



## 2017 SYMPOSIUM SPONSORS



## IN-KIND SUPPORT

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- M.H. Bread & Butter

# SPOTLIGHT ON HEALTH



## OSPREY

**Janet Klein**

Natural Resources Program Manager, Marin Municipal Water District



## NORTHERN SPOTTED OWL

**Renee Cormier**

Avian Ecologist, Point Blue Conservation Science



## COHO SALMON AND STEELHEAD TROUT

**Eric Ettlinger**

Aquatic Ecologist, Marin Municipal Water District



## CALIFORNIA RED-LEGGED FROG

**Darren Fong**

Aquatic Ecologist, Golden Gate National Recreation Area



## FOOTHILL YELLOW-LEGGED FROG

**Joe Drennan**

Wildlife Ecologist and Wetlands Specialist, Garcia and Associates

## RIVER OTTER

**Meghan Isadore**

Executive Director, River Otter Project



# Osprey Monitoring: Kent Lake, Marin County, California 1981-2016



Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image Landsat

Data CSUMB SFML, CA OPC

Google earth

Janet Klein  
Natural Resources Program Manager  
Marin Municipal Water District

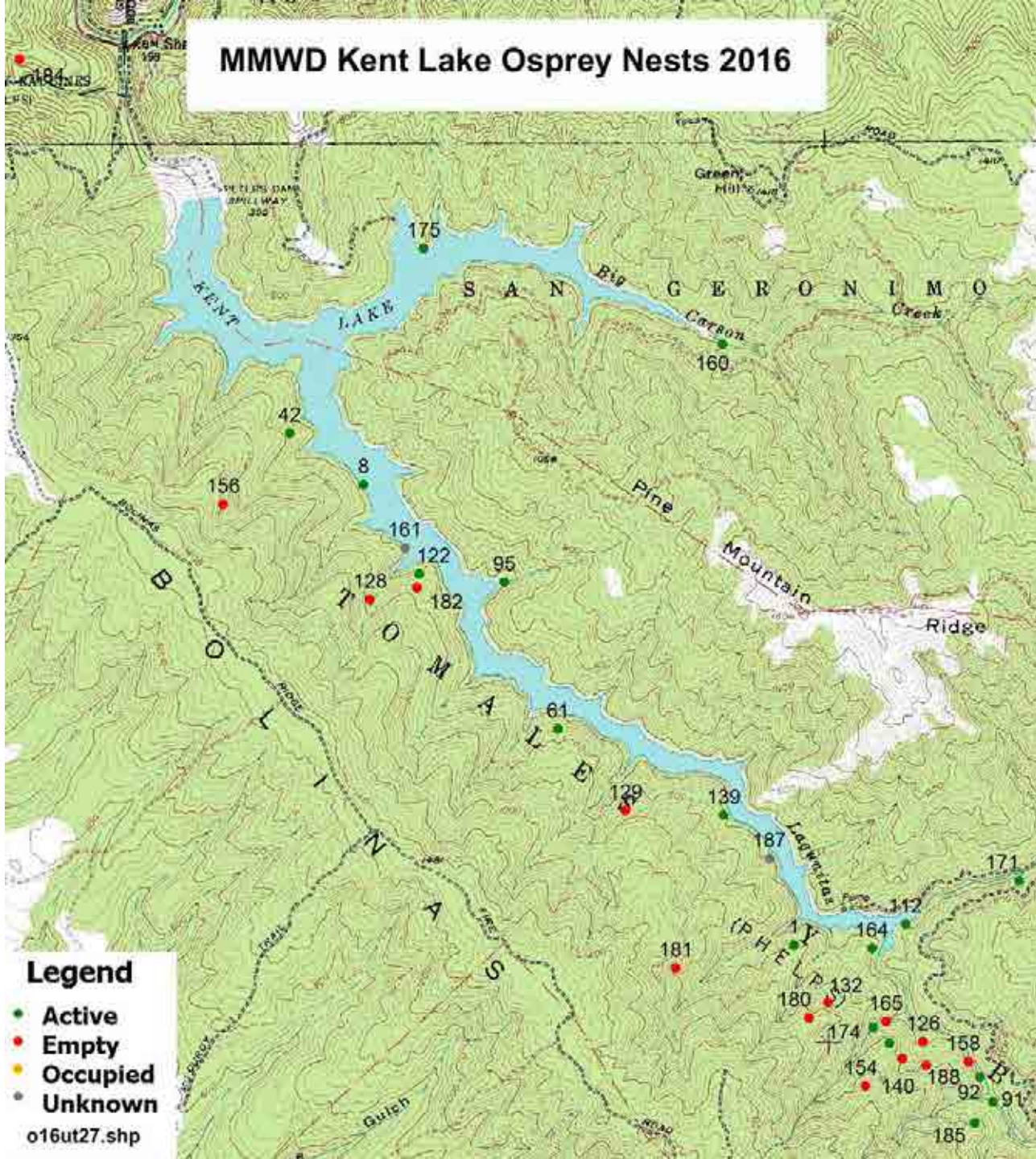




11.06.2007



# MMWD Kent Lake Osprey Nests 2016

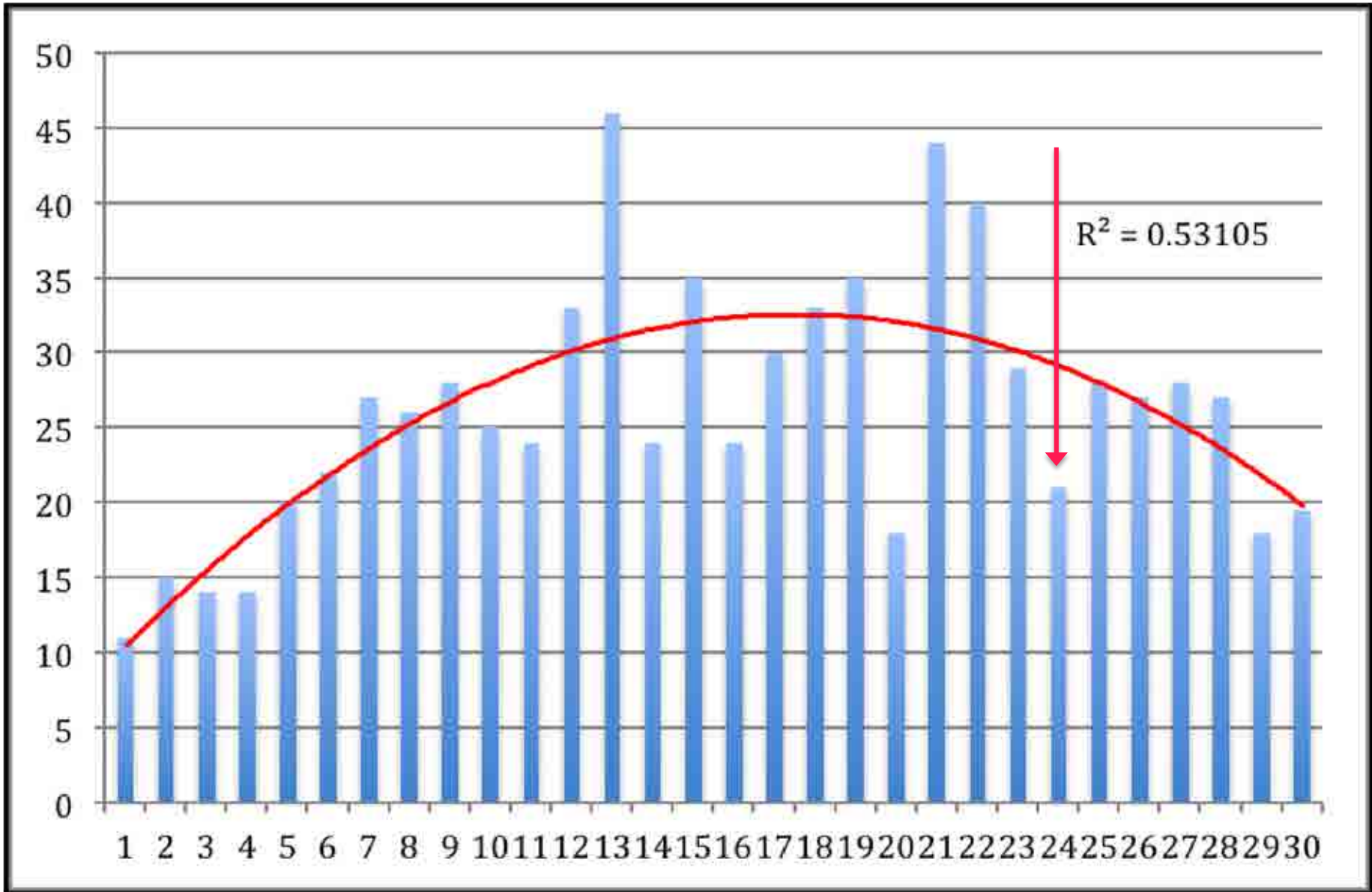


## Legend

- Active
- Empty
- Occupied
- Unknown

o16ut27.shp

# Three decades of Osprey monitoring: Kent Lake, Marin Co.



What happened in 2008?









Image Landsat

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth





# Summary

- Ospreys were common (if patchily distributed) in the western states until the mid-1800s.
- Persecution and environmental contaminants caused declines throughout the range from the late 1800s into the mid-20<sup>th</sup> C
- Banning of DDT in 1972 as well as changing societal attitudes, reservoirs, and use of artificial structures resulted in a recovery
- Current breeding distribution is “widespread and increasing.” (More than ever?)
- Bald Eagles arrived in 2008 causing a shift in population (at least at Kent Lake) initiating a dynamic future for both species.
- The SF Bay area population founded in the mid-1960s at Kent Lake has grown to ~70 pairs in 3 subpopulations using natural sites (Marin County) and artificial sites (San Francisco Bay).



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# Northern Spotted Owls in the One Tam study area



Renée Cormier, Taylor Ellis, Bill Merkle, and Dave Press  
Mt. Tam Wildlife Symposium, October 26, 2017

Photo by Ryan DiGaudio



**Point Blue**

Conservation science  
for a healthy planet.



# Northern Spotted Owl

## (*Strix occidentalis caurina*)

- Iconic species of old growth forests
- Restricted range, habitat, diet
- Federally & State Threatened
- Decline primarily attributed to logging and other habitat loss (declines continue throughout range)
- Current primary threats include habitat loss and Barred Owl invasion



# Monitoring in Marin

- Long-term data in Marin and One Tam Region
- NPS and Point Blue monitor ~80 sites per year



