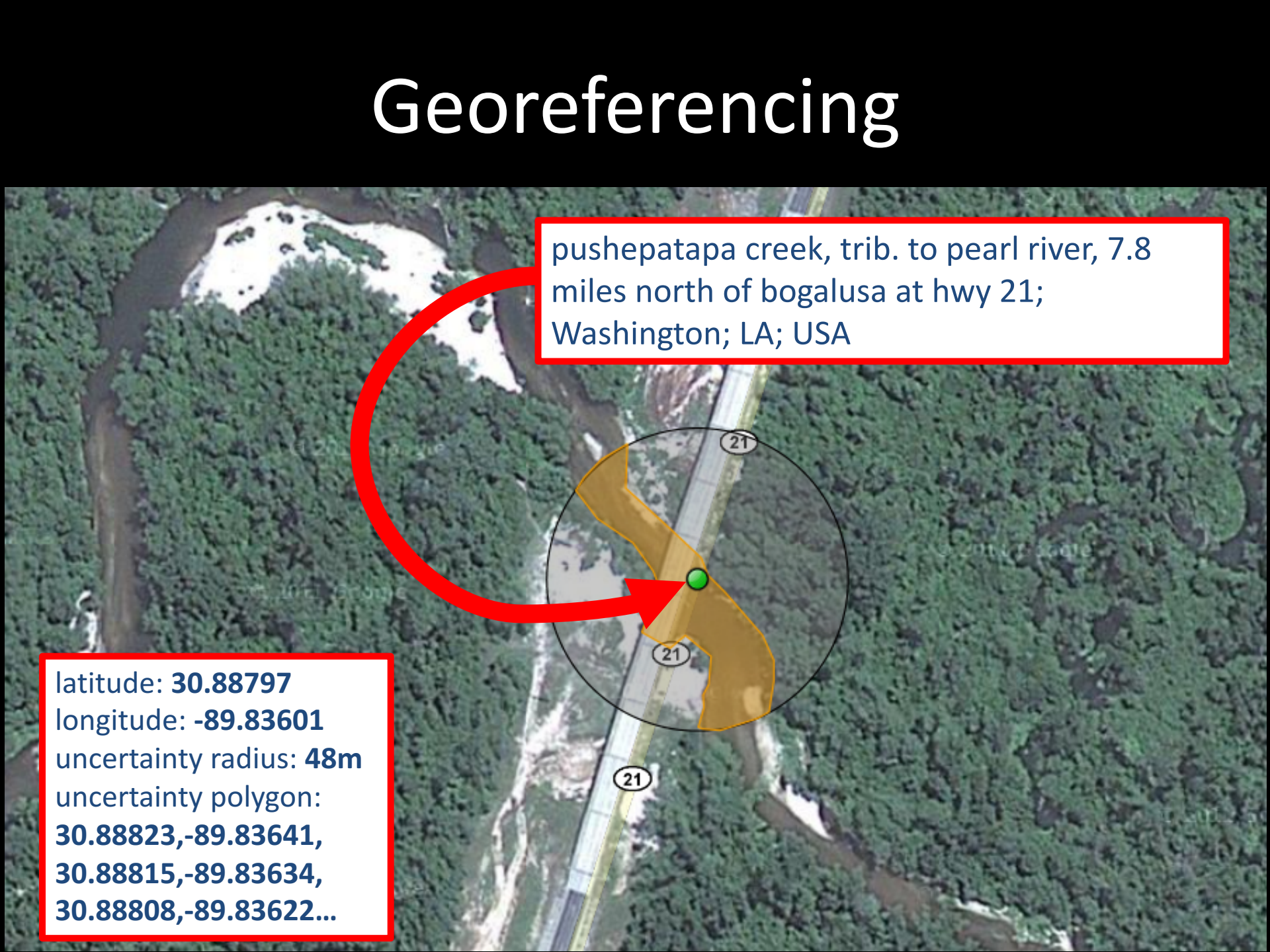


# Fundamentals of Georeferencing Using GEOLocate

Nelson E. Rios



# Georeferencing



pushepatapa creek, trib. to pearl river, 7.8 miles north of bogalusa at hwy 21; Washington; LA; USA

The image is an aerial photograph of a landscape. A road labeled '21' runs vertically through the center. A creek flows from the top left towards the center, crossing the road. A green dot is placed at the intersection of the creek and the road. A yellow shaded polygon surrounds this dot, representing an uncertainty area. A red arrow points from a text box above to the green dot. A black circle is drawn around the road and creek intersection area.

latitude: **30.88797**  
longitude: **-89.83601**  
uncertainty radius: **48m**  
uncertainty polygon:  
**30.88823,-89.83641,**  
**30.88815,-89.83634,**  
**30.88808,-89.83622...**

# The Problem



3 billion specimens with  $\frac{1}{2}$  billion collecting events



# GEOLocate

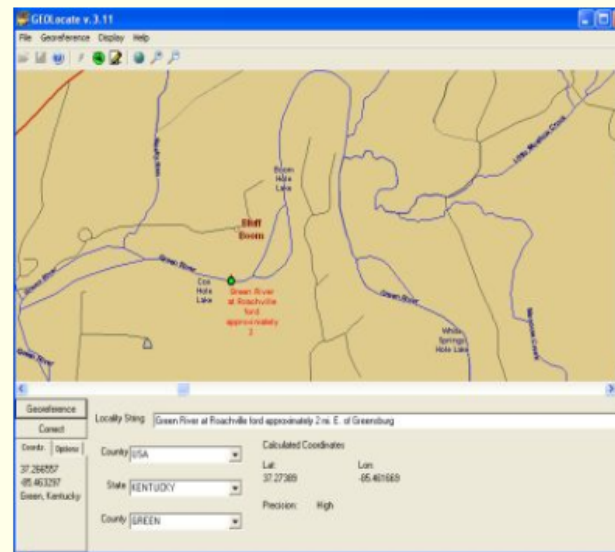


A Platform for Georeferencing Natural History Collections Data

For Users:

- Overview
- GEOLocate Web Application
- Collaborative Georeferencing
- GEOLocate 3.xx (standalone)
  - Global Expansion
- Education & Outreach

Brief overview (video) of the GEOLocate Project.



