



Using GIS & Citizen Science apps to incorporate Inquiry-based learning in your K-12 Classrooms

by **Jennifer Lentz**, Ph.D.

Education Coordinator at the Aquarium of the Pacific

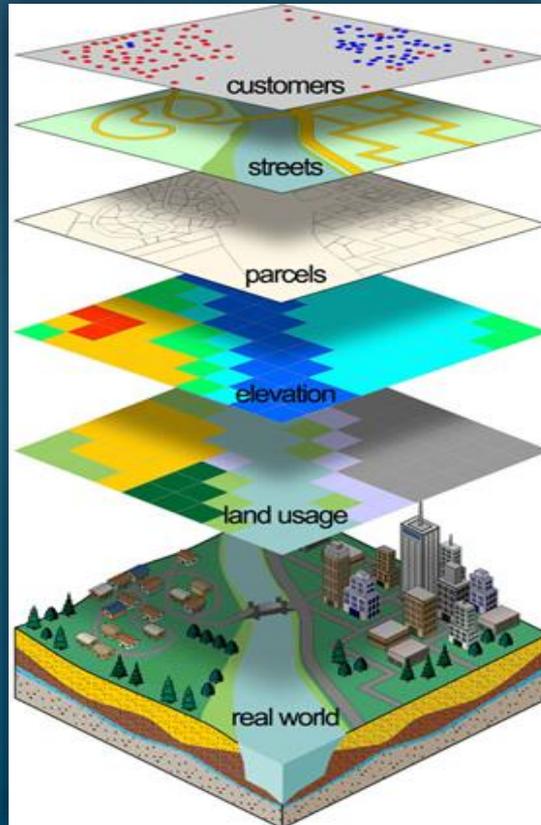
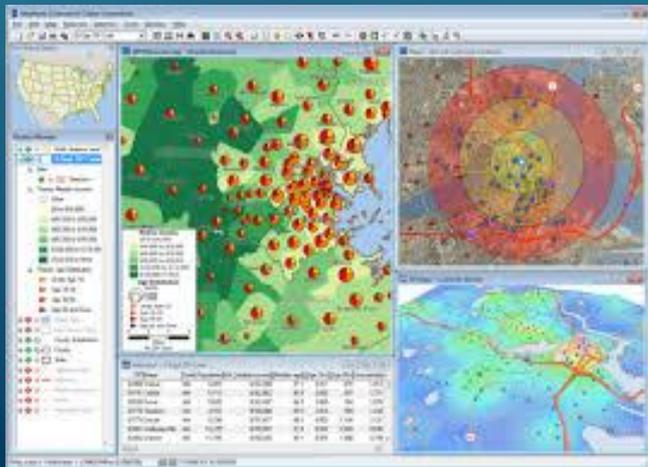
Boeing Teacher Institute (BTI) Presentation

July 27, 2017

Geographic Information Systems



Spatial Analysis

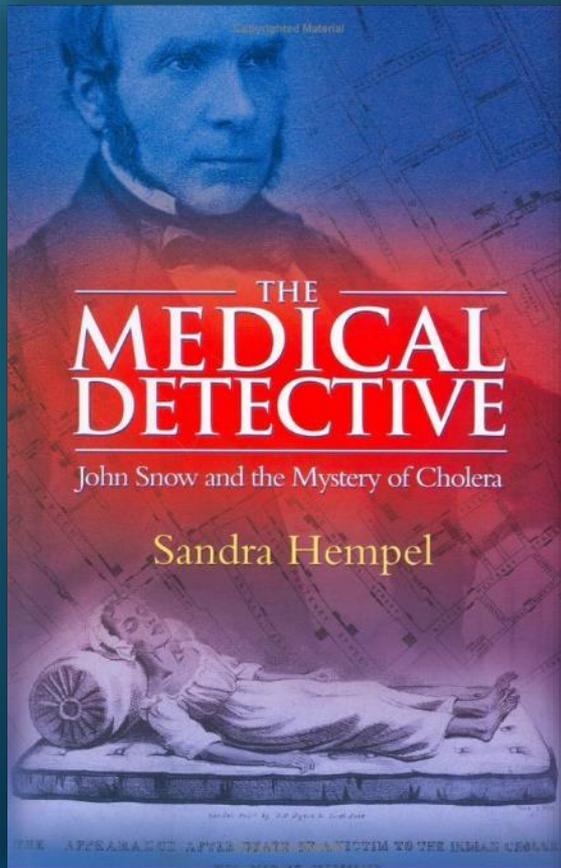


Remote Sensing



Dr. John Snow (1813-1858)

“Father of **Modern Epidemiology**”



ST. JAMES, WESTMINSTER.

The GOVERNORS and DIRECTORS of the POOR
HEREBY GIVE NOTICE,
That, with the view of affording prompt and Gratuitous assistance to Poor Persons resident in this Parish, affected with Bowel Complaints and

CHOLERA,

The following Medical Gentlemen are appointed, either of whom may be immediately applied to for Medicine and Attendance, on the occurrence of those Complaints, viz.—

Mr. FRENCH, 41, Gt. Marlborough St.
(Opposite, Bow's Court, Mansell Street)

Mr. HOUSLEY, 28, Broad Street.

Mr. WILSON, 16, Great Ryder St.

Mr. JAMES, - 49, Princes Street.

Mr. DAVIES, 25, Brewer Street.

SUGGESTIONS AS TO FOOD, CLOTHING, &c.

Regularity in the Hours of taking Meals, which should consist of any description of wholesome Food, with the moderate use of sound Beer.

Abstinence from Spirituous Liquors.

Warm Clothing and Cleanliness of Person.

The avoidance of unnecessary exposure to Cold and Wet, and the wearing of Damp Clothes, or Wet Shoes.

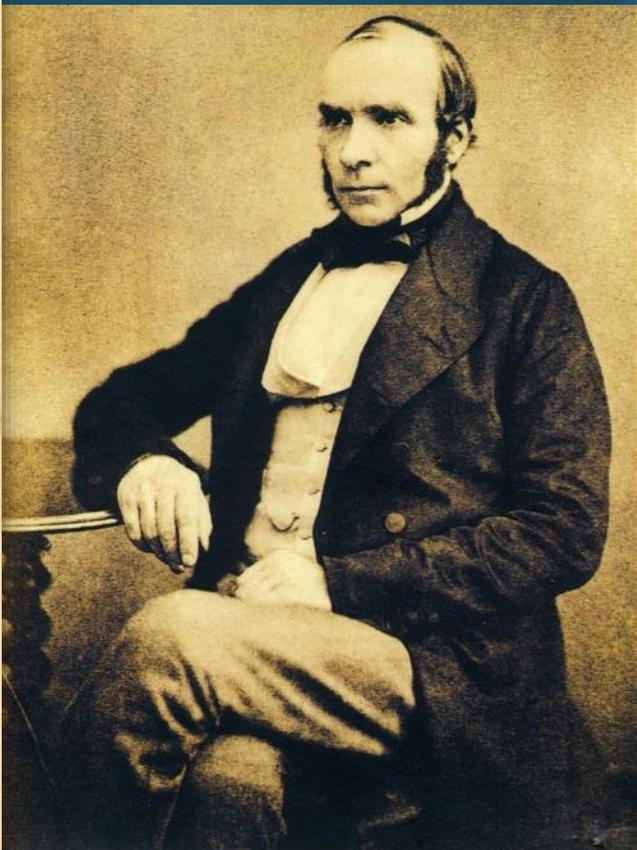
Regularity in obtaining sufficient Rest and Sleep.

Cleanliness of Rooms, which should be aired by opening the Windows in the middle of each day.

By Order of the Board,
GEORGE BUZZARD,
Clerk.

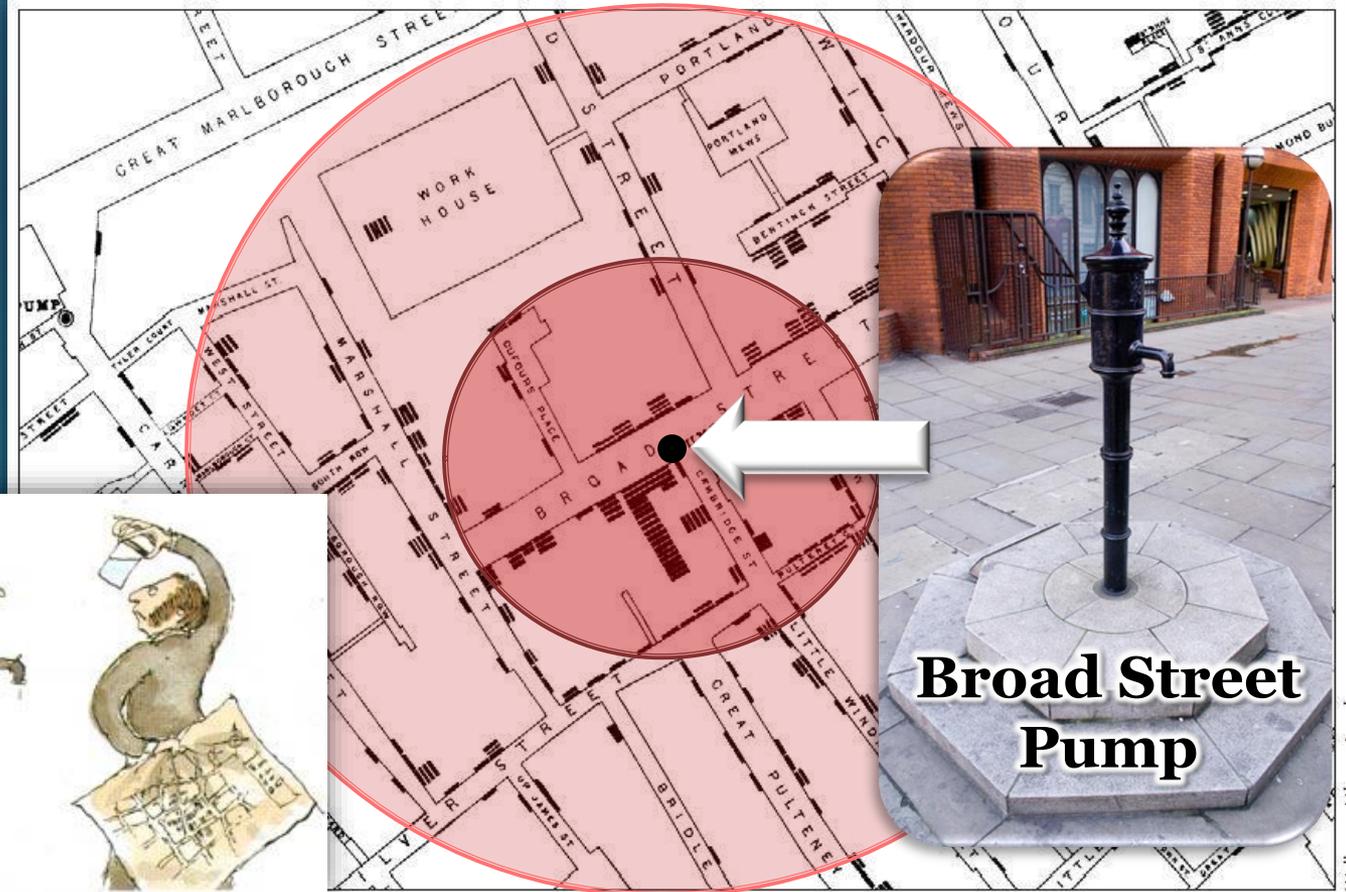
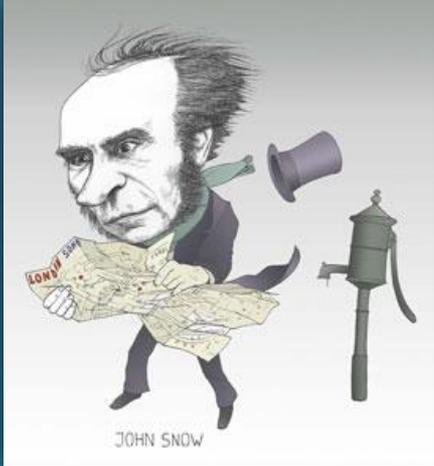
FRANCIS OFFICE, Palace Street,
2nd November, 1831.

