Citizen Science

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Texas Master Naturalist, Sabine-Neches Chapter
November 8, 2018

What is Citizen Science?

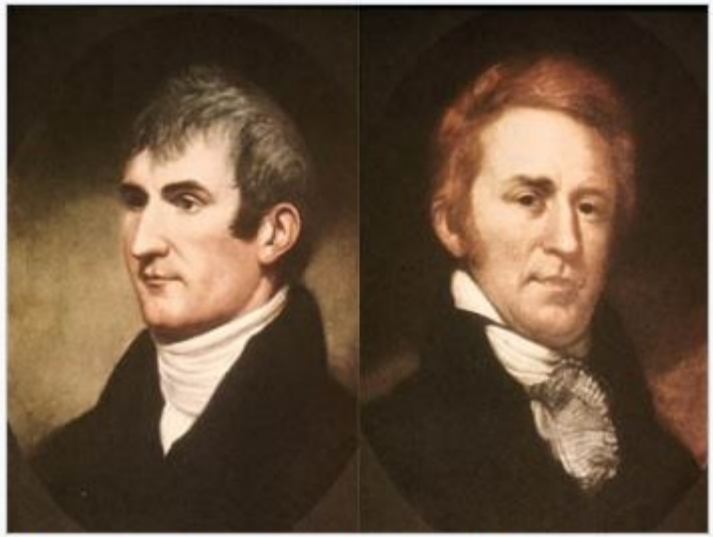
- **Definition** – the engagement of ***amateur naturalists*** in scientific investigations by
  - Asking questions
  - Collecting data
  - Interpreting results
- **Key Concept** - ***Amateur naturalists*** are unpaid volunteers who pursue their interest out of passion for nature
- **Benefit** - Current programs advance our understanding and stewardship of biodiversity

Historical Evolution

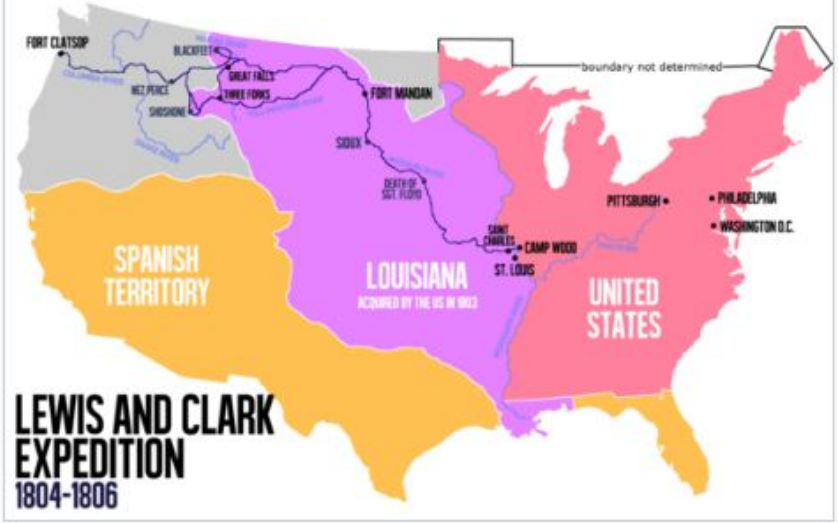
- 1800s –
  - Compiled hand-written scientific journals
  - Collected specimen for natural history collections
  - Solicited data from other scientists by writing letters
- 2000s –
  - Capture images and audio recordings
  - Post observations online where they are accessible to everyone

The Constant –
Critical Contributions

Lewis and Clark Expedition 1804-1806



Meriwether Lewis and William Clark



Route of the expedition

Lewis and Clark – 1804-1806

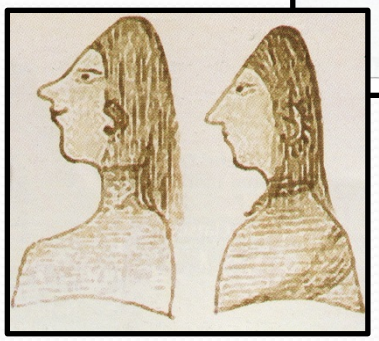
- Commissioned by Thomas Jefferson to establish the most direct water route to the Pacific Ocean
- Challenged to make scientific and geographic observations along the way
- Provided copious notes on the plants, fish, and wildlife around Fort Clatsop
- Drew excellent sketches

…first scientific identification of important flora and fauna of the American West.

Lewis and Clark – 1804-1806

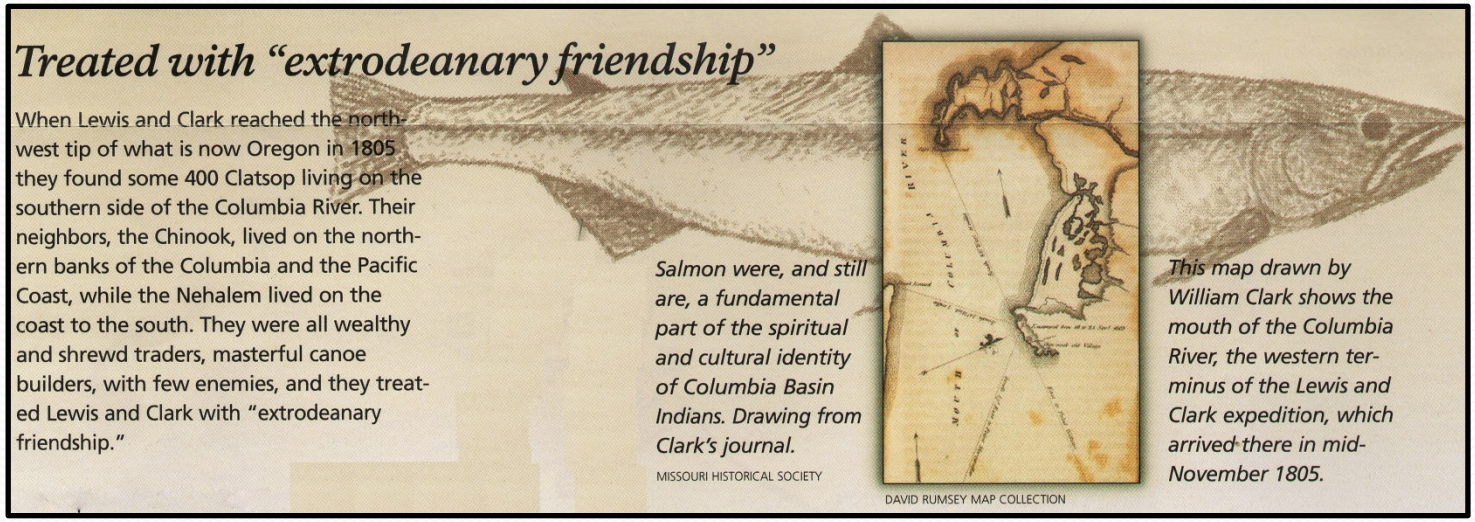
MISSOURI HISTORICAL SOCIETY

Information collected by Lewis and Clark was laboriously recorded in journals like the one shown here. The explorers updated the journals during the Corps of Discovery's three-month stay at Fort Clatsop.



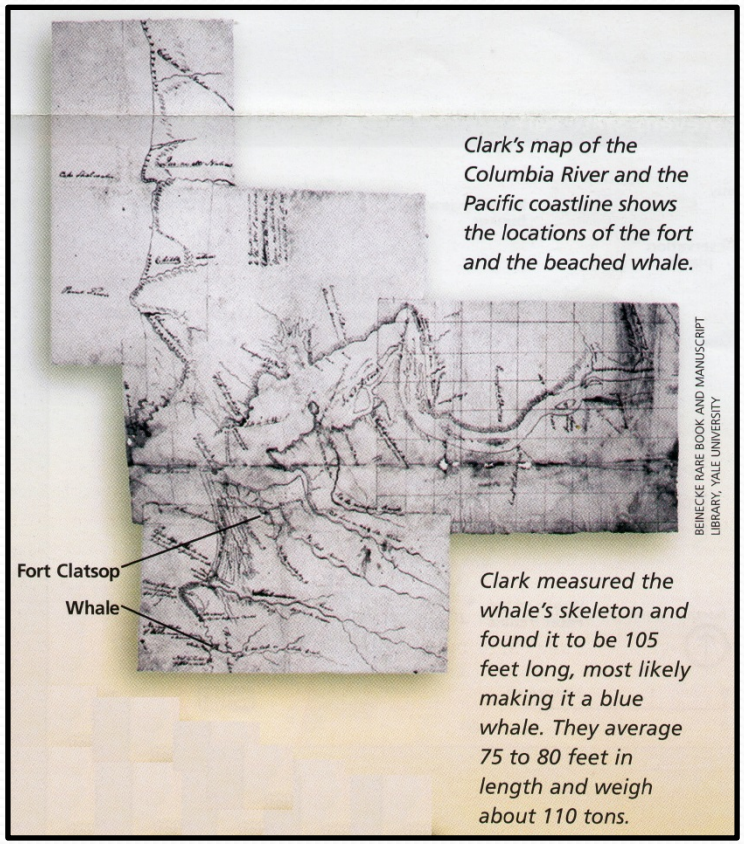
Chinook and Clatsop Indians as drawn in Clark's journal

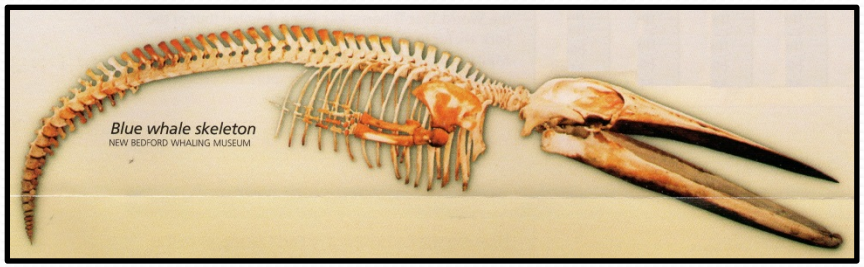
Lewis and Clark – 1804-1806



Mouth of Columbia River and salmon as drawn in Clark's journal

Lewis and Clark – 1804-1806

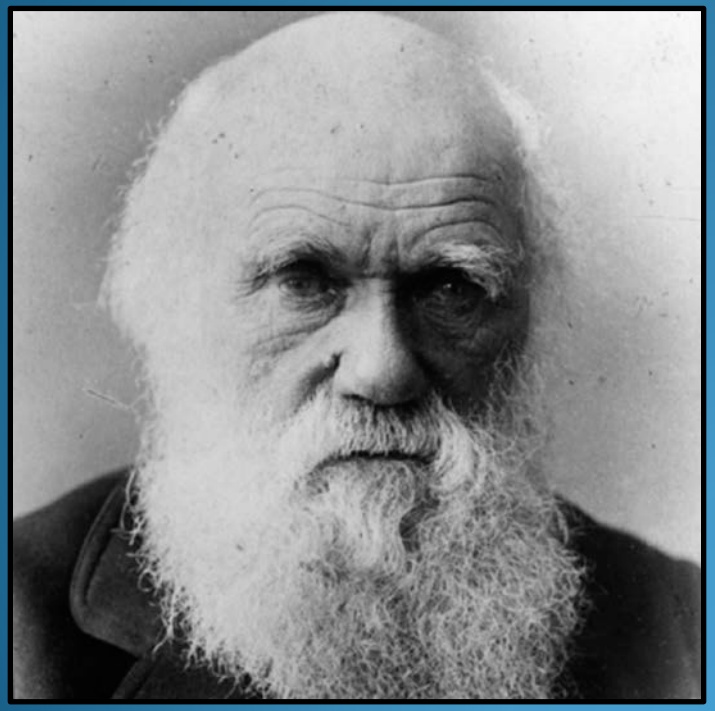


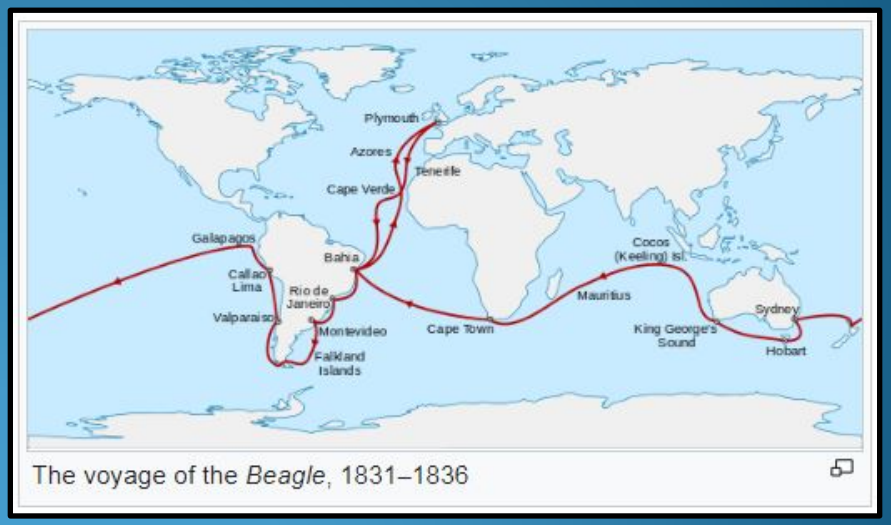


Map of the Columbia River showing location of Fort Clatsop and the beached whale as drawn in Clark's journal

