



The University of Texas at Austin  
Environmental Science Institute

*Hot Science - Cool Talk # 101*

***How a Salamander Saved a  
City: The Science and Politics  
of Endangered Species***

**Dr. David Hillis  
April 22, 2016**

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# *How a Salamander Saved a City*

**The Politics  
and Science of  
Endangered  
Species**

**David M. Hillis**

**The University of  
Texas at Austin**

**April 22, 2016**

*Salamander illustration  
by Calder Kamin*



## **Hot Science Cool Talks**

UT Environmental Science Institute



# If you could return to 1990 from today, how would you advise Austin's City Council about the future?

ralph.arvesen

**Economic development**

**Population growth**

**Water supply protection**

**Increase green spaces,  
parks & wild areas**



# **Metro Austin exceeds 2 million in population**



**“For fifth  
year, 5-county  
area is U.S.’s  
fastest  
growing...”**

Austin American  
Statesman (2016)





# ***Why is Austin on nearly every Top-Ten list as a place to live?***

**Quality of Life**

**Strong economy**

**Vibrant diverse city**

**Excellent entertainment**

**Great parks and recreation**

**“Weirdness” factor**



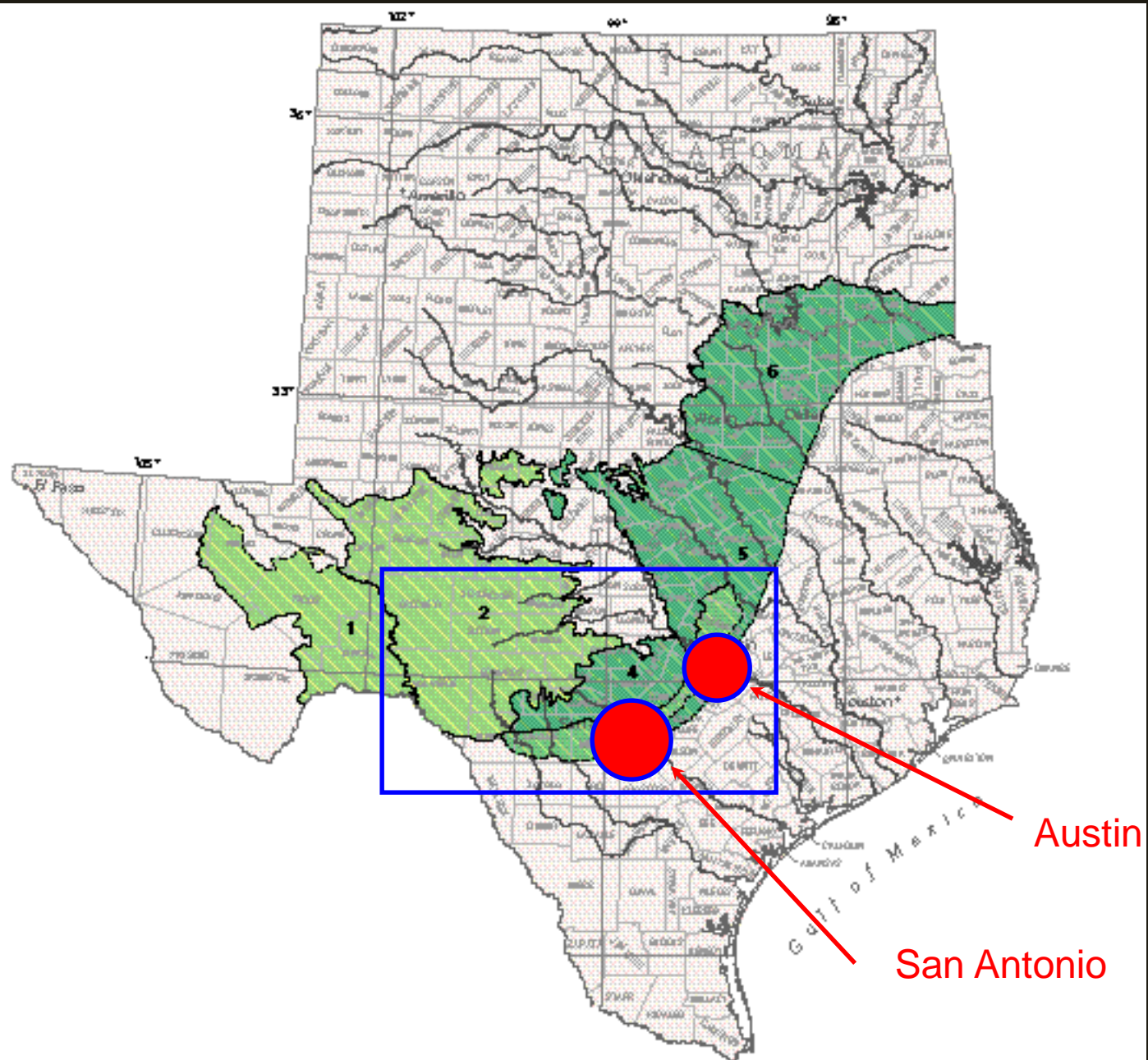
Image Courtesy of Save Our Springs (2016)



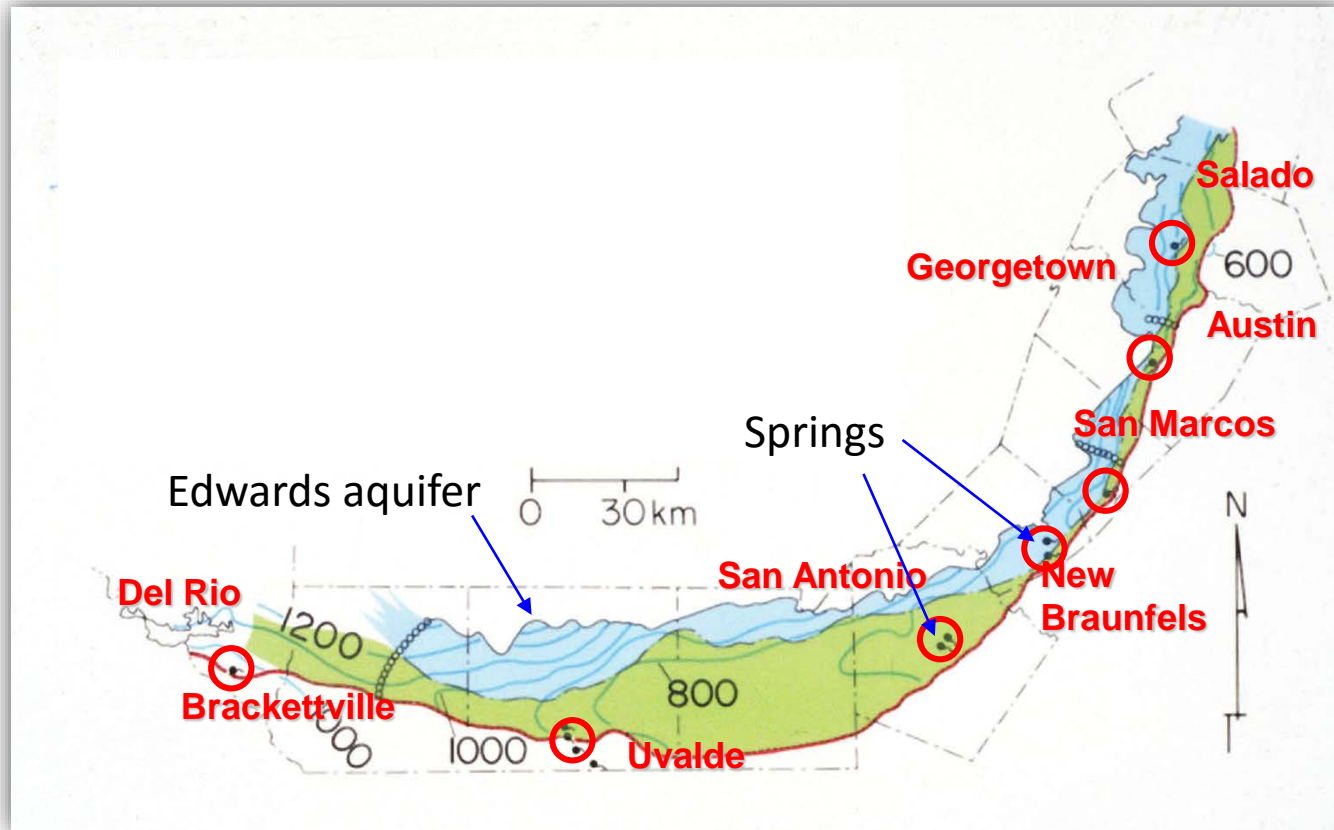
# What are the top complaints about Austin?

