCALING ECOSYSTEM PROCESSES USING COMPUTER MODELS AND REMOTE SENSING - THE BGC EXAMPLE.

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As the scale of our ecological questions grows from plot-based studies to the globe, we require new technologies and understanding to address these larger-scale questions. There are several challenges we face in moving from the smaller scales where we have developed our understanding of ecosystem processes, to the larger scales we are beginning to explore. Ecosystem process models can provide one way to scale ecological understanding across space and time. I address some of these important scaling issues by drawing upon examples from studies that have utilized the Biome-BGC ecosystem model (Running et al.) to estimate landscape-scale fluxes of water and carbon. In particular, we look at the data available for initializing and forcing ecosystem model simulations at larger scales. Satellite imagery is a valuable tool for measuring variations in ecosystem structure across landscapes. We also look at some of the compromises that are sometimes required in order to address urgent questions at larger scales, and how we can evaluate the effects of these compromises using measurements that represent larger-scale processes.

26. PHYSIOLOGICAL CONTROL OF CARBON AND WATER FLUXES IN FORESTS AND ORCHARDS. ITS VARIABILITY AND CONSEQUENCES

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Stomatal function and photosynthetic capacity in two forests (the Chequamegon National Forest, Wisconsin and the riparian forest of the Bosque del Apache, New Mexico) and in a pecan orchard (Las Cruces, NM) display much variability within and between individuals, species, seasons or years, and sites (upland forest, lowland forest, and wetland). In the Wisconsin forest, significant partitioning of the variability is between overstory and understory, by species, and by drought (1997). The remaining large variability on any site must be incorporated into flux models for the net carbon storage and site hydrology. Simulations with our observed ranges of Ball-Berry parameters (found to best fit stomatal behavior) and photosynthetic capacity (as $V_{c,max}$ referred to 25°C) were undertaken in order to estimate (1) which of these parameters (their statistical distributions) are most important to measure accurately and (2) whether integrated fluxes of CO₂ and water respond linearly to parameter values and thus can be modelled with single, aver-aged values of parameters. We find a high flux control coefficient (0.35) for total stomatal conductance g_s over water flux, and a weaker one near 0.10 for carbon flux, for representative summertime conditions. Stomatal response to

humidity and to photosynthetic rate appears to be important, in contrast to simpler stomatal models, but the quantitative importance is seen only in those simulations that resolve distributions of irradiances on leaves rather than single average irradiances. Carbon flux is significantly and nonlinearly sensitive to variations in Ball-Berry slope m alone, but flux becomes highly insensitive when the strong negative correlation of slope with intercept b is accounted. Carbon flux remains sensitive to $V_{c,max}^{25}$, but in linear fashion, and water flux appears linearly dependent upon both m and $V_{c,max}^{25}$. The latter may be taken as the only two independent parameters, eliminating b . Thus, $V_{c,max}^{25}$ seems most important for large-scale simulations with more detailed models such as SiB2. Indirect control of carbon flux by water fluxes that can lead to water stress may be as important as direct control of carbon flux, in certain years. In detailed simulations, single average values of parameters should suffice, given the linearity of fluxes. Additional field measurements indicate that photosynthetic down regulation in response to high irradiance or high leaf temperature should not be significant under almost all summertime conditions.

27. THE CONTRIBUTION OF EL NINO TO VARIABILITY IN THE GLOBAL CARBON CYCLE AND $\delta^{13}C$

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I propose that much of the observed year-to-year variation in atmospheric $\delta^{13}C$ is driven by changes in C_3 plant discrimination, and not solely by changes in ocean and land carbon sinks. If El Nino events impose drought stress over large tropical areas, then even very small changes in discrimination will have a large atmospheric consequence because the gross primary production (GPP) of tropical C_3 vegetation is large (~50 Pg C). I demonstrate the potential magnitude of this effect with inversion equations that include variable discrimination. If GPP and discrimination co-vary on interannual timescales at the global scale, as would be consistent with interannual variability in drought stress driving variation in GPP, then neglecting this component of the atmospheric $\delta^{13}C$ budget will lead to overestimates of land and ocean flux variability. I present global rainfall data over land, observed $\delta^{13}C$ -GPP relationships, and results from a global physiological model (SiB2) in support of this hypothesis.

28. AN OVERVIEW OF STORMWATER QUALITY IN LOS ANGELES COUNTY

Bill DePoto, P.E., Watershed Management Division, Los Angeles County Public Works, Alhambra, CA, 91803

Since 1994, in accordance with NPDES Municipal Stormwater Permits, Los Angeles County Public Works has been compiling stormwater quality information from numerous monitoring sites within the County. The sites sample runoff from critical industries, significant land use types, and major rivers. In addition, a ground breaking study of stormwater impacts was performed on Santa Monica Bay. Analysis of the results has identified 30 "Constituents of Concern" that have an impact on the beneficial uses of Southern California's water bodies. For some constituents, a pattern of occurrence is starting to emerge, but for others, there is no discernable pattern.

29. DISPERSION OF FECAL BACTERIA DISCHARGED FROM FRESHWATER OUTLETS INTO THE NEARSHORE ENVIRONMENT OF SANTA MONICA BAY

M. Taggart, Heal the Bay, Santa Monica, CA. 90404

In the summertime in Southern California, over 80 freshwater outlets and storm drains convey urban runoff across beaches and into the surf zone, often carrying elevated levels of fecal bacteria indicators. Beaches adjacent to these outlets are routinely posted or closed for swimming because of the potential health risks associated with swimming in waters contaminated with human sewage. Heal the Bay and the Southern California Coastal Water Research Project (SCCWRP) are investigating the dispersion of the bacteria in the

surf zone around two small perennial freshwater outlets in Santa Monica Bay: Santa Monica Canyon at Will Roger's State Beach and Malibu Creek at Surfrider Beach. Objectives of this multi-component study include characterizing the variability of shoreline bacteria densities around the flowing drains, identifying the storm drain and ocean parameters that significantly affect the dispersion of the bacteria, and assessing the use of statistical modeling as a predictive tool for local health officials to use in making beach management decisions. Preliminary results show significant temporal and spatial variability in shoreline bacteria densities. Parameters related to ocean mixing and transport processes that significantly contribute to dispersion of the bacteria include longshore velocity in the nearshore, tide height, and wave height. Beach topography, which is interrelated to these ocean parameters and to the development of rip currents, appears to significantly influence shoreline bacteria densities resulting from the flowing storm drains.

30. NEARSHORE DISPERSION OF COASTAL CONTAMINANTS: PROCESSES, SCALES, AND IMPACTS

Burton H. Jones, Department of Biological Sciences, University of Southern California, Los Angeles, CA 90089-0371

Microbiological, chemical, and other contaminants enter the coastal zone from a variety of sources. Some sources have a seasonal signal and other sources are present throughout the year. Depending on the contamination source, the flow volume, and the coastal environment contaminants may be transported by several processes within the coastal zone. The mechanisms of transport affect the distances over which the contaminants may be transported, the potential for human contact, and the ultimate fate of the contaminants. Various programs in the Southern California Bight have examined large scale runoff from normal and El Niño rainfall episodes, dry weather runoff from coastal wetland and river systems, and smaller scale runoff from storm drain systems. These various scales of processes will be compared and discussed in the presentation.

31. DEGRADATION OF INDICATOR BACTERIA AND COLIPHAGE IN SANTA MONICA BAY SEAWATER

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Urban runoff is the most important source of pollution to coastal ecosystems the world over. Along the coastline of Southern California, urban runoff contributes microbial contaminants that can directly impact the health of those using the waters for recreation and food. Our understanding of the degradation of microbial contaminants from urban runoff is poor. Currently, bacterial indicators such as total and fecal coliforms, and enterococci are used to infer microbiological water quality. In order to successfully mitigate and manage urban runoff, we need to understand the fates and degradation of bacterial indicator organisms. Santa Monica Bay Beaches are the focus of a current Total Maximum Daily Load (TMDL), which will require estimates of waste load allocation for implementation. To better understand fates of indicator bacteria and coliphage, we have performed degradation studies in Santa Monica Bay seawater. We have used a suite of degradation studies to examine factors that affect rates of bacterial degradation (temperature, total suspended solids (TSS), UV light, nutrient concentrations, types of urban runoff, etc.). Over 96 hour periods, bacterial indicator degradation rates ranged from 0.7 to 7.5 % per hour, with significantly slower degradation rates at lower temperatures (t-test, $p < 0.05$). Temperature, UV light, and bacterial indicator concentration were the factors that strongly affected rates of degradation. Nutrients and TSS levels had no significant effect on rates of bacterial degradation. This paper will examine degradation of bacterial indicator, and put the results into the context of the upcoming implementation of the Santa Monica Bay Beaches

32. RANKING OF SANTA MONICA BAY STORM DRAINS AS CANDIDATES FOR LOW-FLOW DIVERSION OF DRY-WEATHER URBAN RUNOFF FROM THE CITY OF LOS ANGELES.

M.E. Mullin. City of Los Angeles, Stormwater Management Division, 650 South Spring Street, Los Angeles, CA, 90014

Storm drains have been identified as a major source of bacterial contamination along the shoreline of Santa Monica Bay. Risk of illness increases for beachgoers who swim near storm drains that have elevated concentrations of bacteria related to human and animal waste. Nineteen of the major storm drains entering Santa Monica Bay receive urban runoff from the City of Los Angeles.

A ranking criterion was developed to determine which of these drains pose the greatest risk of illness to the beachgoing public and should be considered as candidates for low-flow diversion. A low-flow diversion captures the drain flow before it reaches the beach area and pumps it to the sewer system. The ranking is comprised of the following factors: drain flow, bacterial concentrations, and bacterial ratios along with drain discharge location and beach usage. This ranking criterion compares favorably with extensive beach water quality measurements near the drain outlet. This ranking has provided the necessary information needed to prioritize low-flow diversion projects. By summer 2002, dry-weather urban runoff from 12 of the 19 drains will be diverted to the Hyperion Treatment Plant for treatment and subsequent discharge 5 miles from shore.

33. MUNICIPAL SPENDING ON RUN-OFF CONTROL IN LOS ANGELES AND ORANGE COUNTY

Tina Cummins. Coastal Community Research, University of Southern California, Wrigley Institute for Environmental Studies, Los Angeles, CA, 90089-0371.

The municipalities of Southern California are currently faced with the task of controlling polluted run-off within their jurisdictions. In order to accomplish this, they must focus on instituting Best Management Practices in their own activities and finding a method to monitor the activities of businesses and individuals to ensure that they are instituting Best Management Practices. The cities of Los Angeles County and Orange County have divided their spending on these tasks into six separate categories: program management, illicit connections and illicit discharges, development planning and construction, public agency activities, public information and participation, and monitoring. This study develops a public choice decision model of municipal spending for categories of run-off control and utilizes the 1998 spending data for the cities of Los Angeles County and Orange County to test the significance of the variables in the model.

34. STORMWATER BEST MANAGEMENT PRACTICES

Michael K. Stenstrom, Civil and Environmental Engineering Department, UCLA, Los Angeles, CA 90095-1593

Pollution reduction from stormwater is challenging for technical as well as institution reasons. Regulating the large number of agencies and landowners who discharge stormwater is a bewildering task. As a result, some agencies and other responsible parties suggest that current technologies cannot provide solutions due to excessive costs. Costs are calculated by multiplying the individual costs of a BMP by the largest number of possible applications. As a result, costs into the millions of dollars are predicted for the Los Angeles region alone. Such simple-minded proposals do not help in solving our collective problem. A better approach is to combine what is known about pollution generation rates from various land-uses and simple costs and transfer functions for BMPs to predict the least cost application of BMPs. An example of this method will be presented using UCLA's Santa Monica Bay stormwater/landuse model and hypothetical but realistic models of simple BMPs. It is shown that targeting specific BMPs to specific landuses can reduce emissions by the same amount at dramatically reduced costs.

35. RESIDENTIAL BEST MANAGEMENT PRACTICES: SIMPLE STRATEGIES FOR SUSTAINABILITY

Rebecca Drayse, T.R.E.E.S. Project, TreePeople, Beverly Hills, CA 90210

TreePeople's Hall House demonstration site is a private single-family residence that has been retrofitted to capture and retain onsite the runoff from a 100-year storm event. The stored water is used for irrigating the property. Yard waste is also retained on the property as mulch, eliminating the need for transport to and space in a landfill. The watershed Best Management Practices (BMPs) employed at the site include: a roofwater washing unit; a cistern collection system; a vegetated and mulched swale; retention grading in the front and back yards; and a driveway drywell. The installation grew out of a design charrette lead by TreePeople's T.R.E.E.S. (Trans-Agency Resources for Environmental and Economic Sustainability) Project. The team that mapped out the BMPs considered the environmental impact of our water use, locally as well as upstream, where the water comes from. The site is designed to work with - rather than fight - nature's cycles of flood and drought, water and waste. An envisioned large-scale implementation of these BMPs in the L. A. basin would significantly reduce stormwater runoff and its pollutants, the demand for water imports and the amount of landfill space required for greenwaste. In cooperation with TreePeople, the USDA Forest Service has recently begun monitoring weather conditions and BMP performance at the site and at a control site next door. The data gathered will be instrumental in the continuing effort to prove the feasibility of sustainable watershed management and to encourage stakeholders to integrate their management activities.

36. THE CITY OF LOS ANGELES' BEST MANAGEMENT PRACTICES (BMPs) PROGRAM TO CONTROL POLLUTANTS IN URBAN RUNOFF.

G.L. Moore. City of Los Angeles, Stormwater Management Division, 650 S. Spring St., Los Angeles, CA 90014.

The City of Los Angeles' Stormwater Management Program was founded in 1990 to conduct and coordinate citywide activities associated with flood control and curbing pollution from urban runoff. A key pollution abatement strategy is the development and implementation of structural Best Management Practices (BMPs). The City has installed a variety of BMPs including residential retention devices, catch basin deflectors and inserts, parking lot filtration and infiltration structures, and low-flow diversion systems. Each of these structures will be discussed along with costs, operation and maintenance and maintenance, and other pertinent issues.

37. URBAN RUNOFF: FROM WASTE TO RESOURCE

Neal Shapiro. Urban Runoff Management Coordinator, City of Santa Monica, 200 Santa Monica Pier, Santa Monica, CA 90401

The City of Santa Monica has demonstrated great commitment to the protection of the Santa Monica Bay. Beginning in the early 1980s, concerns were expressed over the pollutants found in urban runoff entering the Bay. This concern became front-page news in 1984 due to a lawsuit claiming adverse health effects from swimming in the Bay. In 1994, the City adopted a Sustainable City program to safeguard and enhance ecosystems and the community's health through innovative programs and policies. Numerous studies have cited contaminated urban runoff as the greatest single source of water pollution in the country. Santa Monica took a unique approach to this problem after a feasibility study concluded that dry weather urban runoff flows could be economically treated and reused in place of imported potable water. The study led to the construction of the country's first dry weather runoff recycling facility, which began operations in February 2001. The primary objective of the Santa Monica Urban Runoff Recycling Facility (SMURRF) is to turn a perceived "waste" product into a natural resource by eliminating dry weather urban runoff pollution into the Bay and reuse this alternative water supply for landscape irrigation and indoor plumbing. Secondary project goals include raising public awareness about urban runoff prevention and watershed protection through educational exhibits at the facility, and combining strong artistic and architectural elements into a highly functional design. This collaborative design approach between artist, architect, engineer, and public works

department transformed a potentially unsightly treatment facility into a community asset for residents and for over 2 million annual visitors who come to the City.

38. BMPs –NOW AND FUTURE

Eric W. Strecker, GeoSyntec Consultants, 838 SW First Avenue, Suite 430, Portland, OR 97204, estrecker@geosyntec.com.

The science regarding understanding how stormwater best management practices (BMPs) has been severely lacking in its thoroughness. Because of this problem, the claims about the effectiveness of BMPs in reducing or eliminating impacts from urban runoff have in many cases been exaggerated or misstated. This presentation will focus on how we need to do a better job of assessing BMP performance, the results of a cooperative grant agreement between EPA and American Society of Civil Engineers (ASCE) to improve the science on the performance of urban stormwater BMPs. Some of the problems with past efforts will be reviewed along with the resulting findings, including that BMP performance is better described by effluent quality. Percent removals are not a useful way to describe performance. Other performance measures will be discussed. Finally, the paper will briefly discuss emerging trends in BMPs and stormwater management.

39. HOLISTIC APPROACH TO BMPs

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During the initial NPDES permits municipal stormwater management programs were basically developed to comply with stormwater regulations. These baseline programs, however, have not in many cases directly addressed the water quality issues caused by stormwater discharges. As the next round of permits are developed supplemental efforts will be required to identify the water quality issues and the synergistic/antagonistic relationship of constituent contamination. With such information a more holistic approach of BMP development and implementation will need to be identified. This approach will also require consideration of water supply, aquatic and wildlife habitat, and recreational and open space opportunities.

40. NEUROPROTECTIVE ACTIONS OF ESTROGEN AND TESTOSTERONE

Christian Pike, Hanson Family Assistant Professor of Gerontology, Andrus Gerontology Center, University of Southern California

Aging is associated with significant reductions in the sex steroid hormones estrogen and testosterone. Age-related decreases in hormone availability may increase the vulnerability of the brain to the pathological processes of Alzheimer's disease (AD) and related disorders. Importantly, the clinical use of hormone replacement therapies in women delays the onset of AD; related clinical trials are now being pursued in males. Currently, it is unclear which cellular effects of estrogen and testosterone contribute to their suspected inhibition of AD. We propose that sex steroid hormones have neuroprotective properties that increase neuronal resilience against degenerative stimuli implicated in AD. Consistent with this hypothesis, our recent data demonstrate that both estrogen and testosterone protect against neuronal cell death caused by AD-related insults in cell culture paradigms. These findings suggest that sex steroid hormones may modulate neuronal viability throughout life, from neural development through age-related neurodegenerative disorders.

