

H₂O

WORLD
2 0 1 7



Tanya Berger-Wolf

Crowdsourcing, computer vision, and data science for conservation.

Wildbook.org @IBEIS_org
www.cs.uic.edu/~tanyabw

How fast does the elephant population of Africa decline?



Paul Allen @PaulGAllen

How far do whales travel?



How many bobcats are left in the world?



How many turtle hatchlings survive?

© William R. Curtsinger / National Geographic



Orca Killed by Satellite Tag Leads to Criticism of Science Practices

The death of a rare killer whale in the Pacific Northwest has been linked to a tagging effort, causing an outcry and re-evaluation by the science community.





WHEN A USER TAKES A PHOTO,
THE APP SHOULD CHECK WHETHER
THEY'RE IN A NATIONAL PARK...

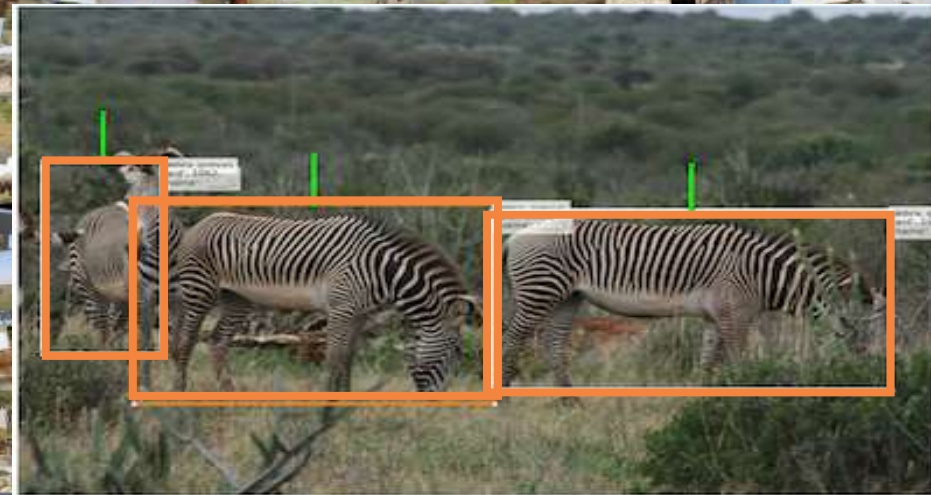
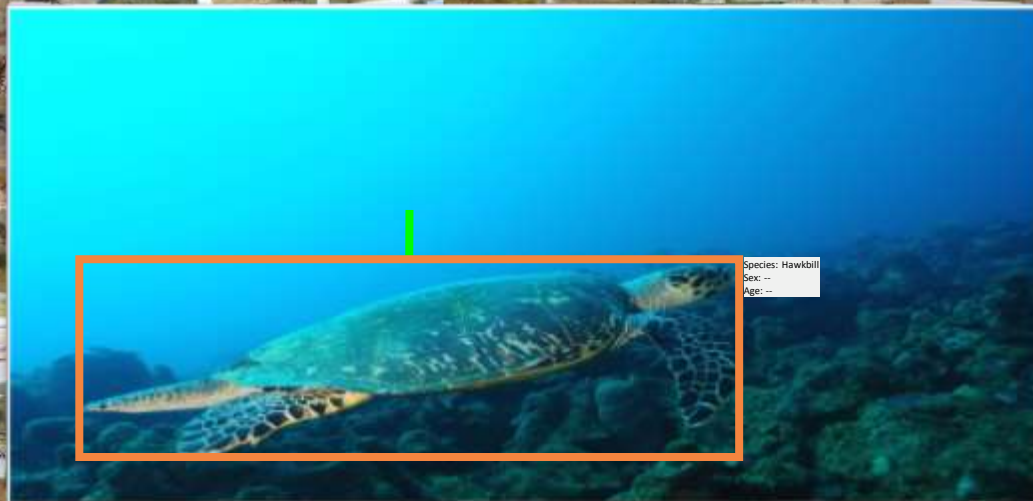
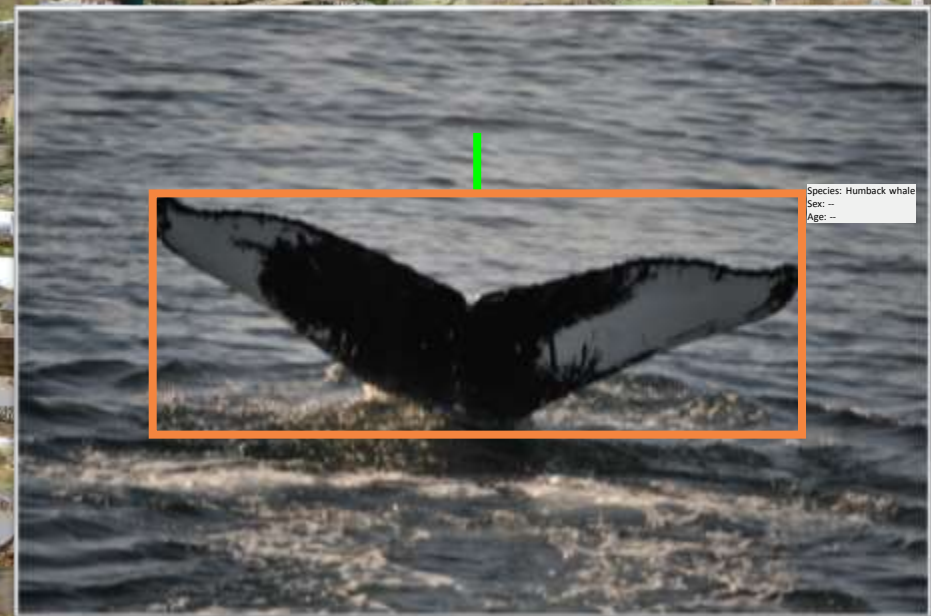
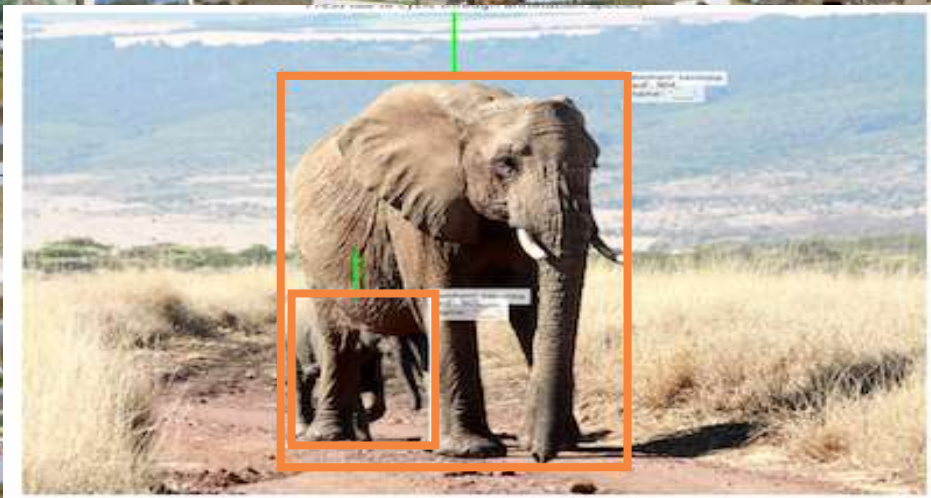
SURE, EASY GIS LOOKUP.
GIMME A FEW HOURS.