For Developers:

- SOAP Services
- JSON/GeoJSON
- Embeddable Web Client



## Web Application

Georeference collections data using your web browser. Quick and easy georeferencing.

## Web Services

Integrate georeferencing into your own databases and applications using GEOLocate webservice.

## Desktop Application

The original standalone desktop application.

## Collaborative Georeferencing

Build communities, share data, relate records across collections and improve verification efficiency.

Copyright© 2014



# Typical GEOLocate Workflow

1 Data Entry & Preparation

*pushepatapa creek, trib. to pearl river,  
7.8 miles north of bogalusa at hwy 21;  
Washington; LA; USA*

2 Automated Processing

*Georeferencing Algorithm*

3 Manual Verification

*Visualize, verify & adjust output  
coordinates & uncertainties*



*latitude: 30.88797  
longitude: -89.83601*

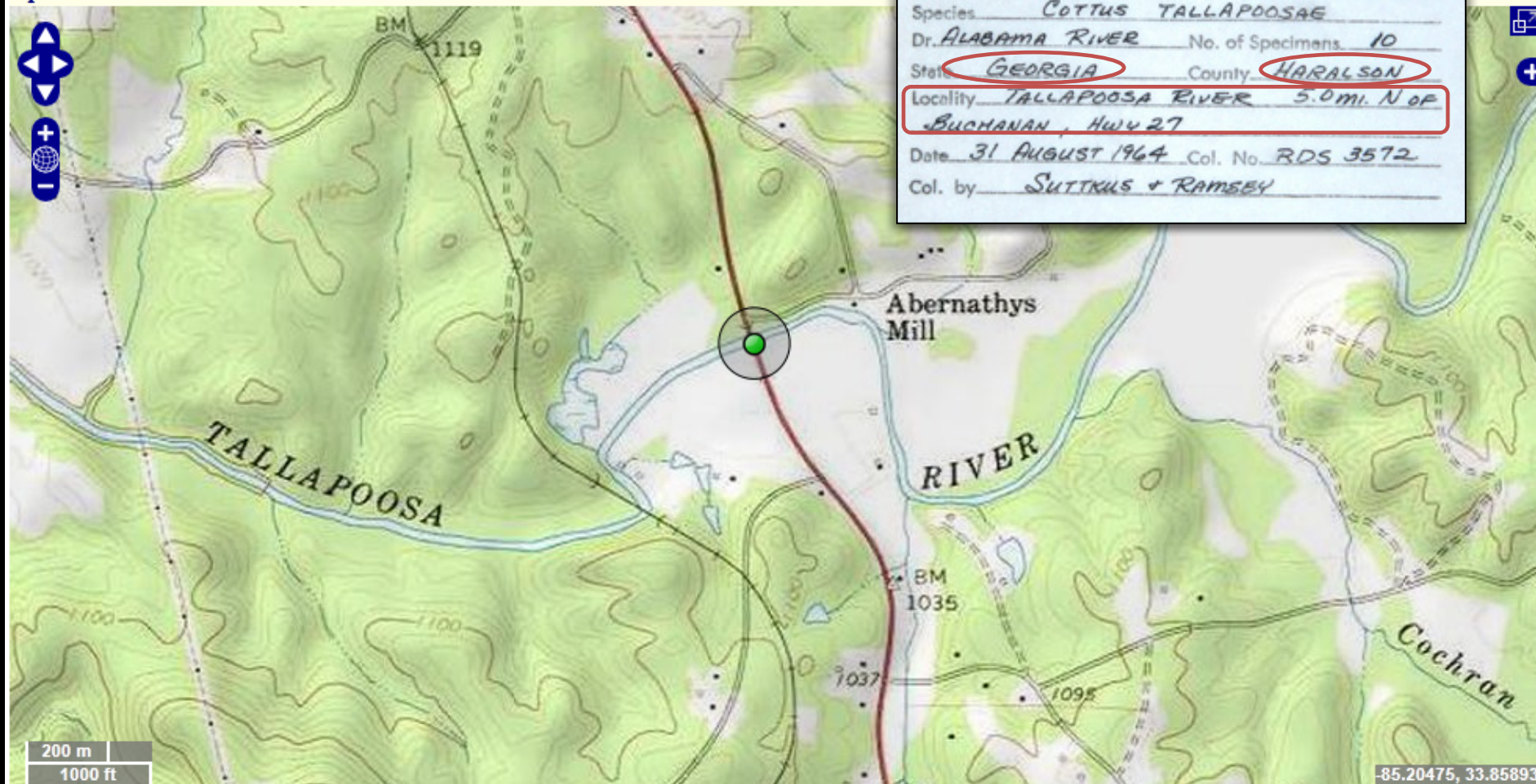
*uncertainty radius: 48m*

*uncertainty polygon:  
30.88823,-89.83641,  
30.88815,-89.83634,  
30.88808,-89.83622...*

# GEOLocate Web Application

1 possible location found.

