

The

EXPLORER

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Newsletter of
Cabrillo National Monument and
Cabrillo National Monument Foundation

Insects and insectivores (bugs and what eats 'em)

As we come to the end of summer, the season when lizards can be seen on every rock and fence searching for a crunchy snack, we turn our attention to the creatures of the class *Insecta* and their predators.

In considering "bugs and what eats 'em," a few definitions should be helpful. These are taken from "Wikipedia" website at <http://en.wikipedia.org>.

An insectivore is any organism with a diet that consists chiefly of insects and similar small creatures. The term "insectivore" can be applied to creatures outside of order Insectivora. There are even insectivorous insects, such as dragonflies, hornets, ladybugs, and praying mantises!

The order Insectivora comprises a variety of mammals having a tendency to eat insects. Familiar members of order Insectivora include shrews, moles, and hedgehogs. The only one that inhabits Cabrillo National Monument is *Notiosorex crawfordi*, the desert shrew.

As for Insects—well, little intro-

duction is necessary. However, before you blurt out, "Ick! Why do those crazy Cabrillo people want to talk about INSECTS?" here are a few reminders:

Some insects pollinate flowering plants, some have been used for treating wounds, and insects can serve as a great source of dietary protein! Many insects complete the nutrient cycle by decomposing dead animals and plants into soil. Insects produce useful substances such as honey, wax, lacquer, and silk. After all, the silkworm was one of the major motivations for Cabrillo's voyage, right? China's silk lured European explorers and established relationships between China and the rest of the world.

Enjoy the bugs, and the bug-eaters too!

Patricia Heusner, Editor

**Scientific Classification
of Insects**

**Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Hexapoda
Class: Insecta**

**Class Insecta, estimates
of numbers**



5,000 Dragonfly Species



20,000 Grasshopper Species



170,000 Butterfly Species



120,000 Fly Species



82,000 True Bug Species



350,000 Beetle Species



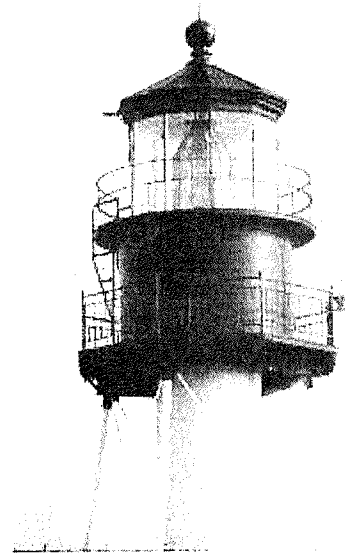
110,000 Bee and Ant Species

From the Superintendent

by Terry DiMattio

The theme for this issue is Insects and Insectivores: Bugs and what eats 'em! Since I know very little about this subject, I thought I would just bring you up to date on some of the projects that are underway here.

The first project is the construction of the museum storage facility. If you look to the left as you approach the entrance station you will see it next to our maintenance building. The contractor, Reva Murphy Associates, is about half finished and is on schedule to complete the building by early November. The walls are up and the roof is on with the shingles soon to follow. The interior walls have been framed in and the electrician is installing the conduit, junction boxes and receptacles. The plumbing has been roughed in and the rails for the movable storage units are set. Within the next few weeks we will see the installation of the heating, ventilation and cooling (HVAC) system that will control the temperature and humidity in the storage area, and the energy-efficient heat pumps that will provide heating and cooling for those working in the office and lab where we will clean, repair and treat our museum objects and archives. When this building is finished we will have, for the first time, an environmentally-controlled facility in which we



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Guardsmen installed
the 3rd Order flashing
lens from the "new"
Point Loma
Lighthouse in the pit
in the floor of the
assistant keeper's
quarters.**

can properly store, account for, study and preserve the historic objects and natural history items, including insects, necessary to learn about, tell the story of, and preserve Cabrillo NM.

The second project we are working on is the rehabilitation of the scenic overlooks along Gatchell Road on the west side of the park. We are working with the National Park Service's Denver Service Center to improve the appearance and access and egress at Tidepool Parking and Coast View and Sea Cove scenic overlooks. We would like to incorporate into the design for these areas, the architectural elements and materials found in the visitor center complex: tan-colored concrete walks with red brick edges, low exposed aggregate walls on which visitors could sit but that would also discourage them from proceeding into closed areas, and round, wooden columns and fence posts. We expect to see the first set of construction drawings this fall or early winter.

The third project is the completion of the rehabilitation of the grounds around the Old Point Loma Lighthouse. The revegetation of the grounds themselves is progressing well. Park staff, Volunteers-in-Parks, and Youth Conservation Corps (YCC) members have been busy spreading native plant seeds and planting container stock from our greenhouse. These plants are taking root, and we are hoping that the rains this winter will result in abundant new growth next spring.

Next spring, in early March, we expect to install the new

exhibits on the Old Point Loma Lighthouse in the assistant keeper's quarters. The NPS Interpretive Design Center in Harpers Ferry, West Virginia has awarded a contract for the fabrication of the exhibits to a firm in Ohio. The last week in July a crew of Coast Guardsmen installed the 3rd Order flashing Fresnel lens from the "new" Point Loma Lighthouse in the pit in the floor of the assistant keeper's quarters. It is once again fully operational and is a beautiful sight to behold.