- Traffic
- Crowds
- Cost of living
- Weather
- Allergies
- Water shortages





# Settlement of Central Texas



Sharp (2003) *Hot Science – Cool Talks*



# Then and Now...

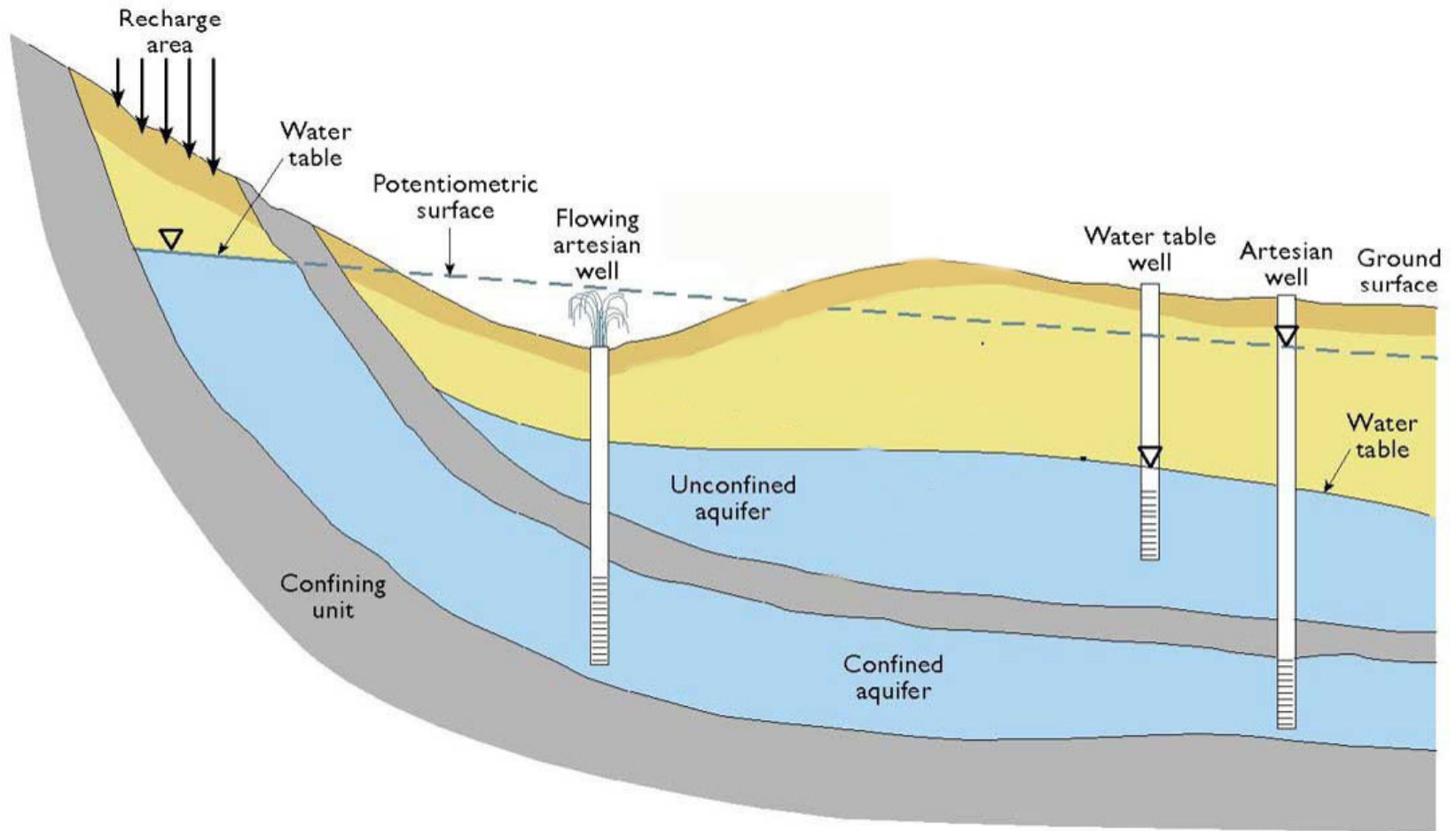


What Salado Springs looked  
like in the 1870s

Salado Springs Today

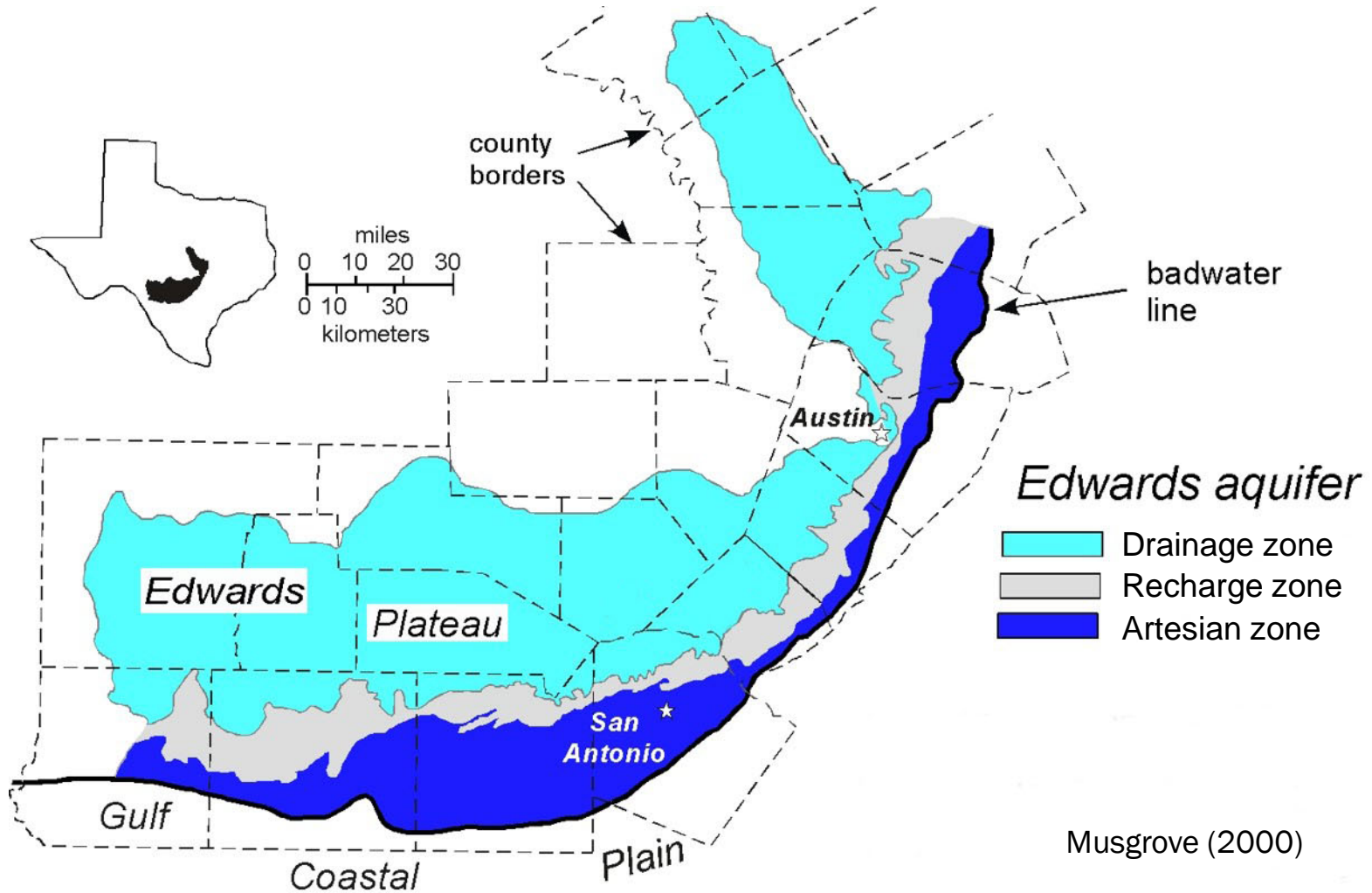


# Artesian Springs and Wells



Modified after Harlan and others, 1989

# The Edwards Aquifer





# Central Texas is a biodiversity hot spot

**Typical Terrestrial  
Salamander**



*Plethodon albagula*,  
White-throated Slimy Salamander

**Salamander sent to  
Stejneger in 1896**



*Eurycea rathbuni*,  
Texas Blind Salamander



# Salamanders in Texas

## Texas Spring Salamander

Discovered in 1937  
by Bishop & Wright



## San Marcos Salamander

Discovered in 1941  
by Bishop







# Barton Springs

Image Courtesy of  
Save Our Springs





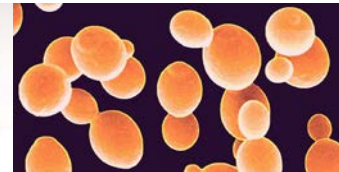
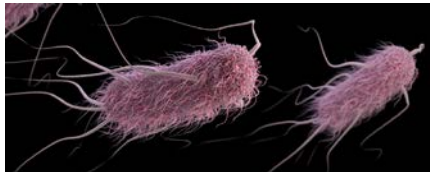
# Barton Springs

Image Courtesy of  
Save Our Springs  
(2016)

# Ideal Model Organisms

**Ideal Model Organisms**  
(e.g., fruit flies, yeast, bacteria)

- **Abundant**
- **Easily cultured**
- **Easy to collect and observe**
- **No permits required**
- **Rapid growth, short generation time**
- **Small, easily sampled genome**



**Texas Spring and Cave Salamanders**

- **Endangered and rarely seen**
- **Difficult to raise**
- **Difficult to collect & observe**
- **Many permits & regulations**
- **Slow growth, long generation time**
- **Giant genome; no genome sequenced**



