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STATE OF CALIFORNIA

Energy Resources Conservation and Development Commission

In the Matter of: APPLICATION FOR CERTIFICATION FOR THE PALEN SOLAR ENERGY GENERATING SYSTEM	DOCKET NO. 09-AFC-7

INTERVENOR CENTER FOR BIOLOGICAL DIVERSITY

Exhibit 3093

Testimony of Gordon Pratt PhD

Re: Impacts to Flying Invertebrates (Insects)
from the Proposed Palen Solar Electric Generating System

Docket 09-AFC-7

Summary of Testimony

The proposed project will be detrimental to numerous insects, some of which may be very rare and endemic. Due to lack of surveys for invertebrates in general, it is impossible for me to fully evaluate the impacts to the insects. It is my opinion that the proposed project will attract insects to the bright lights created by the focused mirrors, and kill or wound them when they enter into the intense radiation. The attraction and loss of so many insects could create an ecological cascade effect on the landscape that affects many other local species including plants that rely on flying insects for pollination and animals that rely on insects for food.

The proposed project in itself as well as in conjunction with other cumulative projects will further imperil already rare species driving them closer to extinction and may result in the need for additional species to be safeguarded under the Endangered Species Act protection.

Qualifications

My qualifications are provided on my Resume attached to this Testimony and as discussed below.

I have over 35 years of experience in entomology including identifying, surveying for and documenting entomological resources in southern California, including the Mojave desert over the last 34 years.

I have a PhD from University of California Riverside in Entomology (Insect Systematics), with an inside minor in insect/plant interactions and an outside minor in Population Biology.

I have directed and participated in numerous field surveys for invertebrates including threatened and endangered species, as well as other rare and common species. I have coauthored and described 32 butterfly (14 *Euphilotes*, 5 *Apodemia*, and 12 *Lycaena*, 1 *Loranthomitoura*) taxa new to science.

I am considered one of the foremost experts on butterflies in southern California

I have published articles on these subjects in peer-reviewed scientific journals and presented papers/posters at scientific meetings – see my attached resume.

I have provided expert testimony on Quino Checkerspot issues at (Sunshine (San Diego) Powerline) hearings.

I am currently a research associate with the University of California, Riverside where I conduct research on endangered butterflies and insect diversities on military installations.

I have reviewed the documents associated with the Palen project site and provide the following testimony relating to flying invertebrate species (insects) and the adverse impact to insects from the solar flux.

Importance of Insects to the Environment

The invertebrates probably represent about 95% of the terrestrial organisms and of these about 95% are insects. The insects are an underappreciated group of organisms largely due to negative human feelings of the so called pest species, such as mosquitoes, horseflies, introduced cockroaches, ants, etc. Many people without thinking believe all insects are pests and none of them have value. There is nothing further from the truth since without them all of our terrestrial ecosystems would collapse due to their absence.

Insects are distinguished from all other organisms by being arthropods or organisms with an exoskeleton, with three body parts (head, thorax, and abdomen), and with 6 legs on the thorax. Many insects have wings while some do not. There are even many species where the adult male has wings, while wings are absent from the adult female. Mouthparts can be very variable from chewing mandibular types to sucking beak like types to sucking straw like types and to sponge like types due to the differences in feeding methods. Some adult insects even lack mouth parts since once they have matured their only purpose are to mate and lay eggs to form future generations.

Insects perform three major functions in terrestrial ecosystems. One they are very important in pollination. Insects such as bees, wasps, butterflies, moths, flies, and some beetles are responsible for the maintenance of genetic variability in plants. Without them many if not most plants would disappear. For instance the Joshua tree depends on one moth species, the Joshua tree yucca moth (*Tegeticula synthetica*), for its pollination. The female moth with her knife like ovipositor cuts into the flower and stuffs it with pollen. No other insect can perform this function, so without the Joshua tree yucca moth the Joshua tree would eventually disappear, since Joshua trees would no longer be able to fruit. With the loss of the moth hundreds of other insect species that depend upon the developing fruits of the Joshua tree could also disappear from lack of food. Interestingly the other yucca species depend upon other yucca moths in a similar relationship.