... AND CHECK WHETHER
THE PHOTO IS OF A BIRD.

I'LL NEED A RESEARCH
TEAM AND FIVE YEARS.



IN CS, IT CAN BE HARD TO EXPLAIN
THE DIFFERENCE BETWEEN THE EASY
AND THE VIRTUALLY IMPOSSIBLE.

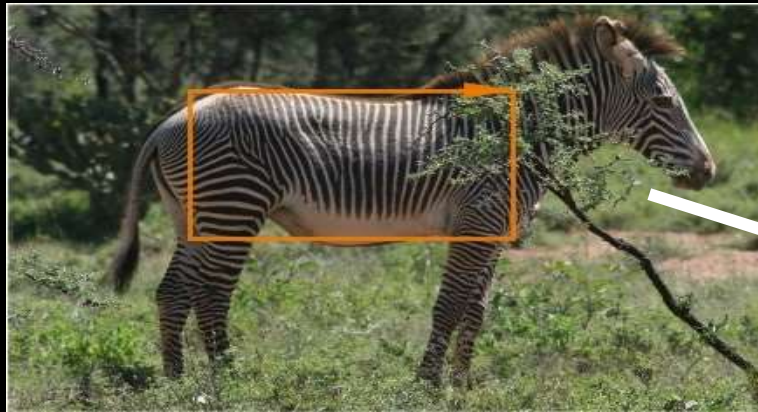


Extracting *Annotations* Using Deep Convolution Neural Networks

Result: regions and species



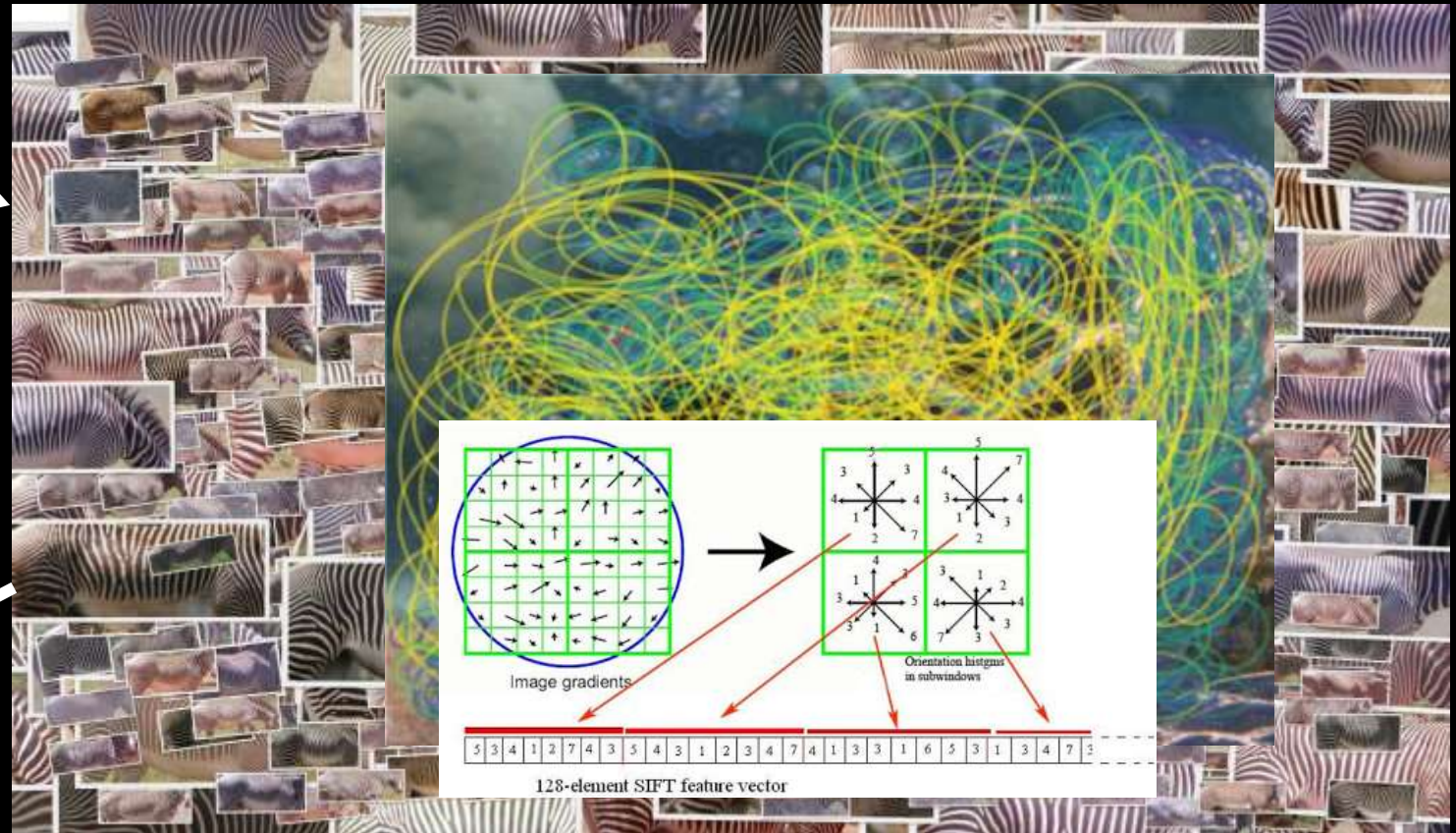
Who is this?



Zippy the Zebra!



Database of thousands





Pinchy

Edit



Marked Individual 5560

Date of Birth

Nickname: Pinchy

Date of Death:

Sex: female

Alternate ID:

Taxonomy: *Physeter macrocephalus*

PIN,AET:3146,IFAW:20029



View all images...

Co-occurrences

Co-occurrences Diagram

Co-occurrences Table

+ - Reset



Biological Samples & Encounter(s) (not all may be currently visible)

548 Encounter(s) (not all may be currently visible)

Biological Samples

2012-05-07			unknown		
2012-05-07			unknown		
2012-05-07			unknown		
2012-05-07			unknown		
2012-05-07			unknown		



- Population count
- Birth/death dynamics
- Species range
- Social interactions
- Species interactions

Marked Individual : A-266
A marked individual is a single animal distinctly identified at one or more points in time.
[Learn more.](#)

Alternate ID: None [\[edit\]](#)

Nickname: Tiger [\[edit\]](#)
Nicknamed by: Jason Holmberg

Sex: male [\[edit\]](#)

