



Monitoring Terrestrial Reptiles and Amphibians in the Mediterranean Coast Network

Cabrillo National Monument 2012 Annual Report

Natural Resource Data Series NPS/MEDN/NRDS—2014/727



ON THE COVER

Adult Southern Pacific rattlesnakes, *Crotalus viridis* under coverboard at array LOMA-09 during June 2012 herpetofauna surveys
Photograph by: Kaye London, Cabrillo National Monument

Monitoring Terrestrial Reptiles and Amphibians in the Mediterranean Coast Network

Cabrillo National Monument 2012 Annual Report

Natural Resource Data Series NPS/MEDN/NRDS—2014/727

Kaye P. London
Stephanie Root

National Park Service
Cabrillo National Monument
1800 Cabrillo Memorial Drive
San Diego, California 92106

October 2014

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from www.mednscience.org or the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

London, K. P. and S. Root. 2014. Monitoring terrestrial reptiles and amphibians in the Mediterranean Coast Network: Cabrillo National Monument 2012 annual report. Natural Resource Data Series NPS/MEDN/NRDS—2014/727. National Park Service, Fort Collins, Colorado.

Contents

	Page
Tables.....	v
Abstract	vi
Acknowledgments.....	vii
List of Terms.....	vii
Introduction.....	1
Methods.....	3
Results.....	5
Lizards	5
Snakes	11
Amphibian	12
Small mammals	13
Discussion	19
Literature Cited	20

Figures

Figure 1. Map of the location of the herpetofauna arrays within the study area including Point Loma Ecological Conservation Area and Cabrillo National Monument management areas.	2
Figure 2. Capture status of 4 lizard species during the 2012 herpetofauna surveys. Not included is <i>A. pulchra</i> , with only one capture of the species in 2012.....	5
Figure 3. Capture rates of lizard species by month in 2012.....	6
Figure 4. <i>S. occidentalis</i> captures by array in 2012.	7
Figure 5. Monthly capture rates classified by sex for <i>S. occidentalis</i> in 2012.....	7
Figure 6. <i>S. occidentalis</i> monthly capture rates of adults and juveniles for 2012.	8
Figure 7. <i>U. stansburiana</i> captures by array during CABR 2012 herpetofauna surveys.	8
Figure 8. <i>U. stansburiana</i> monthly adult captures for 2012.	9
Figure 9. <i>U. stansburiana</i> monthly capture rates by age class in 2012.	9
Figure 10. <i>A. hyperythrus</i> captures by array during in 2012.....	10
Figure 11. <i>E. multicarinata</i> captures by array in 2012.	11
Figure 12. Snake captures and trap type in 2012.	11
Figure 13. Snake captures by array in 2012.....	12
Figure 14. <i>B. major</i> capture rates in 2012.....	13
Figure 15. Arrays where <i>B. major</i> were captured in 2012.....	13
Figure 16. <i>N. crawfordi</i> capture rates by month in 2012.	14
Figure 17. <i>N. crawfordi</i> captures per array in 2012.....	14
Figure 18. <i>N. crawfordi</i> condition at capture in 2012.....	15
Figure 19. <i>N. crawfordi</i> mortality decreases throughout the year in 2012.	15
Figure 20. <i>N. crawfordi</i> mortality and survival across the survey day in order arrays were checked.....	16

Tables

	Page
Table 1. Minimum measurement cut-off lengths for adult age class determination.....	4
Table 1. Herptile and small mammal captures in 2012.....	17
Table 2. Dates and start times for trapping sessions in 2012.	18
Table 3. 2012 Cabrillo herpetofauna array information. MSS: maritime succulent scrub, DIS: disturbed, SMC: southern maritime chaparral.....	18

Appendices

	Page
Appendix A: 2012 HOBO Data.....	21
Appendix B: 2012 Precipitation Data	31

Abstract

The use of pitfall traps and drift fencing has been an effective method for monitoring many species of herptiles. This method has been used at Cabrillo National Monument in San Diego, California since 1995 to monitor trends in reptile and amphibian species within the park. These methods were first used by USGS and then continued as part of the National Park Service Mediterranean Coast Network Inventory and Monitoring Program. The park is located at the southern tip of the Point Loma peninsula near downtown San Diego and is surrounded by water and developed land essentially creating an island of native Coastal Sage Scrub habitat. There are 12 species of herptiles that are currently found within the 163 acre park and species diversity has declined according to historical records. Of the 12 herptile species, 10 were captured in 2012. The only herptile species not detected this year were *Hypsiglena torquata* and *Pituophis melanoleucas*. This year yielded the lowest number of total captures of *Cnemidophorus hyperythrus beldingi*, a state species of concern. Only two juvenile captures were recorded for this species, signaling low recruitment for the year. Continuous inventory and monitoring efforts are important to detect any significant changes in the herptile populations within an urban “island” park and to manage our parks for future generations to enjoy.

Acknowledgments

We would like to thank the many NPS Volunteers in Parks (VIPs) who dedicated their time and efforts in assisting with this project. B. Sharp, K. Pangan, D. Endicott, K. Parker, T. Kibler, B. Greenberg, K. Lion, M. Sampson, A. Cheshire, T. McDermott and others offered great assistance during the 2012 herpetofauna surveys enduring the early mornings and potential hazards of field work. We would like to thank the US Navy for their partnership with this study by allowing NPS to conduct work on military property. Much appreciation also goes to all NPS staff who educate the public of the natural history of Cabrillo National Monument.

List of Terms

CABR: Cabrillo National Monument, 163 acres managed by the National Park Service

CSS: Coastal Sage Scrub vegetation type

DIS: Disturbed habitat

MSS: Maritime succulent scrub vegetation type

NPS: National Park Service, U.S.

PLECA: Point Loma Ecological Conservation Area, 650 acres of land on the Point Loma Peninsula with multi-agency management designated for conservation of native species.

SMC: Southern maritime chaparral vegetation

USGS: U.S. Geological Survey

Contacts

Carlton Rochester: US Geological Survey, San Diego Western Region Division Project Office; crochester@usgs.gov

Robert Fisher, PhD.: US Geological Survey, San Diego Western Region Division Project Office; rfisher@usgs.gov

Bradford Hollingsworth, PhD.: San Diego Natural History Museum, Curator of Herpetology Department; bhollingsworth@sdnhm.org

Stacey Ostermann-Kelm, PhD.: National Park Service Inventory and Monitoring Program, Mediterranean Coast Network, Program Manager; stacey_ostermann@nps.gov

Keith Lombardo, PhD.: National Park Service, Cabrillo National Monument, Chief of Resources & Science; keith_lombardo@nps.gov

Lena Lee: National Park Service Inventory and Monitoring Program, Mediterranean Coast Network, Data Manager; lena_lee@nps.gov

Tom Philippi, PhD.: National Park Service Inventory and Monitoring Program, Fort Collins, Colorado; tom_phillippi@nps.gov

Introduction

Cabrillo National Monument (CABR) is located at the southern tip of the Point Loma peninsula in San Diego, California USA (Fig. 1). The National Park Service (NPS) manages 163 acres of land that is dominated by the coastal sage scrub vegetation community. The park is surrounded by a US Navy base, City of San Diego wastewater treatment plant and residential housing. The surrounding development and habitat fragmentation can negatively affect wildlife and the biodiversity of native reptile species by restricting natural movements of individuals as well as gene flow with adjacent populations (Busteed 2003, Delaney et al, 2010). The herpetofauna monitoring program was initiated in 1995 to inventory and monitor herptile species within and around the park including some areas on US Navy property. Cabrillo National Monument is part of the Point Loma Ecological Conservation Area (PLECA) which is made up of 650 acres of land on Point Loma that is owned and managed by federal and local agencies. The PLECA was designed to protect the cultural and biological resources that can be found on the Point Loma peninsula.

There are currently twelve species of herptiles found within Cabrillo National Monument that are monitored regularly using these methods. Several species of snakes and lizards are thought to be extirpated from the peninsula according to historical records possibly due to landscape changes and habitat fragmentation on and around the Point Loma peninsula. The monitoring efforts are important for detecting changes in the herptile population dynamics and species composition.

The herpetofauna monitoring program on Point Loma was initiated using pitfall traps. There were originally 17 arrays, which included seven pitfall traps and three funnel traps at each array, constructed on Point Loma that were operated by USGS July 1995 until December 2001 for sampling periods of 11 days/10 nights every other month. After Dec 2001, NPS took over the management of the herpetofauna surveys and at this time, herpetofauna was designated as a “vital sign” for the Mediterranean Coast Network (MEDN) Inventory and Monitoring Program (I&M). The vital signs are ecological parameters that are monitored to provide the park natural resource managers and the greater scientific community with scientific information to assist with natural resource management. Beginning in 2002, NPS conducted surveys on a five-day/four-night sampling period once a month for 11 months of the year. Atkinson et al. (2003) determined that a minimum of 40 trap nights per year are needed to detect changes in species richness and abundance of certain target herptile species. In July 2005 and March 2006, arrays six and seven were permanently closed respectively.



Figure 1. Map of the location of the herpetofauna arrays within the study area including Point Loma Ecological Conservation Area and Cabrillo National Monument management areas.

Methods

The approved monitoring protocol (Busteed et al. 2006) was followed during 2012. This protocol was based on the initial monitoring and methods used by Fisher and Case (Fisher and Case 2000, Fisher et al. 2008).

Sixteen arrays were operated during the herpetofauna surveys in 2012. Nine arrays are within Cabrillo National Monument property and the remaining seven arrays are on US Navy property north of CABR. Each array consists of seven pitfall traps and three funnel traps in a “Y” configuration. The pitfall traps are five gallon buckets that are recessed so the tops of the buckets are flush with the surrounding ground. The funnel traps are cylinders made from hardware fabric with plastic funnels attached at each end. Fifteen meters of drift fencing along each arm of the array with 7.5 meters between each pitfall trap are utilized to direct the animals along the fencing and into the traps. A 24”x48”x2” (61cmx 122cmx 5.1cm) plywood coverboard was placed at each array to increase detection rates of cryptic or fossorial animals that are difficult to observe near the arrays and not easily captured in the pitfall or funnel traps.

Within each pitfall trap, there were two plastic PVC pipes of different sizes to serve as hide-tubes for captured animals. Cotton or polyester stuffing was used in the traps to offer bedding material for the small mammals in order to reduce hypothermia. A nine-ounce plastic cup was placed in the traps with the stuffing inside to provide cover for small mammals. Two to four mealworms were placed at the bottom of the cup under the stuffing in order to provide food for shrew captures. Moist sponges were also placed in the bottom of each trap to reduce desiccation of salamander captures. Sponges and polyester bedding were used in the traps year-round.

From January to December 2012, the arrays were scheduled to be opened every month for a four-night sampling period (Table 1). Surveys were not conducted in November but were completed in December for 2012. Traps were closed or never opened if heavy precipitation was in the forecast in order to reduce morbidity and mortality of captures. Traps were also closed if there was a heavy infestation of Argentine ants, *Linepithema humile*, in order to reduce the chance of mortality of captures because ants may attack animals trapped in the pitfall traps. There is a negative correlation with the density of *L. humile* and lizard capture rates (Atkinson et al, 2003). Traps were also not opened if there was flooding in the bottom of the trap or if the ground was saturated with water, which caused flooding from the drainage holes in the bottom of the trap. This usually occurred after heavy rains for only some of the traps.

Data collected from all lizard captures included weight, snout/vent length (SVL), age (adult or juvenile), and gender if possible. SVL measurement cut-off lengths were utilized to categorize lizards by age class (Table 1). Body condition was also noted if any abnormalities were observed. Each individual lizard was marked using toe clip numbers to assign it a unique number. The toe clips along with a small clip of the tail were preserved in 95% ethanol for future genetic studies.

Non-venomous snakes were weighed and measured and some were marked using scale clips in order to assign a unique number to the individual snake. This procedure was not used consistently due to difficulty in applying this technique on smaller snakes. Venomous snakes were neither handled nor weighed for personnel safety. When captured, the total length of the

rattlesnake was estimated and the number of rattles was noted. All herptiles were released in the area of capture after processing.

Table 1. Minimum measurement cut-off lengths for adult age class determination

Species	Minimum SVL for adult classification, in millimeters
<i>Sceloporus occidentalis</i>	50
<i>Uta stansburiana</i>	40
<i>Cnemidophorus hyperythrus beldingi</i>	50
<i>Elgaria multicarinata</i>	Determined by collector
<i>Anniella pulchra</i>	Determined by collector

Notiosorex crawfordi captures were processed as quickly as possible in order to reduce stress and facilitate quick release. Measurements including mass, tail length and body length were recorded. Captures were noted as adult and were not sexed. The shrews were also offered a mealworm during processing.

Other small mammals such as rodents were identified to species. Gender, age estimation, tail length, body length, hind foot length, and ear length were also recorded. Any dead or escaped animal was noted along with all other notes in a PalmOne PDA.

The data were transferred from the PDA to an Access database and then exported to Excel for analysis. The capture rate of each species was calculated by the number of captures per trapping session. The number of captures per trap type (pitfall vs. funnel trap) was also determined for the species that were captured in both trap types. Captures of each species per array was also determined. The recapture rate (number of individuals recaptured to the number of individuals captured for the first time) was calculated for each of the marked species. When age could be determined for *Sceloporus occidentalis*, *Uta stansburiana*, *Elgaria multicarinata*, *Cnemidophorus hyperythrus* (*Aspidoscelis hyperythra*), the number of juveniles and adults were calculated. Recruitment for these species was calculated by dividing the number of unique juveniles of a species captured in 2012 by the number of unique adults of that species captured in 2012.

