CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Arezou Akbarpour; Laura Burke; Sarah Orozco

Project Number
S2401

Project Title
Creepy Crawlies: Exposed

Abstract

Objectives/Goals
The objective of this project was to determine whether different amounts and types of light bulbs can alter the metabolism of an organism. By testing this on ants, crickets, fruit flies, and mealworms, we can apply this information to human beings. We believe that all organisms will respectively have increased metabolisms under the compact fluorescent lighting.

Methods/Materials
Set up the Warburg Apparatus, the instrument which measures the metabolism of small organisms. First measure the metabolism with an ant that is placed in the apparatus. Change the different light bulbs as needed and place the species under the bulb for ten minutes. Do this with all organisms under each bulb and wattage for five times.

Results
The crickets' and mealworms' metabolism increased the most under the halogen lighting. The ants' and fruit flies' metabolism increased the most under the Compact Fluorescent Lighting. For both ants and crickets, their increase under the general purpose was about the same. The increase under these lighting could be due to the exposed coil from the Compact Fluorescent Lighting and the change of color the halogen lighting produces.

Conclusions/Discussion
Possible improvements for future testing of this experiment are testing more organisms' metabolisms. Other possible improvements are testing the different classifications of the ants. Different job classifications do different actions and movements and therefore use up more energy throughout the day; this way one can measure how exercise changes the results. Another change can be adding more types of heat sources and wattages.

Summary Statement
Our project researches the parallel between the effects of different types of lighting on the metabolic rate of small organisms.

Help Received
Friend's mother helped provide lab equipment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Beau Broughton; Torunn Sweers

Project Number

S2402

Project Title

Tidepool Populations: Collapse or Fluctuation? A Study of the Davenport Landing Rocky Intertidal Zone

Abstract

Objectives/Goals

The purpose of our project is to learn how to effectively collect accurate data (biodiversity counts) from the tidepools at Davenport Landing and to compare our data with other data accumulated from previous years: in this way we can observe trends in stability, decline, or increase of organisms, and investigate the possible causes of these trends and to confirm an apparent decline in a clonal species of sea anemone and apparent increase of turban snails at the site and to explore the possible causes of said variations. Although great variability does not allow for a specific hypothesis at this point in our research, we hypothesize that the changes in certain species populations at Davenport Landing are a possible result of effluent from the adjunct abalone farm.

Methods/Materials

Mark the boundaries of the permanent 15x15m plot with meter tapes and permanently placed stainless steel eyebolts. Place a quadrat inside the permanent area using a series of two, three-digit numbers, selected at random, which will be used a coordinates for the quadrat. Center the quadrat over the meter tape.* Record species abundance within the quadrat as directed on the datasheet. Repeat the above procedure until 10 to 20 random quadrats have been completed. *In some cases, the random numbers will place the quadrat in a deep pool or drop-off. When this happens, place the quadrat on a level area as close to the original location as possible.

Results

While our data reflects the likelihood of both a turban snail population increase and an aggregating anemone population decrease, there is not enough data available to us at this time to confirm our hypothesis.

Conclusions/Discussion

Thus far, our data indicates a decrease since 1974 (earliest data collected) in aggregating anemones and an increase in turban snail populations. Our project mentor John Pearse suggested that we look at these two organisms specifically because every other organism that we were monitoring seemed to be retaining a stable population over the years, while both aggregating anemones and turban snails had noticeable population fluctuations. One possible factor is effluent from the adjacent American Abalone Farm, which has been releasing a large amount of algal effluent since 1994. Other factors could include El Niño and the nearby Davenport Creek, which has been known to contain agricultural runoff from nearby farms.