It is requested that this Paper be taken care of, and placed where it can be easily referred to.



Dr. John Snow (1813-1858)

“Father of **Medical Geography**”



Street map of cholera deaths in Soho in 1853 from John Snow's *On the Mode of Communication of Cholera*

Examples of Modern GIS Applications

Crime Analysis



Ecologic & Climate Science



Medical Geography & Spatial Epidemiology



Bring GIS into your K-12 Classrooms



<http://video.esri.com/watch/4500/connected-take-your-students-to-new-places>

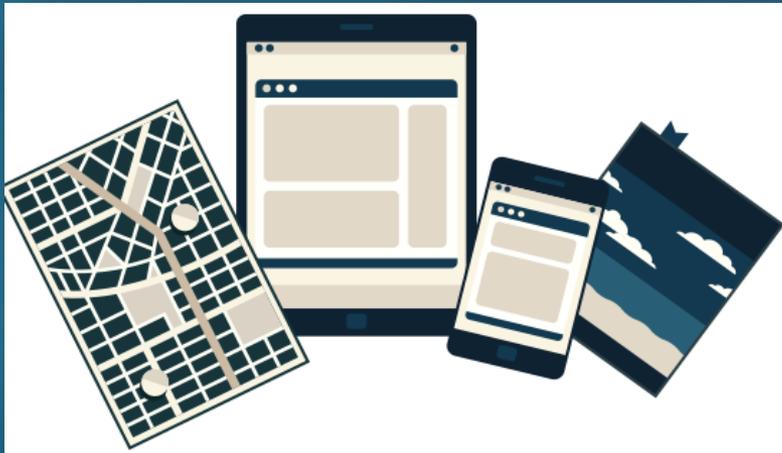
So Easy 4th Graders Can Do It!



<http://video.esri.com/watch/3665/connecting-gis-with-education>

ConnectED Initiative

Free ArcGIS Online Accounts available for
ALL K-12 Schools in the United States!



Free ArcGIS Online School Account

US K12 schools can request a free account for instruction. ([Terms and conditions](#))

Request a Free US School Account X

Organization <input type="text" value="To select, begin typing."/>	Department <input type="text"/>
Street Address <input type="text"/>	City <input type="text"/>
State <input type="text" value="- Select -"/>	ZIP Code <input type="text"/>
School Website <input type="text"/>	School Phone <input type="text"/>
Contact First Name <input type="text"/>	Contact Last Name <input type="text"/>
Contact Email <input type="text"/>	<input type="checkbox"/> Agree to Terms and Conditions

Sign up online at: <http://www.esri.com/connected>

ConnectED Initiative

ArcGIS Online provides **Project-based Learning** in line with **NGSS** standards



These sites include...

- Teacher Stories
- Student Videos
- Case Studies
- Resources
- Lessons Plans

<http://www.esri.com/connected/>

& <http://edcommunity.esri.com/>

Instructional GIS Materials for K-12

GeoInquiries

15 min activities for
Elementary – High School



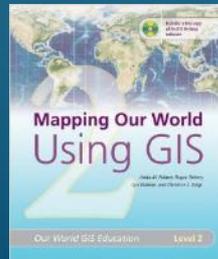
Story Maps

For All Ages & Audiences
Can be used as Lessons or Assignments



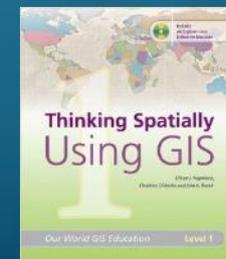
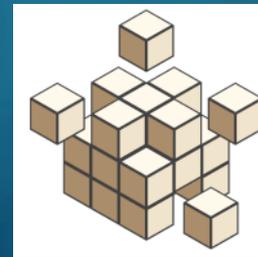
Mapping our World

45-90 min activities for
Middle School



Thinking Spatially

30-60 min activities for
Elementary School (4-6 grade)

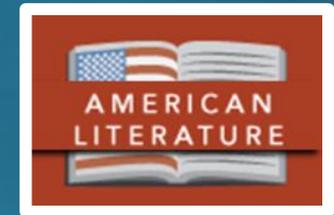
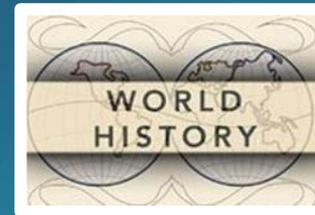


and more!

GeoInquiries

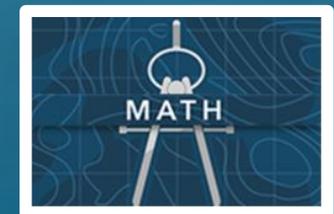
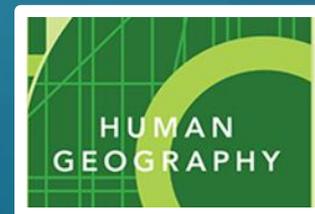
Designed to be Fast (15 min), Easy-to-Use, Standards-based Inquiry Activities designed to be presented by the instructor from a single computer/projector classroom.

Elementary School
(~4th Grade)



High School

Middle School



These activities do NOT require logging in & can be done with or without an ArcGIS Online (AGOL) account

<http://edcommunity.esri.com/geoinquiries/>



GeoInquiries (Middle School)

Earth Science

1. Topography and our national heritage
2. Remote sensing
3. Mining the world's most used minerals
4. Rock types tell stories
5. North American landforms
6. Cracked plates (tectonics)
7. The earth moves under our feet (earthquakes)
8. Plate type effect on volcanoes
9. Mountain building
10. A river runs through it (freshwater)
11. Ocean features
12. Fluid Earth: winds and currents
13. How's the weather?
14. Tropical storms
15. Climate change

Tropical Storm GeoInquiry



Tropical storms

ATMOSPHERE

Target audience – Earth Science, grades 6-9 Time required – 15 minutes

Activity Use hurricane track information to understand factors that encourage the formation of hurricanes.

Science Standards MS-ESS2-5 – Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Learning Outcomes

- Students will use the tracks of hurricanes in 2005 to compare wind speed to the air pressure within the hurricane and sea surface temperature.
- Students will determine the impact of air pressure and sea surface temperature on hurricane strength.

Map URL: <http://bit.ly/earthgeoinquiry14>

Engage

Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- Check the box next to Hurricanes Wind Strength to turn the layer on.
- Click any point on the trails of these hurricane.
- ? What information is stored for each point along the way? [Information about air pressure, wind speed, and ocean temperature is stored.]
- All hurricanes start as tropical depressions (TD).
- Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category - Is - TD.
- Where do most Atlantic storms reach TD status? [Most become TD east of the Caribbean.]

Explore

How does air pressure relate to wind speed in hurricanes?

- The 2005 Atlantic storms caused \$160 billion in damage and 3,913 deaths. Winds cause property damage by blowing off roofs or collapsing buildings, but they also push the surface of the water into a storm swell. Homes and small buildings do not stand a chance against storm-driven ocean swells. Winds are generated by greater differences in air pressure and the geographic size of the low pressure.
- Hover on the Hurricane Wind Strength layer name, click the right drop-down arrow, and then click Show Table.
- In the Hurricane Wind Strength table, click the WIND_KTS (wind speed in knots) column header.
- Click Sort Ascending to arrange the wind speed values in increasing order.
- ? As you scroll down the table, how does the pressure column change relative to wind speed? [They are inversely proportional to each other.]

Explain

What determines the path a storm takes?

- ? Are there areas where lower pressures do not have as strong of winds? [Winds are generally much smaller over land.]
 - ? Why do wind speeds slow down over land? [Rougher land surfaces provide friction, slowing winds down. Also, the heat of evaporated water condensing into clouds is cut off over land.]
 - Close the Hurricane Wind Strength table.
- more ▶

Elaborate

Where do tropical storms get such strength?

- Click the Hurricane Strengthening Zone bookmark.
- Turn on the Sea Temperature 05 layer.
- Click the Sea Temperature 05 title, and then click the AvSeaTemp05 subtitle to expand this layer's legend.
- ? At what temperature do storms consistently pick up energy? (You can also click the dots to verify temperatures.) [Hurricanes may be sustained at lower temperatures, but most storms really grow above 28°C.]

Evaluate

What other areas of the world have good conditions for tropical storms?

- Use the Filter Data toolbox instructions to identify one of the names of the storms.
- Click each dot, and on a whiteboard, create a table of wind speeds and pressure.
- Create a graph of wind speed vs. pressure. [Wind speed should be on the x axis. The pressure should be on the y axis—the resulting graph will go down to the right.]
- ? What type of relationship do these two variables have? [This is an inverse relationship.]
- Click the Home button to zoom out to the entire world.
- ? List two other areas in the world that would be possible targets for tropical storms. [China, Philippines, Indonesia, and Australia are all possible targets.]

FILTER DATA

- Hover on the layer name, click the drop-down arrow, and choose Filter.
- Build the expression Name - Is - Unique.
- Scroll down to choose a unique hurricane name.
- Click Apply Filter, and then click Zoom To.

BOOKMARK

- At the top of the map, click the Bookmarks button.
- Choose your bookmark; the map will take you there.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to U.S. public, private, and home schools as a part of the White House CONNECTED Initiative. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://connected.esri.com>.

THEN TRY THIS...

- Add a U.S. states layer, perform analysis, and aggregate hurricane wind strength by states.
- Color the new layer based on how many hurricanes have crossed the state borders.

TEXT REFERENCES

This GIS map has been cross-referenced to material in the weather sections of chapters from middle-school texts.

- Earth Science by Glencoe McGraw Hill – Chapter 16
- Earth Science by McDougal Littell – Chapter 3D
- Earth Science by Holt – Chapter 16
- Earth Science by Prentice Hall – Chapter 17

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Tropical Storm GeoInquiry

Tropical storms

ATMOSPHERE

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Activity Use hurricane track information to understand factors that encourage the formation of hurricanes.

Elaborate

Where do tropical storms get such strength?

- Click the Hurricane Strengthening Zone bookmark.
- Turn on the Sea Temperature 05 layer.
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- ? At what temperature do storms consistently pick up energy? (You can also click the dots to verify temperatures.) *Hurricanes may be sustained at lower temperatures, but most storms really need above 28°C!*

Browser address bar: <http://bit.ly/earthgeo inquiry14>

ArcGIS Tropical Storms Modify Map Sign In

Details Basemap Share Print Measure Bookmarks Find address or place

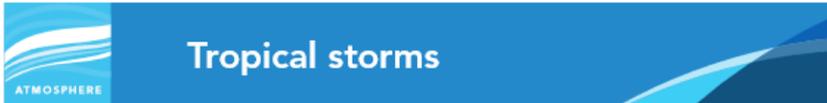
Legend

Hurricanes 2005

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Esri, FAO, NOAA

Tropical Storm GeoInquiry



Tropical storms

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Activity Use hurricane track information to understand factors that encourage the formation of hurricanes.

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- Students will use the tracks of hurricanes in 2005 to compare wind speed to the air pressure within the hurricane and sea surface temperature.
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Map URL: <http://bit.ly/earthgeoenquiry14>

Engage

Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- Check the box next to Hurricanes Wind Strength to turn the layer on.
- Click any point on the trails of these hurricane.
- ? What information is stored for each point along the way? [Information about air pressure, wind speed, and ocean temperature is stored.]
- All hurricanes start as tropical depressions (TD).
- Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category - Is - TD.
- Where do most Atlantic storms reach TD status? [Most become TD east of the Caribbean.]

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How does air pressure relate to wind speed in hurricanes?