Weather data were also recorded for the surveys. Weather conditions including temperature, humidity, wind speed, wind direction and gust speed were recorded at the start and end of each survey day from the CABR Visitor's Center weather station located at -117.239493, 32.674827 decimal degrees. HOBO temperature loggers that were placed at Arrays 5, 8 and 15 on the first day of surveys and collected on the last day of the surveys (Appendix A). All weather data from the HOBOS were downloaded using Boxcar software. Monthly total precipitation data were obtained from the Western Regional Climate Center from the San Diego Airport station (located about 6 km from CABR) (Appendix B).

Results

The 2012 monitoring results yielded captures of 28 species including herptiles ($n=10$), small mammals ($n=8$), and invertebrates ($n=10$). Captures were either in the pitfall traps or funnel traps of the 16 arrays. The capture data do not include observations or animals under the coverboards. Those data were included separately as incidental sightings at or near arrays. There were a total of 42 trapping nights throughout the year with 11 trapping sessions (Table 2). The traps were not run in November.

Array 18 was only opened seasonally due to the federally endangered plant *Corizantho orcuttiana* which has been detected at the array. The array was operational June to December 2012.

Lizards

There were five species of lizards captured in the traps during the 2012 herpetofauna surveys: *Sceloporus occidentalis* (SCOC), *Uta stansburiana* (UTST), *Elgaria multicarinata* (ELMU), *Cnemidophorus hyperythrus* (CNHY), and *Anniella pulchra* (ANPU). *S. occidentalis* accounted for the majority of captures with 66% (Fig. 2).

The capture rate of each lizard and amphibian species was calculated as the number of captures per trapping night per month (Fig. 3). March had the highest number of lizards captured in 2012, while Array 9 yielded the most captures; however they were all of the same species, *S. occidentalis*.

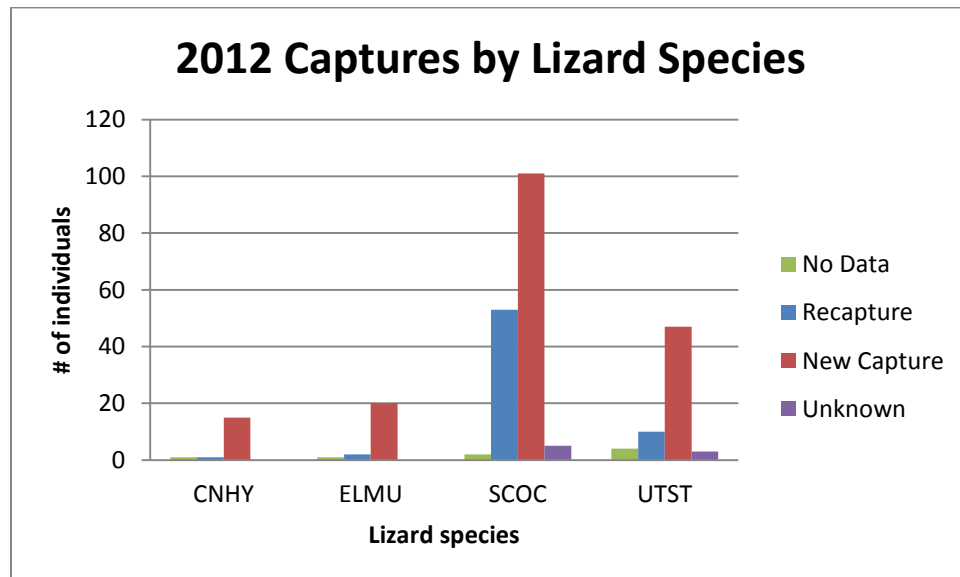


Figure 2. Capture status of 4 lizard species during the 2012 herpetofauna surveys. Not included is *A. pulchra*, with only one capture of the species in 2012.

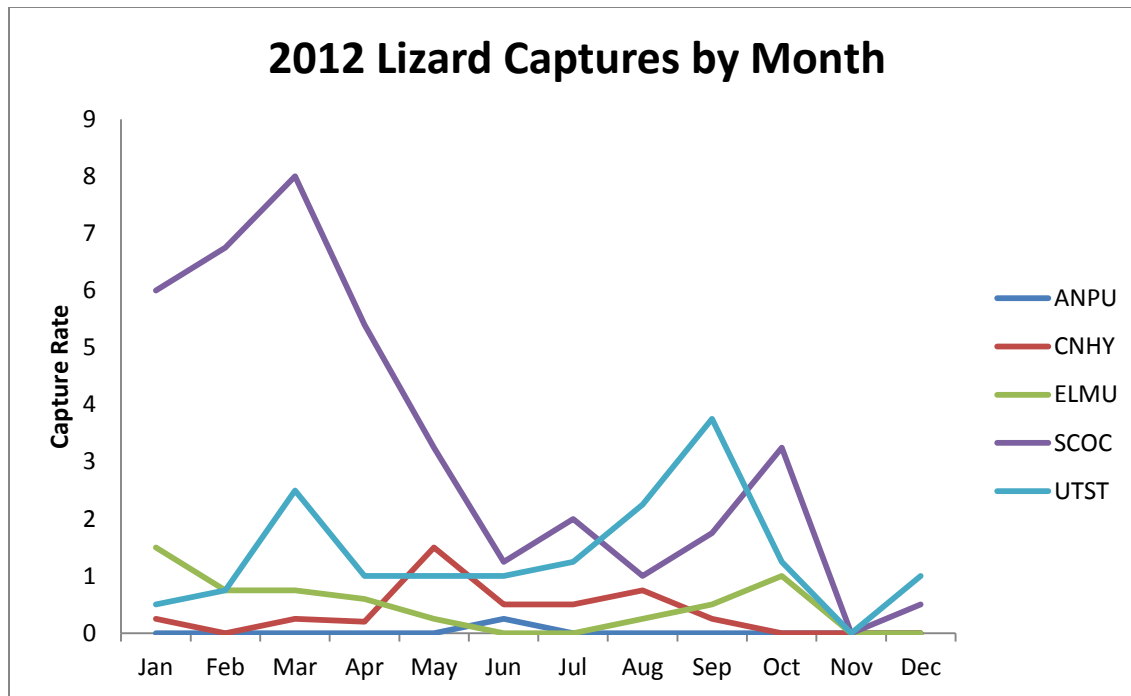


Figure 3. Capture rates of lizard species by month in 2012.

***S. occidentalis* (SCOC):** There were 161 SCOC captured in 2012. The peak of capture rates for SCOC in 2012 was during March with 32 captures. SCOC was captured at each array in 2012 with the greatest number of captures at Array 9 with 24 captures throughout the year (Fig 4). 107 SCOC (67.72%) were captured in pitfall traps while 51 SCOC (32.28%) were captured in the funnel traps. In 2012, 89 SCOC were new captures (56.33%), 53 SCOC (33.54%) had previously been captured and marked.

In all, there were three SCOC had no data for the recapture status and four SCOC were marked as unknown. The unknown status was used when lizards were captures that were too small to mark. Records with unknown captures status were excluded from further analysis.

There were 43 (43.43%) juvenile (< 50 mm) captures and 56 (56.57%) adult ($\geq$ 50 mm) unique captures in 2012. Recruitment index for SCOC was 0.76 (the number of unique juveniles captured in 2012/number of unique adults captured in 2012).

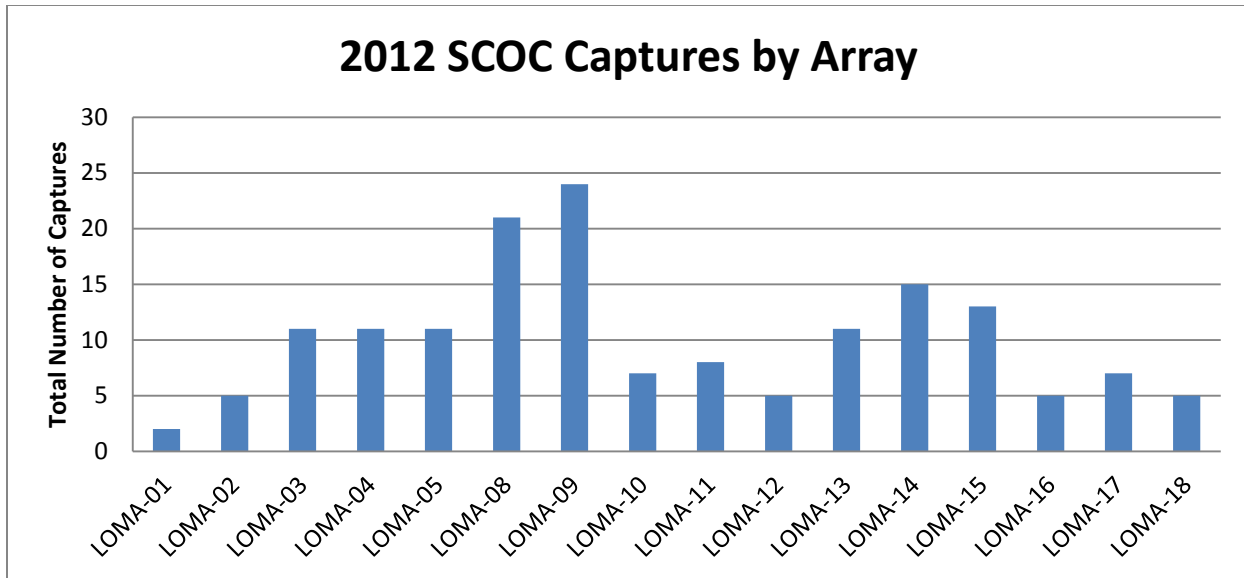


Figure 4. *S. occidentalis* captures by array in 2012.

The greatest number of SCOC captured in 2012 was in late spring, April to July. The greatest number of adult female captures occurred in April with seven. April also yielded the greatest number of males ($n=15$) (Fig. 5). Captures of juveniles was greatest in January with 15 individuals captured (Fig. 6).

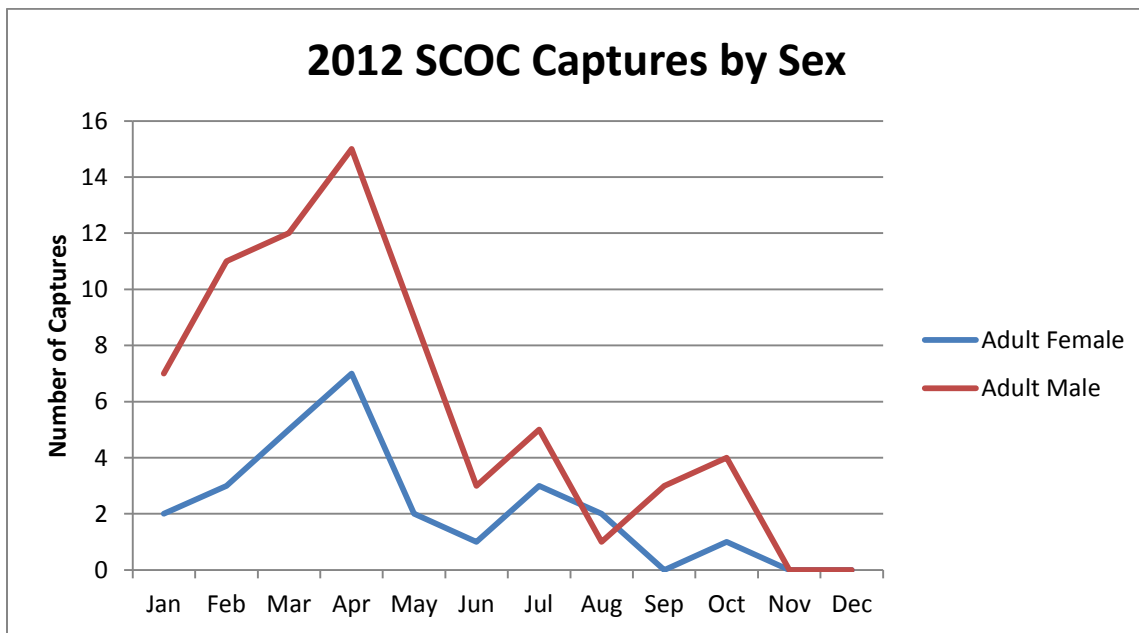


Figure 5. Monthly capture rates classified by sex for *S. occidentalis* in 2012.