41. MOLECULAR AND CELLULAR MECHANISMS OF LEARNING AND MEMORY: FROM THE LAB TO THE CLINIC

Alcino Silva, Departments of Neurobiology, Psychiatry and Psychology, University of California Los Angeles

Our laboratory is studying the biology of learning and memory. We are interested in the molecular, cellular and circuit processes that underlie the storage and recall of information. To accomplish this we are using a variety of techniques including biochemistry, transgenic manipulations, pharmacology, *in vitro* and *in vivo* electrophysiology, neuroanatomical lesions and behavioral analysis. The focus of our studies has been on hippocampal dependent learning and memory. Our results implicate a variety of hippocampal mechanisms in learning and memory, including long-term potentiation, short-term plasticity, the slow afterhyperpolarization and synaptic inhibition. We have found mutations that affect the induction of long-term changes in synaptic function and learning, and others that affect the stability of these synaptic changes and memory (but not learning). For example, our studies have demonstrated that the transcription factor cAMP responsive element binding protein (CREB) is critical for the formation of long-term memory. Recently, using a transgenic mouse with an inducible CREB repressor, we confirmed that CREB is crucial for the consolidation, but not for the encoding, storage or retrieval of conditioned fear memory. Importantly, our results with this inducible CREB repressor also show that CREB is essential for the reconsolidation of existing memories, since repressing CREB function during re-exposure to cues associated with consolidated memories disrupts these memories. Our laboratory is also interested in applying these findings to the development of treatments for learning and memory disorders, such as those observed with aging and in neurofibromatosis type I (NF1).

42. NEUROTROPHIC EFFECTS OF ESTROGEN ON THE CHOLINERGIC BASAL FOREBRAIN

Sonsoles de Lacalle, Department of Biological Sciences, California State University, Los Angeles

A pronounced cognitive decline is the most prominent feature of Alzheimer's Disease. Cholinergic neurons of the basal forebrain (BFCN), which provide the major source of cholinergic input to the hippocampus and neocortex, undergo extensive degeneration in patients with dementia. This neuronal degeneration causes a marked decrease in the expression of cholinergic enzymes. Recent data suggests that estrogen replacement therapy can be effective in preventing memory loss in post-menopausal women. Previous studies have also indicated that administration of exogenous estrogen increases cholinergic function in the basal forebrain of ovariectomized rats, but the mechanism of action remains largely unknown. In the present study we have used cultured primary BFCN to investigate the neuroprotective effects of estrogen. Treatment with 17 β -Estradiol enhanced outgrowth by dramatically increasing neurite number and length in cholinergic neurons in culture after 19 hours of estrogen exposure, accompanied by a significant enlargement in cell body size. These changes reached a two-fold increase after 48 hours of estrogen exposure. Consistent with this enhanced outgrowth, measurement of total protein content reported an increase of almost 4-fold between the control and the estrogen-treated cells. Ongoing work aims at elucidating the signaling mechanisms involved in this response.

43. NEUROTROPHIC FACTORS AND ACTIVITY DEPENDENT MODIFICATION OF THE BRAIN

J. Patrick Kessler, Institute for Brain Aging and Dementia, and the Department of Neurology, University of California, Irvine

The brain has a remarkable capacity for plasticity throughout life, being modified by development, experience, and disease. Neurotrophins, particularly BDNF, can play a critical role in neural plasticity through a variety of mechanisms that include long-term classical trophic factor activity, and short-term neuromodulatory activity. The neurotrophin family includes BDNF, NGF, neurotrophin 3 (NT-3), and NT-4/5. Receptors for the neurotrophins include TrkA, TrkB, TrkC, and a lower-affinity p75 receptor. There is considerable converging evidence that BDNF and other neurotrophins are involved in maintaining and modifying the brain in activity dependent plasticity, and respond to a variety of stimuli that occur during aging. Subtle experiences such as environmental cues, learning, and physical activity can sculpt the structure of the brain, with more abrupt activation, such as trauma or seizure activity, inducing more dramatic

alterations. Neurons, dendritic branches and synapses are gained and lost throughout life, with a decline in structural integrity characteristic of older age. Functional ability, including behavior, is directly related to the condition of the CNS and aging. In old age there is typically a decrease in performance on cognitive tasks and impaired learning and memory that can lead to dementia. Neurotrophin expression is responsive to aging and behavioral activity, thus we propose to explore the role BDNF plays in CNS maintenance and modification. We will present results for our work and others that support the role of BDNF in neural plasticity. The results of these studies will have implications that may elucidate basic mechanisms involved in activity dependent neural plasticity and offer avenues for development of clinical interventions for dementia, including Alzheimer's disease.

44. INDUCTION OF THE NEURAL CREST

Marianne Bronner-Fraser, Albert Billings Ruddock, Professor of Biology, Division of Biology, California Institute of Technology

Neural crest cells arise within the ectoderm during neurulation and give rise to most of the peripheral nervous system, as well as cartilage and bone of the face, melanocytes and various other cell types. The neural crest arises at the juncture between presumptive epidermis and neural plate. However, individual cells in the neural fold cells can form all ectodermal derivatives (epidermis, neural tube, neural crest). Inductive interactions between the neural and non-neural ectoderm can generate neural crest cells, suggesting that signals travel through the epidermis to generate neural crest cells prior to neural tube closure. Induction of the neural crest appears to be a multiphasic process and involves a combination of an early Wnt signal together with later functions for BMP signaling pathways. We have used a variety of molecular screens to isolate molecular constituents involved in neural crest formation. We have identified a secreted factor, Noelin-1, which is expressed in the prospective avian neural plate and may play a role making the neural tube competent to form neural crest. Noelin-1 mRNA is expressed in a graded pattern in the closing neural tube, with highest expression in the neural folds and no detectable expression at the ventral midline. Over-expression of Noelin-1 using recombinant retroviruses causes an excess of neural crest emigration and prolongs the time that the neural tube is competent to generate and regenerate neural crest cells. These results support an important role for Noelin-1 in rendering the neural tube competent to respond to inductive cues to generate neural crest.

45. THE REGULATION OF BRAIN DERIVED NEUROTROPHIC FACTOR THROUGHOUT THE LIFESPAN

Amelia Russo-Neustadt, Department of Biology and Microbiology, California State University, Los Angeles

Brain-derived neurotrophic factor (BDNF) is a member of the neurotrophin family with widespread distribution throughout the brain. BDNF plays important roles in neuroprotection, repair and synaptic functioning throughout the lifespan. Evidence exists that the presence of BDNF may be vital for normal emotional and cognitive functioning, and that its presence may play an important role in the protection of the brain from stress, and the therapeutic effects of treatments for depression. Our laboratory has investigated the combined effects of antidepressant medications, which increase BDNF transcription in the hippocampus when applied chronically, and general physical activity, which can increase BDNF levels much more rapidly. We have found evidence that these two interventions may cooperate or converge at the cellular level. Recent studies have been aimed at clarifying the role of serotonergic and noradrenergic neurotransmitter system activation (a known early event in chronic antidepressant treatment) in the regulation of hippocampal BDNF. We have employed the use of system-specific lesions and receptor-specific antagonists to clarify the role of these systems in the rapid upregulation of BDNF transcription that is observed with general physical activity. We have also sought to understand whether these changes in hippocampal BDNF levels may correlate with behavioral changes associated with protection from stress and depression in animal models. The process of aging is associated with enhanced neurodegeneration and increased vulnerability to neuropathology. We have investigated the changes in hippocampal BDNF levels with age, and have asked whether the response to antidepressant treatment may be blunted or altered in senescent animals. The combination of antidepressant and exercise leads to surprisingly different patterns of regulation in the aging hippocampus from those seen

in young animals. The potential for the aging brain to respond to these interventions provides promising implications for the treatment of neurodegenerative disease.

46. ASTROCYTE ROLES IN NEURAL INJURY, DEGENERATION AND REPAIR, ANALYZED IN TRANSGENIC MICE

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Astrocytes are the most numerous cells in the central nervous system (CNS). They respond to all forms of major and minor CNS insults by a process known as 'reactive astrogliosis', which includes cellular hypertrophy, altered gene expression and proliferation. While much is known about molecules that either influence, or are produced by, reactive astrocytes the functions of these cells are incompletely understood. To investigate the roles of reactive astrocytes, we targeted their cell death genetically. Transgenic mice were generated that express HSV-TK from the Gfap promoter.

Proliferating cells which express transgene-derived HSV-TK metabolize the anti-viral agent ganciclovir to toxic nucleotide analogues which disturb nucleic acid synthesis and induce cell death. Using these transgenic mice we investigated the effects of ablation of reactive astrocytes after forebrain injury. Our findings indicate that reactive astrocytes play fundamental roles in regulating leukocyte infiltration, repairing the blood-brain barrier (BBB), protecting neurons, and restricting nerve fiber growth after CNS injury.

47. APPLICATION OF MULTIMEDIA GIS, ACOUSTIC REMOTE SENSING AND 3D VISUALIZATION FOR MARINE HABITAT MAPPING AND ECOSYSTEM-BASED MANAGEMENT

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Recent state and federal mandates now require our marine resource agencies to adopt an ecosystem-based approach to fisheries management, as well as the designation and design of Marine Protected Areas. While these new initiatives will require extensive information on the character and distribution of habitats used by species of critical interest, acquiring and applying this information effectively and economically presents one of the greatest challenges facing our agencies. Here I will give examples of how multimedia integration of acoustic remote sensing, ROV video, GIS processing and 3D simulations can and are being used to address these issues.

48. MORPHOLOGY OF THE SEAFLOOR OFFSHORE OF LOS ANGELES

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The submarine shelves, slopes, and basins offshore of the greater Los Angeles metropolitan area were mapped in three separate surveys during 1996, 1998, and 1999. Because of large differences in water depth between the shelves and basins, three slightly different high-resolution multibeam systems were used. Data from the surveys have been integrated into a single highly accurate three-dimensional bathymetric map, providing the first substantial update of the submarine geomorphology since the initial compilation by Shepard and Emery (1941). The multibeam mapping generated not only high-resolution bathymetry, but also coregistered, calibrated acoustic backscatter at 30 kHz, 95 kHz, and 300 kHz. The geomorphology can be subdivided into different provinces, such as shelves, marginal plateaus, submarine canyons, basin slopes, aprons, and basins. Each province has unique dimensions, gradients, and backscatter characteristics and they formed in response to a different combination of tectonics, climate, sea level, and sediment supply. Numerous geomorphic features that have tectonic origins are present. These include the tops of large folds and the traces of active faults. One of the most pronounced features, the shelf edge, probably evolved in response to climate and sea-level changes that have occurred in the last 10-20 thousand years. Submarine canyons form and evolve in response to continual processes of slumping and sedimentation. Fluctuations of eustatic sea level have had a profound effect on the area; by periodically eroding the surface of Santa Monica plateau, extending the mouth of the Los Angeles River to various locations along the shelf break, and by

connecting submarine canyons to rivers. A wetter glacial climate undoubtedly generated more sediment to the rivers which then transported the increased sediment load to the low-stand coastline and canyon heads. Large submarine slope failures are evident in the high resolution bathymetry. The most notable of these, the Palos Verdes debris avalanche, occurred on the San Pedro Escarpment. The failure scar of this feature is over 4 km in length, 2 km in width, and is continuous from about 110 m to 800 m water depth. A deposit of coarse and unsorted debris, about 10-12 m thick, covers over 32 km² of the basin floor beneath the failure scar. Local sedimentation rates suggest that the avalanche occurred 130 to 850 years ago. A failure such as this might have generated a local tsunami with an initial wave height of 10-12 m. If it occurred today, such a wave would threaten much of the local coastal infrastructure.

49. GIS AND VISUALIZATION TECHNIQUES FOR ECOSYSTEM MANAGEMENT IN A MARINE SANCTUARY

Waltenberger, Ben. NOAA / Channel Islands National Marine Sanctuary, Santa Barbara, CA, 93109.

An overview of applied remote sensing, GIS, and visualization tools that enhance education, research, and management goals in the marine environment. To better understand physical and cultural phenomena, NOAA's Channel Islands National Marine Sanctuary incorporates a number of data sources. Orbital data from NOAA satellites, survey data collected from our aircraft, and 3D models are integrated with an extensive GIS database of physical, biological, and cultural features. By combining these data sources together, we are creating intuitive ways to understand the ocean environment and the research conducted there. The Sanctuary is additionally working with GIS as a decision support and public participation tool to foster community involvement in coastal decision making. Scientific and socioeconomic data are combined in an interface that allows stakeholders to query and mine the datasets to see how management decisions may affect resources and stakeholder use in a given environment.

50. ACOUSTIC MAPPING OF SQUID AND ROCKFISH NEARSHORE HABITAT OFF SANTA ROSA ISLAND, CALIFORNIA.

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USGS 100 KHz sidescan sonar, 4 KHz subbottom profiler, and bottom video data in the Channel Islands National Marine Sanctuary and Channel Islands National Park, and adjacent southern California Coast is being used to map the distribution of nearshore benthic habitats (0-100 meter water depths) that are particularly important to fished or threatened species such as sandy areas used by Squid for egg laying, and rocky habitat preferred by threatened White Abalone and Rockfish. The USGS sidescan data show areas of low acoustic backscatter intensity that can be interpreted as sandy bottom, and high-backscatter areas that are indicative of rocky bottom. In some areas this interpretation has been confirmed with bottom video. However, some areas with high backscatter intensity are covered by thin sand deposits introducing error in any classification based on backscatter intensity alone. Subbottom data lack the resolution to show any sediment deposits in the area. We use textural analysis methods for quantitative bottom characterization to differentiate exposed bedrock from the thinly covered bedrock and thick sand areas. Second-order texture parameters Entropy and Homogeneity, were computed from normalized gray-level co-occurrence matrices for known areas identified from video, and then used to classify the remaining area in the sonar mosaic. The three bottom types can be differentiated by comparing Entropy, Homogeneity, and average backscatter intensity in areas of intermediate range sidescan sonar data. Near range and far range sonar data degraded by noise, attenuation, or processing artifacts could not be classified with textural analysis methods.

51. AN INTERACTIVE INFORMATION SYSTEM FOR SANTA MONICA BAY

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With the speed information is moving, it is increasingly important for the scientific community to be at the forefront of technological innovations for both the communication and application of their activities. Over the course of the last year work has been carried out to create a pilot information system for the Santa Monica Bay Restoration Project (SMBRP) whose core is an advanced Geographical Information System (GIS) and database (*MS Access*), but whose application is in the dissemination of information via the Internet. This project, called the Los Angeles Virtual Ocean, is a management tool used to collate, store and present the wide variety of data on the Bay. Information such as satellite imagery or aerial photography, nautical charts, SCCWRP's 1994 Southern California Bight pilot survey, or TOWYO data, can be ingested manually, or retrieved automatically over the Internet using standard information exchange protocols such as FTP. The data can then be graphically rendered as false-color images and plots within a precise geo-spatial and temporal context, or processed using built in models and algorithms. A *Java* interface allows anyone using *MS Internet Explorer* to access and browse the metadata stored within the project, re-producing the functionality of the desktop version. A web accessible GIS system, such as ours, creates an innovative solution for the collation, analysis and dissemination of data to both expert users and the public. The potential applications of our software extend beyond its roots in oceanography to the general scientific community.

52. MARINE RESOURCES OF THE SANTA MONICA BAY

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The University of California, Los Angeles and the Santa Monica Bay Restoration Project recently completed the first edition of the Marine Resource Inventory of the Santa Monica Bay CD-ROM. The program is an important new educational reference and a tool for resource planning and management. The program consists of four components: 1) An organism database containing photographs and detailed information on more than 250 marine and terrestrial species found in the Bay and its watershed. 2) The habitats of the Santa Monica Bay component of the program is presented in report format. The physical characteristics, diversity and abundance of species, management measures, threats, etc. for all major habitats within the Bay are characterized in this portion of the program. 3) The mapping component of the program, produced using a Geographic Information System, presents detailed spatial data on the important marine and terrestrial habitats of the Bay. 4) Completing the program, a virtual tour allows the user to explore the Santa Monica Bay through photographs of important species and habitats.

53. THE SUSTAINABLE SEAS EXPEDITIONS: A FIVE YEAR PROGRAM OF EXPLORATION AND EDUCATION

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The Sustainable Seas Expeditions Sustainable Seas Expeditions are a partnership between the National Geographic Society and the National Oceanic and Atmospheric Administration funded by the Richard and Rhoda Goldman Fund. The program is now starting its third year of exploration and education of our nation's National Marine Sanctuaries and will, for the first time, sail into international waters. Expeditions are planned for Mexico, Belize, Cuba, as well as the US Gulf coast marine sanctuaries in 2001. In addition, education programs have grown with new teacher resource materials, a photo gallery of photos taken by DeepWorker pilots, introduction of virtual teacher workshops, continued on-line information on the missions, student ocean conferences, and distribution of a new NGS World Coral Reef Poster. Also, coming this fall will be Dr. Sylvia Earle's new book, the first ocean atlas, printed by the National Geographic Society. This presentation will focus on the virtual aspects of SSE and its education programs.

P1. AN ADDITION TO THE PETRIFIED WOOD FLORA FROM THE EOCENE WAGON BED FORMATION OF WYOMING.

Sabrina S. Thakur, Jennifer H. Jones, Jay H. Jones Department of Biology, University of La Verne, 1950 Third St., La Verne, CA 91750.

Petrified wood samples from the Wagon Bed Formation have been prepared and analyzed to provide taxonomic and paleoclimatic information. The specific goal of this project was to add data from a previously unreported wood type to the floral database. By identifying the relationship between hardwood features of the sample WB-34 and those of modern and fossil woods, this project hopes to determine its taxonomic affinities and provide additional anatomical data for climatic analysis. The sample was prepared using a standard three-section technique and analyzed with light microscopy. The data were then coded and analyzed using Guess v1.1 software to reveal the closest modern and fossil analogs. While no close fossil counterparts were found, comparison with modern woods suggests that the sample could belong to either the Nyssaceae or Styracaceae. *Nyssa* was the closest match within the Nyssaceae and *Styrax* was the closest match within the Styracaceae. Characteristics common to these are vessels with radial groups of four, multiple perforation plates, and pits distinctly bordered. However, the rays of *Styrax* are commonly four to ten seriate, with marginal rows greater than four, features lacking in WB-34. *Nyssa* differs from WB-34 in the absence of pore clusters, the presence of plates with greater than twenty bars, the presence of opposite or scalariform plates, and the absence of rays commonly greater than one millimeter high. Although these and other differences, may prevent accurate placement of WB-34 into a family, data suggest that WB-34 existed in a warm, temperate climate with abundant water.