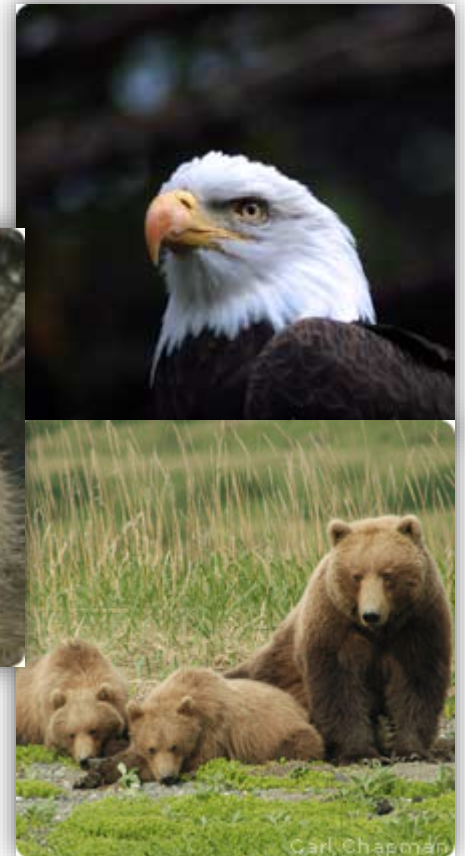


# Barton Springs

Image Courtesy of  
Save Our Springs

# What is an Endangered Species?

- **Endangered Species Act (ESA) created in 1973**
- **A species likely to become extinct throughout all or a large portion of its range**
- **Receives special protections by federal government to help it recover**
- **Must be evaluated and meet certain criteria to be listed as “endangered”**





# Late 1980s...

- Pool cleaning methods nearly eliminate salamanders
- “Liaison Committee” created between city and UT to develop “salamander friendly” cleaning methods



Memorabilia from  
conservation groups





**New methods  
adopted to  
clean Barton  
Springs Pool**





# 1990s...Citizens stand up for the springs

## “Barton Creek backers savor council vote”

*Austin American Statesman, June 9, 1990*

- 1990 hearing opposing McMoran Inc.’s proposal
- Save Our Springs (SOS) Coalition forms
- Formal proposal to USFWS to list Barton Springs salamander as endangered
- Opposition: claimed listing would be “catastrophic” to the economic development of Austin



Pogue (2012) *Austin Chronicle*



**Looking for  
salamanders**



**Salamander  
Trap**





## Exploring wells







# 1992...You CAN fight City Hall

- Save Our Springs Ordinance approved (42,246 to 26,187)
- Pro-environment candidates elected to Austin City Council
- USFWS preliminary finding of Barton Springs salamanders as an endangered species



Pogue (2012) *Austin Chronicle*

# But with lots of negative press...

**“New cry for springs: ‘Save the salamander’**

**Pool may be off-limits if U.S. agrees”**

*Austin American Statesman, January 25, 1992*



**“Save the springs for swimming by  
sizzling the salamanders”**

*Editorial, Austin American Statesman, January 30, 1992*

**“Parks board recommends chlorine for Barton pool”**

*Austin American Statesman, December 20, 1994*



# A New Species is Described...

*Herpetologica*, 49(2), 1993, 248–259  
© 1993 by The Herpetologists' League, Inc.

## A NEW SPECIES OF PERENNIBRANCHIATE SALAMANDER (*EURYCEA*: PLETHODONTIDAE) FROM AUSTIN, TEXAS

New species description  
published in 1993, authored  
by Paul Chippindale, Andrew  
Price, and David Hillis



**Barton Springs Salamander**  
*Eurycea sosorum*



## ...with a name to honor Austinites

“The species is named in honor of the citizens of Austin, Texas, whose efforts to protect the quality of Barton Springs resulted in the passage of a citizens’ aquifer-protection initiative.

This initiative is known locally as the SOS (Save Our Springs) Ordinance, and its supporters are known as SOSers. The specific name *sosorum* is the plural mixed-gender genitive form of the acronym SOS.”



Satan in West Texas ★ Dueling Catfish ★ The Sakowitz Feud

# Texas Monthly

JULY 1992 • \$2.50

## WHITE HOT MAMA

Ann Richards  
Is Riding  
High. Can  
She Be the  
First Woman  
President?





# Politicians begin to weigh in...

**“State calls for more study of Travis salamanders”**

*Austin American Statesman, July 29, 1993*

**“U.S. delays rule on protection of salamander”**

*Austin American Statesman, March 8, 1995*

**“Gov. Bush opposes salamander protection”**

*Austin American Statesman, July 26, 1995*

**“Salamander stirs calls of morality, communism”**

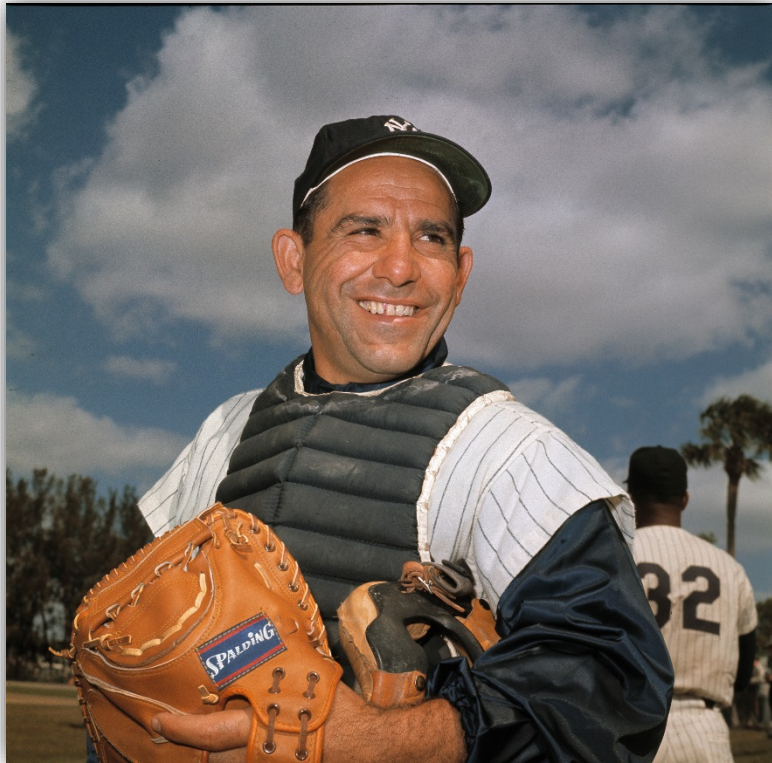
*Austin American Statesman, July 26, 1995*

**“Salamander pulled from endangered consideration”**

*Austin American Statesman, August 29, 1996*

*“In a surprising announcement, Secretary of the Interior Bruce Babbitt said on Wednesday that his agency would withdraw its proposal to list the Barton Springs salamander as an endangered species.”*





Washington Post (2015)

**“It ain’t over till it’s  
over”**

Yogi Berra

Yankees baseball player, coach

1925 - 2015

# September 1996... State of Texas and USFWS convene a panel to make recommendations

***“In my professional opinion, the Barton Springs salamander is the most endangered species of vertebrate in the United States.”***

Vic Hutchinson,  
1996 Salamander Panel



Pogue (2012) *Austin Chronicle*



## **“Suit seeks review for salamander”**

*Austin American-Statesman, October 30, 1996*

“Interior Secretary Bruce Babbitt bowed to politics and ignored science when he refused at the last minute to list the Barton Springs salamander as endangered, it was alleged in a lawsuit Tuesday.”

## **“Babbitt rejected advice on salamander”**

*Austin American-Statesman, December 5, 1996*

“U.S. Interior Secretary Bruce Babbitt rejected the advice of his own scientists in deciding not to list the Barton Springs salamander as an endangered species, newly disclosed records show.”

# The salamander gets its day in court!

U.S. District Judge Lucius D. Bunton ruled:

- Interior Department violated federal law
- Interior Department must base decisions solely on best scientific data



Barton Springs salamander listed as an endangered species in April 30, 1997

You know what happened next...

**“Judge rules salamander deal broke the law”**

*Austin American Statesman, March 27, 1997*







**“No one goes there  
nowadays – it’s too  
crowded”**

Yogi Berra

Protection of the salamander meant protection of Austin’s water supply





Barton Springs  
breeding facility

## Since 1997, the City of Austin has:

- Partnered with TPWD & USFWS
- Built a captive breeding facility
- Hired four full-time biologists to work in watershed protection
- Restored habitat at Barton Springs
- Protected Austin's water resources!

