Sixth Annual Student Research Poster Symposium

May 17, 2002
1-4 p. m.
Holt Hall 225 & 227

Department of Biological Sciences
California State University, Chico

Department of Biological Sciences
California State University, Chico

Recipients of the
Tom Rodgers
Outstanding Researcher Award

1997 Ronald E. Loggins
1998 Maura Eagan
1999 Moaiad A. Kanaan
2000 Carina M. Jung
2001 Cary Coburn

Notes

LOWER DIVISION CLASS PROJECTS

To have spines or not to have spines, that is the question

Ashley Hommer

BIOL 006B – Sponsored by Mr. Robert J. Ballantyne

Can Praying Mantids feed with the loss of the spines that adorn their forearms? Or shall they overcome their handicap by figuring out another way to handle their prey? After I researched this area of their anatomy, I found that these spines are used in the capture and holding of their prey. From my research I realized just how important these projections were. I was bound and determined to hold an experiment on this exciting and intriguing topic. To test the success and feeding of a mantis without the use of their spines, I decided to scrape the spines off and then feed them fruit flies. I figured that by counting the numbers eaten, I would see if they were able to overcome the handicap of no spines. My null hypothesis for the experiment is the loss of the spined appendages will not affect their feeding success. My alternate hypothesis is that the loss of their spines will affect their feeding success. After the five days of observation, I found that the loss of spines made no difference in the feeding success of the Praying Mantids. My experimental mantis 1 was able to eat as much as my control mantis. However, I feel that my experimental mantis 2 was affected by the loss of his spines, for he died four days after removing his spines. In conclusion, the loss of their spines makes no difference in the survival of the mantis.

Does Diet Affect Growth In Mantids?

Carie Myers

BIOL 006B – Sponsored by Mr. Robert J. Ballantyne

Known for their hearty appetite for aphids, beetles, flies, caterpillars, leafhoppers, wasps, and other garden pests, the praying mantis is a viable alternative to toxic insecticides for gardeners. The ideal situation for a gardener is to hatch out several hundred young mantids and end up with five to six pairs of reproductive adults. I wanted to know if there was a connection between diet and growth rates in these young mantids. Several young mantids were randomly split into two groups. One was fed fruit flies, the other was fed rice beetles. Data were collected on growth rates of each individual nymph of the two groups. The growth rates of the two groups were compared to determine which diet was the most successful for growth. Cannibalism was prevalent in both groups causing my data for this experiment to be inconclusive. Because of cannibalism, my research supports my null hypothesis, which states that diet has no affect on growth rates in Mantids.

The Effect of Wood Stain on Ant Behavior

Alan Raetz

BIOL 006B – Sponsored by Dr. Ailsie McEnteggart

The avoidance behavior of wood-nesting ants in the presence of exterior wood stain was studied. Ants were placed in closed containers with both stained and unstained wood pieces for two four-day periods. The dependent measure was the number of ants under each type of wood at the end of each test period. The results were analyzed using a binomial test statistic, which showed that significantly more ants preferred to nest under the control (unstained) wood as opposed to the stained

experimental condition. The results are discussed in terms of the possible use of wood stains as a method of pest control, since stains are likely to have less environmental impact than pesticides or wood treated with heavy metals.

Body symmetry

Johanna Thompson
BIOL 006B – Sponsored by Dr. Ailsie McEnteggart

Humans are bilaterally symmetrical. However, are our two external sides really mirror images of one another? Research has shown that one side of the body's limbs tend to be longer than the other. Humans generally favor using one limb over the other for such everyday tasks as writing, shaking hands, for counterbalance, and kicking objects. These limbs can be referred to as the bodies dominant limbs because of the favored usage. Could it possibly be that dominant limbs are associated with the longer/larger limbs of the mirror image of the body? The alternative hypothesis was that dominant limbs would be larger than nondominant limbs. 18 subjects were used in the study; all had their arms, hands, legs, and feet measured. The averages for each limb were computed and a t-test was performed on those that varied. In conclusion, even though there is a slight difference in our mirror image limbs, it is not significant.

The quantity of bacteria found on bathroom door handles

Rich Alloway, Jessica Bietz, Alisha Morris, John Jemison, Sy Olson
BIOL 008 – Sponsored by Dr. Michael Abruzzo

An experiment was conducted to determine the amount of bacteria present on a sample of door handles of men's and women's restrooms. We hypothesized that there would be more bacteria present on the door handles of the men's restrooms. Replicate samples were collected each week for a three week period from the door handles on all six men's and all six women's restrooms in Holt Hall, CSU, Chico. The samples were collected using sterile swabs and then each sample was used to inoculate a tryptic soy agar plate. The plates were incubated at 37 degrees centigrade for 48 hours. After incubation, the number of bacterial colonies on each plate was determined. Statistical analysis of the data showed that the amount of bacterial growth from the samples collected from the men's door handles was significantly greater than that from the samples collected from the women's door handles. Possible reasons for the observed differences will be discussed.

An Investigation of the Effects of Coffee Mulch on Plant Growth

Erica Gleason, Brian Hudson, Michael McKinney, Trever Wilson
BIOL 008 – Sponsored by Dr. Michael Abruzzo

Because millions of gallons of coffee are consumed each year, millions of pounds of coffee grounds are discarded. Instead of discarding the coffee grounds, the grounds could be recycled by being added to potting soil as a mulch. Thus, the question of whether or not using coffee grounds as a planting mulch has an effect on plant growth was investigated. Bean plants were grown for four weeks in a variety of different mixtures of potting soil and coffee grounds. Plant height and the number of leaves present were measured weekly. Plant weight and the pH of the soil/coffee ground mixtures were also determined. The results show that there are significant differences in plant growth between the different soil/coffee ground mixtures. It is concluded that a mixture of 25% coffee grounds and 75% potting soil yields better bean plant growth than plain potting soil. Therefore, mixing coffee grounds with potting soil could prove to be a great way to recycle the millions of pounds of coffee grounds produced each year.

Water Contamination in Big Chico Creek, One Mile vs. Five Mile

Matt King, Ryan McGahern, Beth Liebenhow, Miles Gilbert
BIOL 008 – Sponsored by Dr. Ailsie McEnteggart

The water in Big Chico Creek has always been said to have lots of contaminants. The goal of our research was to see just what kind of contaminants there were. Our hypothesis was that more contaminants are in the creek at One Mile than at Five Mile areas in Bidwell Park. We took five water samples at both locations and cultured them on nutrient agar. One week after inoculation there was a significant amount of different colored growths present. We counted the different colors and their occurrence on each dish. Dr. Larry Hanne helped us identify the different bacteria. Those present on the dishes were from decaying biological substances. These would most likely be agricultural products that came from water runoff. This may change. As the seasons change from spring to summer, the amount of swimming will increase and the amount of human secretions in the water would increase. Turbidity was determined The water in One Mile was slightly tubid than the water in Five Mile. It is still safe for swimming according to the Federal Standards of turbidity.that requires a reading of less than .5. The water in Five Mile is .45, and the water at One Mile is .3. Water at Five Mile is more turbid because it is not restricted like at One Mile. One Mile is a concrete pool, for swimming, and Five Mile is a wide spot in the creek with stairs going down to the water.