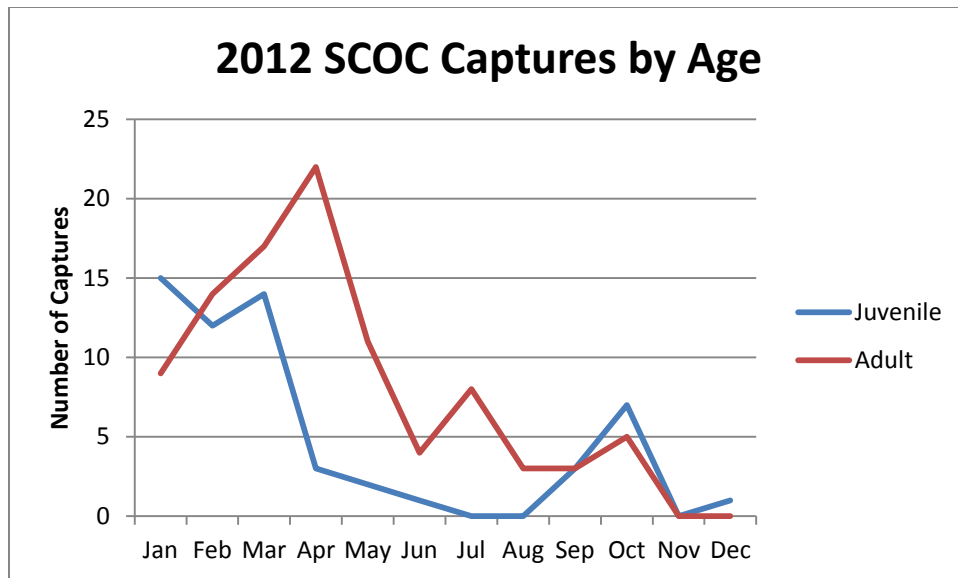


Figure 6. *S. occidentalis* monthly capture rates of adults and juveniles for 2012.

***U. stansburiana* (UTST):** There were 64 UTST captured in 2012. The capture rate was greatest in September 2012 at 3.75 UTST per trap night. UTST was captured at 14 of the arrays and were not detected at Array 8 or 9 (Fig 7). The greatest number of captures was at Array 2 and 5 with 10 captures at each. Fifty UTST (83.3%) were captured in the pitfall traps while 10 (16.7%) were captured in the funnel traps. Of the 60 captures, 43 (71.7%) were new captures, 11 were recaptures (18.3%) and unknown status for 6 of the UTST. In 2012, there were 25 (41.7%) known juvenile (< 40 mm) UTST and 34 (56.7%) known adult (≥ 40 mm) UTST and one of unknown age class.

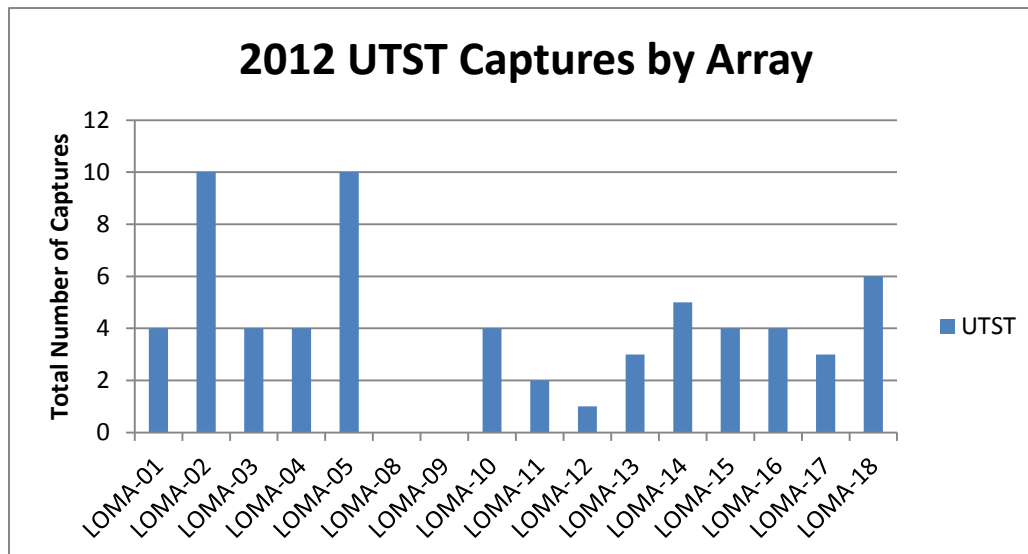


Figure 7. *U. stansburiana* captures by array during CABR 2012 herpetofauna surveys.

Adult UTST captures varied by sex with the greatest number of males captured in March and females in May through June (Fig. 8).

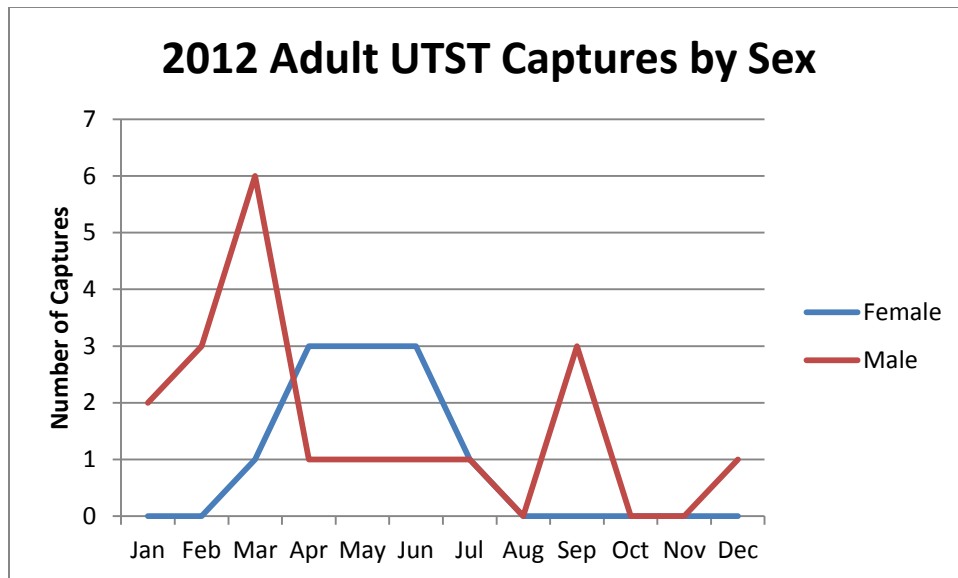


Figure 8. *U. stansburiana* monthly adult captures for 2012.

The capture rates of juvenile UTST compared to adult UTST increased in September. There were no juveniles captured January, April, May, June or December 2012. There were two captured in March 2012 (Fig. 9). Recruitment was estimated as 0.88 juveniles per adult in 2012 for UTST.

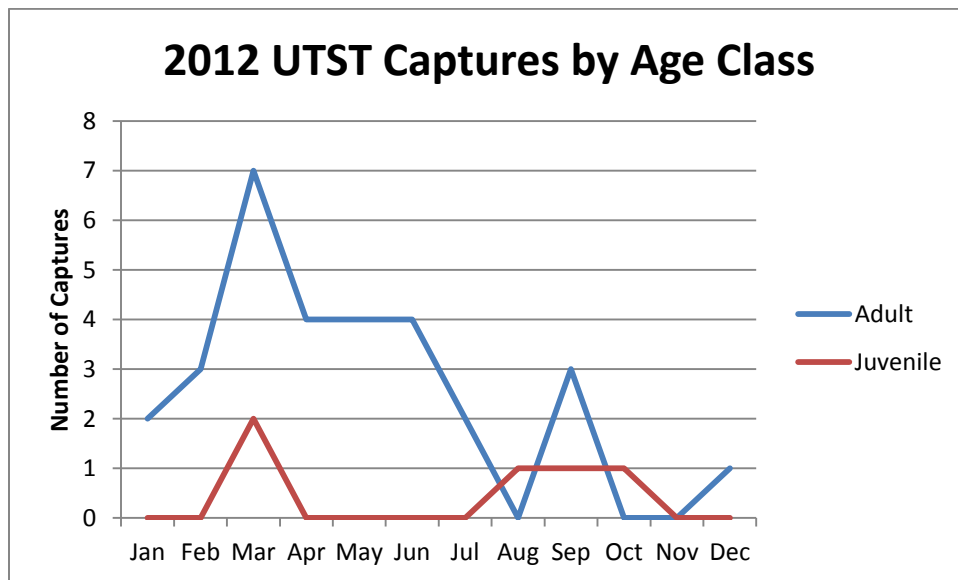


Figure 9. *U. stansburiana* monthly capture rates by age class in 2012.

***Cnemidophorus (Aspidoscelis) hyperythrus* (CNHY):** There were 16 CNHY captured in 2012. There was a sudden increase in captures in May 2012. CNHY were not detected at Arrays 2, 08, 9, 10, 11 or 12, 13, 16, 17 or 18 (Fig. 10).

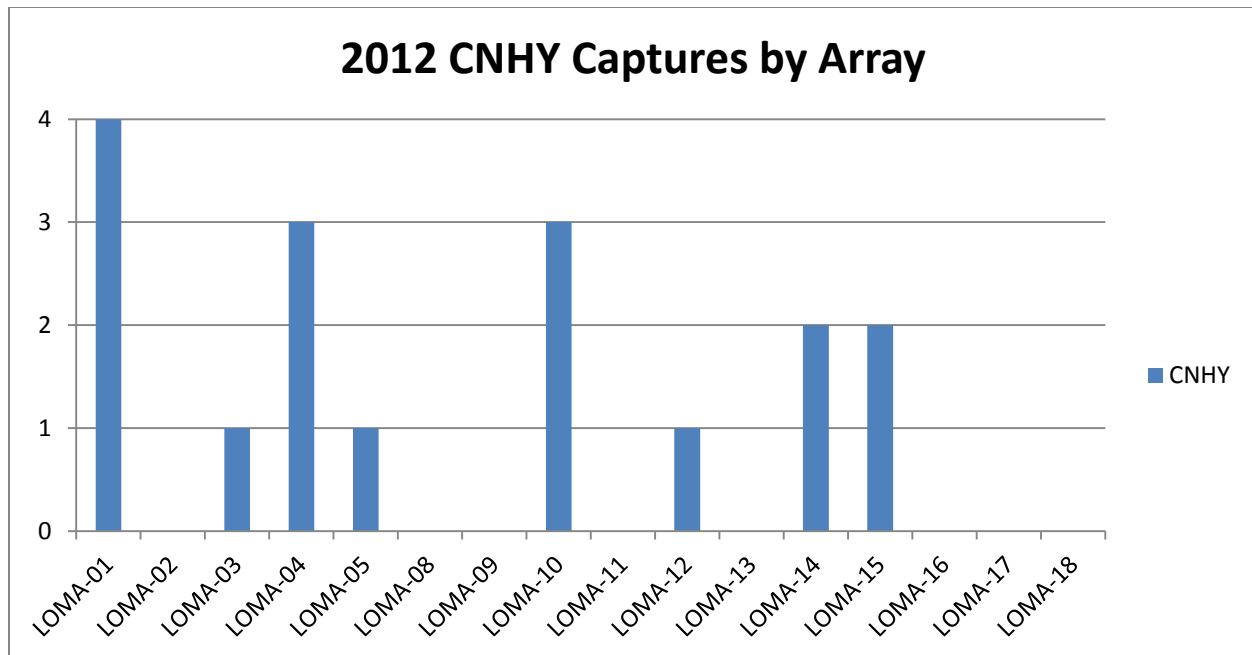


Figure 10. *A. hyperythrus* captures by array during in 2012.

Of the CNHY captured in 2012, 15 were new captures and only one had previously been captured and marked. In 2012, 13 (81.25%) of the captures were caught in pitfall traps and three (18.75%) were caught in the funnel traps. There were two juvenile CNHY captured in the traps in 2012. The age class was determined using 50 mm length as the cut-off for juvenile/adult lengths.

***E. multicaudata* (ELMU):** There were 22 ELMU captured in 2012. This species was present at 13 arrays and absent from arrays 05, 09 and 11 (Fig. 11). Of the 22 ELMU that were captured, 50% were captured in pitfall traps and 50% were captured in funnel traps. There were 20 adults captured and two juvenile captured. The juveniles were documented as such according to the markings and size. There is currently not a designated length determination for aging ELMU so this was determined in the field by the discretion of the collector. Of the 22 captures, 18 were new captures, two were recaptures from previous years and two had no data regarding their capture status.

***A. pulchra* (ANPU):** One ANPU was captured in 2012 in trap 03-3B on 14 June 2012. It measured 125 millimeters SVL and weighed 2.0 grams.

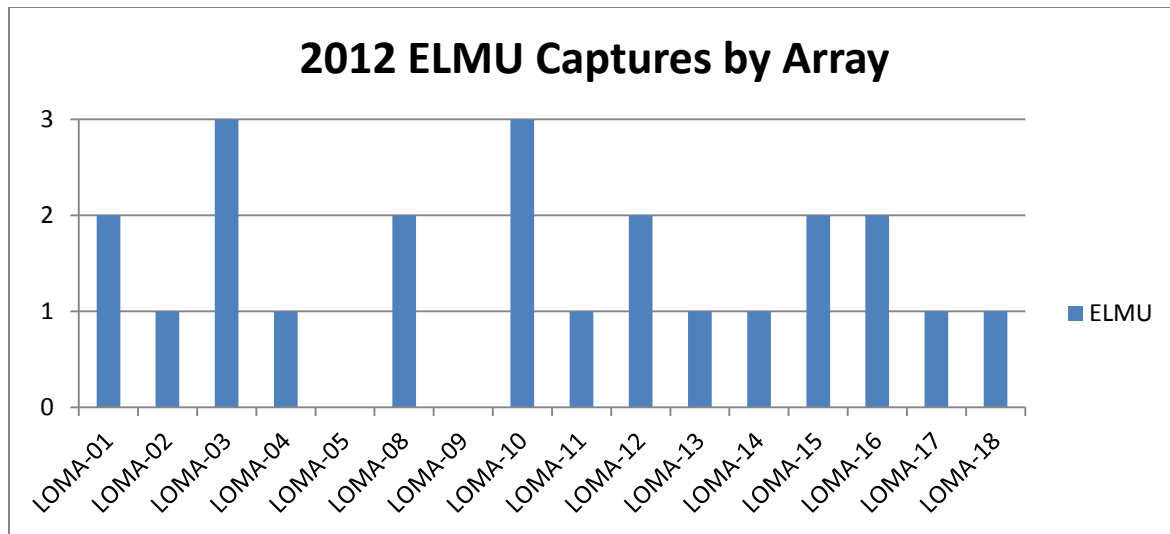


Figure 11. *E. multicarinata* captures by array in 2012.