Second, insects also are important as food resources for many vertebrates such as most lizards, most birds, as well as many small mammals. Although many adult birds feed upon fruits and seeds they feed their developing young largely insects. Those species that do not feed their young insects often feed upon other organisms that depend upon insects for food. One bird the ivory billed woodpecker is thought to have gone extinct in North America in part due to the disappearance of large beetle larvae they depended upon in the cypress swamps of the east.

Interestingly this dependence upon insects affects us in more direct ways. The fence lizards have been attributed at reducing the quantity of lime disease in areas where they are common. This was discovered by the observation where the lizard is common the lime disease is nearly absent. It was found that when the ticks that carry the disease attach to the fence lizard, the lizard clears the tick of the disease through blood exchange with the lizard. Therefore in areas where the fence lizard is common most of the ticks lack the Lime disease. This lizard depends almost 100% upon insects as food. The few if any non-insects that they fed upon probably depended upon insects as food sources.

The third important function is the decomposition of dead animals. There are many insects that are responsible for the exchange of dead organisms into other food resources. Without insects there would be piles of dead organisms around since bacterial decay is smelly and takes time. Vultures, crows, and ravens would not at least initially be able to keep up with the greater availability of dead organisms. Even if they were able to increase their populations, diseases would cause their numbers to rise and fall leaving periods of overabundance of dead animals.

The flies that are responsible for the decomposition of dead animals are extremely important in Forensic Entomology. These flies can be extremely useful if the body is in a stage of decomposition since medical methods under these circumstances cannot determine the time of death. Most fly species that oviposit upon dead animals are active only at specific times of day. By collecting and rearing out the flies from a dead body one can determine the approximate time of day and the day at which the person or animal likely died.

Likely Insect and Butterfly Diversity at Palen Site

No invertebrate survey has been performed for the proposed Palen Solar Power Project site. To obtain a greater understanding of the effects of the potential solar power project at least a season of invertebrate surveys should be performed, since most insects have a narrow (2 week or so) window of activity that runs from the dead of winter through spring into summer with some insect species waiting until late fall. Because surveys have not yet been conducted the information in my testimony is based on the geography and plants found at the site. It has been estimated that for every plant species there are 10 invertebrate species of which 95% will be insects (Ballmer 1995). Since there are 147 plant species on site (TN-58879) it is likely there will be around 1,500 invertebrate species found at the site. This number could be larger if there are more plant species to be found at the potential power plant site.

Of these invertebrates there are likely to be 22 butterfly and skipper species (see table 1-Exhibit 3095) based on the food plants present there (TN-58879) (Opler & Wright 1999, Munroe & Munroe 2004). Although butterflies will be found feeding upon the flower nectar of many plants their larvae will feed only upon the leaves and/or flowers and seeds of specific plants. Because butterflies and skippers feed upon the nectar of many plants many of them are important pollinators. These butterflies and skippers are *Brephidium exilis* (pygmy blue) (Exhibit 3096 - Figure 1), *Leptotes marinus* (marine blue), *Hemiargus ceraunus* (Ceraunus blue), *Hemiargus isola* (Reakirt's blue), *Atlides halesus* (great purple hairstreak), *Strymon melinus* (gray hairstreak) (Exhibit 3097 - Figure 2), *Ministrymon leda* (Leda hairstreak), *Apodemia mejicanus* (formerly *mormo*) *deserti* (desert metalmark), *Apodemia palmeri* (Palmer's metalmark) (Exhibit 3098 - Figure 3), *Calephelis wrightii* (Wright's metalmark), *Danaus plexippus* (monarch) (Exhibit 3099 - Figure 4), *Danaus gillippus* (queen) (Exhibit 3100 - Figure 5), *Junonia coenia* (buckeye) (Exhibit 3101 - Figure 6), *Vanessa cardui* (painted lady) (Exhibit 3102 - Figure 7), *Pontia protodice* (checkered white) (Exhibit 3103 - Figure 8), *Pontia beckeri* (Becker's white), *Anthocharis cethura* (desert orangetip), *Nathalis iole* (dainty sulfur), *Colias cessonia* (southern dogface), *Colias eurytheme* (alfalfa), *Hesperopsis libya* (Mojave sootywing), and *Erynnis funeralis* (funeral duskywing) (Exhibit 3104 - Figure 9). There are likely other butterflies that will wander into the area particularly if their food plants are available just off site.