- The 2005 Atlantic storms caused \$160 billion in damage and 3,913 deaths. Winds cause property damage by blowing off roofs or collapsing buildings, but they also push the surface of the water into a storm swell. Homes and small buildings do not stand a chance against storm-driven ocean swells. Winds are generated by greater differences in air pressure and the geographic size of the low pressure.
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- Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category - Is - TD.
- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

ArcGIS Tropical Storms

1

Modify Map

Sign In

The screenshot displays the ArcGIS web interface for 'Tropical Storms'. The top navigation bar includes 'Details', 'Basemap', 'Share', 'Print', 'Measure', and 'Bookmarks'. A search bar is located on the right. The left sidebar shows the 'Legend' section with 'Hurricanes 2005' listed. The main map area shows a world map with red lines representing hurricane tracks, primarily concentrated in the Atlantic and Caribbean. A scale bar at the bottom left indicates 0, 1000, and 2000 miles. The bottom right corner features the Esri logo and 'POWERED BY esri' text, along with 'Esri, FAO, NOAA'.

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ArcGIS Tropical Storms

New Map Sign In

Details Add Basemap Save Share Print Measure Bookmarks Find address or place

Contents

- Hurricane Wind Strength
- Hurricanes 2005
- Sea Temperatures 05
- Topographic

0 1000 2000mi

POWERED BY esri
Esri, FAO, NOAA

Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- 3** → Check the box next to Hurricanes Wind Strength to turn the layer on.
- Click any point on the trails of these hurricane.
- ? What information is stored for each point along the way? *[Information about air pressure, wind speed, and ocean temperature is stored.]*
- All hurricanes start as tropical depressions (TD).
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- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

The screenshot shows the ArcGIS web interface. At the top, there are navigation buttons: Details, Add, Basemap, Save, Share, Print, Measure, and Bookmarks. A search bar is on the right. The main map area displays a world map with red lines representing hurricane tracks, primarily concentrated in the Atlantic and Caribbean regions. The map is labeled with continents: NORTH AMERICA, SOUTH AMERICA, EUROPE, AFRICA, ASIA, and AUSTRALIA. A scale bar at the bottom left indicates 0, 1000, and 2000 miles. The bottom right corner features the Esri logo and text: 'POWERED BY esri Esri, FAO, NOAA'. The bottom left corner contains links: 'Esri.com · Help · Terms of Use · Privacy · Contact Esri · Report Abuse'.

3 Hurricane Wind Strength

Hurricanes 2005

Sea Temperatures 05

Topographic

Where and how do tropical storms form?

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- Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category - Is - TD.
- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

ArcGIS Tropical Storms

New Map Sign In

The screenshot shows the ArcGIS web interface for a map titled "Tropical Storms". The map displays the Atlantic Ocean with numerous green circular markers representing hurricane tracks. The interface includes a top toolbar with options like Save, Share, Print, Measure, and Bookmarks. A left sidebar shows the Contents panel with "Hurricane Wind Strength" and "Hurricanes 2005" checked. A search bar is located at the top right. The map shows the Atlantic Ocean with labels for North America, South America, Europe, Africa, Asia, and Australia. A scale bar at the bottom left indicates 0, 1000, and 2000 miles. The bottom right corner features the Esri logo and text "POWERED BY esri Esri, FAO, NOAA".

Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- Check the box next to Hurricanes Wind Strength to turn the layer on.
- 4 → Click any point on the trails of these hurricane.
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- All hurricanes start as tropical depressions (TD).
- Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category - Is - TD.
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ArcGIS Tropical Storms

New Map Sign In

Details Add Basemap Save Share Print Measure Bookmarks Find address or place

Contents

- Hurricane Wind Strength
- Hurricanes 2005
- Sea Temperatures 05
- Topographic

This is hurricane DELTA

Winds are blowing at 35.00 knots an hour. It is an E storm at 1,000 mB of pressure and is traveling over seas around 45 celcius.

Zoom to

0 1000 2000mi

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Where and how do tropical storms form?

- Click Modify Map, and then click the Contents button.
- Check the box next to Hurricanes Wind Strength to turn the layer on.
- Click any point on the trails of these hurricane.
- ? What information is stored for each point along the way? *[Information about air pressure, wind speed, and ocean temperature is stored.]*
- All hurricanes start as tropical depressions (TD).
- 5** → Use the Filter Tooltip instructions to filter Hurricane Wind Strength – Category - Is - TD.
- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

ArcGIS Tropical Storms

New Map Sign In

The screenshot shows the ArcGIS web interface for 'Tropical Storms'. The 'Contents' panel on the left lists several layers: 'Hurricane Wind Strength' (checked and highlighted with a red box and the number 5), 'Hurricanes 2005', 'Sea Temperatures 05', and 'Topographic'. The main map area displays a map of the Atlantic Ocean with numerous green circular markers representing storm tracks. A tooltip window is open over a point on the map, titled 'This is hurricane DELTA', with the following text: 'Winds are blowing at 35.00 knots an hour. It is an E storm at 1,000 mB of pressure and is traveling over seas around 45 celcius.' Below the text is a 'Zoom to' button. The map includes a scale bar (0, 1000, 2000mi) and a search bar at the top right.

Where and how do tropical storms form?

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- Check the box next to Hurricanes Wind Strength to turn the layer on.
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- Where do most Atlantic storms reach TD status? *[Most become TD east of the Caribbean.]*

The screenshot shows the ArcGIS interface with a map titled "Tropical Storms". The "Contents" panel on the left shows the "Hurricane Wind Strength" layer checked. A "Filter: Hurricane Wind Strength" dialog box is open, displaying the "Create" tab. The dialog contains the following elements:

- A tab labeled "Create" with a close button (X).
- Buttons: "+ Add another expression" and " Add a set".
- Text: "Display features in the layer that match the following expression".
- Expression field: "AD_TIME" selected from a dropdown, followed by "is" from another dropdown, and an empty text input field.
- Radio buttons: "Value" (selected), "Field", and "Unique".
- Checkbox: " Ask for values" with a dropdown arrow.
- Buttons at the bottom: "APPLY FILTER", "APPLY FILTER AND ZOOM TO", and "CLOSE".

In the background, a map of the Atlantic Ocean is visible with a tooltip for "Hurricane DELTA" showing details like "moving at 35.00 knots" and "storm at 1,000 mB of". The map includes a scale bar (0 to 2000 miles) and the Esri logo.

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The screenshot shows the ArcGIS interface with a map titled "Tropical Storms". The "Contents" panel on the left shows the "Hurricane Wind Strength" layer checked. A "Filter: Hurricane Wind Strength" dialog box is open, displaying the expression "Category is TD". The "APPLY FILTER" button is highlighted with a red box. The dialog also includes options for "Add another expression", "Add a set", and "Ask for values". The map background shows a portion of the Atlantic Ocean and the Americas.

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Tropical Storm GeoInquiry



Tropical storms

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Time required – 15 minutes

Activity Use hurricane track information to understand factors that encourage the formation of hurricanes.

Science Standards MS-ESS2-5 – Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Elaborate

Where do tropical storms get such strength?

- Click the Hurricane Strengthening Zone bookmark.
- Turn on the Sea Temperature 05 layer.
- Click the Sea Temperature 05 title, and then click the AvSeaTemp05 subtitle to expand this layer's legend.
- ? At what temperature do storms consistently pick up energy? (You can also click the dots to verify temperatures.) *[Hurricanes may be sustained at lower temperatures, but most storms really grow above 28°C.]*

Evaluate

ArcGIS Tropical Storms

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Contents

- Hurricane Wind Strength
- Hurricanes 2005
- Sea Temperatures 05
- Topographic





Elaborate

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- Hurricanes 2005
- Sea Temperatures 05
- Topographic

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Esri, FAO, NOAA



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ArcGIS - Tropical Storms

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Bookmarked places

- Strengthening zone

Add Bookmark



Elaborate

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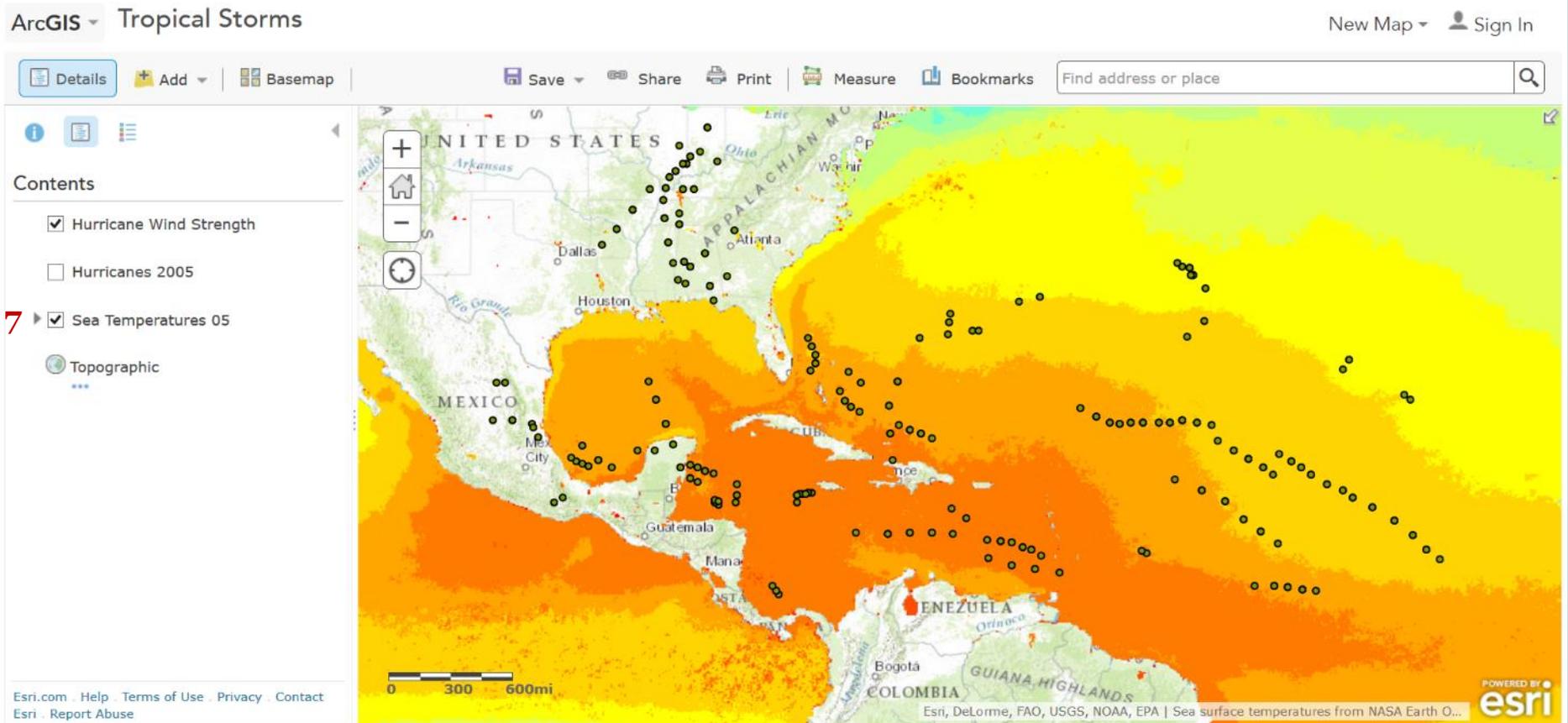
Esri, DeLorme, FAO, USGS, NOAA, EPA