**PARATYPES**  
**TULANE UNIVERSITY COLLECTIONS**  
 Family No. 385 Cat. No. 34409  
 Species COTTUS TALLAPOOSAE  
 Dr. ALABAMA RIVER No. of Specimens 10  
 State GEORGIA County HARALSON  
 Locality TALLAPOOSA RIVER 5.0 mi. N of  
BUCHANAN, Hwy 27  
 Date 31 AUGUST 1964 Col. No. RDS 3572  
 Col. by SUTTKUS + RAMSEY



Workbench **1 possible location found**

Draw polygon
  Place marker
  Measure

Locality String:

Country: 
 latitude: 33.863438
  longitude: -85.213334
  uncertainty: 90 m
  error polygon

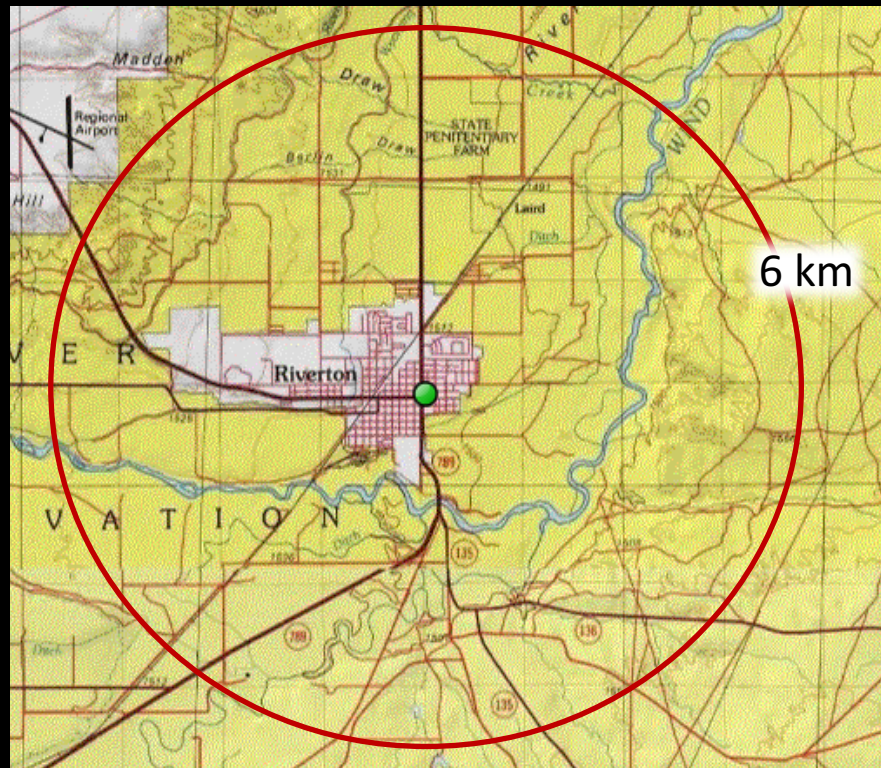
State: 
 33.863438    -85.213334    90    Unavailable

County:

# Algorithm Performance

Versus Known U. S. Localities

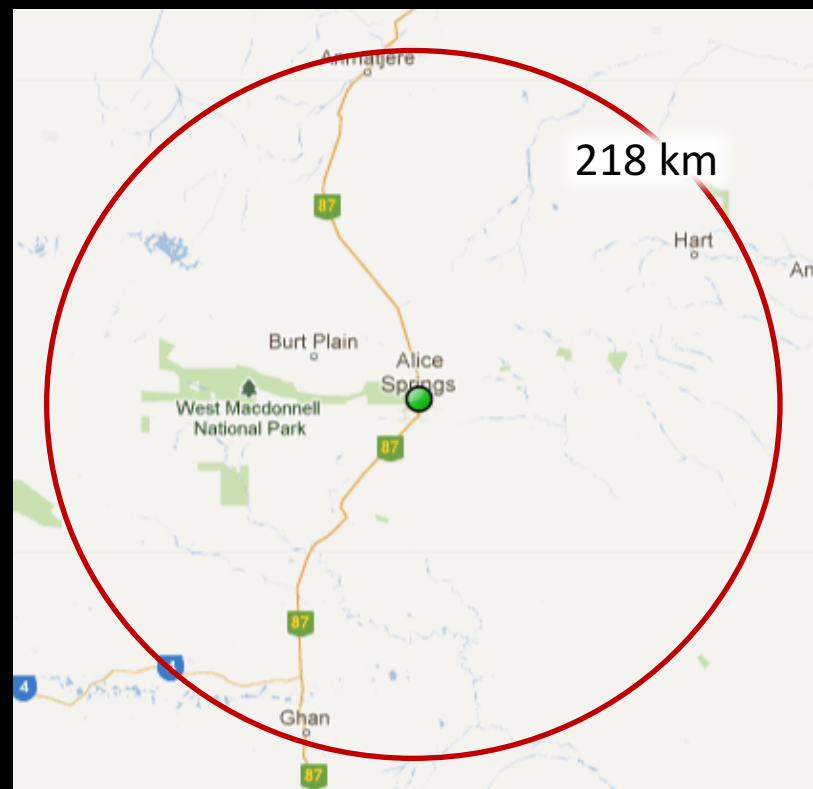
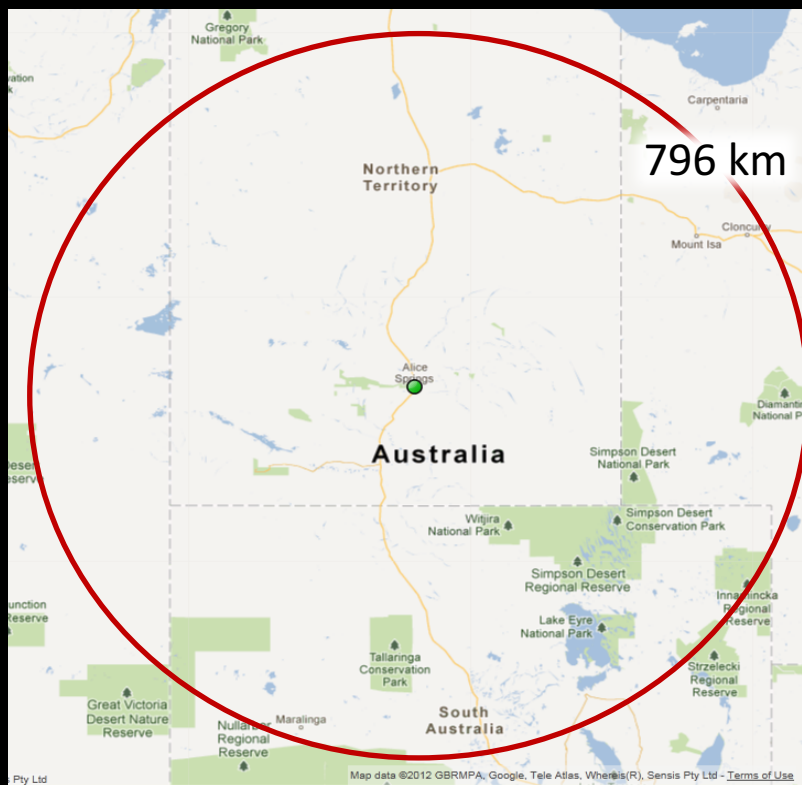
	% Found	Mean Dist. Off	Standard Error
GEOLocate	95%	6.1 km	2.1 km