Lewis and Clark – 1804-1806

Darwin's *Voyage of the Beagle* 1831-1836



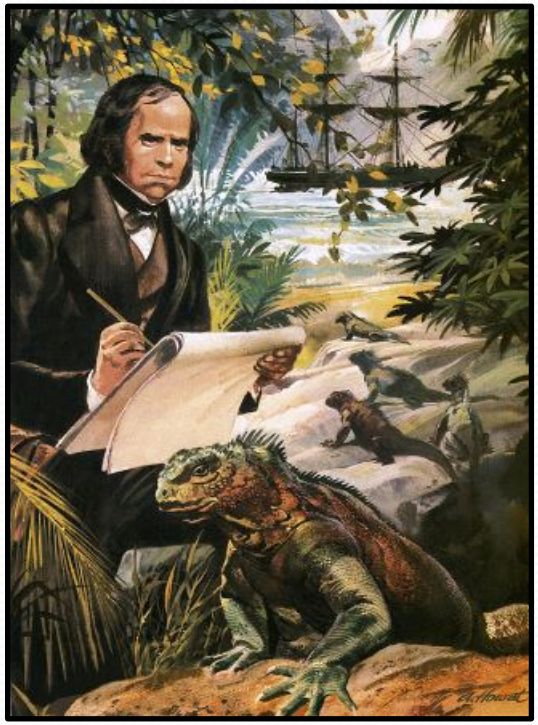


The voyage of the *Beagle*, 1831–1836

Charles Darwin – 1831-1836

- Passionate about natural science
- Eminent geologist
- Prolific writer
- Joined a 5-year expedition aboard the *HMS Beagle* to chart the coastline of South America
  - spent most of that time on land investigating geology and making natural history collections
  - kept careful notes of his observations and theoretical speculations
  - ably collected specimens for expert appraisal

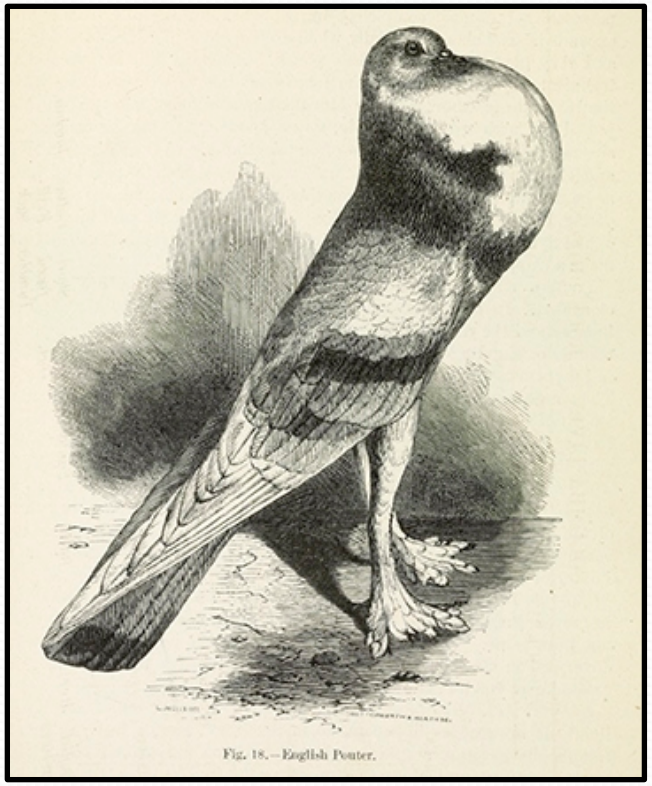
Charles Darwin – 1831-1836



Darwin explored remote regions, encountering birds with bright blue feet, sharks with T-shaped heads, and giant tortoises. He collected plants, animals and fossils, and took copious field notes.

Charles Darwin – 1831-1836

Cactus finch *Geospiza scandens* from Darwin's *Zoology of the Voyage of the H.M.S. Beagle*



Original line drawing of an English Pouter pigeon from Darwin's *Variation in Animals and Plants under Domestication*

Charles Darwin – 1831-1836

NATURAL HISTORY MUSEUM

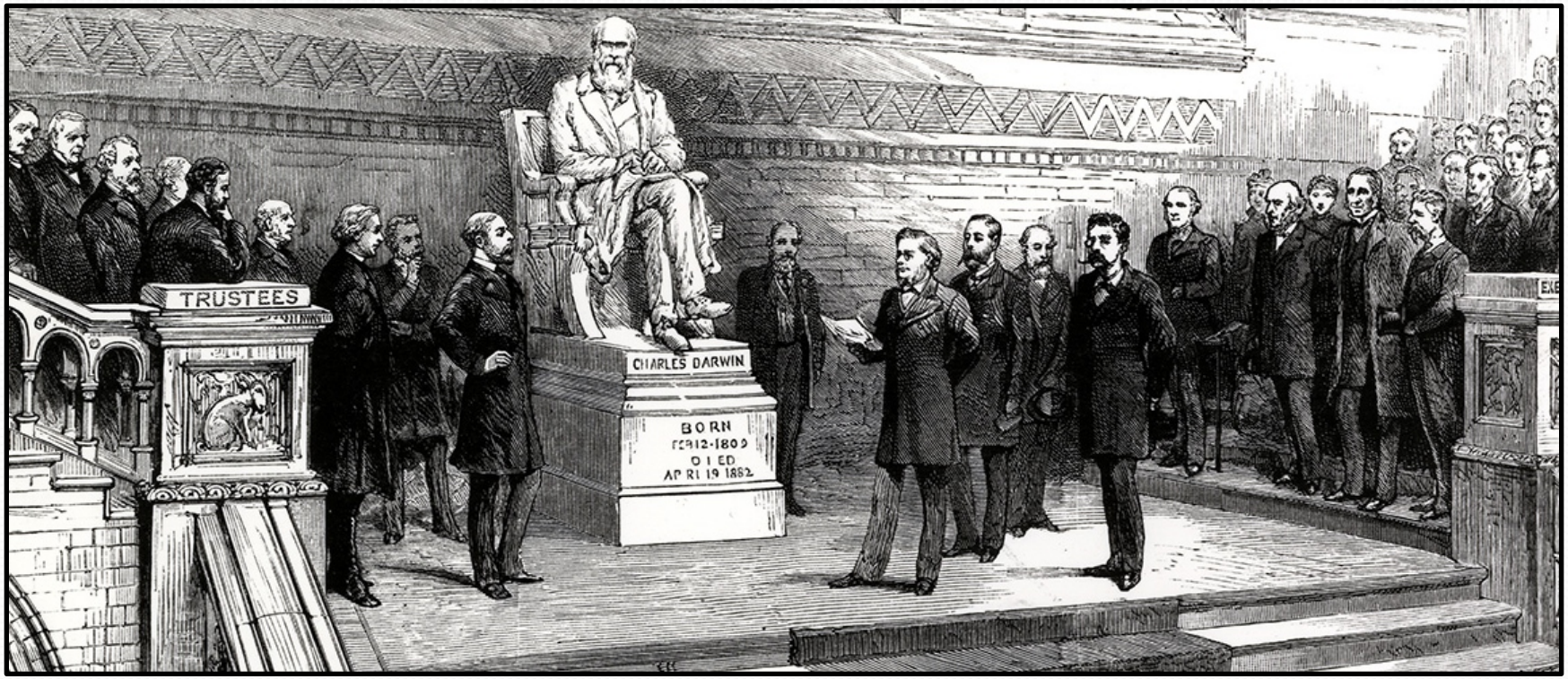
The Natural History Museum
Cromwell Road
London SW7 5BD

The Museum Library's Darwinian collection holds 1,628 works written by Darwin including 477 versions of *On the Origin of Species*. Darwin's work underpins all modern research in evolutionary biology.

Shells collected by Darwin

Fancy breeds of rock dove collected by Darwin

Charles Darwin – 1831-1836



Unveiling a statue of Charles Darwin at the Natural History Museum in 1885

Darwin: History's Most Famous Biologist

Tracking an Icelandic Glacier 1932-2018

Hallsteinn Haraldsson has taken measurements of one of Iceland's melting glaciers since the 1970s.

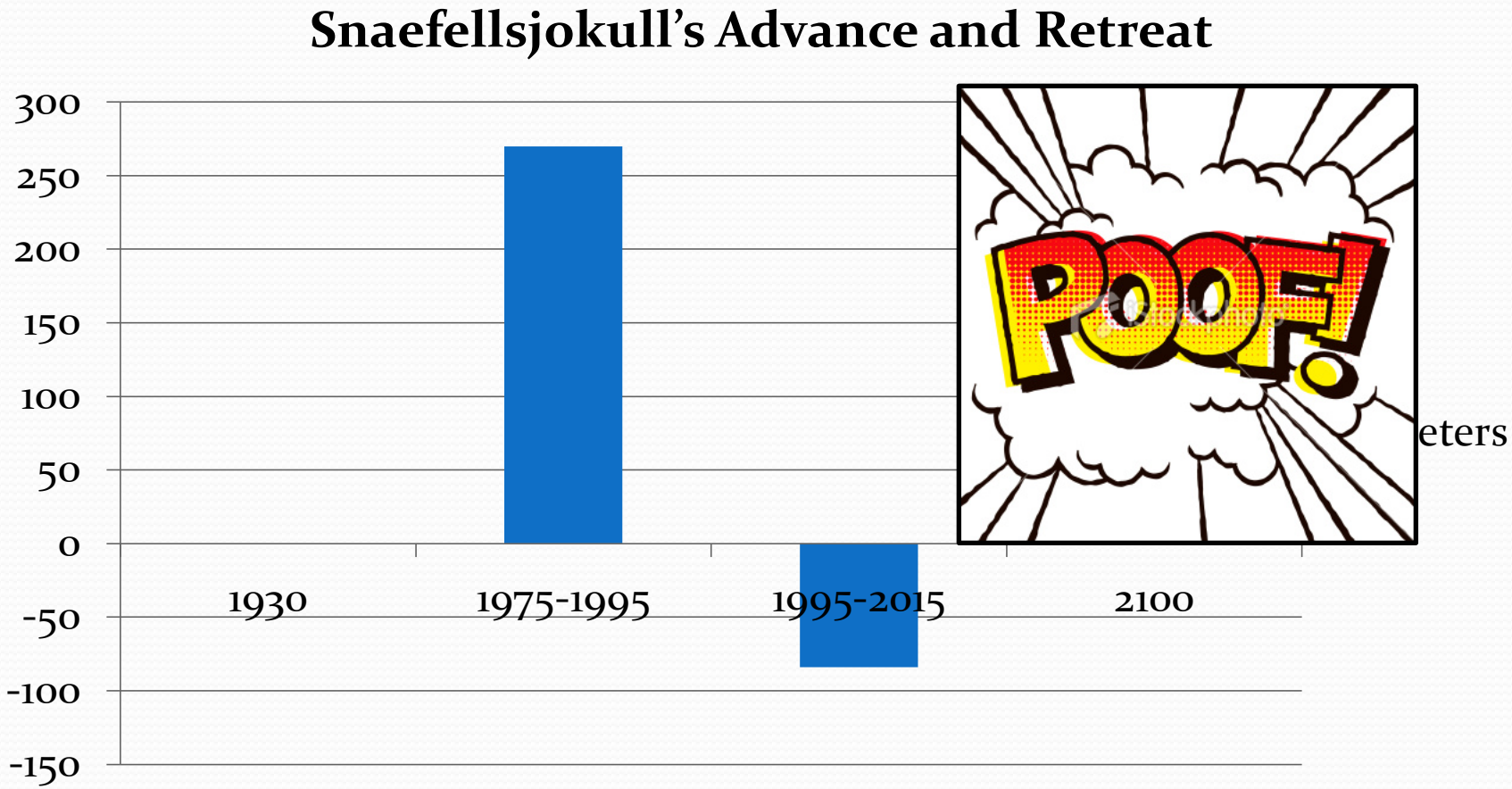
Tracking Snaefellsjokull Glacier

- Location - Snaefellsnes Peninsula in western Iceland (accessed via a 15K walk over rocky terrain prior to the 1990s)
- Low-tech tools used
  - 30m measuring tape (an upgrade from a piece of marked rope)
  - a pencil
  - a yellow paper form

Tracking Snaefellsjokull Glacier

- Data has been collected since the 1930s:
  - In the 1930s, many of the country's glaciers had retreated significantly due to an unusually warm climate
  - From 1975 to 1995, the glacier actually advanced 270 meters
  - From 1995 to 2017, records suggest that Snaefellsjokull retreated 354 meters — a net loss of 84 meters from its position in 1975.
  - When the glacier began its retreat in the 1990s, the family thought of it as a natural fluctuation. Now, they understand, their glacier is disappearing because of global warming.
  - In 2016, scientists announced they expected Snaefellsjokull to vanish entirely by the end of the century.