Snakes

There were ten snakes captured in 2012 which included four snake species. Three snakes were captured in the pitfalls traps and seven were in the funnel traps (Fig. 12). The snakes were captured at arrays 3, 4, 9, 10 and 13 (Fig. 13). The captures consisted of: *Lampropeltus getula* ($n=1$), *D. punctatus* ($n=3$), *M. lateralis* ($n=5$) and *C. viridis* ($n=1$) captured in 2012. Snake species absent in 2012 were *P. melanoleucas* and *H. torquata* which had been captured during the 2011 surveys. *C. viridis* ($n=2$) and *M. lateralis* ($n=1$) were observed under coverboards in 2012, but these snakes were not captured. Other snakes that were detected at or near the arrays but not captured included *C. viridis* ($n=1$), *D. punctatus* ($n=1$) and *M. lateralis* ($n=3$).

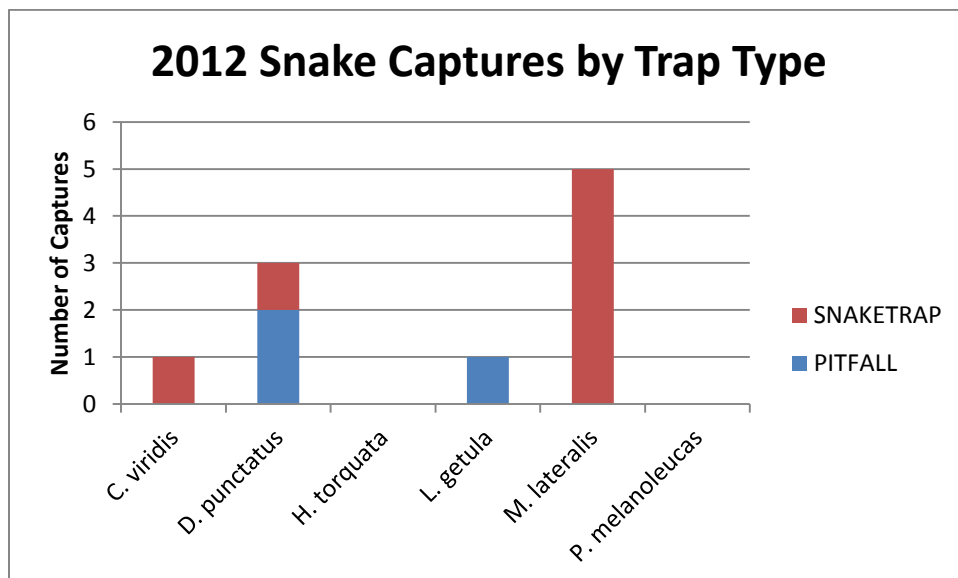


Figure 12. Snake captures and trap type in 2012.

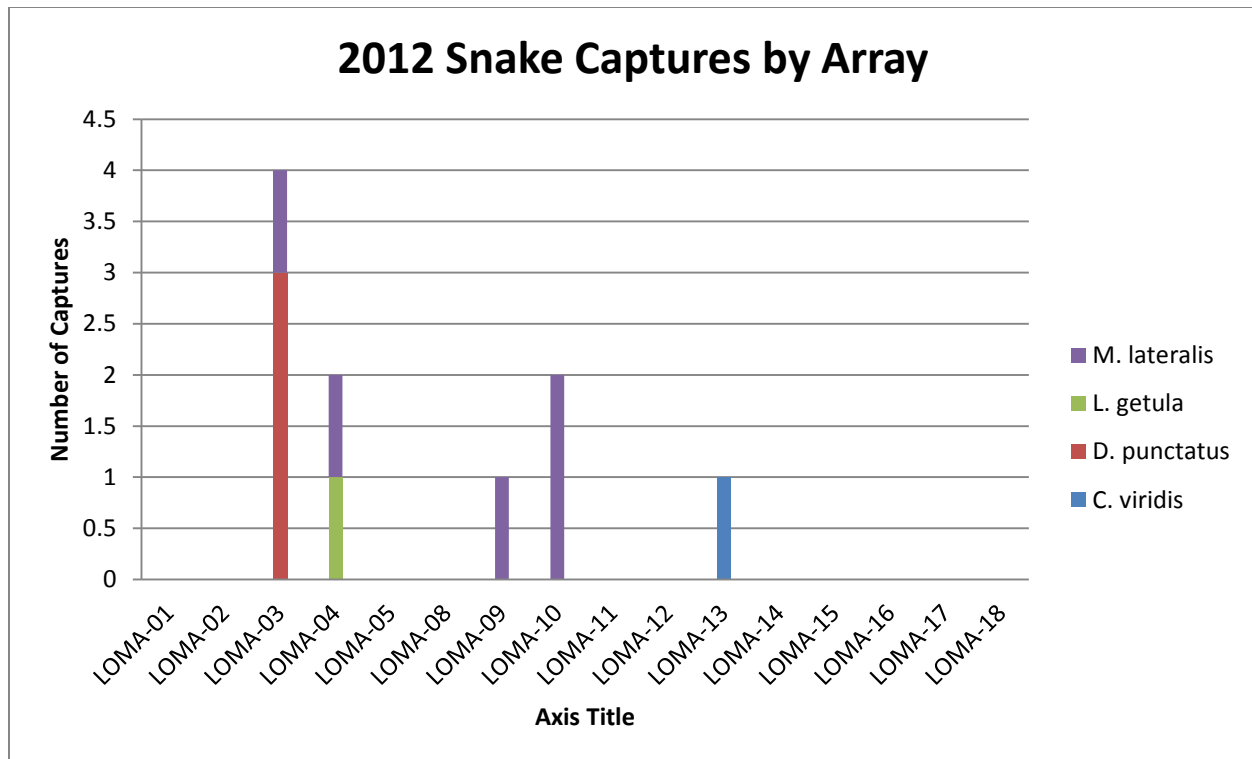


Figure 13. Snake captures by array in 2012.

Amphibian

***B. major (pacificus)* (BAPA):** There were 9 BAPA captured in 2012. These captures were seasonal with seven captured in February, one in March and one in April 2012. The location of the arrays including the surrounding vegetation and soils may play a role in salamander captures by array as 90% of the salamander captures were at arrays associated with maritime succulent scrub while the remaining 10% were in southern maritime chaparral (Fig. 14, Table 3). BAPA was captured at arrays 5, 9, 11, 12, and 16 (Fig. 15). This species was absent from arrays 1 and 2 where there were 3 detections in 2011.

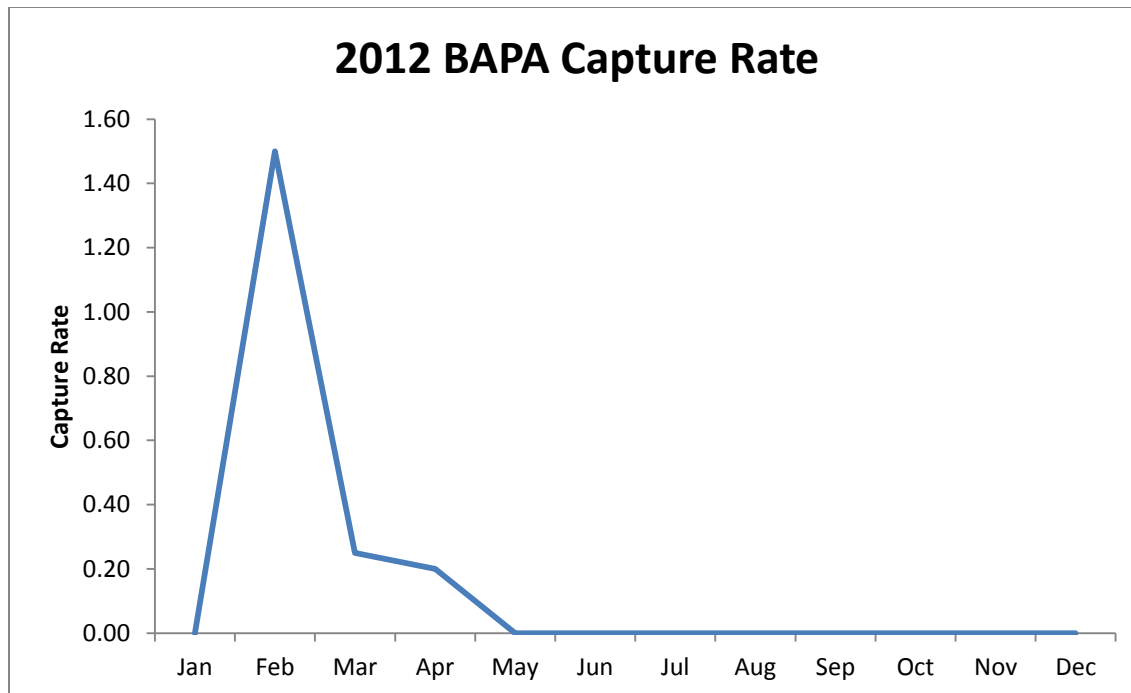


Figure 14. *B. major* capture rates in 2012.

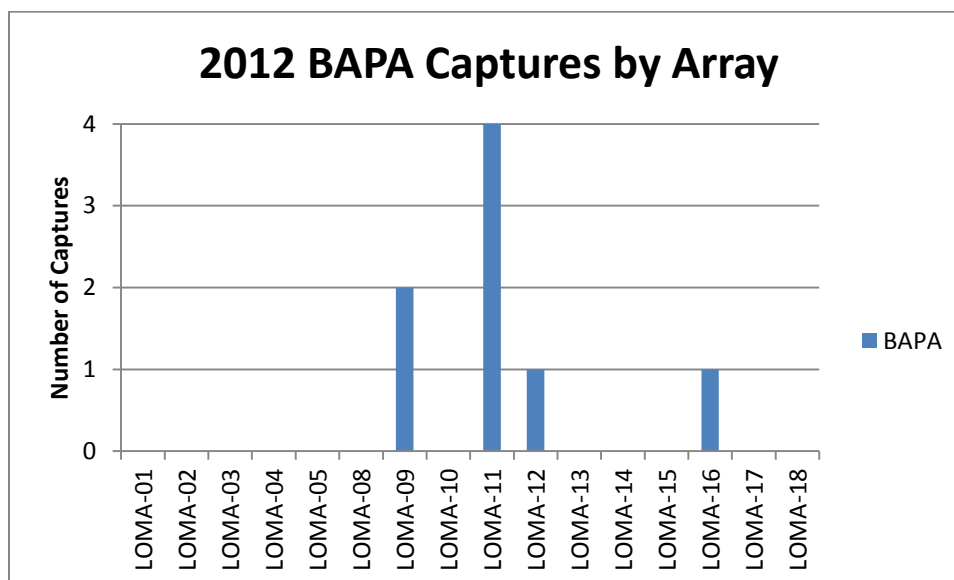


Figure 15. Arrays where *B. major* were captured in 2012.

Small mammals

***Notiosorex crawfordi* (NOCR):** There were 126 NOCR captured in the traps in 2012. All captures were in the pitfall traps. NOCR were captured during every trapping session with the most captures in April ($n=36$) (Fig. 16). NOCR was detected at all arrays except array 5 and array 18 in 2012 (Fig. 17). The mortality rate was high this year with 38.3% ($n=46$) (Fig. 18) but lower than in 2011, and decreased during the calendar year (Fig. 19). There was no information

regarding condition for seven of the NOCR. NOCR has a greater chance of surviving capture in the pitfall traps if the traps are checked early. Mortality is greater than survival by 11:00am which is the average time array 11 was visited (Fig. 20). Mortality can be reduced with use of mealworms and early morning trap checks.

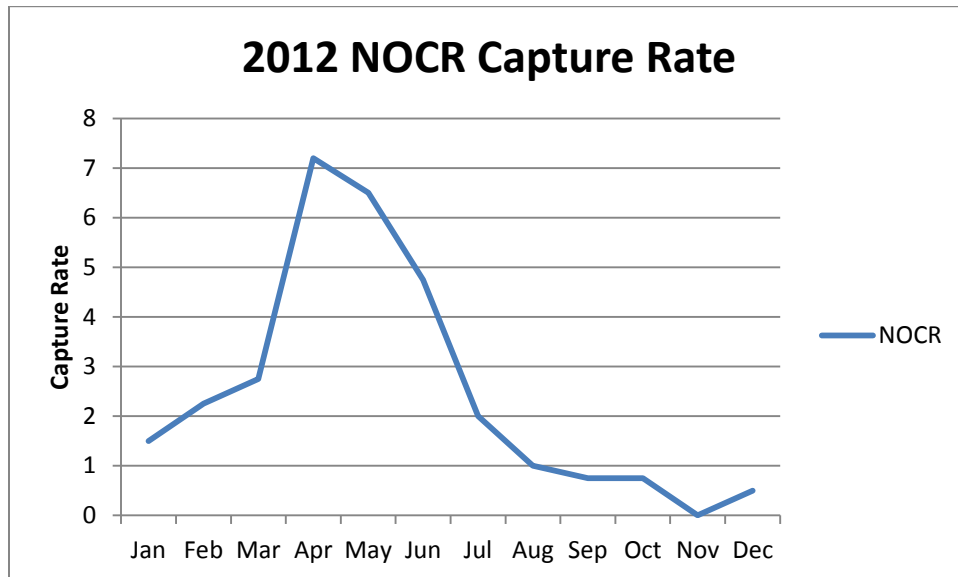


Figure 16. *N. crawfordi* capture rates by month in 2012.

