Biodiversity Surveys for Santa Catalina Island: Reptiles, Amphibians, Ants, and Small Mammals

Adam R. Backlin, Robert N. Fisher, Sara L. Schuster, and Carlton J. Rochester

USGS-WERC San Diego Field Station

Background

In 1995, USGS began an intensive study of the herpetofauna of southern California

Currently includes:

- 68 sites
- 961 arrays
  - 6,727 buckets
  - 2,883 snake traps
  - 43.25 km of fencing

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Background

- In 2002, the Catalina Island Conservancy (CIC) commissioned USGS to develop an infrastructure to survey for reptiles, amphibians, ants, and small mammals.

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Objectives

- Review historic records of reptiles and amphibians.
- Conduct a biological inventory of the reptile, amphibian, small mammals and ants including:
  - Establishment of long-term monitoring stations for reptiles, amphibians, small mammals, and ants.
  - Identify locations or presence of rare species.
    - Santa Catalina shrew, the two-striped garter snake, arboreal salamander, California mountain kingsnake, etc.

Sampling Design

- **Standardized pitfall array design**
  - Reptiles, amphibians, and small mammals
    - 20 pitfall arrays
      - 7 five gallon buckets/array
      - 3 snake traps (funnel traps)/array
      - 3 arms connected by shade cloth/array
    - Arrays sampled in 4 day sampling periods, 32 times for a total of 128 sampling days between February 2002 and December 2004.
  - Ants
    - Integrated within each of the 20 pitfall arrays.
      - 5, 50mL pitfall traps/array
    - Ants sampled in 10 day sampling periods, 2 times per year for a total of 60 sampling days between February 2002 and December 2004.

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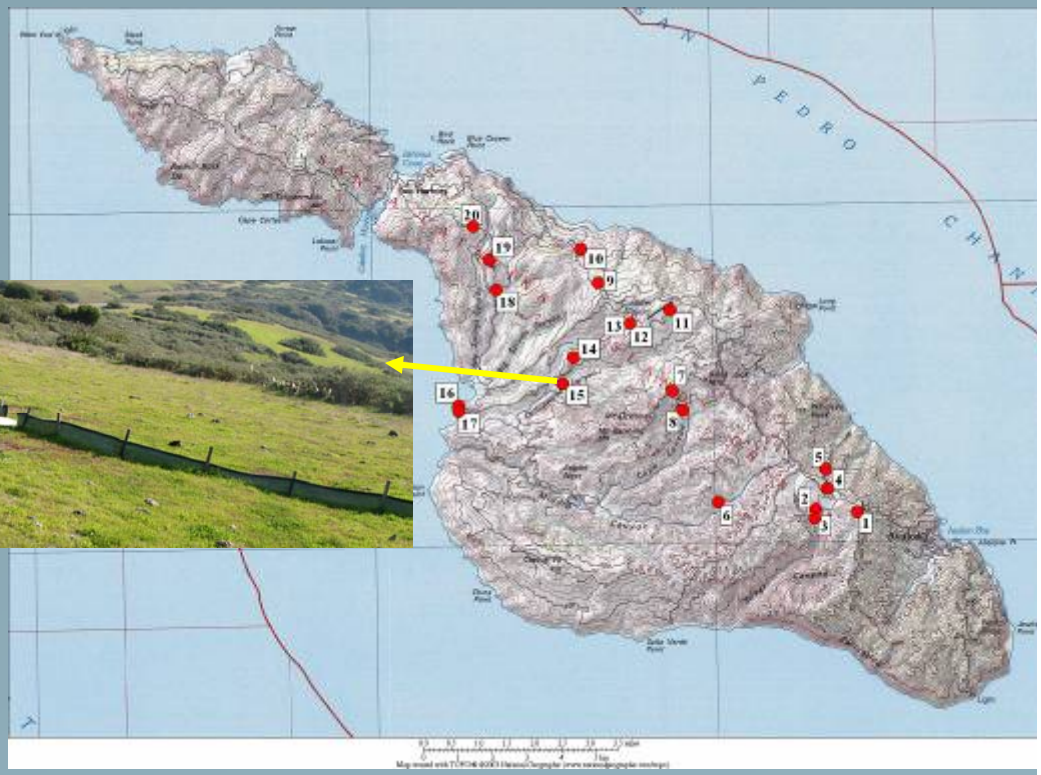
Sampling Design