Summary Statement

We monitored population sizes at Davenport Landing and juxtaposed our organism counts with past data to continue the tradition of monitoring the fluctuations of rocky intertidal organisms, focusing on aggregating anemones & turban snails

Help Received

Project mentored by John Pearse, Professor Emeritus, Department of Ecology and Evolutionary Biology, University of California, Santa Cruz; Used protocols from limpetsmonitoring.org

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aubryn R. Butterfield

Project Number
S2403

Project Title
The Missing Link in CCD

Abstract

Objectives/Goals
To determine if the fat content of a Honey Bee, Apis mellifera, can be a factor contributing to colony collapse disorder.

Methods/Materials
I used a CardioChek Portable Blood Test System to analyze the fat content in various different preparations of bee abdomens. Throughout this 2 year study my method progressed from utilizing 25 bee abdomens in a paste form to 60 in a slurry form. After 92 different tests I developed a standardized operating procedure that I am comparing to the current procedure utilized by the USDA Honey Bee Reseach Unit Laboratory in Weslaco, Texas.

Results
Year 1- Honey Bees from strong hives had 21.5% more fat than Honey Bees from weak hives.
Year 2- Based upon suggestions from the USDA Laboratory, I refined my standardized operating procedure utilizing the CardioChek Portable Blood Test System. These refinements resulted in lowering my standard deviation from 20.7 to 2.5.

Conclusions/Discussion
High fat bees correlated to strong hives and low fat bees correlated to weak hives. The CadioChek Portable Blood Test System can be a rapid and easily accessible tool allowing beekeepers to monitor the fat in their bees.

Summary Statement
To determine if the fat content of a bee is a factor contributing to colony collapse disorder.

Help Received
I received financial assistance and quality control guidance from my parents.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Connor Chesus; Alexander M. Rinkert

Project Number
S2404

Project Title
Birds of Quail Hollow Ranch: A Study of Avian Diversity

Abstract

Objectives/Goals
Quail Hollow Ranch County Park, nestled in the foothills of the Santa Cruz Mountains, is well-known for its natural diversity. Among the most understudied, however, is the park's avian life. This project was designed to provide an insight to the birds of the park, as limited information is known and no other documented, scientific study of birds has been performed at this biologically important area. From the 1920s, Quail Hollow Ranch's landscape has changed dramatically. Formerly an open grassland surrounded by sand chaparral and sand parkland, mixed evergreen forest and riparian associated habitats have become dominant through secondary succession. As habitats appear and disappear, avian species do as well. This led us to ask "What bird species are habitat specialists and what is their abundance?"

Methods/Materials
Through a process of weekly monitoring using point-counts, we are able to analyze and interpret which species occur in the park, and determine their habitat associations, as well as the relationship between the birds and ecological succession.

Conclusions/Discussion
This will provide a #guide# to the park#s present avifauna, and how it may change as ecological succession proceeds.

Summary Statement
The project is about how ecological succession affects the avian diversity at Quail Hollow Ranch.

Help Received
David Suddjian (mentor) and Jane Orbuch (project advisor) provided much guidance.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Andy R. Falconer

Project Number
S2405

Project Title
Effective Barrier Materials for the Brown Garden Snail (Helix aspersa)

Abstract

Objectives/Goals
The objective of the project was to determine the effectiveness of various household and commercial materials to deter and repel the Brown Garden Snail (Helix aspersa).

Methods/Materials
The eight materials tested were: baking soda, salt, Borax, copper tape, egg shells, wood ashes, sand paper, and a control. 12x12 inch zones were surrounded with each treatment. Ten random snails were placed in each treatment zone. The number of snails in each zone was recorded at 1, 2 and 10 hour intervals. Each treatment was replicated three times. Each replicate being done on three different nights. Counts were done at night because this is when snails are the most active. Data was then converted to average percent containment.

Results
Out of the eight materials tested Borax, salt and wood ashes were the most effective at deterring the Brown Garden Snail. Copper tape and baking soda were somewhat effective. Egg shells and sand paper were not better than the control treatment.