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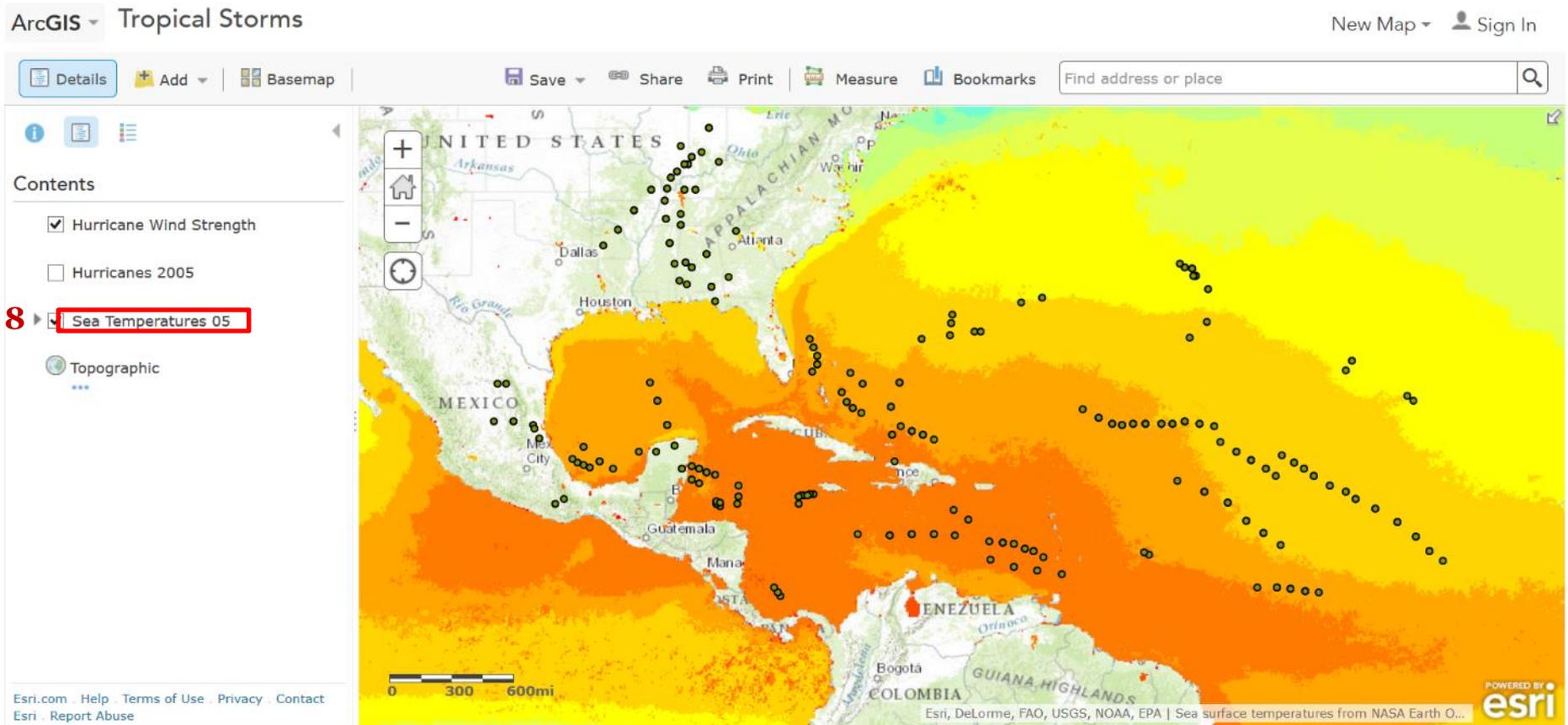




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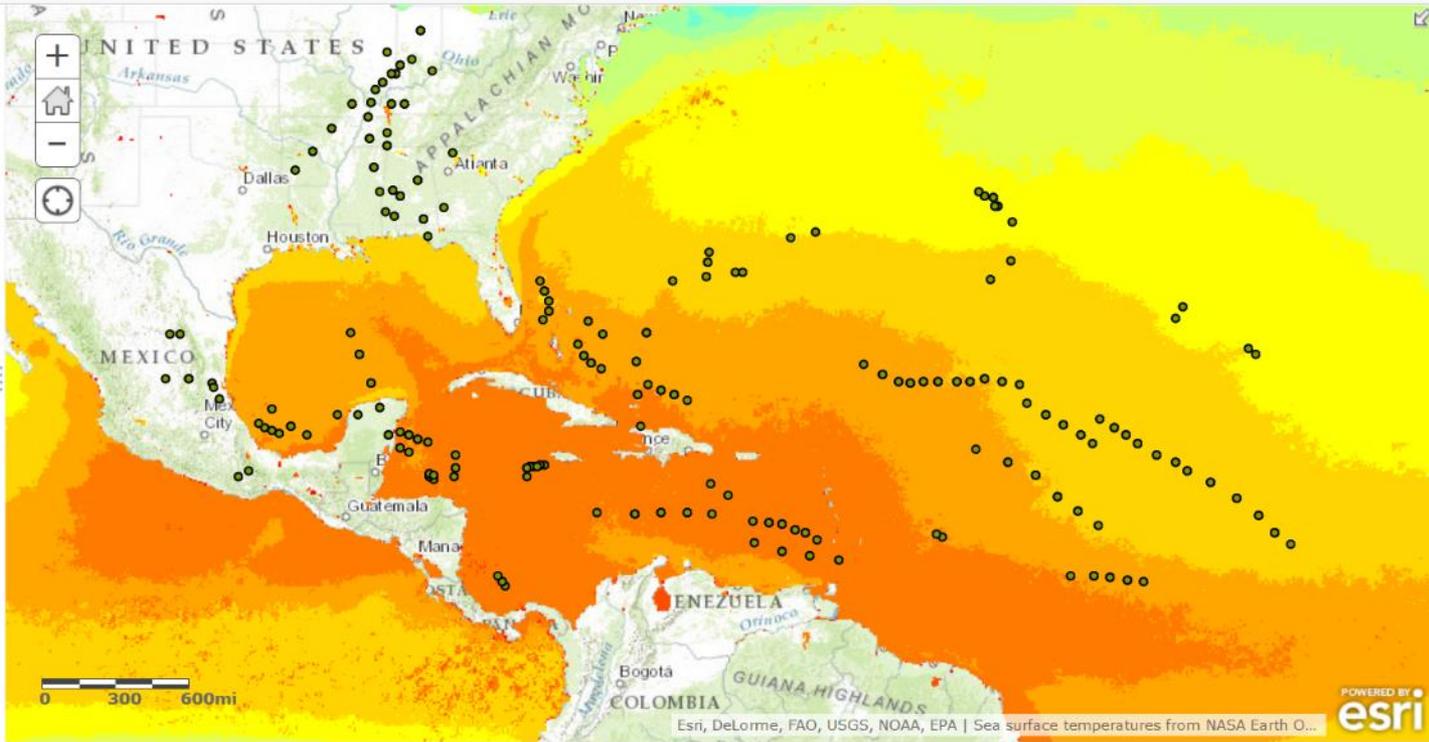
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Elaborate

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ArcGIS Tropical Storms

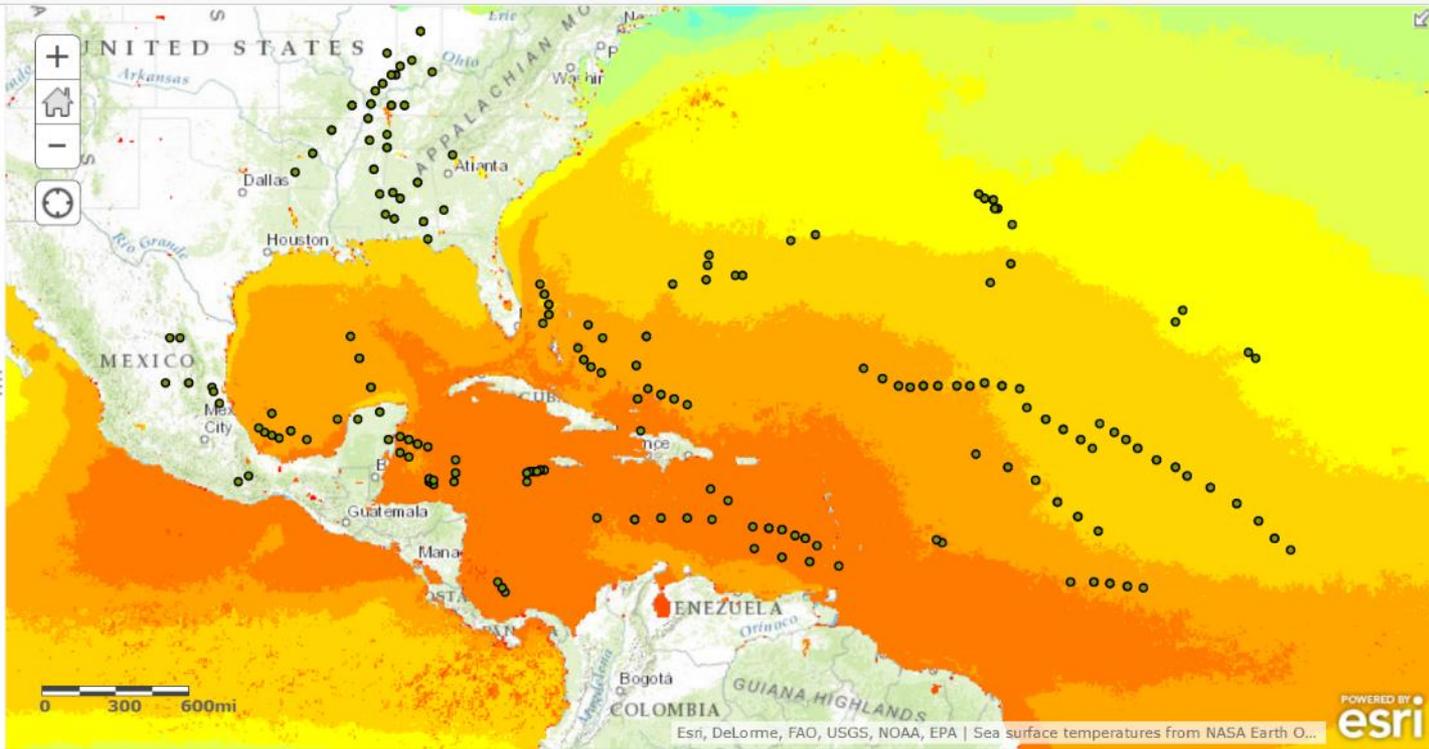
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Contents

AvSeaTemp05

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- 4 - 5
- 6 - 7
- 8 - 10
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Map-based Inquiry Lessons

Story Maps

story map it (verb):

“to actively engage your audience with your data, analysis, and projects”



<http://storymaps.arcgis.com/>

Story Maps work on Multiple Platforms

Aquarium of the Pacific's Magellanic Penguins Story Map

Computers & Laptops

An Aquarium of the Pacific (AOP) story map

Magellanic Penguins

Spheniscus magellanicus

Geographic Range

- Breeding range
- Non-breeding range

1 Magellanic Penguin Geographic Range

2 Aquarium of the Pacific's June Keyes Penguin Habitat

3 Shim ("The Big One")

4 Noodles ("The Bruiser")

5 Patby ("The Shy One")

6 Whatever ("The Bold One")

7 Floyd ("The Culous One")

8 Ludwig ("The Rowdy One")

9 Newsom ("The Baby")

10 Jeremy ("The Sweet One")

11 Henry ("The Wise Elder")

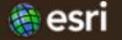
12 Avery ("The Teenager")

Story Maps cover Core Content

The Assassination of Abraham Lincoln

April 14 marks the 150th anniversary of the assassination of Abraham Lincoln. This map tour recounts the bizarre saga of John Wilkes Booth and his co-conspirators.

A story map   



1865: Booth in Washington

1865: Booth in Washington

Booth boarded in the National Hotel at the corner of 6th Street and Pennsylvania Avenue NW. The site is now occupied by the Newseum. Booth, a prominent actor, was admired by Lincoln. Library of Congress

- 1865: Booth in Washington
- March 4, 1865: Lincoln's second inaugural
- March 17: Kidnapping plan foiled
- April 14, morning: The Kirkwood House
- April 14, morning: Ford's Theatre
- April 14, late afternoon: Stalking Ulysses S. Grant
- April 14, evening: Booth waits for Lincoln
- April 14, 10:13 p.m.: The president is shot
- April 14, 10:15 p.m.: Seward attacked and wounded
- April 14, 10:15 p.m.: Seward attacked and wounded
- April 14, 10:15 p.m.: Seward attacked and wounded

<http://arcg.is/1NTUPL3>

The Aquarium's Story Maps website

Home Gallery Map Scene Groups Sign In

AQUARIUM OF THE PACIFIC
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Story Maps Website

Story Maps and other GIS-related projects

- AOP's Magellanic Penguins Story Map**
- AOP's Southern California Steelhead Story Map**
- AOP, The GREEN Aquarium (working draft)**
- BTI 2014 Workshop (working draft)**

The Aquarium of the Pacific's mission is to instill a sense of wonder, respect, and stewardship for the Pacific Ocean, its inhabitants, and ecosystems. Our vision is to create an aquarium dedicated to conserving and building Natural Capital (Nature and Nature's services) by building Social Capital (the interactions between and among peoples).