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Sampling Design

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Sampling Design

3 snake traps
per array

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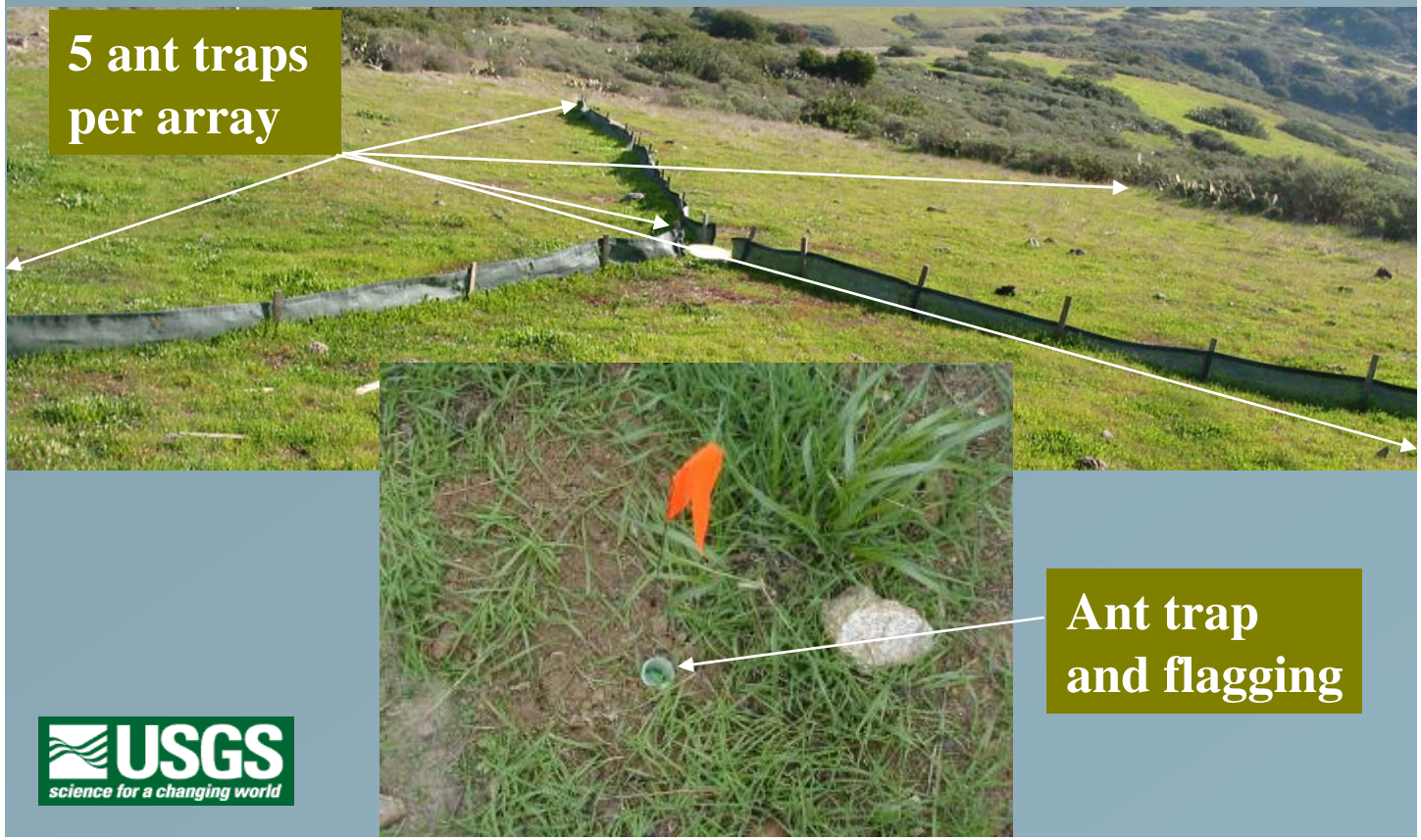
Sampling Design



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Results - Historic Records

- **Searched 3 museums and found 1219 records of reptiles and amphibians from Santa Catalina Island.**
  - LACM, CAS, MVZ