Conclusions/Discussion
Three treatments, Borax, ashes and salt, showed excellent containment properties. These materials are cheap and easy to get. They have potential to be important pest control products for a pest that causes millions of dollars in damage to California agriculture. Future research should test other materials such as diatomaceous earth, spices and sawdust.

Summary Statement
This project was to determine what materials act as effective barriers and deterrents to the Brown Garden Snail.

Help Received
Father helped gather snails. Mother helped glue pictures to poster

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alyssa Goto

Project Number
S2406

Project Title
Worms in Action Helping the Environment

Abstract

Objectives/Goals
The purpose of this experiment was to determine which worm compost produced the best fertilizer based on the plant root that grew the fastest in a period of four weeks.

Methods/Materials
Eisenia Foetida red worms composted for approximately 3 months in 10 plastic containers. I fed only one certain food group (Fruit, Bread, Tea/Coffee, Oats, Pulverized egg shells) in every 2 containers. As the bedding in the containers gradually turned into a rich, dark compost, I transferred each type of compost into petri dishes with different seeds (Radish, Corn, Beans, Cabbage, Sunflowers, Red Peppers,)

Results
The results are currently in progress. The four week period is not yet finished. Whichever seed root grows the fastest, would be the food group that red worms should consume in order to produce the best fertilizer.

Conclusions/Discussion
Gaining knowledge on which type of food would be good to feed red worms so that they can make useful fertilizer, will help the environment when it comes to growing plants, fruits, and vegetables. Also, since red worms will eat anything that comes in contact with them, these critters may help reduce the amount of garbage thrown out every day while simultaneously creating fertilizer to make plants grow better.

Summary Statement
By figuring out which food is best to feed red worms so that they may produce good fertilizer for plants, vegetables, and fruits, the environment will not only contribute to healthy plants but also to the recycling of disposable garbage.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chandler S. Jennings

Project Number
S2407

Project Title
pHishing for Truth: How pH Levels Affect pHish

Abstract

Objectives/Goals
This project is designed to prove that zebrafish (Danio rerio) will completely avoid an area with a high pH level due to the presence of potassium hydroxide (KOH).

Methods/Materials
20 zebrafish were placed in a 20 gallon tank with the bottom four inches filled with water. The tank was then divided into 4 quadrants. Approximately 33 grams of KOH were added to the tank, in order to simulate a household drain cleaner with a high pH level. As the KOH dissociated in the water, the fish's positions throughout the tank were recorded once every minute for 20 minutes.

Results
The zebrafish were unable to completely avoid the rapidly dissociating KOH. As a result, 12 of the 20 zebrafish suffocated within one minute of exposure. The fish's deaths were undoubtedly caused by an overdose of KOH. 33 grams noticeably dissociated in the water too rapidly for the fish to successfully avoid, resulting in the majority of the fish dying.

Conclusions/Discussion
Because the quantity of KOH used dissociated too rapidly, thus killing 12 of the 20 zebrafish, the results were different than what was expected. The results proved that contaminants in water have detrimental effects on aquatic life. However, the designated purpose of the experiment was unable to be proven due to the deaths of the experimental subjects. In order to receive the accurate effects of increasing pH levels on the general behaviors of fish, the quantity of the contaminant added to the water must be more carefully monitored.

Summary Statement
This experiment is designed to demonstrate the effects of increasing pH levels on fish behaviors.

Help Received
Parents helped feed fish; Shawn Noren and Geoff Von Saltza answered any questions; Geoff Von Saltza allowed the use of lab equipment; Jane Holte gave insight on pH and KOH; Charlotte Rosenfield suggested the use of zebrafish; $500 Intel Research Grant provided by COSMOS summer camp.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Bonnie R. Lei

Project Number

S2408

Project Title

Hidden in Plain Sight: Description of a New Species of Spurilla in the Caribbean with a Proposed Mechanism of Speciation

Abstract

Objectives/Goals

By using both morphological and molecular analyses of tropical Atlantic and Pacific populations of Spurilla neapolitana, the first such study conducted in the Aeolidiidae family, a cryptic species was identified in the Bahamas. This new species is described in detail and possible mechanisms of speciation are analyzed.