Only two of these species truly migrate and they are *Vanessa cardui* (painted lady) and the famous *Danaus plexippus* (monarch). The painted lady does not migrate to specific locations but just generally flies north in spring and south in winter. There are locations for the monarch to overwinter in Death Valley (Panamint Range) as well as along the coast of California. Many of the other butterflies on the list move around large distances to replace populations that are lost during the winter or other conditions such as drought.

The Attraction to Flying Insects to the Concentrated Light And Night Lighting from the Proposed Project

Insects use light to navigate during the day and night. For diurnal or day flying insects polarized light is in part used for navigation. Nocturnal insects or night flying insects are thought by many to use moon light. It has been long noted that nocturnal insects are attracted to light. I used this behavior to collect and identify the nocturnal insects and to determine their diversity on several military bases of the Mojave Desert. The study at Edwards Air Force Base is available to the public (Exhibit 3105 - Pratt 1998, Exhibit 3106 – Pratt 2000). I have completed similar reports for China Lake Naval Air Weapons Station, for Marine Corps Air Ground Combat Center (Twentynine Palms), and for Fort Irwin National Training Center as well as a number of other non-desert military bases. Most nocturnal insects are attracted to light at different hours of the night, due to their differences in nocturnal activity. As an example there are many insects that fly only at twilight, others wait until it is completely dark, while others will not fly until after midnight, and some wait until near sunrise.

It is normally assumed that diurnal or day flying insects are not specifically attracted to light, but I have found that they too will be attracted to light particularly as the sun sets. Presumably they are attracted to the higher intensity of light compared to the lower intensity of light as the sun sets. I have also observed that the higher the intensity of light the further the insects seem to travel to get to the light source. Considering how intense the focused light source is from the heliostats of the proposed Palen Solar Power Project, day flying insects could be drawn from miles away. Attracting these insects from miles away also puts them in harm's way from the reflected light as it is focused on the receptor, resulting in the insects burning, as was documented in the Kagan report. It also appears that the high air temperatures near the tower receiver also caused some of the invertebrate deaths noted in the Kagan report (2014) (Exhibit 3107) and I am concerned that high temperatures sufficient to kill invertebrate may persist as the sun is setting and into early evening thereby affecting both day and night flying insects.

Sand Dune Insects

The Palen Solar Power Project is close to a large set of dunes often called the Palen Sand Dunes. These desert dunes are places where not only rare plants and animals occur but very rare and often endemic arthropods (Exhibit 3108 - Andrews et al. 1979). Andrews, Hardy and Guilani studied the beetles of five different sand dunes. Although the only endemic beetles were found on the Algodones and Cadiz dunes, the second highest diversity of beetles found on the sand dunes was on the Palen dunes. Many of these endemic arthropods in addition to beetles are species of grasshoppers, cockroaches, crickets, flies, wasps, butterflies (*Euphilotes* species) and possibly some bees. Many of these insects are important in the pollination of native plants and as food resources to other organisms, such as the rare Mojave fringe-toed lizard. Some insects such as native ants are even important in the planting of seeds beneath the soil surface. These sand dunes have had arthropods evolving on them for millions of years and they are essentially islands in the desert often isolated from each other in such a way that species have evolved independently upon these different sand dune islands.

Many of these endemic insects are poorly known and understood. For instance, the species of dune cockroaches (*Arenavega* species), which are very different from the cockroaches that invade people's homes, are believed to be different taxa on the different sand dunes found in the southwestern United States. Unfortunately there have been very few experts that have worked on these insects so the diversity of this group is not well known. It has been found that many Jerusalem crickets (*Stenoplematus* species) found in different sand dunes are different species (Weisman personal communication). Before Dave Weisman worked on these crickets they were all thought to be one species. The different sand dunes often have different sand treader crickets (*Ammobaenetes* species) as well (Koen personal communication). There are also large flower loving flies (*Rhaphiomidas* species) that differ in different sand dunes and at least one of these has been placed on the endangered list (Ballmer personal communication). Some of these endemic species are also rare enough and their habitat threatened to potentially qualify them for endangered species protections. Some of these endemic insects are likely to be affected by the proposed project, but without adequate surveys to evaluate presence and density, it is impossible to evaluate the impact.