Common Name	Scientific Name	Location																									Total Captures	Total Locations
Herpetofauna		Airport	Avalon	Ben Weston Beach	Big Springs Canyon	Black Jack Mnt.	Cabrillo Harbor	Camp Cactus	Deer Valley Reservoir	Echo Lake	Emerald Bay	Fisherman Cove	Fourth of July Cove	Gallagher Beach	Hayress Reservior	Howland Landing	Johnsons Landing	Little Harbor	Middle Canyon	Renton Mine	Santa Catalina Island	Silver Canyon	Toyon Bay	Two Harbors	Whites Cove	Willow Canyon		
arboreal salamander	*Aneides lugubris*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1
garden slender salamander	*Batrachoseps major*	0	57	0	1	4	0	0	9	6	0	28	3	0	0	4	62	10	47	0	82	0	10	74	7	0	404	15
bullfrog	*Rana catesbeiana*	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	1
Pacific treefrog	*Pseudacris regilla*	0	81	0	9	0	0	0	0	2	12	0	0	0	0	4	26	2	7	0	15	0	0	24	2	0	184	11
side-blotched lizard	*Uta stansburiana*	0	115	2	6	2	0	0	0	6	0	4	0	24	0	12	83	16	40	0	49	4	0	37	22	0	422	15
southern alligator lizard	*Elgaria multicarinatus*	1	18	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	70	2	2	5	8	12	122	11
western skink	*Eumeces skiltonianus*	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	0	0	0	0	13	5
common kingsnake	*Lampropeltis getulus*	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	4	0	0	1	0	0	12	5
gopher snake	*Pituophis catenifer*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	0	0	7	2
southern Pacific rattlesnake	*Crotalus viridis*	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	32	0	0	0	0	0	39	4
two-striped garter snake	*Thamnophis hammondii*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	2
western ringneck snake	*Diadophis punctatus*	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	2	0	0	10	2
Total # of Individuals		2	287	3	16	6	1	1	9	14	12	32	3	24	2	20	179	28	102	1	259	10	12	145	39	12	1219	
Total # of Species		2	8	2	3	2	1	1	1	3	1	2	1	1	1	3	4	3	7	1	10	3	2	6	4	1	73 [1]	
Percent of records at each location		0%	24%	0%	1%	0%	0%	0%	1%	1%	1%	3%	0%	2%	0%	2%	15%	2%	8%	0%	21%	1%	1%	12%	3%	1%	100%	

[1] Total number of unique species locations across Santa Catalina Island

- **We also completed literature searches and found additional records.**
  - Desert night lizard (*Xantusia vigilis*)
  - California mountain kingsnake (*Lampropeltis zonata*)
  - Leopard frog (*Rana sp.*)

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common kingsnake	*Lampropeltis getulus*	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	4	0	0	1	0	0	12	5
gopher snake	*Pituophis catenifer*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2	0	0	7	2
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western ringneck snake	*Diadophis punctatus*	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	2	0	0	10	2
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Results

- **Reptiles**
  - 628 lizards captured (3 species)
  - 28 snakes captured (4 species)
- **Amphibians**
  - 22 salamanders captured (1 species)
  - 11 frogs captured (2 species)
- **Small Mammals**
  - 218 small mammals captured (3 species)
- **Ants**
  - 8,670 ants captured (20 species)

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Results - Reptiles

Common Name	*Scientific Name*	Total Captures	Total Arrays
Reptiles			
side-blotched lizard	*Uta stansburiana*	510	20
southern alligator lizard	*Elgaria multicarinata*	91	19
western skink	*Eumeces skiltonianus*	27	9
common kingsnake	*Lampropeltis getulus*	5	4
gopher snake	*Pituophis catenifer*	4	3
southern Pacific rattlesnake	*Crotalus viridis*	6	6
western ringneck snake	*Diadophis punctatus*	7	4

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Results & Discussion - Reptiles

- Side-blotched lizards most common capture and were found at all arrays.
- Alligator lizards were the second most common capture.
- Santa Catalina Island is the only Channel Island in the US that has the western skink and the southern Pacific rattlesnake.
- The two-striped garter snake (*Thamnophis hammondii*) was not detected in our pitfall traps but is known to occur in Cottonwood Canyon. This snake is rare and is threatened by the introduced bullfrog (*Rana catesbeiana*).