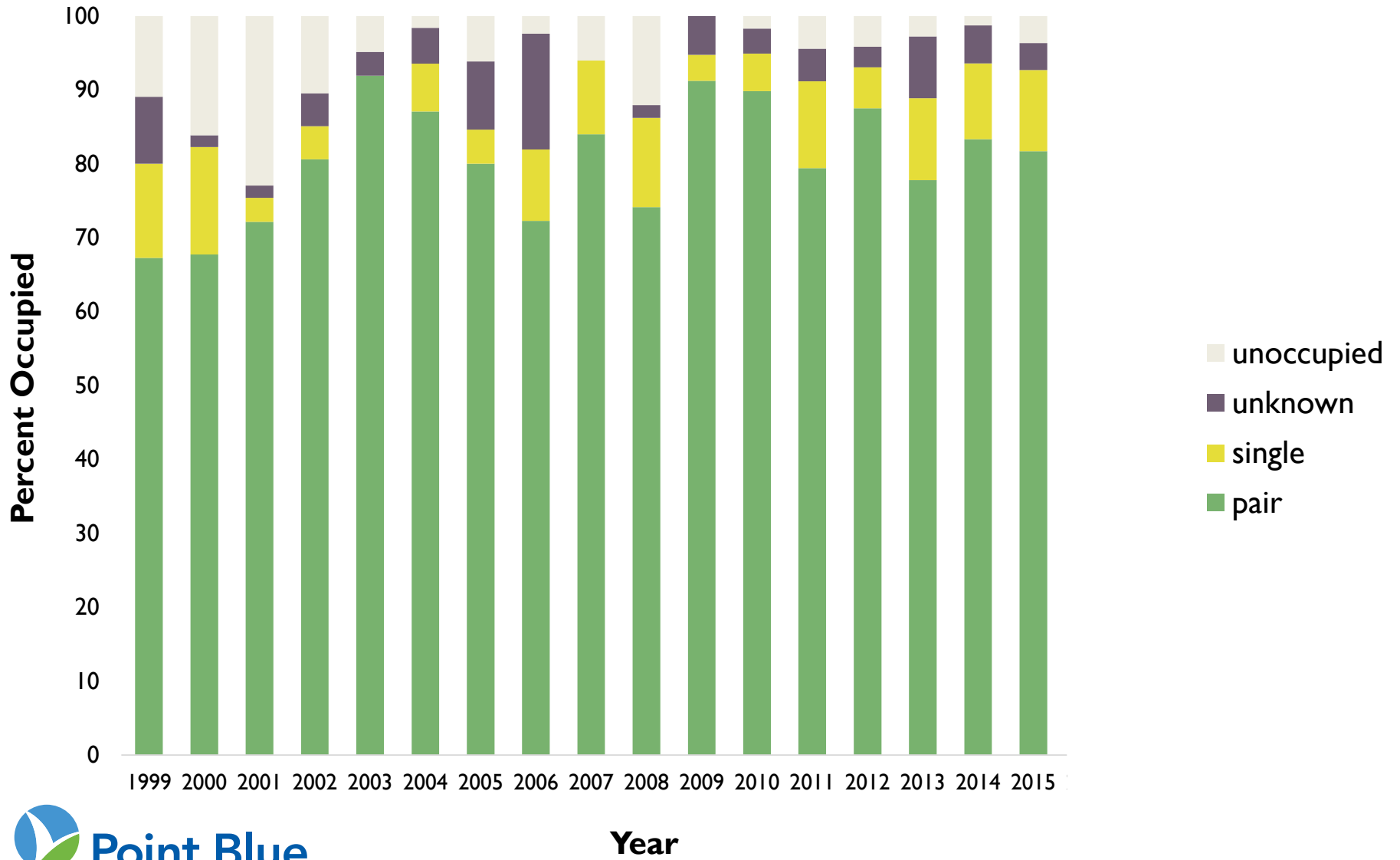
Private &  
Municipal  
Lands

- Historic Sites & Management (Occupancy, Nesting & Reproduction)
- Stressors include: Barred Owls, habitat loss, Sudden Oak Death, climate change, noise and other disturbance, rodenticide poisoning