The Aquarium of the Pacific (AOP) is the fourth most-attended aquarium in the nation. It displays over 12,000 animals in more than 50 exhibits that represent the diversity of the Pacific Ocean. Each year more than 1.5 million people visit the Aquarium. Beyond its world-class animal exhibits, the Aquarium offers educational programs for people of all ages from hands-on activities to lectures by leading scientists. Through these programs and a variety of multimedia experiences, the Aquarium provides opportunities to delve deeper into ocean science and learn more about our planet. The Aquarium of the Pacific has redefined the modern aquarium. It is a community gathering place where diverse cultures and the arts are celebrated and a place where important topics facing our planet and our ocean are explored by scientists, policy-makers and stakeholders in the search for sustainable solutions.

<http://aop.maps.arcgis.com>

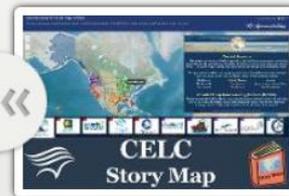
Example of a Story Map about our Exhibits

HOME GALLERY MAP SCENE GROUPS

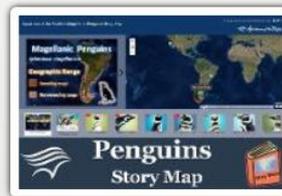
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Story Maps and other GIS-related projects



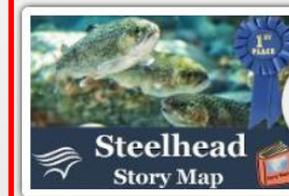
AOP's CELC Story Map



AOP's Magellanic Penguins Story Map



AOP's Seafood Story Map



AOP's Southern California Steelhead Story Map

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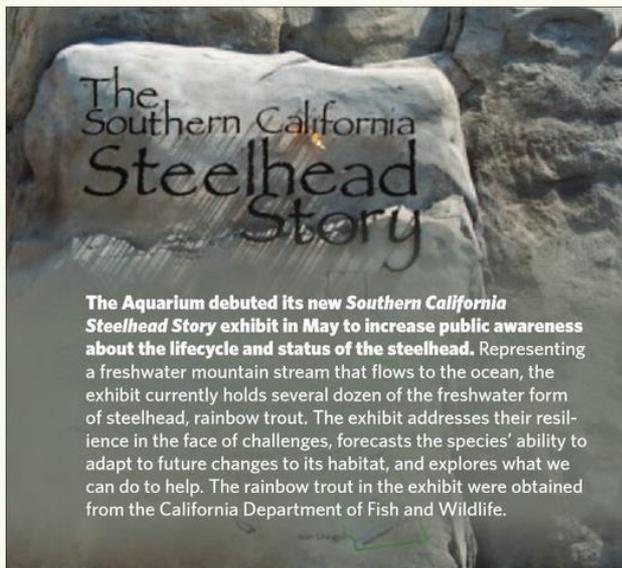
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Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead



Species Overview

Steelhead are members of the salmon family that includes all salmon species, trout, and char. Southern California steelhead are the only members of the salmon family native to Southern California. They are anadromous fish, that is, they hatch and live for a part of their life cycle in fresh water, migrate to the ocean where they spend to mature, and return to a freshwater stream, usually the one where they were hatched, to spawn. Unlike their salmon relatives, they usually do not die after spawning.



Example of a Story Map about our Exhibits

an AOP story map

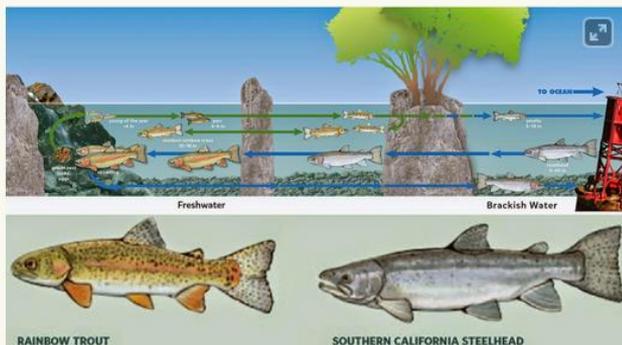


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Steelhead is the name given to ocean-going rainbow trout. Steelhead are born and remain in freshwater for 1-3 years as juveniles, then migrate to the ocean and stay for 1-4 years while growing into adults. When rivers are typically swollen in winter, adults migrate to freshwater to spawn, usually in the stream where they were born. Steelhead belong to a family that includes all salmon, trout, and char. Unlike salmon, which spawn only once, adult Steelhead often return to the ocean after spawning and repeat the spawning migration the next year.



The image on the right is a painting by Ben Lovejoy titled "A Steelhead's Journey" (<http://www.steelheadrecovery.org/images/lovejoy-painting-large.jpg>)



Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead

Historical Southern California Steelhead Populations

At one time steelhead spawned in the majority, if not all, of California's coastal rivers.



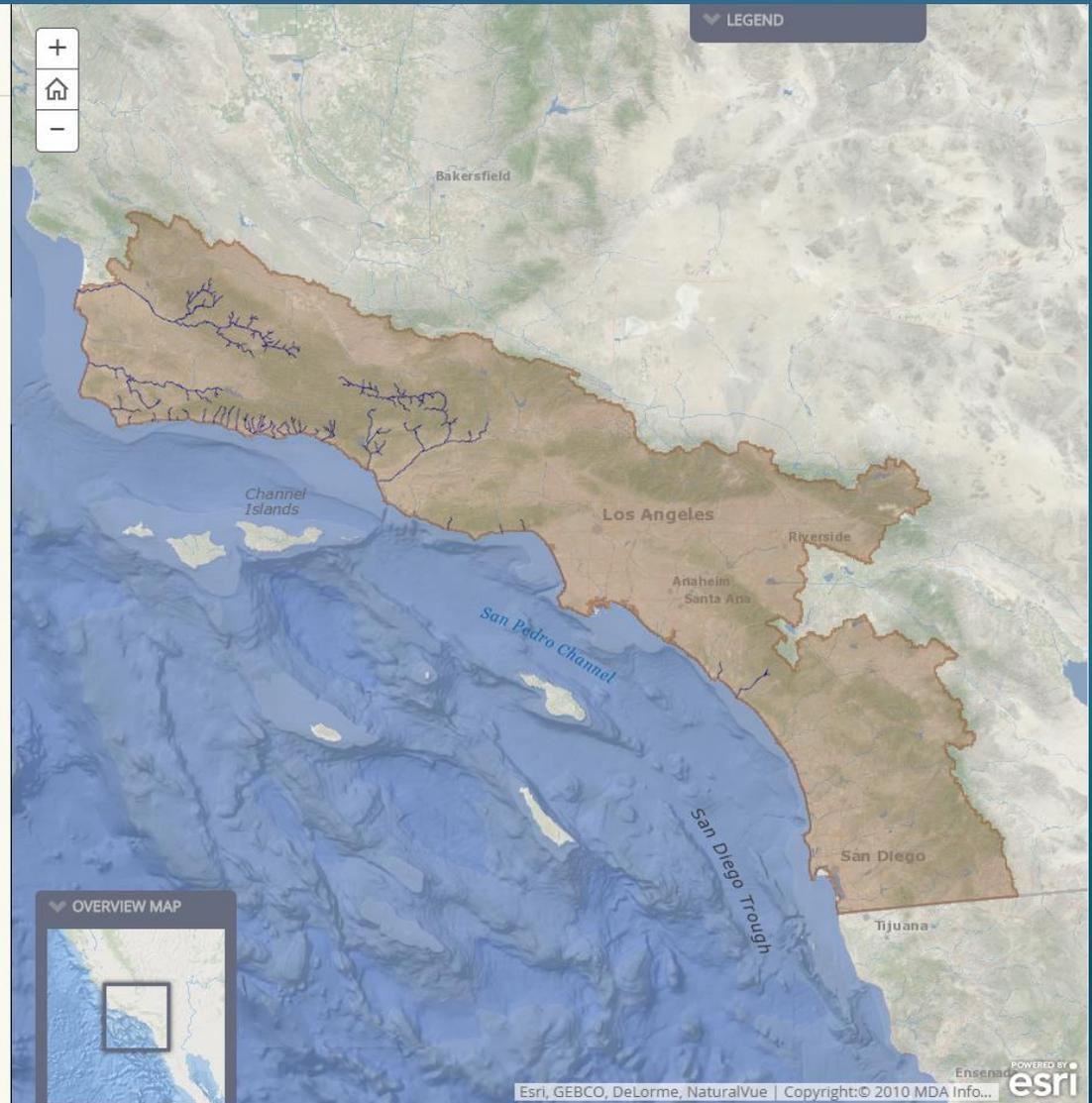
"Ventura River Steelhead Anglers, 1909" (NMFS's 2012 Southern California Steelhead Recovery Plan, page 5)

The map on the right shows the **historical distribution** of Southern California Steelhead populations.

Southern California steelhead can tolerate warm water and have a complex yet flexible life history that increases their resistance to environmental change. Steelhead are at risk of extinction, but restoring water quality and quantity, and removing or modifying man-made barriers to migration in certain Southern California streams would increase their chances of survival.

Present Day Southern California Steelhead Populations

Over the last 100 years the Southern California Steelhead population has declined 99% and some runs are extirpated. Southern California Steelhead are



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Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead

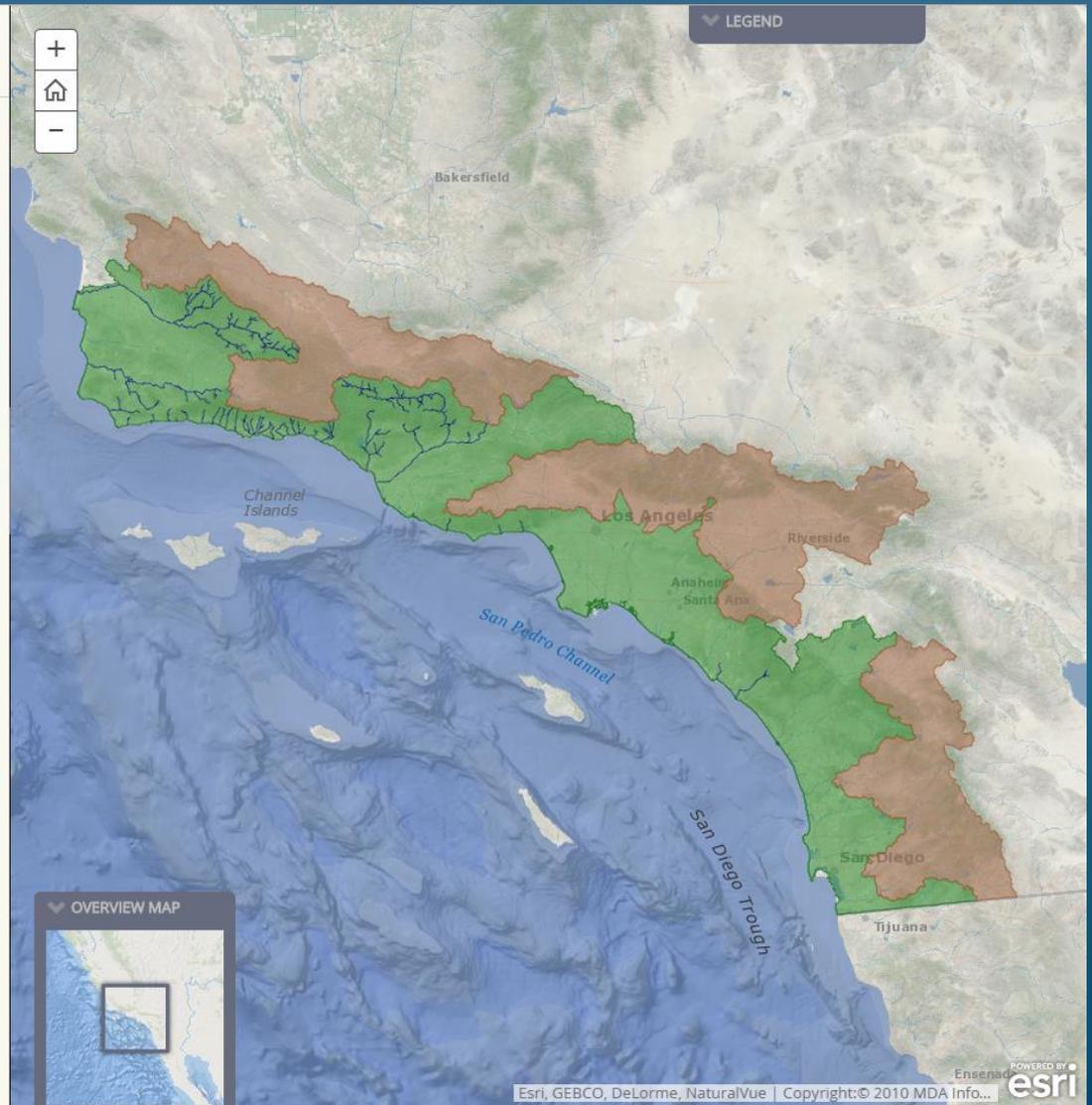
Present Day Southern California Steelhead Populations

Over the last 100 years the Southern California Steelhead population has **declined 99%** and some runs are extinct. Southern California Steelhead are now listed as endangered under the U.S. Endangered Species Act. The southern California population has declined from about 40,000 steelhead to less than 500. This decline was in large part the result of manmade infrastructure (like dams, concrete lined washes, etc).