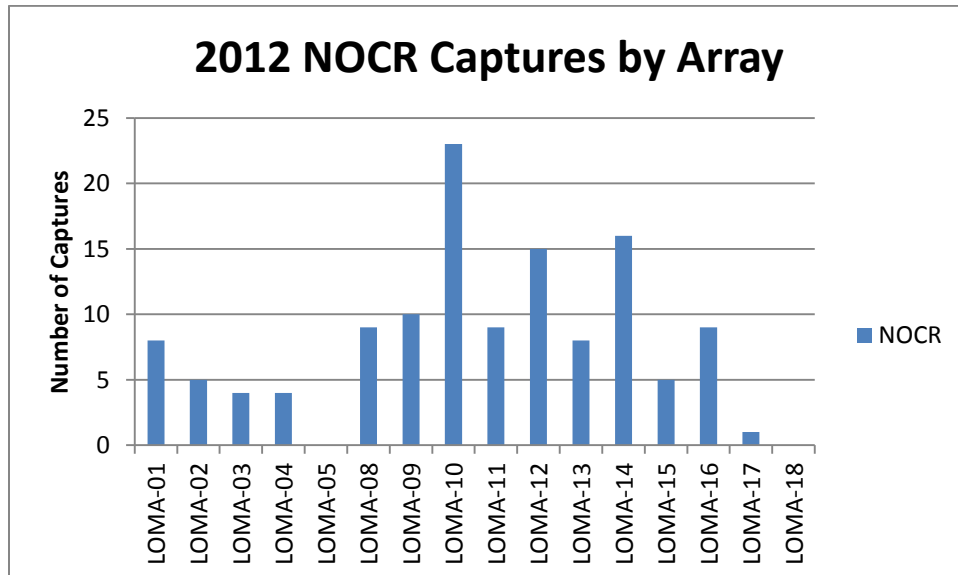


Figure 17. *N. crawfordi* captures per array in 2012.

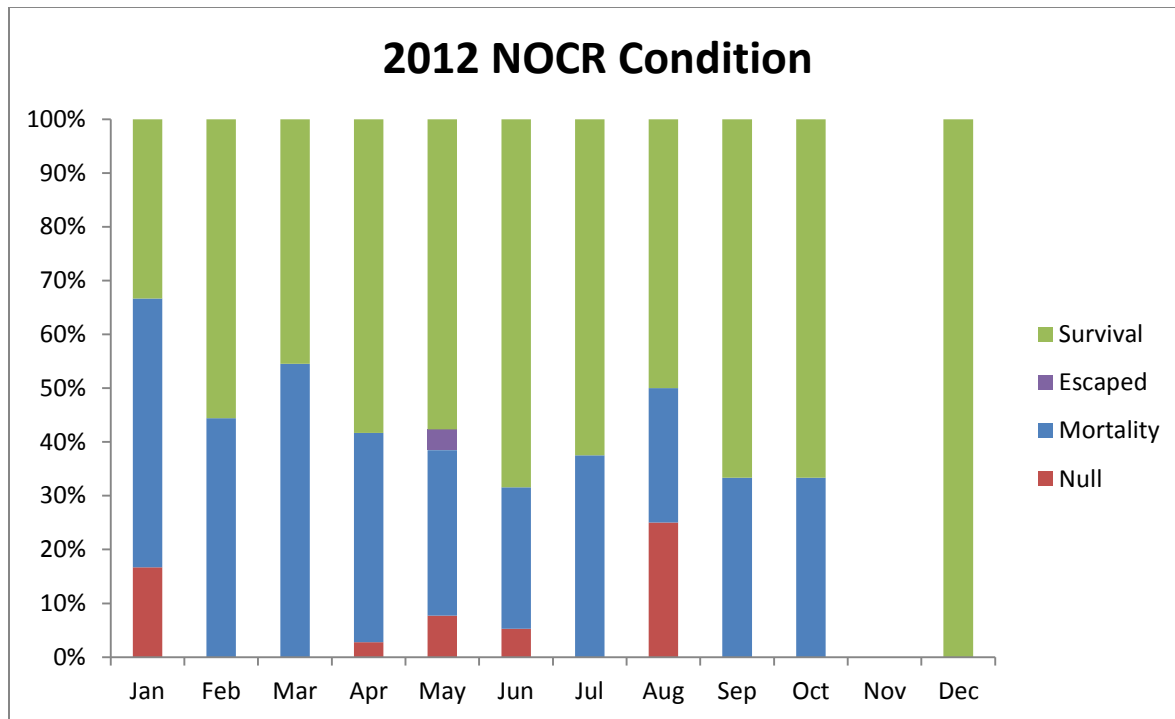


Figure 18. *N. crawfordi* condition at capture in 2012.

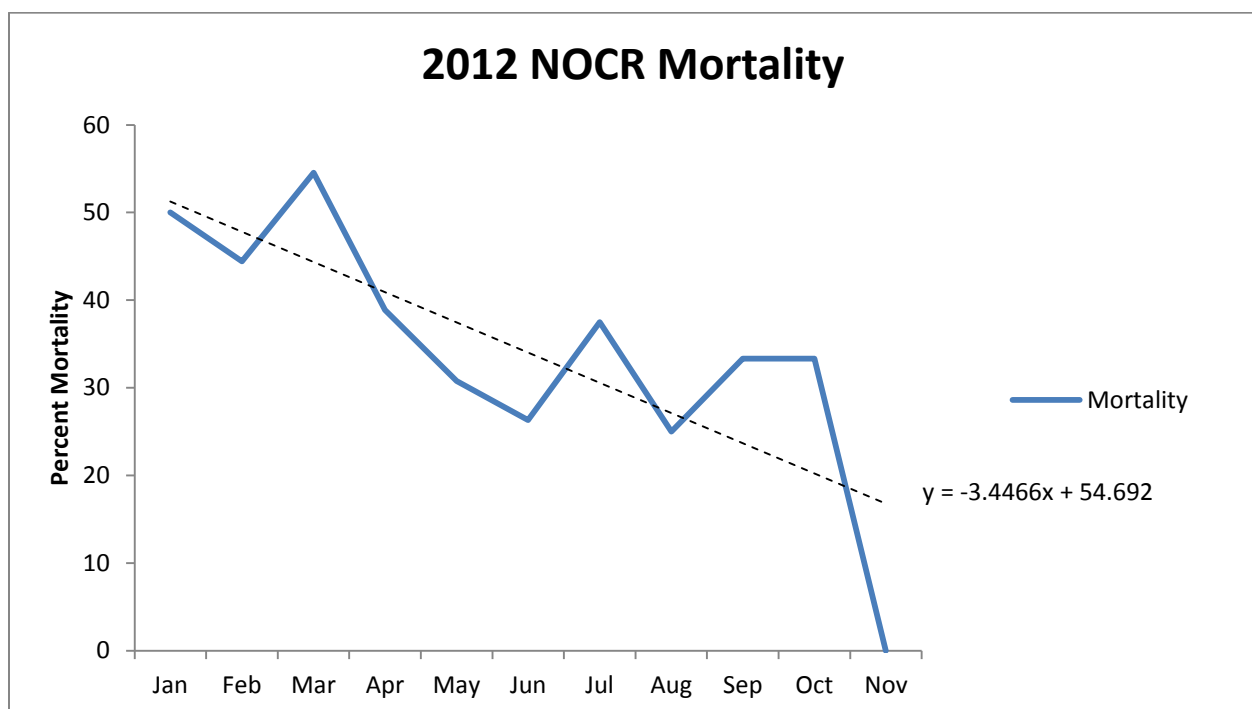


Figure 19. *N. crawfordi* mortality decreases throughout the year in 2012.

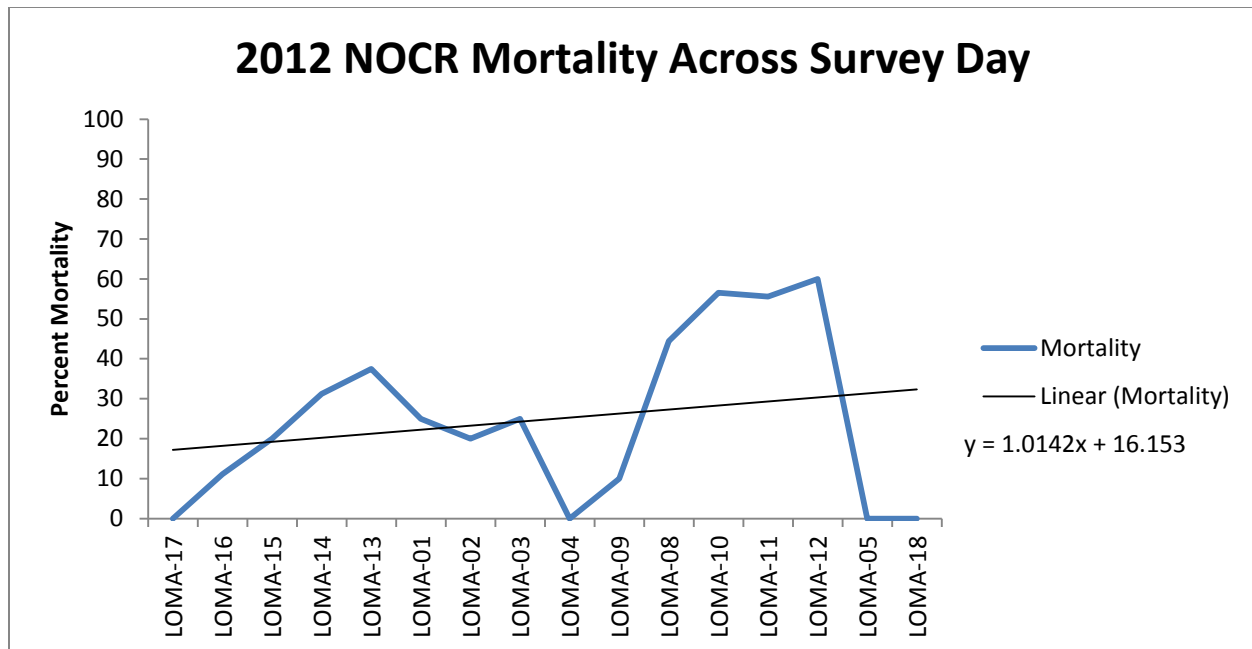


Figure 20. *N. crawfordi* mortality and survival across the survey day in order arrays were checked.

Rodents: The small mammals that were captured in the traps included *Reithrodontomys megalotis* ($n=35$), *Peromyscus eremicus* ($n=16$), *P. maniculatus* ($n=1$), *P. californicus* ($n=1$), unknown *Peromyscus* spp. ($n=4$), *Chaetodipus fallax* ($n=4$), *Mus musculus* ($n=1$) and *Neotoma lepida* ($n=1$). The mice that were not identified were noted as such. None of the rodents were marked therefore recaptures were not identified and recapture rates could not be determined. *Neotoma fuscipes* and *Microtus californicus* were not captured in 2012.

The *N. lepida* capture was a juvenile animal that was captured in a pitfall trap.

Other captures: Other animals captured in the traps included caterpillars ($n=3$), tarantula ($n=1$), centipedes ($n=7$), millipedes ($n=47$), scorpions ($n=40$), sun spiders ($n=18$), Jerusalem crickets ($n=20$), trapdoor spider species ($n=23$) and several other species such as velvet ants, unidentified grubs and unknown invertebrates. The trapdoor spiders of genus *Aptostichus* were documented as *Aptostichus* spp. in the notes. There was one capture of California trapdoor spiders (*Bothriocyrtum californicum*) in 2012.

A federally endangered annual plant, *Corisanthe orcuttiana*, was detected at Array 18 in November of 2011. No surveys were performed from the day of detection through June of 2012 to allow the plants to come to seed. Array 10 had a high infestation of Argentine ants (*Linepithema humile*) which forced closure of many of the traps at that array throughout the year. These traps typically experience the greatest ant infestation during summer months.

Temperature: The temperature varied with the maximum and minimum temperatures between 1.17 ° C at Array 5 in March and 55.97 ° C at Array 15 in July. In March 2012, the HOBO at Array 5 read 49.02 from 0915 to 1005 on 9 March 2012. These extreme temperatures could be due to effects of the sunrise and the aspect of the HOBO logger. In August and September, the HOBO at Array 5 did not record data. There were no temperature data for December.

Precipitation: The annual rainfall as reported from the Western Regional Climate Center was 6.64 inches of rain for 2012. Zero precipitation was recorded June-September 2012 with December having the greatest amount of precipitation at 2.19 inches of rain. Total precipitation in 2012 was 3.49 inches less than the average for 1914-2012

Table 1. Herptile and small mammal captures in 2012.