P2. IDENTIFYING HIGHLY DIVERGENT GENES FROM *TETRAHYMENA*

Louis Lee and Anne Tran, Brunk Research Group, UCLA Department of Organismic Biology, Ecology and Evolution, Los Angeles, CA 90095

The entire DNA sequence of *Tetrahymena thermophila*'s linear mitochondrial genome (~ 47 Kb in length) has been determined. This ciliate has a mitochondrial genome that encodes 44 putative genes; 22 of these can be identified by sequence similarity to genes in public databases. An additional 22 open reading frames (ORFs) have diverged sufficiently that they cannot be readily identified by simple sequence similarity. We are challenged with the task of identifying ORFs that have significantly diverged from recognizable functional genes.

It is not feasible to determine the biochemical function of the *T. thermophila* mitochondrial genes directly. Thus, we rely on a variety of proteomic mining tools to identify these genes. The amino acid sequences are compared with sequences in various databases and are also subjected to an assortment of algorithms designed to narrow the search and target a homologous gene. Some of these algorithms include: (1) databases such as BLAST, pFAM, and PRODOM. (2) physico-chemical properties such as theoretical pI, molecular weight, predicted transmembrane spanning regions and hydropathy measures and (3) a robust statistical test of sequence homology known as a jumble test. As an ultimate comparison, where available, 2-D predictions and 3-D crystal structures of known proteins are used as templates for ORF identification. Although identification through computational methods has its limitations, we can frequently determine the identity of a highly divergent gene with relative certainty once the sequences have been subjected to these various tests.

P3. BURST SWIMMING PERFORMANCE IN LARVAL AND POST-METAMORPHIC WHITE SEA BASS (*TRACTOSCION NOBILIS*)

S.L. Cole and K.A. Dickson. California State University, Fullerton. Department of Biological Science, Fullerton, CA, 92831

Metamorphosis is believed to be a critical period for larval fishes during which mortality is high. During this period, many larval fishes cease to be transparent and become increasingly conspicuous to predators. Thus, increased swimming ability may reduce the probability of predation. Previous work has shown that, in white

sea bass, the probability of escaping predation increases with larval size and that metamorphosing fish had a higher percentage of escapes than did larvae or juveniles. The primary objective of this research was to quantify burst-swimming performance across metamorphosis in the white sea bass, *Atractoscion nobilis*. Larval and juvenile white sea bass ranging in age from 12 to 36 days were obtained from captive breeding populations (Hubbs-Sea World Research Institute) that were maintained at 20-24°C. Fish were randomly selected from the holding tanks each time and were then transported to California State University, Fullerton in an ice chest in seawater kept at approximately 23°C. Locomotor performance of individual fish was evaluated by videotaping the fish at 120 Hz during several escape responses and using computerized motion analysis to determine the maximum velocity during each escape response. Results show an increase in burst swimming performance with age but appear to show no change in this relationship across metamorphosis.

P4. DETECTING AGE OF SOUTHERN CALIFORNIA CHAPARRAL STANDS WITH SPECTRAL REFLECTANCE

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Frequent fires in Southern California chaparral vegetation lead to a mosaic of differently aged stands, which vary in species composition, biomass and photosynthetic activity. This study explored the ability of remote sensing to detect the age of chaparral vegetation at the canopy scale. Using a field spectrometer the spectral reflectance of stands aged 0, 3, 20 and more than 40 years was measured at 1-meter intervals along 100-meter transects over a full year. Since we found that existing spectral reflectance indices are limited in their ability to distinguish stand ages, we explored alternative indices that represent the structural and physiological differences between stand ages. Discriminant analysis was used to determine the wavelengths that account for most of the variability between ages in a given season. The best season for detecting stand age of chaparral vegetation by remote sensing is April to June. After normalization for different light intensities, first derivative and variance spectra (coefficient of variance) of average transect reflectance provide an effective means of age-separation. Discriminant analysis uses the blue-green (500-520 nm), the red (640-690 nm), the red edge (710-770 nm), and the near infrared (820-900 nm) spectral regions to differentiate between stand ages. An index combining those spectral regions as well as the annual variability within ages efficiently separates stand ages and is an improvement over the use of conventional spectral reflectance indices. This index could be used to map stand age from airborne imagery.

P5. ESTIMATION OF VEGETATION WATER CONTENT AND BIOMASS USING WATER ABSORPTION FEATURES IN SPECTRAL REFLECTANCE.

Sims, D.A. and J.A. Gamon., California State University, Los Angeles, CA, 90032, USA.

NDVI is widely used in remote sensing for estimation of vegetation cover and light absorption. However, because of the almost complete absorption of red wavelengths by chlorophyll in the first layer of leaves, NDVI saturates at relatively low leaf area indices. This also means that NDVI is not particularly sensitive to variation in leaf thickness, which affects biomass but has relatively little effect on red absorptance. As an alternative, water band indices can potentially "see" further into a vegetation canopy because light absorption by water in the shorter wavelength water bands is much weaker than the absorption of red light by chlorophyll. Water band indices are also sensitive to variation in leaf thickness since thicker leaves generally contain more water. In spite of a large number of water band index studies, few have directly compared water band indices to measured canopy water content or biomass. We measured spectral reflectance of plant canopies for a wide range of species and then harvested portions of the canopies to determine total biomass and water content. The water band indices were best correlated with the component of total canopy water present in thin green tissues (ie leaves, small stems, fruits). Water band indices based on water absorption around 1200 nm produced the best correlations, but correlations were nearly as good for indices based on the 970 nm water band. Indices based on the 1480 nm water band showed a greater tendency to saturate at higher canopy water contents. These relationships did not vary significantly between plant functional types.

P6. COMPARATIVE ULTRASTRUCTURE OF THE INTESTINAL EPITHELIUM IN THREE RELATED SPECIES OF SILVERSIDE FISHES WITH DIFFERENT DIETS

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Few ultrastructural comparisons have been made of the intestinal epithelium in fishes with different diets, and little can be said about expected differences in this tissue between carnivorous and herbivorous species. We explored possible diet-related specializations of the gut epithelium in stomachless fishes by comparing the surface area of the brush border and qualitative features of the absorptive cells in three closely related species of New World silversides (Atherinopsidae) using electron microscopy. Proximal, middle and distal regions of the intestinal surface of *Atherinops affinis* (a functional herbivore), *Atherinopsis californiensis* (an omnivore) and *Leuresthes tenuis* (a carnivore) were compared within and among species. Comparisons completed to date indicate that the microvilli are tallest in *A. affinis*, shortest in *A. californiensis* and of intermediate height in *L. tenuis*. The height of the microvilli appears to be greater in the proximal and middle regions than in the distal portion of the gut of *A. affinis*, whereas the microvilli of the distal region appear to be taller in *A. californiensis* and *L. tenuis*. Qualitative analysis of the mitochondria and the absorptive and secretory vacuoles in the three species is in progress.

P7. DETERMINING OPTIMAL AVIRIS WAVELENGTHS FOR THE IDENTIFICATION OF BOREAL FOREST LAND COVER TYPES.

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Hyperspectral imagery from the Airborne Visible Infrared Imaging Spectrometer (AVIRIS) was used to determine an optimal set of wavelengths for vegetation mapping. Our initial efforts utilized imagery acquired over central Canada to classify boreal land cover types. From the 224 spectral AVIRIS channels available, approximately 40 wavelengths associated with important biochemical and/or biophysical processes in vegetation were selected. Employing discriminant analysis, various combinations of these bands were obtained and then used in a maximum likelihood classification routine to map land cover for three seasons. Our analysis indicated that a small number of wavelengths, ~ 13, associated with plant structure or physiological function provided one of the best vegetation classifications for this area, above 80% according to a vegetation map prepared by the Saskatchewan Environment and Resource Management, Forestry Branch – Inventory Unit (SERM-FBIU). In addition to providing improvements in boreal land cover mapping, this method offers the advantage of being fairly simple to apply. Further study is focusing on the applicability of this method for other biomes, including Southern Californian ecosystems.

P8. MONITORING NITRATE AND ORTHOPHOSPHATE CONCENTRATIONS OF AN ORANGE COUNTY NURSERY DURING STORM EVENTS

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Due to the concern for the health of Upper Newport Bay Ecological Reserve, an intensive stormwater monitoring study of Hines Nursery was conducted. This nursery, a very large commercial nursery situated in the northeastern portion of the Newport Bay Watershed in Orange County, was monitored extensively during a storm event recorded January 25th, 2000. A light rain preceded this storm event, which led to high antecedent moisture content in soils. This high moisture content in soils contributed to high runoff rates from the nursery. Nitrate concentrations in runoff from Hines Nursery varied from 132 mg/L to 260 mg/L during the monitoring period. The nitrate concentration in runoff from the nursery increased during the sampling period, reaching the maximum levels when final samples were collected at each station. Flow rates at the sampling points decreased during the sampling period as precipitation and

runoff declined. The simultaneous increase in nitrate concentration and decrease in runoff amounts is probably due to (1) drainage of nitrate-laden waters from shallow soil profiles (lateral subsurface flow), and (2) drainage of residual surface flows that had been in contact with soils longer than runoff that flowed from the nurseries during the early stages of monitoring. Runoff waters during the early stages of monitoring had shorter amounts of time to interact with soils and did not dissolve as much nitrate in soils. Orthophosphate concentrations in runoff from Hines Nursery varied from 8.50 mg/L to 10.50 mg/L on January 25, 2000. Orthophosphate concentrations in runoff waters show no consistent increasing or decreasing patterns at all stations during the monitoring period.

P9. PHOTOSYNTHESIS AND PIGMENTS OF ARCTIC TUNDRA SPECIES LINKED TO REMOTE SENSING

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The objective of this study is to understand the photosynthetic physiology of the three main cover types (vascular plants, mosses, and lichens) at Barrow, Alaska and how it can be determined by using ground-based remote sensing techniques. Spectra gathered from remote sensing was distilled into indices (NDVI-“greenness and chlorophylls”, PRI-“relative photosynthesis and xanthophylls”, and WBI-“canopy water content”) based on reflectance values. In addition pigment analysis, small chamber photosynthesis and respiration (~80 cm²), and photosynthetic efficiency measures of individual species was used to provide a basis for understanding how the arctic vegetation’s optical properties are linked to physiology. The cover types demonstrated vastly different seasonal patterns in photosynthetic rate, spectral reflectance, and photosynthetic efficiency; vascular plants showed a seasonality in NDVI while mosses and lichens did not. Analysis showed that lichens lacked most of the pigments normally found in vascular plants (e.g. xanthophylls and chlorophyll b) had lowered photosynthetic efficiency, and lowered photosynthetic rates. As the environment changes and impacts the seasonality of carbon fluxes the ability to detect these changes with remote sensing will be valuable.

P10. LINKING BIODIVERSITY AND SPECTRAL REFLECTANCE IN SOUTHERN CALIFORNIA CHAPARRAL AND COASTAL SAGE SCRUB

Brian R. Zutta, Miriam J. Schmidts, Daniel A. Sims, John A. Gamon, California State University, Los Angeles

Effective and accurate assessment of biodiversity over large regions must be accomplished through remote sensing. Our objective was to measure the spectral reflectance of Southern Californian vegetation, and use spatial, temporal, and spectral variability to establish a relationship between a biodiversity and optical properties. A field spectrometer was used to measure reflectance at 1-meter intervals along 100 meter transects of chaparral and coastal sage scrub vegetation, located in the Santa Monica Mountains of Southern California. Discriminate analysis was used to characterize the variability of spectral reflectance in space and time. This analysis revealed a significant relationship between spectral information and measures of biodiversity. However, there was limited power to distinctly classify all species through their optical properties. Application of this approach may lead to better understanding of the impacts of disturbance and global change on biodiversity.

P11. OCCURENCE OF *GYRODACTYLUS PERFORATUS* (MONOGENEA) ON ITS FISH HOST (*CLEVELANDIA IOS*) FROM BODEGA BAY AND TOMALES BAY, CALIFORNIA

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The monogenetic trematode *Gyrodactylus perforatus* was previously reported to infect populations of the arrow goby, *Clevelandia ios*, from Bodega Bay, California. *Clevelandia ios* were sampled from Bodega Bay

and nearby Tomales Bay using two different collection methods and examined for *G. perforatus*. Procedures for removal, processing and examination were previously developed for microscopic monogenes in other fish hosts and these processes were adapted for this study as necessary. *Gyrodactylus perforatus* was found on hosts in Tomales Bay, thus extending its range beyond its type locality, Bodega Bay. Parasitism by *G. perforatus* on *C. ios* was statistically significant between the samples and higher in Bodega Bay.

P12. CHARACTERIZATION OF MHC CLASS I LOCI IN THE ISLAND FOX (*UROCYON LITTORALIS*)

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The Channel Island Fox (*Urocyon littoralis*), a threatened species, inhabits six of the California Channel Islands. The Santa Catalina population recently experienced a devastating outbreak of Canine Distemper Virus (CDV). Our work addresses the possibility that certain Major Histocompatibility Complex (MHC) Class I alleles at specific loci may confer resistance to CDV. Different loci, including DLA-88, have been characterized in surviving Catalina *U. littoralis* via amplification with primers specific to domestic dog MHC Class I loci. SSCP-PCR and sequencing analysis allows us to characterize the different alleles that exist at each locus. Data will be presented on MHC variation for Island foxes. Sequences will be analyzed for selection and compared to published domestic dog sequences.

P13. CART - A ROBOTIC SYSTEM FOR ENVIRONMENTAL SAMPLING

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Many critical issues in ecology suffer from under-sampling. We simply do not have the personnel and tools in place to measure what we need to know, in enough places, with adequate sample sizes. The intent of the Compact Automated Research Transport (CART) project is to design and build a mechanical system for automatic field sample collection. This system is capable of taking samples at precisely the same locations repeatedly under varying weather conditions. The CART, with its own onboard power and control systems, can operate without supervision for prolonged periods of time. Additional features such as the truss / tripod setup requiring minimal tooling, the folding antenna assembly that doubles as a CART carrying handle, and the easy access panels all make the system ideally suited for field work. A prototype CART system is currently being built and tested for the purpose of monitoring vegetation features related to surface-atmosphere transport of carbon dioxide.

P14. STAND-SCALED CARBON AND WATER VAPOR FLUX MEASURING BY CO₂ LT CHAMBERS IN SOUTHERN CALIFORNIA CHAPARRAL

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Stand-scaled (2 by 2 meters) carbon and water vapor flux have been studied under six different CO₂ treatments using CO₂ LT (CO₂ controlled, Natural Lit, Temperature controlled) null balance chambers in Southern California chaparral (dominated by *Adenostoma fasciculatum* H. & A. in northeast San Diego County) since 1996. By using the chamber technique, we measured net ecosystem carbon and water vapor flux directly and continuously. The annual net ecosystem carbon flux under different CO₂ treatment was accumulated from daily carbon flux. Increasing CO₂ from 250 PPM to 750 PPM, for three years, caused the GPP to increase by 56%, which is equal to 537 gC/m². The CO₂ effects on the chaparral ecosystem during these years were variable according to the regression line slopes of annual net ecosystem exchange (NEE) versus CO₂ treatment. The result showed that the water availability counteracted the CO₂ effect during these years' net ecosystem flux measurement. The direct effects of elevated CO₂ on the plant at the leaf level

included increased photosynthesis as well as decreased stomatal conductance and transpiration. A positive effect of CO₂ on ecosystem evapotranspiration (ET) was detected by *in situ* chamber technique.

P15. PHYSICAL ACTIVITY, ANTIDEPRESSANT TREATMENT, AND BDNF EXPRESSION IN THE AGING BRAIN

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Brain-derived neurotrophic factor (BDNF) promotes the survival and differentiation of developing neurons and participates in activity dependent plasticity mechanisms such as long-term potentiation (LTP). BDNF is also implicated in protecting mature neurons from atrophy and apoptosis in the diseased human brain. Recent studies have reported that antidepressant treatment and physical activity have an additive and potentiating effect on BDNF messenger ribonucleic acid (mRNA) expression within the dentate gyrus, CA1, CA3, and CA4 cellular fields of the young rat hippocampus (Russo-Neustadt et al 1999). The hippocampus is known to play a vital role in functions such as learning and memory and behavioral regulation. In this study we examined the effects of antidepressant treatment, physical activity and the combination of these two interventions on BDNF mRNA expression in the aging brain. Senescent (24 month) rats were treated with tranylcypromine (7.5 mg/kg) by intraperitoneal injection over a 14-day period. Physical activity groups were placed into a water maze for two-minute swimming intervals. BDNF mRNA expression levels were localized in several areas of the hippocampus by *in situ* hybridization, using a [³⁵S] labeled riboprobe complementary to the BDNF mRNA sequence. Autoradiography films were analyzed by computer-assisted densitometry. Compared to control animals receiving saline (vehicle) injections, the combination of antidepressant treatment and physical activity led to significant BDNF mRNA increases within the CA1 and CA2 areas of the hippocampus (also above the levels obtained with each intervention alone). These results suggest that specific interventions (antidepressant treatment and physical activity) can enhance BDNF mRNA expression in the aging brain, which may contribute to improving therapeutic treatments in neurodegenerative diseases such as Alzheimer's disease.

P16. NORADRENERGIC ACTIVATION MAY PARTICIPATE IN THE ELEVATION OF BDNF mRNA OCCURRING WITH GENERAL PHYSICAL ACTIVITY

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Brain derived neurotrophic factor (BDNF) serves an important role for neuronal development, differentiation, maintenance and survival. The presence or absence of growth factors like BDNF may be important in neurodegenerative diseases such as Alzheimer's Disease (AD) since BDNF levels are diminished in AD patients. Previous studies have indicated that antidepressant treatment and physical activity up-regulate transcription and translation of BDNF in several brain regions including the hippocampus. Antidepressant treatment exerts its therapeutic effects through re-uptake inhibition of norepinephrine or serotonin. We have tested the possibility that activation of serotonergic (5-HT) or noradrenergic (NE) neurotransmitter systems may be essential for the increase in BDNF mRNA levels observed with physical activity. We administered chlorpromazine (10mg/kg i.p.) followed by para-chloroamphetamine (PCA) (60mg/kg), to rats as a systemic 5-HT lesion. Alternatively, N-(2-chloroethyl)-N-ethyl-2-bromobenzylamine (DSP-4) was administered (50mg/kg i.p.) in order to deplete NE input. Three days (PCA) or one week (DSP-4) post-lesion, experimental animals engaged in voluntary physical activity for one week. BDNF mRNA levels were quantified in the hippocampus by *in situ* hybridization and computerized densitometry. One week of exercise led to a significant enhancement of full-length BDNF mRNA levels in several hippocampal regions. Lesion with PCA neither diminished these levels, nor changed baseline (sedentary) BDNF mRNA levels. Lesion with DSP-4 appeared to significantly attenuate the increase in BDNF mRNA levels in the CA3, CA4 and dentate gyrus. These results suggest that activation of the NE system may participate in the up-regulation of BDNF mRNA occurring with general physical activity.