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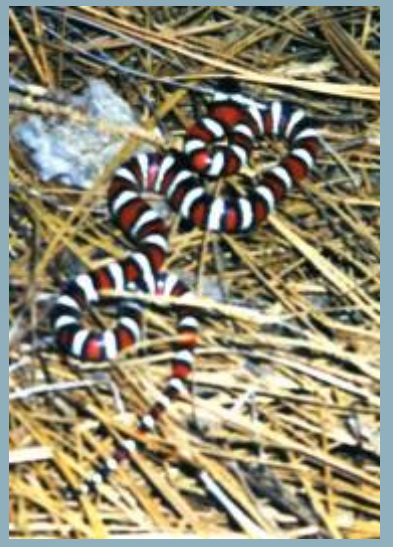
Results & Discussion – Undetected Reptiles

- The desert night lizard (*Xantusia vigilis*) is know from the Wrigley Botanical Garden in Avalon by a single record in 1952 (Savage, 1952). This lizard most likely does not currently occur on Santa Catalina Island and the single record may represent an escaped pet or accidental translocation from moving plants.

- The California mountain kingsnake (*Lampropeltis zonata*) has been reported a few times from the island from 1910 (C.F. Holder, 1910) until present. It is unclear if there is a breeding population on the island or if these animals are escaped pets. Most recently Scott Panzer, an island resident, provided a picture of an animal from Black Jack Campground from 1998.



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Results - Amphibians

Common Name	*Scientific Name*	Total Captures	Total Arrays
Amphibians			
garden slender salamander	*Batrachoseps major*	22	8
Pacific treefrog	*Pseudacris regilla*	9	7

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Results & Discussion - Amphibians

- The garden slender salamander was detected mostly during the winter months and can be found in most habitats on the island.
- The Pacific treefrog is the only native frog to the island. It is restricted mainly to areas with water but can be found anywhere that is moist. It also is likely an important food source for the rare two-striped garter snake.
- The introduced bullfrog appears to be abundant in most of the reservoirs across the island. A complete survey of all perennial water should be completed at which time an eradication plan should be developed.

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Results & Discussion – Undetected Amphibians

- The leopard frog (*Rana spp.*) is known from a single specimen most likely from Summit Reservoir (Rorabaugh et al., 2002). It is likely a released pet but if this frog becomes established on the island it would have a similarly negative affect as the bullfrog.

- The arboreal salamander (*Aneides lugubris*) is also known on the island from a single specimen from Middle Ranch in 1941 (Hilton, 1945). Even though we did not detect this species it may still occur on the island. It could also have been introduced with materials from the mainland.

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Results – Small Mammals

Common Name	*Scientific Name*	Total Captures	Total Arrays
Small Mammals			
Santa Catalina Island deer mouse	*Peromyscus maniculatus catalinae*	63	20
Santa Catalina Island harvest mouse	*Reithrodontomys megalotis catalinae*	151	18
Santa Catalina shrew	*Sorex ornatus willetti*	4	4

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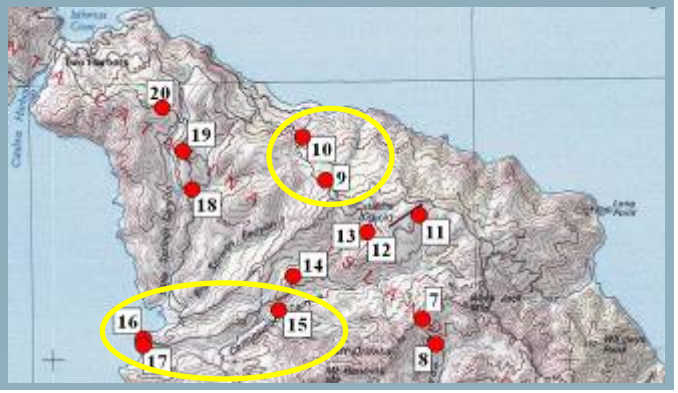
Results & Discussion – Small Mammals

- The Santa Catalina Island deer mouse was ubiquitous on the island and was detected at all 20 arrays.
- The Santa Catalina Island harvest mouse was also very common and detected at 18 of the 20 arrays.
- The Santa Catalina shrew was captured 4 times at 4 different arrays. Only 8 shrews have been detected on the island prior to this study. The CIC has supplemented our pitfall trapping effort to better understand the distribution and abundance of this rare species.