# Algorithm Performance

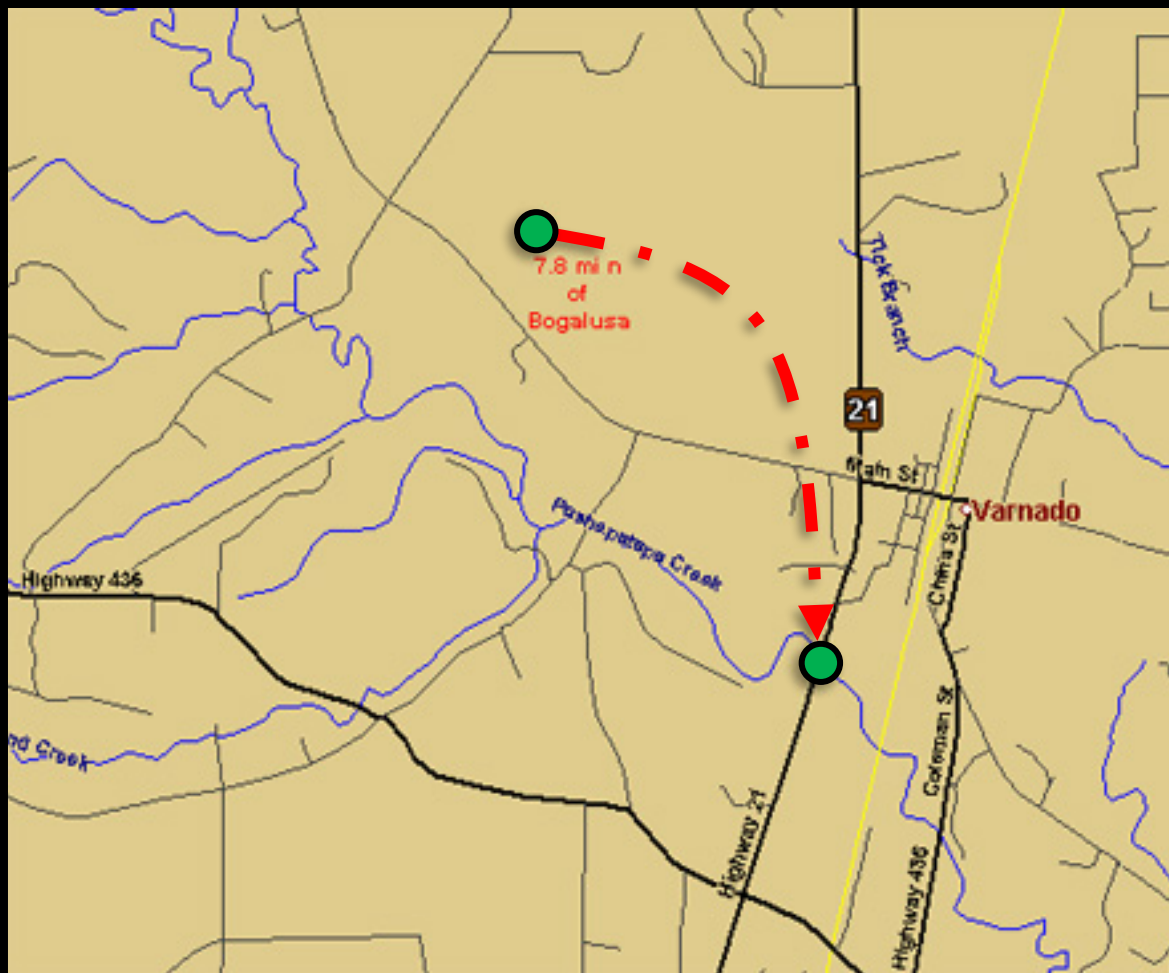
## Versus Known Australian Localities

	% Found	Mean Dist. Off	Standard Error
GEOlocate	86 $\Rightarrow$ 97%	796 $\Rightarrow$ 218 km	154 $\Rightarrow$ 48 km