Ferns of The Big Chico Creek Ecological Reserve

Eric Peterson
BIOL 009 – Sponsored by Dr. Ailsie McEnteggart

This study of the ferns of Big Chico Creek Canyon, adjacent to upper Bidwell Park, in the Ecological Reserve, focused upon *Pentagramma triangulari,* and *Pellaea mucronata*. It was suspected that *Pentagramma triangularis* would be the dominant species throughout and that percentages would vary from upper levels of the canyon to the lower. During research *Pellaea andromedifolia* and *Polypody californicum* were also encountered. Ferns were recorded by species in horizontal levels separated 15M from the highest elevation, (540M) descending lower into the canyon by stages 185M. On each level an area 200m X 10M was examined for fern sporophytes that were easily visible. Data were analyzed and charted for population dominance and diversity. Diversity was determined using the Shannon-Wiener index of diversity. *Pentagramma triangularis* was the dominant species in all levels, never less than 56% of the sample. *Pellaea mucronata* was 2nd in population for most levels although replaced by *Pellaea andromedifolia* in levels 9-11. Diversity increased with descent into lower, sheltered, wetter, and rockier levels. The H' value of diversity for the lowest level being 0.73. These species of ferns are able to withstand xeric conditions and appear to dwell in a more diverse community, with respect to the fern population, when the habitat more nearly resembles the traditionally wet and comparatively invariable conditions that we traditionally associate with the fern family habitat.

Effects of a Salty Environment on Skin vs. Terrestrial Microflora

Clint Acheson, Heather Foltz, Rachel Holtman, Keri Witzansky
BIOL 011 – Sponsored by Dr. Gordon Wolfe

Staphylococcus epidermidis is part of the normal human skin microflora. Since it is exposed to high salt from the sweat glands, we hypothesized it could have evolved to become more resistant to a high salt environment than a bacterium isolated from the terrestrial environment. To address this, cultures of *S. epidermidis* and a *Bacillus* species isolated from the surface of a plant leaf were grown. We exposed a group of each of them to varying salt concentrations for 30 minutes, then we did a serial dilution to determine the number of survivors. We found that the numbers of surviving *Bacillus* in the higher salt concentrations was markedly lower than the number of original bacteria, whereas the numbers of viable *S. epidermidis* dropped only slightly in the high salt environment compared to its numbers in low or no salt. *S. epidermidis* therefore did have a much greater tolerance for high salt concentrations than did the *Bacillus* isolate.

Removing Bacteria from Chico Creek Water: Effectiveness of Treatments

Jason Bell, Jesica Porter, Momein Refaat, and Teng Yang
BIOL 011 – Sponsored by Dr. Gordon Wolfe

There are many filtration devices on the market these days. Science and the media have kept our society educated about water contamination. We wanted to see how reliable filters were at removing bacteria from Chico Creek water samples. We filtered samples of water through two different filters and also treated two other samples by boiling and iodine treatment. We took dilutions of the filtrate and collected them on membrane filters, which were incubated on TSA plates at 37° C to allow remaining bacteria to grow. We found that boiling was the most effective treatment to kill bacteria in creek water. Filtration removed some, but not all bacteria.

pH tolerances of *Staphylococcus* and *Bacillus*

Mike Stanley, Norman Weitzel, Erik Skogland and Emily Begas
BIOL 011 – Sponsored by Dr. Gordon Wolfe

This experiment was designed to test different pH levels of *Staphylococcus* and *Bacillus* to determine if bacteria would grow better in an acidic or basic environment. We hypothesised that *Staphylococcus* would grow best at a neutral pH while *Bacillus* would grow best at a wide range of pH. The pH's we selected were 3, 7 and 10. We plated out a 1 ml sample of each bacteria at each pH. Unexpectedly, the *Staphylococcus* was more tolerant to the varying pH levels than *Bacillus*.

UPPER DIVISION CLASS PROJECTS

Effects of Mycorrhizae on the Growth of Tomato.

Jeremiah Christiansen, Vernon McCartney and Ross Rowland
BIOL 215 – Sponsored by Dr. James Pushnik

Mycorrhizae are found in association with many plants all around the world. Mycorrhizae are a type of root fungus, forming a mat called a Hartig net. We set up 16 planters all of which were approximately 1 meter in height. Planters were filled with a coarse gravel to allow for good drainage and plenty of air space. All the planters have openings approximately 30cm from the top and another opening 60cm from the top of the container. We cleaned, weighed and planted tomato plants in each container, half of which (8) received 3 small packets, near the roots of Mycorrhizae. We set up a continuous watering system which recycles the water from a reservoir which collects all the water drained down through the planters, this water is pumped back up to the plant. The water was fortified with a nutrient solution which was low in Phosphorous, but high in all other essential elements. We dropped the water table to each of the openings at 2-week intervals. At the end of our 6-week growth period planters were opened carefully to remove the plants with their roots intact. Weights were taken to see any change in biomass. We hypothesize that the plants with the Mycorrhizae would be more able to obtain water and nutrients, producing more biomass. We also think that the plants with Mycorrhizae will be able to obtain water and nutrients when the water table is lowered, better than plants without the Mycorrhizae root fungus.

Elephant Grass Growth Trial Under Varied Water Status and Chemistry

Garrett Liles, Eric Peterson and Ejay Dehal
BIOL 215 – Sponsored by Dr. James Pushnik

Interest in water remediation and disposal related to fruit and vegetable canning poses problems to land and facilities managers nation wide. The canning process is water intensive one where fruit is transported throughout the facility by floatation. Water is also used to remove fruit skins (with the help of NaOH, sodium hydroxide). The quantities of wastewater remaining after the process pose problems. Efforts to better deal with this waste has led managers to plant trails for potentially viable crop species. Water chemistry, limited dissolved oxygen content and the volume of water that is delivered at one time greatly limited the plants that can be grown. Elephant grass (Pennisetum spp. promor A) is a tropical C4 grass that has been domesticated in the country of Brazil. The interest in water use and ability to withstand varied water chemistry has led to interest in growing this plant as a remediation and economic crop. This project was designed to investigate the ability of this grass to grow under saturated and field capacity water status conditions with a sodium absorption ratio of 13, electrical conductivity of ~1mmolc/L, ~2% sugar solution and no nutrient limitations (20-20-20 with micronutrients). This research was conducted at the CSU Chico farm greenhouses with field trails to ensue in Palermo, California at the Pacific Coast Producers ranch.