The map on the right shows the **current steelhead population range**, the **historical range** which is now anthropogenically blocked, and the locations of **major dams**.



"Bradbury Dam, Santa Ynez River" (NMFS's 2012 Southern California Steelhead Recovery Plan, page 9)



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Example of a Story Map about our Exhibits

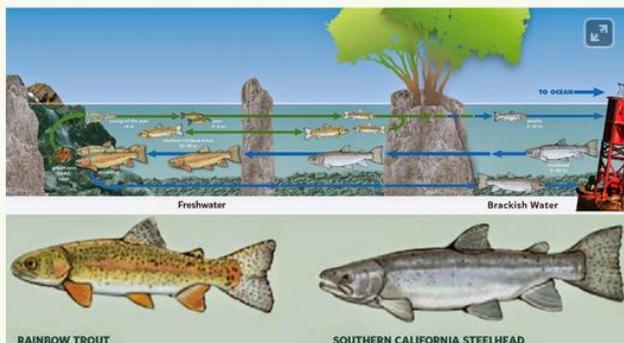
an AOP story map



Southern California Steelhead

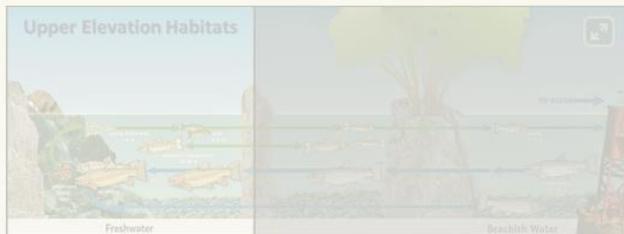
At the Aquarium

The Aquarium's steelhead exhibit transports visitors along a mountain path, allowing them to view these fish in three areas, representing the species' journey from freshwater to brackish water, and finally to the ocean. Through this exhibit, the Aquarium hopes to reveal the secrets of a little-known fish that lives amongst us in our urban environment and inspire conservation of this unique animal.



Upper Elevation Habitats

The places where adults spawn, eggs hatch, and young fish develop (0-1 year).



Example of a Story Map about our Exhibits

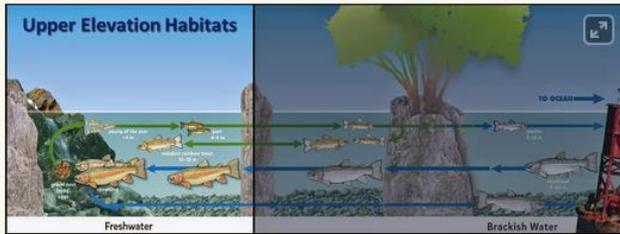
an AOP story map



Southern California Steelhead

Upper Elevation Habitats

The places where adults spawn, eggs hatch, and young fish develop (0-1 year).



The first segment of the Aquarium's steelhead exhibit represents the **Upper Elevation Habitats** and is filled with **juvenile rainbow trout** (< 4 inch long).



Mid-Elevation Habitats

The places where young fish continue to grow. Some will stay in fresh water for life and remain as rainbow trout. Others will migrate to the ocean and become steelhead.



LEGEND

OVERVIEW MAP



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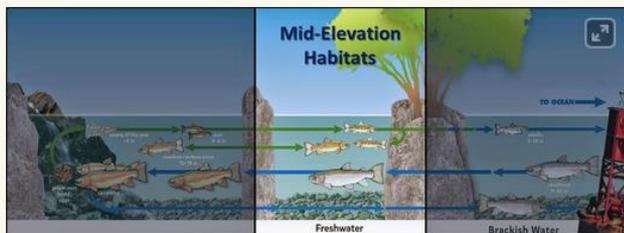
an AOP story map



Southern California Steelhead

Mid-Elevation Habitats

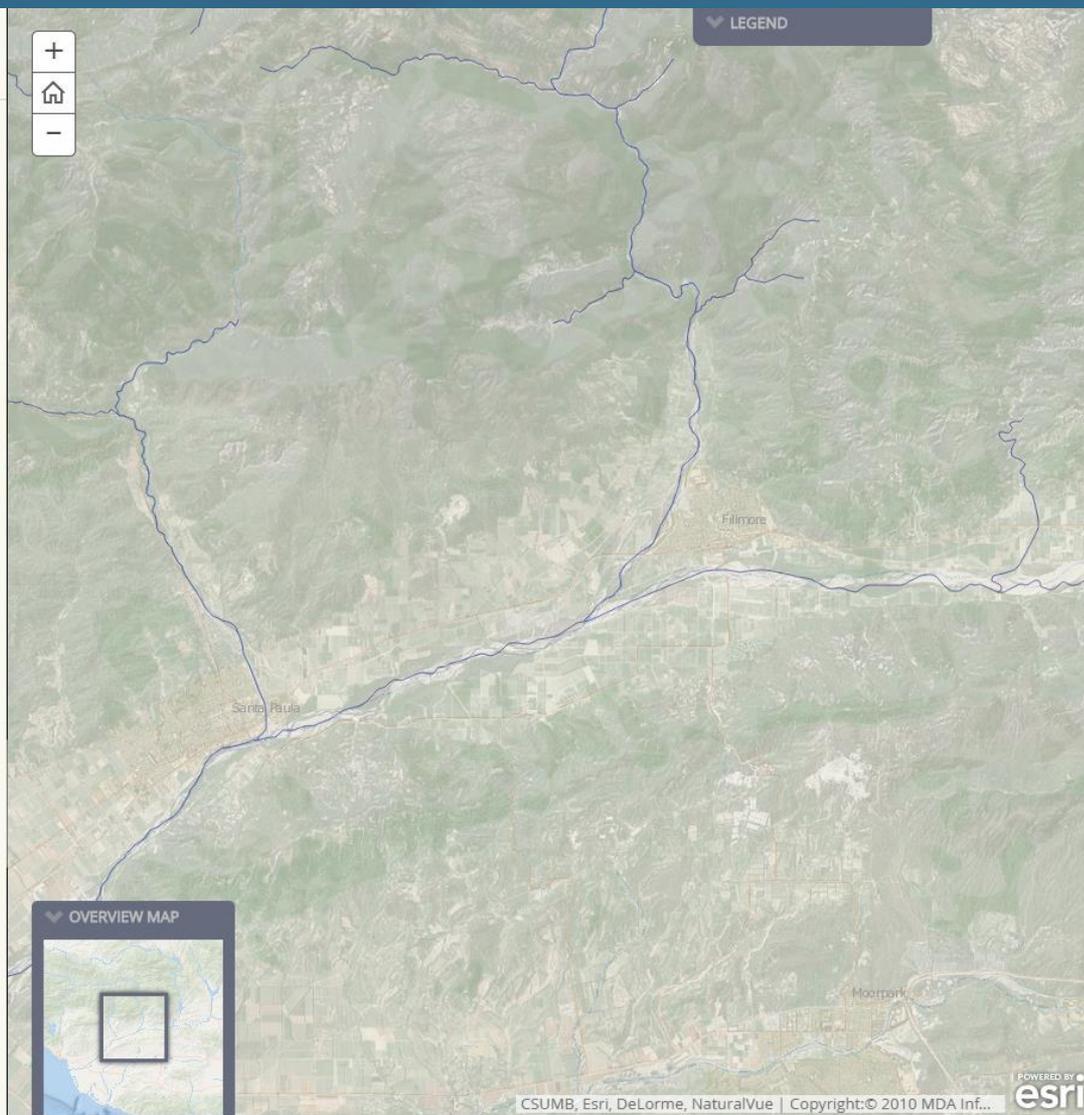
The places where young fish continue to grow. Some will stay in fresh water for life and remain as rainbow trout. Others will migrate to the ocean and become steelhead.



The middle segment of the Aquarium's steelhead exhibit represents the mid-elevation habitats and is filled with the resident rainbow trout (10-18 inch long)



Estuarine Habitats



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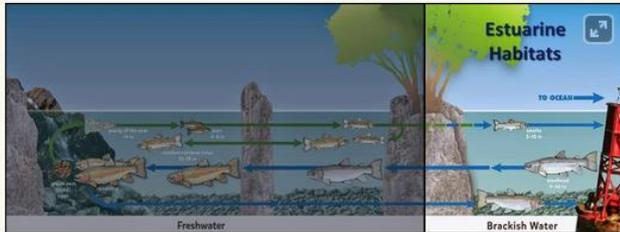
an AOP story map



Southern California Steelhead

Estuarine Habitats

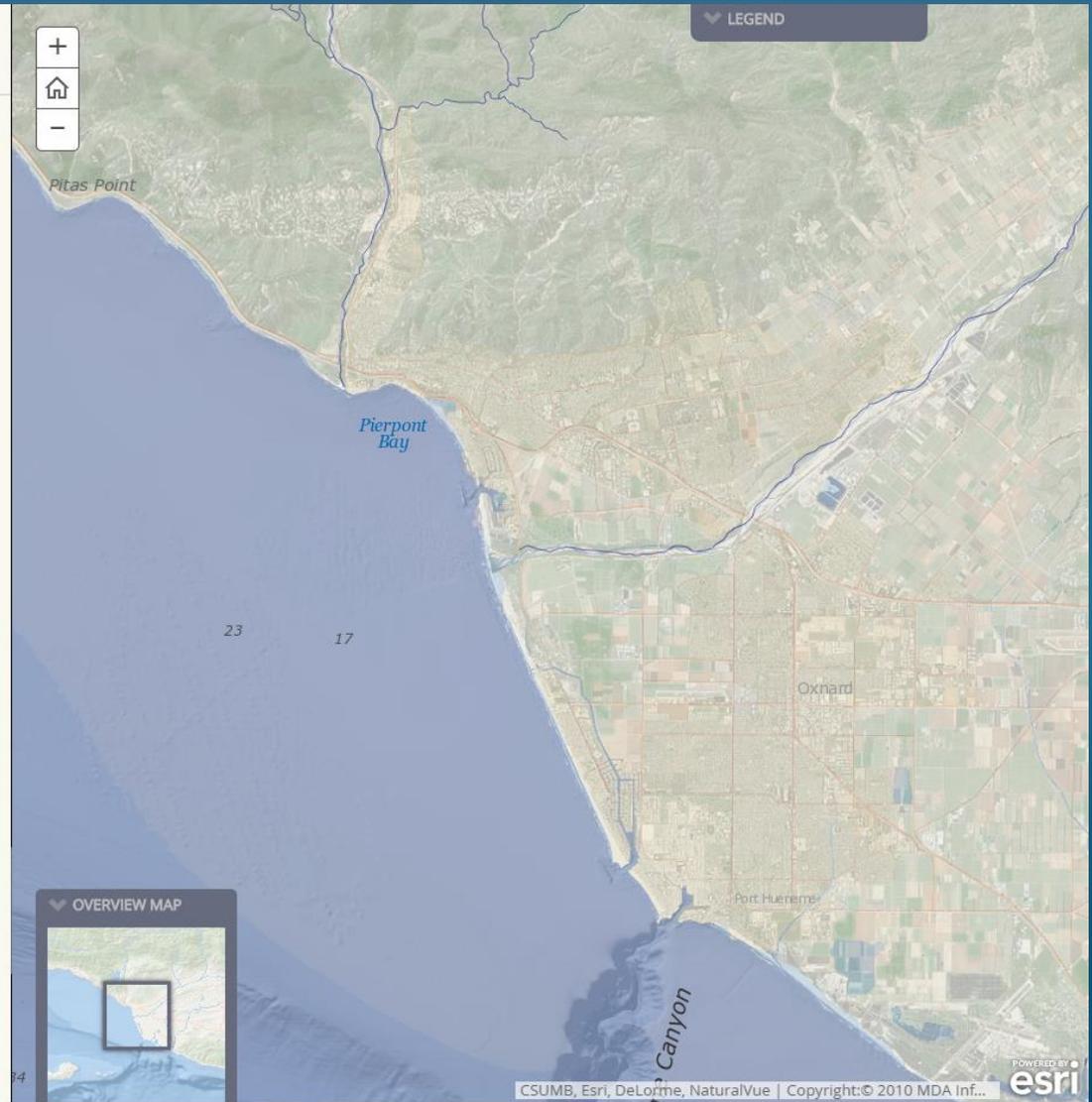
The places where most young fish grow and develop in preparation for their journey to the ocean where they become steelhead and the places to which they later return from the ocean on their way back upstream to spawn.