# Verification & Adjustment of Automated Outputs



**Computed coordinates  
are displayed on digital  
maps**

**Manual verification of  
each record**

**Drag and drop  
correction of records**

# Moving Beyond Points



Point



Point & Radius



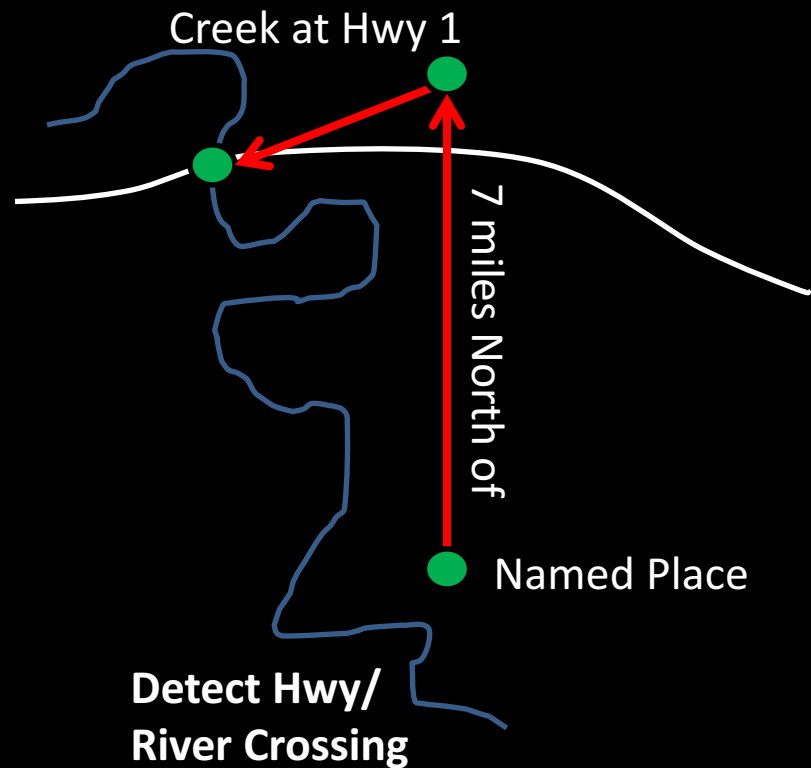
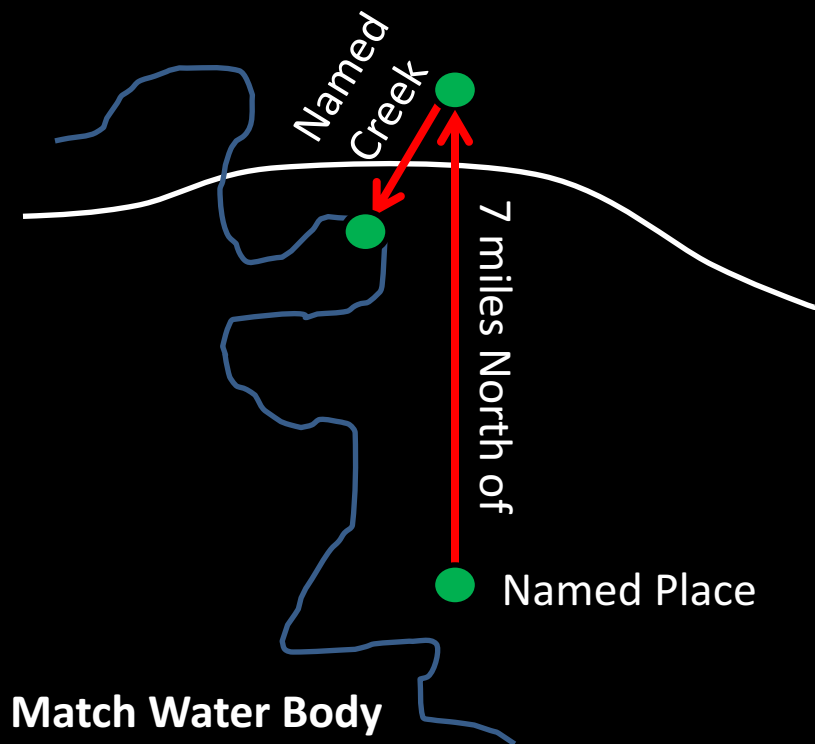
Point, Radius & Polygon



## Georeferencing options

- Match Water Body |  Detect Hwy/River Crossing |  Do Uncertainty
- Do Error Polygon |  Displace Polygon |  Restrict to Lowest Adm. Unit