Comparison of Plant Performance Between Organic and Synthetic Fertilizers on Greenhouse Tomato Transplants

Matt Molyneaux, Dan Kelm, Kimberly Lobosky and Nathan Burke

BIOL 215 – Sponsored by Dr. James Pushnik

The extensive use of synthetic fertilizers is causing increasing social concern about environmental impacts of these chemicals in ground water and soil. Alternative practices do exist, but will they function to produce the same quality plant material while also increasing sustainability within the horticulture industry? This study compares a single application of organic fertilizer at planting with weekly fertilization of a water soluble, synthetic fertilizer. Measurement of chlorophyll content with two methods, and analysis of weights of root and shoot tissue on a dry matter basis, was done to determine a significant difference between the treatments. No difference was found between organic and synthetic treatments for chlorophyll content at the (.05) level of significance. Similarly there was no difference found in weights of root and shoot tissues. There was however a significant difference between control (unfertilized) treatments and the synthetic and organic trials.

Phenology and Reproductive Capability of *Ranunculus canus* (Ranunculaceae)

Michelle Bergeron

BIOL 258 – Sponsored by Dr. Robert A. Schlising

This study investigated the basic phenology and reproductive capability of the Sacramento Valley Buttercup (*Ranunculus canus*) in the Mediterranean climate of the Vina Plains Preserve, north of Chico, California, Spring 2002. The area consists of slightly undulating grassland where the buttercup is distributed in random clumps within the Preserve. A small plot of these annual herbs was divided into several transects in order to randomly select sample plants. Fruit-producing flowers per small, single-stem plants (n = 7) was (mean +/- SE) 46.8 +/- 10.6; per medium, slightly-branched plants (n = 7) was 62.9 +/- 21.4; per large, highly-branched plants (n = 3) was 53.3 +/- 11.7. Statistical analysis shows no significant difference (p = 0.78) is present between these groups. Overall achenes per fruit-producing flower (n = 17) was found to be (mean +/- SE) 13.8 +/- .043. *Ranunculus canus* phenology proceeded as expected with the budding of the plant most common in the beginning of the study, 26 March, followed by a majority of flowering plants, and ending the study, 23 April, with no existing flower buds or open flowers, only fruits present. Possible methods of achene dispersal are attaching to animal coats via a small hook-like extension on the end of the achene, or by dropping from the fruit-producing flower and receding within a small circumference of the parent plant allowing for the dense growth in clumped populations.

Successful Fruit Production of *Dodecatheon hendersonii* (Shooting Star)

Jacqueline Cole

BIOL 258 – Sponsored by Dr. Robert A. Schlising

The reproductive success of 25 plants in a population of the perennial *Dodecatheon hendersonii* was studied at a savanna in Millville, California (March-May 2002). The success of these herbaceous plants was measured in two ways: buds turning into flowers and flowers into ripe fruits. The total number of reproductive structures (mean+/-SD per plant, n=25), was 6.8+/-2.843 for buds. 5.8+/-2.566 for flowers, and 5.3+/-2.428 for fruits. t-tests, using equal variances, showed there was not a significant difference between the mean production of buds and flowers (p=0.198) and flowers and ripe fruits (p=0.500). Because of these results, the two null hypotheses were not rejected. *Dodecatheon hendersonii* was reproductively successful with 86% of its buds turning into flowers and 92% of its flowers turning into fruits.

Lupinus bicolor: Almost Living Up to Its Full Potential.

Robyn Sue Hancock

BIOL 258 – Sponsored by Dr. Robert A. Schlising

Lupinus bicolor (Fabacea)is a native annual found only on the west coast of North America. Because it is an annual, its reproductive success this year is vital to its existence in the future. Southwest of Paradise, CA, fields of *Lupinus bicolor* were observed, where lupines reproductive and developmental success were documented. Over a 7 week period 180 *Lupinus bicolor* were sampled, 30 every 9 days. The second sampling date, March 28, 2002 showed the maximum number of flowers produced per plant which was 6.7. The flowers then decreased and developing seed pods increased to 5.4 on April 24, 2002. By May 3rd an average of 5.0 seed pods had dispersed per plant. This showed a loss of one flower or seed pod per plant this season. Only 74.6% of flowers developed into seed pods that dispersed. A t-test showed that the numbers were statistically different (p=.0004).

Foraging and Behavioral Tendencies of the Larvae and Adults *Battus philenor*

Andrea Hines and Ejay Dehal

BIOL 258 – Sponsored by Dr. Robert A. Schlising

Observations *of Battus philenor*, the Pipevine Swallowtail, were made weekly from March 26 – May 9, 2002 at 1-Mile Area Bidwell Park, California. This was done in efforts to illustrate the foraging preferences of the larvae and the behavioral tendencies (with emphasis on foraging aspects) of the adults. Larvae consumption of *Aristolochia californica*, California pipevine, in quantity was 25.22±15.91 on leaves (n=6 periods of observation) and 20.50±14.32 on stems (n=6). We hypothesized that there was no difference between larvae feeding preference for leaves or stems. A t-test indicated that the leaf vs. stem choice did not differ significantly (p>0.5923). Commonness of the adult behaviors, in terms of total length of time done in minutes, showed higher instances of flying, sitting, then performing mating dances. Several flowering plants were seen in the habitat, amongst them the thistles, lilacs, and the winter vetch were studied as food sources. The adults chose to imbibe nectar mostly from the winter vetch. In accordance with their life stages, the tendencies of the Pipevine Swallowtail species were disparate in that the larvae preferred to continuously feed while the adults were more likely to be seen flying about and occasionally feeding.

Is there a Relationship between *Ficus carica* and Local Birds in a Mediterranean Climate?

Teresa Munoz

BIOL 258 – Sponsored by Dr. Robert A. Schlising

Because fig tree fruit is an important food resource for rain forest vertebrates, fig trees and vertebrates have an intimate relationship in tropical rain forests, their main habitat. To determine if fig trees serve the same purpose in a Mediterranean climate, the interactions between *Ficus carica*, the common fig, and local birds in Oroville, California were studied. To establish the importance of these trees as a habitat and food resource for local birds, responses of birds to temperature change, leaf and fruit content per tree, and fruit size were recorded. Additionally, the number of birds visiting neighboring non-fruit trees was documented. To conclude what role local birds play in fig tree seed dispersal number and behavior of visiting birds was observed and recorded. No birds were seen eating during the time of observation (12:00 pm – 1:00 pm) on either fig or non-fruit trees. Also, no relationship was found between number of birds visiting the figs and temperature, which ranged between 22 and 35°C during the course of this study (3/24/2002 to 5/9/2002). No correlation between number of bird visits and leaf or fruit content per tree, or fig fruit size was established. This may be because the fruit did not mature, and therefore was not attractive to visiting birds. An average of 1.89 more bird visits were recorded on the non-fruit trees. This could be explained by the difference in height of the two tree populations. Non-fruit trees were taller than fig trees and therefore more readily accessible to birds.

How Does *Escherichia coli* Help Determine Time of Death

Rachael Rados

BIOL 258 – Sponsored by Dr Robert A. Schlising.