P17. GEOLOGIC MAPPING OF ARAM CHAOS, MARS: A POSSIBLE HARBOR FOR EARLY MARTIAN LIFE

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Aram Chaos is a large, ~300 km in diameter, highly modified crater in the equatorial region of Mars that shows evidence that it once may have harbored life within a paleolake. The interior of Aram Chaos dominated by chaotic terrain, which is possibly created by near-surface water/magma interaction. The Thermal Emission Spectrometer (TES) aboard the Mars Global Surveyor (MGS) has revealed a significant accumulation of bulk crystalline hematite covering an area ~5000 km² which is likely to have been formed through water related processes. To better understand the nature of any paleoenvironments within Aram Chaos, the geomorphology of the crater interior has been mapped using MGS image and elevation data. The interior of the crater has been mapped into four distinct geomorphic terranes, *chm*, *slp*, *msm*, and *ims*. *Chm* is an older highly chaotic unit, ringing the younger, slumped and hummocky terrain of unit *slp*. In the northeast section of the crater lies a smooth mound, unit *msm*, rising above *slp* that is divided into individual mesas. *Msm* has been incised to expose a highly friable surface of unit *ims* where the hematite spectral signatures occur. Units *msm* and *ims* appear relatively young and can be interpreted to be lacustrine or eolian deposits or a resurgent caldera of a sub-ice volcanic construct. High-resolution images of *msm* show that it is a surface resistant to weathering protecting the underlying friable *ims* and elevation data shows that it is exposed up to 1000 meters below the surface of *msm*.

P18. ESTIMATING GROUNDWATER CONSUMPTION FROM IRRIGATED FIELDS USING REMOTE SENSING DATA

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Landsat image data of Antelope Valley from 1974 to 2001 were examined for calculating the total acreage of irrigated croplands and identification of crop types. Crop type and acreage information will be used by engineers to determine the total amount of water used by irrigation. Maps compiled from these images show a dramatic decline in irrigated crop acreage between 1986 and 1998. Furthermore, Government remote sensing studies indicated this decline would continue well past the year 2000. However, recent satellite images reveal that the estimates of continuing decline were premature. Indeed, the irrigated crop acreage has increased significantly during the last two years, further exacerbating the ground water overdraft concerns of the local communities. During the first stage of this study standard image classification technique was used. It was too simplistic and failed to consider certain special cases like freshly planted fields that did not have crop reflectance properties, but yet consumed water. This presentation will demonstrate the use of a GIS-based knowledge base in image classification for improving the acreage estimation and crop type identification.

P19. FOURIER TRANSFORM INFRARED (FTIR) STUDIES OF HETEROGENEOUS REACTIONS BETWEEN GASEOUS POLLUTANTS IN THE ATMOSPHERE AND NITRIC ACID (HNO₃) ON SILICA SURFACES AS A FUNCTION OF THE TYPE OF SURFACE AND RELATIVE HUMIDITY (RH).

A.M. Rivera-Figueroa, M. Mochida and B.J. Finlayson-Pitts. University of California, Irvine. Department of Chemistry, Irvine, CA, 92697-2025.

Over the last few years it has become increasingly obvious that the partitioning of nitrogen oxides in the atmosphere, in particular the NO_x/HNO₃ ratio, is not accurately reproduced by models. In order to account for this discrepancy, several reactions of different gaseous pollutants –methane (CH₄), sulfur dioxide (SO₂), carbon monoxide (CO), and nitrogen oxide (NO)- with adsorbed nitric acid (HNO₃) on a variety of surfaces – silica (SiO₂) porous glass and powdered silica (Cab-O-Sil®) have been studied using Fourier transform infrared spectrometry (FTIR). These reactions are known to be thermodynamically feasible. However, we found that under ambient conditions (1 atm, 298 K), reactions between HNO₃ adsorbed on either the silica or

Cab-O-Sil[®] surface and CH₄, SO₂ and CO do not occur. On the other hand, the reaction of adsorbed HNO₃ and NO does proceed. The effect of the relative humidity (RH) on the progress of this reaction, as well as the kinetics of this reaction is being studied. This reaction might be an important source of generating nitrous acid (HONO) in polluted urban air in Southern California.

P20. SOURCES OF EXCESS NUTRIENTS IN THE SAN DIEGO CREEK WATERSHED

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The San Diego Creek Watershed extends over much of Orange and Los Angeles Counties, California. It is bound to the north by the Santa Ana Mountains, to the southeast by the San Joaquin Hills, and on the south by Upper Newport Bay. This area was a marshland up until the early 1900s, at which time it was drained for irrigated agricultural use. An extensive drainage system consisting of concrete-lined and unlined channels was constructed for this purpose. Currently, the surrounding areas are experiencing tremendous urban growth. Field studies are focusing on possible sources of excess nutrient contamination (nitrogen and phosphorus) in the San Diego Creek Watershed. Ground water (seeps, weepholes) and surface water samples are taken from the drainage channels and analyzed for these constituents. The upper part of the watershed contains nursery and agricultural operations believed to contribute significant amounts of N and P to the watershed through the application of fertilizers. Preliminary investigations have detected levels of nitrate as high as 359 mg/l as NO₃⁻, and phosphate levels of 14.96 mg/l PO₄³⁻ in surface water runoff from nurseries. In the lower watershed, preliminary data suggest ground water seepage into drainage channels contributes large amounts of nitrate (up to 120 mg/l NO₃⁻) into the watershed. High levels of PO₄³⁻ are most likely contributed by construction activities causing sediment loading through runoff, and also by the use of "reclaimed" water for irrigation of greenbelts and parks. This irrigation water has tested as high as 2.93 mg/l PO₄³⁻.

P21. NEUROTROPHIC EFFECTS OF ESTROGEN ON THE CHOLINERGIC BASAL FOREBRAIN

Reymundo Dominguez, Cathy Jalali and Sonsoles De Lacalle. Department of Biology and Microbiology, California State University, Los Angeles

Memory loss and cognitive decline are the most prominent features of Alzheimer's Disease (AD). The cholinergic neurons of the basal forebrain (BFCNs) provide the major source of cholinergic input to the hippocampus and the neocortex, have been shown to undergo degeneration in AD patients. This neuronal degeneration causes a marked decrease in the expression of choline acetyl transferase (ChAT) which synthesizes the neurotransmitter acetylcholine (ACh). Estrogen replacement therapy has been shown to be effective in treating memory loss in post-menopausal women. Additionally, previous studies have indicated that administration of exogenous estrogen increases the cholinergic function in the basal forebrain of ovariectomized rats. The expression of cholinergic markers such as ChAT or vesicular ACh transporter (VAChT) have been used to measure the cholinergic function in the basal forebrain.

54. VISITOR IMPACTS ON ROCKY SHORES: ARE SOUTHERN CALIFORNIA'S MARINE PROTECTED AREAS PROTECTING COASTAL RESOURCES?

S. N. Murray. Department of Biological Science, California State University, Fullerton, CA 92834-6850.

In Southern California and elsewhere, unlawful human collecting and visitor foot traffic are damaging rocky intertidal populations even in Marine Protected Areas (MPAs). The intensities of human visitation and collecting on rocky shores will be described in long-established and signed MPAs located in urban Southern California. Results of studies describing impacts of collecting and visitor foot traffic on rocky intertidal populations also will be reported. Based on our observations and results, regional MPAs may not be protecting shore populations from visitor damage as configured and managed. Certain populations, even in

MPAs, may be exhibiting reductions in abundance and experiencing important shifts in population structure, resulting in lower frequencies of the larger-sized, more fecund individuals. Efforts are currently on-going in California to improve protection of coastal resources through implementation of the Marine Life Protection Act (MLPA). Relationships between MLPA implementation and improved reserve protection for rocky intertidal organisms in Southern California also will be discussed. (Supported by NOAA Grant NA46RG0472 to USC Sea Grant and the California State Resources Agency.)

55. SEASONAL OCCURRENCE AND SPECIES RICHNESS OF THE AVIFAUNA ON THE LONG BEACH BREAKWATER: A MAN-MADE SURROGATE HABITAT.

J.W. Johnson and R.A. Schallmann. Naval Weapons Station Seal Beach, Seal Beach, CA, 90740; CSU Long Beach, Department of Biological Sciences, Long Beach, CA, 90815.

Rocky intertidal habitat in the southern California bight is in short supply, with the vast majority of potential habitat being largely modified, disturbed or absent. In 1943, the Long Beach Breakwater was constructed and now serves as a surrogate habitat for many taxa in both subtidal and littoral zones. We performed 45 censuses from 1992 to 1995 to obtain an overview of avian species richness and abundance on the Long Beach breakwater. We attempted to gather data from all four seasons over multiple years to determine seasonal use. We surveyed a large portion of the Long Beach breakwater and used this data to estimate values for the balance of the breakwater. Of the 33 species observed during our survey, 5 were abundant, 7 were common, and 21 were uncommon. The most abundant species observed were Brown Pelican and Western Gull. Ten species were present year round, 15 were season specific and 8 were observed on two or fewer occasions. Although many species were found year round, only the Black Oystercatcher was recorded as breeding on the breakwater. Of observed species, 18 are northern migrants and 4 are southern migrants. We categorized the activities of the birds as foraging, roosting or breeding. This study seeks not only to define the avian species that use this man-made surrogate habitat, but also to quantify seasonal fluctuations in species richness and biomass as well as the ways this habitat resource is being utilized.

56. FACTORS AFFECTING FISH DIVERSITY ON A TEMPERATE REEF III: THE FISH ASSEMBLAGE OF PALOS VERDES POINT, 1974-2000

D. J. Pondella, II and J. S. Stephens, Jr. Vantuna Research Group, Occidental College, Moore Laboratory of Zoology, 1600 Campus Rd. Los Angeles, CA 90041.

The nearshore fish assemblage of the Palos Verdes Peninsula has been monitored quarterly from 1974-2000. All conspicuous fishes were surveyed by three life history stages: adults, subadults and juveniles. After the primary faunal shift associated with the 1978-79 El Niño which resulted in a change from an Oregonian fauna to a San Diegan fauna has been well documented for both fishes and invertebrates. What is not well understood, however, is the long-term results of this faunal shift, nor the magnitude of the event. Our data tracks a decline in the density of most species during this period. In many cases these trends are a result of increased mortality early in ontogeny independent of predator density. The significance of these trends and their implications for reef productivity will be discussed.

57. YOU'VE GOT TO KNOW WHERE THEY GO: HOME RANGE AND SPILLOVER POTENTIAL OF KELP BASS (*PARALABRAX CLATHRATUS*) IN BIG FISHERMAN'S COVE MARINE RESERVE, SANTA CATALINA ISLAND, CALIFORNIA.

D.T. Topping, C.G. Lowe, C.L. Snellen, Y.P. Papastamatiou, D.P. Cartamil, and G. Moss. Dept. of Biological Sciences, California State University Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840.

Determining the space utilization, activity patterns, and habitat use of economically important gamefishes is critical for effective design and placement of marine reserves. The kelp bass (*Paralabrax clathratus*), an important nearshore gamefish in southern California, might benefit from this type of management strategy. Home range areas (95% Kernel Utilization Distributions) were determined for adult kelp bass (25 to 40 cm SL) in the Big Fisherman's Cove no-take Marine Reserve located at Catalina Island. Ten kelp bass were

surgically fitted with small acoustic transmitters and tracked up to 90 hrs during multiple, continuous 24-hour periods over the course of a month. Home range areas of fish tracked varied widely, ranging from 33 to 11191 m², averaging 4304 ± 1337 m² (± SE). Home range areas of kelp bass increased significantly with increased water temperature ($r^2 = 0.86$, $p = 0.0003$). Two of the ten fish tracked left the reserve (spillover), in which this time outside the reserve only accounted for 18.4 and 37 % of their home range area. Based on the relatively small home ranges observed, even small marine reserves such as Big Fisherman's Cove (130,000 m²) can provide adequate fishing protection for mature fish.

58. CALIFORNIA'S MARINE RESERVES ARE BEING COMPLETELY REORGANIZED, STARTING WITH THE NORTHERN CHANNEL ISLANDS.

I. Tetreault-Beers. Member of the Master Plan Team for the Marine Life Protection Act. UCLA Environmental Health Sciences, Los Angeles, CA 90025.

The knowledge gathered from marine ecological research is now being put to the test to help rebuild the world's declining fisheries. Resource managers and governments are looking to marine scientists for guidance as they design marine reserve networks to conserve species and enhance fisheries. Scientists are striving to provide answers using the best available information. Over 150 marine ecologists recently signed a statement of consensus regarding the efficacy of no-take reserves, and the Theory of Marine Reserves will be published this summer. This talk will highlight the complex process of balancing the interests of fishermen, environmental groups, and scientists in the politically-charged debate currently unfolding in California.

59. AN OVERVIEW OF LONG-TERM CHANGES IN INTERTIDAL AND SUBTIDAL ALGAL ASSEMBLAGES NEAR THE DIABLO CANYON POWER PLANT

S. Kimura. Tenera Environmental, San Luis Obispo, CA 93401.

The Diablo Canyon Power Plant is located in central California, midway along a 20 km length of rocky coastline between Morro Bay and Avila Beach. The power plant began commercial operation in 1985, and the discharges from the cooling system create a warm-water environment in Diablo Cove that is several degrees C above ambient. Permanent intertidal and subtidal stations near the power plant have been monitored for algal, invertebrate, and fish abundance since 1976. The long-term data enables us to analyze for changes in control and impact areas before and during power plant operation. Algal assemblages have changed substantially in the vicinity of the power plant in response to the thermal plume discharge. Foliose algal cover declined in the intertidal zone, leaving crustose taxa and increased bare rock space. Limpets and barnacles have become more abundant in areas where algal cover has declined. Changes in shallow subtidal zones occurred in two phases. In the first phase, bull kelp, *Nereocystis*, and subcanopy kelps, *Pterygophora* and *Laminaria*, declined immediately after power plant start-up. Red algal understory species composition also changed, but total understory algal cover did not change substantially. The second phase began in the early 1990s when a large increase occurred in giant kelp, *Macrocystis*, which resulted in a decline in the red algal understory from shading. Coastal areas further than 0.5 km from the power plant have remained largely unchanged. Our findings underscore the importance of long-term studies to fully account for direct effects of increased water temperatures and secondary effects resulting from biological interactions.

60. HABITAT DESIGN AND RESULTS FOR A KELP (*MACROCYSTIS PYRIFERA*) RESTORATION PROJECT OFF TAJIGUAS, SANTA BARBARA COUNTY

D. C. Barilotti San Diego State University and D. C. Lees, Littoral Ecological and Environmental Services.

The kelp restoration objectives of the project, to create new habitat where 272 or more adult kelp plants provided at least 470 plant years of resource benefits, were successfully met within 18 months after the granitic quarry rocks for the habitat were deployed in May 1999. The habitat area hadn't supported stable stands of kelp in the past, probably due to a thin layer of sand over the bedrock that interfered with recruitment. Several considerations for habitat design and restoration that were made for this project that

may not occur elsewhere included: (1) Kelp plants in the Tajiguas area reach adult size (8 or more fronds) in about 4 months after being transplanted as 1 to 2 frond plants. (2) The Tajiguas area has high sea urchin recruitment. (3) Substrate vertical relief of 30 cm or more above the sand is needed to minimize the recruitment success of *Pterygophora californica* that competes with *Macrocystis* for space. (4) Frond density should not exceed 10 fronds/m² to minimize self-shading effects. (5) All objectives for the habitat had to be met before November 2002. (6) By growing kelp spores into the sporophyte generation on nylon lines in the laboratory and then growing them in the field near the habitat until they have 1 to 2 fronds on them, plants suitable for transplanting can be produced in 2-3 months. (7) The habitat had to persist into regulatory "perpetuity".

61. BEHAVIOR OF INTRODUCED ROCKS AND PRE-EXISTING SAND FOLLOWING CONSTRUCTION OF SUBTIDAL ARTIFICIAL KELP HABITAT.

D. C. Lees, Littoral Ecological & Environmental Services and D. C. Barilotti, San Diego State University

Following removal of underwater pipelines through the kelp beds in Santa Barbara County while decommissioning their subsea wells in 1997, Phillips Petroleum was required by regulatory agencies to install an area of artificial kelp habitat sufficient to support 470 adult kelp plants (*Macrocystis* sp.) for one year. In response, we designed and Phillips constructed 0.7 hectares of rocky habitat in an area of shallow sand offshore from a natural reef supporting kelp. Over 1,200 quarry rocks 1 – 1.75 m in diameter were distributed over the project area, covering between 8 and 16 percent of the sandy seafloor. We monitored the behavior of: 1) 30 of these rocks; and 2) the sand in and around this new structure for 18 months. The introduced rocks sank only minimally into the underlying sand, even in areas of deep sand. They thus appear to provide long-term substrate acceptable for kelp recruitment during periods when kelp is surviving elsewhere. Introduction of the rocks comprising the new habitat resulted in a general loss of sand in the restoration area. Bedrock became exposed in areas where sand overburden was less than 0.3 m deep prior to habitat construction. A rich epifaunal assemblage has developed on the rocks and appears to support a variety of invertebrates and fishes. In addition, a dense suspension-feeding assemblage dominated by the tubicolous worm *Diopatra ornata* developed in the sandy habitat among the rocks in the new habitat. These assemblages likely provide considerable forage for the fish assemblage that inhabits

62. OVERVIEW OF SONGS ARTIFICIAL KELP REEF MONITORING PROGRAM – MONITORING PLAN AND SUMMARY OF THE PHYSICAL ATTRIBUTES OF REEF.