The maintenance crew is installing the tongue and groove, cedar siding on the inside walls and ceiling, and this fall will install the track lighting. With a little planning, and luck, everything will come together and we will be able to open the new exhibit to the public by the end of March 2005, 114 years after the Old Point Loma Lighthouse ceased operating.

As you can see, there is a lot going on at Cabrillo National Monument. These projects will enable us to better care for the park and its resources, and improve our visitors' enjoyment of this special place.

We are working on other projects and activities, in particular the 41st Annual Cabrillo Festival, which will be held from Friday, October 1

Cabrillo Festival



through Sunday, October 3. We hope you will be able to join us on Sunday for the reenactment of Cabrillo's landing, the cultural program, delicious Mexican, Native American, Portuguese and Spanish food, children's activities, Kumeyaay basket weaving,



acorn grinding and flint knapping demonstrations, and 16th century soldiers' living history encampment. It promises to be a day filled with history, food, and fun for the entire family.



Okay, okay—we know that spiders are arachnids, not insects. But this terrestrial invertebrate is included here as a very interesting insectivore. Ed.

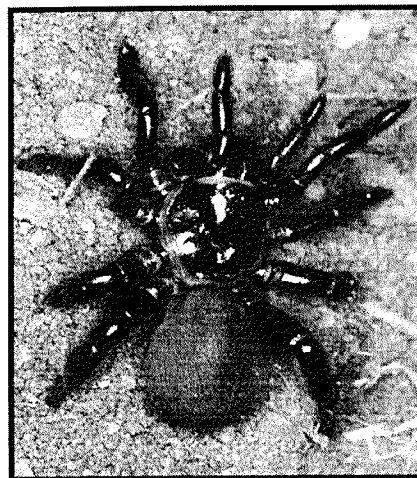
Bothriocyrtum californicum: The trapdoor spider

By Carol A. Martin

As I walked up Cabrillo Road on one of those evening strolls, enjoying the surrounding beauty, I spotted something unusual and often overlooked—a trapdoor. Not just any old steel door

into the victim. The venom kills the prey in seconds and begins to digest the tissue, making a soup to be sucked up at leisure.

Active black males can be seen at night wandering about in the spring guided by the scent from a female. Silk is fashioned around her burrow. He performs a drumming dance that lulls her into a state of receptiveness. If he is unlucky he becomes a meal when the predatory instinct of the larger female strikes. If he is lucky, a cocoon will be attached to the silk lining deep in the



Peter Bryant, UC Irvine

are long and they often pursue their quarry for some distance at a quick pace before striking. Soon the haul of ants, other insects, baby birds, mice and baby snakes has satisfied their appetites for the night. With eight legs they can carry up 140 times their weight.



Peter Bryant, UC Irvine

Spider emerging from burrow. Notice silk-lined undersurface of the trap door.

leading underground to yet another tunnel. No. This small one-inch D-shaped camouflaged door leads to a tunnel softly lined with spun silk. By day the door remains tightly held shut. By night the silk and earth door is invitingly open and eight eyes keep watch. A pair of hairy yet sensitive legs waits just inside, feeling for any ground vibration. The trip wire is set to surrounding twigs, and at the slightest twitch waiting fangs plunge

twelve-inch tunnel containing the eggs waiting to hatch into miniature versions of the mother. They stay deep underground for several weeks, crawling out in the autumn. Small burrows start to appear near the mother's larger one. The brown, one-inch female might stay in a tunnel her whole life, making it bigger as she grows for two years. She might dig side tunnels for extra hiding space.

In this drier climate, their legs



Carol Martin

Burrow with trap door closed

Now the soup cauldrons are full for that midday snack. And as the sun rises the trapdoor shuts against prowling scorpions, wasps, and people.

Insects and seawater don't mix

By Bonnie J. Becker
Marine Biologist, CNM

Most people know that there are more known species of insects in the world than any other group of animals, with approximately two million described species. Given that 70% of the world is covered in water, and 75% of all known species are insects, one would expect that there are many species of marine insects. Can you think of any?

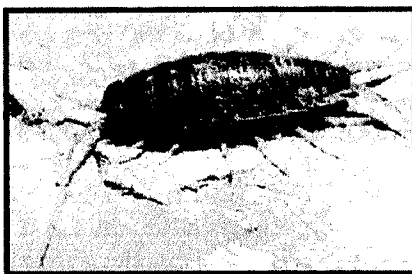
Down in our tidepools, we have one conspicuous insect, the ever-present kelp fly that hangs out in the rotting kelp wrack on the shore. But this is not a truly marine insect, since it does not spend any time in the salt water. There are many animals that look like insects: lobsters, crabs, shrimp, isopods, and amphipods. All have segmented bodies, multiple appendages for different purposes, antennae, and other bug-like characteristics that can be reminiscent of an insect. But while these organisms and insects are both in the phylum Arthropoda, our marine "bugs" are all members of the class Crustacea and insects fall into the class Insecta.