I hypothesized that the deterioration of the intestinal tract after death would allow *Escherichia coli* to escape into the environment and help in determining the time of death of a victim. This was done with 8 laboratory rats that had been euthanized and placed into a cage made of chicken wire, and put out at the Vina Plains Preserve, just north of Chico, CA. Since growth rate of bacteria is dependent on temperature, daily average temperatures were added up to achieve accumulated degree days (add consecutive average temperatures together). Data, taken from March 21-27, 2002, showed that *E .coli* was not present until 54 accumulated degree days, and died off by 350 accumulated degree days. This shows that if the rat corpse had been dead for 1-3 days *E. coli* could be traced, and the date could be narrowed down. If the victim had been deceased for less than 24 hours, or more than 3 days, no presence of *E. coli* would be found. This field has not had much research put into it yet, but there were many other microorganisms that were also part of the decay process that could eventually help to narrow down time of death.

Sun vs. shade on the reproductive success and plant fitness of *Calochortus tolmiei* (Pussy Ears) inhabiting a serpentine outcrop near Magalia, CA

Ross Rowland

BIOL 258 – Sponsored by Dr. Robert A. Schlising

A population of *Calochortus tolmiei* (Liliaceae) was examined to identify the factors limiting reproduction on a serpentine outcrop on the northern bank of the west branch Feather River in Magalia, CA. *C. tolmiei* is a common species that occurs

on the shadier areas of dry, open slopes of coniferous forest. It has only one leaf from 10-40 cm long, and generally produces only two flowers. A 25x25 meter area was established to encompass a bare rock opening surrounded by low lying McNab Cypress, and the location of individuals were separated into two categories to illustrate shade preference and plant fitness: 1) those exposed to full sunlight at least 6 hours a day and 2) those that are in full shade or diffuse light all day. Leaf length measured in centimeters (mean +/- S.D.), was 21.4 +/- 5.57 for plants in sun (n= 63), and 27.1 +/- 5.05 for plants in the shade (n= 63). 107 flowers and/or buds were produced by the plants in shade of 48.6 % were infected with an insect larva and only 25.2 % of the flowers/buds reached fruiting. The sunlit plants produced 110 flowers and/or buds, of which, 24.5 % were infected with an insect larva with 30.0 % of the flowers producing a fruit.

The Relative Abundance of the Foothill Yellow-Legged Frog (*Rana boylii*) in Three Branches of Dye Creek, California

Jennifer L. Burghardt

BIOL 259 – Sponsored by Dr. Michael Marchetti

Over the last decade in California, a significant decline in the distribution and abundance of the foothill yellow-legged frog (*Rana boylii*) has been shown in Sierran foothill streams. In response to these declines, *R. boylii* was listed as a state Species of Special Concern (1994). Declines have been attributed to many causes including the introduction of exotic species. In particular, the non-native bullfrog (*Rana catesbeiana*), has been singled out as major contributor to the declines of ranid frog species native to the western United States. We examined a hypothesis of negative interactions between *R. boylii* and *R. catesbeiana* by conducting a faunal and habitat survey of Dye Creek, where both species co-occur. In Dye Creek, (Tehama Co., CA), we found a significant difference in the distribution and relative abundance of *R. boylii* in the three main branches of the creek. The north fork is dominated by *R. boylii*, whereas the south fork and main branch show evidence of invasion by *R. catesbeiana* and have a dramatically lower abundance of *R. boylii*. Scarcity of *R. boylii* individuals encountered on the south fork and main branch are hypothesized to be attributed to competition and predation by *R. catesbeiana*, where differences in flow regime may have resulted in a slightly altered habitat, suitable for supporting invasion by *R. catesbeiana*.

Fish Larvae Attraction to the Light spectrum

Helen Nhan, Brittany Blain, Jeff McComb, Jason Beauchamp, Rob Huebner, Matt Manuel, Laura Ware

BIOL 261 – Sponsored by Dr. Michael A. Marchetti

Light traps were deployed in the backwaters of the Sacramento River along River Road, south of West Sacramento Avenue. In order to test fish larvae's color selectivity, five replicates were used in six light traps - three small and three large. All the traps were proportioned to each other and patterned after one another. Sampling was done over six consecutive nights during the phases with the least amount of moon , a half hour after sunset. Data was collected, analyzed, and grouped into Catastomidae, Cottidae, and all other species. Results showed statistically that Catostomidae alone were selective for particular colors of light. By observation of the data, yellow and green were shown to be favored. Collectively, the fish larvae showed no significant selectivity for a particular replicate. Selectivity for various color replicates thus appears to be insignificant.

Relative abundance of drifting larval fishes in a temporary and a permanent stream in the Sacramento River watershed

Susan Hornsby, Jen Presleigh, Dave Bowling, Mark Lynch, Nick Demetras, John D. Karnegis, Chuck Carroll, Scott Gregory
BIOL 261 – Sponsored by Dr. Michael Marchetti

The Sacramento River watershed consists of permanent tributaries as well as numerous small temporary streams. The physical and chemical characteristics of a tributary are partly controlled by the stream's size, and these characteristics can influence fish production. In this study, we measured the relative abundance of larval fish in two tributaries to the Sacramento River: Big Chico – permanent, and Mud Creek – temporary. We hypothesized that physical characteristics, such as stream discharge, would be related to larval fish abundance. Using weekly drift net samples from February to April 2002, we found that larval fish abundance peaked during mid-April in Mud Creek and during late April in Big Chico Creek. Discharge was always higher in the permanent tributary, but both streams followed a similar pattern of declining flows. The higher ambient water temperatures in Mud Creek may explain the earlier emergence and higher catch-per-unit-effort (CPUE) of fish larvae than those in Big Chico Creek. Early emergence and faster growth associated with warmer temperatures is known to increase survival of larval fish. We speculate that temporary tributaries could contribute significantly to the Sacramento River system, especially during dry years.

Habitat Utilization and Selection by the avian community of the Sacramento River Riparian Forest

Kim Coen and Brian Levenson
BIOL 265 – Sponsored by Mr. Raymond J. Bogiatto

We conducted a survey of the avian community within a riparian forest at the Indian Fishery Wildlife Area, 7 miles west of Chico, Butte County, California during the months of April and May 2002. Transects were designed surveyed for both plants and birds within our 150m X 50m study area. Our goals were (1) to determine the species composition of both the avian and vegetation communities, (2) to calculate a foliage height profile of the vegetation present, (3) to determine Shannon diversity (H') values for plant species, foliage heights, and bird species to be used in a comparison with values generated from other habitats, and (4) to determine whether bird species use the various plant species and foliage heights randomly or selectively; our null hypothesis being that there is no difference in the relative proportion of plant species and foliage heights, and the relative utilization of these habitat components by each bird species. The most common avian species were the common yellowthroat and American robin. Although our analyses are incomplete, early results suggest that riparian bird species use both plant species and foliage heights selectively.

Behavior of Resident and Neotropical Migrant Bird Species in a Foothill Woodland Habitat in Butte County, Ca, April-May, 2002

Karen Tandy and Mikki Westbie
BIOL 265 – Sponsored by Mr. Raymond J. Bogiatto

We conducted a study of resident and neotropical migrant bird species using low-elevation foothill woodland habitat on the Butte Community College campus, near Oroville, Butte County, California. Surveys were conducted from April 28 through May 13, 2002. Goals of our project were to (1) determine avian and vegetation

species composition, (2) to generate a foliage height profile for our habitat, (3) to calculate Shannon Diversity values (H') for plant species, foliage heights, and bird species, and (4) to collect data on habitat utilization by birds during several morning surveys in order to determine whether utilization of plant species and foliage heights by birds is selective or random. Our relatively undisturbed 1 ha survey area was located at an elevation of approximately 300 to 500 feet in an area dominated by blue oak, gray pine, with an understory of grasses and forbs. Please refer to our poster for our results.

