



Lepidoptera of Crater Lake National Park

Results from the 2015 Surveys



ON THE COVER

Photograph of lepidopterists Gary Pearson (foreground) and Dana Ross conducting diurnal sampling along the Pinnacles Road (top left), black light trap and 12 volt battery assembly used for collecting nocturnal macro-moths (top right), and zephyr anglewing butterfly, *Polygonia gracilis zephyrus* (bottom)

Photograph courtesy of Linda Kappen

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Dana N. R. Ross

Curatorial Associate
Oregon State Arthropod Collection
Oregon State University
Corvallis, OR 97331

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Introduction

Crater Lake National Park was designated a National Park in 1902 with the preservation of its natural resources chosen as a core objective in the Park's enabling legislation. However, over the last 114 years there have been very limited efforts conducted to better understand the life history characteristics or impacts of Park management activities on many of the wildlife species at Crater Lake National Park. Conducting basic inventories to better understand the distribution of various species throughout the Park will provide much needed information to ensure the National Park Service (NPS) is meeting its mission to preserve natural resources for future generations.

Biological inventories help describe the complexity of life on Earth by documenting species present in a given place and time. Once a biological baseline has been created for a site, relative changes to the flora or fauna may be documented by future researchers through additional sampling or repeat surveys. Typically, plants and vertebrate animals have been the focal groups for these studies (McCullum 1974, Hill 1976, Follett 1979, Holm and Olson 2011, Mohren 2015). Invertebrate groups such as insects have been included much less frequently, perhaps due to the large number of species involved and the relative lack of trained taxonomic experts.

Lepidoptera (butterflies and moths) are an abundant and biologically diverse order of terrestrial insects that provide essential ecosystem services. As voracious larvae, the caterpillars are major herbivores of plants. As adults, most species seek nectar and are pollinators of the plants whose flowers they visit. As caterpillars and adults, Lepidoptera are an important food source for birds, bats and many other animal species. Since butterflies and moths are mobile insects that have a high reproductive capacity, they respond quickly to environmental change and are often among the first species to colonize newly available habitats. They are ideal subjects for studies dealing with both short term impacts such as from habitat management and longer term ones such as those dealing with climate change.

Tilden and Huntzinger (1977) were the first to provide a baseline for the butterflies of Crater Lake National Park. During the years 1957-1962, they documented butterflies from many locations throughout the park. Combining their results with a relatively limited number of existing voucher specimens and published observations, they presented a total of seventy-eight species. During that same time period, Huntzinger sampled a number of macro moth species which now reside in the National Park Service Collection. Their work is the basis for the comparative present-day inventory initiated here, over one-half century later.

While the results presented herein are from just three short visits within a single year (2015), they confirm the persistence of many butterfly species documented previously. Several species of butterflies and many more of macro moths – some exceedingly rare - were documented within the boundaries of Crater Lake National Park for the first time. With sufficient effort over several years, this study will culminate in a comprehensive dataset for hundreds of species of Lepidoptera. It will provide for the first comparison of the butterfly fauna in over fifty years and will establish the first formal baseline for macro moths in the park's history.

Methods

Timing of Fieldwork

Field sampling was conducted over three, four consecutive day periods during July, August and September when butterflies and moths are generally abundant at higher elevations. This time period coincides with frequent warm, sunny days when diurnal species are active and can be easily sampled. Calendar dates were selected to coincide with the new moon period to maximize the effectiveness of black light traps for nocturnal moths.

Survey Area

To be efficient during each visit, the 2015 survey area was limited to the southern portion of the park. Sites included both high elevation locations around the southern half of the rim and various sites along the length of Hwy 62 and in the southern panhandle area.

Diurnal Sampling

Various sites offering open, sunny habitats (Table 1, Figure 1) were sampled during each monthly visit. Butterflies and day-flying macro-moths were targeted during the mid-day hours (1000-1600 hours) and when conditions were most favorable for their detection. Conditions were considered favorable when it was 60F or warmer, sunny to mostly sunny, with calm to moderate wind. For each site visited, the area was carefully searched on foot and a checklist was created for all species observed. Micro-habitats most attractive to diurnal Lepidoptera – sunny areas with flowers or moisture – were paid particular attention. An aerial insect net was used to briefly capture, inspect, and release those individuals that could not be identified on the wing. Over the course of the season, one or more voucher specimens were collected (Scientific Research and Collecting Permit #CRLA-2015-SCI-0004) for each species encountered, when such was possible. Vouchers were pinned and mounted, with taxonomic determination and field data labels pinned below each specimen, once dried. Voucher specimens will be deposited in the National Park Service Collection.