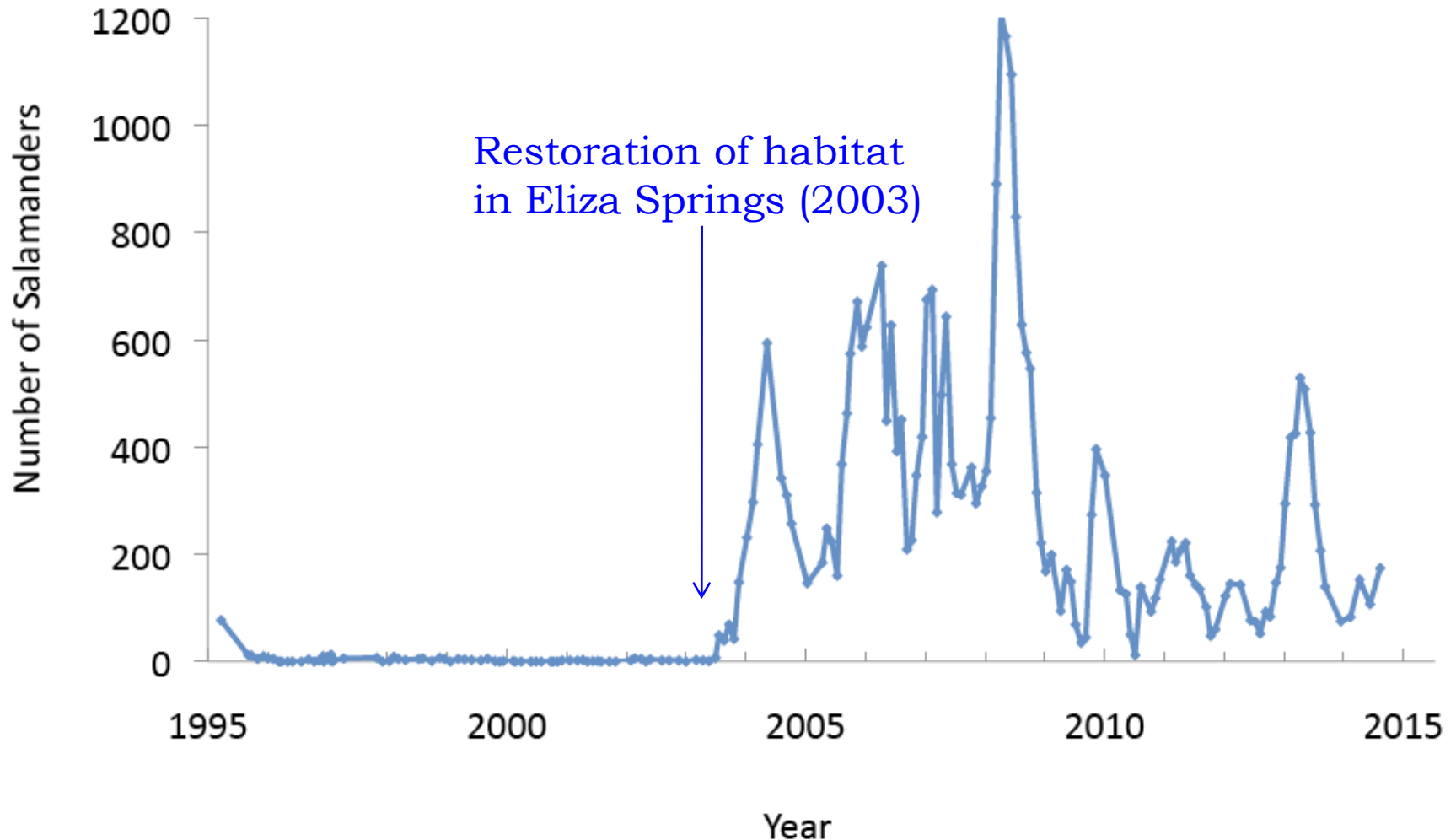




# **Eliza Spring salamander SCUBA survey**

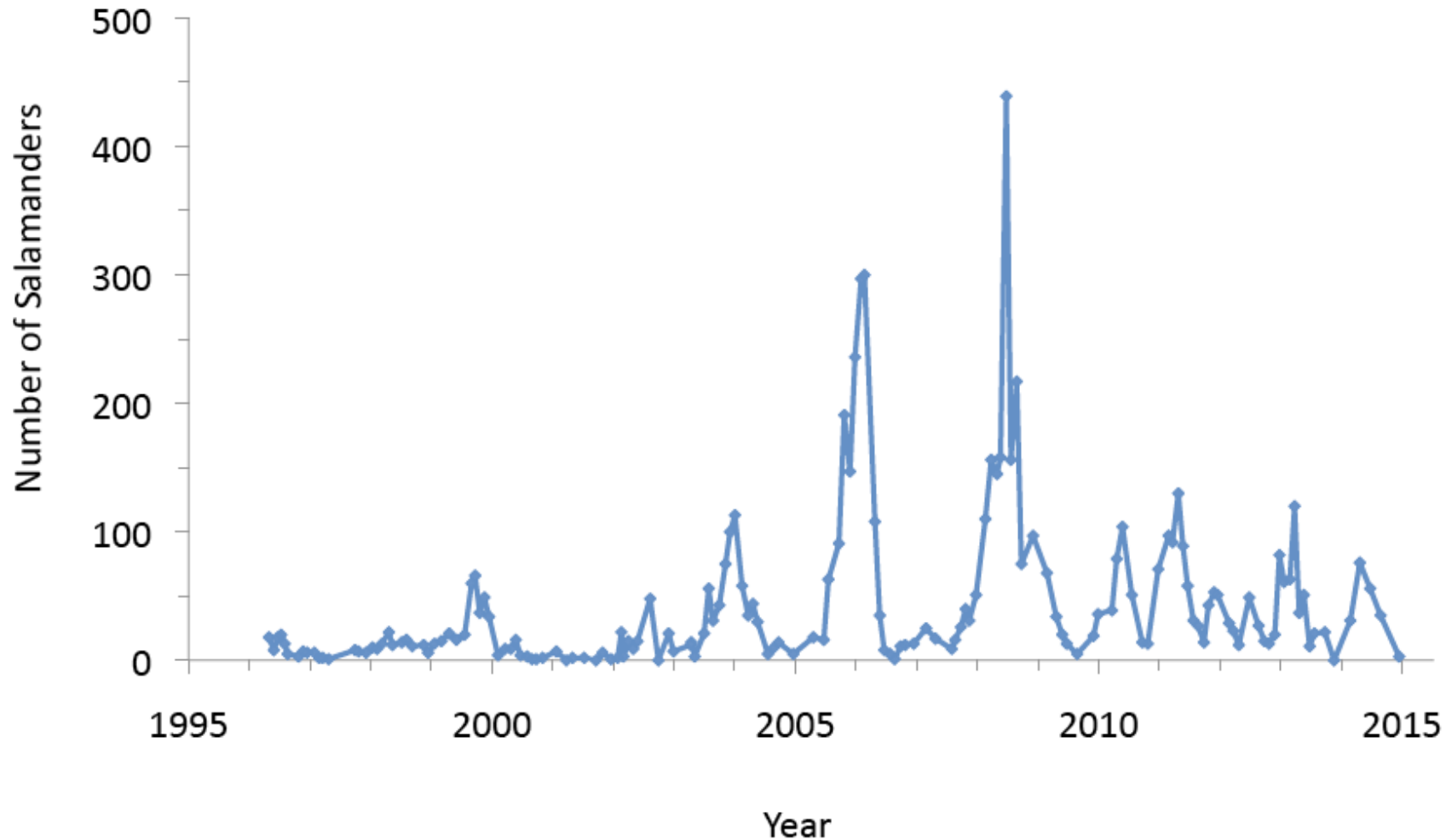
Austin Watershed  
Protection Department  
(2015)