Grasshoppers are often specific to sand dunes. As an example *Spaniacris deserticola*, a desert lubber grasshopper was often found on sand dunes. This grasshopper has become extremely rare and was proposed as an endangered species (Exhibit 3109 - Tinkham 1975, Weisman personal communication). It seems that whenever human development moves into an area this grasshopper disappears. It is an amazing insect since it is extremely well adapted to heat. The ground can be extremely hot (>135 degrees F) and they land on it and seem to be unaffected by the heat. Other grasshoppers that land on the ground during these same hot conditions will not stay there more than a second or two but take off to land somewhere in a bush. This desert grasshopper could hold some fascinating answers as to how they adapt to the heat which in turn could be useful for human purposes and others in the context of climate change adaptation.

This potentially endangered grasshopper as well as another rare sand dune grasshopper species, *Xeracris snowii*, (Exhibit 3110 - Figure 10) both feed exclusively on a single plant species *Tiquilia plicata* (Exhibit 3111 - Strohecker et al. 1968, Weisman personal communication). This plant is found at the Palen Solar Power Project (Exhibit 3095 - Table 1). For this reason these grasshoppers could be present at the project site. Unlike butterflies, these grasshoppers feed exclusively on a single plant species (*Tiquilia plicata*) throughout their life. Their presence requires this plant. Both grasshoppers do not travel very far from this food plant (Exhibit 3109 - Tinkham 1975, Exhibit 3111 - Strohecker et al. 1968).

Conclusion

Once these desert insects have been attracted to the light concentrated by the heliostats, and the extreme heat and/or solar flux/radiation kills all of them, the loss of flying insects could in time cause a wasteland to occur surrounding the solar project, not only affecting the local birds and lizards in the immediate area but ultimately the diversity of plants on

and surrounding the site and in a larger area that could include Joshua Tree National Park and other nearby conservation areas.

There may be many unexpected effects as well. As an example many dragonflies which travel great distances over the deserts may be attracted to and killed by the solar plant. Dragonflies which fly during the day are important predators of mosquitoes and mosquito larvae (as dragonfly larvae) and since mosquitoes are nocturnal they will not be affected by the proposed Palen Solar Power Project and due to the loss of dragonflies, the mosquitoes could dramatically increase in numbers. The diseases carried by mosquitoes could in turn also increase. This could have wider effects than one may think.

Some attempt should be made to reduce the mortality to insects and other organisms. I do not know if it would be possible for the effects of the proposed power plant to be reduced by somehow blocking the light so that it is not visible to flying insects, or whether another potential method to limit impacts would be to create screens that keep flying insects well away from the heat/light. Given the scale of the proposed project, it is unclear to me at this time how such measures would be constructed but I believe that these or similar measures to avoid and minimize impacts to invertebrate must be considered given the potential for a large impact to these species and the ecosystem as a whole from the proposed project.

Declaration of Gordon Pratt PhD

Re: Impacts to Flying Invertebrates (Insects) from the Proposed Palen Solar Energy Generating System

Docket 09-AFC-7

I, Gordon Pratt, declare as follows:

1) I am currently a semiretired research associate with the University of California, Riverside where I conducted research on endangered butterflies in southern California and insect diversities on military installations.

2) My relevant professional qualifications and experience are set forth in the attached resume and the attached testimony and are incorporated herein by reference.

3) I prepared the testimony attached hereto and incorporated herein by reference, relating to the impacts of the proposed project on flying invertebrates (insects).

4) I prepared the testimony attached hereto and incorporated herein by reference relating to the proposed Palen Solar Electric Generating System in the Chuckwalla Valley in Riverside County.

5) It is my professional opinion that the attached testimony is true and accurate with respect to the issues that is addressed.

6) I am personally familiar with the facts and conclusions described within the attached testimony and if called as a witness, I could testify competently thereto.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief.

Dated: June 19, 2014 Signed: Gordon Pratt

At: 6 miles south of Anza, Riverside County, California

Curriculum Vitae Gordon Pratt

NAME: Gordon F. Pratt

PLACE AND YEAR OF BIRTH: Toronto, Ontario, May 9 1953

CITIZENSHIP: Became a Naturalized Citizen of the United States on October 30, 1992 at Philadelphia, Pennsylvania: Naturalization No. A08 583 460.

EDUCATION: Northeastern University, 1971-1976, Boston, Mass., Bachelors Science in Biology with Honors.