Vegetation and Avian Diversity Relationships within a Sacramento Valley Grassland Habitat

Kyle Hartwigsen and Tyana Maddock
BIOL 265 – Sponsored by Mr. Raymond J. Bogiatto

We conducted a study of plant species and foliage height utilization by birds using a grassland habitat on the Vina Plains Preserve, Tehama County, California from April - May, 2002. Our goal was to determine whether birds exhibit random or selective utilization of grassland plant species as well as the various foliage height intervals present. The landscape on the Vina Plains is dominated by grasses and forbs with no woody plant species present. As a result, only one foliage height interval (less than 1 meter) was available to avian species. The western meadowlark was the only bird species abundant enough (with 5 or more observations) for quantification, and they were not found to use any of the grasses or forbs for perching; grass and forb cover is used by meadowlarks as escape and nesting cover. Our results are preliminary and will be presented on our poster.

The Measurement and Analysis of a Bird Community within a Chaparral Habitat at the Big Chico Creek Ecological Preserve, Butte County, California

Nathan Burke, Caleb Casey and Valerie Rentz
BIOL 265 – Sponsored by Mr. Raymond J. Bogiatto

Bird and plant species surveys were conducted within a rugged chaparral environment at the Big Chico Creek Ecological Preserve (BCCEP) during May, 2002. Our project goals were to characterize the plant and bird communities present, and to evaluate bird habitat utilization in terms of vertical distribution, and relationships to plant species present. Common bird species found in the chaparral habitat were the western scrub-jay, Anna's hummingbird, blue-gray gnatcatcher, and wrentit. Early morning foraging and roosting activities were observed for these and other birds. Although there were some instances where scrub-jays used high vantage points on specific vegetation overlooking the study area, many types of vegetation were used at differing heights, resulting in no true selection by these bird taxa for specific plant species or foliage heights. Therefore, the utilization of vegetation species and specific foliage height intervals within our chaparral study area was found to be random.

The Use of Plant Species and Foliage Height by Birds within a Big Chico Creek Riparian Forest

David Koenig, Monica McCabe, and Eric Peterson
BIOL 265 – Sponsored by Mr. Raymond J. Bogiatto

We conducted an investigation of the utilization of both plant species as well as specific foliage heights by birds within a riparian forest habitat along Big Chico Creek, Butte County, California. Data on plant species, foliage heights, and bird

species were collected by means of surveys along transect lines located every 10 meters within our study area. The foliage height profile of this riparian environment ranged from zero to over 10 meters in height, and the various bird species where found to use all height intervals within our foliage profile. Foliage height, plant species, and bird species diversities (Shannon Diversity Index) were also generated during our study. We used the Chi-Square statistic in order to test for differences between the relative availability of each plant species and foliage height interval and the actual utilization of these habitat components by birds. Our results, which will be presented on our poster, will indicate either a random or selective utilization of each plant species and foliage height interval.

UNDERGRADUATE INDEPENDENT RESEARCH PROJECTS

Tagging Study of the Galapagos Shark *Carcharhinus galapagenis* at Midway Atoll (NWHI)

Jeremiah Christiansen
BIOL 199 – Sponsored by Dr. Ailsie McEnteggart, Dr. Gerald Crow, Waikiki Aquarium, and Dr. Mark Heckman, University of Hawaii, Manoa

The Galapagos shark is found in most of the tropical and sub-tropical waters of the world. As juveniles they are found in shallow waters usually around oceanic islands and as mature adults are found in deep pelagic zones. The past two summers ('00 & '01) I have spent time taking classes and doing research on these Galapagos sharks at Midway Atoll, which is located 1200 miles NW of the main Hawaiian islands. Both summers we tagged small 18 juvenile sharks around the outer reef of the atoll. During the summer of 2001 I observed the sharks by Scuba diving with them and trying to catch them while fishing. I was able to observe behaviors and get an idea of one shark's movement around the atoll. With the data I have collected combined with the data of other scientists, divers, and fisherman I hope to paint a picture of the movement and distribution of the Galapagos sharks of Midway atoll.

Molecular characterization of microbial enrichment cultures from Big Chico Creek

Matt Eltgroth and Kelly Ottone
BIOL 199 – Sponsored by Dr. Gordon Wolfe

There has been little or no previous work done to characterize the microbial diversity of Big Chico Creek. For our study, we collected water samples from an area of the creek that runs through the Chico State campus. We selectively enriched these cultures under conditions of light vs. dark, and with or without the addition of 0.01% peptone. Samples were taken along periods of a time course. We extracted DNA from each of these, and amplified 16S and 18S rRNA gene segments using specific PCR primers. Utilizing denaturing gradient gel electrophoresis (DGGE), we separated unique amplicons representing individual rRNA genes belonging to different organisms. We are currently obtaining sequences of these amplicons, but preliminary results have revealed the both aquatic (*Cytophaga-Flavobacterium*) and soil (*Agrococcus/Microbacterium*) bacterial taxa. DGGE permitted us to perform analysis of the diversity of microbial communities within our enrichments. We observed strong rRNA shifts in response to organic amendments in both prokaryotic and eukaryotic assemblages, while light vs. dark showed only slight differences, suggesting that nutrients are more limiting than light in Big Chico Creek. These results may represent what occurs in natural settings however, our enrichment conditions do not exactly duplicate those likely to be found in the stream, so our findings are not entirely applicable. The information gained from this research will improve the understanding of the effects of environmental changes on microbial populations.

Using the symbiotic relationship of *Azolla* and *Anabaena* to increase N_2 production for rice plants

Mike Larson
BIOL 199 – Sponsored by Dr. David M. Wood

Nitrogen is necessary for maximum rice grain yields, and sufficient naturally occurring amounts are rarely present in soils where rice is grown. Urea (46-0-0) is the chemical fertilizer most commonly used in rice production and overuse damages associated ecosystems. *Anabaena azollae* fixes atmospheric nitrogen in excess for *Azolla filiculoides*, and this research will determine if it can replace urea as a nitrogen source for rice. *A. filiculoides* was inoculated into micro-plots from November 2001 until January 2002 and will be incorporated as green manure after this growing period. The micro-plots and the controls will then be planted with medium grain rice. The trial will determine the effect of this nitrogen source on the rice plants by measuring rice grain yields at the conclusion of the growing season in September of 2002.