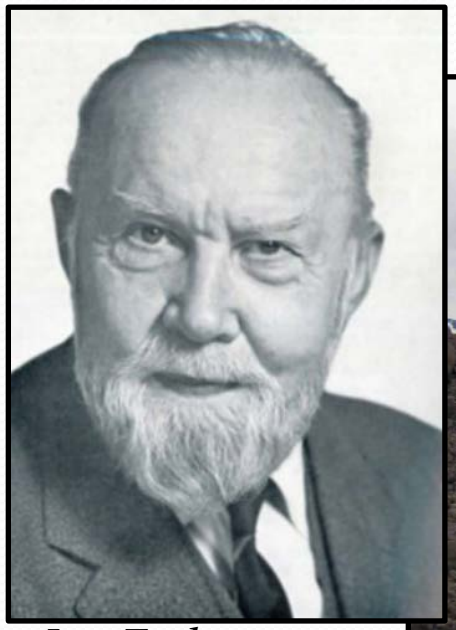
Tracking Snaefellsjokull Glacier



Tracking Snaefellsjokull Glacier

- Jon Eythorsson established the first program to monitor the growth and retreat of Iceland's glaciers in 1932 and recruited farmers.
- Hallsteinn Haraldsson's family inherited Snaefellsjokull.
- Today some 35 volunteers monitor 64 measurement sites around the country.
- Vacancies for glacier monitors are rare and highly sought-after.
- It's very likely one of the longest-running examples of citizen climate science in the world.

Tracking Snaefellsjokull Glacier



Jon Eythorsson
1895–1968

Jon Eythorsson's granddaughter, Kristjana Eythorsdottir, now monitors a terminus at Langjokull, a large glacier in the south of Iceland 100 times the size of Snaefellsjokull.

Citizen Science Today

Citizen Science 1.0 – Collecting Data

Citizen Science 2.0 – Asking Questions and Analyzing Data

1.0 Collecting Data

- Provides **naturalists** with an opportunity to expand their knowledge and increase their abilities
- Allows **biologists** to tap into the potential of the naturalist community
- **Results in sustaining a community's connection to wild populations and stewardship of habitat**

2.0 Analyzing Data

- Identify a hypothesis and assumptions (forces you to think about how you can prove your hypothesis and minimize your assumptions)
- Make it fun (follow your passion and your curiosity)
- Validate your data (use photographs or sound recordings when possible)
- Communicate your results (share your results with your Texas Master Naturalist chapter or publish them)

Opportunities for Data Collection Abound!

- Christmas Bird Count
- EarthEcho Water Challenge
- CoCoRaHS
- iNaturalist
- Globe at Night
- eBird
- Texas Nature Trackers →

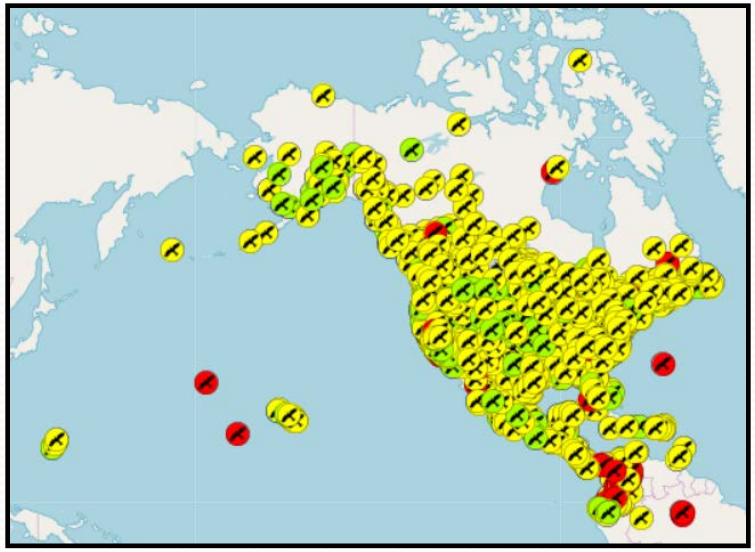
Herps of Texas
Mammals of Texas
Birds of Texas
Bees and Wasps of Texas
Texas Freshwater Mussels
Monarchs and Milkweed
Red Crowned Parrot
Terrestrial Mollusks
Fishes of Texas
Rare Plants of Texas

Audubon's Christmas Bird Count

- Held between Friday, December 14, and Saturday, January 5
- One of only two large pools of information informing ornithologists and conservation biologists how the birds of the Americas are faring over time
- Conducted by thousands of volunteers across the U.S., Canada, and many countries in the Western Hemisphere over a 24-hour period on one calendar day (2018 marks the 119th year!)
- Local dates (coordinated by the Golden Triangle Audubon Society) are scheduled as follows:
  - Friday, Dec 14 - Johnson's Bayou
  - Saturday, December 22 – Turkey Creek
  - Thursday, December 27 – Sea Rim Park (and south Pleasure Island)
  - Thursday, December 29 – Beech Creek
  - Tuesday, January 1 – Orange County

Audubon

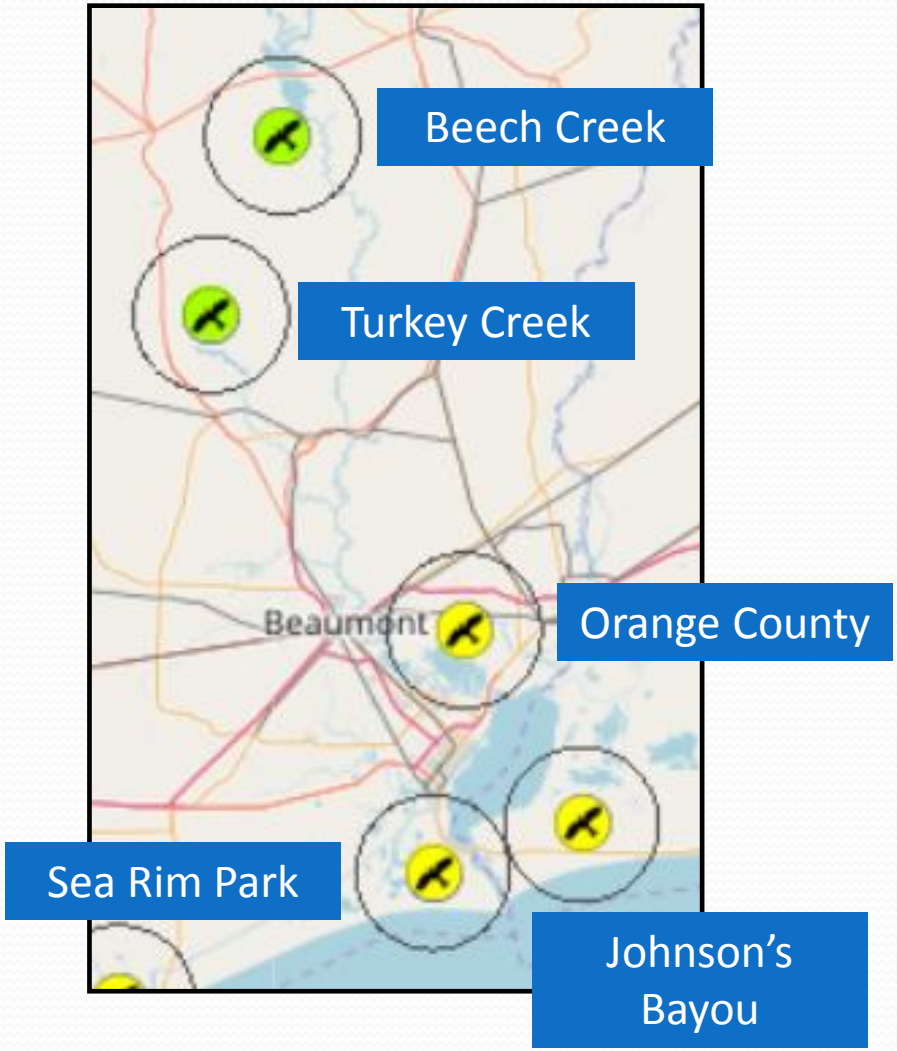
Audubon's Christmas Bird Count



North America Counts

Local Coordinator:
John Whittle – johnawhittle@aol.com

Golden Triangle Audubon Society Meeting - Thursday, November 15 at Tyrrell Park

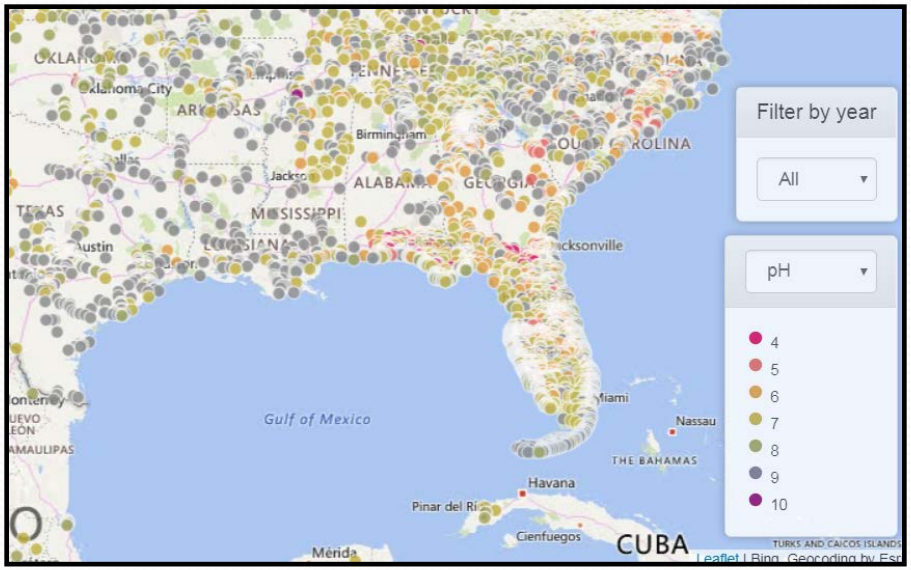


EarthEcho Water Challenge

- An international program that runs annually from March 22 through December
- Equips citizens to protect the water resources we depend on every day
- Builds public awareness and involvement in protecting water resources around the world by engaging citizens to conduct basic monitoring of their local waterbodies

EarthEcho Water Challenge

- Sign up for an account.
- Order a kit ($25.00).
- Add observations.
- Browse results.



http://www.worldwatermonitoringday.org/

CoCoRaHS (KO-ko-rozz)

- A non-profit, **Co**mmunity-based, **Co**llaborative network of volunteers who measure and report **Ra**in, **H**ail, and **S**now in their backyards
- Was born in 1998 with the intent of doing a better job of mapping and reporting intense storms
- Is the largest all-volunteer network in the world
- Reality – Doppler radar can't give exact measurements; ground truth comes from observations
- Aim – to provide high quality precipitation data

CoCoRaHS

- Includes over 20,000 active observers in the United States, Canada, Puerto Rico, the U. S. Virgin Islands, and the Bahamas
- Three requirements for joining:
  - An enthusiasm for watching and reporting weather conditions
  - A desire to learn more about how weather can affect and impact our lives
  - Agreement to purchase the approved rain gauge

CoCoRaHS – How to Join

- Sign up at cocorahs.org.
- Purchase a 4" rain gauge (from Randy for $32).
- View the training video or attend a training session.
- Set up the gauge in your back or front yard.
- Observe precipitation daily and record online.