10 Encounter(s) (not all may be currently visible)

Date	Location	Data Types	Number	Alternate ID	Sex	Spot Data	Occurring With	Behavior
2012-7-19	north ningaloo		2792012211016	None	unknown	L		
2012-7-15 13:00	north of Millering Visitor Center, Ningaloo Reef, Western Australia		157201201210	None	unknown	R		crusing north
2012-7-15 10:30	north ningaloo		2792012203155	None	unknown	LR		
2012-7-15 12:15	north ningaloo		410201222372	None	male	LR		
2012-7-12 11:30	north ningaloo		101020122939	None	male	L		
2007-6-26	Ningaloo Reef, Western Australia		272007235438	None	unsure	L		
2003-5-25	Ningaloo Marine Park		7112005104424	None	unsure			
2003-4-22	Ningaloo Marine Park (Coral Bay)		63200682910	None	unsure			
2003-4-5	Ningaloo Marine Park (Coral Bay)		193200613021	None	male	R		
2002-	Ningaloo Marine Park		101020050212	None	unsure	L		

MEET AN ADOPTER



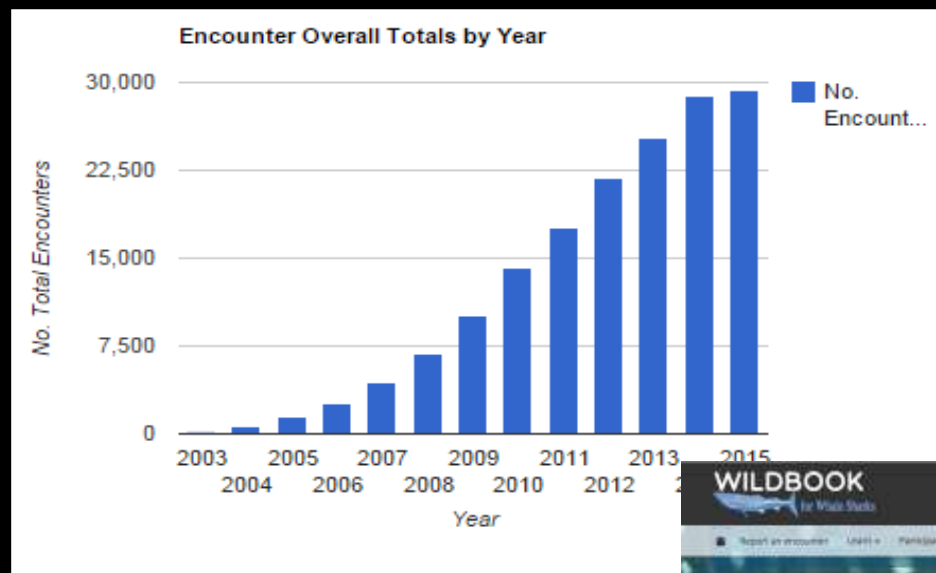
Sea Breeze Resort Exmouth

Why are research and conservation for this species important?

"The most beautiful male Whale Shark around. It has few spots and lots of stripes."

Adoption type: Corporate adoption
Adoption start: 2012-07-30
Adoption end: 2013-07-30

[\[edit this adoption\]](#)



WILDBOOK
for Whale Sharks

Adopt a Shark

Report an encounter | Upload | Participate | Individuals | Researchers | Search | Export | **47 encounters**



8431 identified whale sharks
38919 reported sightings
5200 citizen scientists
134 researchers and volunteers



Collaborating Researchers (click each to learn more)



Adoption and following

YouTube scraped daily

Achieve collaboration where none existed!



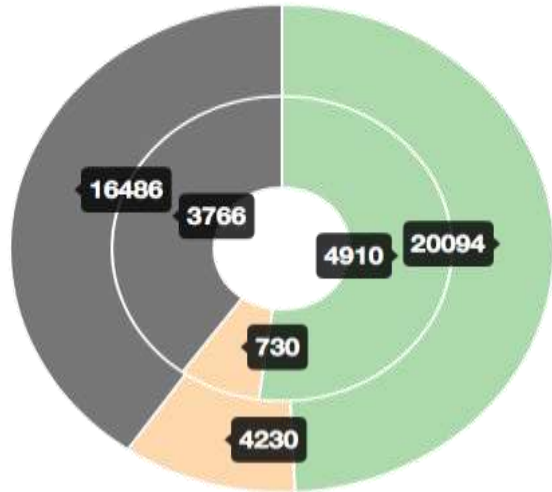


Jan 30-31, 2016
hundreds of people
45 locations
40,000+ images
95% of zebra species
2352 animals