Table 1. Location, habitat, and elevation range of sites where diurnal surveys occurred in 2015 at Crater Lake National Park.

Site	Habitat Type	Centered at (Lat / Lon)	Elevation Range (feet)
Park Headquarters	riparian, meadow, forest openings	42.899 / -122.134	6,490-6,580
Steele Circle	meadow, forest roadside	42.889 / -122.134	6,325-6,400
Castle Crest	riparian, forest openings	42.892 / -122.131	6,400-6,450
Dutton Ridge	pumice field	42.883 / -122.081	7,350-7,405
Mt Scott Trailhead	pumice field	42.928 / -122.028	7,630-7,690
Cloudcap Overlook	Open areas on rim of crater	42.936 / -122.048	7,875-7,950
Pole Bridge Creek	riparian, quarry	42.844 / -122.150	5,840-5,980
Upper Sun Creek	riparian & meadow	42.887 / -122.095	6,525-6,650
Lower Annie Creek	riparian, forest openings	42.779 / -122.062	4,400-4,500
South Crater Peak Trail	forest openings	42.803 / -122.059	4,720-4,750
Sun Notch	meadow, forest roadside	42.901 / -122.096	7,040-7,175
Kerr Notch	meadow, forest openings	42.923 / -122.058	7,325-7,450
Pinnacles Road	steep open hillside, roadside	42.907 / -122.072	6,580-6,650

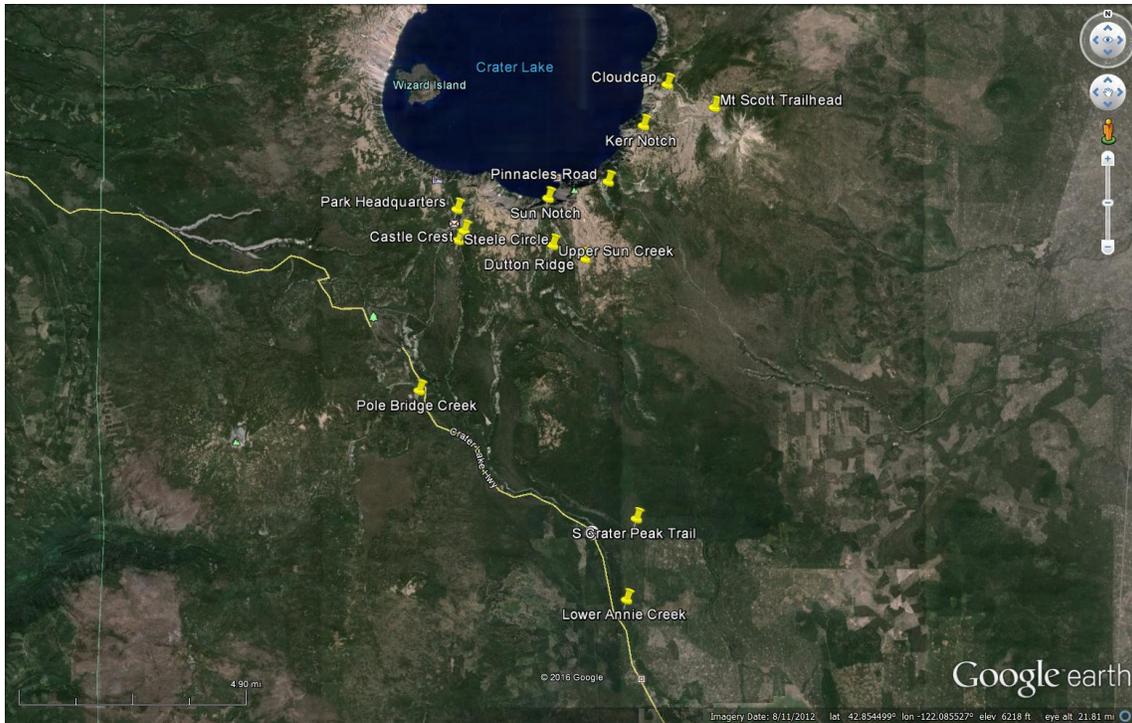


Figure 1. Locations of diurnal sampling during the 2015 field season at Crater Lake National Park.

Nocturnal Sampling

A total of 15 sites were selected for once-per-month nocturnal moth sampling (Table 2, Figure 3). Sites were distributed along the Hwy 62 corridor that included both slopes of the Cascade Range, at higher elevations near the south rim and near Goodbye picnic area in an effort to collect within a variety of habitat types for a good cross section of the moth species present within the park.