# Number of Salamanders-Eliza Springs

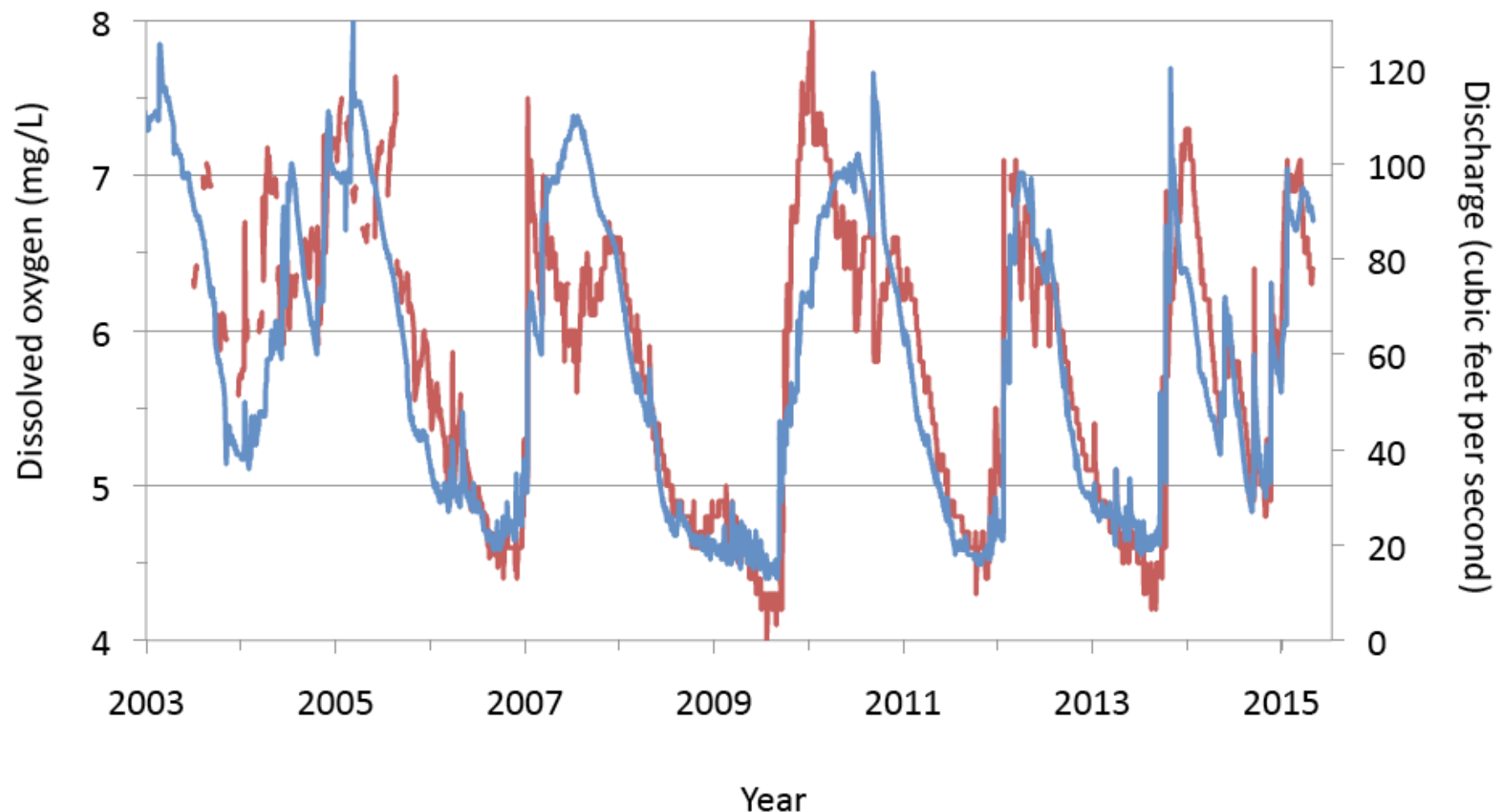




# Number of Salamanders-Barton Springs Pool



# Dissolved Oxygen vs. Discharge at Barton Springs Pool







# Dee Ann Chamberlain

City of Austin  
Watershed Protection  
Department



**Is this a new  
species of  
salamander?**



“You can observe a lot by just watching”  
- Yogi Berra



Henry Fitch (1909 – 2009)