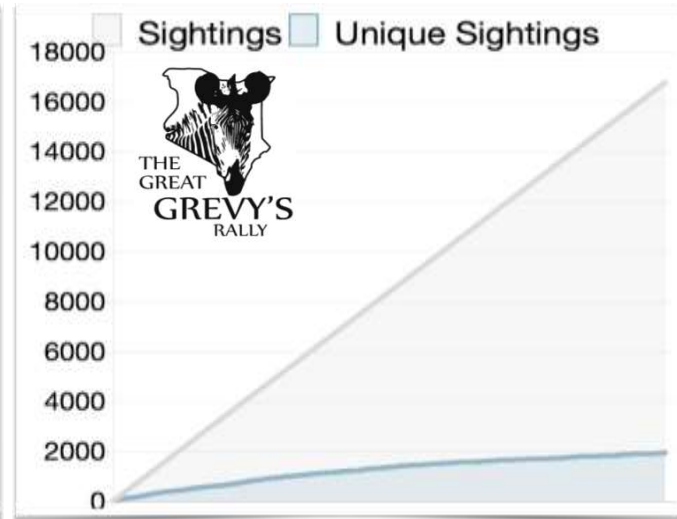
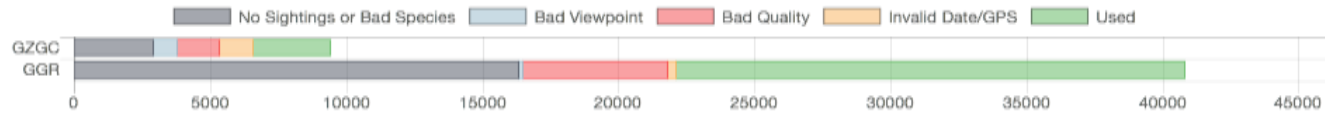
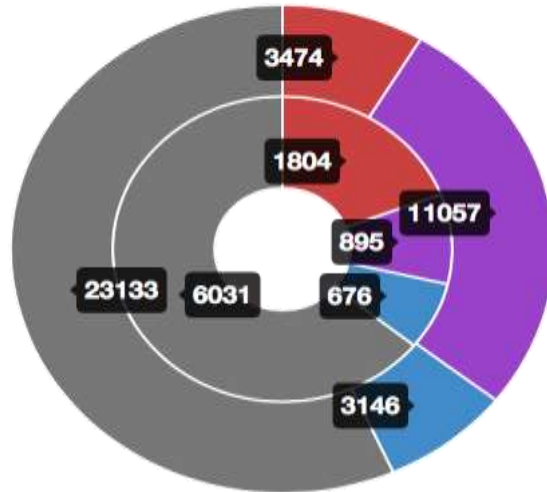


Can we count using photos?

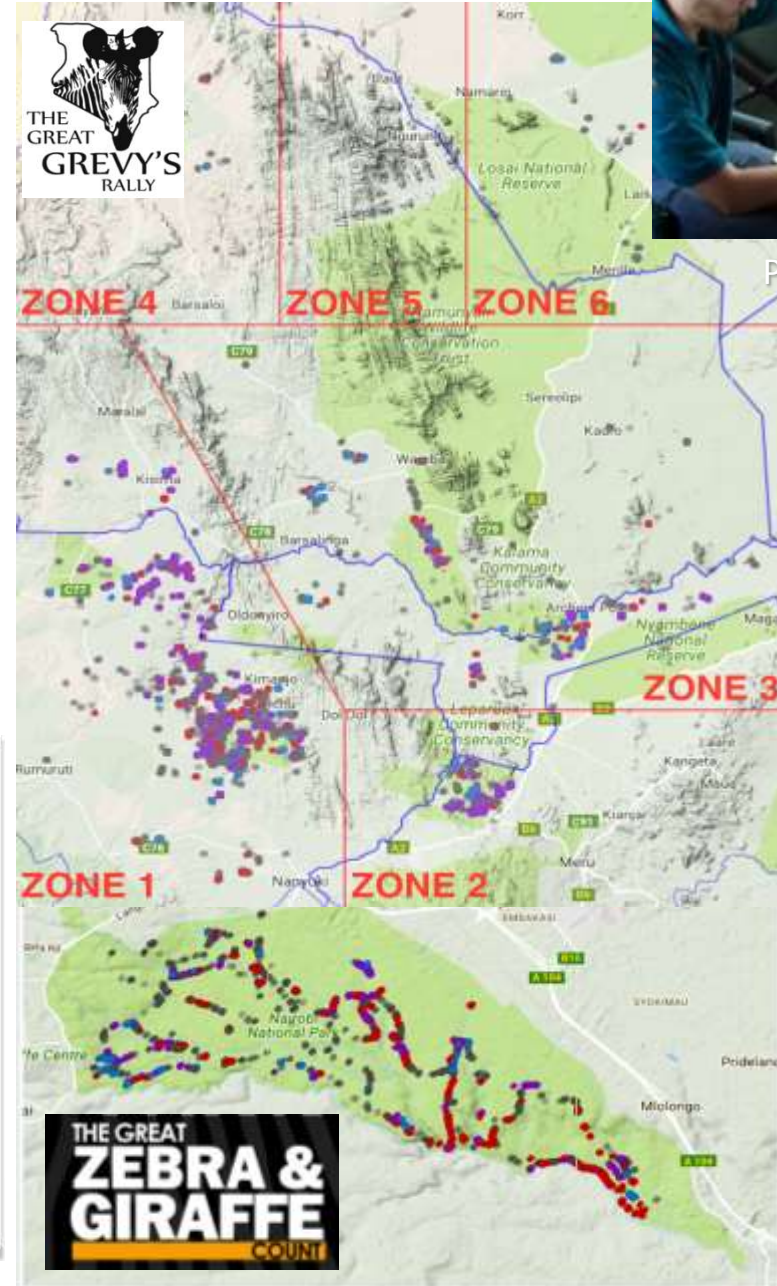
■ Correct Viewpoint
■ +/- 45 Viewpoint ■ Unused