D. Huang and D. Malone, California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009

The SONGS Artificial Reef near San Clemente, California is the first of a two phase mitigation project to construct an artificial kelp reef to compensate for the losses of kelp bed resources caused by the operation of the San Onofre Nuclear Generating Station (SONGS) Units 2 and 3. The first phase of this project is a 5-year experiment whose primary objective is to determine the substrate types and configurations that best provide adequate conditions for establishing and sustaining giant kelp and other reef-associated biota. Information obtained from this experiment will be used to design the second phase which consists of building a reef large enough to support 150 acres of kelp forest community. The experiment consists of 56 0.4 acre "modules" with 6 physical designs: 2 substrate types (quarry rock and recycled concrete) and 3 coverages (17%, 34%, and 67%). Two additional treatments involve transplanting small kelp plants to modules consisting of 34% quarry rock and concrete. Three methods were used to assess the physical makeup of the artificial reef: 1) side-scanning sonar was used to estimate module boundaries and areas; 2) Uniformly distributed points were used to estimate the percent cover of hard and soft substrates; and 3) gain or loss of sediment was measured with permanent steel stakes. Results from diver surveys done during the first year of this study showed: (1) The mean coverage of hard substrate of treatments ranged from 41 to 85%, which is similar to that of nearby reference reefs, but considerably higher than the nominal design coverages 2) Total area of hard substrate increased slightly on all reef designs due to a combination of redistribution of reef material and scour of hard sand that exposed natural hard substrate underlying the reef. 3) Scour and accretion of soft sediment was

slight. Accretion tended to occur in module interiors, while scour was largely confined to the margins of the modules. The implications of these physical characteristics to biota on the artificial reef will be discussed.

63. PATTERNS OF SURVIVORSHIP AND RECRUITMENT OF *MACROCYSTIS PYRIFERA* AT THE SONGS ARTIFICIAL KELP REEF.

J. Bunch, California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009

A primary goal of the San Onofre Artificial Kelp Reef is to create a habitat capable of permanently sustaining giant kelp (*Macrocystis pyrifera*) populations at densities equal to or greater than 4 adults 100 m^{-1} . The abundance, size, and sorus areas of adult and subadult giant kelp were estimated on the artificial reef and on nearby natural reefs in March and August, 2000 as well as the size and type of substrate to which they were attached. Survival of adults between surveys was estimated using tagged plants, and the abundance of juveniles (plants with two stipes but less than a meter tall) and recruits (blades with single stipes) were determined using quadrat sampling during a single survey in June and July, 2000. We also followed the growth and survivorship of very small *Macrocystis pyrifera* that were transplanted to the artificial reef. Adult kelp were significantly less abundant on the artificial reef compared to the natural reefs (mean = 0.1 vs. 16.0 m^{-2}). Most of these plants occurred on small substrates < 26cm largest dimension, and their abundance decreased with distance from the San Mateo kelp bed. This spatial pattern of abundance coupled with the fact that adults were older than the artificial reef strongly suggest that the San Mateo kelp bed was the source of adults, which undoubtedly drifted or bounced along the bottom until they were trapped by the artificial reef. The survivorship of these trapped drifters was significantly lower than that of adult plants on the natural reference sites (mean = 0.3 vs. 0.7). Unlike adults, the abundance of juveniles and recruits was significantly greater on the artificial reef compared to the natural reference reefs (mean = 25 m^{-2} vs. 250 m^{-2}). The abundance of kelp juveniles and recruits was negatively correlated with stipe density at the reference reefs and was higher at artificial reef modules near the San Mateo kelp bed than at those farther away. This suggests that shading and canopy cover inhibits recruitment at the natural reference reefs. This result is corroborated by the negative correlation between growth and survival of transplanted kelp and stipe density on the artificial reef. The fact that recruitment of kelp juveniles and recruits was not correlated with sorus density (a measure of spore availability) on the artificial reef further suggests that the drifting adult plants which colonized the reef soon after its construction were not a significant spore source for new kelp recruitment. Although our results indicate that kelp recruitment is higher near natural populations, they also provide evidence of effective spore dispersal (that which results in recruitment) over distances of at least 2.5 kilometers.

64. PATTERNS OF INITIAL BENTHIC COMMUNITY DEVELOPMENT AT THE SONGS ARTIFICIAL KELP REEF.

D. Toole, California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009

Abundances and percent cover of all understory algae and invertebrates present at the San Onofre Artificial Kelp Reef were determined to assess initial patterns of benthic community development. Quantitative surveys using band transects, quadrats, and systematic point contacts were conducted between June and August 2000, approximately 9 to 11 months after the construction of the artificial reef was completed. Species richness of algae on the artificial reef were similar to the natural reference reefs, while invertebrate species richness was somewhat lower. In both cases, species diversity was greater at the reference reefs than at the artificial reef. On the artificial reef, the ascidian, *Styela montereyensis*, comprised 45% of the solitary invertebrates counted, while another ascidian, *Chelyosoma productum* accounted for over 50% of colonial invertebrates. *Desmarestia ligatum* composed approximately 25% of the solitary algae, while polysiphonious red and filamentous brown algae constituted over 40% of the colonial algae surveyed. Although the distribution of species differed between the artificial reef and control sites, the use of available substrate was similar. These findings suggest that initial community development on the artificial reef was dominated by fast growing, opportunistic species.

65. A COMPARISON OF THE FISH ASSEMBLAGES AT THE SONGS ARTIFICIAL KELP REEF AND AT OTHER NATURAL AND ARTIFICIAL REEFS IN SOUTHERN CALIFORNIA.

D. Gates, California Coastal Commission SONGS Project Office, 2270 Camino Vida Roble, Suite L, Carlsbad, CA 92009

Similarities between the fish assemblages on the San Onofre Artificial Kelp Reef and at nearby natural reefs (San Mateo kelp bed and Barn Kelp bed) were examined. All age classes of fish on the 56 experimental modules at the artificial reef and along various transects at two nearby natural reference reefs were censused along fixed benthic and surface transects during the fall of 2000, approximately 1 year after construction of the artificial reef modules was completed. Data of species number and abundance from the artificial reef also were compared to similar data taken after a similar time interval at the nearby Pendleton Artificial Reef (PAR). In addition to transect counts, cryptic fish species were sampled in quadrats between June and August of 2000, 9 to 11 months after reef construction. The density of benthic fish was higher on the artificial reef compared to the natural reference reefs, while surface fish density was lower (due to lack of kelp canopy at the artificial reef). The abundance of non-cryptic benthic juveniles and adults at the artificial reef was higher than on the natural reference reefs (approximately 25 compared to 15 100 m^{-3}) at the reference reefs. Density of benthic young-of-year fish was also higher on the artificial compared to the reference reefs (30 versus 12 100 m^{-3}). The density of cryptic fish on the artificial reef was triple that of the natural reference reefs (mean = 0.9 m^{-2} vs. 0.3 m^{-2}). In general, these differences between artificial and natural reefs increase with the amount of artificial substrate. Although fish densities were higher at the artificial compared to the natural reefs, species richness and diversity were similar and comparable to values seen on PAR during the first year following reef construction. The total biomass of the major species was equal at the artificial and natural reefs, however, most biomass on the artificial reef consisted of juveniles and young-of-year fish, while biomass on the natural reefs consisted of larger and older fish. These results suggest that artificial reefs may rapidly establish benthic fish assemblages that resemble those on natural reefs.

66. SAVING OPEN SPACE. THE PUENTE-CHINO HILLS WILDLIFE CORRIDOR. HILLS FOR EVERYONE. (A 45-minute Video Presentation)

William S. Kowalik and Jill Anne Kowalik. Producers, 2181 El Cajonita Drive, La Habra Heights, CA 90631.

The proposed symposium presentation is an informational and inspirational video about the Puente-Chino Hills Wildlife Corridor, a unique urban wilderness in the middle of one of the most densely populated areas in the world. Filmed entirely on location in the Puente-Chino Hills, the video presents geographic information about this extraordinary open space, footage of the wildlife populations that inhabit it, interviews with people who use the Corridor for recreation, and contributions from various public officials or private citizens. Featured speakers include Dr. Kevin Starr, distinguished California historian and California State Librarian (on the importance of open space for our culture), Bob Henderson (Chairman of the Board, Native Habitat Preservation Authority), State Senator Ross Johnson (on his role in the establishment of Chino Hills State Park), Claire Schlotterbeck (long-time open space activist), biologists Dr. Cheryl Swift (Whittier College), Chris Haas (Cal Poly Pomona), and Lisa Lyren (Cal Poly Pomona), Congresswoman Hilda Solis, as well as a number of other local activists. The video is an attempt to present issues of Corridor preservation to the general population via Public Access cable television and was made to inspire citizen concern for this precious and fragile resource. It is currently being shown in the cities of Whittier, La Habra Heights, La Habra, Hacienda Heights, Rowland Heights, Diamond Bar, the unincorporated part of Walnut, and Brea. The producers are also approaching cable stations in Yorba Linda, Chino Hills, Chino, Corona, and Fullerton for broadcasting time.

67. CORRIDORS TO OBLIVION; STRATEGIES FOR PROTECTING HABITAT IN URBAN SETTINGS.

D.A. Guthrie, Joint Science Department, Claremont McKenna, Scripps and Pitzer Colleges.

In most cases, undeveloped land in the Los Angeles basin consists of isolated remnant patches of degraded habitat. Continued protection of these areas from development must be predicated on human use of these areas for recreational purposes. The design of corridors to connect these patches to source areas on the edges of the basin is a misuse of the corridor concept and is indefensible from the point of safety to both wildlife and the surrounding human population. A better strategy would be to educate the public to the value of natural open space for animals as well as for their recreational purposes. The habitat thus saved will have value to some wildlife, but will represent an unbalanced system in continual need of monitoring and manipulation. Research priorities should be aimed at understanding how to manipulate these habitats, meeting the needs of endangered species, and habitat improvement.

68. PRESERVING AND RESTORING THE COAL CANYON BIOLOGICAL CORRIDOR

Gearv W. Hund, California Department of Parks and Recreation, Inland Empire District, 17801 Lake Perris Drive, Perris, CA. 92571

The Puente-Chino Hills are located in the California Floristic province, one of 25 global hot spots of biological diversity. They are also part of the Southwest Ecoregion, an area containing a greater diversity of plants and animals than any other area of comparable size in the United States. One of the few remaining low elevation areas in Southern California with large tracts of wildland, they are rich in biological diversity. Their preservation is thus of worldwide as well as of local and regional importance to conservation. Human development including roads, and urban areas has fragmented and nearly isolated the Puente-Chino Hills from other wildland areas. Coal Canyon is the last remaining fully restorable linkage between the Santa Ana Mountains and the Puente-Chino Hills, an area of over 500,000 acres. Studies have documented its use by wildlife including large and medium bodied carnivores. If this corridor were lost, it is estimated that many at-risk species would become locally extinct. Two private parcels separated Chino Hills State Park, a 13,000-acre reserve in the Puente-Chino Hills, from Department of Fish and Game lands and the Cleveland National Forest in the Santa Ana Mountains. One of the parcels had an approved specific plan for development and the other has commercial zoning. Joining with conservation groups, local government, and state and federal agencies, California State Parks initiated an effort in 1995 to acquire the two remaining private parcels. In the fall of 2000, after five years of sustained effort State Parks acquired the first of the two private parcels. Efforts are ongoing to purchase the remaining parcel. In the future restoration and improvement efforts will be undertaken to enhance the corridor at Coal Canyon. These will include revegetation, the restoration of ecosystem processes, and under-crossing improvements. Monitoring of the effects of these improvements will also occur. The future of biological diversity in the Puente-Chino Hills will, in part, be dependent on the success of these efforts.

69. CHARACTERISTICS OF VEGETATION IN THE PUENTE HILL/CHINO HILL CORRIDOR.

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The Puente Hill/ Chino Hill corridor extends from the intersection of Orange, San Bernardino, and Riverside County northwest to Los Angeles County. The corridor represents one of the last undeveloped ranges of hills within Los Angeles County, and also accounts for a large percentage of the remaining coastal sage scrub habitat in Los Angeles County as well as significant stands of walnut woodland. Vegetation mapping of the corridor reveals relationships between vegetation series and slope exposures. The purpose of this study is to quantify the types of vegetation present in the corridor, and to examine the importance of slope exposure and slope degree in determining the location of plant series in the Puente Hill /Chino Hill corridor. The results of this study have implications for restoration and for habitat management in particular the use and timing of prescribed burns to manage fuel loads. Preliminary data suggest that some vegetation series are more prone to invasion by Mediterranean annuals. If series can be predicted by slope exposure and slope degree along with other factors, and if the "invasability" of a series can be predicted by post-fire recovery, then fuel modification plans can be designed that are more sensitive to the preservation of the remaining coastal sage shrub habitat.

70. BIRD CONSERVATION PRIORITIES IN THE PUENTE-CHINO HILLS

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The Puente-Chino Hills, extending 50 kilometers west into the Los Angeles Basin, represent one of the most significant lowland habitats for birds in the Los Angeles Metropolitan Area. Predictably, they are highly threatened by residential home development and associated impacts, including road construction. During 1997 and 1998, I surveyed the breeding bird community in the hills to investigate patterns of bird distribution along the hills, specifically to determine areas of high importance to globally or regionally sensitive taxa, such as Golden Eagle (*Aquila chrysaetos*), Least Bell's Vireo (*Vireo bellii pusillus*), California Gnatcatcher (*Poliophtila californica*), Yellow-breasted Chat (*Icteria virens*) and Grasshopper Sparrow (*Ammodramus savannarum*) and all of which maintain breeding populations in the hills. Four main areas seem particularly important for breeding birds: the extensive grasslands south of Rowland Heights (Los Angeles Co.), Upper Tonner Canyon (San Bernardino Co.), the Alluvial Coastal Sage Scrub of northern Brea (Orange Co.) and the Santa Ana River corridor (Riverside/Orange Co.). Other areas contribute strongly to local species diversity in the hills, notably Sycamore/Turnbull Canyon (Los Angeles Co.). Current conservation challenges will be discussed in light of ongoing habitat destruction along the hills.

71. MANAGEMENT CONSIDERATIONS OF WILDLIFE CORRIDORS FOR COASTAL CACTUS WREN POPULATIONS IN SOUTHERN CALIFORNIA

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The coastal Cactus Wren (*Campylorhynchus brunneicapillus*) is an obligate avian inhabitant of the Coastal Sage Scrub plant community in southern California. Destruction, degradation, and fragmentation are major threats to this habitat type and its corresponding animal species assemblages. While empirical knowledge about the dispersal ability and patterns in coastal Cactus Wrens is limited, it is considered a non-migratory and highly sedentary resident species. The coastal subset currently exists in relatively small, isolated, genetically homozygous subpopulations, a product mainly of habitat loss and fragmentation from rapid urbanization of the region. These combinations of factors make coastal populations especially vulnerable to any type of habitat modification and are important management concerns. The establishment and maintenance of wildlife corridors within the Coastal Sage Scrub habitat type could provide a means of maintaining viable populations of coastal Cactus Wrens in the long-term. Corridors have the potential to address multiple management issues for the species by affording protection to large, contiguous habitat blocks, increasing outbreeding opportunities for isolated subpopulations, and encouraging establishment of new subpopulations as individuals use corridors to access other areas containing optimal breeding habitat. Promoting connectivity between the various subpopulations will increase their genetic heterozygosity and ultimately affect the size and overall fitness of the metapopulation at the regional level.

72. PRELIMINARY RESULTS OF RESERVE-WIDE MONITORING OF CALIFORNIA GNATCATCHERS IN THE NATURE RESERVE OF ORANGE COUNTY.

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In 1999 and 2000, I directed standardized spring California Gnatcatcher (CAGN) surveys at 40 randomly selected, stratified, monitoring sites in the Nature Reserve of Orange County (NROC). During both years, CAGN density was 13 times greater at "edge" versus "core" sites. Apparent causes include higher elevations, steeper slopes, and patchier scrub in core areas. Also, habitat fragments were included in the NROC based on their large CAGN populations, and major fires in 1993 and 1998 burned mainly core areas. High CAGN density along road edges likely results from road placement in relatively flat areas, and car strikes may reduce predator levels in this stratum. Low CAGN density near residential edges may reflect placement of homes on hilltops, and possibly human-related disturbances. Most occupied scrub is approximately 1.0 to 1.5 meters tall; *Artemisia californica* is the most abundant shrub, followed distantly by *Eriogonum fasciculatum* and, surprisingly, *Salvia mellifera*. Consistent with the results of some other monitoring programs in the region, CAGN territories in the NROC decreased approximately 50% from 1999 to 2000. A steeper 72% decline occurred at 16 sites that held one to four pairs in 1999, and nine of these sites were unoccupied in

2000. A more modest drop of 41% was documented at 11 sites with five or more pairs in 1999, and none was unoccupied in 2000. These preliminary results demonstrate the CAGN's dependence upon "edge" habitats in a severely fragmented landscape, and the importance of CAGN reserve design that includes numerous large, well-connected "source" populations.

73. DISTRIBUTION, RELATIVE ABUNDANCE, AND ROADWAY UNDERPASS RESPONSES OF MAMMALS THROUGHOUT THE PUENTE-CHINO HILLS

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We tested what factors promote or limit the exchange of large predators, mesopredators, and ungulates across an urban wildlife corridor bisected by roadways. Track surveys were conducted across the Puente-Chino Hills to determine associations between the distribution and relative abundance of mammals and landscape variables. Mule deer, striped skunk, domestic dog, and domestic cat activity was associated with narrow portions of the corridor, whereas bobcat and long-tailed weasel activity was associated with wider portions of the corridor. At roadway underpasses, landscape and underpass dimension variables were correlated against the probability and the frequency of a species using an underpass as determined by track and camera surveys. Top predators were more likely and more frequent at underpasses in parts of the corridor that were wider and less fragmented. Mesopredators were more likely and more frequent at underpasses in parts of the corridor that were narrower and more fragmented. Top predators and ungulates were more sensitive to smaller underpasses, whereas mesopredators were more tolerant. In general, the probability of underpass usage was primarily dependent on the surrounding landscape variables, whereas the frequency of underpass usage was primarily dependent on specific underpass dimensions. The success of predator movement between habitat patches separated by roadways will ultimately depend on situating large underpasses away from areas of high road density and residential development. Wider corridors will allow for continued predator movement across the landscape, potentially alleviating increases in mesopredator abundance.