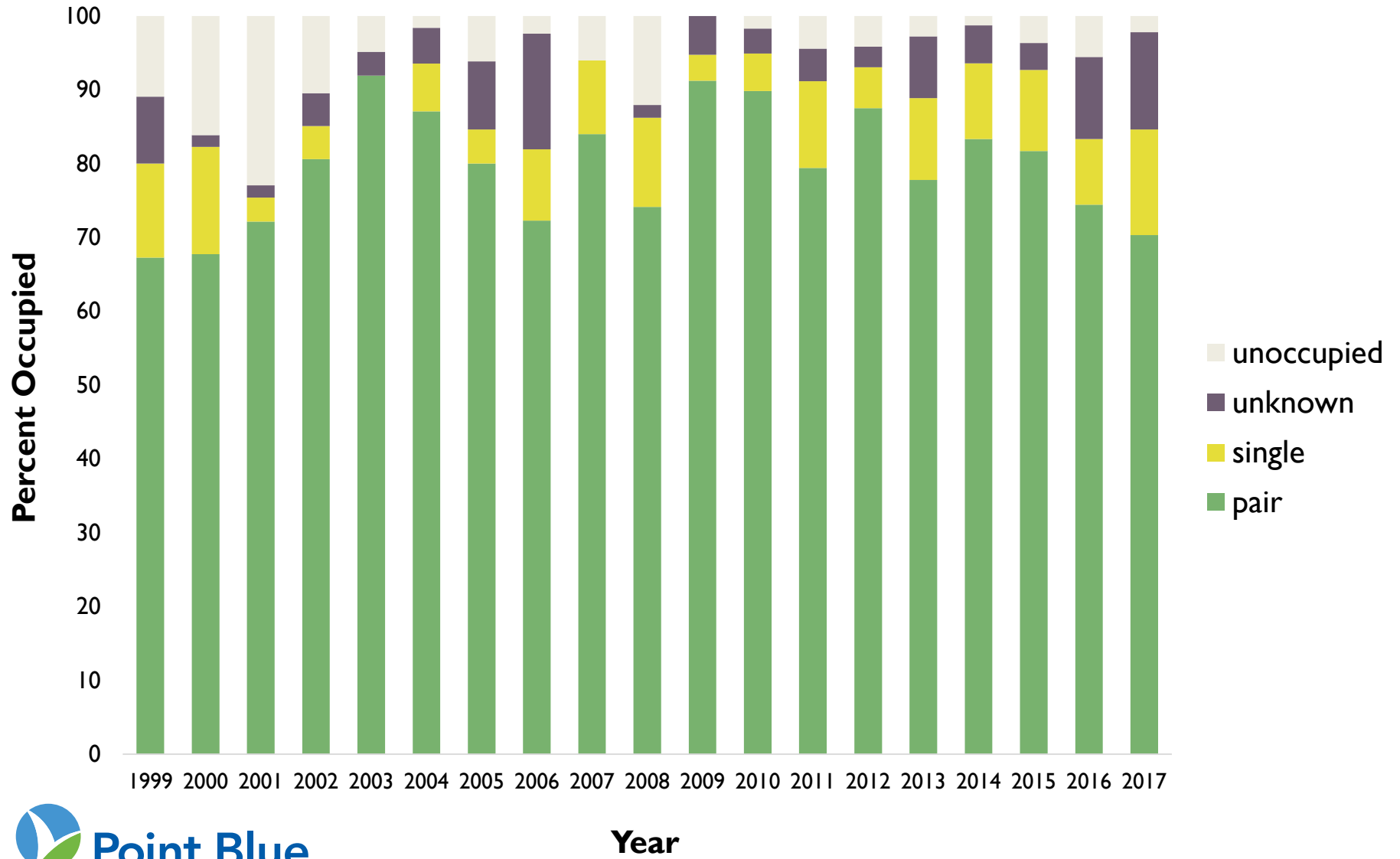




# Occupancy

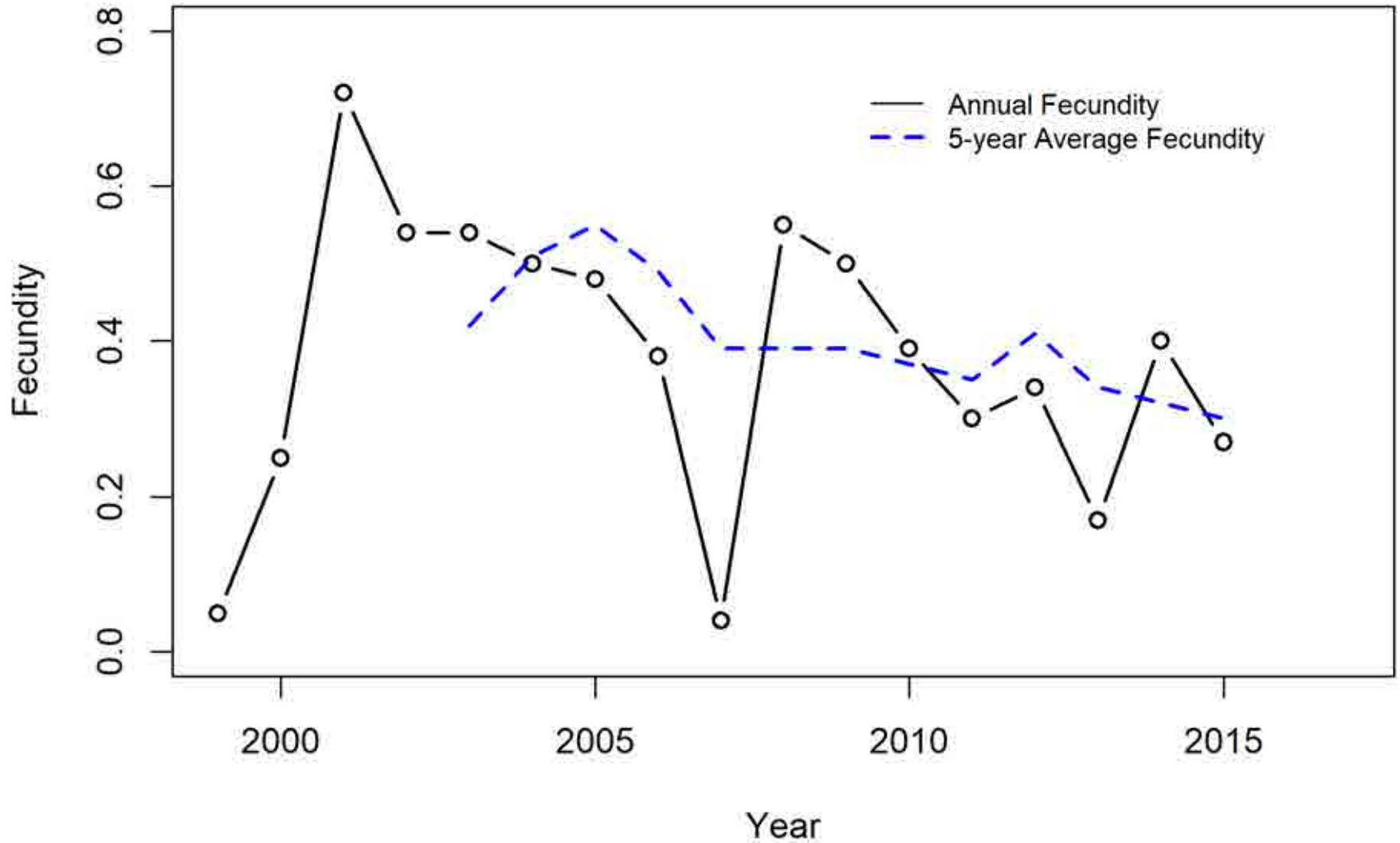


# Occupancy Updated

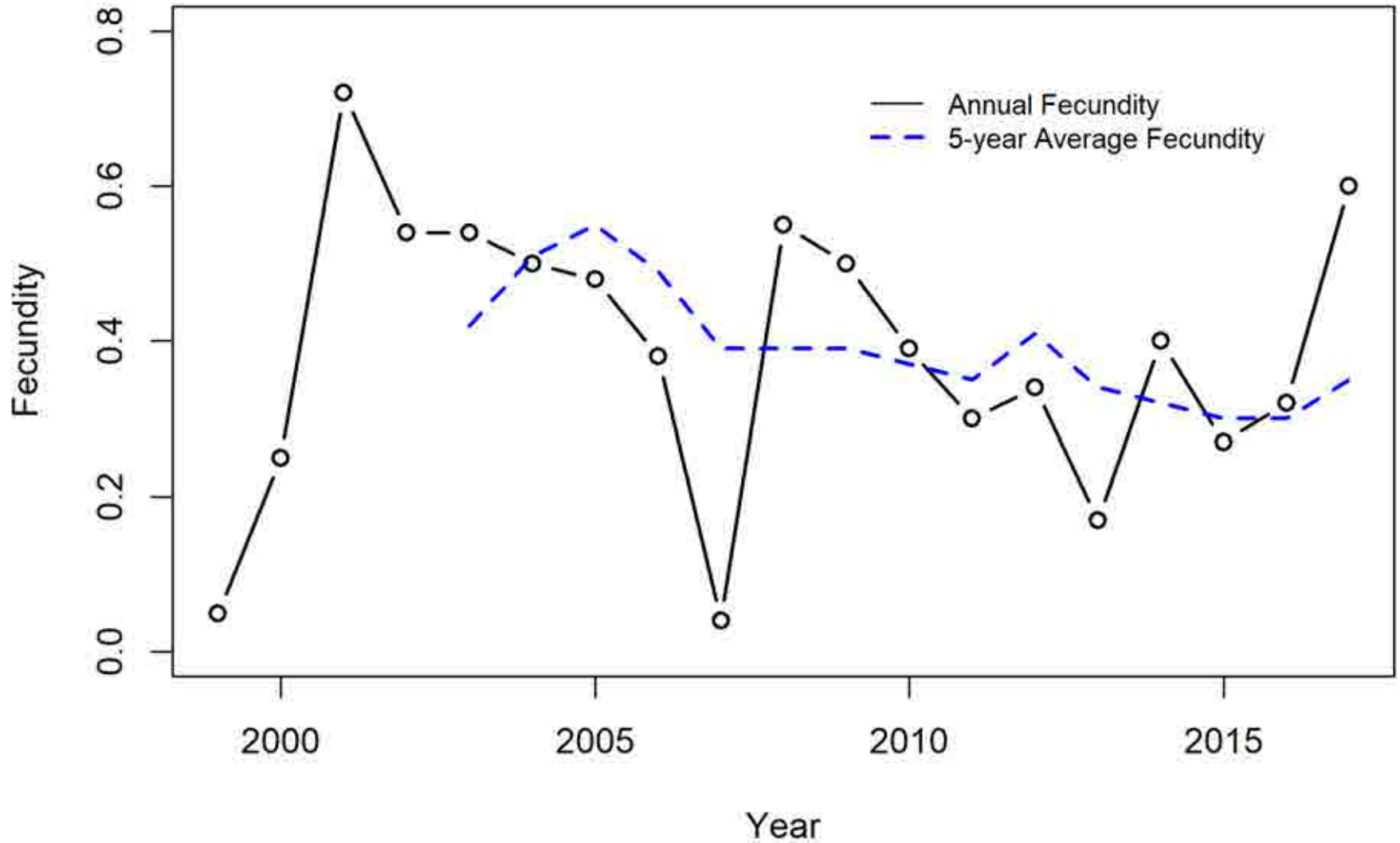




# Fecundity



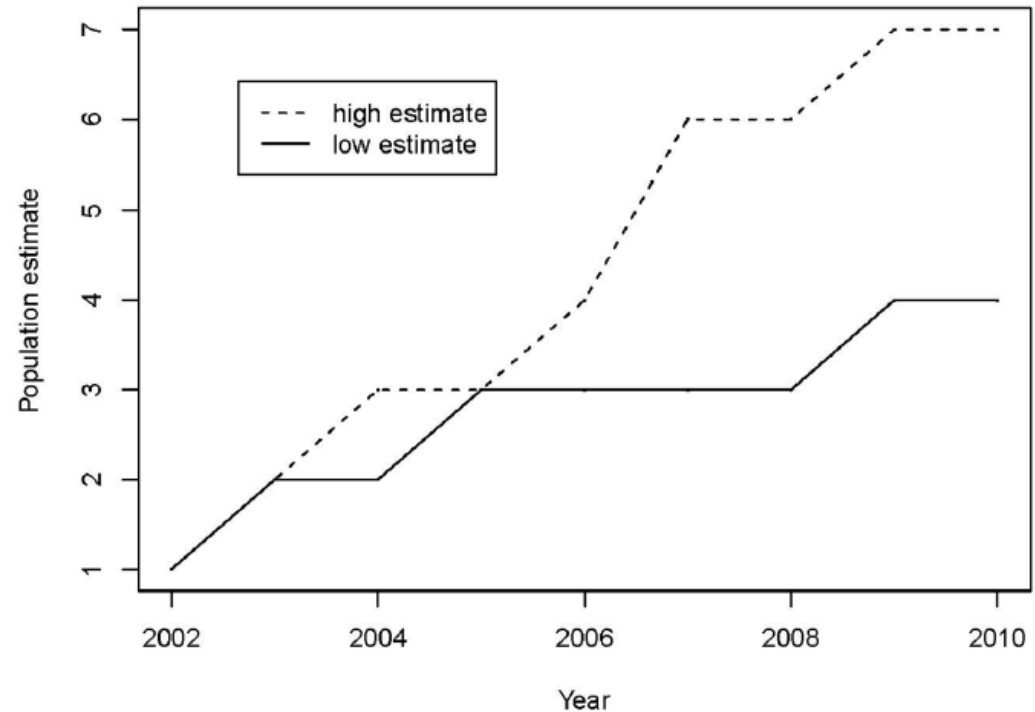
# Fecundity Updated





# Barred Owls Updated

- Estimates of up to 4-7 Barred Owl in Marin County in previous years (Jennings et al. 2011)
- 2015: 3 detected (2 areas)
- 2016: none detected
- 2017: one detected



# Overall: One Tam

# Northern Spotted Owls = Good





# Acknowledgements

- California State Parks
- Golden Gate National Parks Conservancy
- Marin County Open Space District
- Marin Municipal Water District
- National Park Service (GGNRA, Point Reyes National Seashore, Muir Woods National Monument)
- National Park Foundation
- Point Reyes National Seashore Association
- The David and Vicki Cox Foundation
- Town of Ross
- The many private landowners who allow us to access their properties

# SPOTLIGHT ON HEALTH



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# Three Fish and Two Creeks in Five Minutes



Eric Ettlinger  
Aquatic Ecologist  
Marin Municipal Water District  
[eettlinger@marinwater.org](mailto:eettlinger@marinwater.org)

October 26, 2017

# Focal (*Favorite*) Fish of Mt. Tam

- Coho Salmon and Steelhead Trout
  - Endangered by habitat loss and degradation.
  - Prey for many bird species, and otters.
  - Deliverers of nutrients from the ocean.
  - Ambassadors for land and water stewardship.
- Threespine Stickleback
  - Common, widespread, but lacking data.
  - Charismatic (They're related to sea horses!)
    - Elaborate courtship followed by male parenting.
    - They can swim backwards.
    - Easily identifiable, when you know how to find them.



# Surveyed Streams of Mt. Tam

- Lagunitas Creek
  - Drains the north side of the mountain.
  - Hosts the southernmost wild coho population in the world, and multiple projects are underway to save it.
  - Steelhead are relatively abundant, while still threatened.
- Redwood Creek
  - Drains the south side of the mountain.
  - Of the three coho year classes, two are weak and one is nearly extirpated.
  - Hosts a small steelhead population (~20 adults/year).