Queen's University, 1976-1979, Kingston, Ont., Masters in Molecular Biology, Oct., 1979.

University of California, Riverside, Fall 1980 - Fall 1988, PhD. in Entomology (Insect Systematics), with an inside minor in insect/plant interactions and an outside minor in Population Biology.

HONORARY SOCIETIES: The Academy
Phi Sigma

AWARDS: Outstanding Teaching Assistant for Entomology at UCR in 1984 (for Insect Systematics).

John Adams Comstock Award that is given for outstanding student presentation at the June 1985 Lepidopterist Society Meetings of the Pacific Slope Branch in the San Bernardino Mts.

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Lepidopterists' Research Society
Friends of the Entomology Research Museum
Lepidopterists' Society
Entomological Society of Washington
Pacific Coast Entomological Society
High Country Garden Club

TEACHING

Demonstrator: Queen's University, Kingston Ontario, Canada

Introductory Cell Biology, 1976
Ecology, 1977
Entomology, 1977-1979

Teaching Assistant: University of California, Riverside, CA

Embryology, 1982
Biology 1B, 1983
Parasitology, 1983
Insect Systematics, 1983-1986
Immature Insect Taxonomy, 1984-1986
Field Entomology, 1985

Instructor: University of California Extension, Riverside, CA

Biology and Ecology of Southern California Butterflies, 1998-2001
Field Entomology, 2001

Instructor: Quino Workshop, fall 1997, winter 1998, fall 1998, winter 1999, winter 2000

WORK AND RESEARCH EXPERIENCE:

This was part of the work-study program at during my undergraduate degree at Northeastern University

1) Behavioral Modification of Autistic and Mentally Retarded children at Manhattan State School, Manhattan, N.Y. Fall 1972.
2) Teaching and caring for mentally retarded adults at Greenwich School for the Mentally Handicapped in Ellenville, N.Y. Spring 1973.
3) Nurses Aide at Parker Hill Hospital in Boston, Massachusetts 1974-1975.

Academic Research

Queen's University, Masters Research: Isolation and Characterization of mRNA for the proteins Calliforin and Vitellogenin of the Blowfly *Calliphora erythrocephala*. Dr. B. N. White and Dr. G. R. Wyatt, Department of Biology, Sept. 1976- Oct. 1979.

University of California, Riverside, CA., Phd. Research: Evolution and Biology of *Euphilotes* biotypes (Lepidoptera: Lycaenidae) using electrophoretic, biological, and

morphological characters. Dr. John D. Pinto, Dept. of Entomology and Dr. Clay Sassaman, Dept. of Biology, Sept. 1980- Dec. 1988.

University of Delaware, Newark, DE, Post-doc Research: Evolution and population structure of the *Enchenopa binotata* complex using morphological, biological, and electrophoretic characters. Dr. Tom Wood, Dept. of Entomology and Applied Ecology, July 1989- June 1991.

University of Delaware, Newark, DE., Post-doc Research: Evolution of various North American Groups of Insects to Identify various Vicariant Mechanisms using morphological, biological, and electrophoretic characters in association with biogeographical patterns of distribution. Dr. Tom Allen, Dept. of Entomology and Applied Ecology, September 1991- January 1993.

University of California, Riverside, CA, Post-doc Research:

1993-1994 Identification of electrophoretic markers of *Aphytis melinus* and *A. liganensis* (parasites of California red scale) for population studies and determining efficacy of biological control releases. Dr. Bob Luck, Dept. of Entomology, July 1993-1994.

1994-1998 Butterfly Survey of three military bases in the Mojave Desert. These bases are located at China Lake Naval Weapons Center, Fort Irwin Military Reservation, and Edwards Air Force Base and cover about 4,000 square miles of the Mojave Desert.

1996-1999 Invertebrate Survey of Edwards Air Force Base. This research was to determine areas of high species richness and endemics, for management purposes.

1997-1998 Invertebrate Survey of Fort Irwin Acquisition Areas to follow before and after military training.

1997-2002 Study of Invertebrates that indicate damage level of habitat out at Fort Irwin National Training Center. This is heavily trained area that has many local areas that differ in their damage level due to training.

1997-present Survey of endangered Quino Checkerspot through the California Fish and Game. This survey also involves rearing and studying the checkerspot under laboratory conditions.