Scientific Name	Species Code	Common Name	Number of Captures
Amphibian			
<i>Batrachoseps major</i>	BAPA	Pacific Garden slender salamander	9
Reptiles			
<i>Anniella pulchra</i>	ANPU	Legless lizard	1
<i>Cnemidophorus hyperythrus</i>	CNHY	Orange-throated whiptail	16
<i>Elgaria multicarinata</i>	ELMU	Southern alligator lizard	22
<i>Sceloporus occidentalis</i>	SCOC	Western fence lizard	159
<i>Uta stansburiana</i>	UTST	Side-blotched lizard	62
<i>Crotalus viridis</i>	CRVI	Southern Pacific rattlesnake	1
<i>Diadophis punctatus</i>	DIPU	Ring-necked snake	3
<i>Hypsiglena torquata</i>	HYTO	Night snake	0
<i>Lampropeltis getula</i>	LAGE	California kingsnake	1
<i>Masticophis lateralis</i>	MALA	Striped racer	5
<i>Pituophis catenifer</i>	PIME	Gopher snake	0
Mammals			
<i>Notiosorex crawfordi</i>	NOCR	Desert shrew	127
<i>Chaetodipus fallax</i>	CHFA	San Diego pocketmouse	4
<i>Microtus californicus</i>	MICA	California vole	0
<i>Peromyscus californicus</i>	PECA	California mouse	1
<i>Peromyscus eremicus</i>	PEER	Cactus mouse	16
<i>Peromyscus maniculatus</i>	PEMA	Deer mouse	1
<i>Peromyscus species</i>	PESP	<i>Peromyscus species</i>	4
<i>Reithrodontomys megalotis</i>	REME	Western harvest mouse	35
<i>Neotoma lepida</i>	NELE	Desert wood rat	1
<i>Neotoma fuscipes</i>	NEFU	Dusky-footed wood rat	0

Table 2. Dates and start times for trapping sessions in 2012.

2012 Trapping Session	Date Opened	Date Closed	Survey Start Time	Number of trap nights
1 (Jan)	9 Jan 2012	13 Jan 2012	07:30	4
2 (Feb)	6 Feb 2012	10 Feb 2012	07:30	4
3 (Mar)	5 Mar 2012	9 Mar 2012	07:30	4
4 (Apr)	9 Apr 2012	10 Apr 2012	07:30	
	16 Apr 2012	19 Apr 2012		4
5 (May)	21 May 2012	25 May 2012	07:30	4
6 (Jun)	11 Jun 2012	15 Jun 2012	07:30	4
7 (Jul)	16 Jun 2012	20 Jul 2012	07:30	4
8 (Aug)	13 Aug 2012	17 Aug 2012	06:30	4
9 (Sep)	10 Sep 2012	14 Sep 2012	06:30	4
10 (Oct)	15 Oct 2012	19 Oct 2012	07:00	4
11 (Dec)	5 Dec 2012	7 Dec 2012	07:00	2
TOTAL # Trap Nights				42

Table 3. 2012 Cabrillo herpetofauna array information. MSS: maritime succulent scrub, DIS: disturbed, SMC: southern maritime chaparral.

Site Name	Habitat	UTM Easting	UTM Northing	Elevation (m)	Order Checked
LOMA-01	MSS	476784	3616177	26	6
LOMA-02	MSS	477081	3614952	22	7
LOMA-03	MSS	477296	3614404	22	8
LOMA-04	MSS	477280	3614528	33	9
LOMA-05	SMC	477224	3617604	83	15
LOMA-08	MSS	476247	3618441	33	11
LOMA-09	MSS	477117	3615177	42	10
LOMA-10	DIS	476221	3618694	35	12
LOMA-11	MSS	476808	3616292	37	13
LOMA-12	MSS	476769	3616260	31	14
LOMA-13	MSS	477389	3614716	109	5
LOMA-14	MSS	477375	3614750	113	4
LOMA-15	MSS	477677	3614610	54	3
LOMA-16	MSS	477682	3614669	55	2
LOMA-17	MSS	477735	3615295	37	1
LOMA-18	SMC	477241	3617695	75	16

Discussion

The results of the 2012 herpetofauna surveys at Cabrillo National Monument yielded captures of ten out of 12 known herptile species of the Point Loma Peninsula. The herptile species not detected this year were *Pituophis catenifer* and *Hypsiglena torquata*. Both of these species were detected during the 2011 herpetofauna surveys. *H. torquata* is a relatively uncommon snake and has only been captured 4 times since 1995. *P. catenifer* was not detected during the 2012 herpetofauna surveys but had been detected within the park by staff and visitors. This species has been captured in the traps only ten times since 1995. There is also concern regarding *C. hyperythrus*; there were only two juveniles captured in 2012 and this year yielded the lowest number of captures of that species. Since this is a state species of special concern, future management should consider focusing on the orange-throated whiptail and habitat. Regional trends should also be compared to determine potential population changes across its range.

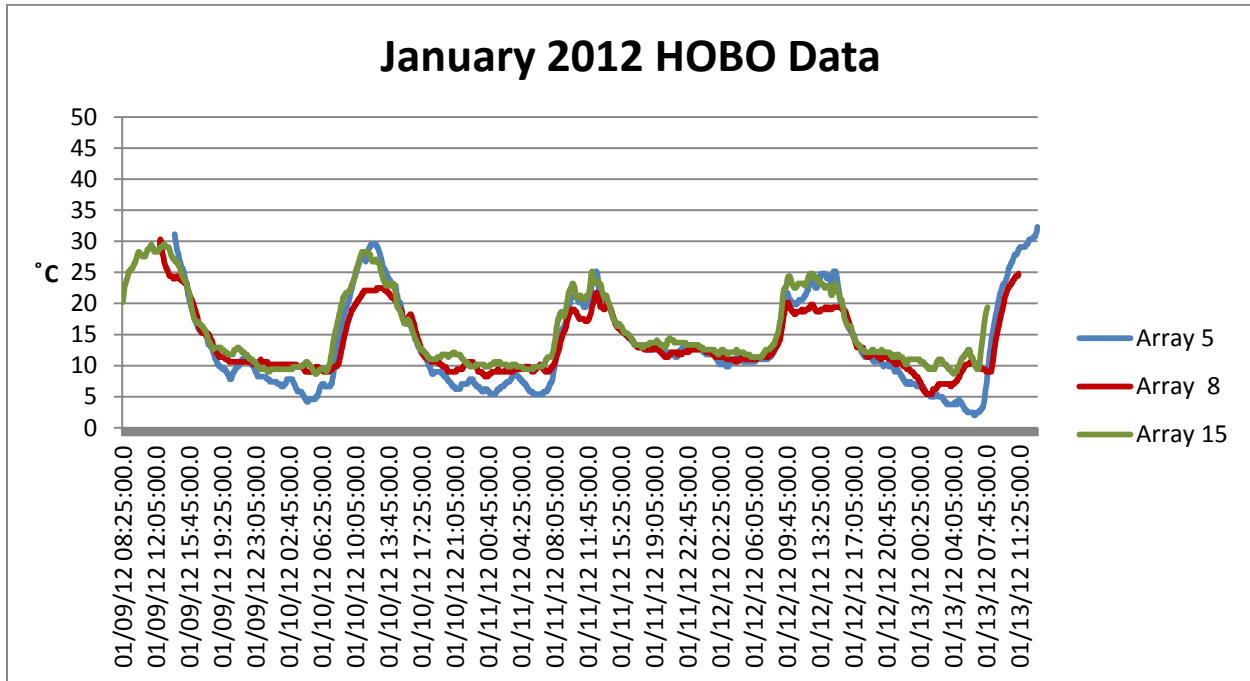
Of the small mammals, *Microtus californicus*, *Neotoma lepida* and *Peromyscus californicus* were not captured in the traps; *N. lepida* and *P. californicus* but had been detected in 2011 or subsequent years. *M. californicus* has not been captured nor detected since 2007 according to records.

Literature Cited

- Atkinson, A. J., R. N. Fisher, C. J. Rochester, and C. W. Brown. 2003. Sampling design optimization and establishment of baselines for herpetofauna arrays at the Point Loma Ecological Reserve. Page 44 in W. E. R. Center, editor.
- Busteed, G., J. L. Cameron, M. Robertson, S. P. D. Riley, L. Lee, A. Compton, E. Berbeo, and T. Duffield. 2006. Monitoring of Terrestrial Reptiles & Amphibians in the Mediterranean Coast Network: Santa Monica Mountains & Cabrillo National Monument, Version 1.0.
- Busteed, G. T. 2003. Effects of habitat fragmentation on reptiles and amphibians in coastal sage scrub and grassland communities. California State University, Northridge, Northridge, CA.
- Delaney KS, Riley SPD, Fisher RN (2010) A Rapid, Strong, and Convergent Genetic Response to Urban Habitat Fragmentation in Four Divergent and Widespread Vertebrates. PLoS ONE 5(9): e12767. doi:10.1371/journal.pone.0012767
- Fisher, R. N., and T. J. Case. 2000b. Southern California herpetofauna research and monitoring: 1995-1999 data summation report in S. California Fish & Game, and C. U.S. Fish & Wildlife Service, editors.
- Fisher, R. N., Stokes, D. C., C. J. Rochester, and T. J. Case. 2008 (Update). Herpetological monitoring using pitfall trapping design in southern California. Page 54. USGS.

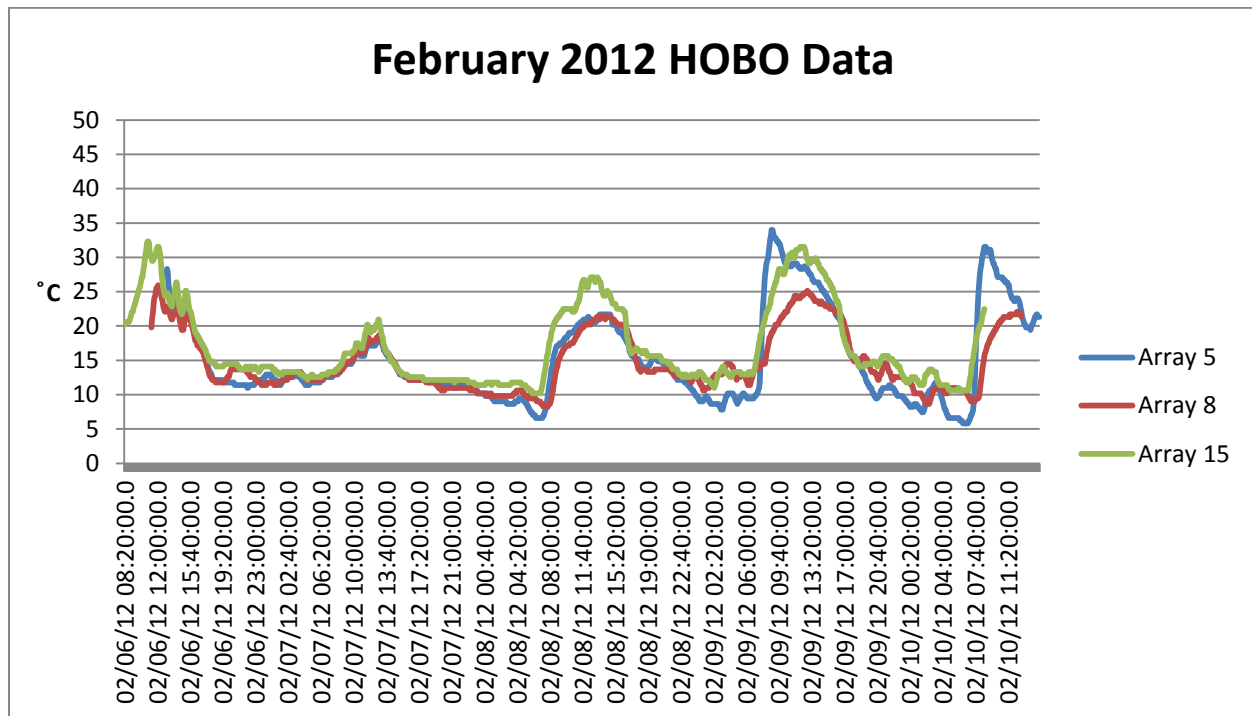
Appendix A: 2012 HOBO Data

January 2012



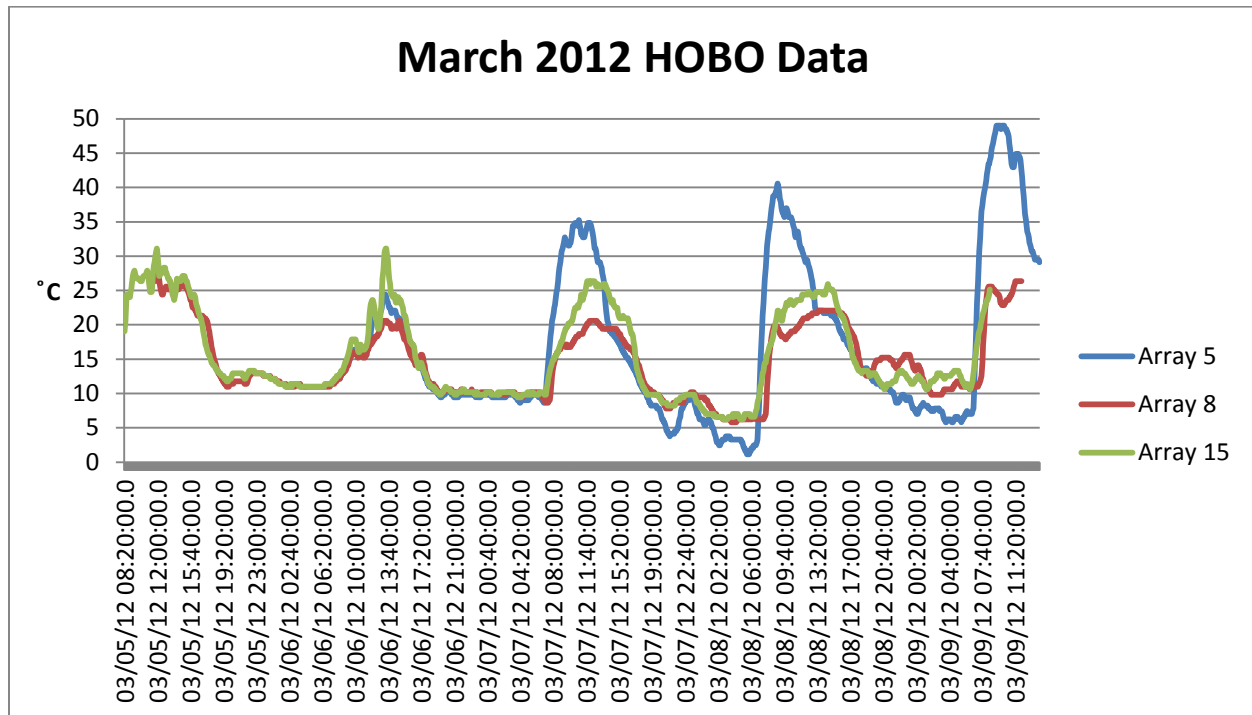
Jan 2012	Array 5	Array 8	Array 15
max	29.5	32.34	30.31
min	8.63	2.03	5.4
mean	15.43	13.34	13.52