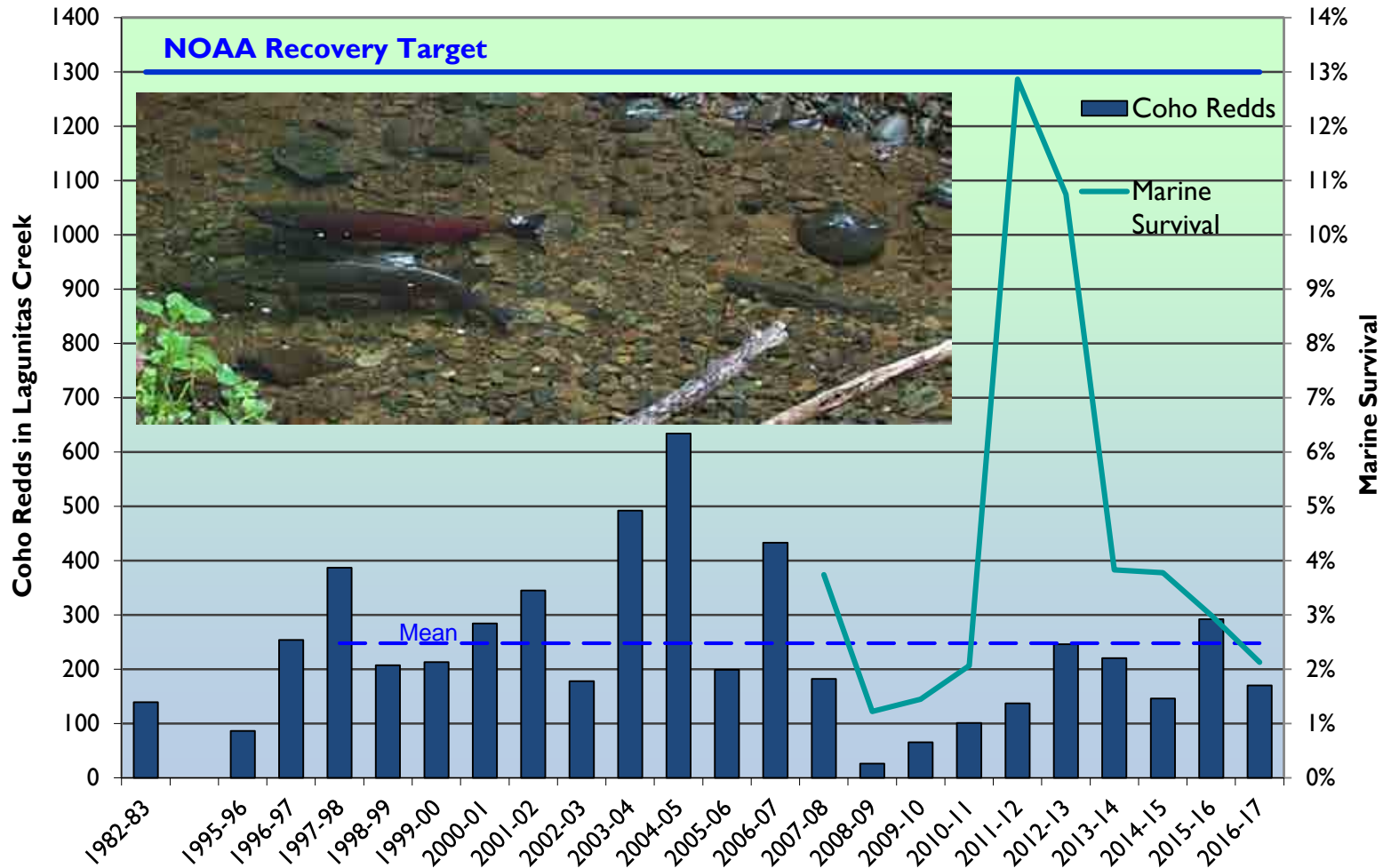


# A Lagunitas Creek Salmon School Reminiscent of Decades Past





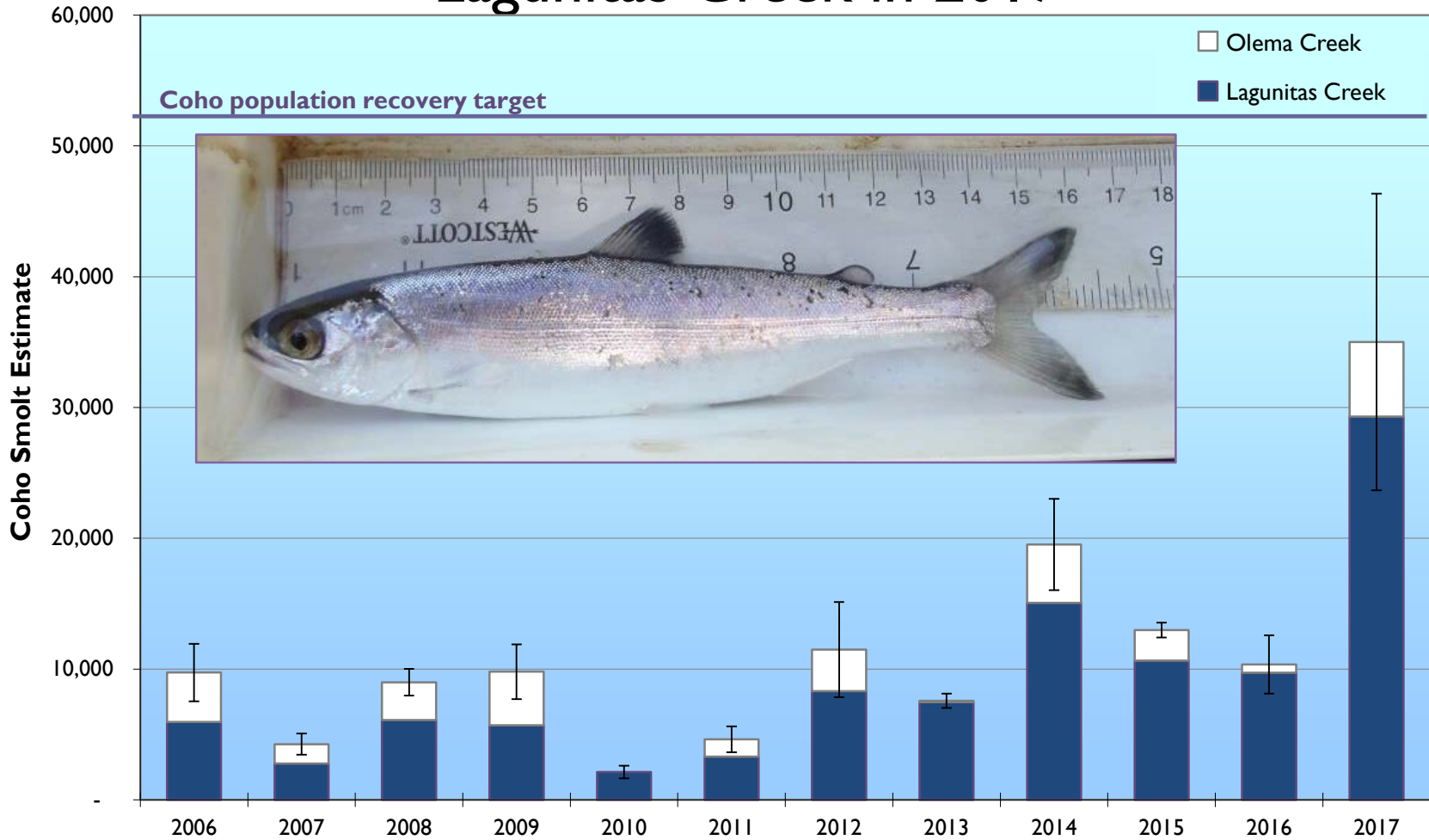
# Lagunitas Creek Coho Redd Counts



Note: The NOAA recovery target is 2,600 adults or 1,300 redds assuming two



# Record Numbers of Coho Smolts Emigrated from Lagunitas Creek in 2017



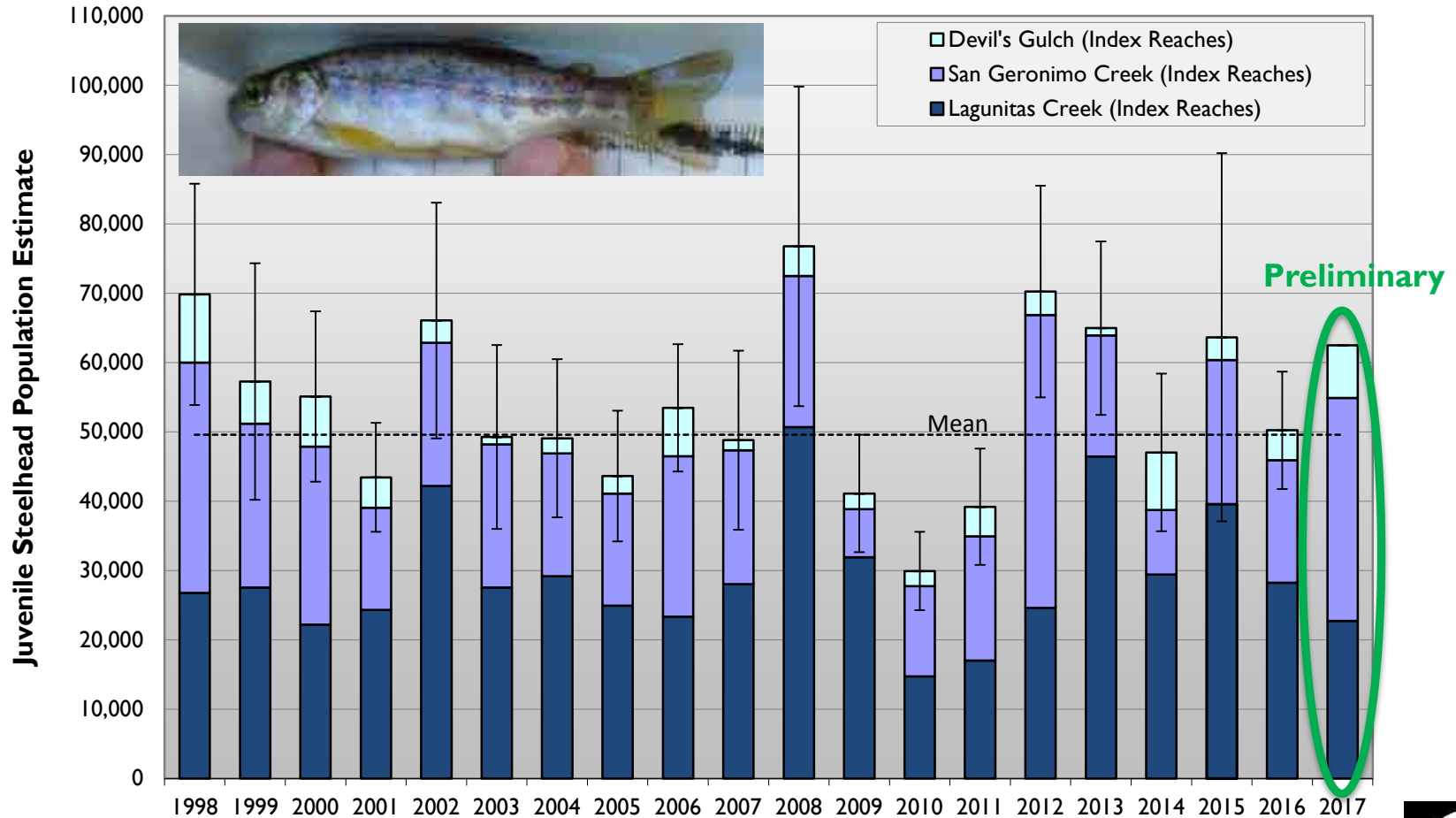
# In 2016, 106 Adult Coho Were Returned to Redwood Creek

- These mostly four-year-old fish were raised in a hatchery after being removed from the creek.
- This “jumpstart” will hopefully prevent the loss of this year class.

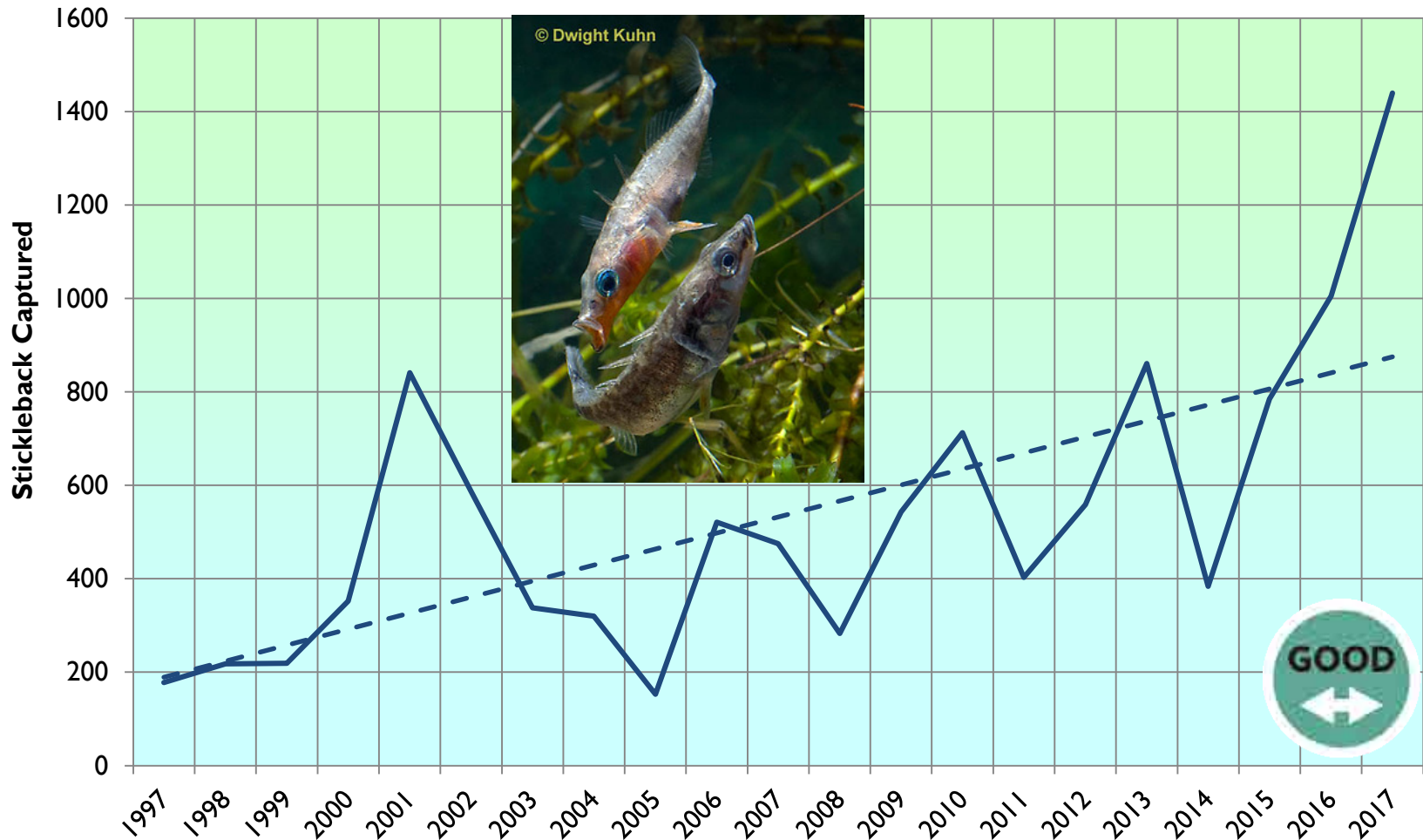




# Lagunitas Creek Juvenile Steelhead



# In 2017, Lagunitas Stickleback Were Off The Hook!



# Conclusions

- The fishes of Mt. Tam continue to face many threats:
  - Warming water.
  - Catastrophic floods and/or drought.
  - Catastrophic wildfire.
  - Declining/shifting ocean productivity.
  - Introduced species (mollusks, fish, pathogens).
  - Residential development.
- But lots of work is being done:
  - Stream and floodplain enhancement.
  - Coho jumpstart in Redwood Creek.
  - Land conservation.
  - Volunteer actions.

Climate change



# SPOTLIGHT ON HEALTH



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Executive Director, River Otter Project

# California red-legged frog (*Rana draytonii*)



Darren Fong  
Aquatic Ecologist  
Golden Gate National Recreation Area  
[darren\\_fong@nps.gov](mailto:darren_fong@nps.gov)

October 26, 2017

## Why was it selected as a Mt. Tam health indicator?:

- Large, easy to monitor species.
- Relatively long-lived (<10 yrs)
- Resident in our watersheds
- Breeds in wetlands and aquatic sites and sensitive to hydrologic conditions.
- Federally listed as threatened

## Desired Condition:

Long-term population trend of California red-legged frogs unchanged or increasing.

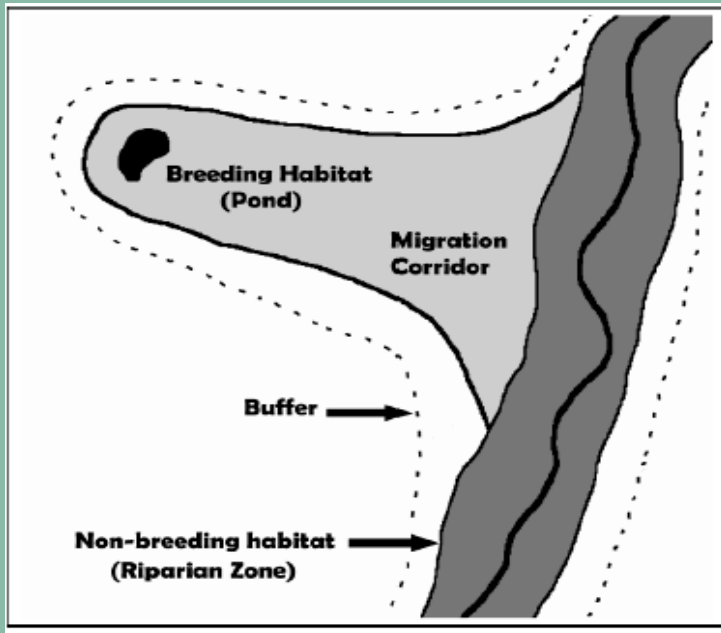






# Biology

- Generally breeds in off-channel habitats (ponds, lagoons) in winter (Dec-Mar)
- Seasonal movements (to and from breeding sites)
- Mid-level predator, diet mostly terrestrial invertebrates
- Prey for many animals



From Fellers and Kleeman (2007)