1999 Survey of the endangered Laguna Skipper in the Palomar and Laguna Mts through the Cleveland National Forest. This study is to determine present condition of the skipper in the Laguna Mountains, survey for additional food plants, and to monitor the skipper in the Palomar Mts.

1998 An author of the Recovery Plan for the El Segundo Blue for USFWS.

1999-present Survey of invertebrates found around springs in China Lake Air Naval Weapons Station.

2001-present Survey for arthropods Installation Wide at Twentynine Palms Marine Base.

2000-2003 I was part of the Quino Technology Team, which was involved in the decision process of the endangered Quino Checkerspot butterfly.

2000-2001 survey for the Sacramento Mountains Blue, *Icaricia icarioides* subspecies.

2000-2001 survey for the Sacramento Mountains Green Hairstreak, *Callophrys affinis* subspecies.

2000-2001 survey for the butterflies found in the southwest corner of New Mexico.

2002-2005 survey for arthropods in Marine Corps Air Ground Combat Center (U.S. Navy).

2003-2004 survey for the Hunter Mountain Copper a subspecies which John Emmel and I named.

2003-2005 survey for the Lotis Blue in Mendocino and Sonoma Counties.

2004-2006 survey for arthropods in Vandenberg Air Force Base.

2003-2007 consult and monitor for the Palos Verdes Blue.

2003-2007 examine genetic differences in populations of members of the *Apodemia mormo* complex and populations of *Glaucopsyche lygdamus* in the western Mojave Desert (Cal State University at Dominguez Hills).

2007 surveyed for the El Segundo Blue Butterfly (ESBB) and trained biologists to survey for ESBB to Liz Bell, Morgan Ball, Alice Abela, and John Labonte.

2004-2008 perform field experiments on larval diapause in the Quino Checkerspot.

2007-2008 examined DNA of *Euphilotes* populations to determine the relationships of the Vandenberg Air Force Base population of the El Segundo Blue Butterfly to the populations at the El Segundo Dunes and neighboring Palos Verdes Peninsula.

2008 University of California, Riverside, CA, Research Assistant:

2008-2010 surveyed to collect larvae and adult Quino Checkerspot Butterflies to transfer them to restored habitat at the La Posta Mountain Warfare Training Facility.

2009-2010 determined the distance and depth that El Segundo Blue Butterfly larvae crawl on and into the ground to pupate.

2004-2010 captive breed the endangered Quino Checkerspot Butterfly.

2009-present survey for arthropods at springs and Lane Mountain Milkvetch on the south range of China Lake Naval Air Weapons Station.

2010 University of California, Riverside, CA, Research Associate:

USFWS Permit – TE004939-10

This permit was recently updated in January 2011. The permit is for captive breeding of the endangered Palos Verdes Blue, and rear El Segundo Blue Butterfly larvae from females from Vandenberg Air Force Base. Included in the permit is to survey for and identify the Laguna Mountain Skipper, Palos Verdes Blue, El Segundo Blue, and Lotis Blue

OUTSIDE INTERESTS

1) Water color painting
2) Nature photography
3) Hiking & backpacking
4) Talks to young school children on Reptiles and Amphibians, butterflies, or insects in general
5) Butterfly & insect collecting
6) Growing plants, for understanding requirements and provide food for larvae.
7) Rearing butterfly larvae, at present I have reared over 300 butterfly species
8) Video recording of life histories and behavior of butterflies in nature.

PUBLICATIONS:

Ballmer, G. R. & G. F. Pratt. 1989. A Survey of the Last Instar Larvae of the Lycaenidae (Lepidoptera) of California. J. Res. Lep. 27: 1-80.

Ballmer, G. R. & G. F. Pratt. 1989. Instar Number and Larval Development in *Lycaena phlaeas hypophlaeas* (Boisduval) (Lepidoptera: Lycaenidae). J. Lep. Soc. 43: 59-65.

Ballmer, G. R. & G. F. Pratt. 1992. Quantification of Ant Attendance of Lycaenid Larvae. J. Res. Lep. 30: 95-112.

Ballmer, G. R. & G. F. Pratt. 1992. *Loranthomitoura*, a new genus of Eumaeini (Lycaenidae). Trop. Lep. vol. 3: 37-46.