In fact, there are very few species of truly marine insects. Although many taxa have a freshwater phase of their life cycle, most of these do not tolerate salt water. A few species of insect will live in intertidal habitats, either in marshes, beaches or tidepools, but most of these organisms continue to live a partially or mostly terrestrial existence (such as our kelp flies). There is, however, a small number of species that can tolerate very high levels of salinity or low levels of oxygen. The few open-ocean

insects that exist tend to be flies that make a living on the surface of the water.

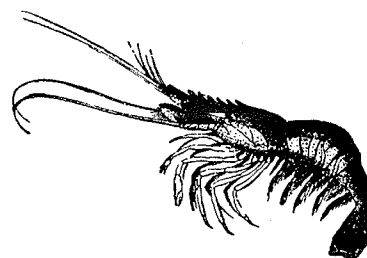
A number of possible theories explain why there are so few marine insect species. A webpage written by a group of scientists including Dr. Lanna Cheng of the Scripps Institution of Oceanography, lists six alternate hypotheses for why they are absent. If you would like to learn more about their ideas, take a moment to visit their page, <http://www.unk.edu/acad/biology/hoback/marineinsects/home.html>.

As successful as the insects have been in evolving to life on land, they are not important players in the ocean. Their distant cousins, the crustaceans, have had much better luck. Crustaceans can be found in all parts of the ocean and are more diverse than all other marine invertebrates. Arthropods have conquered land and sea, but the insects are more of a land-loving lot, leaving the mariner's life to the crustaceans.



The "rock louse," *Ligia occidentalis*, a common inhabitant of the splash zone in the intertidal, resembles an insect, but is actually an isopod crustacean.

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The Harlequin bug

by Jim Nauman

Back in the days when I was leading nature walks on the Bayside Trail, I would always stop about half way down at an exceptionally handsome specimen of yellow-flowered bladderpod, *Cleome isomeris*. On the slender, gray-green leaves of this particular specimen I could invariably find several 8-10 mm-long, attractively patterned red, yellow, and black bugs to show the visitors. These are Harlequin bugs, *Murgantia histrionica*, (often mistakenly called Harlequin beetles). The name reflects the bug's resemblance to the gaudy costume of Harlequin, one of the principal characters of the 16th century Italian *Commedia dell'Arte*.

Color and pattern in nature usually exist for a purpose, not merely to provide decoration. In the harlequin bug, these are an example of aposemitism—warning coloration. From the leaves of the bladderpod, the insect sucks peppery, unpleasant-tasting juices which it absorbs and retains, imparting a very unpalatable flavor to its body. After a bitter experience or two, predators learn to recognize the bugs' pattern and will avoid it. This is similar to the protection from predators afforded by the warning coloration of the monarch butterfly, which has a foul taste from feeding on the milkweed plant.

Harlequin bugs develop from a neatly packaged set of 10-13 eggs, resembling tiny barrels,

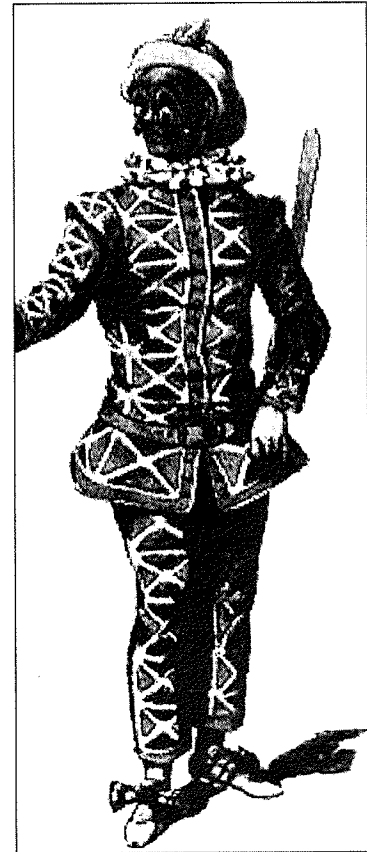
complete with black bands at either end. These are found on the underside of leaves, usually in the spring. The developing insects go through five nymphal stages over a period of four to nine weeks before they become adults. The nymphs resemble miniature adults, their coloring becoming more intense as they develop.

Harlequin bugs are found throughout the southern United States, believed to have originated in Central America and Mexico. They are a significant crop pest, principally affecting plants known as crucifers, such as cabbage, mustard, broccoli, radishes, and turnips. Hordes of these insects suck the sap from the plants, which soon wither and die.

Getting back to the bladderpod, it is found in the coastal and maritime sage scrub communities and parts of the Sonoran desert. It is interesting that this plant is not a crucifer but rather a member of the caper family. Experts feel that compounds related to the sap of the crucifers are present in bladderpod. For some reason, the bug doesn't seem to have the same devastating effect on bladderpod that it has on the crucifers. The plant on the Bayside Trail and many others there and around the lighthouse persist year after year with no obvious signs of damage.

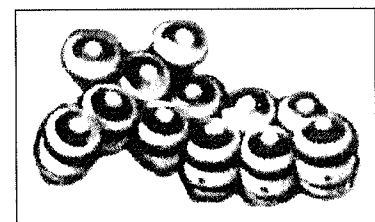
Next time you are hiking on the trail or walking between the lighthouse and whale overlook, look for the bladderpod and its colorful resident bugs and reflect on the interesting relationship between insect and plant. You can identify the plant by its bulbous seed pods and showy yellow flowers with long stamens. In the spring, if you look at the leaves carefully, you may be able to spot some of the unique eggs (below, greatly magnified).