74. HOME RANGE USE, BEHAVIOR, AND MORTALITY OF COYOTES (*CANIS LATRANS*) AND BOBCATS (*FELIS RUFUS*) IN RELATION TO ROADWAYS AND UNDERPASSES IN SOUTHERN CALIFORNIA

L.M. Lyren¹ and K.R. Crooks². ¹United States Geological Survey, Biological Resources Division, Western Ecological Research Center, San Diego Field Station, San Diego, CA 92182-1015 and ²University of Wisconsin-Madison, Department of Wildlife Ecology, Madison, WI 53706-1598.

Mammalian carnivores may be sensitive to habitat fragmentation due to roadway construction. As a solution, roadway underpasses have received increasing attention; however, relatively little data exists on how carnivores respond to roadways or use the underpasses. We present results from a study of movement patterns and underpass use of coyotes and bobcats along CA 71, a freeway bisecting the eastern end of the Puente-Chino Hills wildlife corridor in urban Los Angeles. Recent reconstruction of a 5-km segment included installation of wildlife fencing, 3 large wildlife culverts, and 20 smaller water culverts. From February 1998 to February 2000 we captured and radio-tracked 29 coyotes and 4 bobcats and fitted an additional 24 coyotes with dog collars. Telemetry data were augmented by remotely triggered camera surveys at the culverts. Mean home range sizes for 15 coyotes and 3 bobcats were 13.72 ± 3.92 and 8.89 ± 3.45 km² while core-use area sizes were 1.71 ± 0.48 and 1.31 ± 0.40 km², respectively; both area sizes differed between age, social, and behavior classes. Nine individuals maintained core-use areas that overlapped roadways and several had linear home ranges paralleling the roadways. Buffer zones established alongside roadways were not used proportional to their availability by 11 individuals. Telemetry and remotely triggered cameras documented 320 roadway crossings, which included 130 confirmed uses of underpasses by 15 collared individuals. However, surface crossings, particularly in areas where wildlife fencing was absent, accounted for 50% of study animal mortality. Overall, our study should provide valuable information on the effectiveness of roadway underpasses for wildlife in fragmented landscapes.

75. BIO-HOTSPOTS: REGIONAL CONSERVATION PLANNING IN SOUTHERN CALIFORNIA.
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The biodiversity crisis is especially prevalent in Southern California due to our high rates of edemism, diversity of habitats, and extreme development pressure. The biodiversity challenge is manifested in three tangible ways; loss of sensitive species, loss of wetlands, and degradation of water quality. Traditional case by case, command and control approaches to dealing with these issues has been largely ineffective and has resulted in cumulative impacts to natural resources, and conflict between regulatory agencies and the public. The need for alternative solutions has resulted in California being on the cutting edge of regional conservation planning. Three landscape-scale assessment and planning approaches pioneered in Southern California will be discussed; Natural Communities Conservation Plans (NCCP) focusing on sensitive species, Special Area Management Plans (SAMP) focusing on streams and wetlands, and the State Non-point Source Pollution Control Program (NPS) focusing on water quality. Early efforts under these programs have resulted in lessons regarding the spatial and temporal aspects of the planning process that can be applied to future efforts.

76. CO-PARTITIONING OF LEAD WITH MTBE INTO WATER: IMPLICATIONS FOR MTBE – SOURCE CORRELATIONS.

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Lead isotopic ratios of groundwater impacted by the release of oxygenated, unleaded gasoline indicate isotopic equilibrium between dissolved phase gasoline constituents and the unleaded gasoline. If MTBE and lead co-partition into groundwater, lead isotopic analyses could be an important forensic tool in MTBE-source correlations. In this study, we first demonstrate the organolead concentrations of nine unleaded gasolines exhibit significant correlations ($R^2 > 0.98$) with MTBE, benzene, and methylcyclohexane; correlations between organolead and other water-soluble gasoline constituents are poor. To further evaluate the role of MTBE in lead transport, given the higher aqueous solubility of MTBE relative to benzene and methylcyclohexane, we performed two unleaded gasoline – aqueous partitioning experiments using two different brands of gasoline (water/gasoline ratios of 1:1 and 5:1). The gasoline phase was reacted with fresh volumes of water over the course of ~ 2 to 3 weeks; after each interaction, the aqueous phase was analyzed for MTBE, lead, and lead isotope ratios. Co-partitioning of organolead with MTBE is supported by our results which indicate: a strong systematic relationship ($R^2 = 0.998$) between the cumulative MTBE and Pb in the aqueous phase; Pb isotopic equilibrium between the unleaded gasoline and aqueous phase; and gas chromatography that shows MTBE to be the predominant dissolved phase gasoline constituent. Hence, lead isotopic analyses of groundwater impacted by an unleaded gasoline release provide a mechanism to correlate dissolved MTBE to its suspected unleaded gasoline source.

77. PHYSICAL-CHEMICAL CHARACTERIZATION OF WEST COAST MANUFACTURED GAS PLANT (MGP) SOILS

T.C. Harmon, G.A. Burks and M. Hosseini, Department of Civil & Environmental Engineering, University of California, Los Angeles, 90095-1593

This work summarizes the results from on-going laboratory and field investigations addressing the problem of former manufactured gas plant (MGP) facilities in the West. In particular, we are examining contamination associated with lampblack, a sooty byproduct of the oil gasification process employed at western MGPs. Polycyclic aromatic hydrocarbons (PAHs) are typically the contaminants of greatest regulatory concern in the lampblack matrix. First, physical characteristics of a lampblack-contaminated soil are summarized in terms of its particle size distribution, solid density and petrographic thin sections. Next, data are presented for solid and vapor phase PAH concentrations associated with model PAH mixtures and lampblack-impacted soils collected at several Southern California MGP sites. Finally, the desorption of PAHs from lampblack under thermally enhanced conditions is demonstrated as a viable remediation strategy. Conclusions emanating from the work include the following: (1) A large fraction of the PAH contamination

can be linked to the smallest particles, (2) Solid PAH mixtures in lampblack do not behave as a continuous solid solution (i.e., pure component vapor pressures are observed), and (3) Moderately high temperatures (roughly 200 °C or greater) are necessary for expeditious desorption of most of the PAHs from these solids (a small portion persists). The results will be discussed in the context of a proposed pilot-scale *in situ* thermal desorption demonstration project planned for summer 2001.

78. HEAL THE BAY'S MALIBU CREEK STREAM TEAM

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Malibu Surfrider Beach is chronically polluted by tainted discharge from Malibu Creek. The beach is frequently closed to swimming by the Health Department. Malibu Creek supports small, highly vulnerable, populations of three endangered species: tidewater goby, *Eucyclogobius newberryi*, steelhead, *Oncorhynchus gardneri*, and red-legged frog, *Rana aurora*. Heal the Bay created the Malibu Creek Stream Team (Stream Team) in 1998 to investigate Malibu Creek's pollution and aquatic habitat problems. Trained volunteers perform virtually all of the Stream Team's duties. The Stream Team has two major components: Water Chemistry, and Stream Walks. The Water Chemistry program analyses water quality and stream conditions monthly at seven sites on Malibu Creek and its tributaries. During Stream Walks, the team closely examines stream channels for everything that potentially influences water quality and/or aquatic habitat conditions. State-of-the-art technology and equipment are used. Data collected is of high quality and is useful for facilitating sound watershed management decisions. Utilizing volunteers minimizes expenses, allowing a large watershed-scale survey to be accomplished that would otherwise be cost-prohibitive. Excessive algae growth, enhanced by nutrient loading, has been identified as a primary ecological concern. Disease-causing microbes, the cause of numerous beach closures, have been detected in storm drain outflows. Augmented stream flows from a water treatment plant, and from urban runoff, have been found to significantly increase the amount of time that the lagoon's sand spit is breached, which in turn increases the frequency of beach closures.

79. DISCHARGE OF POLLUTED GROUNDWATER INTO MALIBU CREEK AND LAGOON RESULTING FROM SEPTIC SYSTEM LOADING AND STREAM AQUIFER INTERACTIONS.

R.D. Vergets, California State University Los Angeles, Department of Geology, Los Angeles, CA, 90032-8203.

The Malibu Creek Watershed is approximately 35 miles west of Los Angeles and covers 109 square miles draining portions of the Santa Monica Mountains and Simi Hills. Malibu Lagoon provides a valuable wetland habitat and an outdoor classroom for many schools. The lagoon covers 29 acres and experiences problems with eutrophication and bacteria. Increased discharges into Malibu Creek during winter cause Malibu Lagoon to breach, and discharge into Surfrider Beach. These discharges release bacteria resulting in beach closure. In the 1960's groundwater in Malibu was used for drinking water and agriculture. The quality of groundwater declined due to seawater intrusion and septic system discharges. Today, the main source of drinking water is imported at approximately 8.500 acre-feet per year. Small coastal streams drain the southern slopes of the mountains. While naturally ephemeral, the importation of water combined with discharges of septic system effluent have increased base flow. Groundwater and surface waters (including stormdrains) were sampled during August 1999 through December 1999 prior to, during, and after Malibu Lagoon Breached. Groundwater near a septic system leachfield contained ammonia at up to 34.7 mg/L and high concentrations of bacteria. Stormdrain discharges contained ammonia at up to 39.2 mg/L and bacteria > 160,000 MPN/100 ml Total Coliform. > 160,000 MPN/100 ml Fecal Coliform, >16,000 MPN/100 ml E. Coli and > 1,600 MPN/100 ml Enterococcus. Stream aquifer interactions controlled by lagoon discharges cause the discharge of polluted groundwater to surface water via stormdrains and quasi-natural pathways.

80. LAND USE CHANGE AS A CAUSE OF TRACE METAL CONTAMINATION OF A SHALLOW AQUIFER, ORANGE COUNTY, CALIFORNIA

B.J. Hibbs and M. Lee. California State University, Los Angeles, Department of Geological Sciences, Los Angeles, CA, 90032

The highest concentrations of selenium (Se) in shallow groundwater in the Irvine Subbasin of Orange County, California coincides with marshland areas that were displaced by agriculture. Concentrations of Se in groundwater in former marsh areas usually exceed 25 µg/L (or parts per billions), and are as high as 478 µg/L. In areas where marshes were never present, concentrations of Se in groundwater are usually less than 25 µg/L. The marshes are presumed to have been oxygen-deficient, following modern analogs in undisturbed habitats along the California coast. In oxygen deficient marshlands, Se is usually in the form of selenite or elemental Se, two relatively insoluble forms of Se that collect in the sediment at the bottom of the marsh. We hypothesize that the elevated concentrations of Se in groundwater where the marshes once existed are a direct result of the destruction of the marsh. Today, oxygenated groundwaters flow through the soils where the marshes once existed, remobilizing Se as selenate, a water soluble and oxidized form of Se that is highly mobile in aquifer systems.

81. ISOTOPIC EVALUATION OF SOURCES AND MIXING RELATIONS FOR RECENTLY RECHARGED GROUNDWATERS, NORTHERN ORANGE CO., CA

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Stable isotope, tritium-helium, and general mineral analyses of groundwaters from the Lower Forebay region of the Santa Ana River-Coastal Groundwater Basin indicate that the upper ~1000 to 1200 feet of the aquifer system is dominated by mixtures of native and imported waters that were recharged within the last 30 years. At least four water sources are represented in groundwater mixtures sampled above 1424' bgs: (1) SAR, or modern Santa Ana River water ($\delta^{18}\text{O} \approx 7.5\text{‰}$; TDS ≈ 590 mg/L; nitrate ≈ 5 mg/L); (2) pSAR, or older, pre-development Santa Ana River water having negligible tritium contents (-9‰ ; 200 mg/L; 0 mg/L); (3) CR, or imported Colorado River water (-12‰ ; 660 mg/L; 0.5 mg/L); and (4) ppt, or local precipitation (-6.5‰ ; 12 mg/L; 0 mg/L). Mixing relations can be resolved even when the total compositional variation of the modern SAR over the last 40 years is taken into account. Mixing between SAR, CR and ppt occurred prior to or during recharge; mixing of SAR and pSAR occurred below ~1000 bgs. A fifth type of recharged water, imported from northern California, was mixed into the upper Santa Ana River far upstream of the Forebay area and could not be recognized as a discrete endmember in the sampled groundwaters. Tritium-helium dates enable a remarkably good correlation of the groundwater mixtures to the historical record of water importation. We interpret atypically low-TDS, low-chloride groundwaters as being SAR-ppt mixtures formed during the high rainfall, El Niño events that occurred in 1968/69 and between 1979 and 1983.

82. THE ROLE OF GROUNDWATER IN GEOLOGIC HAZARDS

W. Richard Laton, Ph.D., Assistant Professor, Department of Geological Sciences, CSUF

Almost every imaginable natural hazard exists in Southern California. Groundwater is usually the lost component when it comes to defining hazards. Southern California is a complex area of differing geologic and hydrologic conditions representing many differing hazards. Hazard identification defines the magnitude and associated probabilities of natural hazards that may pose threats to human interests in specific areas. Through the advanced utilization of geographical information systems (GIS), maps of Engineering geology, shallow groundwater, surface water, liquefaction, subsidence, and landslide susceptibility can be produced. Utilizing the available data, planners are able to make appropriate choices in land use management. Through this methodology, groundwater becomes an important player in hazard management.

83. CAN THE SALTON SEA BE DESALTED: A COST BENEFIT ANALYSIS

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The Salton Sea began as a fresh water lake and in 9.5 decades became hypersaline at 44 parts per thousand (ppt). Annually one million acre-feet of agricultural waste water carrying 4.5 million tons of salt flow into the Salton Sea at the same time one million acre-feet of water is evaporated from it. At present steady-state conditions, the salinity of the Salton Sea will increase into the future at about 1 ppt/year. Approval has been granted for 300,000 acre-feet of Colorado River agricultural water allotment to be diverted from the Salton Sea to San Diego County. This will cause the Sea's salinity to rise to about 220 ppt by the year 2011. If one million acre-feet of the Sea's water is instantaneously desalted and returned to the Sea, its salinity will only reduce from 44 ppt to 32.6 ppt at a cost of 1.3 billion dollars. Kuwait has the largest desalting plant in the world, but can desalt only 81 acre-feet per day of hypersaline water. At that rate it will take 33 years to desalt one million acre-feet of the Sea's water. If, instead, one million acre-feet of Salton Sea water were instantaneously pumped to the Gulf of California 120 miles away and the same amount of Gulf water were pumped into the Salton Sea its salinity would only be reduced to 41.5 ppt. Meanwhile, 4.5 million tons of salt would still be coming in annually. The technology is too limited and the cost too great to undertake desalting the enormous volumes of water required to reverse the rising salinity of the Salton Sea.

84. LIVING ON THE EDGE: CHLORIDE, BROMIDE AND NITRATE ION REACTIVITY AT THE AIR-WATER INTERFACE.

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Aqueous phase reactions influence the chemistry of the Earth's atmosphere. For example in the presence of UV-radiation and ozone, deliquesced model sea-salt aerosol have been shown to release molecular chlorine, which is an oxidant source in the marine boundary layer. This paper will discuss reactions at the air-water interface that explain observations of gaseous molecular bromine (Br₂), bromochloride (BrCl) and molecular chlorine (Cl₂), in the high Arctic measured using atmospheric pressure chemical ionization mass spectrometry. Peak mixing ratios for these compounds monitored before and during polar sunrise were ~25 parts per trillion for Br₂ and ~35 parts per trillion for BrCl. Chlorine was never detected above the 3 sigma detection limit of 2 part per trillion. The implications of this work to atmospheric chemistry in the Southwestern United States will be discussed in addition to developing studies on the photolysis of nitrate ions in water ice.

85. FOURIER TRANSFORM INFRARED (FTIR) STUDIES OF HETEROGENEOUS REACTIONS BETWEEN GASEOUS POLLUTANTS IN THE ATMOSPHERE AND NITRIC ACID (HNO₃) ON SILICA SURFACES AS A FUNCTION OF THE TYPE OF SURFACE AND RELATIVE HUMIDITY (RH).

A.M. Rivera-Figueroa, M. Mochida And B.J. Finlayson-Pitts. University Of California, Irvine. Department Of Chemistry, Irvine, CA, 92697-2025.

Over the last few years it has become increasingly obvious that the partitioning of nitrogen oxides in the atmosphere, in particular the NO_x/HNO₃ ratio, is not accurately reproduced by models. In order to account for this discrepancy, several reactions of different gaseous pollutants –methane (CH₄), sulfur dioxide (SO₂), carbon monoxide (CO), and nitrogen oxide (NO)- with adsorbed nitric acid (HNO₃) on a variety of surfaces – silica (SiO₂) porous glass and powdered silica (Cab-O-Sil[®]) have been studied using Fourier transform infrared spectrometry (FTIR). These reactions are known to be thermodynamically feasible. However, we found that under ambient conditions (1 atm, 298 K), reactions between HNO₃ adsorbed on either the silica or Cab-O-Sil[®] surface and CH₄, SO₂ and CO do not occur. On the other hand, the reaction of adsorbed HNO₃ and NO does proceed. The effect of the relative humidity (RH) on the progress of this reaction, as well as the kinetics of this reaction is being studied. This reaction might be an important source of generating nitrous

acid (HONO) in polluted urban air in Southern California and also in converting nitric acid back into reactive, gas phase forms.

86. MONITORING AMBIENT GAS PHASE POLLUTANTS ON A FINE SPATIAL SCALE IN EAST LOS ANGELES

Charlene Acdan Chin, Daisy Mah, and Scott L. Nickolaisen, Department of Chemistry & Biochemistry, California State University, Los Angeles, CA 90032

The variation of pollutant concentrations on a regional scale in the Los Angeles Basin is well known. The predominant on-shore winds push primary pollutants toward the San Gabriel Valley and Inland Empire. The mountains surrounding the L.A. Basin trap pollutants in these areas and allow the chemistry of the polluted urban troposphere to create ozone and other secondary pollutants that are most damaging to human health. Because of the regional weather patterns, pollutants levels are lower in the coastal regions and peak in the northeastern San Gabriel Valley and the Pomona, San Bernardino, and Riverside areas. However, the effects of very localized topography and meteorology on pollutants exposures have not been well established. We have undertaken a study to measure ambient pollutants levels on a fine spatial scale where sampling sites are separated by 200 – 1000 m to determine the possible effects of local conditions on pollutant concentrations. We present preliminary results of ozone and hydrocarbon measurements taken in the neighborhood surrounding the CSULA campus. The sampling area is bounded by major freeways to the south and east and is characterized by undulating terrain, several taller building, light industry, and residential neighborhoods. Ozone measurements were made with portable long path length absorption UV/vis spectrometer. Hydrocarbon measurements were made by collecting samples in Teflon bags and then analyzing the contents by gas chromatography/flame ionization detection. We also record weather conditions at the sampling sites to account for microclimatological conditions.