The last segment of the Aquarium's steelhead exhibit represents the estuarine habitats and is filled with the smolts (5-10 inch), which will hopefully turn into steelhead (9-40 inch) someday.



[Read More](#)



Example of a Story Map about our Exhibits

an AOP story map



Southern California Steelhead

Steelhead

Historian John G. "Tom" Tomlinson, Jr., in collaboration with the Aquarium of the Pacific, has written a book documenting the local history of the Southern California Steelhead, including historic photos, postcards, fishery data, newspaper clippings, and rainfall statistics.

This book gathers historical information about this fish species and describes its resilience in the face of the region's changing watersheds, rainfall levels, and manmade infrastructure.

Against the Currents is available for sale in the Pacific Collections gift store or online at shop.aquariumofpacific.org

Learn More

Watch "Southern California Steelhead: Against All Odds" by California Trout



available online at: <http://vimeo.com/79393289>

More information about southern California Steelhead can be found online at:

- The Aquarium's Online Learning Center "Southern California Steelhead" page
- National Marine Fisheries Service (NMFS) [Steelhead profile](#)
- The [Recovery Plan for Southern California Steelhead](#) (Jan. 2012)

Learn More

BTI 2014 Map Tour Story Map

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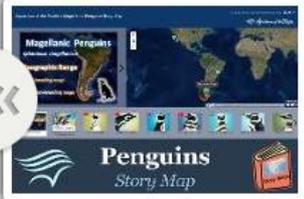


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Penguins
Story Map

AOP's Magellanic Penguins Story Map



Steelhead
Story Map

AOP's Southern California Steelhead Story Map



The GREEN Aquarium
Story Map (working draft)

AOP, The GREEN Aquarium (working draft)



BTI 2014 Workshop
Story Map (working draft)

BTI 2014 Workshop (working draft)

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BTI 2014 Map Tour Story Map

Home Gallery Map Scene Groups

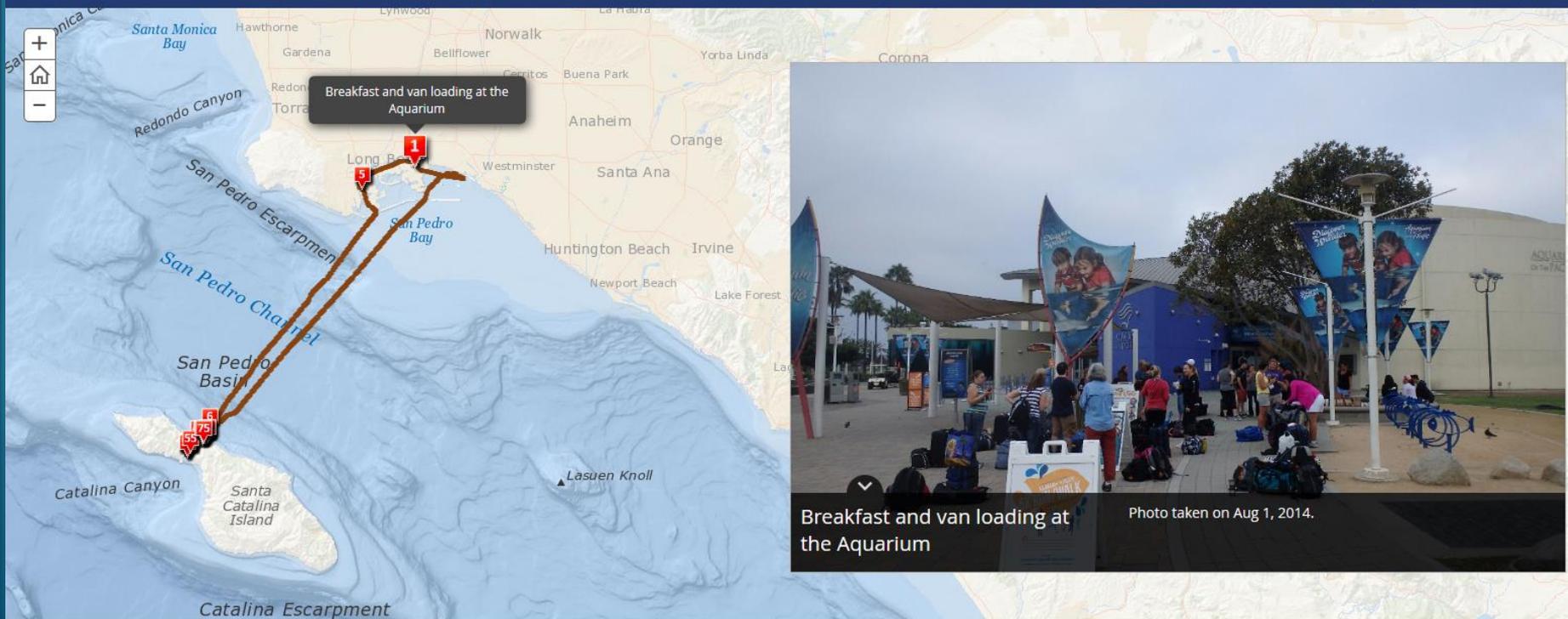
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AOP's 2014 BTI Workshop

This is a Map Tour story map of the journey taken by participants in the Aquarium of the Pacific's 2014 Boeing Teacher Institute (BTI) Workshop

an AOP story map



Breakfast and van loading at the Aquarium

Photo taken on Aug 1, 2014.



Create Your Own Story Map

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by filling out this form: <https://esri.app.box.com/connectedrequest>



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Street Address <input type="text"/>	City <input type="text"/>
State <input type="text" value="- Select -"/>	ZIP Code <input type="text"/>
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Contact First Name <input type="text"/>	Contact Last Name <input type="text"/>
Contact Email <input type="text"/>	<input type="checkbox"/> Agree to Terms and Conditions

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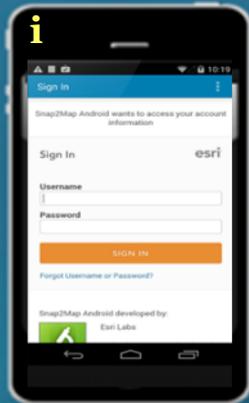


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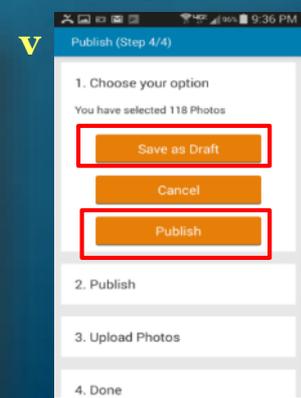
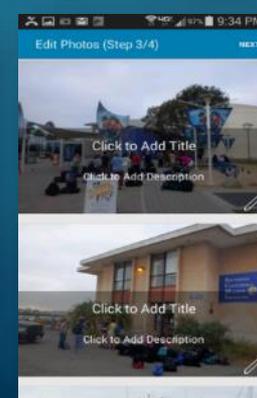
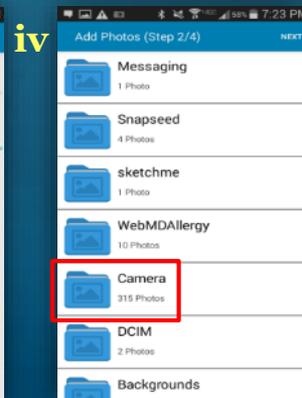
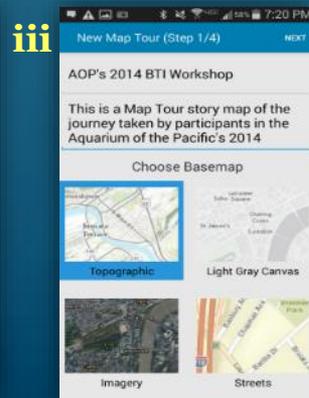
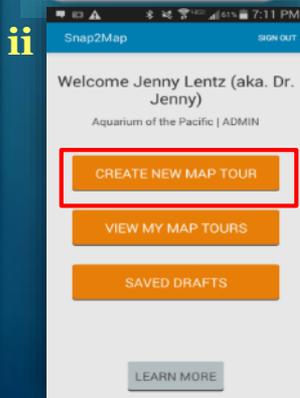
- 1. Create a **FREE ArcGIS Online Organization Account**
- 2. Download & Install the “**Snap2Map**” App
- **3. Collect Data (photos) on your Smart Device**
 - Make sure your smart-device’s **Location** settings are turned on
 - This includes making sure your **camera’s geotagging** feature is ON

Create Your Own Story Map

- 1. Create a **FREE ArcGIS Online Organization Account**
- 2. Download & Install the **“Snap2Map” App**
- 3. **Collect Data (photos)** on your Smart Device
- 4. **Open the Snap2Map App**



- i. Sign in to your ArcGIS Online Organization Account
- ii. Select **“Create New Map Tour”**
- iii. Fill in the **Title, Description, &** select a **Basemap**
- iv. Select the **folder & photos** to be included in your Story Map
- v. **Save and Publish** your newly created Map Tour Story Map!



Map Tour Story Map Tutorial

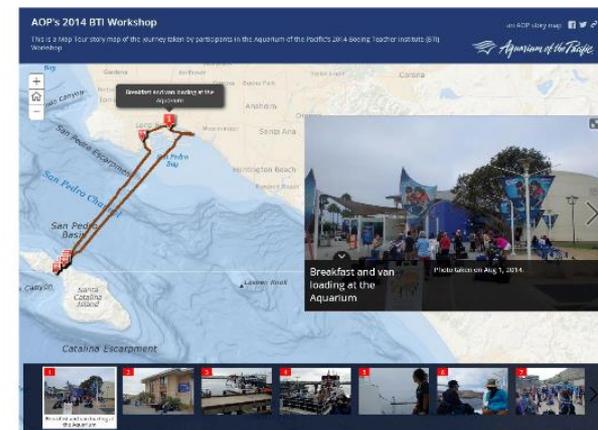
Story Map Tutorial and links FREE GIS Lesson Plans for K-12 Classrooms

available online at:

[http://JenniferALentz.info/
Teaching/Tutorials/
CreatingMapTourStoryMaps_2014.pdf](http://JenniferALentz.info/Teaching/Tutorials/CreatingMapTourStoryMaps_2014.pdf)

Creating “Map Tour” Story Maps

How to create a Map Tour Story Map quickly and easily using your smartphone or tablet, and your ArcGIS Online Organization Account



This Tutorial was Created by
Jennifer Anne Lentz, Ph.D.
Education Specialist at the Aquarium of the Pacific

*This tutorial, and other teaching-related materials by Dr. Lentz are available online at:
<http://jenniferALentz.info/Teaching.html>*

Citizen Science Apps & Inquiry Based Learning



Photo Courtesy of USC Sea Grant

What are Observations?