■ Day 1 Only ■ Resightings
■ Day 2 Only ■ Unused



Parham et al. '17



THE GREAT ZEBRA & GIRAFFE COUNT




The IUCN Red List of Threatened Species™

2016-3

[Login](#) | [FAQ](#) | [Contact](#) | [Terms of use](#) | [IUCN](#)

[About](#) | [Initiatives](#) | [News](#) | [Photos](#) | [Partners](#) | [Sponsors](#) | [Resources](#) | [Take Action](#)

[Home](#) » [Equus grevyi](#) (Grevy's Zebra)



© Jean-Christophe Vié

Equus grevyi

<http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T7950A89624491.en>

Scope: Global
 Language: English
[Download assessment](#)

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	<ENDANGERED>	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT
NE	DD	LC	NT	VU	EN	CR	EW	EX

In Kenya, the Grevy's Zebra population declined from around 13,700 in 1977 (Dirschl and Wetmore 1978) to 4,300 in 1988 (KREMU 1989). They then declined further to 2,400-2,700 in 2000 (Nelson and Williams 2003) and 1,570-1,980 in 2004 (KWS 2012), to an estimated population size of 1,470-2,140 in 2006 (B. Low pers. comm. 2007); a decline of 85-90% over 29 years. In 2008, the population was estimated to consist of 2,400 individuals, indicating that either counting techniques had improved or that the population had stabilized or even increased, or a combination of the two (Mwasi and Mwangi 2007, KWS 2012). An assessment of all existing counts carried out by Kenya's Grevy's Zebra Technical Committee in 2012 estimated that by 2011 the population in Kenya was approximately 2,500. **In January 2016 a comprehensive census of Grevy's zebra in five counties in Kenya was conducted ("The Great Grevy's Rally").** The census comprised of 350 people (members of the public, conservancy members, rangers and scouts from conservancies and National Parks and Reserves, and scientists) driving over 25,000 km² recording Grevy's zebras using GPS enabled cameras. Over 40,000 photos of Grevy's Zebra were taken. The photographs were sent to the US-based IBEIS team to process the images, identifying unique individuals seen on days 1 and 2 as well as the number seen on day 1 that were re-sighted on day 2. From these three values population size estimates could be computed. In the future, such analyses will be performed by Kenyan scientists once the software is made publicly available. From the sight-resight analysis the population was estimated **to be 2,250 individuals (95% CI of +/- 93; KWS 2016).** For the first time, Laikipia county has the highest number of Grevy's Zebras (supporting over half of Kenya's Grevy's Zebra population), surpassing Samburu and Isiolo counties, the traditional heartland of the species. An additional 80-100 animals were estimated in Tsavo, Oserian, Meru National Park, and the Laisamas area - areas that were too dangerous or inaccessible to survey during the census period (KWS 2016). The total Kenya population in 2016 is therefore estimated to be ~2,350 individuals. The population will be re-censused in August 2017. It is expected that the Kenyan population of Grevy's Zebra will remain stable, or may increase due to conservation efforts.