Emmel, J. F. & G. F. Pratt. 1998. New Subspecies of Lycaeninae from California and a Type Locality Restriction for *Chrysophanus cupreus* W. H. Edwards (Lepidoptera: Lycaenidae). In Systematics of Western North American Butterflies. Editor Thomas C. Emmel. Mariposa Press, Gainesville, Florida.

Emmel, J. F., T. C. Emmel, & G. F. Pratt. 1998. Five new subspecies of *Apodemia mormo* (Lepidoptera: Riodinidae)from southern California. In Systematics of Western North American Butterflies. Editor Thomas C. Emmel. Mariposa Press, Gainesville, Florida.

Fourney, R. M., G. F. Pratt, D. G. Harnish, G. R. Wyatt, & B. N. White. 1982. Structure and Synthesis of Vitellogenin and Vitellin from *Calliphora erythrocephala*. Insect Biochem. 12: 311-321.

Longcore, T., R. Mattoni, G. Pratt, & C. Rich. 1997. On the Perils of Ecological Restoration: Lessons from the El Segundo Blue Butterfly. 2nd Interface Between Ecology and Land Development in California. J. E. Keeley, Coordinator. Occidental College.

Mattoni, R., G. F. Pratt, T. R. Longcore, J. F. Emmel, and J. N. George. 1997. The endangered quino checkerspot butterfly, *Euphydryas editha quino* (Lepidoptera: Nymphalidae). J. Res. Lep. 34: 99-118.

Pratt, G. F. 1987. Competition as a Controlling Factor of *Euphilotes battoides allyni* (Lepidoptera: Lycaenidae) Larval Abundance. Atala 15: 1-9.

Pratt, G. F. 1988. The Evolution and Biology of *Euphilotes* Biotypes. Unpublished doctoral dissertation, University of California, Riverside, 653 pp.

Pratt, G. F. 1994. Evolution of *Euphilotes* (Lepidoptera: Lycaenidae) by seasonal and host shifts. Biol. Jour. Linn. Soc. 51: 387-416.

Pratt, G. F. 1998. Terrestrial Invertebrates of Edwards Air Force Base, 1996. Technical Report EL-98-xx of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS 39180

Pratt, G. F. 1999. Terrestrial Invertebrates of Edwards Air Force Base, 1997. Technical Report EL-99-xx of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS 39180

Pratt, G. F. 1999. Butterflies and Moths of the Western Mojave Desert (China Lake Naval Air Weapons Station, Fort Irwin National Training Center, and Edwards Air Force Base), Entomology Department, University of California Riverside, CA 92521, 148 pp.

Pratt, G. F. 1999. The Battoides Group. In A Field Guide to Western Butterflies. Paul Opler, Houghton Mifflin Company. 540 pp.

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Pratt, G. F. 2000. Terrestrial Invertebrates of Edwards Air Force Base, 1996-1998 final report. Technical Report EL-00-xx of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS 39180

Pratt, Gordon F. 2001. The Quino Checkerspot: Its Biology and Life History Final Report. Report published through the University of California for the California Fish and Game Account Title CDFG FG7182ES Luck 6/98, 96 pp.

Pratt, G. F. 2005. Terrestrial Arthropods of the Marine Corps Air Ground Combat Center, Twentynine Palms, California 2001-2005, Entomology Department at the University of California at Riverside, 102 pp.

Pratt, G. F. 2006. Terrestrial Arthropods of Vandenberg Air Force Base, Lompoc, California, Entom 2004-2005, Entomology Department at the University of California at Riverside, 30 pp.

Pratt, G. F. 2008. Buckwheat Blues: Part 1, Introduction and Rita, Spalding's, and Small Blues. American Butterflies 16: 4-32.

Pratt, G. F. 2010. Report on larval movement during the wandering stage of the El Segundo blue, Entomology Department at the University of California at Riverside, 3 pp.

Pratt, G. F. & W. Alley. 1998. The Arthropods of the Langford Lake Impact Zone 1997. In 1997 Biological Monitoring and Environmental Impact Assessment. Dominguez Hills Corporation, 1000 East Victoria Street, Carson, California 90747.

Pratt, G. F. & W. Alley. 1999. Arthropod Survey of Fort Irwin Acquisition Sites 1998. Dominguez Hills Corporation, 1000 East Victoria Street, Carson, California 90747.

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