BMP4 and Retinoic Acid Function in Combination to Regulate Cartilage Development

Rachel Brock[1], Dr. Robert Thomas[1], Dr. Rocky Tuan[2] and Dr. Lillian Shum[2]
BIOL 289 – California State University, Chico[1], Cartilage Biology and Orthopaedics Branch, NIAMS, NIH[2]

Bone morphogenetic protein type 4 (BMP4) and retinoic acid (RA) are both endogenous molecules that are necessary for normal skeletal development, but how they interact to regulate chondrogenesis is not well known. In micromass cultures of E10 mouse limb bud mesenchymal cells, treatment with BMP4 at the beginning of culture, that is, day 0, inhibited chondrogenesis, whereas treatment with BMP4 on day 1 of culture (E10+1) enhanced chondrogenesis. We hypothesize that these stage-dependent differential responses are due to different levels of RA in the embryonic limb buds. We found that treatment of E10+1 cells with BMP4 resulted in dose-dependent increase in chondrogenesis, whereas treatment with RA led to dose-dependent inhibition of chondrogenesis. Elevated levels of RA appeared to redirect cell fate from chondrogenesis to apoptosis. When E10+1 cells were exposed to both BMP4 and RA, we observed increasing levels of RA abrogated BMP4-induced cartilage formation. BMP4 inhibited chondrogenesis in the E10+1 cells in the presence of high levels of RA. On the other hand, treatment of E10 cells with BMP4 inhibited chondrogenesis. However, in the presence of citral, an inhibitor of RA synthesis, BMP4 was less effective in inhibiting chondrogenesis. Reduced levels of RA redirected cell fate in response to BMP4 from apoptosis to chondrogenesis. These results suggest that high endogenous RA levels in E10 cells inhibit BMP4 stimulation of chondrogenesis. Lower RA levels in E10+1 cells no longer inhibit BMP4 promotion of cartilage formation. Cartilage cell fate determination in response to BMP4 is dependent on the concentration of RA.

Bacteriological Risk Assessment of a Community Lake in Chico CA

J. Gaynor and M. Torres
BIOL 298A – Sponsored by Dr. Larry Hanne and Dr. Larry Kirk

Small community lakes may be of importance in public health, especially when they may contain pathogenic microorganisms. Our research has focused on analysis of the potential bacteriological risk associated with Horseshoe Lake, a small community lake in Chico, CA with a resident population of approximately 20 waterfowl. The bacterial species of major importance include *Campylobacter jejuni*, *Escherichia coli*, *Salmonella spp.*, and *Enterococcus spp.* We collected water samples from specified sites at Horseshoe Lake biweekly for the past 6 months. 25 mL samples were filtered through 0.45µm millipore filter and filters were placed onto Campy media (for *Campylobacter* isolation), EC with MUG (for *E. coli*), SS media (for *Salmonella*), and mEA agar (for *Enterococcus*). Plates were incubated at appropriate temperatures and atmospheric conditions, and concentrations of bacteria determined at 24 hours. Our findings suggest that water temperature and rainfall affect the concentration of these indicator species. We will report relative risk of infection based upon infectious dose 50's during each season analyzed.

Characterization of p-Nitrophenol Monooxygenase from *Arthrobacter aurescens* TW17

Zach Kraus and Reed Sorenson
BIOL 298A – Sponsored by Dr. Larry Hanne and Dr. Larry Kirk

The soil bacterium *A. aurescens* strain TW17 has been shown to break down p-nitrophenol (PNP), a toxic by-product of parathion pesticide. The initial reaction in degradation of PNP by this organism is catalyzed by a nitrophenol monooxygenase. This enzyme has been shown to be induced by other phenolic compounds with electronegative groups in the 3or 4 position. We carried out a set of experiments to characterize the in vivo half life and substrate specificity of the monooxygenase. This enzyme is not a constitutive enzyme and requires induction by PNP before it is synthesized in the cell. We determined that, after induction, the *in vivo* half-life of this enzyme is approximately 2 hours. We were also interested in looking at the effects of PCP on the degradation of PNP. We found that PCP significantly decreases the rate at which this organism degrades PNP. These results add to the story our research group is beginning to develop regarding *Arthrobacter* degradation of PNP.

GRADUATE PROJECTS

To what degree does reproductive output vary between years for a neglected native geophyte, *Triteleia laxa*?

Brianna Borders, Petra Lee, Dylan Van Dyne
BIOL 352 – Sponsored by Dr. Robert A. Schlising

Triteleia laxa (TRLA), Liliaceae, is a widespread native geophyte of grasslands and savannahs, which has relatively little published information on its reproductive biology. We are reporting the 2002 reproductive output of a TRLA population located at the Wurlitzer tract of the Vina Plains Preserve (Butte County, CA) as mean number of flowers per plant, fruits per plant, and seeds per fruit. In addition, we are comparing our data with those collected from the same TRLA population in 2000. T-tests show that the means of all three parameters from the 2002 population were significantly higher (at least >.01) than those from 2000. Mean flowers per plant (mean ± S.D.) in 2002 was 12.56 ± 4.31 (n=50, p=.001), compared to a mean flowers per plant in 2000 of 8.03 ± 4.49 (n=34). Mean fruits per plant in 2002 was 7.56 ± 2.98 (n=50, p=.01), compared to a mean fruits per plant in 2000 of 5.24 ± 3.33 (n=34). Mean seeds per fruit in 2002 was 18.99 ± 6.87 (n=50, p=.01), compared to a mean seeds per fruit in 2000 of 14.9 ± 6.32 (n=33). We also determined that the mean proportion of ovules that set seed in 2002 was only 0.57. Since these aspects of *Triteleia laxa*'s reproductive biology have not been documented, our data contribute to an understanding of TRLA's life cycle. These results can serve as baseline data to which subsequent years' data might be compared, and raise questions that could be explored in the future. It would be interesting to attempt to correlate such variables as total yearly precipitation or pollinator activity with the reproductive output of *Triteleia laxa*.

Natives or non-natives: Has the habitat of *Triteleia laxa* at Vina Plains Preserve changed in four years?

Michelle Cederborg, Christine Hantelman, Lesly Hess
BIOL 352 – Sponsored by Dr. Robert Schlising

An ecological study of the geophyte *Triteleia laxa* Benth. (Liliaceae) has been conducted since 1998 at The Nature Conservancy's Vina Plains Preserve, 26 km north of Chico, CA. Although not pristine, the Preserve contains remnants of purple needlegrass (*Nasella pulchra*) habitat. The study site was subjectively chosen in 1997 because of the presence of *Triteleia laxa* (TRLA). Vascular plants observed growing in a 0.25-meter square quadrat around 42-55 marked TRLA plants were quantified for the years 1998 through 2002, excluding 2001. Total number of taxa at the study site varied from 33 to 40 during the four-year study period with the average number of taxa per plot ranging from 9.2 to 13. Taxa most frequently associated (found in more than 50% of the plots) with TRLA in 2002 were *Nasella pulchra, Latuca serriola, Triteleia laxa, Erodium botrys, Taeniatherum caput-medusae, Vulpia microstachys, E. cicutarium, Trifolium hirtum*. Associates data were analyzed for differences in species composition between years. Frequency of natives and non-natives were compared between years to determine if there were significant changes during the four years. This study, part of a larger ongoing investigation, gives a detailed characterization of one TRLA habitat at Vina Plains Preserve.