Photos

People

Groups



Advanced

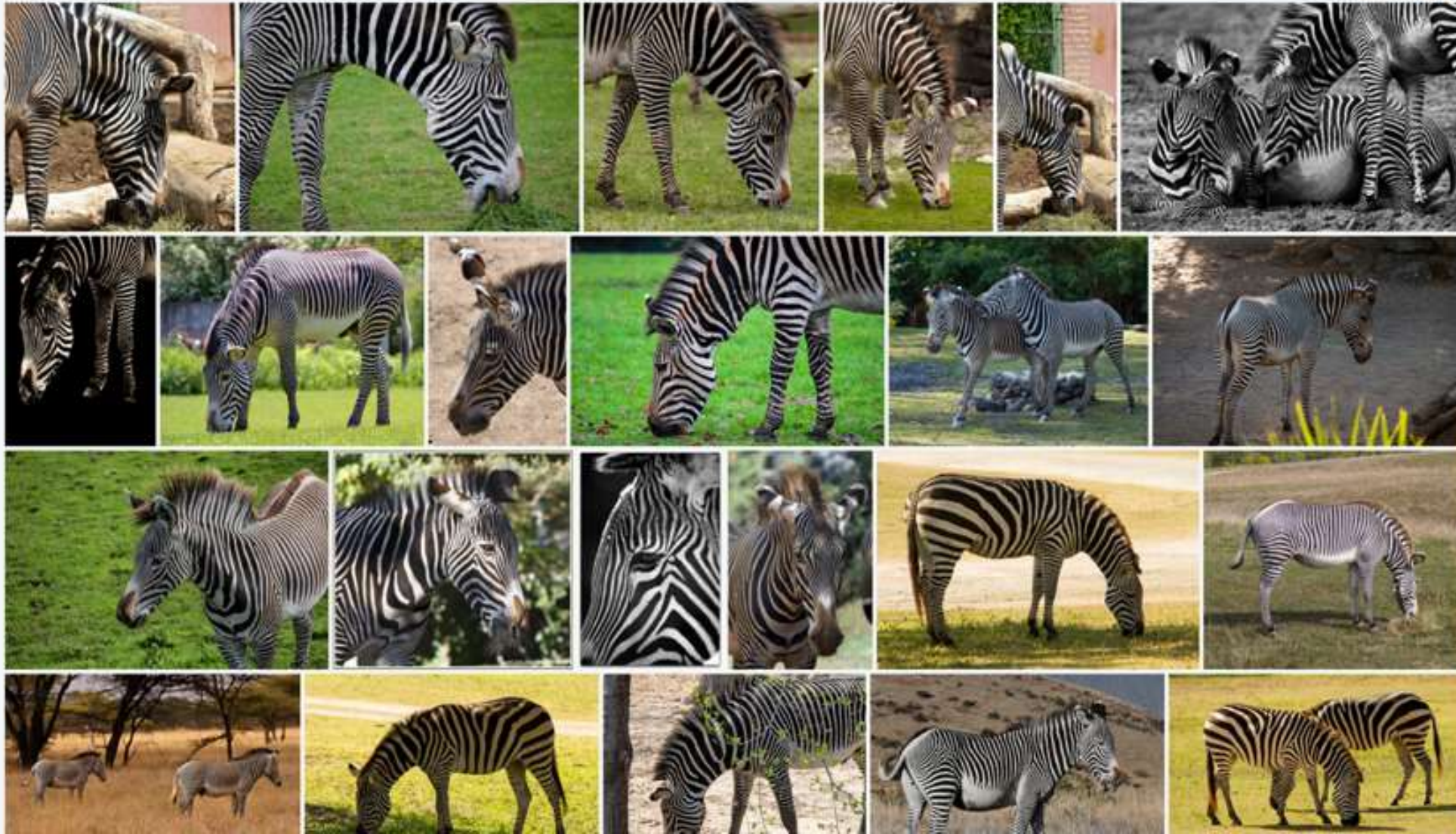
Any license

SafeSearch on

Relevant



Everyone's photos

[View all 7737](#)