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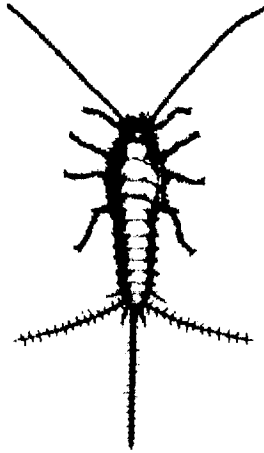
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It's not *The Meek Shall Inherit*. . . . It's the microwavable! *by Nancy Parkinson Walton*

by Nancy Parkinson Walton



During a recent lunch hour in the Cabrillo National Monument break room, I approached the microwave oven with frozen entrée in hand. It was occupied zapping someone else's fare and I waited the five minutes for it to finish. I then removed the carton and put in mine and ran it on high for another three minutes. When its unmelodious "ding" signaled that it was done, I reached for the food, lifted it out, and darn near dropped it as I watched a healthy-sized silverfish saunter

out from under the glass turntable. Now I can personally attest that this creature was exposed to at least eight minutes of high microwaving, and was still able to walk a straight and purposeful line out of the microwave until he met his unfortunate end under a ranger's trigger-thumb squash!

So the next time you are having high-and-mighty thoughts about all our accomplishments and our foolhardy dominion of the earth and sky, just remember who will really inherit it all—the *insects*!!

Editor's note: Nancy Walton, Volunteer-first-class at CNM, has a special aversion to silverfish stemming from her experience in libraries, archives, and museum collections. These seemingly indestructible insects are fond of dining on materials such as paper, glue, and cloth, particularly enjoying coated papers and photographs because of their starch content. Inasmuch as silverfish are the traditional nemesis of librarians, it is paradoxical that the official newsletter of the Association of Library & Information Science Students (ALISS) at the University of Washington is called the *Silverfish*.

Orchestra Minutiae

[illegible]

Gulp

Ted Washington

Point Loma's avian insectivores

By Claude G. Edwards, CNM Volunteer

For me, the term "insectivore" conjures up several images, some entertaining and some rather repulsive, but in my mind, I put a funny twist to it! Basically, an "insectivore" is something that eats or feeds upon insects—be it a bird, a bat, or even so-called carnivorous plants! Insectivorous birds are very important, to us and the world around us, because if they were not around, there would be a lot more insects in our midst. You can imagine what that might mean to you personally.

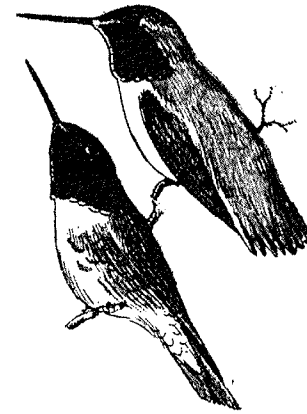
There are quite a few well-known, familiar, and enjoyable insectivorous birds that have been recorded all over Point Loma (Cabrillo National Monument, 2000), and many are appropriately named. The bird family "Tyrannidae" is aptly named the tyrant flycatchers, in part for the aggressive nature of some species, and also for their typical style of feeding—catching flies. They also feed on gnats, mosquitoes, dragonflies, moths, and more. Flycatchers typically perch and keenly scan for an appropriate-sized morsel. In an instant, they sally forth, capture it with an audible "snap" of their bill, and usually return to

the same perch where they began. The larger the flycatcher, the larger the insects they can prey upon.

Different groups of the "tyrant flycatchers" occupy different niches or levels in their environment, permitting a variety of species to be present at the same location at the same time. The small, energetic, and similar-looking members of the genus *Empidonax* typically capture small insects within and close to dense vegetation. Wood-pewees, in the genus *Contopus*, which also includes the olive-sided flycatcher, tend to perch out in the open and often up high. Phoebees, in the genus *Sayornis*, prefer to hunt closer to the ground, but still out in the open. The ash-throated flycatcher, part of the *Myiarchus* group, tracks down insects in taller brush and open woodland, but within the vegetation. Kingbirds, in the genus *Tyrannus*, are bold and conspicuous species that perch on poles, wires, fence-posts,

and treetops, giving away their location with raucous calls.

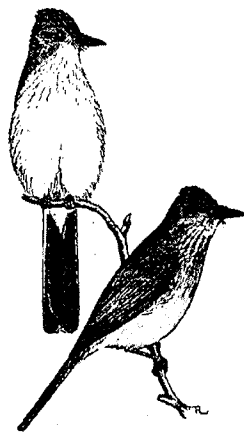
Another aptly-named group of insect-eating birds are the "gnatcatchers," genus *Poliophtila*, which are in the family Sylviidae. These actively chase small flying insects as



Insects are an important part of the lives of hummingbirds, which not only find them in the flowers they visit, but also out in the open.

well as glean them directly from plant foliage. This behavior is shared by their cousins the kinglets, genus *Regulus*, which often and distinctively hover in place for a few moments while hunting. These, and the other birds mentioned herein, can be found and studied in more detail in several of the popular field identification guides, such as those by Roger Tory Peterson, the National Geographic Society, and National Audubon Society (2000).