Tricorder, version TR590  
*Star Trek* TV series



# Is a “Biocorder of Life” Possible?

## Step One

- DNA isolation and amplification of a series of target genes

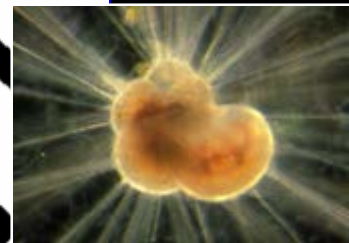
## Step Two

- Rapid sequencing of amplified genes

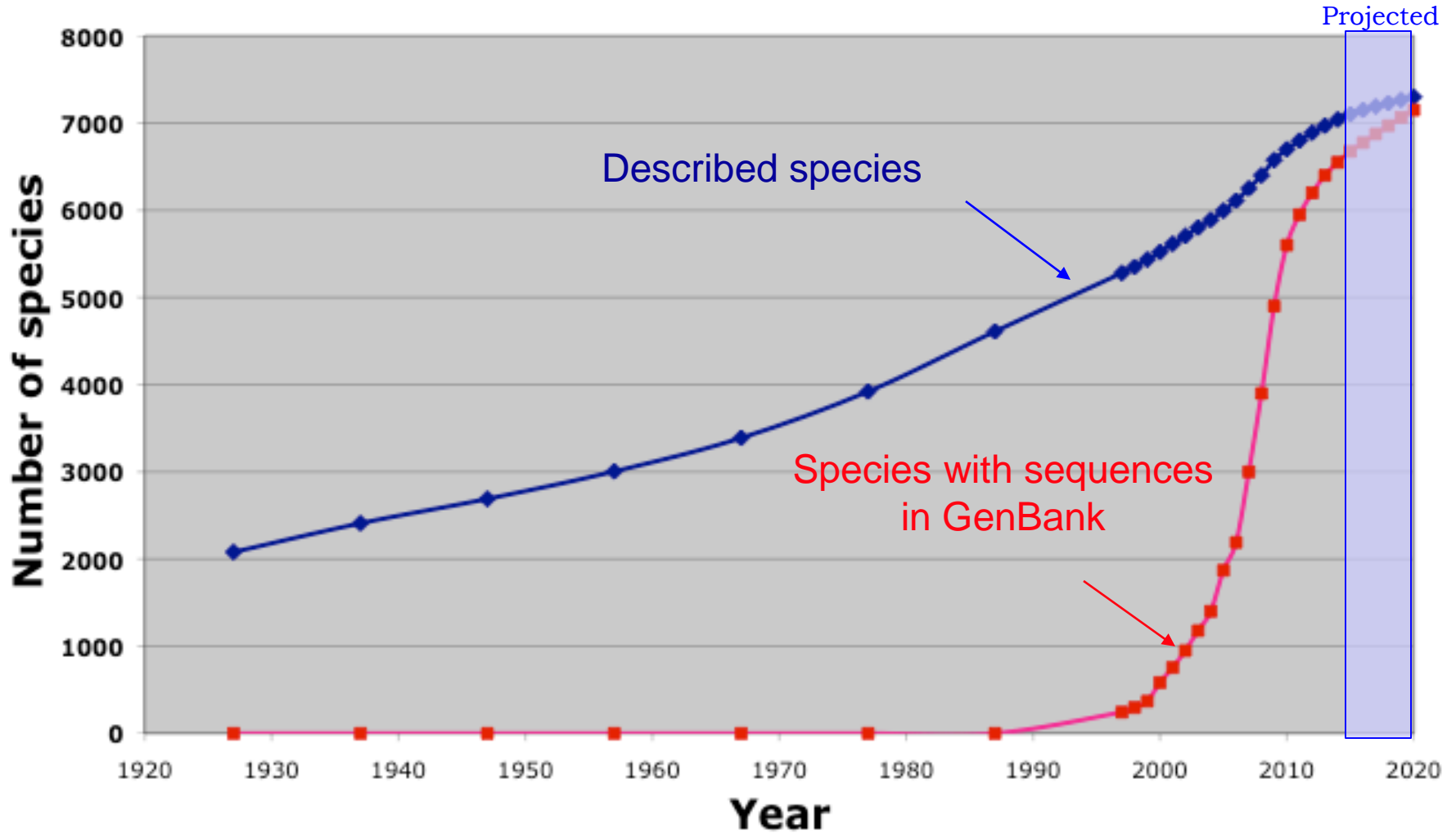
## Step Three

- Placement of unknown within the Tree of Life





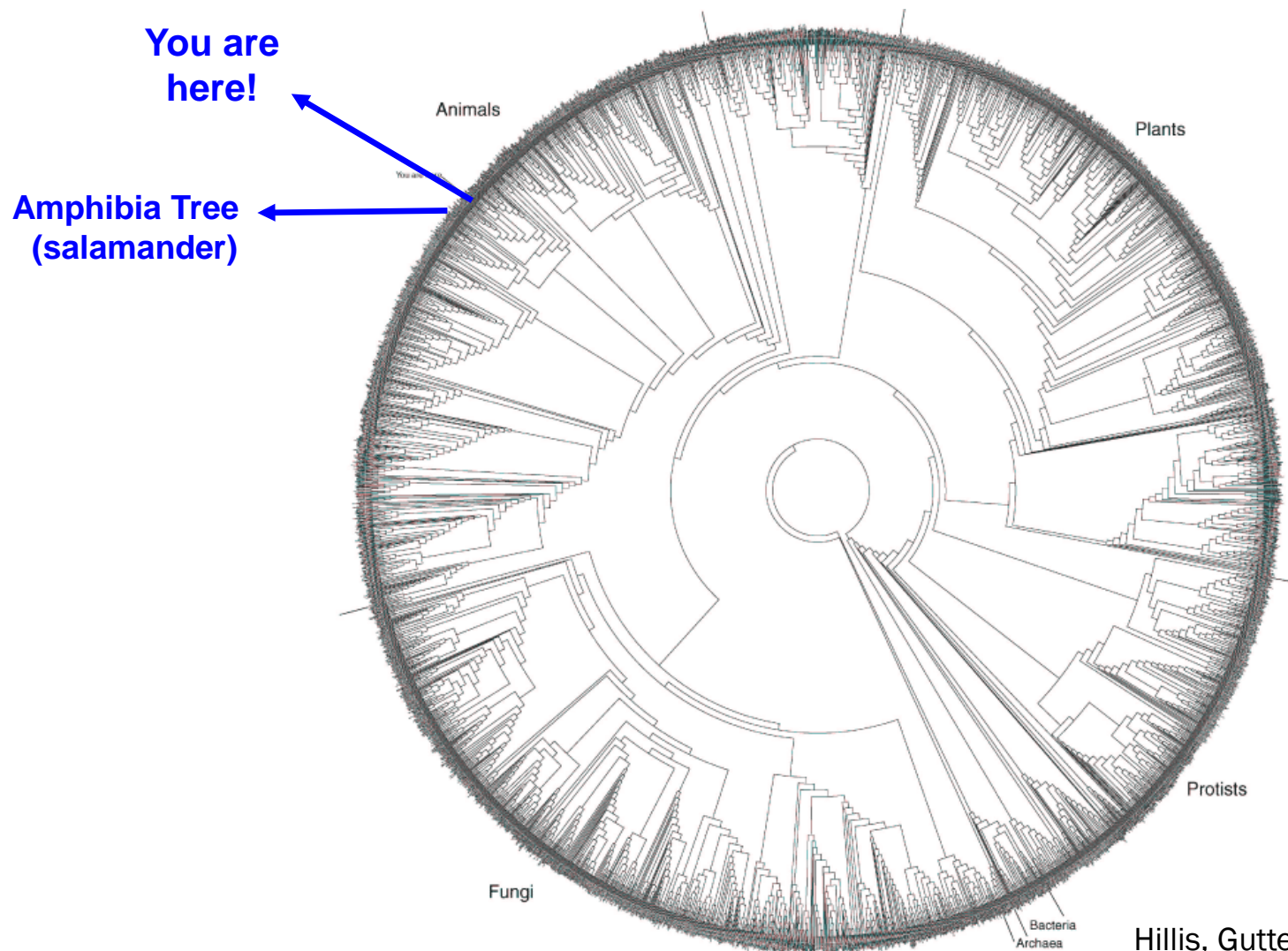
# Amphibian species and sequences







# Tree of Life



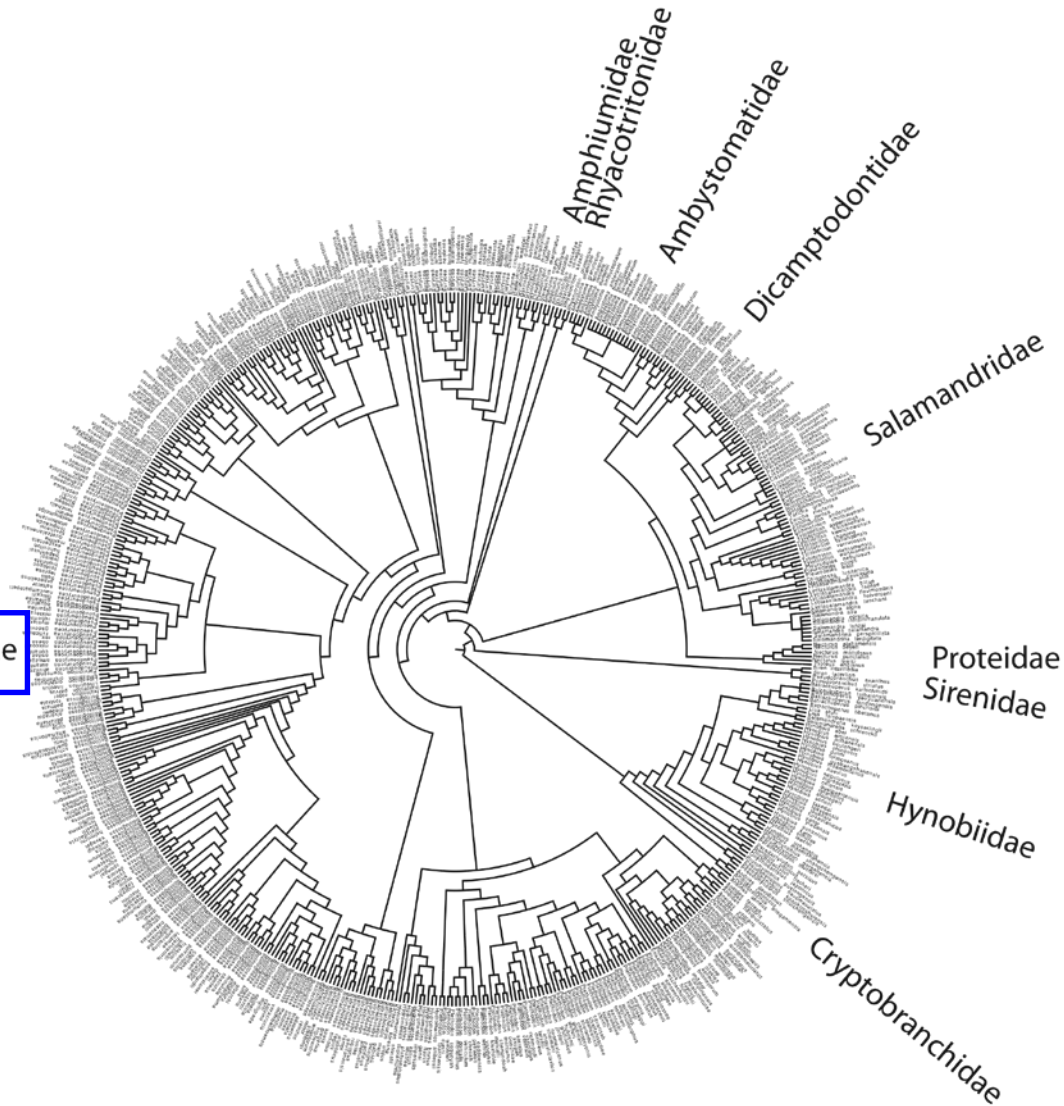
Hillis, Guttell & Zwickl *Science*  
300:1692-1697