Tube

ickr

Smit

**H₂O**
WORLD
2017



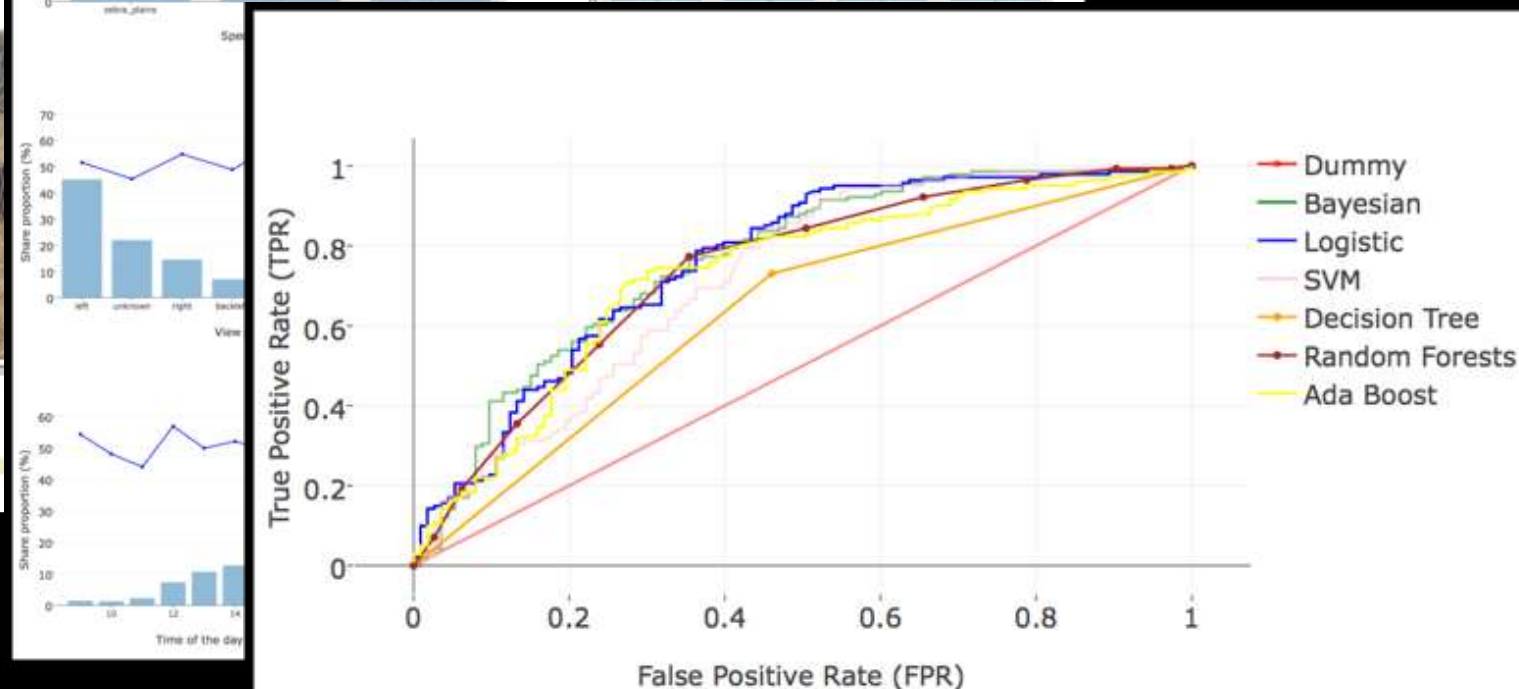
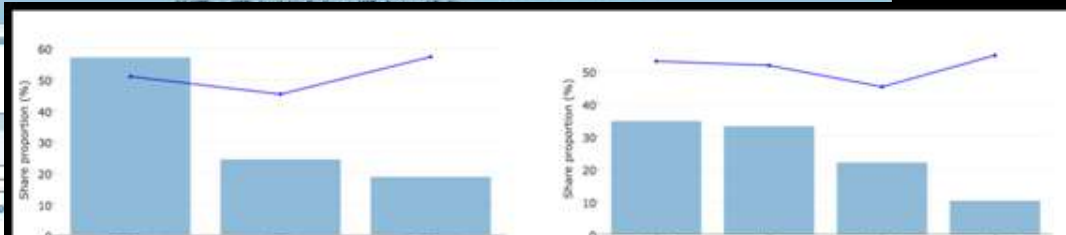
Social Media Bias Problem



Menon et al. '17

Learnable
problem

No animal
bias?



Grevy's Population estimate using Flickr

Sight year	Resight year	Population Estimate	Error
2004	2005	0	-100%
2005	2006	0	-100%
2006	2007	2035	-9.5%
2007	2008	1842	-18.13%
2008	2009	1521	-32.4%
2009	2010	2782	23.64%
2010	2011	6580	192.4%
2011	2012	3624	61.1%
2012	2013	4447	97.6%
2013	2014	2336	3.8%
2014	2015	2272	0.9%



WILDBOOK

for Whale Sharks

Adopt a Shark

Report an encounter

Learn

Participate

Individuals

Encounters

Search

Contact Us

Administer

Help us protect and study the world's biggest fish!

Report your sightings

Adopt a shark



ILMOITA HAVAINTO

TÄSTÄ ON KYSE

GALLERIA

Internet of Turtles

LIITY JA LAUSUUTA



KUVASITKO
SAIMAANNORPAN?

ILMOITA HAVAINTO

Machine learning and data science
allow us to go from pixels to

Science

Conservation

Public engagement

At large scale and high resolution
over space, time, and individuals





Jason Holmberg Jon Crall Mike Costelloe Jon Van Oast Chuck Stewart
Marco Maggioni Clara Machogu Blair Costelloe Dan Rubenstein Jason Parham Tanya Berger-Wolf



Drew Blount Zaven Arzoumanian Zach Jablons Jon Wrona Dan Lowe Sreejith Menon

Engaging researchers and volunteers around the globe...