CoCoRaHS Goal –

- One observer **every square mile** in urban areas
- One observer **every 36 square miles** in rural areas

Are you interested?

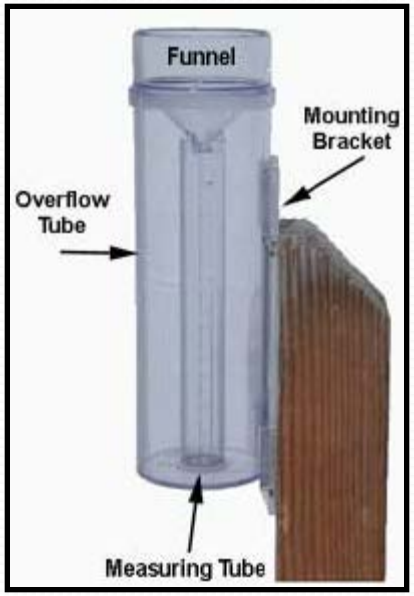
CoCoRaHS – The Gauge

Box Contents

Components (inner and outer cylinders, funnel, and mounting bracket with screws)

Assembled gauge with post system from Home Depot for $18

CoCoRaHS – The Gauge



The instructional diagram

CoCoRaHS – Recording Data

My Data Entry : Daily Precipitation Report Form

For observations spanning more than 24 hours, please use the multiple day accumulation report.

Precipitation Report Form Submit Reset

Station Number : TX-JJ-13

Station Name : Port Arthur 3.0 NNE

* Denotes Required Field

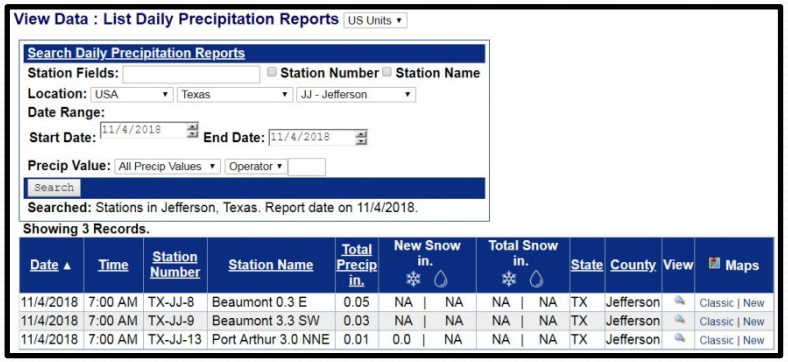
11/4/2018 ***Observation Date**

8:00 AM ***Observation Time**

0.00 in. ***Rain and Melted Snow to the nearest hundredth inch that has fallen in the gauge during the past 24 hours, or T for trace, or NA for unknown.**

Observation Notes: (This will be available to the public)

CoCoRaHS – Viewing Local Data



View Data : List Daily Precipitation Reports (US Units)

Search Daily Precipitation Reports

Station Fields: Station Number Station Name

Location: USA | Texas | JJ - Jefferson

Date Range:

Start Date: 11/4/2018 End Date: 11/4/2018

Precip Value: All Precip Values | Operator

Search

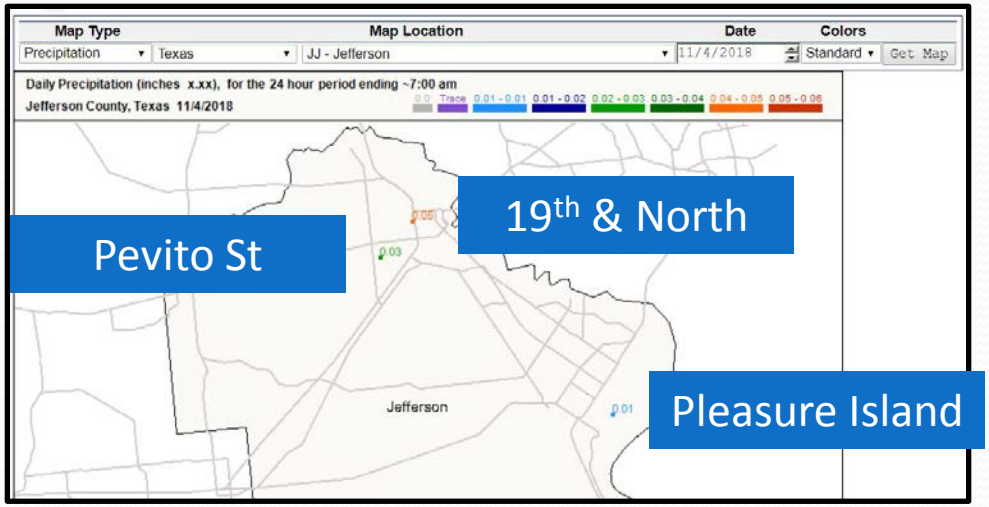
Searched: Stations in Jefferson, Texas. Report date on 11/4/2018.

Showing 3 Records.

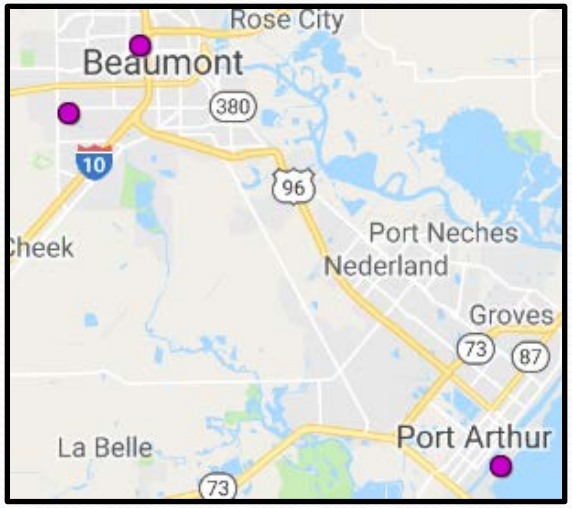
Date	Time	Station Number	Station Name	Total Precip in.	New Snow in.		Total Snow in.		State	County	View	Maps
11/4/2018	7:00 AM	TX-JJ-8	Beaumont 0.3 E	0.05	NA	NA	NA	NA	TX	Jefferson		Classic | New
11/4/2018	7:00 AM	TX-JJ-9	Beaumont 3.3 SW	0.03	NA	NA	NA	NA	TX	Jefferson		Classic | New
11/4/2018	7:00 AM	TX-JJ-13	Port Arthur 3.0 NNE	0.01	0.0	NA	NA	NA	TX	Jefferson		Classic | New

Tabular View

Classic Map View



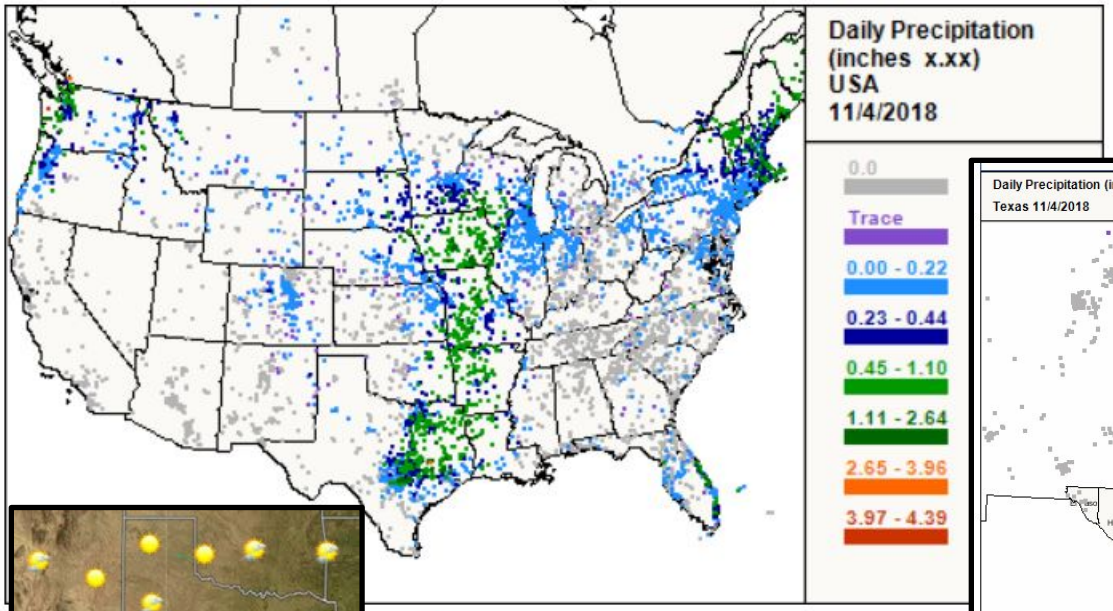
New Map View

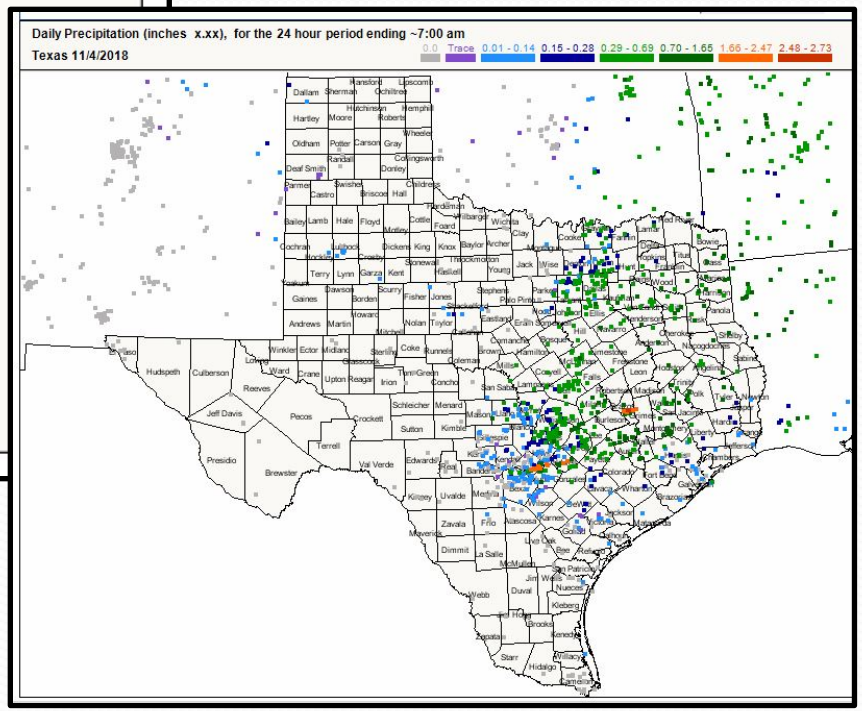


CoCoRaHS – Viewing More Data

Reports received today 11/04/2018 as of 11:08 AM EST

Daily	Multi-day	SigWx	Hail	Condition	ET
7,049	119	0	0	71	23





CoCoRaHS – Who Uses it?