# Tree of Life –Tree of all known salamanders

Lungless  
Salamanders

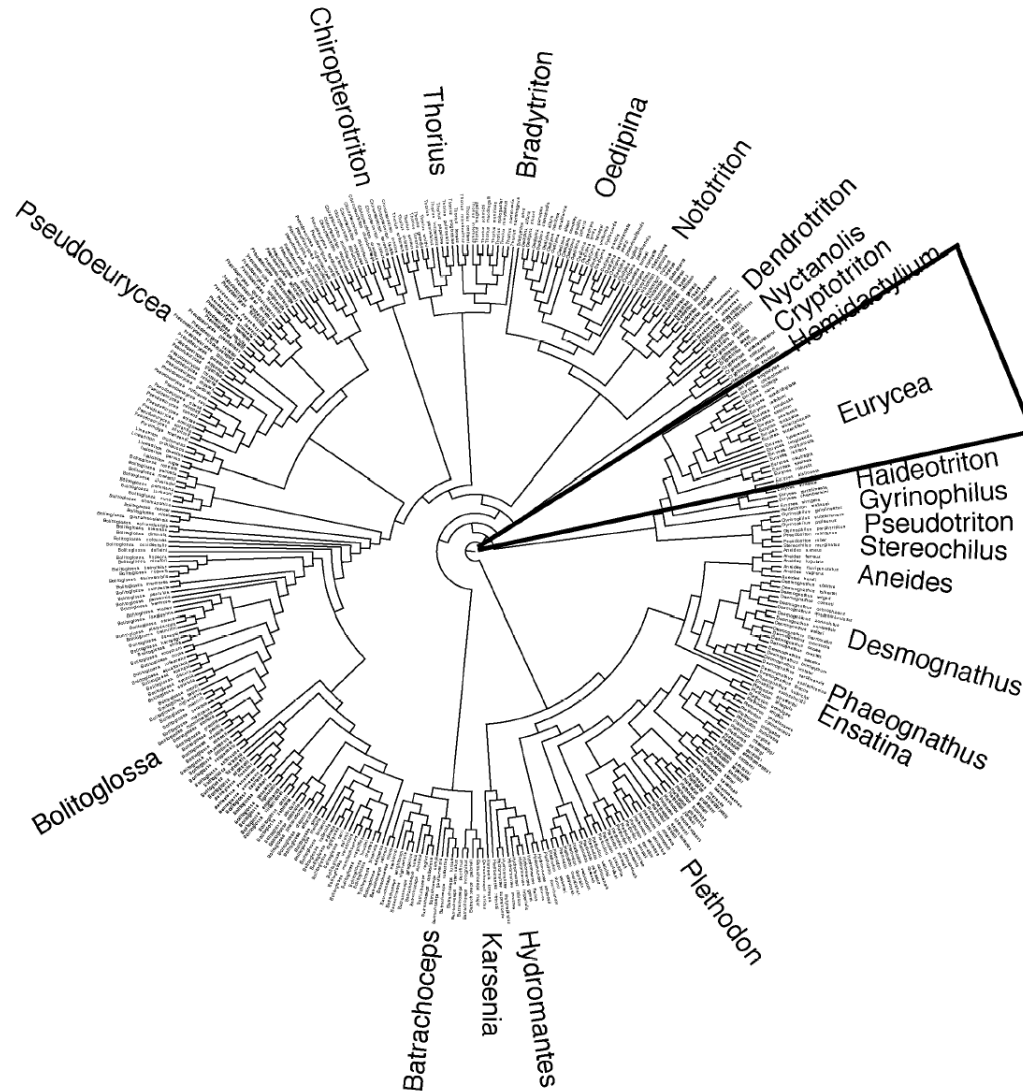


Plethodontidae

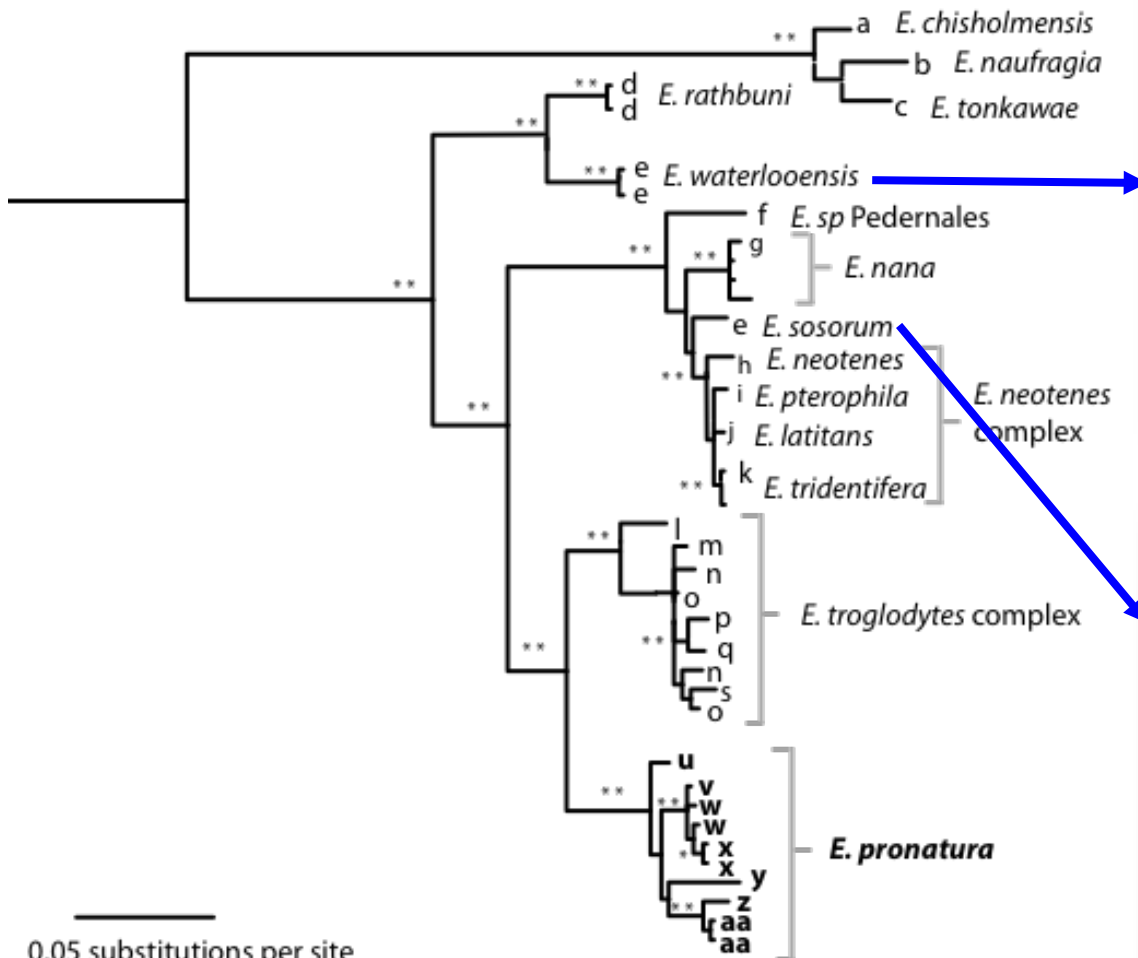




# Tree of Life – Lungless Salamanders



# Spring and cave salamanders of Texas



0.05 substitutions per site

\*\* Posterior probability  $\geq .99$

\* Posterior probability  $\geq .95$



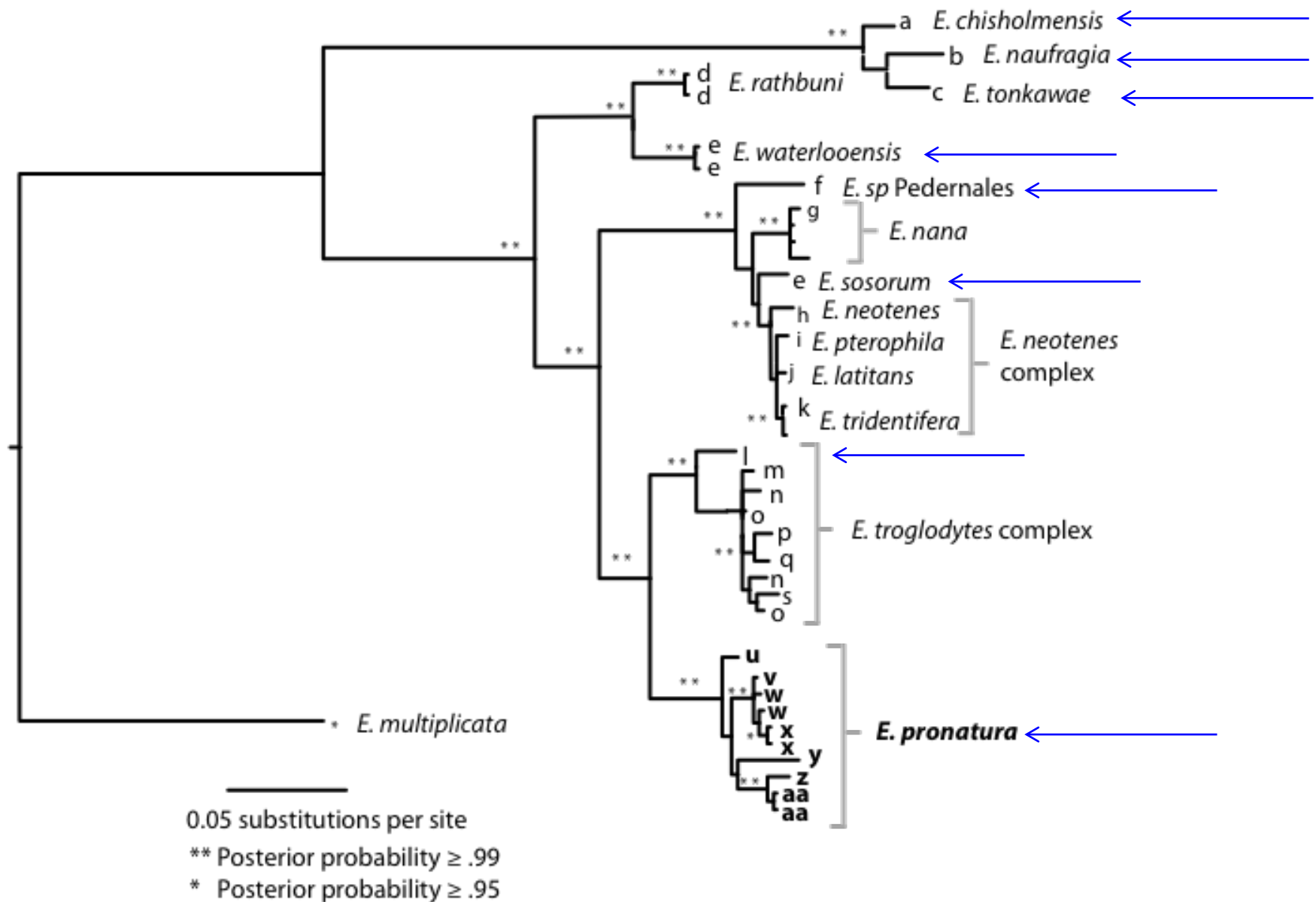
Austin Blind salamander



Barton Springs salamander



We've continued to discover new species in other regions of the aquifer:





**“It’s like déjà vu all over again” -Yogi Berra**

**“Different salamander, same goal”**

*Austin American Statesman, June 14, 2005*



© Nathan F. Bendik

“An Austin environmental group has asked officials to add the Jollyville salamander to the list of endangered species, potentially creating new development controversies along the Travis-Williamson county line.”