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Results & Discussion - Ants

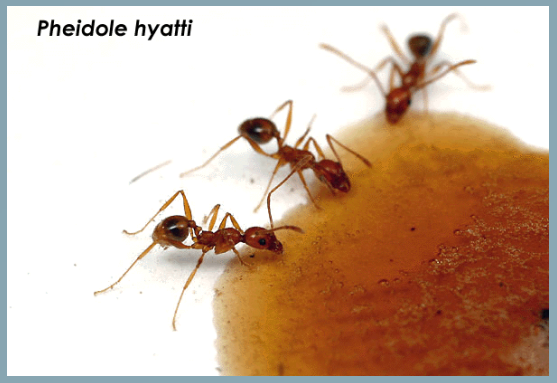
Subfamily / *Scientific Name*	Common Name	Ant Species Identifed: Sleeper 1989	Hebard and Heller 1999	USGS 2002-2004	Total Number of Ants Identified on Santa Catalina Island
Dolichoderinae					
Linepithema humile	Argentine ant	X	X	X	
Tapinoma sessile	oderous house ant		X	X	
Formicinae					
Brachymyrmex depilis			X	X	
Camponotus clarithorax	carpenter ant			X	
Camponotus bakeri	carpenter ant	X	X		
Camponotus sp CA-03 [1]	carpenter ant	X	X	X	
Formica argentea	wood ant		X		
Formica subelongata	wood ant			X	
Prenolepis imparis	winter ant		X	X	
Myrmicinae					
Aphaenogaster patruelis		X	X	X	
Cardiocondyla mauritanicais			X		
Crematogaster californica	acrobat ant		X	X	
Crematogaster coarctata	acrobat ant	X		X	
Crematogaster marioni	acrobat ant			X	
Cyphomyrmex wheeleri	fungi-growing ant		X	X	
Messor andrei	harvester ant	X	X	X	
Monomorium ergatogyna		X	X	X	
Pheidole clementensis				X	
Pheidole hyatti		X	X	X	
Solenopsis molesta	theif ant	X	X	X	
Solenopsis texana catalinae		X	X	X	
Temnothorax andrei			X	X	
Temnothorax sp CA-05				X	
Total Species		10	17	20	23

[1]Species name has changed across the three studies

Hebard, E., and N. Heller. 1999. Distribution and impact of the Argentine ant on Santa Catalina Island, California. Report. The Catalina Island Conservancy, Avalon, CA. 10 pp.

Sleeper, E. L. 1989. Checklist of the Arthropoda known to occur on Santa Catalina Island, California. Part II: the Hexapoda (Insecta). Draft copy on file with The Catalina Island Conservancy, Avalon, CA.

Results & Discussion - Ants



Ants Subfamily *Species Name*	Common Name	Total Captures	Total Arrays
Dolichoderinae			
Linepithema humile [1]	Argentine ant	5103	11
Tapinoma sessile	oderous house ant	40	3
Formicinae			
Brachymyrmex depilis		2	2
Camponotus clarithorax	carpenter ant	1	1
Camponotus sp. CA-03	carpenter ant	110	10
Formica subelongata	wood ant	48	6
Prenolepis imparis	winter ant	79	6
Myrmicinae			
Aphaenogaster patruelis		49	5
Crematogaster californica	acrobat ant	97	7
Crematogaster coarctata	acrobat ant	7	1
Crematogaster marioni	acrobat ant	3	1
Cyphomyrmex wheeleri	fungus-growing ant	7	1
Messor andrei	harvester ant	3	1
Monomorium ergatogyna		294	15
Pheidole clementensis		11	3
Pheidole hyatti		2755	10
Solenopsis molesta	thief ant	20	8
Solenopsis texana catalinae [2,3]		8	3
Temnothorax andrei		32	12
Temnothorax sp CA-05 [3]		1	1
Total # of Individuals		8670	
Total # of Species		20	

[1] Highly invasive species
[2] Species endimic to Santa Catalina Island
[3] Species in the process of being verified

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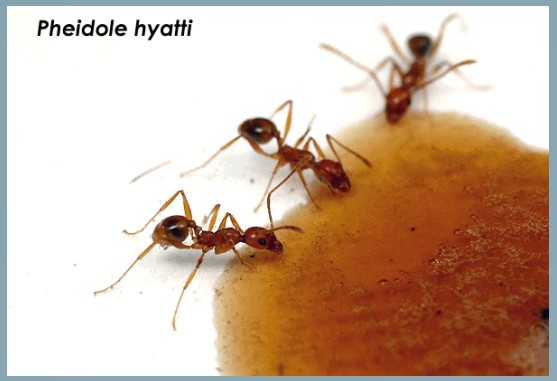
Results & Discussion - Ants