87. PARTICULATE AIR POLLUTION SAMPLING AND ANALYSES: A STUDY OF VARIABILITY WITHIN A SUBURBAN EAST LOS ANGELES NEIGHBORHOOD

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During the summers of 1999 and 2000, an interdisciplinary group of CSULA and Temple City High School students conducted an air pollution research experiment in residential Alhambra, California, approximately 6 miles east of downtown Los Angeles. The experiment was aimed at determining how particulate air pollution varied spatially and temporally over distances varying from meters to a few kilometers within a residential neighborhood. High volume air samplers collected total suspended particulates (TSP), while in the second year, Mini-vols were used to sample PM₁₀ (particulate matter with diameters of 10 microns or less). The locations of the samplers were chosen to test how particle concentrations varied with distance from busy traffic corridors, especially from Interstate-10. TSP values showed increases with increasing traffic volume, as well as decreases with distance from roadways. Land use and weather also played an important role in particulate variations. Weekday levels exceeded weekends. Chemical composition of particulates also varied considerably, especially between locations near I-10 and those further away. Comparisons between TSP and PM₁₀ levels and chemical make-up will be discussed along with some of the problems encountered in sampling on a neighborhood scale.

88. TEMPORAL AND SPATIAL DIFFERENCES IN PASSIVE MONITOR NITRITE OXIDATION RELATIONSHIPS WITH AVERAGE HOURLY AMBIENT OZONE CONCENTRATIONS.

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Nine passive ozone monitors were co-located with active ozone monitors at sites in the Sierra Nevada Bioregion between Lassen Volcanic National Park to Sierra National Forest. In addition 85 other passive monitors were located between active monitor sites throughout this bioregion. Passive monitors were

exchanged every two weeks between May and October 1999. Spatial patterns of ozone air pollution were estimated over the season, and relationships developed between passive monitors and active ozone monitors using nonparametric Lowess surface estimation. Individual co-location sites had different relationships between passive and active monitoring systems. Using local estimates of the relationship between passive and active monitors doubled the amount of variation explained by the model relative to using a single relationship to estimate ambient ozone concentrations from passive monitors. Local differences in the relationship between passive and active monitors may be due to variations in the active and passive monitoring equipment, local meteorological conditions, or differences in diurnal ozone concentration patterns.

89. GETTING A BEAD ON FISH LENGTH: USING UNDERWATER VIDEO AND LASER SIGHTS TO DETERMINE LENGTHS OF KELP BASS (*Paralabrax clathratus*) IN THE FIELD.

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Many researchers currently use video fish transects with parallel laser sights to assess fish size and population density. The current method of using video fish transects with parallel laser sights to obtain fish lengths is dependent on a complete lateral view of the fish in the video, which may be difficult to obtain. In this study, the relationship between body depth (cm) and standard length (cm) significantly linear ($n = 70$, $r^2 = 0.97$, $p = 0.000$) and body depth (cm) and weight (g) was found to be significant ($n = 70$, $r^2 = 0.97$, $p = 0.000$). Body depth, which does not change when the fish is bending, can be used as a predictor of the length and weight of kelp bass in the field. Laboratory calibrations made from fish of known lengths and weights indicate an accuracy of ± 0.72 cm and ± 2.9 g. Applying this technique in the field, we were able to measure up to 27 fish within a 45min dive. Therefore, this method may provide an efficient and accurate fishing independent means of assessing size classes of kelp bass in the field.

90. PARASITES ON FISHES IN SANTA MONICA BAY, AN AREA INFLUENCED BY A MAJOR WASTEWATER OUTFALL

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Many biotic and abiotic factors influence the prevalence and mean intensity of fish parasites. Exposure to pollution may result in stress and thus potentially can increase a fish's susceptibility to diseases and parasites. The goal of this study was to evaluate the effects of wastewater in terms of infestation rates (e.g. prevalence and mean intensity) of ecto- and meso- parasites on two orders of fishes, Pleuronectiformes and Scorpaeniformes. Fishes were caught by otter trawl at stations adjacent to and away from the five-mile outfall located in Santa Monica Bay, in July/August and November 1998, and February and May 1999, and subsequently frozen for further analysis. A total of 4,128 fishes consisting of 18 different species were collected and all parasites were removed. A total of 2,547 parasites, comprised of copepods, isopods, monogenes, and leeches were removed from the host fishes. Most parasites showed some degree of host-specificity (13 of 25 species were removed from a single host species). The California scorpionfish, *Scorpaena guttata*, had the highest mean intensity (14). There was no significant seasonal variation for prevalence or mean intensity. However, wastewater seems to significantly influence the prevalence of parasites on fishes (26.0% at outfall stations and 17.3% at reference stations). In addition, the mean intensity was higher at the outfall stations (4.6) compared to the reference stations (2.83). Thus, the use of prevalence and mean intensity of parasites on fishes as a biological indicator of pollution in the aquatic environment deserves further study.

91. THE ORIGIN OF PRE- AND POST-ROTENONE TREATMENT LAKE DAVIS NORTHERN PIKE
(*ESOX LUCIUS*)

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After an extensive effort by the California Department of Fish and Game to rid Lake Davis (CA) of introduced northern pike (*Esox lucius*) by rotenone poisoning in 1997, the fish reappeared in 1999. Questions arose as to the putative origin of the post-treatment pike. Using molecular techniques combined with assignment statistics we are identifying the origin of the pre- and post-treatment Lake Davis pike. Northern pike have previously been shown to contain little genetic variation at allozymes and mitochondrial DNA. We used published di-nucleotide microsatellites to identify potential source populations for the Lake Davis pike. The post-treatment fish are most likely survivors of the initial poisoning of Lake Davis. Identifying the original source for the Lake Davis pike is difficult, as pike have been introduced repeatedly throughout the western North America. Newly isolated tetra-nucleotide microsatellites are currently being used to further discover variation that may better help in the identification of origin of the Lake Davis pike.

92. ENDOCRINE RESPONSE TO STRESS IN THE JACK MACKEREL: POTENTIAL
RELATIONSHIP TO GROWTH

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The impact of experimental induction of a stress response in the jack mackerel, *Trachurus symmetricus*, was characterized with respect to glycemic status, serum concentrations of the steroid hormone, cortisol, and levels of the growth regulators, insulin-like growth factor-binding proteins (IGFBPs). Mackerel were caught offshore near Catalina Island and placed into 1000-L circular aquarium for 5 d without further disturbance ("confinement" group) or they were subjected to an additional 30 or 60 min of handling prior to blood sampling ("handling" groups). Controls were caught and blood samples taken immediately (within 2 min). As compared with the control fish, fish in the confinement group exhibited significant elevations in serum glucose concentrations (>2-fold, $p < 0.01$) and greater than six-fold elevations in the stress hormone, cortisol ($p < 0.001$). In response to the additional handling stress, cortisol levels were elevated yet further as compared with that in the confinement group ($p < 0.05$ at 60 min), while glucose concentrations could not be further increased. Serum profiles of the growth-regulatory insulin-like growth factor-binding proteins (IGFBPs) exhibited changes reflective of a growth-inhibited state in the stressed mackerel, with the greatest magnitude of such changes evident in the fish with the highest cortisol levels (60 min handling group). The results thus far suggest that stress-induced cortisol is associated with elevated circulating glucose levels and may play an inhibitory role in growth via changes in the IGF system. [Support by NSF grant IBN-9600783 & NIH grant GM50089]

93. THE EFFECT OF REPRODUCTIVE MODE AND HABITAT PREFERENCE ON THE GENETIC
STRUCTURE OF SEVERAL EASTERN PACIFIC ESTUARINE FISHES.

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Estuarine habitats along the Eastern Pacific are threatened ecosystems. Both direct habitat loss and anthropogenically induced modification through eutrophication, dredging, filling and pollution have resulted in declines of many of the organisms that depend on these habitats. We have investigated the effect of reproductive mode and degree of habitat preference on genetic structure of two estuarine fishes, the bay pipefish (*Syngnathus leptorhynchus*) and the staghorn sculpin (*Leptocottus armatus*). The pipefish is a brooder, lacks a dispersal phase, and prefers eelgrass habitat. The staghorn sculpin has a protracted planktonic larval stage, uses the estuaries only as nursery and feeding grounds after which it swims offshore. We used mitochondrial DNA control region sequence data to compare the genetic structure of these two fishes from Alaska to Baja/southern California. Preliminary data suggests higher geographic structure in the pipefish. Additionally, we will compare these findings to other estuarine fish taxa.

94. TEMPORAL STABILITY IN THE FALL SEASON PARASITIC INTERACTION OF THE CYMOTHOID ISOPOD *LIRONECA CALIFORNIA* ON THE SHINER PERCH (*CYMATOGASTER AGGREGATA*) IN BODEGA BAY, CALIFORNIA

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The abundance, prevalence, and mean intensity of the infestation of the cymothoid isopod *Lironeca californica* on the shiner perch (Perciformes: Embiotocidae: *Cymatogaster aggregata*) was measured in the fall of 1990, 1998, and 2000 from the host population that inhabits Campbell Cove, Bodega Bay, California. These measures were compared to those from a previously reported fall sample taken from the same location in 1986. Abundance values ranged from 21.7% to 36.6%. Prevalence and mean intensities for all samples fell within 95% confidence intervals. Pairwise Fisher's exact tests for prevalences, t-tests for mean intensities, and Mood's median tests for intensities all yielded non-significant probabilities of $P > 0.24$. This host-parasite interaction has been reported to vary seasonally at another location. The failure to falsify our null hypothesis of no difference among multi-year fall samples may have revealed a "stable" fall-winter upper bound to an interaction that may undergo an annual cycle. Given the possible ephemeral nature of this host-parasite interaction, such temporal patterns deserve additional study to understand their causes.

95. TEMPERATURE EFFECTS ON THE FEEDING BIOLOGY OF THREE SEAWEED-EATING SPECIES OF *TEGULA* (TROCHIDAE; GASTROPODA) FROM CENTRAL AND SOUTHERN CALIFORNIA

Everett Yee and S. Murray, California State University, Fullerton, Department of Biological Science, Fullerton, CA 92834

Changes in sea temperature are known to determine the distributional limits of coastal populations of marine invertebrates. However, the mechanisms by which temperature determines these distributions are poorly understood. Two possible mechanisms, food consumption and nutrient uptake, are essential to growth and reproduction, although little is known about the effects of temperature on the feeding biology of most coastal invertebrates. Trochid snails are ideal candidates for such studies because several closely-related species have distributions limited to regions either north or south of Point Conception, California. Populations from three closely-related *Tegula* species were used to determine the effects of temperature on consumption rates and gut passage times: one cold-water species (*T. brunnea*), one warm-water species (*T. aureotincta*), and warm and cold-water populations of a cosmopolitan species (*T. funebris*). We hypothesized that: 1) *T. aureotincta* would experience reduced consumption rates, assimilation efficiencies, and increased gut passage time at colder temperatures; 2) *T. brunnea* would experience similar reduced consumption rates and assimilation efficiencies, but at warmer temperatures; and 3) *T. funebris* would exhibit reduced temperature effects. Snails were fed kelp while maintained at 11, 15, 19, and 23°C. Consumption rates for the two warm-water populations and *T. brunnea* were significantly greater at warmer temperatures, whereas the rates for the cold-water population of *T. funebris* were significantly greater at colder temperatures. No trends were found in the gut passage time for any population. Every population, except that of *T. brunnea*, showed a decrease in assimilation efficiency with an increase in temperature. This study suggests that rising sea surface temperatures may alter trochid distributions by affecting rates of food consumption and reducing nutrient acquisition.

96. BEHAVIORAL TIME-BUDGET STUDY OF THE YELLOW TANG, *ZEBRASOMA FLAVESCENS* IN AN ARTIFICIAL AND NATURAL REEF ENVIRONMENT

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Herbivorous fishes are an important element in the ecology of reef systems, as they are one of the most numerically abundant teleosts found on tropical coral reefs. This study focuses on the behavior and time-budget strategies of the yellow tang, *Zebrasoma flavescens* (Acanthuridae) in an artificial reef ecosystem and in a natural environment. Observations were made at the Biosphere 2 Center (B2) Ocean Biome in Oracle,

Arizona and along reefs in Kaneohe Bay, Oahu, Hawaii. Fish in the B2 ocean displayed five different behaviors, which were recorded and timed while snorkeling: feeding (48% of the day), foraging (25%), hovering (25%), aggressiveness (1%), and fleeing (1%). On the Kaneohe Bay reef, only two of the same behaviors were observed: feeding (15%) and foraging (15%), while aggressive and fleeing behaviors were not. Captive B2 fish hovered, displayed aggression and reacted by fleeing, whereas wild individuals spent the remainder of their time swimming along the reef (70%). Differences in time allocation for feeding and foraging between the two sites were significant ($df=1069$, $p<0.001$; $df=1309$, $p<0.001$ respectively). Results from this investigation suggest that variation in resource availability between the two sites likely affects the behavior of *Z. flavescens*.

97. ROUTINE AND STANDARD METABOLIC RATES OF THE ROUND STINGRAY (*Urolophus halleri*)

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The round stingray (*Urolophus halleri*) is one of the most common elasmobranchs in bays and coastal areas in Southern California; however, little is known about its energetics and trophic impact in these environments. Static respirometry techniques were used to quantify routine and standard metabolism in neonates, juveniles, and adult rays. Standard (SMR) and diel routine metabolic rates (RMR) were measured as the rate of oxygen consumption over a 24 hr period. SMR and RMR were measured for six individuals ranging in weight from 37 – 451g. RMR showed no observable diel patterns ($P>0.05$). Mass specific VO_2 (mgO_2/hr) changed predictably with body size according to the relationship $VO_2 = 0.2 W^{0.82}$ for SMR. Mass specific standard metabolic rate of neonates (37 g) was 1.6 times that of adults (451 g). Mass corrected VO_2 ranged between 119 to 72 $mg/kg/hr$ at 20°C. SMR of larger round stingrays (451g - 72 $mg/kg/hr$) are slightly higher than those measured for *Dasyatis sabina* of similar size (463g - 62 $mg/kg/hr$) at 20°C. The results of this study can be used to study the bioenergetics of this species and to gain a better understanding of its functional role in its community.

98. THE IMPACT OF NATIVE PREDATORS ON AN INVASIVE WHELK: SEA OTTERS AND SEASHELLS BY THE SEASHORE.

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The recent expansion of Kellet's whelk (*Kelletia kelletii*: Buccinidae) into central from southern California added a novel species to kelp forest communities. These whelks act both as important predators of native prey species and as a novel prey resource for native predators (sea otters, crabs, sea stars, octopus, and drilling gastropods). A 4 yr study of permanent shell removal plots at the Hopkins Marine Life Refuge in Monterey Bay identified potential predators of the whelk and determined the types and frequencies of shell damage. Most shell debris consisted of "window" damage (42%), whorls only (25%), or spires only (21%). Feeding trials with captive sea otters demonstrated that otters were capable of producing "window" damage. Shells collected in the field indicate that the process that creates windows can also separate the body whorl and spire. Similar whelk shells in southern California were extremely rare and very old. Thus, the recently established whelk populations in central California are severely impacted by sea otters, which account for nearly 90% of the shells observed in the field. Furthermore, the apparent failure of local reproductive efforts by resident whelks in central California suggests these populations do not sustain themselves and are "sinks" that could become locally extinct. Such an extinction would represent a rare marine example of native predators contributing to the failure of an invader.

99. A COMPARISON OF PLASTIC AND PLANKTON IN THE NORTH PACIFIC CENTRAL GYRE

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Marine debris poses a threat to marine organisms through ingestion. Here we assess the potential for ingestion of plastic particles in the open ocean by measuring the relative density and mass of neustonic plastic and zooplankton near the central high-pressure cell of the North Pacific Ocean. Neuston samples were collected at 11 random sites, using a manta trawl lined with a 300u mesh. The abundance and mass of neustonic plastic was the largest ever recorded in the Pacific Ocean at 334,271 pieces/km² and 5,114 g/km². Plankton abundance was approximately five times higher than that of plastic, but the mass of plastic was approximately six times that of plankton. The most frequently sampled types of identifiable plastic were thin films and polypropylene/ monofilament line. Most of the unidentified plastic in our samples was miscellaneous fragments. Cumulatively, these three types accounted for 98% of the total number of plastic pieces.

100. THE PALEOECOLOGY OF LATE PLEISTOCENE FRESHWATER OSTRACODES
RECOVERED FROM SEDIMENTS IN THE CHINO BASIN, SOUTHERN CALIFORNIA.

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Eight species of limnic ostracodes have been identified from late Pleistocene sediments recovered from the Chino Basin, southern California. The claystone sample lacks coarse sands and silt indicative of high-energy fluvial depositional environments. Both ostracode species composition and sediment lithologies suggest a large freshwater marsh environment. The proposed marsh had an expansive littoral zone and central deep open water reservoir. The shallow water features are inferred from large numbers of cyclopyridid and cypridid ostracodes and the abundant remains of fossil charophyte gyrogonites in the sample. The presence of *Limnocythere herricki*, a lacustrine species, indicates a deep water zone. Fossil ostracode taxa in this sample suggest a much cooler and wetter climate during the time of sediment deposition. This unique fossil ostracode fauna is similar to modern ostracodes present in the central Canadian prairie and waters of the low to mid elevation transitional woodland and forest zones of the western United States.