- ***Weather Forecasters***
- ***Hydrologists***
- ***Water Management Agencies***
- ***Researchers***
- ***Farmers and Ranchers***
- ***Climatologists***
- ***Insurance Agents***
- ***Engineering Companies***
- ***Recreation Managers***
- ***Educators…and others***

CoCoRaHS 1998 - 2018 celebrating 20 YEARS

OLYMPEX Advanced Data Analysis Exercise

Type: Interactive
Audience: Formal, 9 - 12
Standards: ESS3.D
Keywords: OLYMPEX, ground validation, data analysis, graphing
Summary: This data exercise has students look up precipitation ground data and satellite data for a site in Washington State and do a comparison using a data table and a graph. The activity is expected to take about 45 minutes.

iNaturalist

- Developed in 2008 by four students while pursuing a Masters degree at UC Berkeley School of Information
- Is currently a joint initiative of the California Academy of Sciences and the National Geographic Society
- Helps you identify the plants and animals around you while creating research quality data for scientists who are trying to understand and protect nature
- Connects you with a community of over 750,000 scientists and naturalists

iNaturalist

iNaturalist

- Goals:
  - *Primary* goal is **to connect people to nature**
  - *Secondary* goal is **to generate scientifically valuable biodiversity data** from these personal encounters
- What it is not:
  - A science project
  - A photo backup
  - A mapping tool
  - A way to collect secret info

10,702,120	77,529	47,097	292,711
OBSERVATIONS	SPECIES	IDENTIFIERS	OBSERVERS

iNaturalist – Observations

Who you are

You'll need to make an **iNaturalist account** and please only post your own personal observations

Where you saw it

Record both the coordinates of the encounter as well as their accuracy. You can obscure the location from the public

What you saw

Choose a group of organisms like **butterflies** or better yet a specific organism like the **Monarch butterfly**. If you provide evidence you can leave this blank and the **community can help**

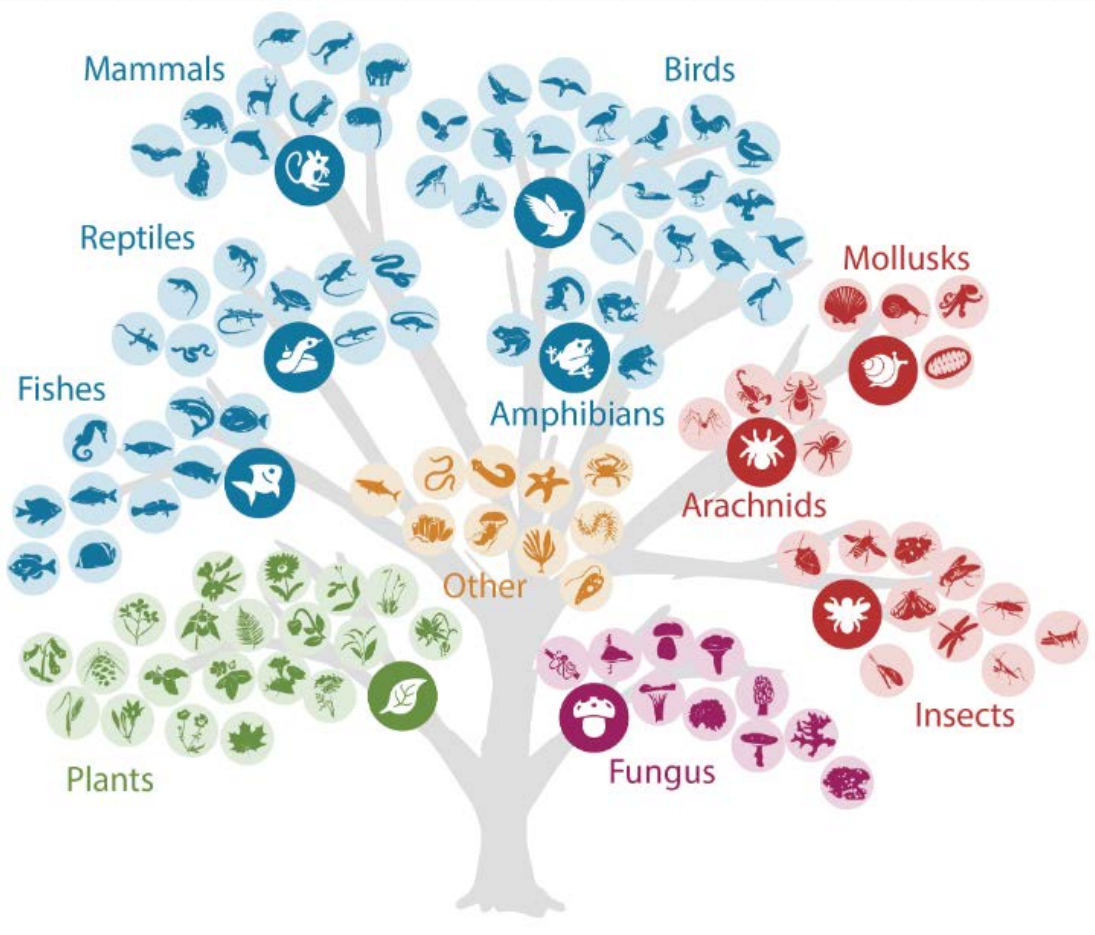
When you saw it

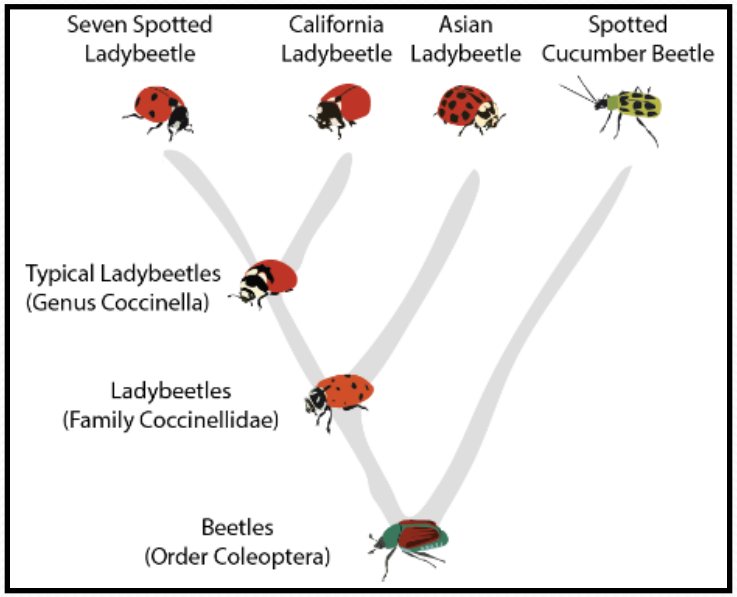
Record the date of your encounter, not the date you post it to iNaturalist

Evidence of what you saw

By including evidence like a **photo or sound**, the community can help add, improve, or confirm the identification of the organism you encountered. Help the community by taking clear well framed photos, by including multiple photos from different angles

iNaturalist – Identification

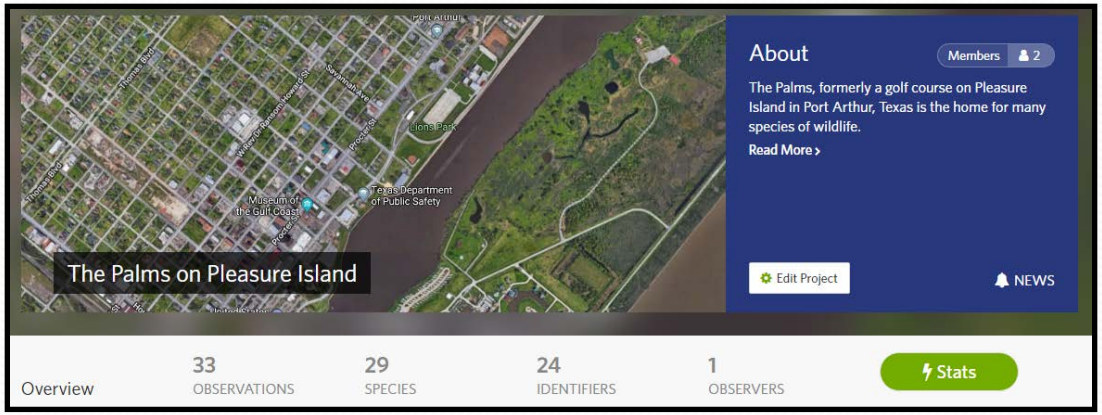




iNaturalist – Project Types

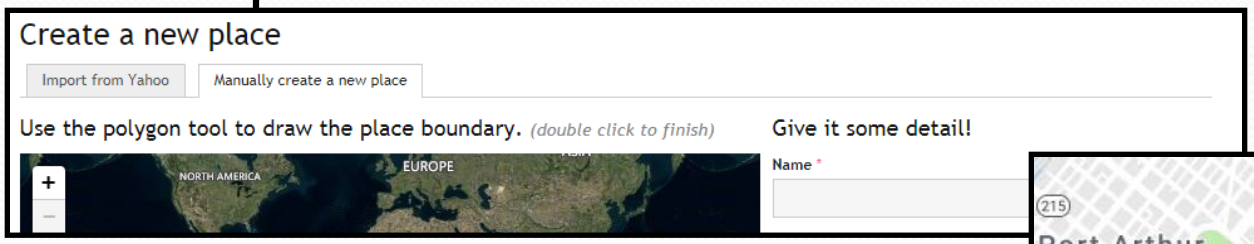
- **Collection** – a saved Observations Search meeting taxa, place, and time requirements that looks snappy and offers outreach features such as a banner, icon, URL, and a journal for communication with followers
- **Umbrella** – a collection of projects such as the 2018 City Nature Challenge where followers could compare and contrast observations in 60 cities
- **Traditional** – the only type offered prior to April 2018; more labor intensive for curators and admins

iNaturalist – Collection Projects

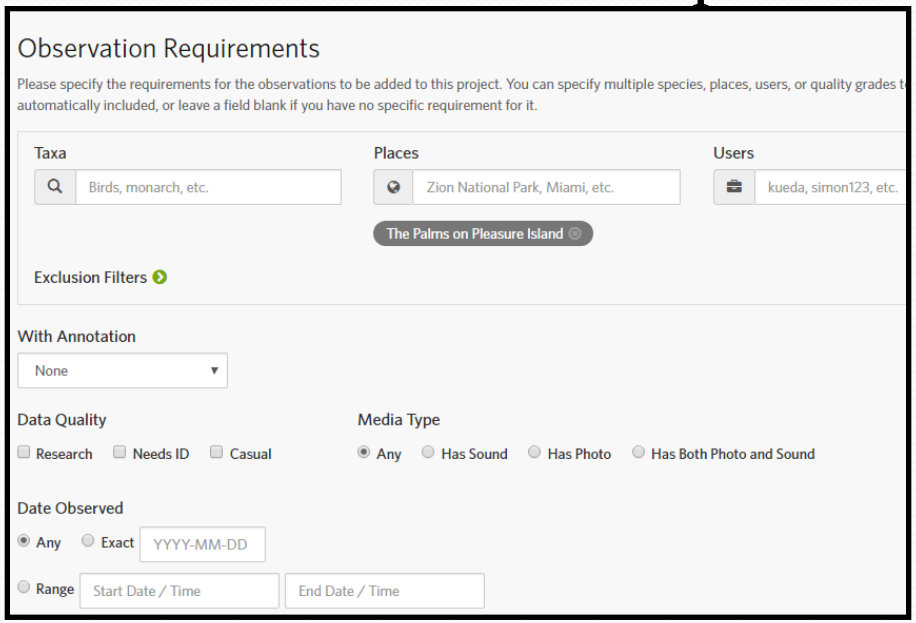


iNaturalist – Collection Projects

- Create a place if one doesn't exist.