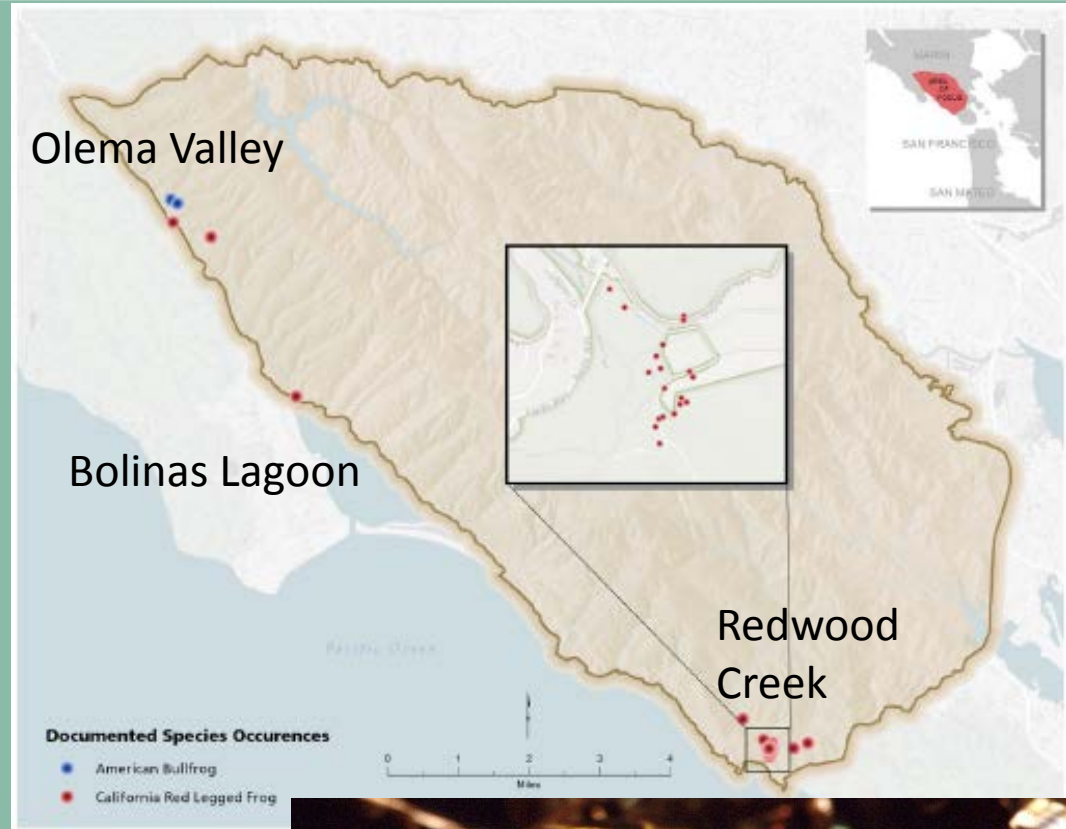


## Metric 1:

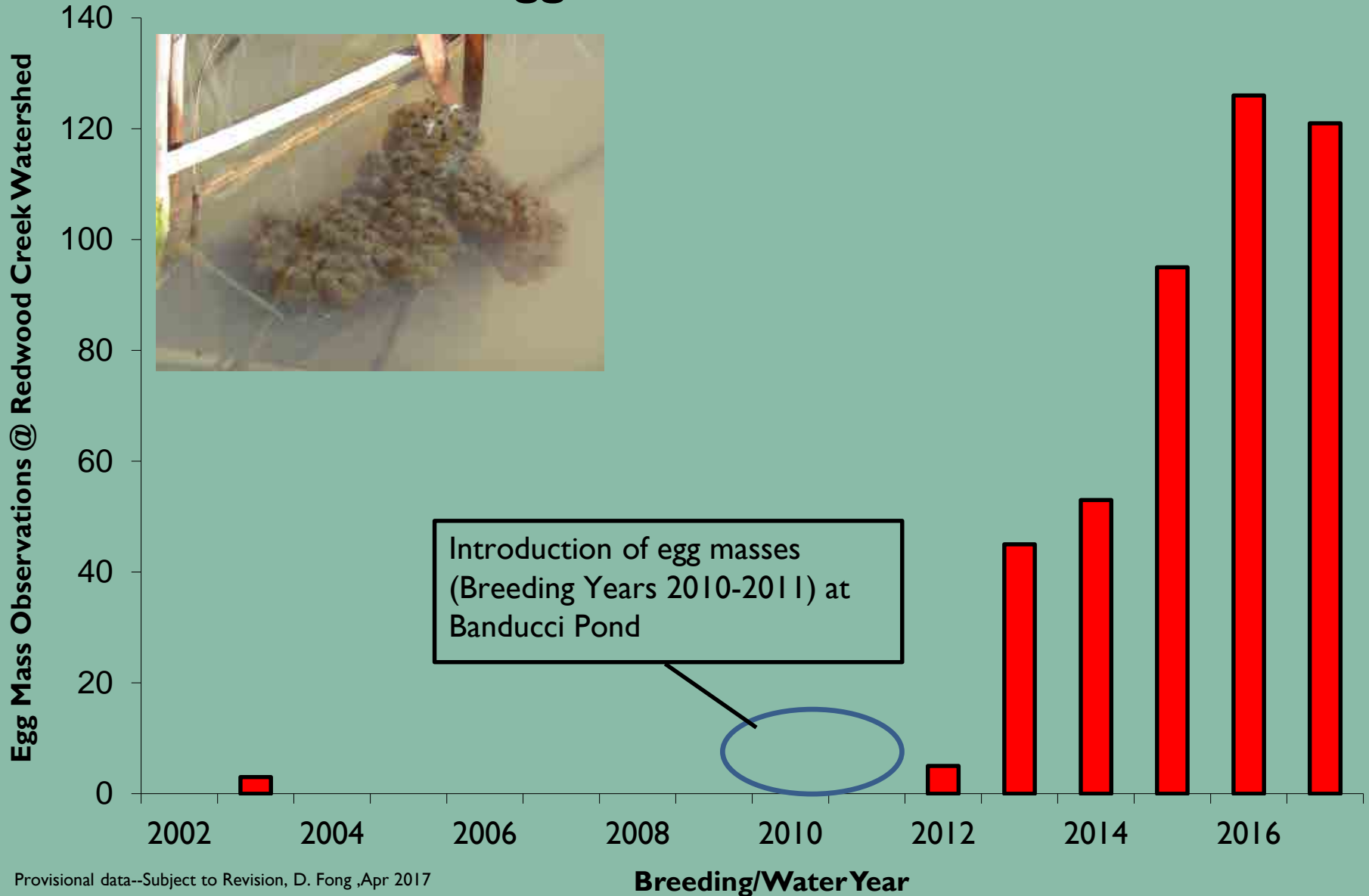
Presence in suitable breeding habitat (occupancy)

## Metric 3:

Number of sites occupied by non-native predators



## Metric 2: Number of egg masses observed





# Wrap-Up

## 2017 Breeding Survey Summary:

- Water, water everywhere
- Red-legged frog breeding at more sites within Redwood Creek watershed
- Breeding at Bolinas Lagoon site- first time since NPS monitoring started in 2012
- Need better survey data for Olema Creek watershed

HEALTH INDICATOR	CONDITION & TREND	CONFIDENCE
California Red-legged Frog		Moderate

# SPOTLIGHT ON HEALTH



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Executive Director, River Otter Project

# ONE TAM

## Mt. Tam Wildlife Symposium

### **Foothill yellow-legged frog**

Joe Drennan, Garcia and Associates



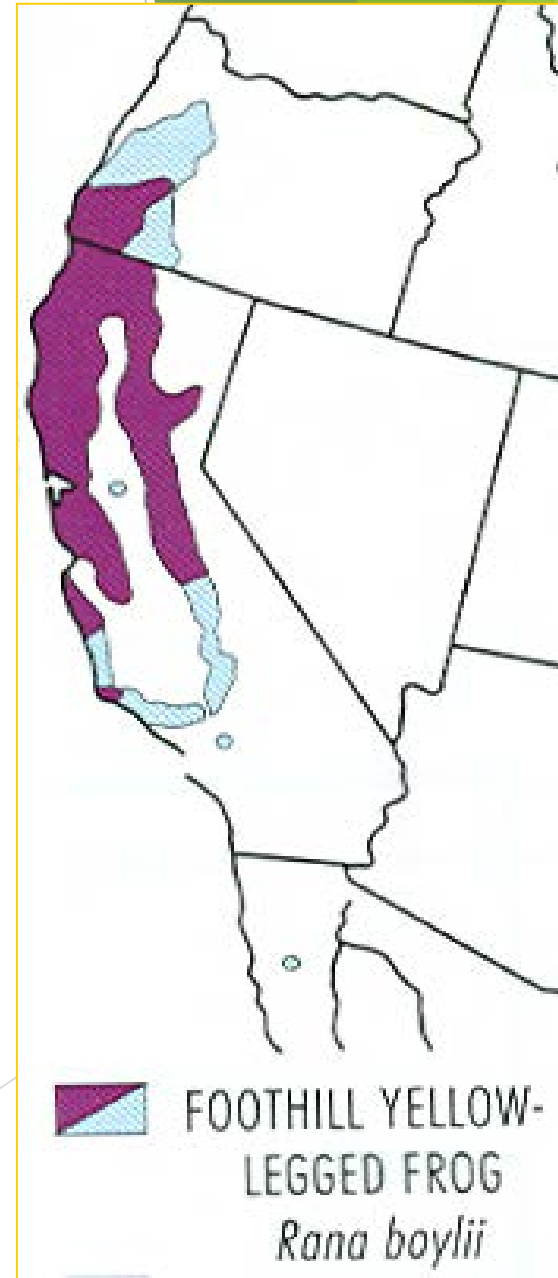


**Foothill yellow-legged frog (*Rana boylii*, FYLF)**



# Foothill Yellow-Legged Frog Current Status

- California Species of Special Concern
- Forest Service Sensitive Species
- Federal Species of Concern
- Candidate for threatened status under CESA





# Little Carson Falls Main Breeding Pools



**Pool 3**



**Pool 2**



**Pool 1**



# Natural History

- ▶ Four distinct life stages:

egg

larvae

juvenile

adult

- ▶ Primarily diurnal

- ▶ Inhabits streams and rivers





## FYLF

- Gray, brown, reddish or olive in color
- Females larger than males at breeding age (1.5 to 3.5 inches)
- Throat and chest usually dark spotted
- Highly aquatic, usually just a few hops from the stream
- Usually found in habitat with rocks and sunny banks for basking
- Males have swollen thumb base or 'nuptial pads'

# Annual Egg Mass Counts

## Little Carson Creek and Big Carson Creek

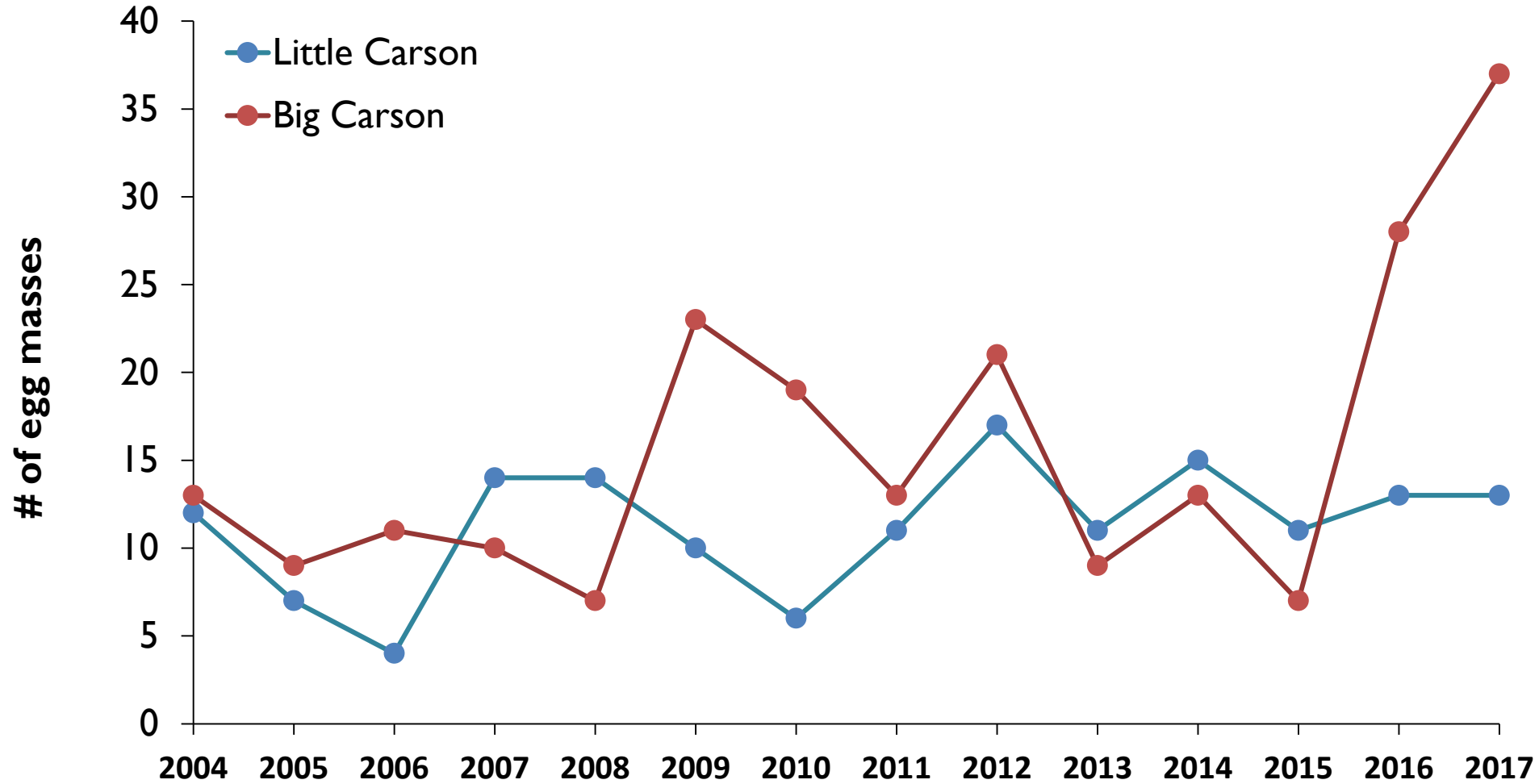
Site	Number of Egg Masses per year													
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Little Carson	12	7	4	14	14	10	6	11	17	11	15	11	13	13
Big Carson	13	9	11	5	2	11	10	7	13	8	7	1	19	31
BCC Trib 1	*	*	*	0	2	1	0	0	0	0	1	0	4	0
BCC Trib 2	*	*	*	5	3	11	9	6	8	1	5	6	5	6
Subtotal BCC	13	9	11	10	7	23	19	13	21	9	13	7	28	37
<b>Total Egg masses</b>	<b>25</b>	<b>16</b>	<b>15</b>	<b>24</b>	<b>21</b>	<b>33</b>	<b>25</b>	<b>24</b>	<b>38</b>	<b>20</b>	<b>28</b>	<b>19</b>	<b>41</b>	<b>50</b>

\*Tributary egg masses were not tallied separately for BCC 2004-2006.