101. LONG-TERM CHANGES IN THE ROCKY INTERTIDAL FLORA ALONG THE PALOS VERDES
PENINSULA (LOS ANGELES COUNTY).

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Long-term changes in rocky intertidal seaweed and seagrass populations along the Palos Verdes Peninsula (Los Angeles County) were studied at five sites. These sites were first established by E. Y. Dawson in the late 1950s. They were resurveyed in the late 1960s and 1970s by Thom and Widdowson and Nicholson and Cimberg, and in the early 1980s by Harris. Frequency and cover data were collected for all macrophyte populations, and were compared with records obtained during the previous studies to examine changes in floral composition and abundances over the past fifty years. During this time, the human population has increased greatly throughout Southern California resulting in modifications of the coastal landscape along the Palos Verdes Peninsula and throughout the region. Improvements have been made in sewage treatment practices, changing effluent conditions previously believed to impact intertidal populations. In addition, significant changes in oceanographic climate have occurred during the five decadal period of study. Our results show that changes in the intertidal flora continue to occur along the Palos Verdes Peninsula. Cover of opportunistic and disturbance resistant seaweeds appears to have increased and of large, fleshy algal species to have decreased. Marked differences continue to occur in the macrophyte floras at these sites along the western and southern portions of the Peninsula. (Supported by NOAA Grant NA46RG0472 to USC Sea Grant and the California State Resources Agency.)

102. INVASIVE MARINE CHLOROPHYTE, *CAULERPA TAXIFOLIA*, DISCOVERED AT TWO
SOUTHERN CALIFORNIA SITES.

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In June 2000, the invasive green seaweed, *Caulerpa taxifolia*, was discovered in Agua Hedionda Lagoon in Carlsbad, California. A second infestation was confirmed in two man-made ponds in Huntington Harbour in

Huntington Beach, California. Genetic analyses have confirmed that the *Caulerpa* at both California locations is the highly invasive aquarium strain that was inadvertently introduced into the Mediterranean in the mid-1980's. Although *C. taxifolia* is native to tropical waters of the world, a more vigorous strain of the species was cultured in European aquaria that is tolerant of cold water and highly invasive. Its rapid spread has reportedly caused serious economic, recreational, and ecological damage to portions of northwestern Mediterranean where it has become well established. This strain was first detected in the Mediterranean in 1984 as a 1yd² patch and today is reported to blanket over 15,000 acres of seafloor, displacing seaweeds, seagrasses, and other native communities. Recognizing the potential risk posed by this species' arrival to California ecosystems, immediate action was taken by local, state and federal agencies as well as scientists and private industry to develop a rapid response plan. Merkel & Associates designed an eradication approach that was implemented in Carlsbad in summer 2000 and is currently underway in Huntington Harbour. Eradication efforts involve covering the alga in-situ with heavy PVC tarps and treating the area under the sealed tarps with chlorine. Regular monitoring is necessary to detect and treat regrowth at both sites. Surveillance along the coastline is currently being coordinated to detect any additional infestations in Southern California.

103. A PALEOCLIMATIC ASSESSMENT OF THE MIDDLE TO UPPER EOCENE OF CENTRAL WYOMING BASED ON A FOSSIL WOOD ASSEMBLAGE.

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A preliminary paleoclimatic assessment, of the Middle to Upper Eocene, of central Wyoming has been made, using a small assemblage of woods from the Wagon Bed Formation. Approaches utilized include analysis of closest living relatives, the nature of historically utilized wood characters such as diffuse vs. ring porosity, as well as more recent and comprehensive statistical techniques. The latter utilize regression derived formulas and multiple characters. The current sample of 12 distinct forms is somewhat limiting. However, utilization of several approaches suggests a relatively equable climate. Calculated climatic values indicate a mean annual temperature of approximately 14 degrees Celsius and a mean annual range in temperature of 10 degrees Celsius. Other values calculated include the coldest month mean temperature (7 degrees Celsius), and the length of the "dry" season (1.3 months). The calculated mean annual precipitation was in excess of 145 cm. Current efforts are directed toward analyzing additional samples in hopes of increasing the sample size.

104. THE LACK OF RELATIONSHIPS BETWEEN NUTRIENTS AND ALGAE COVERAGE IN MALIBU CREEK AND LAGOON.

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There is an inherently high degree of variability and complexity to nutrient-algae relationships and a number of complicating environmental variables that affect our ability to set nutrient standards, including TMDLs, to control algae growth. We present a case study of the analysis of a 20 year record of attached algae (*Cladophora glomerata*) and nutrients in Malibu Creek and Lagoon, in an attempt to understand the relationships between algae coverage and nutrient dynamics. The creek and lagoon are listed as impaired due to excessive algae growth and eutrophication. Results of the analysis of the long-term data set indicate a lack of positive relationships between algae coverage and in-stream nutrient concentrations or load to the lagoon. Nutrient concentrations do not appear to be limiting to algae growth in the creek and, therefore, stringent nutrient limits are unlikely to be protective of beneficial use. However, apparent causal relationships may be found in the dataset. Periphyton algae vary positively with light and negatively with winter season current scour. The algae occur primarily in the low-flow, sunlit summer months and only in open, unshaded areas of the creek. Recent monitoring results confirm the large differences in insolation between open areas with abundant algae growth and shaded, relatively algae-free areas. High summer water temperatures may be limiting to algae growth, as well. Physical factors appear to be more important than nutrient chemistry in determining the degree of algae growth in the creek and lagoon.

105. INSULAR POPULATION DYNAMICS OF DEER MICE (*PEROMYSCUS MANICULATUS SUBSP.*) ON SANTA BARBARA AND SAN MIGUEL ISLANDS: INTRINSIC POPULATION RESPONSES TO EXTREME DENSITIES.

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Deer mice have been monitored on San Miguel and Santa Barbara islands since 1992 as part of the long term ecological monitoring program at Channel Islands National Park. Data describing common population parameters were collected annually from 1992 to 2000 during 66 sampling events during spring and fall seasons on five grids. Mouse population densities on San Miguel Island rose dramatically to over 900/hectare after the loss of the island fox (*Urocyon littoralis littoralis*), the only terrestrial predator of mice, from the system. Densities on Santa Barbara Island routinely reached over 600/ha in fall seasons. The recent estimates for mouse densities on San Miguel are higher than ever previously recorded for the islands, suggesting that the release of predation pressure by the loss of the fox triggered unchecked population increases. Island fox have never been present on Santa Barbara Island, and mice there appear to have developed intrinsic means of population regulation. On San Miguel Island the number of individual mice captured only once in a trapping session was positively correlated with higher densities, whereas on Santa Barbara Island there was no such relationship. Increased dispersal in high-density environments is often noted in populations where individuals are not adapted to intraspecific competition for space and resources. The situation on Santa Barbara Island suggests a greater innate tolerance by these mice to high population densities where terrestrial predators are unknown, and less tolerance by San Miguel mice where predation has been the predominant regulating mechanism.

106. THE UNPUBLISHED WORK OF YUK-MAAN LEUNG ON THE ECTOSYMBIOTIC CILIATED PROTOZOA OF THE NEBALIIDS.

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Over twenty years, Yuk-Maan Leung worked on the ectosymbiotic ciliated protozoa of the order Chonotrichida present on species of the family Nebaliidae (Class Crustacea, Order Leptostraca). Chonotrichs are ectosymbiotic ciliates which permanently attach themselves to hosts by slender, non-contractile stalk, a stout podium, or broad posterior adherent area. Yuk-Maan Leung obtained material from 34 sites and his research represents a comprehensive understanding of the geographical distribution (Pacific, Atlantic, and Indian Oceans and the Mediterranean Sea) of the Chonotrichs of neballiids as well as the distribution of chonotrich species on the different parts of the neballiids.

107. NONLINEAR CIRCUIT WITH OSCILLATING IMPEDANCE

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The perplexing behavior of cellular neural networks (CNN) is the subject of numerous, rapidly developing fields. Potential applications of CNN include simulation of biological systems such as cognitive operations, and novel computing approaches such as computing with dynamic attractors and chaos. We synthesized a new circuit as a candidate for the CNN cell. The circuit is a nonlinear modification of the well-known generalized impedance converter (GIC). Two Schottky diodes were used as the nonlinear elements. We derived equations describing the circuit behavior. From the equations we found that the circuit complexly responds to electromagnetic signals, and demonstrates certain exotic features. The most prominent feature of the circuit is that its impedance is a quasi-periodical function of voltage, temperature, and frequency. The real component of the impedance is always zero, and the oscillating imaginary component alternates its sign, causing the circuit to behave as a capacitor or an inductor. Due to its fluctuating character we called this circuit the "chameleon circuit". We assembled and studied two oscillators based on the "chameleon circuit". We found that even with fixed elements the circuit exhibits multiple states of oscillation with different waveforms, phase portraits, and power spectrums. Under specific conditions the circuit demonstrates chaotic dynamics. The rich behavior of the "chameleon circuit" renders it practical for both theoretical analysis and practical applications.

108. THE GREEN TEA POLYPHENOL, EPIGALLOCATECHIN GALLATE, INDUCES APOPTOSIS IN MALIGNANT CELLS.

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Dr. James and Dorothy Morre concluded, in a comparative study with green and black tea, that green tea induces apoptosis, via the activation of a tumor suppresser gene, in malignant tumor cell cultures more effectively than black tea. Apoptosis (programmed cell death, PCD) can be started by exogenous factors and other studies have confirmed that the polyphenols of green tea can act as these exogenous factors. Green tea has six different polyphenols made of catechins and gallates: catechin (C), epicatechin (EC), epigallocatechin gallates (EGCg), galocatechin (GC), epigallocatechin (EGC), and epicatechin gallate (ECg). EGCg has been the most effective in cancer prevention (Yamamoto, Takehiko. et. al. Chemistry and Applications of Green Tea. New York. CRC Press. 1997). It is plausible that green tea could be an effective anti-cancer agent. I attempted to prove that the green tea polyphenols, epigallocatechin gallates (EGCg), had the ability to induce apoptosis in cancer cells. In these experiments I first prepared an aqueous extract from crushed green tea leaves and subjected the extract to agarose gel electrophoresis to isolate and segregate the green tea polyphenols. The gel fraction containing the EGCg was identified by ultraviolet spectrophotometry, where EGCg has a distinctive absorption at 280 nM. The EGCg fraction was added to cancer cell cultures and fluorescent spectrophotometry was used to detect the activation of caspase proteins resulting from initiation of apoptosis in the cell cultures. Green tea polyphenols (specifically epigallocatechin gallates) are the most effective inducers of apoptosis (in vitro) and these polyphenols should be further examined as an effective tool against tumorigenesis and metastases.

109. IMMUNE RESPONSE OF NEONATAL RHESUS MACAQUES TO RECOMBINANT SIMIAN IMMUNODEFICIENCY VIRUS USING ENZYME LINKED IMMUNOSORBENT ASSAY

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A model for human immunodeficiency virus (HIV) infection in humans is simian immunodeficiency virus (SIV) infection of rhesus macaques. In this study, the humoral immune responses of neonatal macaques to two different attenuated vaccines against SIV (SIV_{HyIFN} and SIV_{Δnef}) were compared. The enzyme-linked immunosorbent assay (ELISA) was used to determine the titer of anti-gp160 and anti-gag immunoglobulins in the monkey's plasma. SIV, which is similar to HIV-2 and causes an AIDS-like condition in macaques, is used as a model to study the viral pathogenesis and effectiveness of prospective vaccines for AIDS. In the hopes of finding vaccines that will "cure" AIDS, many studies have been conducted with SIV using the whole-inactivated virus, viral subunits, and live attenuated virus. Such studies are important for the greater non-research world because AIDS is a devastating disease affecting the human population on a global scale. Unfortunately, many of these vaccines did not induce any significant protection from SIV infection. In this study attenuated vaccines containing recombinant SIV with either a deletion of the nef gene (SIV_{Δnef}) or with the gene for gamma interferon inserted in its place (SIV_{HyIFN}) were investigated by testing the humoral immune response to gp160 and gag proteins of SIV. Although there was not a major difference in the mean titers of anti-gp160 antibodies, the insertion of IFN-γ gene does stimulate the immune response of neonatal macaques by enhancing the anti-gag titers during the early weeks of infection. Therefore, use of recombinant SIV_{HyIFN} may provide a practical application in future vaccines, which could lead to the development of an efficacious vaccine for AIDS.

110. A HIGH-RESOLUTION PALEOMAGNETIC SECULAR VARIATION RECORD FROM THE EQUATORIAL WEST PACIFIC OCEAN SPANNING THE LAST 65,000 YEARS

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The earth has a magnetic field that varies in both space and time. The dynamo source generating the field is complicated and is not fully described by paleomagnetic records that come predominately from the mid-Latitude Northern Hemisphere. We have established a new paleomagnetic intensity and directional record extending as far back as 65,000 years BP from deep-sea sediment cores from equatorial west Pacific ocean. This core, MD982181, has a very high sedimentation rate (~49 cm/kyr on average) and it meets the rock magnetic criteria for sedimentary paleomagnetic studies defined by Tauxe (1993). A complete record of geomagnetic excursion including both intensity and direction was discovered at ~41,000 years BP and related to the documented Laschamp excursion. The Laschamp excursion at this site is characterized by (1) a 90 out-of-phase relationship between inclination and declination, (2) 107.5 change in declination (60E~ 40W) and 57.5 change in inclination (35~-47), (3) two counterclockwise VGP loops with mirror symmetry about the site longitude, (4) 1000-year cyclicality in inclination and declination. We have correlated the very detailed paleointensity record of MD982181 with a well-dated North Atlantic Ocean record to yield an independent estimate of the core chronology. These two sites display close alignment in their paleomagnetic variation pattern. We believe the error of the age assessment is less than 400 years.

111. CLOSE SOLUTIONS OF VECTOR EQUATIONS WITH COMPUTER C++ IMPLEMENTATION THAT ALBERT EINSTEIN DID NOT FINISH.

Richard (Chao-Kuo) Lin, 833 Market Street, #300, San Francisco, CA, 94103.

We solve the vector-tensor equations that can be solved in vector forms, namely, in close form. This is a job not done yet even in Albert Einstein's formulation. Vector calculus has no division hence is not closed, because there are two multiplications exist (the dot and cross multiplication). The need for a closed vector system is crucial in solving advanced algebraic vector equations. After a new multiplication (the dyadic multiplication) was introduced, we are able to combine the dot, cross and dyadic multiplication to derive the identity tensor. The identity in real number (+1) and the identity in matrix (+1), are examples of identity, which are used in defining addition and multiplication. Therefore, by finding the formulae of identity for vector calculus, we gain a powerful tool in solving the vector equations in vector forms, namely in close forms. High school algebra ends in complex number because complex number is closed. However, by introducing anti-dual tensor, metric tensor, identity tensor, and zero tensor, we conclude that vector algebra is closed. The Standard Template Library also stops at the complex number. Therefore, we also introduce a vector-tensor class addendum to complete the library.

112. UNIFIED APPROACH TO SOLVING QUADRATICS AND CUBIC EQUATIONS WITH PRATICAL USAGE IN SCIENCE AND MATHEMATICS.

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Using an alternative method in deriving cubic and quadratic equations led to solutions not found in those of mathematical textbooks. With the new solutions, math students and scientists can attain more accurate solutions composed of integer type components, unlike the float type expressed in Cardano's cubic equation. With the new equation, Algebra students can comprehend factoring and quadratic equations more easily. This process takes fewer steps and should be an addendum to any related mathematical textbook.

113. THE COMPETITION OF NATIVE CALIFORNIA SEA MUSSELS (*MYTILUS CALIFORNIANUS*) AND NON-NATIVE JAPANESE OYSTERS (*CRASSOSTREA GIGAS*) FOR NUTRIENTS AND HABITAT

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Are non-native Japanese oysters (*Crassostrea gigas*) threatening the nutrient sources and habitat of native California sea mussels (*Mytilus californianus*)? Both species are common filter-feeding bivalve mollusks, but the oyster generally grows larger. Although the oysters are farmed throughout Northern California,

Oregon, and Washington, the oysters in Los Angeles are most likely imported as larvae in ballast water released by ships in port. Generally, the two species do not compete, because mussels are found on surf-exposed rocks and wharf piles and oysters are found on rocks and shells in bays and mudflats. Both species are, however, found in the Los Angeles Harbor and on the rocks lining the entrance to Las Salinas de San Pedro, a man-made salt marsh near Cabrillo Beach. This experiment investigated the feeding requirements of both species, using brine shrimp as food in over twelve six-hour periods. We measured dissolved oxygen levels and temperature hourly, to indicate metabolic rates. The mollusks lived in identical two-gallon tanks attached to a closed salt water system and were collected from the same area. We measured the mass, length, width, and depth of each mollusk at the beginning and end of the experiment. We also surveyed the salt marsh and harbor for both species.

114. THE SYSTEM DYNAMICS OF ALTERNATIVE FUEL VEHICLES

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According to industry projections, alternative fuel vehicles – which include cars with electric, hybrid, and fuel cell engines – will come to dominate the automobile market in the next decade. To analyze the probability of this projection according to current factors, this research project incorporates different economic and environmental statistics and then uses a system dynamics model to analyze the effects these variables have on the supply and demand of alternative fuel vehicles (AFVs). By creating mathematical functions that model current economic and environmental conditions through the analysis of collected data, while projecting future data from these current statistics, a program (Vensim Standard Version 1.62-4) working with these system dynamics models that organize factors in a web form will perform different situations of the alternative.

115. MAGNETIZATION OF MATERIALS USED IN CONSTRUCTION OF CRYOSTATS AT LOW TEMPERATURES

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We collected low temperature data on the induced magnetic moments of several materials commonly used in the construction of low temperature cryostat. Such materials are nearly non-magnetic at room temperature, but can exhibit significant magnetic susceptibility at low temperatures, thus distorting the magnetic field in low temperature experiments. Data was collected with an S.H.E Variable Temperature Susceptometer at temperatures from 12 to 2 K and at applied magnetic field strengths of 0.25 Tesla to 4 T. All of these samples exhibited some temperature and/or field dependence in their susceptibility. Our analysis of this data is intended to sort out the various contributions to the magnetism, such as electron paramagnetism (metals), diamagnetism, and magnetic impurities. We found that the aluminum alloy exhibited the weakest magnetism of the metals and no temperature dependency. The fused silica (an insulator) was very weakly diamagnetic, as expected. The heated grafoil displayed small paramagnetic contributions, most likely due to residual impurities in the graphite. Our sample of stycast 2850 (an epoxy with an aluminum oxide filler) displayed greater fixed magnetization than some of the other metallic samples, but less susceptibility, which can be contributed to ferromagnetic impurities. The teflon was weakly temperature dependent and diamagnetic, as was vespel. Stainless Steel 304 displayed the most magnetization, up to 100 times that of the other samples, and unusual temperature dependence, making it a material which should be avoided in field sensitive regions of a low temperature cryostat. This data can be used to improve low temperature cryostat design.