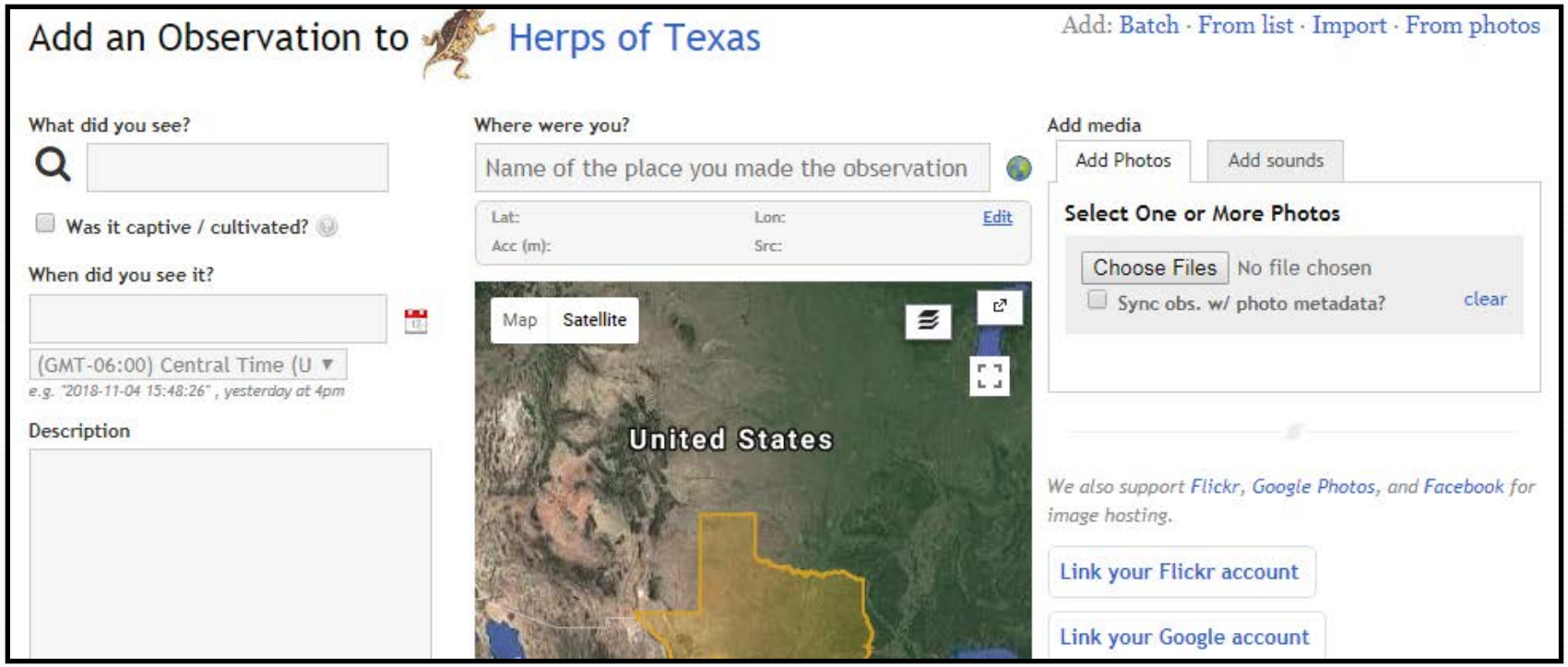


- Define Observation Requirements.



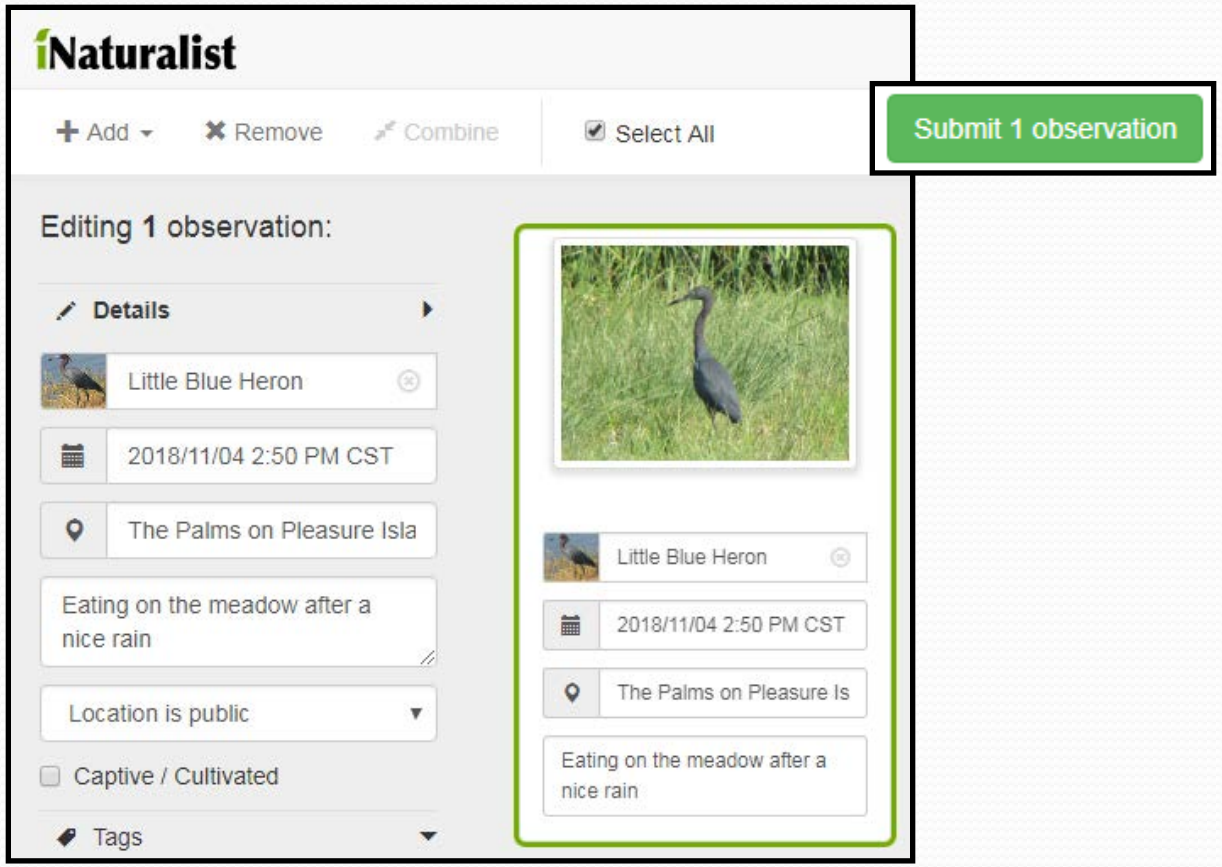
iNaturalist – Collection Projects

- Add observations (an encounter with an individual organism at a particular time and location).



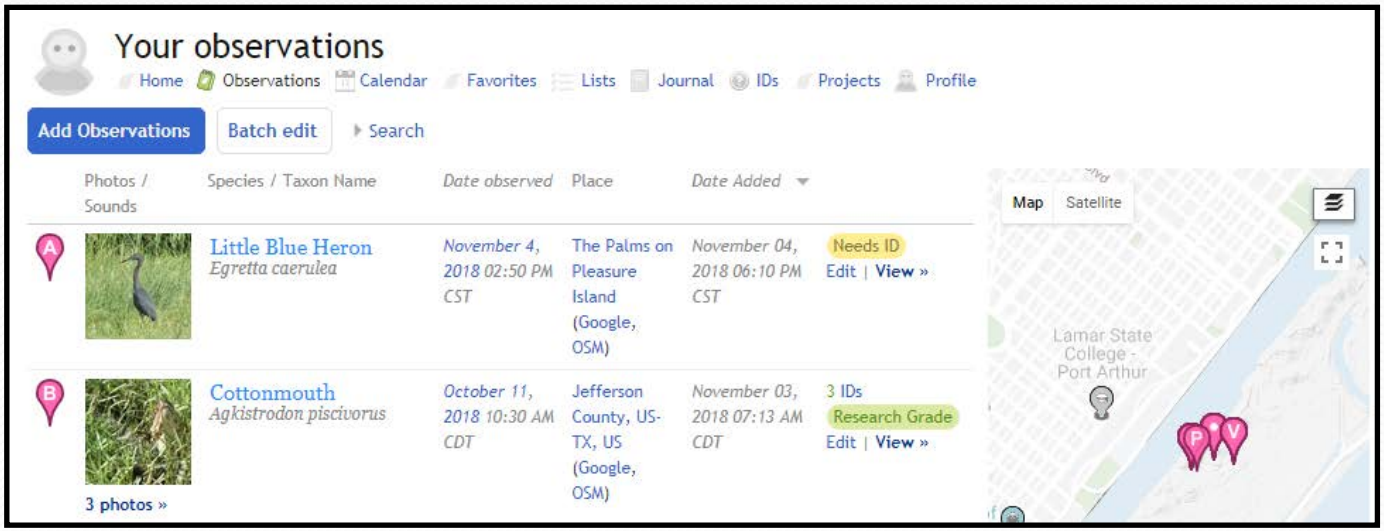
iNaturalist – Collection Projects

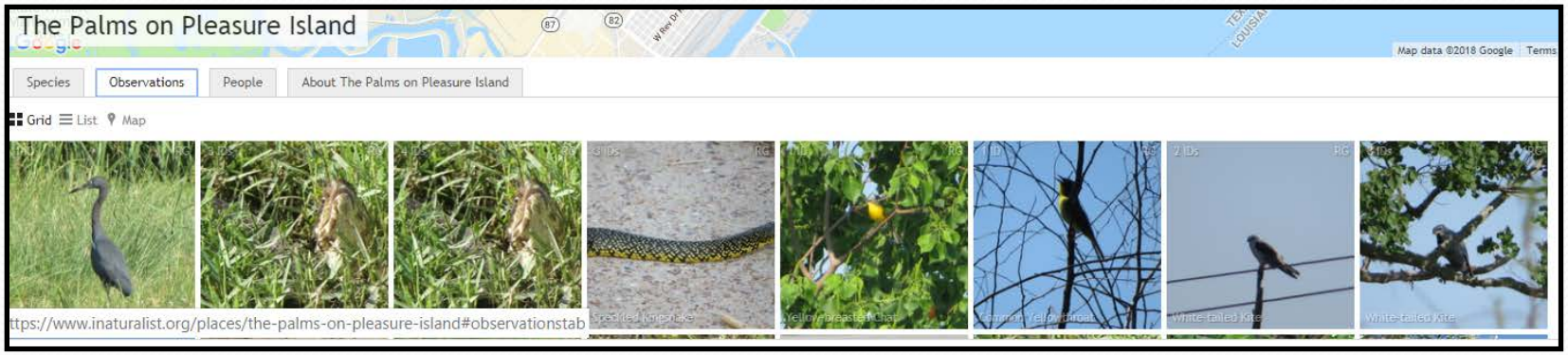
- Edit observations.



iNaturalist – Collection Projects

- View observations.



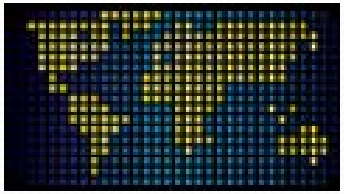


iNaturalist – Limitations

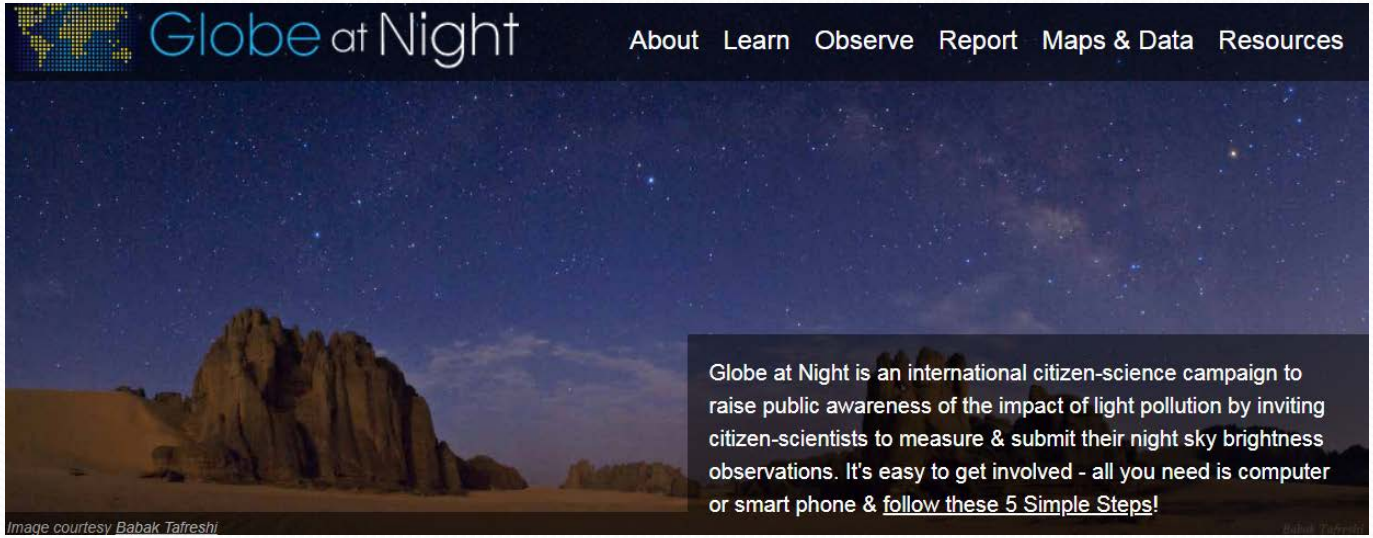
- iNaturalist doesn't capture data related to sampling effort in the way that platforms such as eBird do. The disadvantage of the presence-only data is that it is much more complicated to infer absence. If this is essential to your project, iNaturalist may not be the best platform for you.
- Sounds(mp3, or m4a formats) can be added directly to iNaturalist using the web version; however, the Android and iOS apps do not currently support sound uploads.