**“Williamson County officials oppose federal protection of salamander”**

*Austin American Statesman, January 22, 2014*



**But Austin and Travis County have learned to embrace their inner salamanders!**

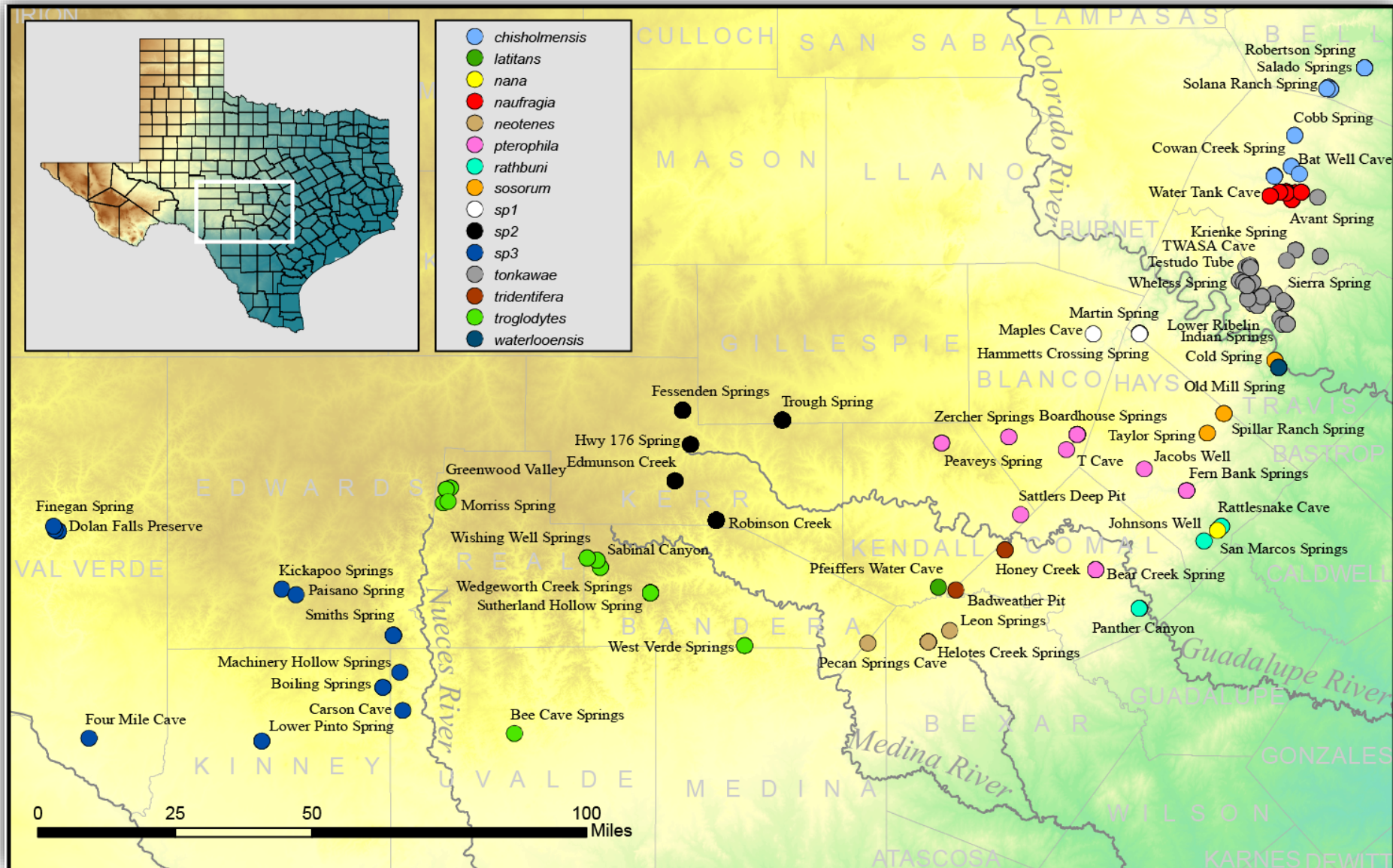
**“Travis County commissioners asked to back staff recommendation to list salamanders as endangered”**

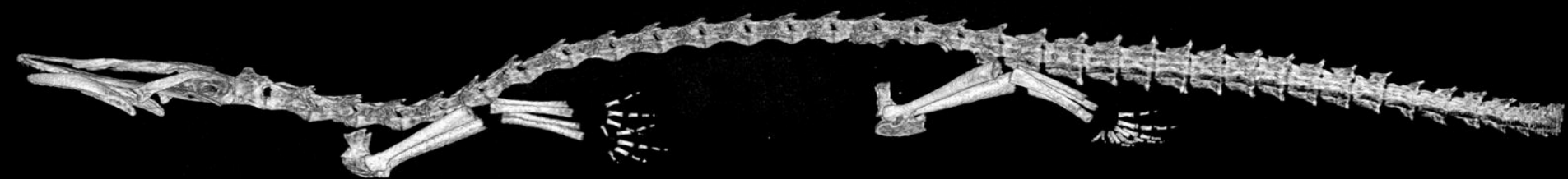
*Austin American-Statesman, October 9, 2012*

**“Travis County** staffers said Tuesday that they **support the listing** of four species of salamanders in Central Texas on the federal government’s endangered species list...[joining] the **City of Austin**, which voted on the issue Sept. 27, in **supporting the listing.**”



# Salamander Species Unique to Central Texas







## **Drilling for salamanders**



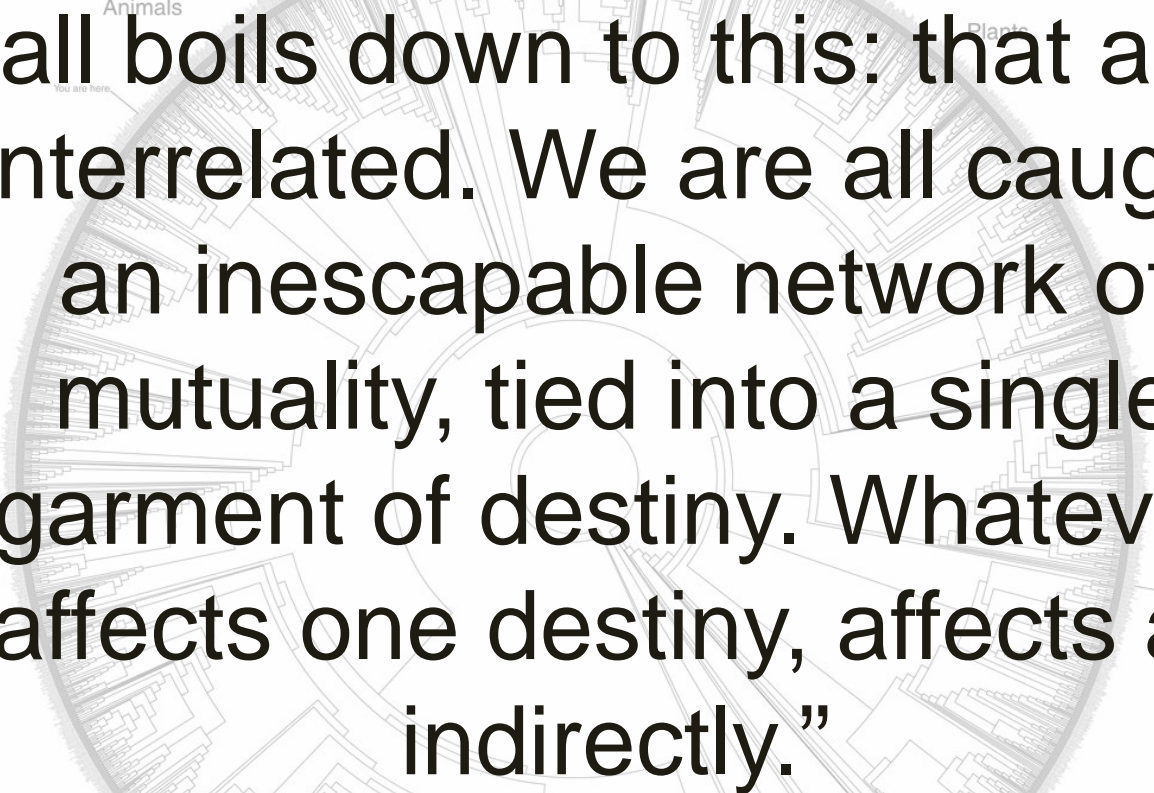
# Have the salamanders done enough to save the humans?



*Salamander illustration  
by Calder Kamin*

**It is not humans  
versus  
salamanders.**

**Saving  
salamanders =  
Saving humans  
(and the water  
supply that we  
all need to  
survive)**



“It all boils down to this: that all life is interrelated. We are all caught in an inescapable network of mutuality, tied into a single garment of destiny. Whatever affects one destiny, affects all indirectly.”

Martin Luther King, Jr.







# Acknowledgements

- Former graduate students: Paul Chippindale, Emily McTavish, April Wright
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- Texas Parks and Wildlife Department: Andy Price, Chad Norris, and Andy Gluesenkamp
- NSF for funding through Presidential Young Investigator Award; USFWS for Section 6 funding through the Endangered Species Act (via the TPWD)
- The late Yogi Berra for a lifetime of wonderful contributions to the American idiom
- The moral, communist salamanders of the Edwards Plateau



Questions?

# Dr. David Hillis



David M. Hillis received his B.S. degree (with honors) from Baylor University in 1980, and M.A., M.Ph. and Ph.D. (all with honors) from The University of Kansas in 1983, 1984, and 1985, respectively. After two years on the faculty at the University of Miami, he joined the Department of Zoology at UT Austin in 1987 and was awarded a prestigious National Science Foundation Presidential Young Investigator Award the same year. In 1992, he was appointed to the Alfred W. Roark Centennial Professorship in Natural Sciences, and in 1998 became the first Director of the School of Biological Sciences at the University of Texas - Austin. In 1999, Hillis was one of 32 people chosen to receive a prestigious MacArthur Foundation fellowship, known informally as the “genius award”.

David Hillis' research interests span much of biology, from development of statistical and computational methods for analyzing DNA sequences, to molecular studies of viral epidemiology, to studies of the diversity and phylogeny of life (particularly vertebrates), to the origin and behavior of unisexual organisms. He has published over 130 scholarly articles and two technical books, and has served as Editor or Associate Editor of a dozen scientific journals. He is an active member of many scholarly societies and national research panels, and has served as the President of the Society of Systematic Biologists. In the past decade, the 23 graduate students and 12 post docs in his laboratory have produced an additional 120 independent scholarly articles.