Swifts and swallows are unrelated but similar-looking "aerial insectivores," exhibiting and utilizing physical structures and behaviors to procure their respective insect diets. They fly



gracefully and often at high speeds, twisting to and fro in the air. They can be found in flocks, calling as they go, deftly picking off small insects with great relish.

There are also other species of birds inhabiting our native and landscaped areas that survive on a diet that includes insects along with nectar, fruit, and seed. Insects are an important part of the lives of hummingbirds, which not only find them in the flowers they visit, but also out in the open. Hummingbirds are known to weave frenetically through a barely perceptible cloud of small flies or gnats. They also have been observed rising along the sides of tree trunks in search of small spiders.

The sleek, crested phainopepla is our only "silky-flycatcher." It actively chases

insects from the air in balance with the mistletoe berries they are also fond of. You might be surprised to know that two species of woodpeckers in our area—the acorn and Lewis's woodpeckers (*Melanerpes formicivorus* and *M. lewis*, respectively)—are also talented aerial insectivores: Although not as sleek as swifts and swallows, and not as quick as flycatchers, they launch from their perches and capture insects out of mid-air with great flourish. Along with other woodpeckers, they also employ their long, barb-tipped tongue to extract wood-boring insects from tree bark.

Other birds such as vireos, wood-warblers, tanagers, blackbirds and orioles swell

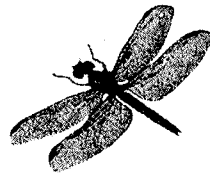
the ranks of avian insectivores that thrive and play their part in the balance of consuming just enough insects to leave some behind for the next day. It may seem that there are more than enough to go

around, but insects form part of the lowest and largest portion of what is often termed the "food pyramid." Their abundance and energy fill the ranks of birds and other wildlife that feed on them, and on up the food chain.

So the next time you see a bird catch a bug, thank it, and marvel at the contribution it makes to the vigor and health of life all around you!



Three poems from *Insectlopedia*, by Douglas Florian, copyright 1998



The Daddy Longlegs

O Daddy
Daddy O
How'd you get
Those legs to grow
So very long
And lean in size?
From spiderobic
Exercise?
Did you drink milk?
Or chew on cheese?
And by the way,
Where are you knees?
O Daddy
Daddy O
How'd you get
Those legs to grow?

The Dragonfly

I am the dragon,
The demon of the skies.
Behold my bold
Enormous eyes.
I sweep
I swoop
I terrorize.
For lunch I munch
On flies and bees.
Mosquitoes with
My feet I seize.
I am the dragon:
Down on your knees!

The Mosquitoes

Mosquitoes are thin.
Mosquitoes are rude.
They feast on your skin
For take-out food.

The Terrestrial Invertebrate Inventory on the Point Loma Ecological Reserve

By Tiffany Luas Duffield



If you have had the opportunity to accompany me during a "herp week", then you have had the chance to see some creepy, intricate, and very cool insects and insectivores that reside within the Point Loma Ecological Reserve (PLER)! Some you may have recognized include the velvet ant (insect), scorpion (insectivore), Jerusalem cricket (insect), wind scorpion (insectivore), stink bug (insect), and centipede (insectivore). These invertebrates that fall into the herpetofauna (reptile and amphibian) pitfall traps have been a part of the Natural Resource Science (NRS) Division's terrestrial invertebrate inventory.

The terrestrial invertebrate inventory comprises three stages: 1) collecting, 2) sorting and processing, and 3) identi-

fying. When completed it will help the NRS understand the invertebrate communities in the PLER, and will in turn help our current and future understanding of other natural resources on the PLER.

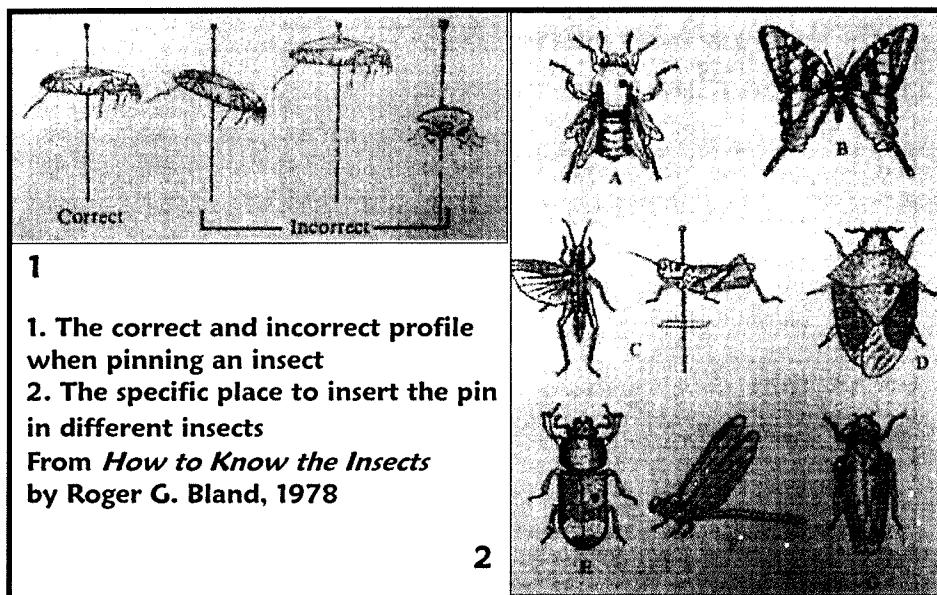
The collection component of the inventory began in 1998 and ended just this year in March. The US Geological Survey (USGS) began collecting invertebrates in conjunction with the herpetofauna pitfall traps in order to have an understanding of the invertebrate communities in the same areas that those traps are located. On the last day of each "herp week," invertebrates that fell into the traps were collected. No more than three of the same species were collected at a single array (group of traps), and specimens were released from the traps on previous