February 2012



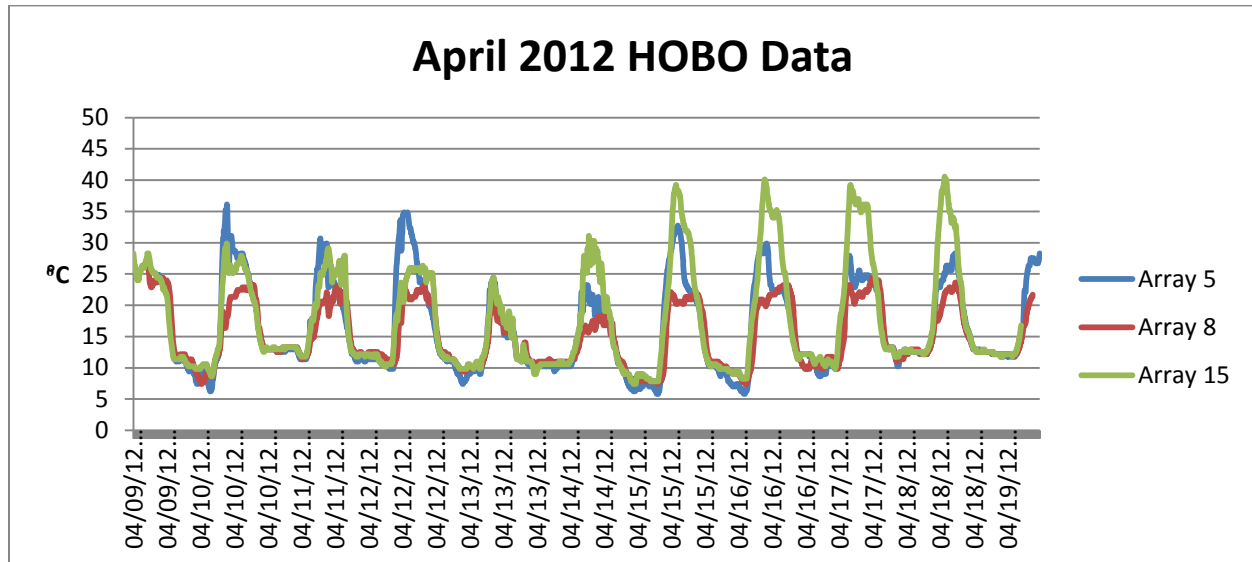
Feb 2012	Array 5	Array 8	Array 15
max	34.01	25.95	32.34
min	5.81	8.23	10.21
average	15.13	14.80	16.85

March 2012



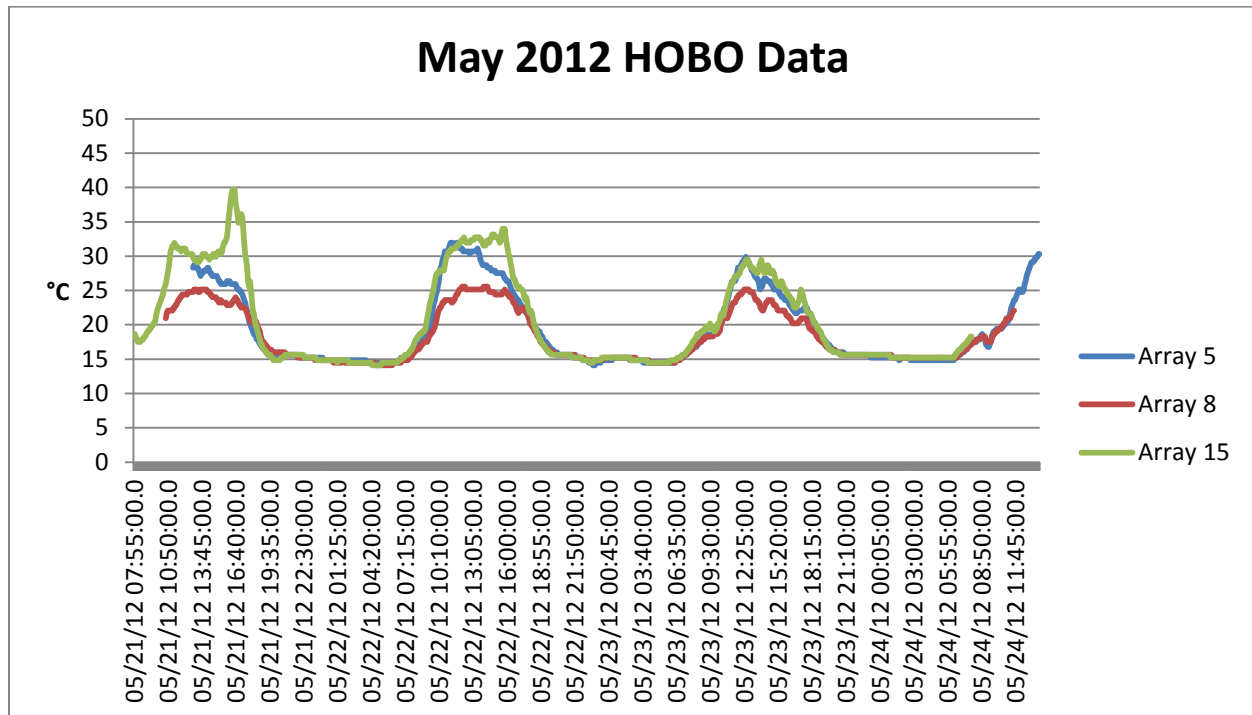
Mar 2012	Array 5	Array 8	Array 15
max	49.02	28.70	31.12
min	1.17	5.81	6.22
average	17.04	14.50	15.47

April 2012



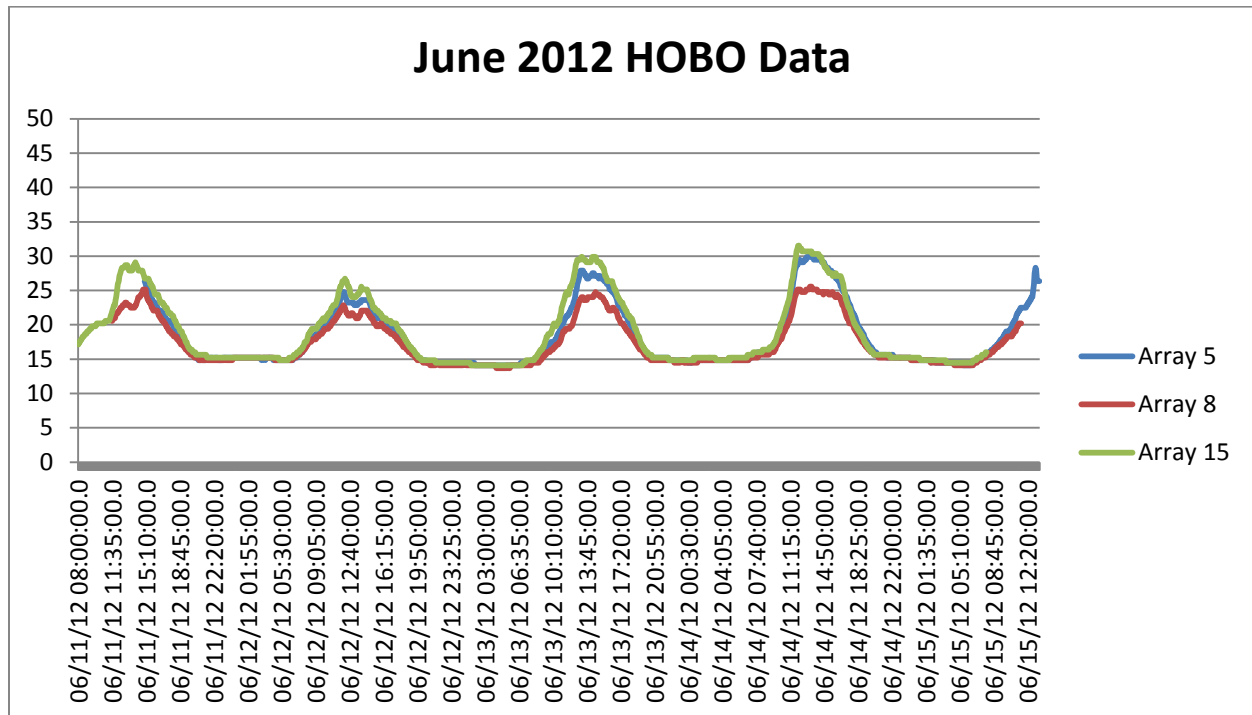
Apr 2012	Array 5	Array 8	Array 15
max	36.13	25.95	40.59
min	5.81	7.43	7.43
average	16.22	15.06	17.55

May 2012



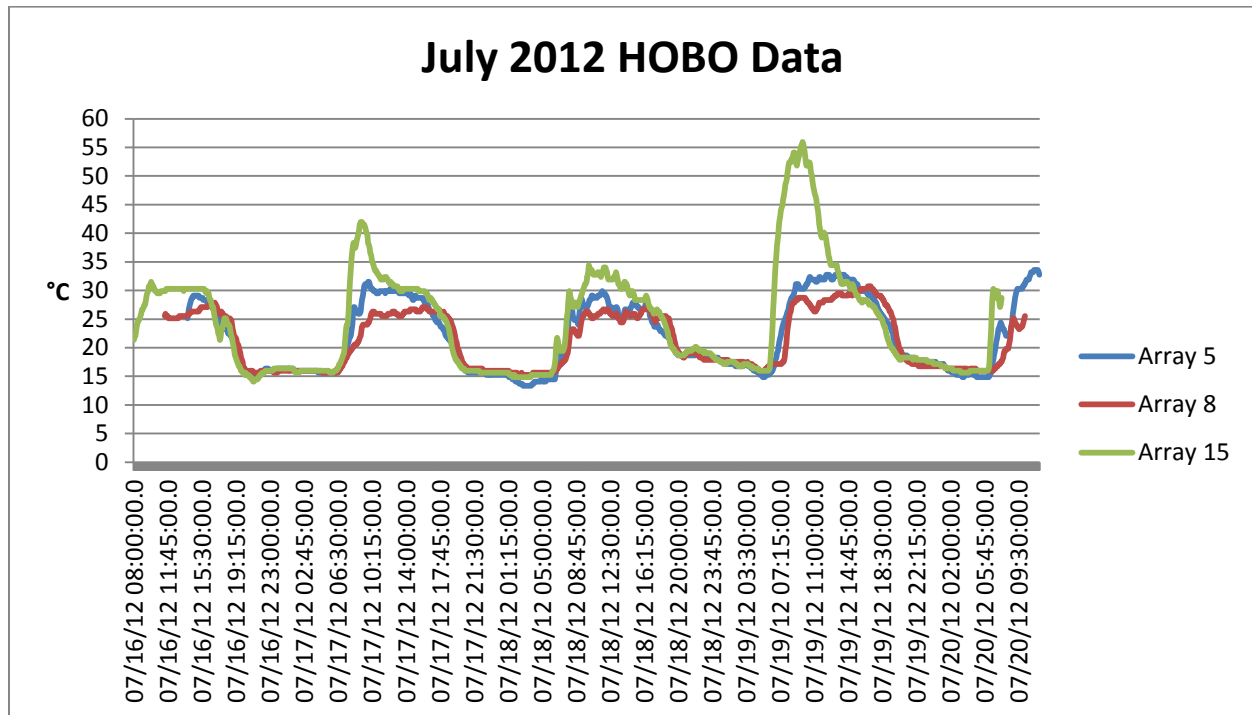
May 2012	Array 5	Array 8	Array 15
max	31.93	25.56	39.67
min	14.09	14.09	14.09
average	19.35	18.33	20.40