A Scientific Observation involves using your senses &/or tools to gather & record information in order to learn more about the natural world



Photo Courtesy of USC Sea Grant

Types of Data to Include in 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



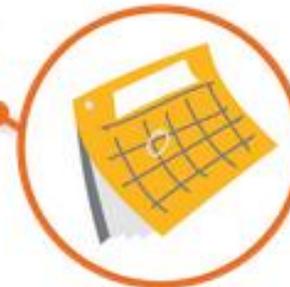
What you saw

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



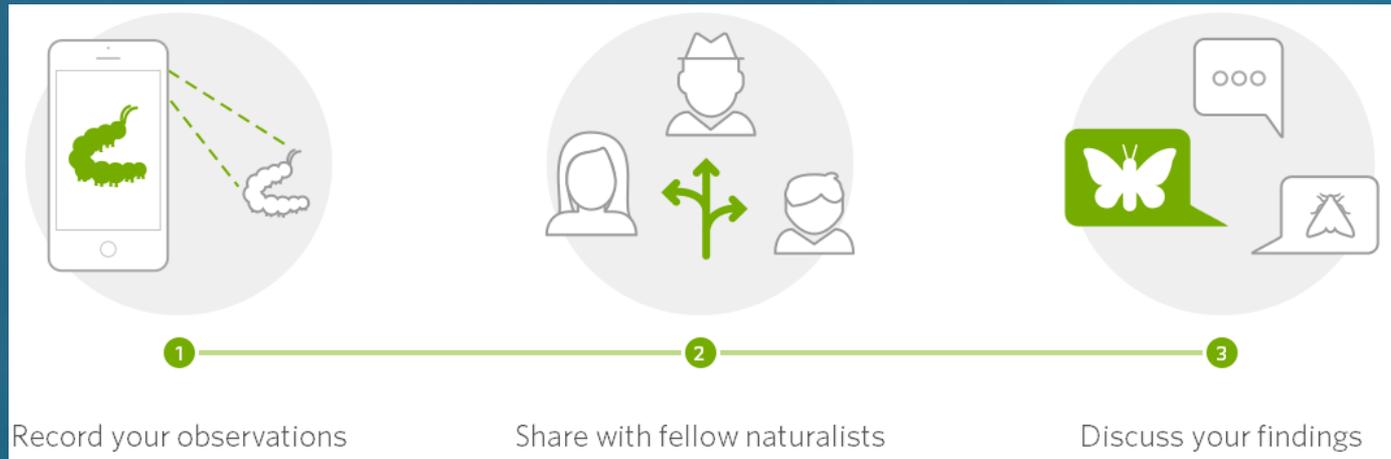
Evidence of what you saw

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 Citizen Science App

- iNaturalist is a **FREE** tool that allows people to **record, share, and discuss their observations**



- iNaturalist is designed to work on all devices



it even works without cell reception or wifi

Using iNaturalist during BTI

iNaturalist.org Observations ▾ Species ▾ Projects ▾ Places Guides People 0 9 drjenny ▾

« Projects Terms & Rules | Leave this project

Boeing Teacher Institute (BTI)

July 27th – 31st, 2017

ADD OBSERVATIONS

BOEING

AQUARIUM OF THE PACIFIC Sea Grant
University of Southern California

BTI 2017

Observation Area

Stats

Totals

0

Observations »

0

Species »

0

People »

Most Observations



Unknown

Most Species



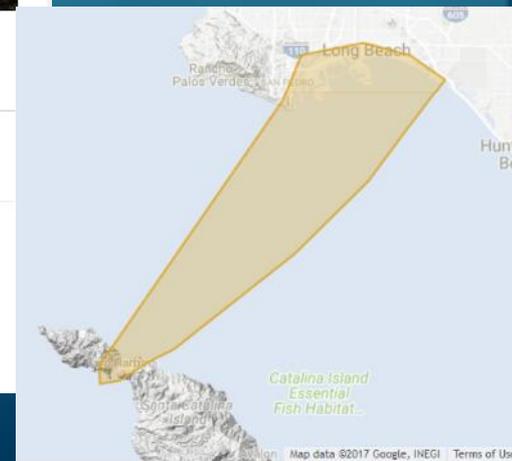
Unknown

Most Observed Species



Unknown

**These fields will begin to change
as people join this project and start to
add observations**



<https://www.inaturalist.org/projects/bti-2017>

Exploring iNaturalist Projects & Observations

iNaturalist.org Observations ▾ Species ▾ Projects ▾ Places Guides People 0 9 drjenny ▾

« Projects Terms & Rules | Edit project | Leave this project

Pelican Cove

SNAPSHOT CAL COAST Bioblitz

Pelican Cove - MPA Bioblitz 2017
June 30, 2017, 7:30 AM - 10:30 AM PDT

ADD OBSERVATIONS

Event Stats

Totals	Most Observations	Most Species	Most Observed Species
510 Observations »	gwennoda 50 observations	sykospark 21 species	Starburst Anemone 41 observations
63 Species »	drjenny 46 observations	gwennoda 19 species	Striped Shore Crab 31 observations
26 People »	janet46 45 observations	peters4 18 species	Gooseneck Barnacle 23 observations
	peters4 38 observations	drjenny 16 species	Ochre Sea Star 21 observations
	nareen2 36 observations	neneana 14 species	Pink Volcano Barnacle 18 observations

Exploring iNaturalist Projects & Observations

The screenshot shows the iNaturalist interface for a project titled "Tidpooling Bioblitz at Pelican Cove". On the left, a Google Map displays the project location at Pelican Cove, with numerous colored observation pins clustered in a yellow-outlined area. The map includes labels for "Palos Verdes Dr S", "Salvation Army Trail", "Palos Verdes", "Pelican Cove Park", "Terranea Top Park", and "Terranea Trail".

On the right side of the page, there are several sections:

- Members:** Shows 28 members with profile pictures and a "View all members »" link.
- Your membership:** Shows 46 observations.
- Add from your observations:** Includes a link to "Download template for use in the bulk uploader".
- Export observations:** Offers export options for Atom, KML, and CSV.
- Project curator tools:** A list of actions including "Find suitable observations", "Find unsuitable observations", "Export with private coordinates", "Filter by curator identification", and "Identify observations".
- About:** A text block describing the project: "Join us for our 2nd Annual Tidpooling Bioblitz at Pelican Cove. This Bioblitz is part of the Snapshot Cal Coast, which is a state wide effort to get as many sightings of plants and animals living along the California Coast as possible over a 2 week period (June 23-July 2, 2017). Sharing your observations will help researchers to better understand and protect marine life in ...more ↓". It includes "Like 0" and "Share" buttons.

At the bottom left, there is a "Journal" section with the text: "Your project journal is a tool for communicating with project members. You can use it to make announcements, set priorities, or talk about your project's findings. To get started, [create a post](#) »".

Below the journal is the "Recent observations" section, which includes a "View all »" link and a grid of four observation photos. The photos show various marine life, including what appears to be a sea slug and other small organisms on rocks.

Exploring iNaturalist Projects & Observations

Recent observations [View all »](#) Grid List researchers to better understand and protect marine life in ...more ↓

[Like 0](#) [Share](#)

[aopcitsci](#) created this project on June 05, 2017
Is this inappropriate, spam, or offensive? [Add a flag](#)

[Embed a widget for this project on your website](#)

 Nuttall's Hornmouth	 Insects	 Black Tepee	 Pink Volcano Barnacle
 California Spiny Chiton	 Cocksshell Limpet	 Tree Limpet	 Western Sea Roach
 Chysozoans	 Red Algae	 Feather Boa Kelp	 Worm Snails
 Crested Periwinkle	 Striped Shore Crab	 Feather Boa Kelp	 Feather Boa Kelp
 Scrub-like Algae	 Coralline algae	 Crested Worm Snail	 Clear Nereastroidea
 Unlabeled observation	 Unlabeled observation	 Unlabeled observation	 Unlabeled observation

Exploring iNaturalist Projects & Observations

« cbader's observations Previous Next

California Spiny Chiton (*Nuttallina californica*) · Observed by cbader · June 30, 2017 · 08:52 AM PDT

☆ Add to favorites Identify + Add to project Share

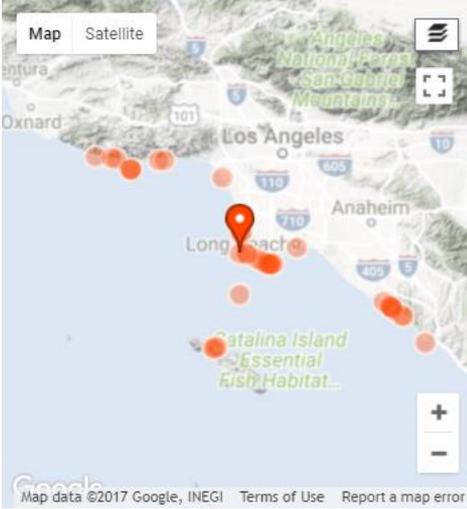


Photo © cbader, some rights reserved

Added: Jul. 02, 2017 16:41:52 +0000

App: iNaturalist iPhone App

[Add/edit more fields](#)



Location: [San Pedro Channel, CA, US](#) (Google, OSM) [Details](#)

cbader's ID:
California Spiny Chiton
(*Nuttallina californica*) [Agree?](#)

Community ID:
California Spiny Chiton
(*Nuttallina californica*)
About

1 person agrees

[Identotron](#)

Projects

- Snapshot Cal Coast 2017
- #AOPcitsci Snapshot Cal Coa...
- Pelican Cove - MPA Bioblitz...

Comments & Identifications

  cbader's ID: **California Spiny Chiton** (*Nuttallina californica*) [Agree?](#)

Posted by [cbader](#) 10 days ago

  pliffgrieff's ID: **California Spiny Chiton** (*Nuttallina californica*)

Posted by [pliffgrieff](#) 10 days ago



[View 11 from June 30, 2017 »](#)

Data Quality Assessment

Quality grade: Research [Details](#)

Exploring iNaturalist Projects & Observations

« Back to cbader's calendar

Previous >

Observations by cbader on June 30, 2017

11
taxa

-  1 plant
-  5 other animals
-  4 mollusks
-  1 insect

11
observations

- 11 from Los Angeles County, CA, US
- 11 from California, US
- 11 from United States
- 11 from North America

4
life list firsts

-  True Limpets
-  Tortoiseshell Limpet
-  Black Tegula
-  California Spiny Chiton

Grid List Map



Using iNaturalist during BTI

1) Download & Install iNaturalist on your smart phone or tablet

2) Open the App & Sign in

Sign in using your Facebook or Google accounts, or create an account using your email address & a username & password of your choosing

3) Under Projects search for “BTI 2017” and select to Join

4) As you make observations throughout BTI make sure to save each observation into this Project

If you're making lots of observations we recommend turning the Auto Upload/Sync setting OFF so that it doesn't drain your battery

5) Step-by-Step instructions on how to use iNaturalist can be found online at:

http://JenniferALentz.info/Teaching/Tutorials/iNaturalist_Training.pdf

http://JenniferALentz.info/Teaching/Tutorials/iNaturalist_BatchAdd-Edit.pdf

Making Observations at the Aquarium

You are welcome to start making observations while you are here at the Aquarium. But since this is an artificial setting, make sure to select the **“Captive/Cultivated”** option on any observations of species in our exhibits



This PowerPoint Presentation,
as well as other presentations and handouts are available online at:

<http://JenniferALentz.info/Teaching/>



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(or at least where the author found them).*