Globe at Night

- **Goal:** To raise public awareness of the impact of light pollution by inviting citizen-scientists to measure their night sky brightness
- **Negative impacts of light pollution** (excessive, misdirected, or obtrusive artificial outdoor light):
  - washes out starlight in the night sky,
  - interferes with astronomical research,
  - disrupts ecosystems,
  - has adverse health effects, and
  - wastes energy



Globe at Night



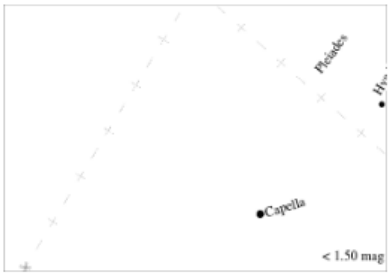
Five Easy Star Hunting Steps

1. Find ***your*** constellation in the night sky.
2. Find ***your*** latitude and longitude.
3. Go outside more than an hour after sunset (8-10 pm local time). The Moon should not be up. Let your eyes become used to the dark for 10 minutes.
4. Match your observation to a magnitude chart and note the amount of cloud cover.
5. Report the date, time, location, the chart you chose, and the amount of cloud cover. Compare your observation to thousands around the world!

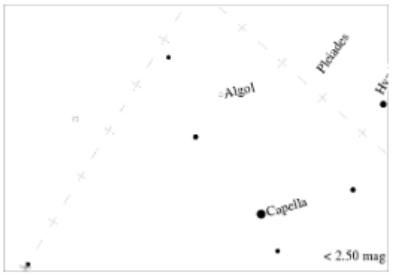
Globe at Night – Finding Perseus

Globe at Night – Using Charts

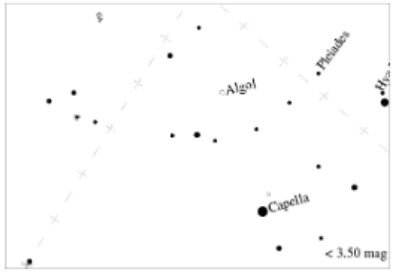
Magnitude 0/Cloudy Sky



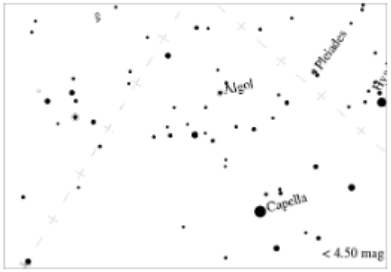
Magnitude 1 Chart



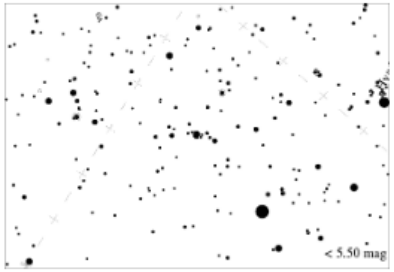
Magnitude 2 Chart



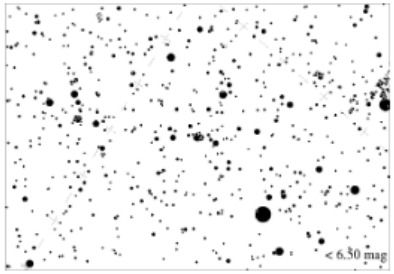
Magnitude 3 Chart



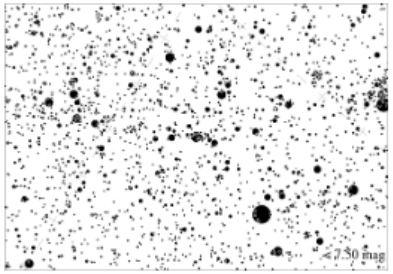
Magnitude 4 Chart



Magnitude 5 Chart

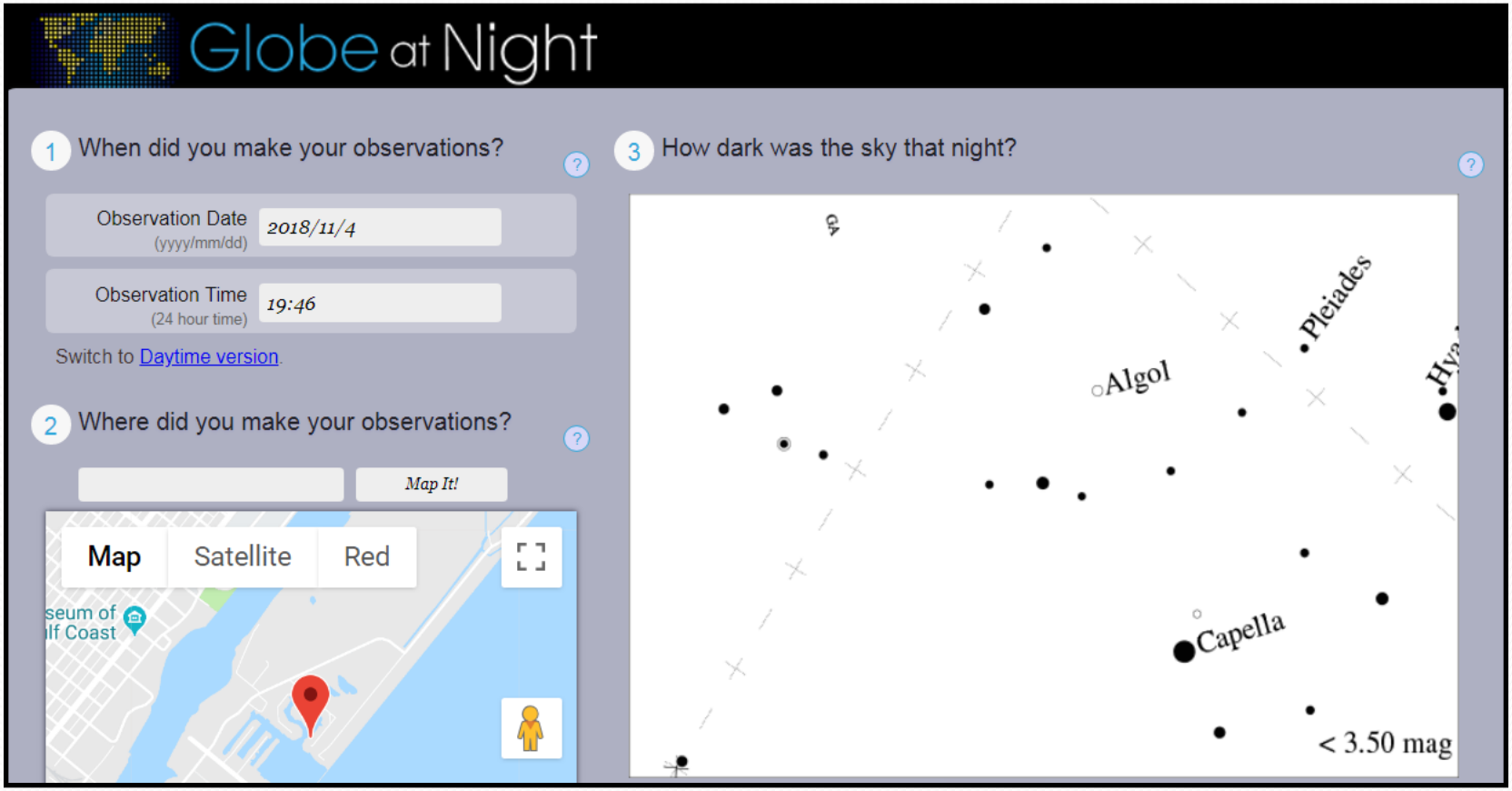


Magnitude 6 Chart

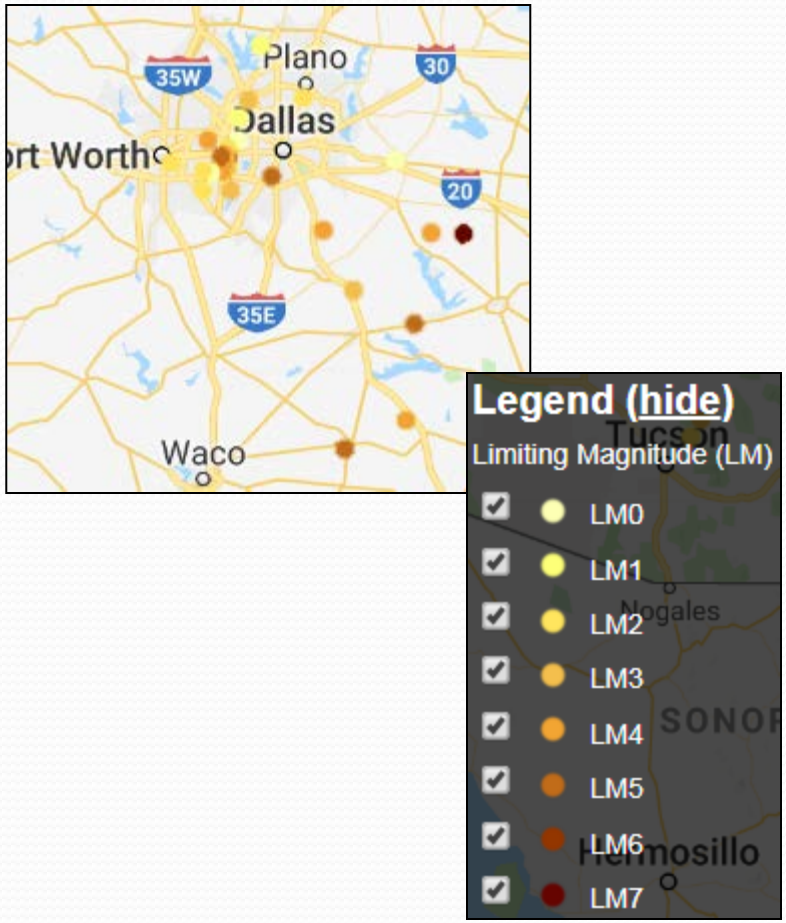


Magnitude 7 Chart

Globe at Night – Recording Data



Globe at Night – Comparing Data



Globe at Night

Observation Details

Year: 2018
Observation ID: 14956

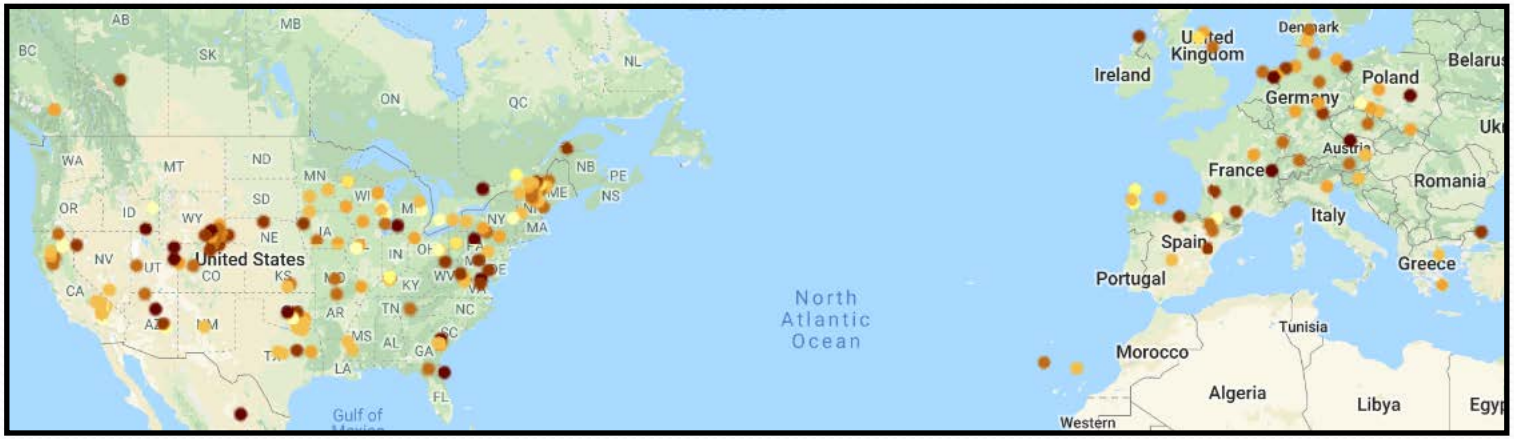
Observation Date: 2018-11-02 21:39:00
Country: United States - Texas
Latitude/Longitude: 30.1467, -98.017