# Annual Egg Mass Counts

## Little Carson Creek and Big Carson Creek



# Chin Photograph Recapture Data 2008 to 2016

Digital photography used to identify individual frogs by the unique pigmentation patterns on the lower jaw.

- 432 individual frogs have been identified on Little and Big Carson Creeks since 2008.
- Chin photo data helps determine growth rates, longevity, and movement patterns.
  - 153 individual females
  - 279 individual males

Adult Male (M9)



- First captured on Big Carson Creek on May 15, 2008 and recaptured every year through 2017.
- Estimated to be at least 12 years of age based on SUL (41 mm) at first capture.





## 2017 Highlights

- Big Carson Male – BCC-M9 recaptured again in 2017. At least 12 years old based on SUL at first capture.
- These two populations have continued to breed successfully during severe drought and high rainfall years.
- 78 adult and juvenile FYLF observations on Little Carson Creek in 2017; and 118 on Big Carson Creek and tributaries.
- 2017 adult, juvenile and egg mass DNA sampling results are in the works.
- In June 2017, CDFW designated FYLF a candidate species for CESA listing. USFWS expected to rule in 2020 on a 2012 request to list the species under the federal ESA.



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# One Tam Wildlife Symposium

October 26, 2017

Megan Isadore – Exec. Director, River Otter Ecology Project

415.342.7956

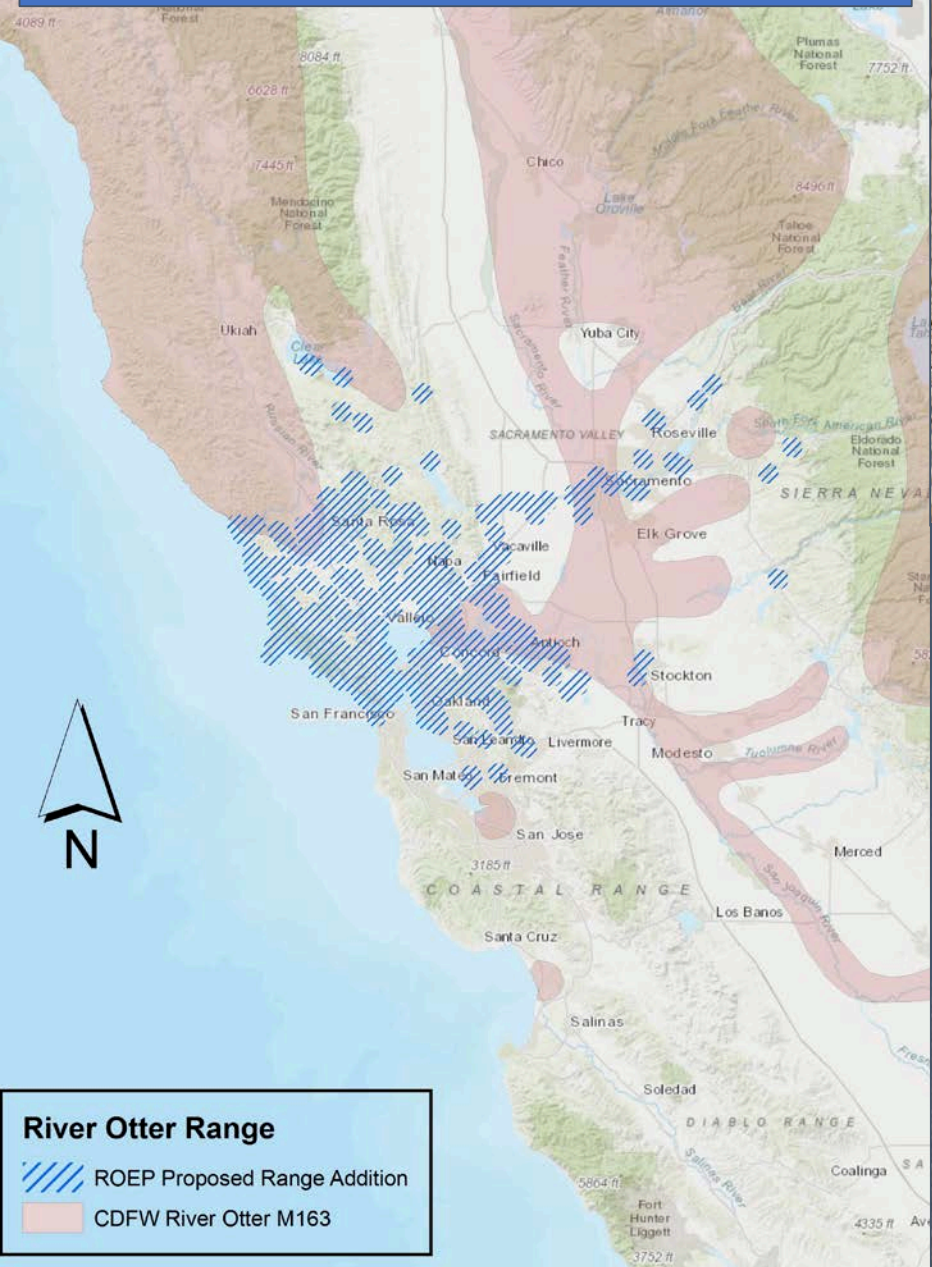
Megan at [riverotterecology.org](http://riverotterecology.org)



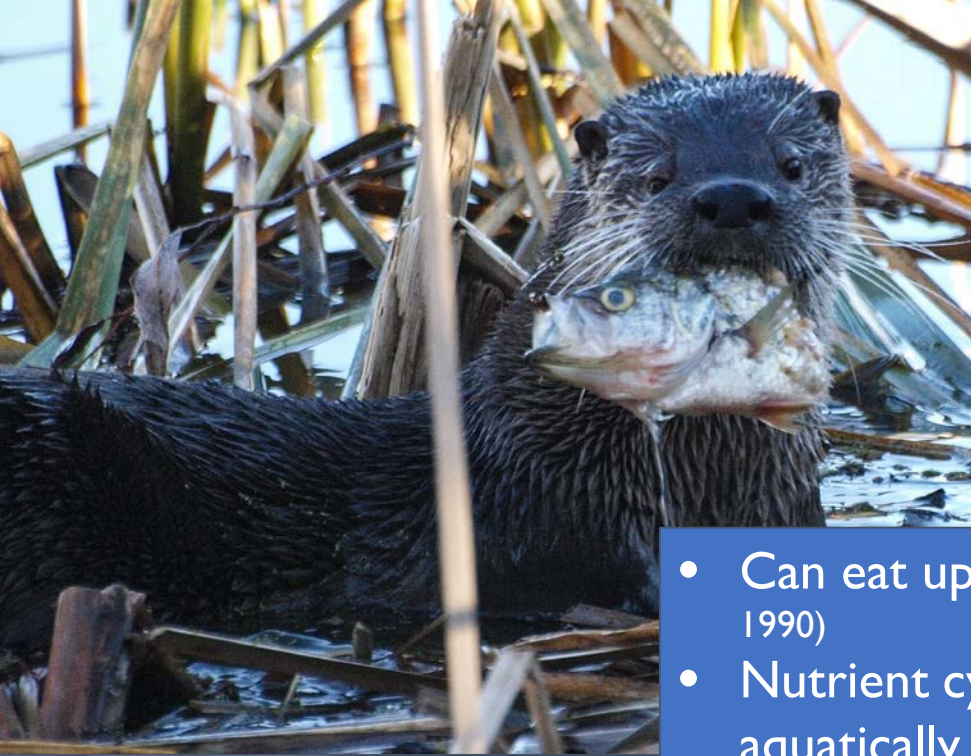


# River Otter Range, SF Bay Area

(River Otter Ecology Project, Otter Spotter 2012-2017)



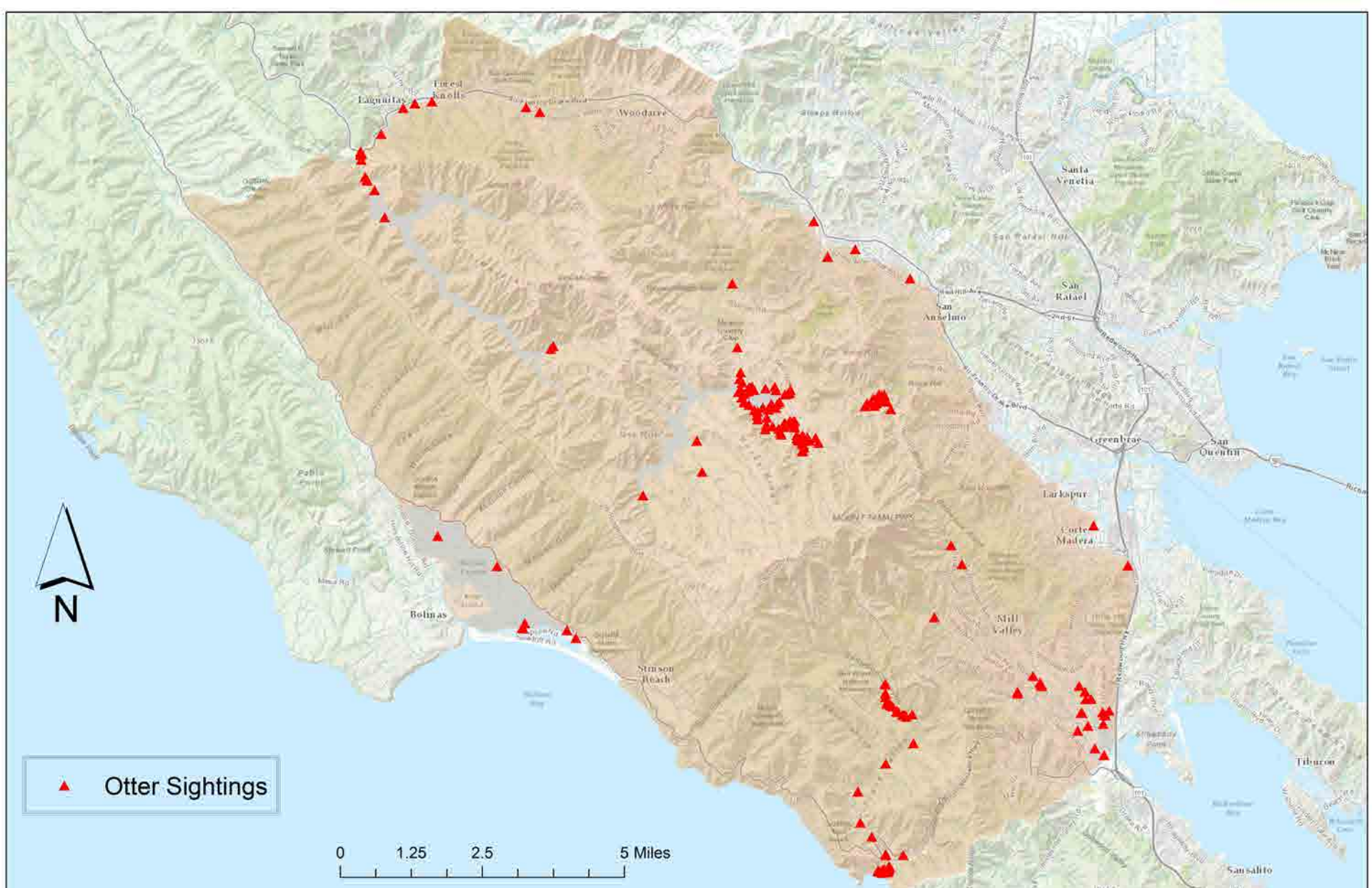




- Can eat up to 2-3 lbs fish per day (Serfass et al. 1990)
- Nutrient cycling: Animals that deposit aquatically derived nutrients on terrestrial landscapes link food webs and affect a variety of in situ processes (Crait & Ben-David, 2007)