mornings of the week, meaning only those specimens that fell in on Thursday evenings were collected. This protocol was followed to ensure a low impact on the invertebrate populations. Since the pitfall traps are five-gallon buckets dug into the ground with the rim at ground level, the inventory focused on ground-dwelling invertebrates, and did not capture many of the flying invertebrates. Although, we have on occasion found bees, damselflies, and moths in the traps.

In 2001, volunteer and former USGS employee Krista Pease and former NPS biotech Emily Jones requested funding to sort and preserve the collected specimens according to entomological standards. This funding was approved and provided by the Cabrillo National



Sorting and Processing: A. All invertebrates from an array in a vial; B. Sorting "to be pinned" vs. "to be put in a vial"; C. Each species in an individual vial; D. A beetle pinned with label; E. A shelf full of pinned insects.



Monument Foundation. This sorting and processing component is still underway. It began in 2001 with Krista and Emily and has continued with new NPS biotech, Tiffany Luas Duffield, and numerous volunteers from both agencies. To date, we have sorted and processed four years' worth of vials (1999–2002).

In order to sort and process the specimens, we first have a vial full of invertebrates that were collected at a particular array on a certain date, for example array #9, September 2003 (see photo series A). All of the invertebrates that were collected at array 9 in September 2003 are then sorted as either "to be pinned" or "to be put in a vial" (B). The general rule for which species are pinned versus put in a vial is based on the body of the specimen. Those with rigid exoskeletons that can withstand desiccation are pinned. This includes ants, wasps, beetles, most crickets (not Jerusalem crickets), bees, moths, butterflies, roaches, flies, and other

similar insects. Those with soft bodies, or soft abdomens, are preserved in individual vials with 70% ethanol. These tend to be arachnids (spiders, wind scorpions, scorpions) as well as isopods (pill bugs), centipedes, and millipedes. After sorting these into the two groups, the soft-bodied specimens are grouped by species and put into smaller individual vials with 70% ethanol and a label indicating the date and location of collection. For example, we would have one vial with millipedes from array 9, September 2003 and another vial with isopods from array 9, September 2003, and so on (C). Those species needing to be pinned would be individually labeled and pinned according to the very specific directions given in an entomology text (D). As you can see from the diagrams (1 and 2) provided, there are very specific directions for the height of the pin in the insect, the position of the insect on the pin, and where the pin is inserted into the insect. All of this sorting and processing is

done with great care every Wednesday, of a non "herp week", at the USGS lab.

To give you an idea of how many specimens we have worked through so far:

- We have sorted through four years' worth of vials filling three and a half shelves of pinned insects and almost five shelves of individual vials. Each shelf holds 480 vials or approximately 300

pinned insects (E). That makes 2400 vials and almost 1000 pinned insects we have sorted thus far.

- Assuming there were invertebrates present at each of the 17 arrays every month of the year for the full six years of the inventory, upon completion of the project we will have sorted through 1,224 vials, and if we estimate an average of 10 specimens per vial, that is 12,240 individuals to either pin or put in a vial—and identify!

The third stage of the inventory, identification, has begun but is in its infancy. Identifying invertebrates is a difficult task since many invertebrates have not yet been described. The approach we are using in this inventory is to first sort all specimens by what seem to be similar individuals, and then go through the groups to classify by order, then family, then genus and species where possible. Also, specimens will be sent to specialists who have years of experience working with specific groups of invertebrates. Those specimens we

Continued on next page

We have collected on the order of 10,000 invertebrates over the course of six years. These individuals are currently being sorted according to entomological standards to provide a museum collection for future researchers, staff, and volunteers at Cabrillo National Monument.

have identified will also be verified by these specialists to ensure accuracy. Although some species have not been described, we have classified some specimens to order or family. The beginning draft of our identification list includes individuals from the order Araneae (true spiders), Archaeognatha (jumping bristletails), Geophilomorpha (centipedes), Isopoda (pill bugs), Opiliones (daddy long legs), Scorpiones (scorpions), Sulfugae (wind scorpions), and Thysanura (silverfish). We have yet to start identifying some of the crickets, wasps, ants, roaches, moths, and beetles.