Language:  ▾

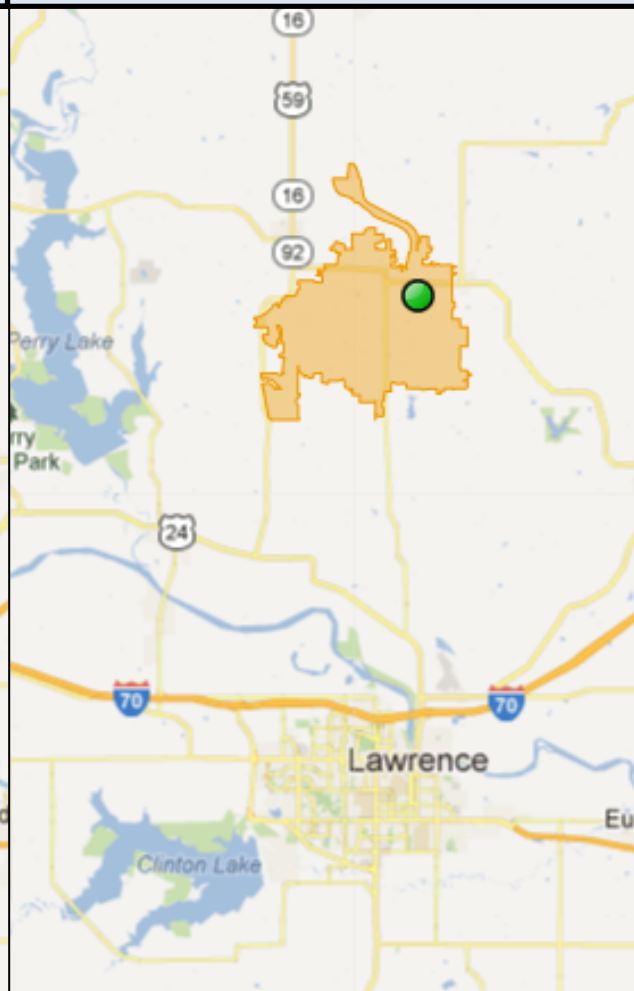


# Generating Polygons:

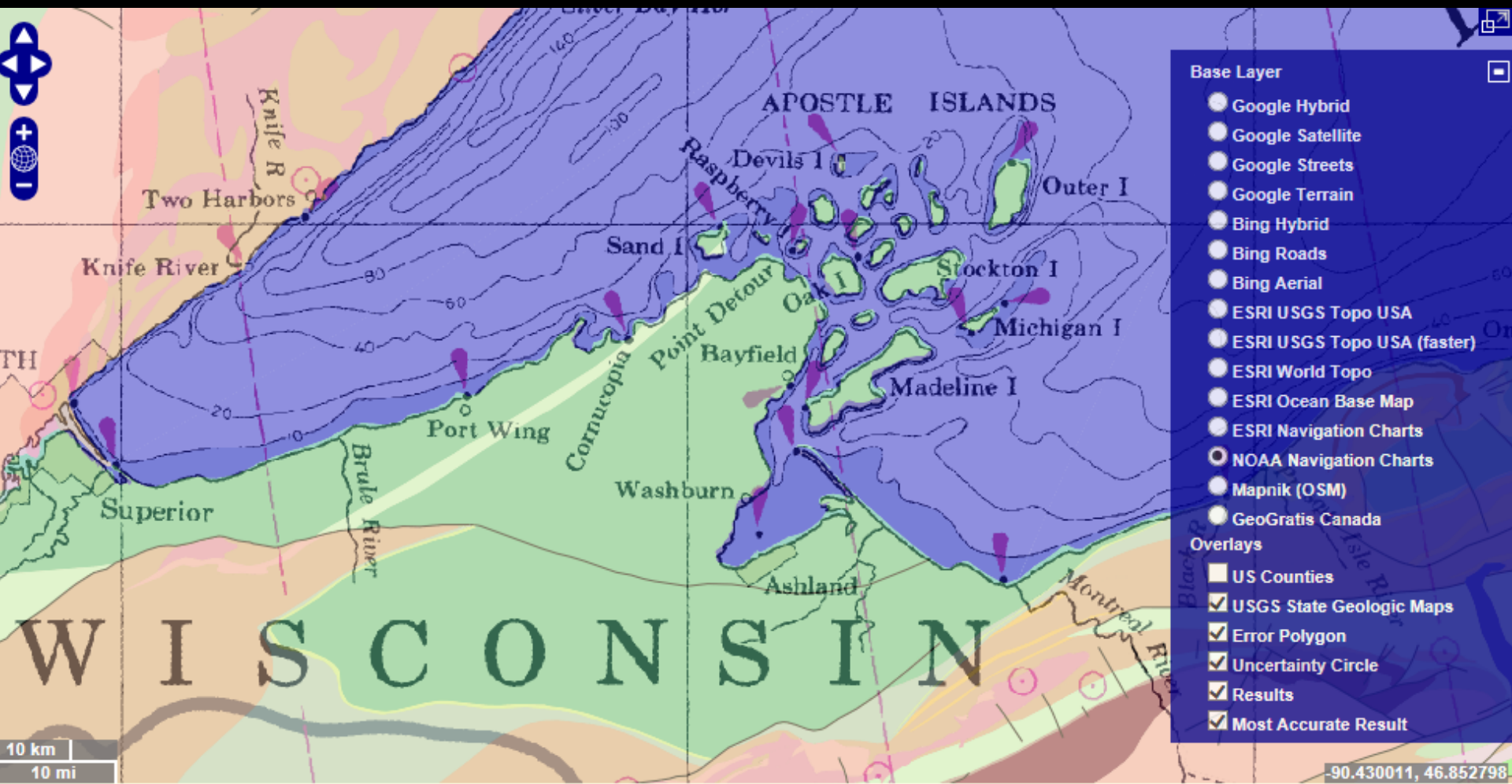
Lawrence, KS

15 mi N of Lawrence, KS  
no displacement

15 mi N of Lawrence, KS  
displaced polygon



# Visualization: Base Layers



# Primary Clients

The following based web clients are available to allow you to georeference data directly from your web browser:



## Standard Client

Simply type in your locality description and get back georeferenced results. Start here if you are new to GEOLocate.



## Batch (File Based) Client

Allows you to upload a .csv file and batch process it. ([file formatting instructions](#))