A BioQuip universal black light trap (Figure 2) was used for sampling. The unit incorporates a 22 watt circline bulb above a collection bucket, and is powered by a 12 volt battery. A fumigant placed within the enclosed lower space of the bucket kills specimens as they are trapped. Traps were placed in the field in the evening and retrieved the following morning. Samples were labeled with location and date of collection, frozen for transport and temporary storage until processed. The sampling process included sorting and counting all macro moths collected and making taxonomic identifications to the species level. Sample data was entered into a database. Voucher specimens were prepared in the same manner as butterflies (see above).



Figure 2. Black light trap used to conduct nocturnal sampling.

Table 2. Location, elevation, and habitat of nocturnal sampling locations at Crater Lake National Park in 2015.

Trap Site #	Site	Habitat Type	Location (Lat / Lon)	Elevation (feet)
1	Hwy 62 at west park boundary	conifer forest understory	42.902 / -122.283	4,875
2	Hwy 62, 1 mi east of west park boundary	conifer forest understory	42.898 / -122.264	5,120
3	Hwy 62, 3.7 road east of west park boundary	open hilltop within conifer forest	42.881 / -122.187	5,710
4	0.75 WNW jxn Hwy 62/PCT	conifer forest understory	42.882 / -122.185	6,000
5	Hwy 62, summit	open ridgetop within conifer forest	42.872 / -122.184	6,225
6	Pole Bridge Creek, 150 yds W of Hwy 62	riparian opening within conifer forest	42.843 / -122.148	5,845
7	Upper Annie Creek Falls Overlook, W side of Hwy 62	conifer forest understory	42.818 / -122.119	5,415
8	Hwy 62, 2.2 mi N of south park boundary	cottonwood-aspen forest understory	42.797 / -122.076	4,750
9	Lower Annie Creek	conifer forest understory	42.771 / -122.159	4,390
10	South Crater Peak Trailhead	conifer-hardwood shrub clearcut	42.802 / -122.062	4,720
11	Goodbye Picnic Area	riparian understory within conifer forest	42.871 / -122.152	6,030
12	Steele Circle	meadow within conifer forest	42.890 / -122.133	6,390
13	Rim Drive, 0.6 air miles WNW of park headquarters	open headwater depression	42.900 / -122.147	7,005
14	Upper Sun Creek	open riparian hillside	42.884 / -122.097	6,535
15	Dutton Ridge, on N side of Rim Drive	open pumice field	42.885 / -122.081	7,410



Figure 3. Locations of nocturnal sampling during the 2015 field season at Crater Lake National Park.

Results

A total of 160 species of Lepidoptera were sampled during 2015. Of these, 41 species were butterflies (Table 1) and 119 species were macro moths (Table 2).

Table 3. List of 41 butterfly species captured in 2015 at Crater Lake National Park.

Family	Genus & Species
Hesperiidae (Skippers)	<i>Erynnis persius</i> <i>Hesperia colorado</i> <i>Hesperia juba</i> <i>Ochlodes sylvanoides</i> <i>Polites sabuleti</i> <i>Polites sonora</i> <i>Pyrgus communis</i>
Papilionidae (Swallowtails & Parnassians)	<i>Papilio eurymedon</i> <i>Parnassius clodius</i>
Pieridae (Whites & Sulphurs)	<i>Colias eurytheme</i> <i>Colias philodice</i> <i>Euchloe ausonides</i> <i>Neophasia menapia</i> <i>Pieris rapae</i> <i>Pontia occidentalis</i>
Lycaenidae (Blues, Hairstreaks & Coppers)	<i>Cupido amyntula</i> <i>Lycaena mariposa</i> <i>Lycaena nivalis</i> <i>Plebejus acmon</i> <i>Plebejus anna ricei</i> <i>Plebejus icarioides</i> <i>Plebejus saepiolus</i> <i>Plebejus species on Eriogonum pyrolifolium</i>
Nymphalidae (Brushfoots)	<i>Adelpha californica</i> <i>Boloria epithore</i> <i>Cercyonis oetus</i> <i>Chlosyne hoffmanni</i> <i>Limenitis lorquini</i> <i>Nymphalis antiopa</i> <i>Nymphalis californica</i> <i>Oeneis nevadensis</i> <i>Phyciodes mylitta</i> <i>Polygonia gracilis zephyrus</i> <i>Speyeria egleis</i> <i>Speyeria hesperis</i> <i>Speyeria hydaspes</i> <i>Speyeria mormonia</i> <i>Speyeria zerene</i> <i>Vanessa atalanta rubria</i> <i>Vanessa cardui</i> <i>Vanessa virginiensis</i>

Table 4. List of 119 moth species captured in 2015 at Crater Lake National Park.