Methods/Materials

Specimens from 5 Caribbean, 2 Pacific, and 4 European locations were analyzed. Diagnostically reliable features including the radulae, jaws, reproductive organs, and external morphology were compared through the use of SEM micrographs and camera lucida. Partial 16S rRNA and H3 histone coding genes were extracted from non-cerata tissue using Chelex, then amplified through PCR. Filtered and diluted amplicons were sequenced then aligned using Geneious Pro 4.8.3. Phylogenetic trees were constructed in PAUP*4.0b10 and date estimates for uncalibrated nodes were derived using r8s 1.5.

Results

Qualitative morphological evaluation of the external morphology, radulae, and reproductive system indicated the Bahamas population of S. neapolitana as the most divergent and a likely cryptic species. Radulae were further analyzed quantitatively with a Mann-Whitney U Test (P=0.01) using cusp and denticle length and width ratios and the statistical data confirmed qualitative observations. Maximum likelihood phylogenetic trees (100 bootstrap replicates) constructed from 16S rRNA and H3 histone gene sequences revealed the Bahamas population to be in a separate clade from all other S. neapolitana, providing further evidence that this population is a cryptic species.

Conclusions/Discussion

By utilizing a molecular clock constructed using the Langley-Fitch likelihood method and calibrated by the formation of the Isthmus of Panama, the divergence of this new species from S. neapolitana was determined to be 5.88 million years ago. Paleogeographic data indicate that during this time, in the Late Miocene, ocean current flow in the Caribbean was altered by the closure of a major channel. This created greater geographical isolation of the Bahamas population from the rest of S. neapolitana, likely leading to subsequent speciation. These results provide crucial insight into the biodiversity of this genus and provide a better understanding of how geological phenomena affect the evolution of marine populations.

Summary Statement

A cryptic species, discovered through morphological and genetic analyses of Spurilla neapolitana populations, is described with a comparison to S. neapolitana and a mechanism of speciation based on changes in ocean currents is proposed.

Help Received

Used lab equipment at California State Polytechnic University, Pomona under the mentorship of Dr. Angel Valdes.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Adrienne B. McColl

Project Number
S2409

Project Title
Effects of Density on Development of Larval Red Rock Shrimp, Lysmata californica

Abstract

Objectives/Goals
This project was conducted to determine how density of organisms affects the metamorphic development of larval red rock shrimp, Lysmata californica. Results from this project will potentially be applied to aquaculture for all crustaceans as well as larval rearing and morphological studies in related species.

Methods/Materials
1.A gravid female was taken from the living collections at Cabrillo Marine Aquarium and placed in a holding tank until larvae hatched.
2.Two tank designs were used to vary density: 1) a 43L pseudokreisel holding 20 larvae per 800mL in high density conditions, and 2) fourteen Tupperware containers holding only 3 larvae per 800mL each in low density conditions. All systems were kept on a warm sea water system of 21-21.7 degrees Celsius.
3.Over 5 trials, the larvae were observed daily to determine their metamorphic stage by recording the appearance or changing number of body structures.
4.All larvae were fed algae enriched Artemia nauplii (brine shrimp). The pseudokreisel was cleaned as needed and the water changes were done daily on the Tupperware containers.

Results
Four metamorphic stages were described over the course of 11 days. Results show that animals in the high density tank tend to develop slower than the animals in low density tanks.

Conclusions/Discussion
Density is a very important concept to understand when studying or raising crustaceans. It has a heavy impact in development of crustaceans in captivity. It is important to target optimum density to ensure maximum survival.
Each stage of metamorphosis observed is important in providing the larvae with additional appendages for suspension, finding food, and movement through the water column as they grow.
In future research, I would like to study effects of density on another species in the Lysmata family as well as a more distant relative.