Otter Spotter community science sightings, 2012 – present

Lower Kent Lake  
 2014 – 6  
 2015 – 8  
 2016 – 9

River Otter Ecology Project  
 Camera Trap Data, 2014 - 2016

Mt. Tam Reservoirs

2014 – 5  
 2015 – 6  
 2016 – 7

Redwood Creek/Muir  
 Beach

2014 - 3  
 2015 - 1  
 2016 - 1

**ROEP One Tam Camera Sites 2017**

**Site Name**

- ▲ Bon Tempe (1 and 2)
- ▲ Lake Lagunitas
- ▲ Muir Beach (1 and 2)
- ▲ Peters Dam
- ▲ Phoenix Lake (Inlet)
- ▲ Phoenix Lake (South Side)

Populations reflect trends, not absolute population numbers. Populations are likely a slight undercount due to lack of differentiating characteristics among individuals.



# Muir Beach Restoration



- Reconnect creek to floodplain
- Rotate & raise parking lot out of floodplain
- Build foot bridge over floodplain
- Restore habitat for species
- Engage & educate public



Coastal otters and connectivity:  
Otters hunt larger, slower fish in nearshore waters.







Thank you!



# ADDRESSING DATA GAPS



## BATS

**Gabriel Reyes**

Biologist, U.S. Geological Survey



## BEES

**Gretchen LeBuhn**

Professor, San Francisco State University



## USGS Bat Research in One Tam and Marin County Open Spaces

Gabriel Reyes, Catey Ritchie, Elizabeth Edson, and Brian Halstead





# Why bats?

Unappreciated and  
unstudied members of  
the ecosystem



## Why bats?

Unappreciated and unstudied members of the ecosystem

Provide important ecosystem services, and face many threats



## Why bats?

Unappreciated and unstudied members of the ecosystem

Provide important ecosystem services, and face many threats

Over 1300 species currently described, or about a quarter of mammal species





## Why bats?

Locally we have 13 species (potentially up to 15)



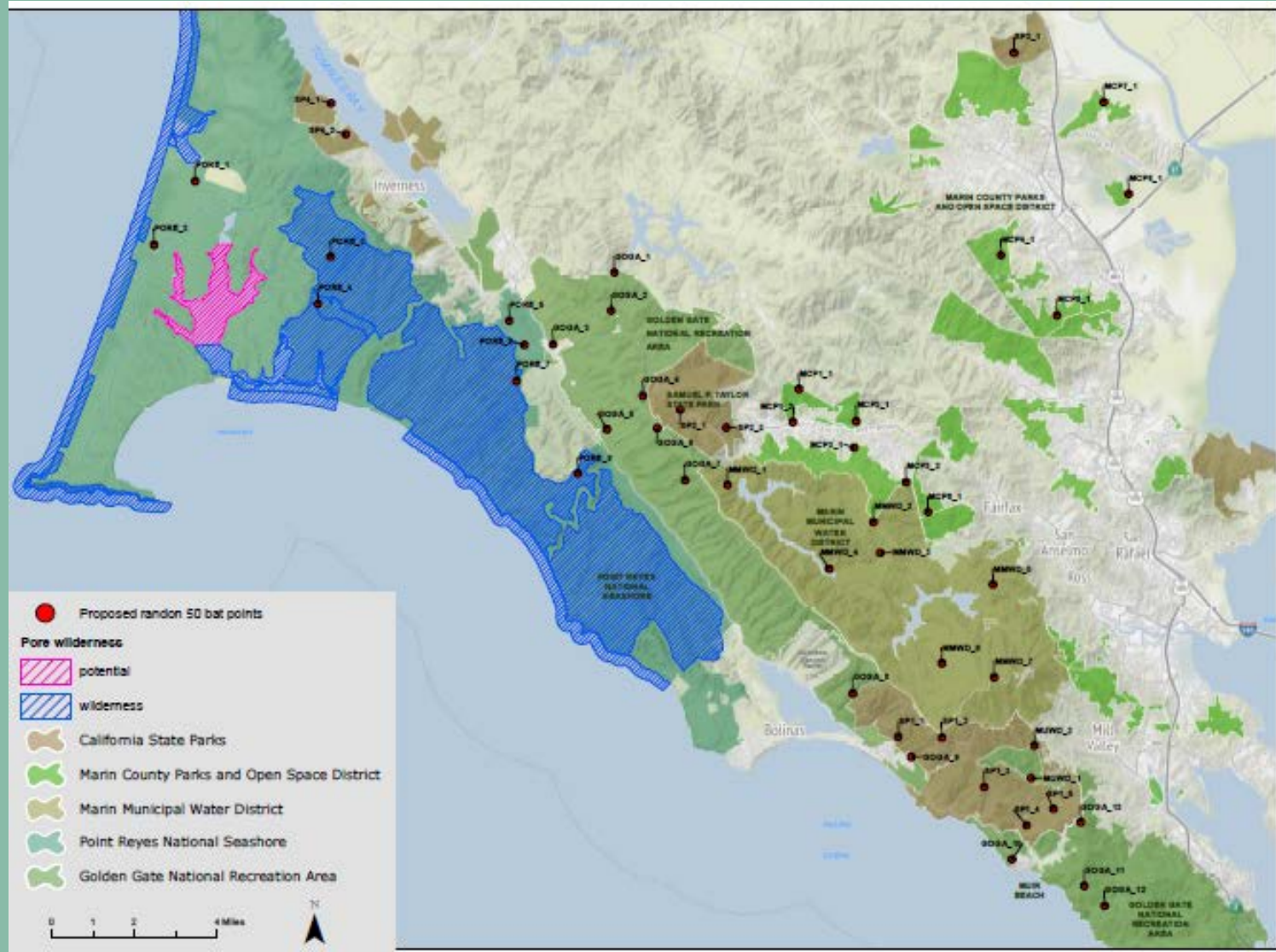
## Goals:

Study nocturnal habitat use and associations

Learn more about forest roosting habitat of understudied species

Fill in data gaps to allow for more effective and informative long-term monitoring and management