Once the inventory is complete, we will have a list of terrestrial invertebrate species and a voucher collection of species. This information will help us manage current projects such as the herpetology monitoring. If we find declines in certain lizard species that rely on native ant populations, we can look to see if there has been a decline in the native ant populations and possibly attribute the lizards' decline to lack of prey. We can then direct our managing efforts towards restoring the native ant populations. Also, in the long term, this inventory can serve as a baseline of information for the PLER. Baseline studies are useful to

understand changes that occur within ecosystems over time or after large disturbances. With the large dataset from the current inventory, we can collect invertebrates every few years to see changes over time, and we can collect invertebrates after disturbances, such as fire or habitat removal, to see what changes have occurred, if any.

Not only will the inventory provide a list of species, but it will also provide a voucher collection which can be used by researchers and park personnel. Voucher specimens provide a reference for species identification and have data associated with it, such as date and location of collection, collector, details of the taxonomy, and other curatorial information. The voucher allows scientists to see the exact specimen that was used to identify a species. Vouchers are also used to teach identification techniques for specific species. We hope to use our invertebrate vouchers for both purposes. Some of the species will be housed in museum storage so that in the future, researchers can see what species were present in the park, what they looked like, and what they were identified as, and these same specimens will be used to train volunteers and employees to identify specific invertebrates.

The invertebrate inventory on the PLER is an ongoing endeavor to help the NRS understand the invertebrate community. We have collected on the order of 10,000 invertebrates over the course of six years. These individuals are currently being sorted according to entomological standards to provide a museum collection for future researchers, staff, and volunteers at Cabrillo National Monument. Aside from having a collection, the inventory will also provide a list of species found within the PLER, which will aid managers in conserving not only the invertebrate species but also other natural resources, such as the reptile and amphibian species, which are linked to invertebrate populations.



Insect Parts

- 6 legs**
- 5 total eyes, usually (2 compound and 3 simple, called ocelli)**
- 4 wings, usually**
- 3 body segments (head, thorax, abdomen)**
- 2 sensory antennae**
- 1 ectognathous (exposed) mouth, with either chewing or sucking function**

from Wikipedia

A sampling of Cabrillo's other insectivores

Avian insectivores were discussed in Claude Edwards's article; Carol Martin wrote about the trapdoor spider, a terrestrial arthropod. Much could be written about Cabrillo's many other insect-eaters, but we have chosen to focus here on an amphibian, a reptile, and two mammals.

The only amphibian at Cabrillo NM is the garden slender salamander *Batrachoseps major*. These four-to-six-inch-long creatures might be mistaken for a large earthworm until one notices the eyes and the tiny legs. They may be found under rocks and in litter, particularly during the rainy season. Having no lungs, they breathe through their skin and must be kept moist. There is no larval stage, the young resembling tiny adults. They forage for small invertebrates at night.



Chris Brown



The western fence lizard *Sceloporus occidentalis* is the most commonly encountered reptile at Cabrillo, often seen basking along the trails and sidewalks. The male is often called the "bluebelly," because of the blue patches on its belly and throat. During courting or antagonistic maneuvers it appears to be doing pushups as it elevates its body and then flattens it out to show the blue patches.

Its diet consists of insects and various other arthropods. Basking in prominent places makes it easy prey for snakes, hawks, and mammalian predators.

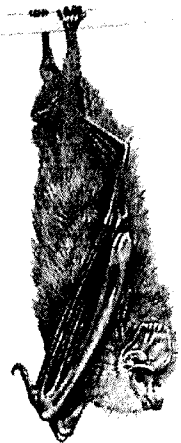
The desert shrew *Notiosorex crawfordi*, the smallest mammal on Point Loma, has a voracious appetite for a wide variety of insects. Having a very high metabolism, it is said to eat 75% of its body weight each day. In the Spring 2003 issue of *The Explorer* Tiffany Duffield wrote a very interesting article about this little insectivore. Another article, in the June 1995 issue of this publication, by Samantha Weber, describes a battle to the death between a shrew and a fence lizard. The shrew was the loser.



Chris Brown

Another mammal, the red bat *Lasiurus blossevillei*, was also the subject of an *Explorer* article—this one by Bonnie Becker and VIP Jaime Hicks in the Spring 2002 issue. A

single red bat was seen by USGS bat biologist Drew Stokes, the species confirmed by an ANABAT sonogram. But just one bat can catch and consume a huge number of insects, particularly flies and moths. The red bat is found along the Pacific coast from British Columbia to South America.



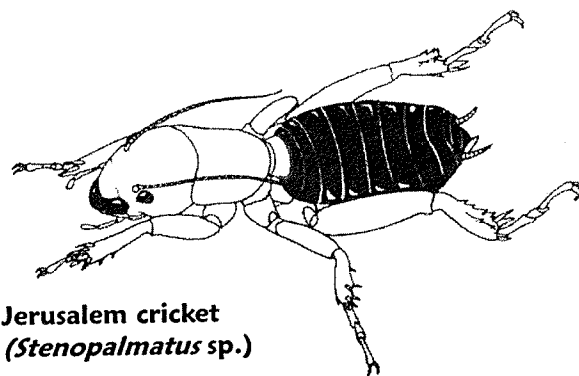
La Niña de la Tierra

by New Thanyachareon

Cabrillo National Monument has breath-taking scenery with awe-inspiring views of downtown San Diego, the Coronado Bridge, and the Old Point Loma Lighthouse, just to name a few of the attractions.