Family	Genus & Species
Drepanidae	<i>Ceranemota tearlei</i>
Erebidae	<i>Catocala semirelicta</i> <i>Gnophaela vermiculata</i> <i>Hypena humuli</i> <i>Lygephila victoria</i> <i>Mycterophora rubricans</i>
Geometridae	<i>Apodrepanulatrix litaria</i> <i>Digrammia curvata</i> <i>Digrammia neptaria</i> <i>Drepanulatrix carnearia</i> <i>Drepanulatrix unicalcararia</i> <i>Dysstroma formosa</i> <i>Ennomos magnaria</i> <i>Enypia packardata</i> <i>Enypia venata</i> <i>Eudrepanulatrix rectifascia</i> <i>Eulithis destinata</i> <i>Eulithis xylina</i> <i>Eupithecia misturata</i> <i>Eustroma fasciata</i> <i>Eustroma semiatrata</i> <i>Gabriola dyari</i> <i>Hesperumia sulphuraria</i> <i>Nemoria darwiniata</i> <i>Nepytia umbrosaria</i> <i>Perizoma curvilinea</i> <i>Pero mizon</i> <i>Plemyria georgii</i> <i>Sicya crocearia</i> <i>Speranza bitactata</i> <i>Speranza colata</i> <i>Speranza quadrilinearia</i> <i>Stamnodes marmorata</i> <i>Stenoporpia dejecta</i> <i>Stenoporpia pulmonaria</i> <i>Tetracis jubararia</i> <i>Tetracis pallulata</i> <i>Triphosa haesitata</i> <i>Xanthorhoe defensaria</i> <i>Zenophleps lignicolorata</i>
Lasiocampidae	<i>Tolype distincta</i>
Noctuidae	<i>Abagrotis apposita</i> <i>Abagrotis pulchrata</i> <i>Abagrotis trigona</i> <i>Agrotis ipsilon</i> <i>Andropolia theodori</i> <i>Apamea amputatrix</i> <i>Apamea tahoensis</i> <i>Aseptis binotata</i> <i>Aseptis ethnica</i> <i>Brachylomia rectifascia</i> <i>Caradrina montana</i> <i>Cosmia elisae</i> <i>Cosmia praeacuta</i>

Table 5 cont. List of 119 moth species captured in 2015 at Crater Lake National Park.

<p>Noctuidae</p>	<p><i>Cryphia cuerva</i> <i>Dichagyris variabilis</i> <i>Enargia infumata</i> <i>Enypia packardata</i> <i>Eremobina uncinata</i> <i>Eurois astricta</i> <i>Eurois occulta</i> <i>Euros cervina</i> <i>Euxoa biformata</i> <i>Euxoa aequalis</i> <i>Euxoa albipennis</i> <i>Euxoa brunneigera</i> <i>Euxoa comosa</i> <i>Euxoa extranea</i> <i>Euxoa henrietta</i> <i>Euxoa infausta</i> <i>Euxoa intrita</i> <i>Euxoa munis</i> <i>Euxoa murdocki</i> <i>Euxoa ochrogaster</i> <i>Euxoa plagigera</i> <i>Euxoa punctigera</i> <i>Euxoa quadridentata</i> <i>Euxoa satis</i> <i>Euxoa septentrionalis</i> <i>Helicoverpa zea</i> <i>Hydraecia obliqua-medialis complex</i> <i>Ipimorpha ?nanaimo</i> <i>Ipimorpha (species uncertain)</i> <i>Lacinipolia comis</i> <i>Lacinipolia davena</i> <i>Lacinipolia olivacea</i> <i>Lacinipolia stricta</i> <i>Mesogona olivata</i> <i>Mesogona rubra</i> <i>Mythimna unipuncta</i> <i>Nephelodes demaculata</i> <i>Nephelodes minians</i> <i>Noctua pronuba</i> <i>Oligia divesta</i> <i>Panthea virginarius</i> <i>Parabagrotis exsertistigma</i> <i>Parabagrotis sulinaris</i> <i>Platysenta albolabes</i> <i>Pleromelloida cinerea</i> <i>Protolampra rufipectus</i> <i>Protorthodes curtica</i> <i>Rhyacia clemens</i> <i>?Schinia honesta</i> <i>Schinia vaccinia</i> <i>Spaelotis bicava</i> <i>Spodoptera praefica</i> <i>Sympistis californiae</i></p>
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Table 6 cont. List of 119 moth species captured in 2015 at Crater Lake National Park.