What May Cause Limited Seed set in *Triteleia laxa* at Vina Plains Preserve?

Alfred Kannely
BIOL 352 – Sponsored by Dr. Robert A. Schlising

Triteleia laxa is a common perennial found in the hills and grasslands of California. It blooms in April or May and produces a large purple inflorescence as well as small amounts of nectar. Through marking plants and bagging individual flowers in this study *Triteleia laxa* has been shown to be self-incompatible. Pollen and stigmas were both sampled and analyzed using a scanning electron microscope. The resulting size, shape and texture of the pollen grains indicate that insects are the main pollination vector. Pollen ovule ratios were also calculated and determined to be to lower than most wind pollinated plants. From field observations the Pipevine Swallowtail was found to be the main pollinator since it was consistently observed at our population. The number of flowers 32 butterflies visited, as well as time at the population was recorded. Pipevine Swallowtails were observed to visit from 1-30 *Triteleia laxa* flowers before leaving the study area and spent from a few seconds to several minutes on each flower. Very rarely bees were also observed to visit *Triteleia laxa* flowers. Seed set was determined by counting the number of ovules and seeds present in ripe fruit. Because of the low number of ovules that matured to seeds it was concluded that our population was pollination limited.

Timing of Resource Allocations in a Common Grassland Geophyte of the Northern Sacramento Valley

Paul Kirk and Rob Irwin
BIOL 352 – Sponsored by Dr. Robert A. Schlising

Triteleia laxa is a common geophyte in the grasslands at Vina Plains Preserve and is known to possess a synanthous habit: vegetative and reproductive growth appear simultaneously. This habit has been described in a variety of geophytes and fits into a larger scheme of resource allocation, which includes the annual regeneration of the corm. The purpose of this phenology was to quantify resource allocation among vegetative, reproductive and storage biomass, at the same sites that preliminary data had been collected in 1997-1999. We estimated vegetative and reproductive biomass by measuring leaf and scape lengths of 54 plants weekly for ten weeks beginning 14 February 2002. We collected 20 corms every two weeks over a ten-week period beginning 28 February 2002. Cormlets were separated from "mother" corms and all were dried to constant weight. The bulk of the vegetative growth occurred prior to our first sampling date. Mean leaf length was 22.8 cm (SE 0.47) at this date, and reached a maximum of 28.1 cm (SE 0.67) two week later. The flowering buds on marked plants were first seen on 14 March and mean scape height four weeks later was 22.7 cm (SE 1.6). Relative to corm observations in 1998, the bulk of cormlet regeneration apparently occurred about two months sooner. Preliminary results from 28 February show that the mean dry weight of the cormlets was more than 15 times greater than that of the "mother" corms. The timing of corm regeneration is plastic and may be related to water availability.

Blood Parasites in the California Spotted Owl (*Strix occidentalis occidentalis*) and the Northern Spotted Owl (*Strix occidentalis caurina*)

Laurie A. Clark
BIOL 398 – Sponsored by Dr. Richard Demaree

With a survival rate of 69%, and a range from 56%-76%, in the population of California spotted owls (*Strix occidentalis occidentalis*) being followed for my thesis, we were prompted to look at possible parasite loads. We specifically looked for *Plasmodium sp., Leucocytozoon sp., Haemoproteus sp., Trypanosoma avian,* and microfilaria. Smears were made from blood samples collected from the brachial veins of captured birds. We analyzed a total of 23 blood smears, 14 from the California spotted owl and nine from the Northern spotted owl (*Strix occidentalis caurina*) to ascertain the presence and quantities of these five blood parasites. 96% of the total samples were positive for at least one parasite. *Plasmodium sp.* was not identified in any samples. *Leucocytozoon sp.* (71%), *Haemoproteus sp.* (71%), *Trypanosoma avium* (14%), and microfilaria (35%) were all identified in the California spotted owl samples. The Northern spotted owl samples contained *Leucocytozoon sp.* (78%), *Haemoproteus sp.* (78%), and microfilaria (44%). Multiple infections were common in both owl species: 57% in the California spotted owl and 78% in the Northern spotted owl. Although this is a small sample size, we were able to identify multiple blood parasites in both populations. We are currently expanding our data set to include samples from five other Northern spotted owl sites in Oregon for parasite species and quantity comparisons.

Variation in Shell Morphology of the Northwestern Pond Turtle (*Clemmys marmorata marmorata*) from Three Freshwater Habitats in Northern California

Glen M. Lubcke, Jack S. Campbell, Gary A. Lechner
BIOL 398 – Sponsored by Dr. Dawn S. Wilson

Intraspecific geographic variation in turtle morphology has been well documented in many freshwater turtle species. Growth rates, sexual size dimorphism, and mean population body sizes have been shown to vary significantly among localized geographic populations and often such differences have been attributable to local environmental effects in diet and abiotic factors associated with habitat type. Here we compare two years of morphometric mark/recapture data on the northwestern pond turtle (*Clemmys marmorata marmorata*) from three study sites in northern California that differ in several habitat characteristics. Among sites adult turtles differed in several morphometric characters such as carapace length, body height, and body width. We attribute these among site size differences to differences in prey availability, water temperature and/or microhabitat structure (e.g, water velocity). Within sites, it appears that males and females are similar in carapace length but differ in body height and body width. These data coincide with hypotheses that through ontogeny females become more domed or boxier than males to increase internal volume for egg storage and maturation. We currently are studying diet and microhabitat use of pond turtles at these three diverse sites, to gain a better understanding of the phenotypic plasticity in body size observed.

Phylogenetic Analysis of an *Arthrobacter* p-Nitrophenol Monooxygenase Gene

J. Amendola
Sponsored by Dr. Larry Hanne

Para-nitrophenol (PNP) is a common soil contaminant resulting from hydrolysis of parathion used in industrial and agricultural applications. PNP has been listed as a priority pollutant by the EPA. Gram-positive *Arthrobacter* spp and a *Nocardia* sp, which degrade PNP via a monoxygenase pathway, have been isolated from orchards adjacent to Chico California. Curing studies have shown the gene(s) responsible for PNP degradation are plasmid encoded. The purpose of this study was to utilize PCR to analyze the evolutionary origins of the PNP monooxygenase gene. PCR primers were designed by locating conserved polypeptide regions of monoxygenases found in the Gram negative, *Ralstonia pickettii*, *Burkholderia cepacia*, and a Gram-positive *Arthobacter* species. Amino acids with low codon redundancy were then chosen as the basis for two forward and two reverse 14 base pair degenerate primers. The result was amplification of a 498 base pair gene fragment, which was sent to SDSU for sequencing. Biology Workbench was used to perform Gene Bank database search and construct phylogenetic trees. The highest matches were with p-chlorophenol dehalogenases and with the PNP monooxygenase from another *Arthrobacter* species. Preliminary analysis suggests that the *Arthrobacter* PNP monooxygenase evolved from DNA sequences involved in dehalogenation.