June 2012



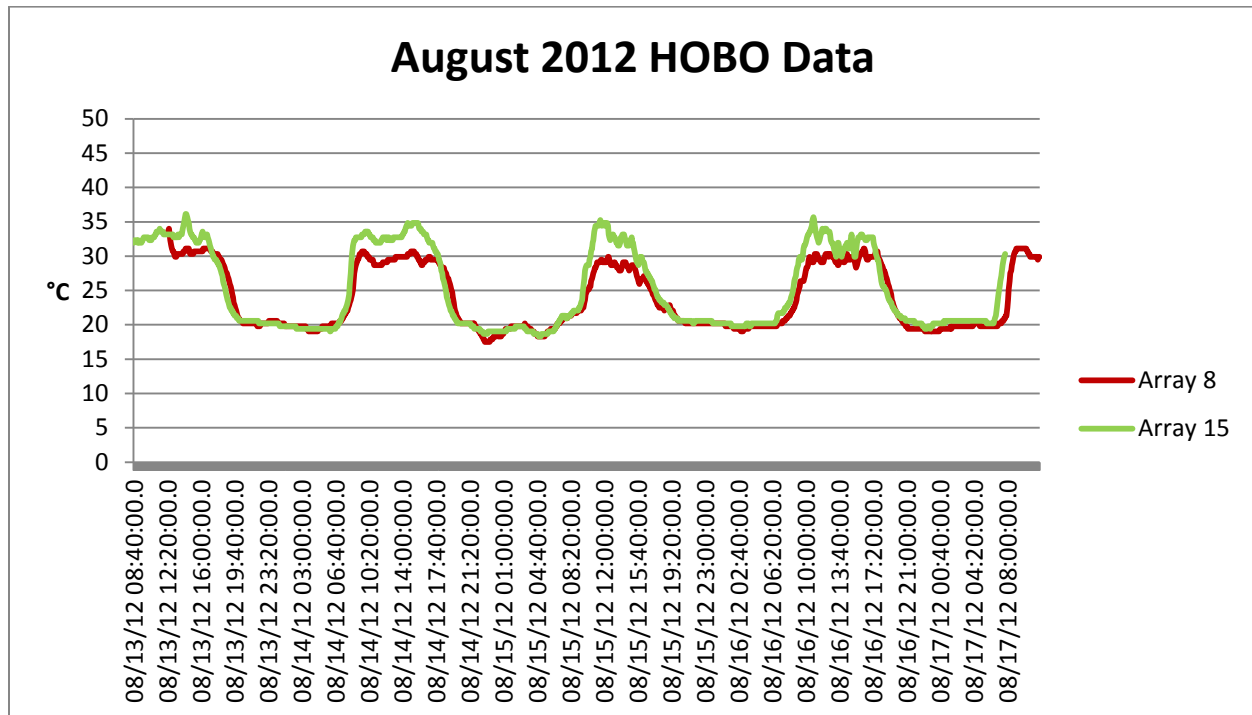
Jun 2012	Array 5	Array 8	Array 15
max	29.9	25.56	31.52
min	14.09	13.70	14.09
average	18.16	17.37	18.89

July 2012



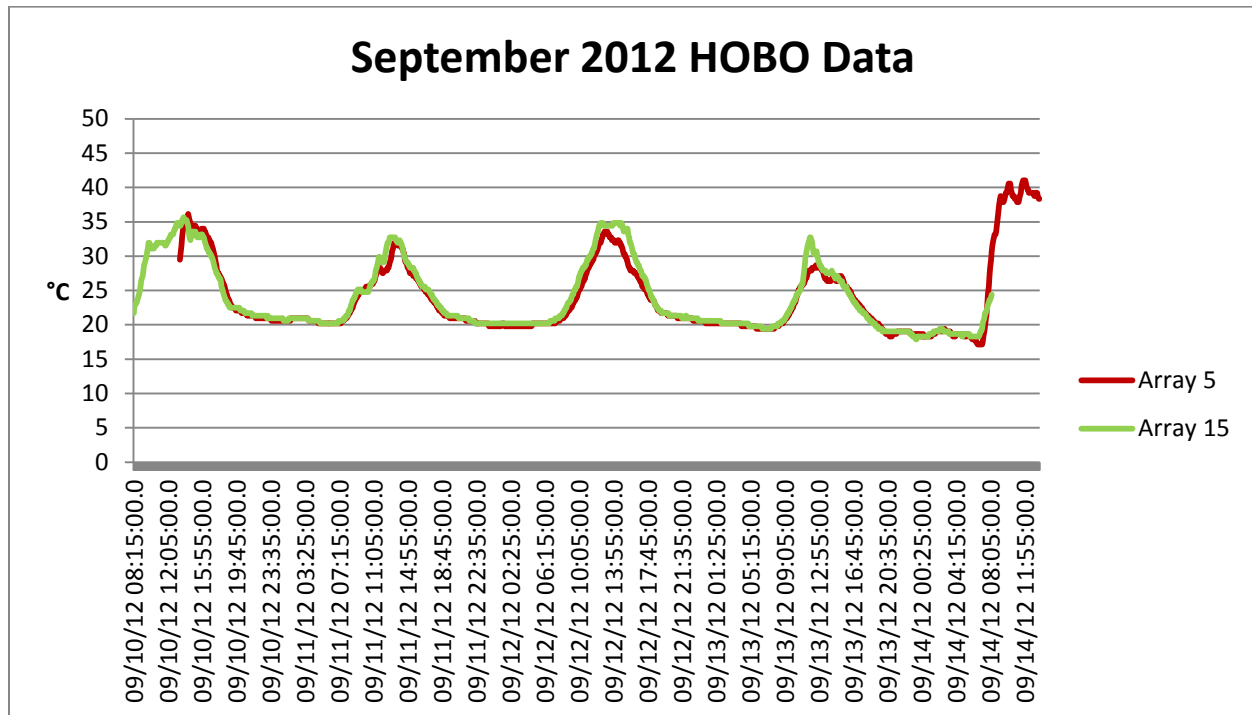
Jul 2012	Array 5	Array 8	Array 15
max	33.59	30.71	55.97
min	13.32	15.23	14.09
average	21.97	21.25	24.33

August 2012



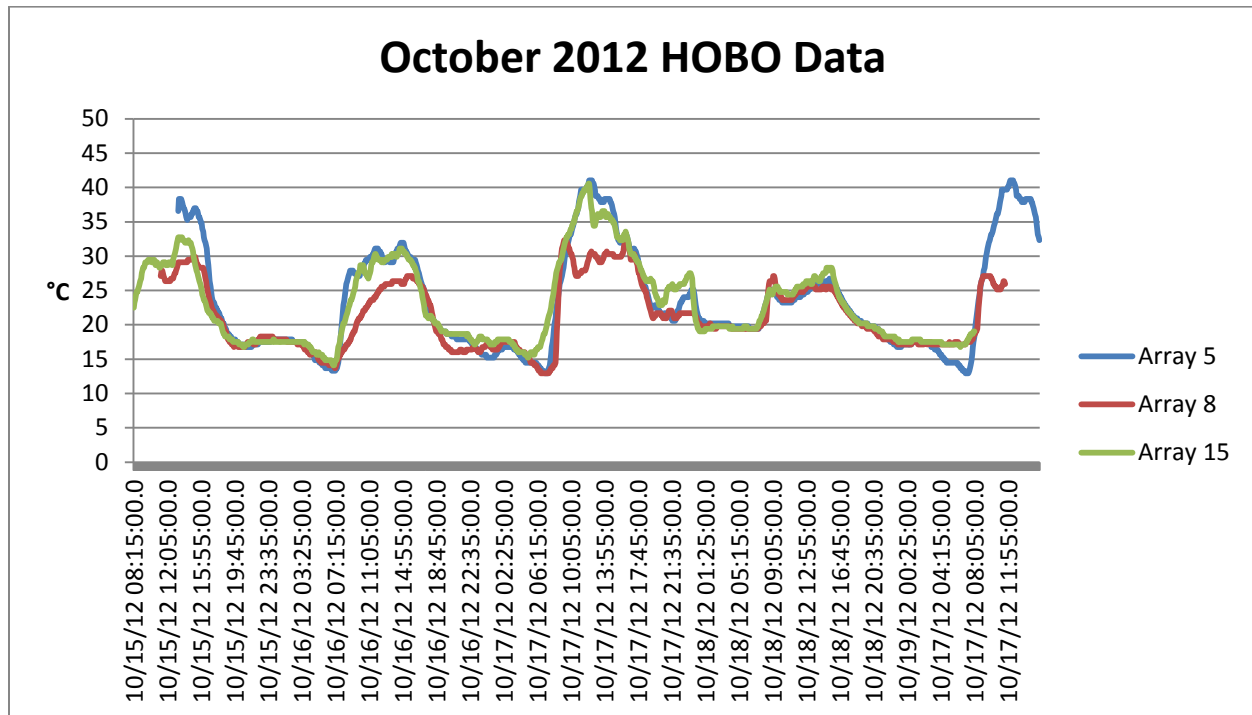
Aug 2012	Array 8	Array 15
max	34.01	36.13
min	17.52	18.28
average	23.85	25.13

September 2012



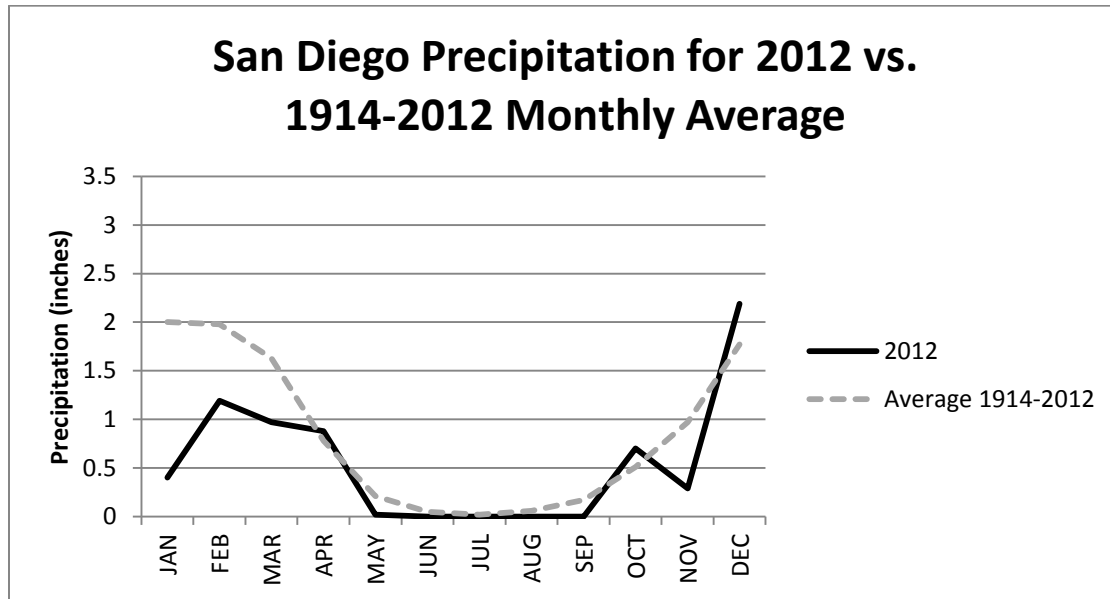
Sept 2012		
	Array 5	Array 15
max	41.05	35.70
min	17.14	17.90
average	23.84	23.75

October 2012



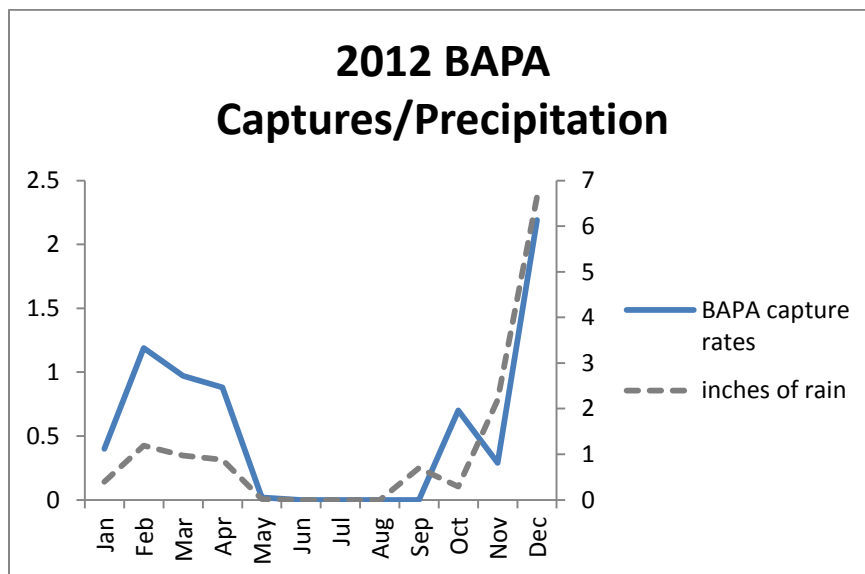
Oct 2012	Array 5	Array 8	Array 15
max	41.05	32.34	40.59
min	12.93	12.93	14.09
average	23.36	21.28	22.90

Appendix B: 2012 Precipitation Data



Precipitation data from Western Regional Climate Center (<http://www.wrcc.dri.edu/>).

The weather station used was San Diego WSO Airport located at lat 32°44', long 117°10' at the elevation of 3 feet above sea level.



Batrachoseps pacificus captures and annual precipitation in inches during 2012 herpetofauna surveys.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 342/126857, October 2014

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

EXPERIENCE YOUR AMERICA™