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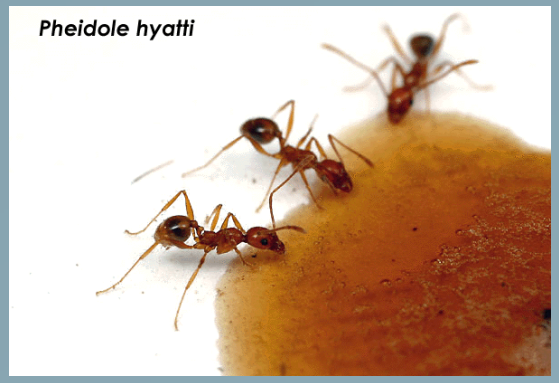

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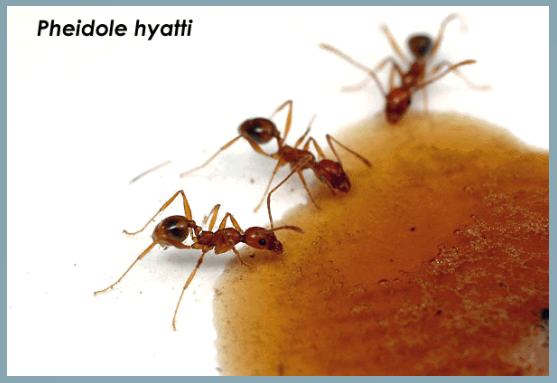

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Results & Discussion – Non-native Ants

- **2 non-native ants have been detected on Santa Catalina Island, *Cardiocondyla mauritanicais* and the Argentine ant.**
- **The invasive Argentine ant was the most numerous capture with 5,103 animals and was found at 11 of the 20 arrays.**
  - Argentine ants out compete the native ants and at 2 arrays they were the only ant species detected.
  - Argentine ants decrease the native ants species diversity. At arrays with Argentine ants, there was an average of 3 species/array. Arrays without Argentine ants, average 8 native ant species/array.

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Results & Discussion – Ant Example

- Both species occur at ≥ 50% of the arrays and had the most numerous captures.
- They only co-occur at 1 array.
- Only 2 *Pheidoe* were captured at the array with the Argentine ant.
- Appears the Argentine ant is out competing this native ant, 14 other native ants show similar patterns.

Ants Subfamily *Species Name*	Common Name	Total Captures	Total Arrays
Dolichoderinae			
Linepithema humile [1]	Argentine ant	5103	11
Tapinoma sessile	oderous house ant	40	3
Formicinae			
Brachymyrmex depilis		2	2
Camponotus clarithorax	carpenter ant	1	1
Camponotus sp. CA-03	carpenter ant	110	10
Formica subelongata	wood ant	48	6
Prenolepis imparis	winter ant	79	6
Myrmicinae			
Aphaenogaster patruelis		49	5
Crematogaster californica	acrobat ant	97	7
Crematogaster coarctata	acrobat ant	7	1
Crematogaster marioni	acrobat ant	3	1
Cyphomyrmex wheeleri	fungus-growing ant	7	1
Messor andrei	harvester ant	3	1
Monomorium ergatogyna		294	15
Pheidole clementensis		11	3
Pheidole hyatti		2755	10
Solenopsis molesta	thief ant	20	8
Solenopsis texana catalinae [2,3]		8	3
Temnothorax andrei		32	12
Temnothorax sp CA-05 [3]		1	1
Total # of Individuals		8670	
Total # of Species		20	

[1] Highly invasive species
[2] Species endimic to Santa Catalina Island
[3] Species in the process of being verified

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Conclusions

- **Reptiles and Amphibians**
  - We detected 3 lizard species, 4 snakes, 1 salamander, and 2 frogs. While this may not represent the full extent of species on the island, it does represent the majority. The remainder of species undetected would require additional survey techniques. Other species that may be detected are:
    - California mountain kingsnake
    - Arboreal salamander
    - Leopard frog

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Conclusions

- **Small Mammals**
  - We detected 3 small mammal species. Additional survey methods would be helpful to better understand the distribution and abundance of the native animals and additional trapping locations would help identify non native species such as the house mouse, black rat, and any others that are on the island.
- **Ants**
  - We detected 20 ants species on Santa Catalina Island. We recommend expanding this ant sampling protocol to obtain a more comprehensive understanding of the total ant diversity. It could also be implemented in areas of new development to monitor the spread of the invasive Argentine ant.
  - We did not detect the highly invasive red imported fire ant (*Solenopsis invicta*) which has recently spread on the mainland in southern California.

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