Noctuidae	<i>Sympistis columbia</i> <i>Sympistis poliochroa</i> <i>Sympistis sandaraca</i> <i>Syngrapha celsa</i> <i>Tesagrotis corrodera</i> <i>Ufeus satyricus</i> <i>Xestia finatimis</i> <i>Xestia infimatis</i> <i>Xestia mustelina</i> <i>Xestia smithii</i> <i>Xylena nupera</i> <i>Xylomoia indirecta</i>
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Discussion

Within the Crater Lake National Park survey area, many spring-summer plants bloomed early and senesced rapidly under conditions of very little snowpack in 2015. In response, the Lepidoptera fauna - and butterflies in particular – appeared to have reduced abundance and to fly earlier than expected in a typical year. Future sampling that occurs during a year of more normal snowpack should confirm this hypothesis. Sampling during May and June, and incorporating additional areas of the park will undoubtedly add significantly to the Parks butterfly and moth checklists.

Butterflies

A total of 37 species were observed that had been documented previously within the park. In addition, the following 4 species are reported from the park for the first time. Images for all species can be seen at the Butterflies of America website (<http://butterfliesofamerica.com/>).

- 1) **Mormon Fritillary (*Speyeria mormo*)** – NEW for Crater Lake NP. Not reported by Tilden & Huntzinger (1977), it was common during July and August in upper Sun Creek Meadow (6,550-6,600 feet).
- 2) **Common Checkered-Skipper (*Pyrgus communis*)** – NEW for Crater Lake NP. Based on a single specimen, the subspecies is uncertain. Sampled from the lower Crater Peak trailhead area on 7/18/2015 at about 4,700 feet. Additional specimens should be sampled to determine subspecies status.
- 3) **Large Marble (*Euchloe ausonides*)** - NEW for Crater Lake NP. A single specimen was sampled on 7/19/2015 from upper Sun Creek Meadow (6,600 feet).
- 4) **Clouded Sulphur (*Colias philodice*)** – NEW for Crater Lake NP. A single worn male was sampled on 7/19/2015 from upper Sun Creek Meadow (6,600 feet).

Moths

This is the first documented effort to focus on inventorying moths in the Park. While significantly more sampling will be required before the macro moths are well documented, some particularly important distribution records for the family Noctuidae are presented here. Images of these species are available through the Pacific Northwest Moths website (<http://pnwmoths.biol.wvu.edu/>).

- 1) ***Abagrotis pulchrata*** – NEW for Crater Lake NP. Klamath County record.
- 2) ***Brachylomia rectifascia*** – NEW for Crater Lake NP. Klamath County record.
- 3) ***Euros cervina*** – NEW for Crater Lake NP. Klamath County record. Fourth PNW location.
- 4) ***Euxoa trifasciata*** – NEW for Crater Lake NP. Klamath County record. Rare, high elevation species.
- 5) ***Mesogona rubra*** – NEW for Crater Lake NP. Klamath County record.
- 6) ***Condica albolabes*** – NEW for Crater Lake NP. Fourth Oregon record. Third PNW location.
- 7) ***Protolampra rufipectus*** – NEW for Crater Lake NP. Klamath County record.
- 8) ***Protoperigea anotha*** – NEW for Crater Lake NP. Klamath County record. Third Oregon location.
- 9) ***Sideridis maryx*** – NEW for Crater Lake NP. Klamath County record.
- 10) ***Sympistis californiae*** – NEW for Crater Lake NP. Klamath County record.

- 11) *Sympistis poliochroa* – NEW for Crater Lake NP. Klamath County record.
- 12) *Sympistis sandaraca* – NEW for Crater Lake NP. Klamath County record.

This year's effort provided a great start to understanding the distribution and presence of moth species in the Park. While only about one-half of the Tilden and Huntzinger butterfly fauna was encountered, several new butterfly species were added to the Parks species list. Future efforts should focus on sampling from new locations and unusual plant communities, as well as during the spring to early summer time period. Particularly species-rich sites should be revisited for additional sampling.

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Crater Lake National Park
Hwy 62, 1 Sager Building
Crater Lake, Oregon 97604