When people visit the park all eyes tend to look straight ahead toward the horizon, but a few of the visitors scan the grounds and some may even catch glimpses of our native animals scurrying to and fro. Some might even see the elusive Jerusalem cricket *Stenopalmatus* sp.

Although not a true cricket, it is recognized by a wingless, hairless body with a large bald head, spined legs, and an over-sized black-ringed abdomen. These insects are also known as "sand crickets" and "Children of the Earth" (Niñas de la Tierra). Because of their large size and humanoid-shaped heads, they were feared by some Native Americans of the Southwest and Mexico and were objects of superstition. The



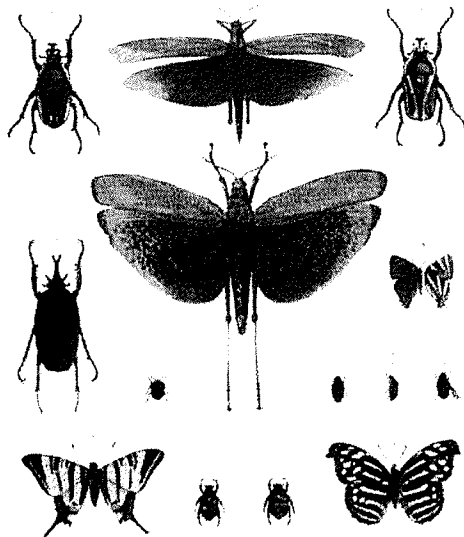
Jerusalem cricket
(*Stenopalmatus* sp.)

Navajo thought them to be poisonous and gave them chilling names like "skull insect" and "bone-neck beetle." Although nonpoisonous, they can still bite with considerable force. They are nocturnal and live in the ground, but sometimes they get stranded after a night of exploring above ground.

They eat roots and tubers. At times they will eat dead animals and may even resort to cannibalism.

Unlike crickets which make chirping sounds, the Jerusalem crickets drum their large abdomens against the ground, but only during mating season. They lay eggs in the ground and live up to two years.

A unique species indeed, and if you keep your eyes open, scanning the grounds, you might just catch a glimpse of one.





Cabrillo National Monument Foundation

Calendar

September 23-26, 2004
Spain's Legacy In The Pacific

October 1-3
41st annual Cabrillo Festival

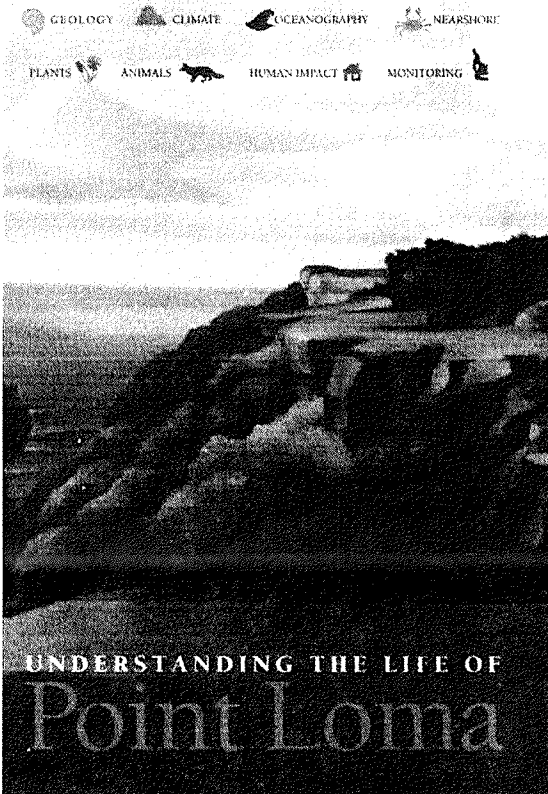
New Members

We welcome the following new members
who have joined CNMF since May 1.

Linda Blair
Alan and Ann Clopine
Peter Deering
Michael Giller
Daniel Rahilly
Katherine Rogerson
Dean Sands
Susan Sharpe
Sharie Shipley
Carolyn Storlie
Frank Vaughn

Many thanks for your support!

Please visit our website at
www.CNMF.org



After a long gestation period, the CNMF publication *Understanding the Life of Point Loma* has arrived! The 184-page book is an easy-to-read overview of the coastal sage ecosystem and nearshore marine environment of the Point Loma peninsula. The authors—all experts in their fields—describe the ecosystems, the biodiversity of the plant and animal communities, and the interdependence of the populations of those communities. Throughout the book, the importance of preserving these precious and diminishing resources is stressed.

Designed by award-winning graphic designer Christina Watkins, the publication is lavishly illustrated with color photographs, charts, and diagrams. This book is a "must read" for everyone interested in the fascinating and rare natural resources of Point Loma. Come in and pick up your copy today.

*Make a
Lasting
Legacy*



The CNMF Endowment Fund, established in 1997 with the San Diego Foundation, is another way you can support the endeavors of Cabrillo National Monument. Interested donors can contact us at (619) 222-4747 or by e-mail at CNMFKaren@aol.com



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