Summary Statement
This project was conducted to determine how density affects morphological development and survival of larval red rock shrimp.

Help Received
Dr. Kiersten Darrow helped finalize my poster and revise my previous work; Cora Webber helped me become familiar with red rock shrimp and with photography; Used facility and equipment at Cabrillo Marine Aquarium Aquatic Nursery

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Michael A. Salmond

Project Number
S2410

Project Title
When Half a Worm Is Not Enough: Effects of Magnetism on Planaria Regeneration and Growth

Abstract

Objectives/Goals
If I expose six sets of (5) bisected Planaria to 3 different magnetic fields of increasing strength (2 sets of 5 bisected Planaria per magnetic strength), will the Planaria's ability to regenerate and grow be adversely affected?

Methods/Materials
At least 50-60 live Planaria, Ice, Scalpel, Spring water, 9 Petri dishes with lids, 9 Circles of steel sheet metal, 175 disk Neodymium magnets (50 strength 1, 50 strength 2, 75 strength 3), Micrometer Caliper, Tin snips, Marker Pen, Eyedropper, Tweezers, Table Top Magnifier with light, Eggs, Cooking Baster, Labels

Cut 9 tin circles the size of the Petri dishes and number them 1A, 1B, 2A, 2B, 3A, 3B, 4, 5, and 6. Place 25 magnets of strength 1 on 1A and 1B, 25 magnets of strength 2 on 2A and 2B, 25 magnets of strength 3 on 3A and 3B, and 25 magnets of strength 3 on 6. Fill each dish with ½ cup spring water. Bisect 35 Planaria halfway between head and tail taking care to not cut the nucleus and place 5 heads and tails in each of dishes 1A through 4. In Dishes 5 and 6 place 5 whole Planaria. Place the dishes over the matching tin magnetic fields. Change 35 ml of the water each day and measure the Planaria whole and bisected parts each day for 14 days. Record all results. Feed the whole Planaria a small amount of hard boiled egg yolk every 4 to 5 days. On the 7th and 14th days count how many whole Planaria have regenerated in dishes 1A through 4.

Results
The only Planaria that had positive growth rates were Dishes 1A, 1B and 4 (no magnets). Dishes 5 and 6 suffered a great loss of size. Dishes 1A, 1B, and 4 had almost all bisected Planaria regenerate. Dishes 2A through 3B had respectively poorer results. The stronger the magnets, the worse the regeneration rates and growth. The ability to measure the Planaria was somewhat difficult due to the Planaria#s ability to expand and contract during measurement. The ability to count regenerated Planaria was reliable.

Conclusions/Discussion
The magnetic fields had a huge negative impact on both the bisected Planaria#s ability to regenerate as well as all Planaria to grow. Also, bisected Planaria without magnets had more incentive to grow than whole Planaria without magnets. Further study in this area would definitely be worthwhile especially when considering future applications of magnetism in the medical field and the environmental field.

Summary Statement
Increasing magnetism negatively impacts Planaria's ability to regenerate and grow.

Help Received
Sister / cousin (helped record measurements on 2 days); mother (helped with graph design); father (helped with equipment purchasing)

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jeongmin Shin

Project Number
S2411

Project Title
Ontogeny of Honey Bee Orientation Flights

Abstract

Objectives/Goals
The orientation flights that honey bees undertake before foraging is crucial for navigation as the knowledge base of the environment is established during these flights. To examine the ontogeny of orientation flights in detail, the flight experiences were examined in correlation to the honey bees' maturity and whether the areas explored though these flights were omni-directional, regardless of the hive orientation.