Limiting magnitude: 6
Constellation: Perseus
SQM: 20.34
Cloud cover: clear

Globe at Night – Participating

- **2018-19 Dates**
  - Nov 29 – Dec 8
  - Dec 19 – Jan 7
  - Jan 27 – Feb 5
  - Feb 26 - Mar 7
  - Mar 27 -Apr 5

More than 15,000 observations from over 105 countries were reported during the 2017 campaign.
Will you help exceed those numbers in 2018?



eBird

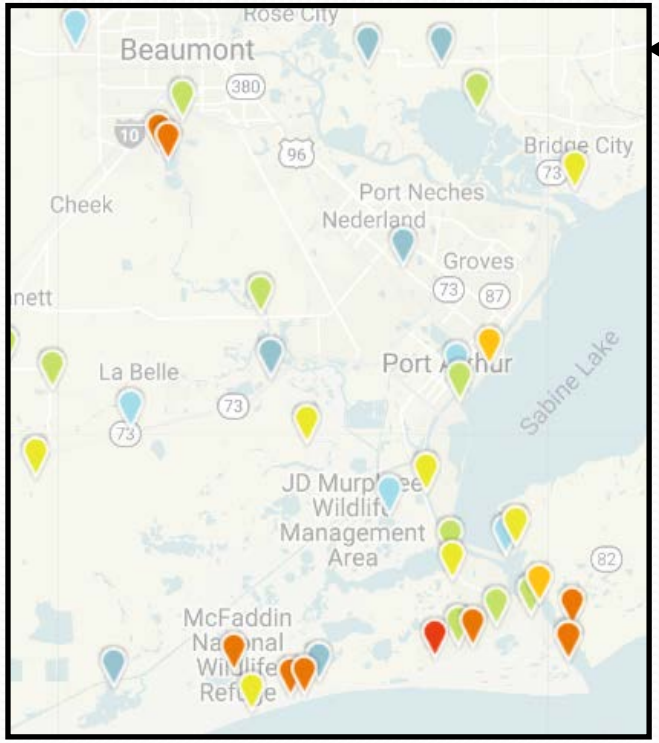
- **Goal**: To gather information in the form of checklists of birds, archive it, and freely share it to power new data-driven approaches to science, conservation, and education
- Boasts the world's largest biodiversity-related citizen science project, with more than 100 million bird sightings contributed each year by eBirders around the world
- Managed by the Cornell Lab of Ornithology in collaboration with hundreds of partner organizations, thousands of regional experts, and hundreds of thousands of users
- Documents bird distribution, abundance, habitat use, and trends through checklist data collected within a simple, scientific framework

eBird – Explore HotSpots

Explore Hotspots

Discover the best places for birding nearby or around the world.

← Starting point



← Area hotspots, located by zooming into the map

Findings for all years →

Sabine Woods (UTC 026)

Jefferson, US-TX

Year-round, Current Year

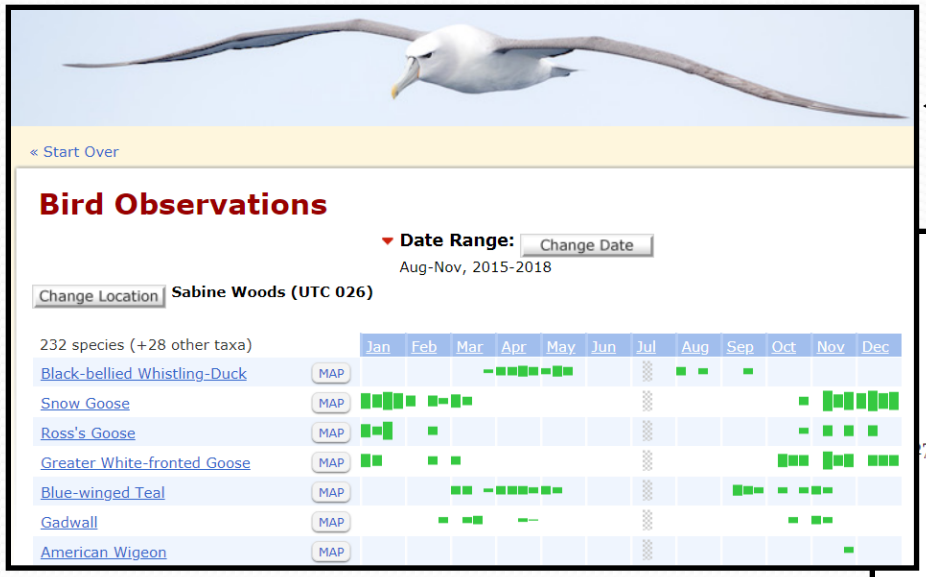
250 SPECIES

883 CHECKLISTS

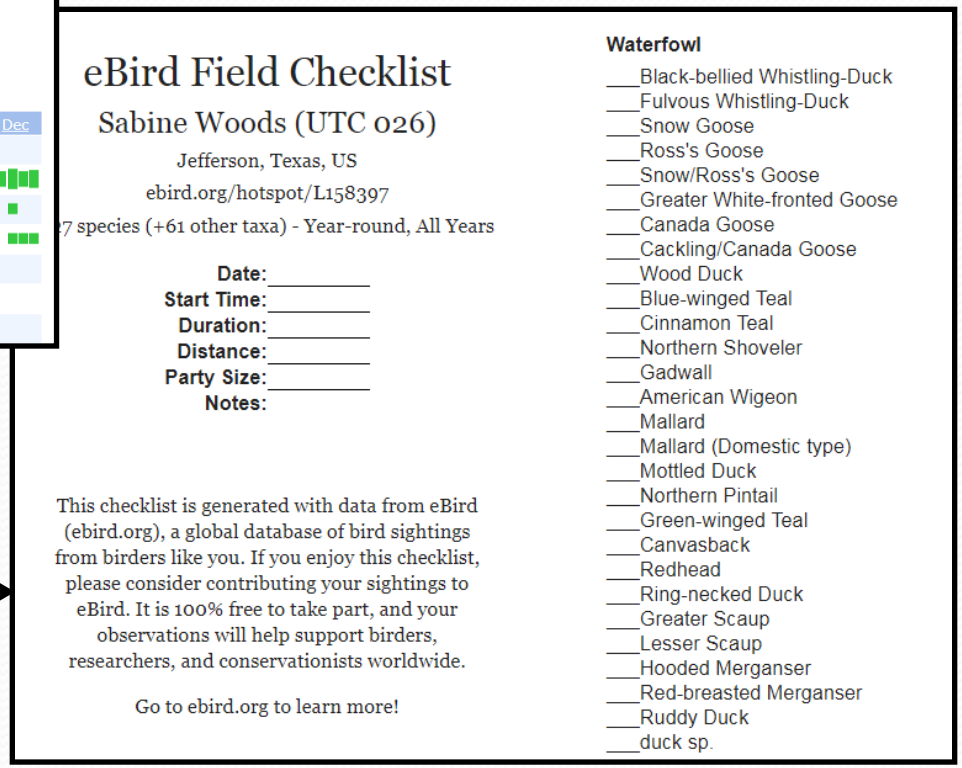
Bar Charts | High Counts | Directions

Submit Data | View Details

eBird – Make a Checklist



Checklist showing frequency of past sightings



eBird Field Checklist

Sabine Woods (UTC 026)

Jefferson, Texas, US

ebird.org/hotspot/L158397

7 species (+61 other taxa) - Year-round, All Years

Date:_____
Start Time:_____
Duration:_____
Distance:_____
Party Size:_____
Notes:

This checklist is generated with data from eBird (ebird.org), a global database of bird sightings from birders like you. If you enjoy this checklist, please consider contributing your sightings to eBird. It is 100% free to take part, and your observations will help support birders, researchers, and conservationists worldwide.

Go to ebird.org to learn more!

Waterfowl

___Black-bellied Whistling-Duck
___Fulvous Whistling-Duck
___Snow Goose
___Ross's Goose
___Snow/Ross's Goose
___Greater White-fronted Goose
___Canada Goose
___Cackling/Canada Goose
___Wood Duck
___Blue-winged Teal
___Cinnamon Teal
___Northern Shoveler
___Gadwall
___American Wigeon
___Mallard
___Mallard (Domestic type)
___Mottled Duck
___Northern Pintail
___Green-winged Teal
___Canvasback
___Redhead
___Ring-necked Duck
___Greater Scaup
___Lesser Scaup
___Hooded Merganser
___Red-breasted Merganser
___Ruddy Duck
___duck sp.

Printable checklist specific to the area

eBird – Report Data

Location Sabine Woods (UTC 026), Jefferson County

Date and Effort Sat Nov 03, 2018 10:30 AM

Protocol: Traveling

Party Size: 3

Duration: 1 hour(s), 30 minute(s)

Distance: 1.0 mile(s)

Observers: Steve Mayes

Species 21 species total

2 Mourning Dove

1 Great Egret

1 Green Heron

2 Turkey Vulture

Provides data from sighting

Can indicate absence of species

2 Northern Harrier

1 Broad-winged Hawk

1 Belted Kingfisher

1 Yellow-bellied Sapsucker

1 Red-bellied Woodpecker

1 Downy Woodpecker

2 Eastern Phoebe

1 Loggerhead Shrike

2 Blue Jay

1 House Wren

3 Blue-gray Gnatcatcher

1 Golden-crowned Kinglet

4 Ruby-crowned Kinglet

1 Northern Mockingbird

1 Swamp Sparrow *

1 Black-and-white Warbler

2 Yellow-rumped Warbler

Are you submitting a **complete checklist** of the birds you were able to identify?

Yes

eBird – The Science Impacts

- Transforms a global birding community's passion for birds into critical data for research, conservation, and education
- Gathers unprecedented volumes of information on where and when birds occur in the world
- Provides year-round information on all bird species at high spatial and temporal resolutions
- Enables next generation species distribution models that provide full life cycle information about birds at relatively fine scales across broad spatial and temporal extents
- Contributes to hundreds of conservation decisions and peer-reviewed papers, thousands of student projects, and help inform research worldwide
- Provides an unparalleled information resource on birds

Texas Nature Trackers

Plus…

Terrestrial Mollusks, Rare Plants, Bees and Wasps, Red Crowned Parrot, Fishes, Monarchs and Milkweed, and Freshwater Mussels

Summing it up –

- Citizen science is ***the participation of the general public in scientific research efforts***
- Citizen science data can reveal:
  - Species distribution
  - Migration patterns
  - Presence of invasive species
- Citizen scientists contribute research data for free!

ORIGINAL RESEARCH ARTICLE
Front. Ecol. Evol., 28 July 2017 | https://doi.org/10.3389/fevo.2017.00086

Citizen Science as a Tool for Augmenting Museum Collection Data from Urban Areas

Dakota M. Spear[1*†], Gregory B. Pauly[2,3] and Kristine Kaiser[1,3,4]

"For the four focal species, the RASCals citizen-science project generated modern locality records ***4–252 times more rapidly*** than museum collections. In ***27 months***, the RASCals citizen-science project generated 0.36–23.8 times more modern locality records than museum collections acquired over **more than 24 years**."

How about you?

- What is your passion?
- How can you contribute?

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Life's better outside.®

Citations

- Haggerty, Michelle M. and Mary Pearl Meuth, ed. Texas Master Naturalist Statewide Curriculum, Texas A & M University Press, College Station, TX, 2015.
- Dickie, Gloria. *Undark*, June 4, 2018. https://undark.org/article/climate-change-iceland-glaciers-keepers/
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  - eBird. 2017. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: http://www.ebird.org. (Accessed: October 8, 2018).
  - Christmas Bird Count. https://www.audubon.org/conservation/science/christmas-bird-count
  - Earth Echo Water Challenge. http://www.worldwatermonitoringday.org
  - Texas Nature Tracker Projects. https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/texas_nature_trackers/projects/
  - CoCoRaHS (Community Collaborative for Rain, Hail, and Snow. https://www.cocorahs.org/
  - Globe at Night. http://www.globeatnight.org