## Acoustic Monitoring

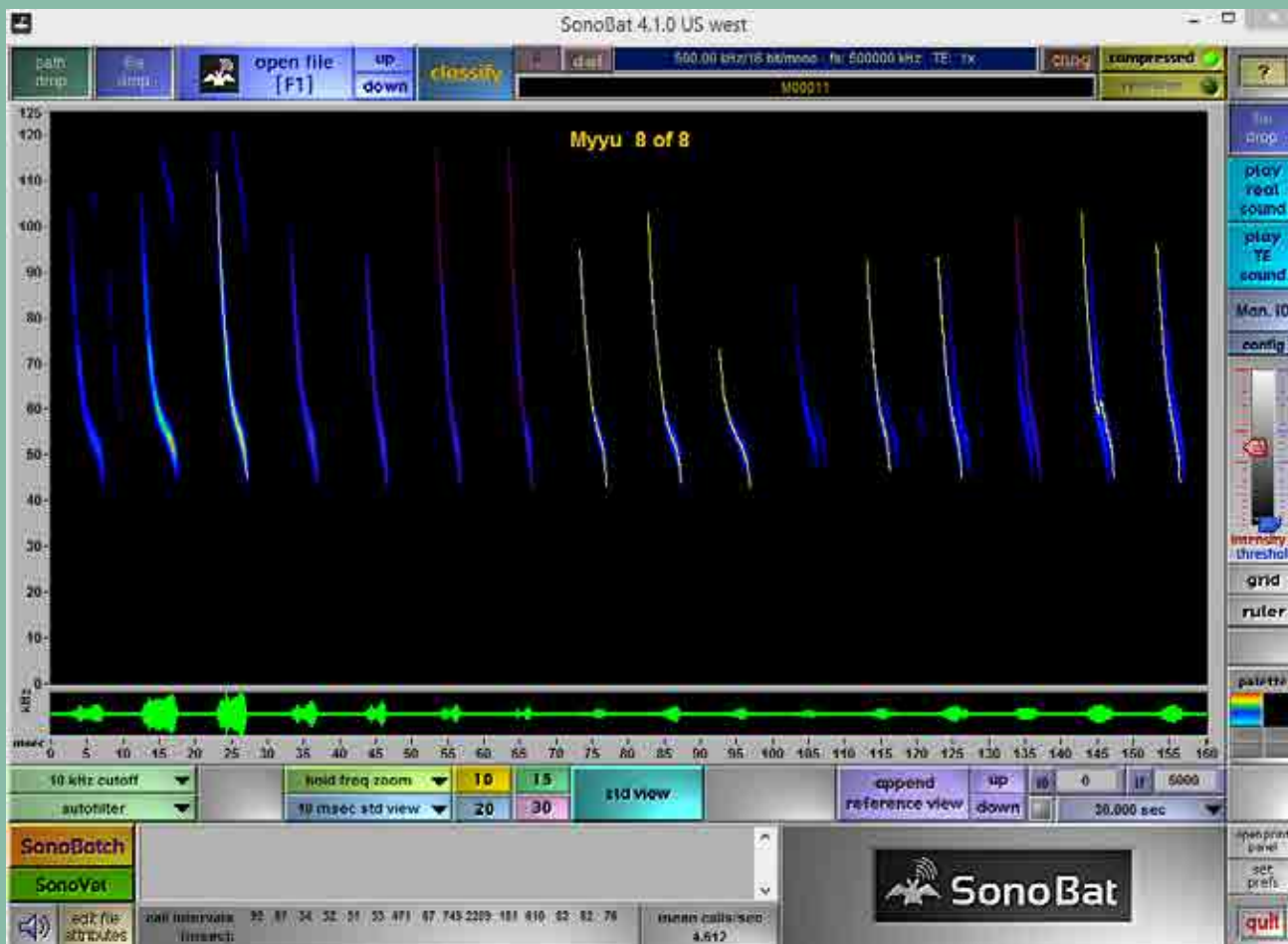




## Acoustic Monitoring

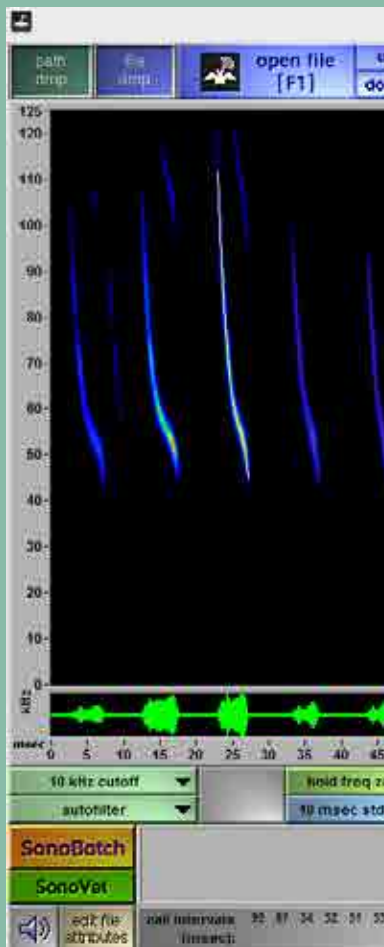


## Acoustic Monitoring





## Acoustic Monitoring





## Acoustic Monitoring

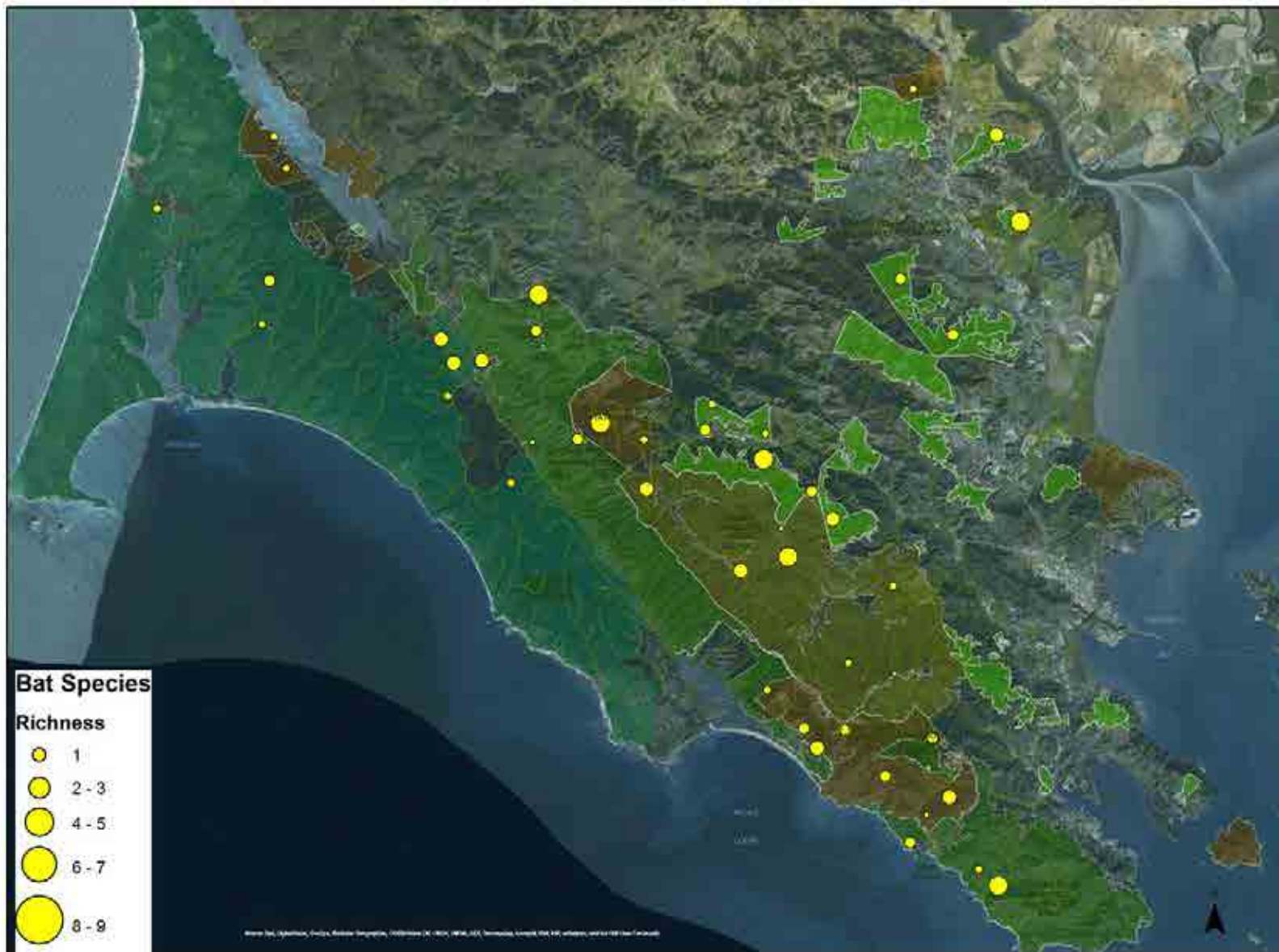


## Acoustic Monitoring





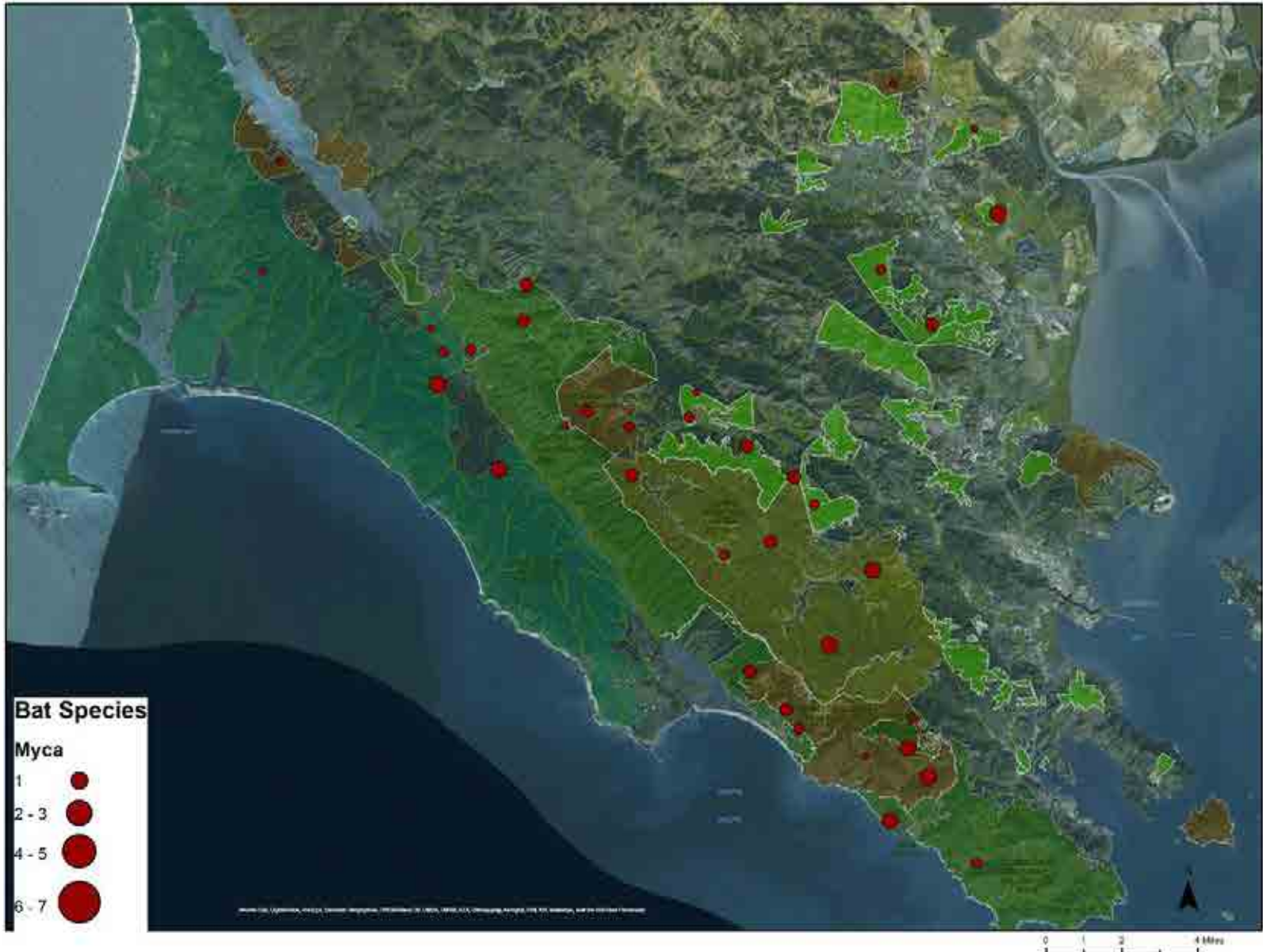
## Bat Species Richness







## California myotis





## Pallid bat







## Mist Netting







## Mist Netting Locations



## Mist Netting











So far...

We have captured 8 species and confirmed presence of breeding bats at many sites across our study area



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We have captured 8 species and confirmed presence of breeding bats at many sites across our study area

Found new hoary bat migration “corridors”





## So far...

We have captured 8 species and confirmed presence of breeding bats at many sites across our study area

Found new hoary bat migration “corridors”

Completed our first year of acoustic monitoring and detected potentially 13 species across our study area





## Next Steps...

The image displays the SonoBat 4.1.0 US West software interface. The main window shows a spectrogram of bat calls with a frequency range from 0 to 125 kHz and a time range from 0 to 290 seconds. The calls are represented by blue and green vertical lines. The interface includes various controls such as 'play root sound', 'play TE sound', 'Mm ID', 'zoom', 'ruler', and 'palette'. Below the spectrogram, there are settings for 'S kHz', 'bold freq zoom', 'autofilter', and 'append reference view'. The bottom of the interface features the 'SonoBatch' and 'SonoYet' panels, along with a 'moon calcs/sec' display.

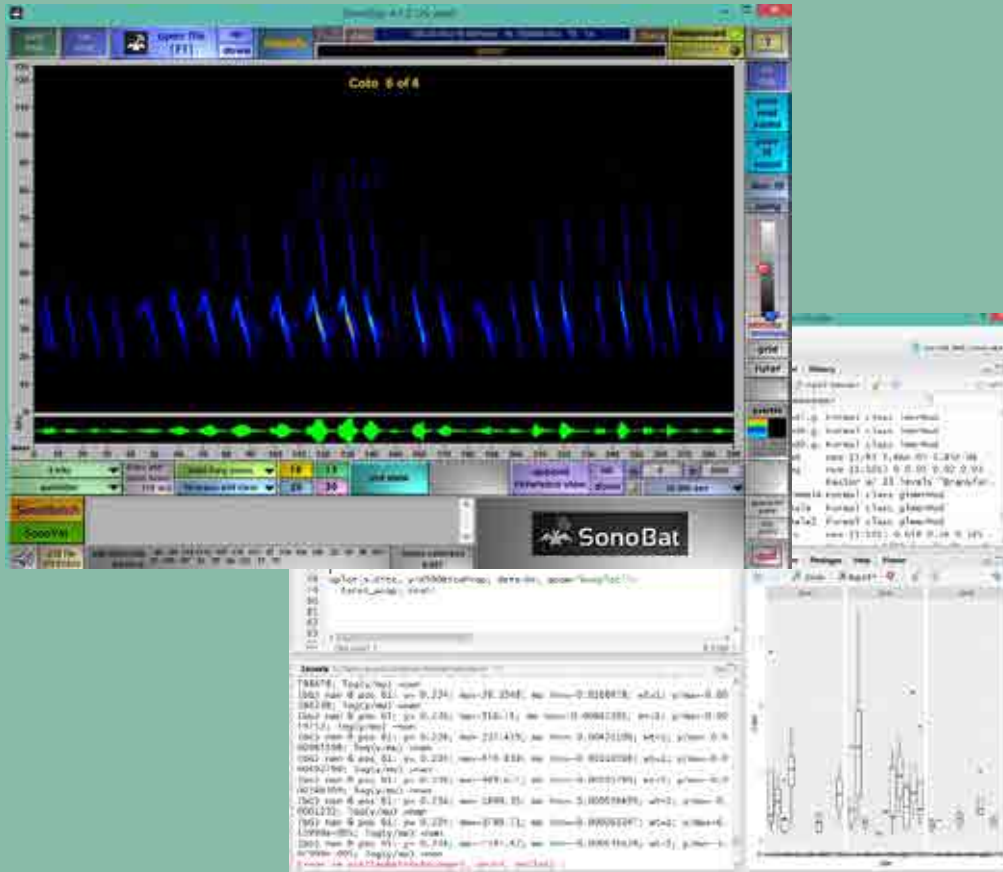
On the right side, there is a data analysis window showing a list of variables and their values. The variables include 'rateMod7.g', 'rateMod8.g', 'rateMod9.g', 'relgrad', 'riceseq', 's', 'smoothFemale', 'smoothMale', 'smoothMale2', and 'stderrs'. The values are displayed in a table format. Below the table, there is a plot showing the distribution of the variables. The plot is a box plot with multiple boxes, each representing a different variable. The y-axis is labeled 'Cov' and the x-axis is labeled 'Site'. The plot shows the distribution of the variables across different sites.

```

(bg) nan @ pos 61: y= 0.234; mu=-237.419; mu inv=-0.00421196; wt=1; y/mu=0.0
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00246399; log(y/mu) =nan
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0001232; log(y/mu) =nan
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Error in eval(substitute(expr), envir, enclos):

```

## Next Steps...







## Next Steps...



# Acknowledgements

Funding and research collaborators at One Tam, especially Sharon Farrell and Jon Yip.

The staff of Point Reyes, Muir Woods, Marin County Parks, Marin Municipal Water District, California State Parks.

And of course the army of bat wranglers!



Paul Myers Parks Conservancy



Alison Taggart-Barone Parks Conservancy





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