The Influence of Fasting Insulin and Dietary Glycemic Index on Blood Lipids in a College Population

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Recent studies suggest that dietary glycemic index (GI) increases the risk for heart disease. Other studies report that high-carbohydrate diets lead to increases in blood insulin and triglyceride (TG) and a decrease in HDL-cholesterol (HDL-C), characteristics of metabolic syndrome. The purpose of this study was to test if fasting insulin and dietary GI are independently associated with HDL-C and TG. 100 subjects completed a questionnaire, 2-day diet record; had a fasting blood draw; and had anthropometric measures. On average, subjects were 23 ? 6 y with BMIs of 24.3 ? 4.5. Of 100 subjects, 19% smoked, 31% were overweight, 15% had elevated cholesterol, 16% had elevated triglyceride, and 9% had low HDL-C. Additional results (mean ? SD) are: 7.3 ? 4.5 ?IU/ml (Insulin), 178 ? 36 mg/dl (TC), 97 ? 24 mg/dl (LDL-C), 47 ? 12 mg/dl (HDL-C), and 146 ? 154 mg/dl (TG). Fasting insulin was associated with BMI ($r = 0.33$, $p < 0.01$), waist circumference ($r = 0.37$, $p < 0.01$)), TG ($r=0.41$, $p<0.01$), HDL-C ($r=-0.18$, $p=0.07$), and TC/HDL-C ($r=0.31$, $p<0.01$). Dietary GI was associated with waist circumference ($r=0.21$, $p<0.05$) and BMI ($r=0.18$, $p=0.08$) but not associated with any of the plasma lipids. Results from multiple regression analysis revealed that fasting insulin was independently associated ($p<0.01$) with plasma TG after adjusting for BMI, waist circumference, age, smoking status, activity index, and gender but was not independently associated with HDL-C or TC/HDL-C. Thus, fasting insulin but not dietary GI may be predictive of the lipid profile associated with metabolic syndrome.

Feasability study on foraging ecology of passerines in riparian forest, with emphasis on the black-headed grosbeak (*Pheucticus melanocephalus*)

Scott A. Chamberlain
Sponsored by Dr. David Wood and Dr. Karen Holl

Riparian habitat along the Sacramento River, and elsewhere, is undeniably crucial to many threatened and endangered species such as migratory passerine birds. Studying foraging during the breeding season may lead insight into the general ecology of passerines. The fecal contents of small birds trapped in mist nets were collected, June through August 2001, in Riparian forest along the Sacramento River, and were compared to invertebrate samples collected (beat trays and bucket traps).. There was no significant within site variability in bucket trap biomass on 25-June, 26-July and 24-August at Phelan Island ($p=0.1204$, $N=21$), and Sul Norte ($p=0.4507$, $N=19$).. Controlling for site differences, and comparing the number of arthropod individuals consumed by male and female Black-Headed Grosbeaks (BHGR), there was no significant difference (student's t-test, $p=0.7639$, $N=21$). Controlling for sex, and comparing BHGR fecal samples at the two sites, returned no significant difference (students t-test, $p=0.9329$, $N=25$). The three bucket trapping sites contained distinctive arthropod communities more by biomass than by numbers of individuals. Beat tray biomass between sites was only significantly different on one sampling date. Fecal contents did not correlate with trap contents on any occasions (X^2 test).

Salmonid prey selection: evaluating a food availability model in northern California

Elaine Esteban
Sponsored by Dr. Michael P. Marchetti

Many biomonitoring programs use benthic invertebrates to assess the effects of disturbance on aquatic systems. These techniques traditionally focus on changes in species distribution rather than changes in ecological interactions, such as food webs. Russell Rader (1997) created a method of using the data collected in traditional biomonitoring to assess the amount of food available to salmonids. Since salmonids are predominantly visual, opportunistic drift feeders, not all aquatic invertebrates are equally available to them as food. Rader projected macroinvertebrate availability based on each taxa's likelihood of entering the drift. He evaluated his model with adult brook trout (*Salvelinus fontinalis*) and cutthroat trout (*Onchyrhychus clarkii pleuriticus*) in sub-alpine streams of the central Rocky Mountains. The availability index is based on macroinvertebrate morphology, life history and behavior, and consequently is likely to be applicable elsewhere. We evaluated Rader's model in the Feather River using juvenile steelhead (*Onchyrhynchus mikiss*) and juvenile chinook salmon (*O. tshawytscha*). We collected 24 macroinvertebrate samples and 120 juvenile fish in both January and April 2001. We compared the stomach contents of the fish to the model's predictions and to the relative abundance of macroinvertebrates in the benthos. The stomach contents of the fish were better predicted by invertebrate abundance than by the model. The most abundant taxa in the benthos was also the most common food in the stomachs. Consequently Rader's model was not a useful tool in assessing the amount of food available to juvenile salmonids in the Feather River.

Influence of Auxin and Sucrose on the Genetic Regulation of Xylogenesis in *Arabidopsis thaliana*

Stephen Karr
Sponsored by Dr. James Pushnik

The accumulation of carbon dioxide (CO_2) in the atmosphere is of global concern. The unifying component in global warming is the increase in atmospheric "greenhouse gasses" mainly CO_2. Therefore, it is of utmost importance to find a method that has the potential to reduce the amount of CO_2 in the atmosphere, most economically by its incorporation into xylem. The principal focus of this research has been to identify the environmentally sensitive genetic regulatory processes involved in xylogenesis in the model species *Arabidopsis thaliana*. To examine where xylogenesis was occurring we used transgenic plant callus with a GUS reporter gene construct with an auxin responsive element (LHA2). This construct was used to correlate the expression of the GUS gene expression to xylem formation by means of a continuous spectrophotometric assay for the GUS gene and xylem element density counts. Callus was grown on xylem induction media (1X MS media, 1mg/L BAP, 10mg/L IAA, 3% sucrose and 0.8% agar), callus initiation media (1X MS media, 1mg/L BAP, 3mg/L 2,4-D, 3% sucrose and 0.8% agar) and xylem induction media with increased sucrose (1X MS media, 1mg/L BAP, 10mg/L IAA, 6% sucrose and 0.8% agar) from one to four days. Gene expression was examined using differential displays to find genes expressed on the various media. We have found five genes that show regulation during xylogenesis.

What constitutes beneficial rearing habitat for juvenile Chinook salmon (*Oncorhychus tshawytscha*) on the Sacramento River: An analysis using otolith microstructure.

Michael P. Limm
Sponsored by Dr. Michael P. Marchetti

Central Valley salmon have been studied intensively over the past few decades. Much of this research has focused on the effects of dams, harvest, habitat loss, and alteration of natural flow regime. We are currently investigating habitat selection and habitat related growth difference in juvenile Fall-run Chinook salmon (*Oncorhynchus tshawytscha*) on the Sacramento River. We utilize otolith microstructure to estimate daily relative growth rates in the river channel, backwater sloughs, and non-natal seasonal tributaries. To examine possible mechanisms leading to growth differences, prey availability, prey preference, and invertebrate biomass are estimated at each site. The 2001 data reported here suggests higher growth rates in the backwater areas versus the main channel.