Methods/Materials
The experiment was conducted in East Lansing, Michigan (42°40.7' N and 84°28.7' W) during the summer, from July 10th to July 31st, 2009. Located in the fields of the Bee Biology Building of Michigan State University, three beehives were set up in similar locations but oriented in different directions. To each colony, 3000 bees were paint-marked on their thoraces and introduced. On the day of orientation tests, bees that were painted on their thoraces were recovered from each colony by an insect vacuum, cooled on ice, and marked with paint on the abdomen to distinguish among the eight location points per age group. For each age group in one hive, 25 bees were released from each different location points. We then observed the return rate of the honey bees an hour after the release.

Results
Examining the data presented through the return rate, the development of orientation flight experiences in honey bees is presented clearly. The older aged bees have higher return rates than those of younger bees in the same distance, confirming the first hypothesis. However, an interesting pattern noted is that the disparity of homing rates in orientation flight decreased as honey bees matured, suggesting that the orientation flight experiences increase predominantly when the honey bees are young. The data regarding the orientation of the flight entrance also confirms the second hypothesis as the direction does not influence any of the areas explored by the honey bees.

Conclusions/Discussion
The study establishes two important components of orientation flights; the orientation flights are concentrated when the bees are younger and the area explored through theses flights are omni-directional, regardless of the hive orientation. Utilizing the results, a theory was established that is believed to connect the two main causes of the Colony Collapse Disorder (CCD), the recent bee disappearing phenomenon. The theory will be presented in detail during the presentation.

Summary Statement
The project investigates the development of the orientation flight experience in relevance to honey bees' maturity and reaches new results that may offer insights to the recent CCD (colony collapse disorder).

Help Received
Used lab equipment at Michigan State University under the supervision of Dr. Huang; Participiant in High School Honors Science Program (HSHSP)

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Jeannie Tran; Van Tran; Katerina Trinh

Project Number

S2412

Project Title

Identifying Trends of Wolbachia pipientis Infection in Various Species of Arthropods

Abstract

Objectives/Goals

The purpose of our experiment is to identify the infection patterns of the Wolbachia bacteria in arthropods through DNA analysis in order to better understand the proliferation of the Wolbachia gene and its effect on arthropod populations.

Methods/Materials

After identifying the sample arthropods, which were either store-bought or collected in nature, we used polymerase chain reactions (PCR) in order to replicate segments of the DNA strands of each sample. Though the use of agarose electrophoresis, we separated the DNA fragments by size and then stained the gels with ethidium bromide. The banding pattern on the gels indicated the presence or absence of Wolbachia in our samples.

Results

Though research is still being conducted, 132 arthropods have been tested thus far. The DNA of 50 samples were inconclusive and of the remaining 82 that tested positive for cytochrome c oxidase (the internal positive control for insect DNA), 34.1% were also positive for Wolbachia. Approximately 54.5% of commercially-bred arthropods tested positive for Wolbachia, compared to approximately 20.4% of the collected arthropods.

Conclusions/Discussion

From our data, we may conjecture that the Wolbachia bacterium is ubiquitous, as even though all infected samples had similar backgrounds, they were not all collected from similar locations. This could either indicate that the bacterium is proliferating or that the bacterium is simply being discovered in an increasing number of species. Our data demonstrates that the presence of Wolbachia in store-bought, or commercially-raised, arthropods is higher than that in arthropods caught in nature. We may also conjecture that the bacterium is potentially communicable between different species rather than solely genetically transferred as previously thought. Our data indicates that the bacteria may exist in parts of the arthropod#s physiology other than its reproductive organs, as the infected species are unlikely to have mated with one another and the ancestors of the infected arthropods are likely to have fed on the decaying matter of infected organisms.

Summary Statement

We are identifying the presence of the Wolbachia bacterium in various arthropod species through DNA extraction, PCR, and electrophoresis in order to better understand the proliferation of Wolbachia and its effect on arthropod populations.

Help Received

BABEC Wolbachia workshop provided procedure guidelines; Borrowed equipment from SCCBEP; Mr. Allen handled ethidium bromide; Mr. Lyter identified arthropod species