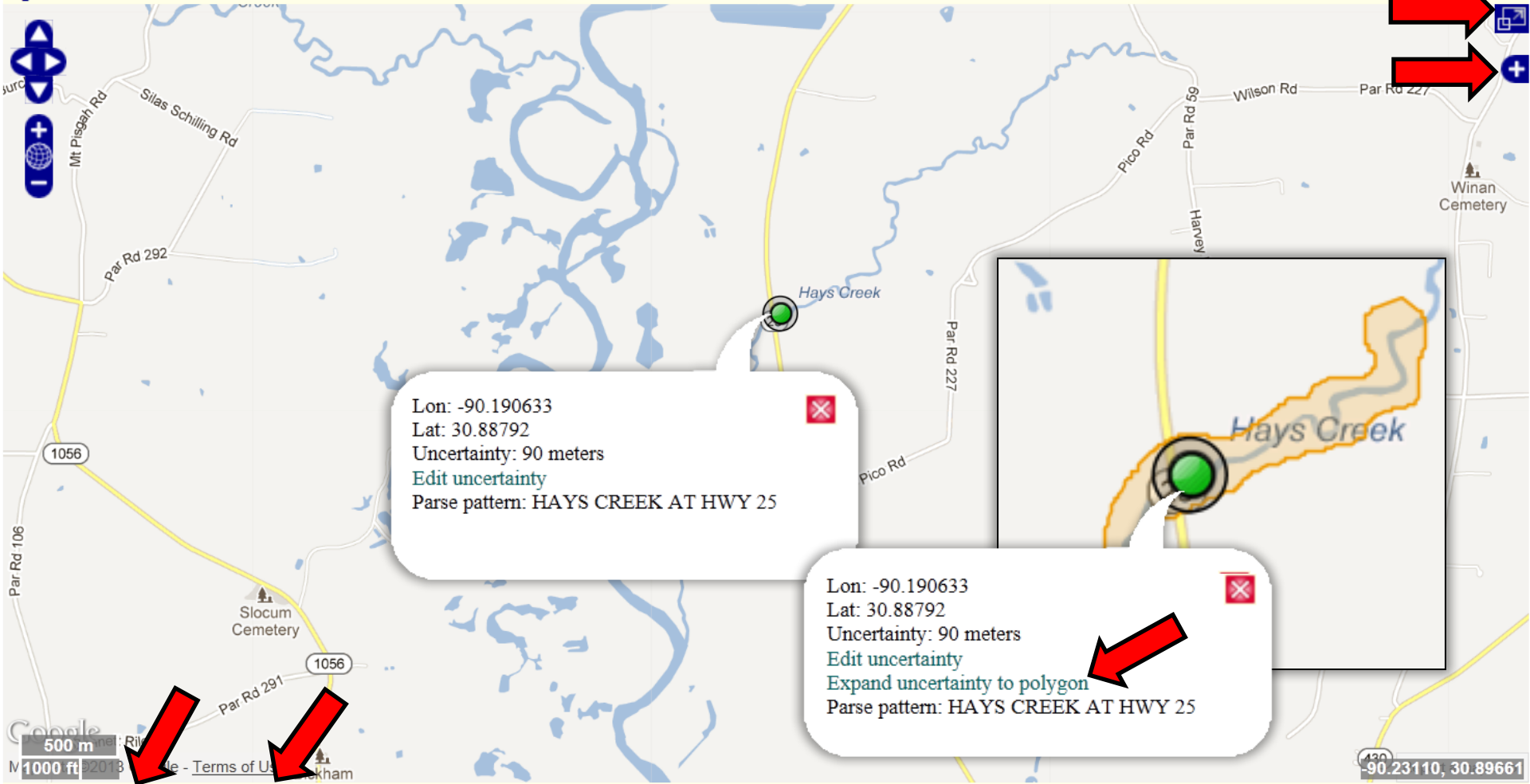
## Collaborative Georeferencing Client

Utilizes the collaborative georeferencing framework. Ideal for largescale multi-institution projects. ([https link](#))

# Core Features



1 possible location found.



**Workbench** 1 possible location found

Georeference | Options |  Draw polygon |  Place marker |  Measure

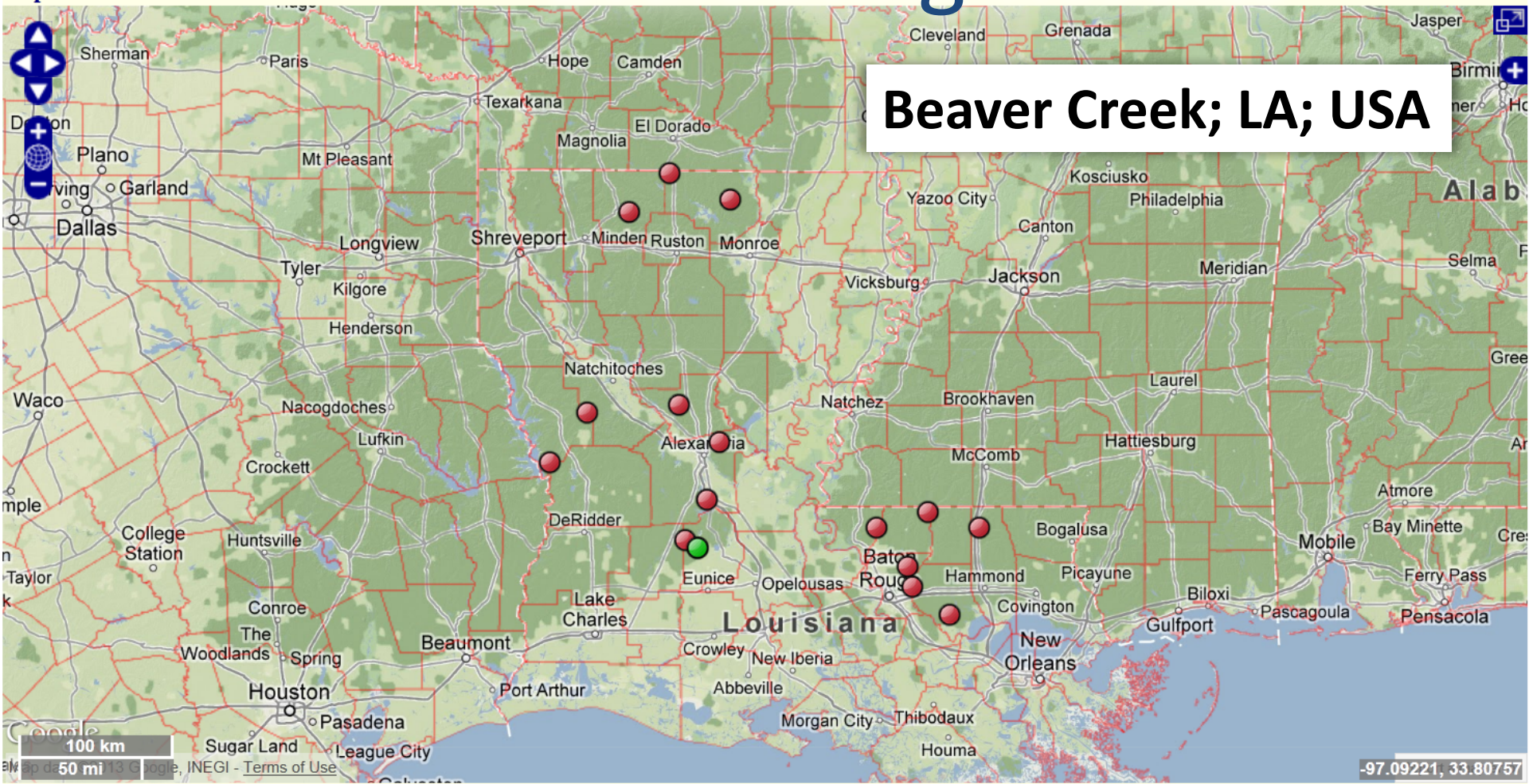
Locality String:

Country:   latitude: 30.88792  longitude: -90.190633  uncertainty: 90 m  error polygon

State:

County:

16 possible locations found.



## Beaver Creek; LA; USA

Workbench 16 possible locations found

- ⊗ ● lat: 30.75611, lon: -92.49056, pattern: BEAVER CREEK, error polygon: Unavailable, uncertainty: 210 m, precision: Low(27)
- ⊗ ● lat: 31.61778, lon: -92.61583, pattern: BEAVER CREEK, error polygon: Unavailable, uncertainty: 210 m, precision: Low(27)
- ⊗ ● lat: 30.34528, lon: -90.71333, pattern: BEAVER CREEK, error polygon: Unavailable, uncertainty: 210 m, precision: Low(27)
- ⊗ ● lat: 30.9675, lon: -90.86361, pattern: BEAVER CREEK, error polygon: Unavailable, uncertainty: 210 m, precision: Low(27)
- ⊗ ● lat: 32.76556, lon: -92.97306, pattern: BEAVER CREEK, error polygon: Unavailable, uncertainty: 210 m, precision: Low(27)
- ⊗ ● lat: 30.63722, lon: -91.00306, pattern: BEAVER CREEK, error polygon: Unavailable, uncertainty: 210 m, precision: Low(27)

Remove Secondary Points



# Batch Georeferencing



Workbench 2 possible locations found

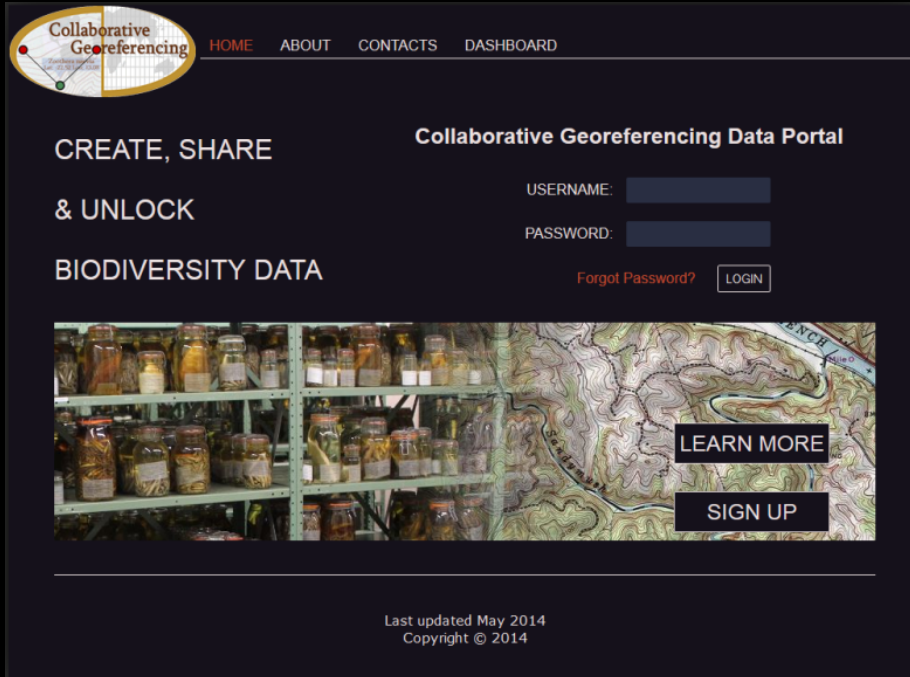
Show 8 records Page Georeference Georeference Options Correct Draw polygon Place marker Measure

Locality	Country	StateProvince	County	Latitude	Longitude	Corrected	precision
Chambers Spring Road 2.5 km S of Hwy 412, 8.0 km E of Siloam Springs, T17N, R33W,	USA	Arkansas	Benton	36.188027	-94.451005	no	High(89)
Osage Creek, 1.0 mile N on gravel road to bridge crossing, gravel road jcts with	USA	Arkansas	Benton	36.189077	-94.395375	no	High(97)
Yocum Creek, near Oak Grove (Pass 11a), Sec. 30	USA	Arkansas	Carroll	36.454986	-93.322008	no	Low(35)
Village Creek State Park, S of driving range, Sec. 6	USA	Arkansas	Cross	35.16111	-90.70833	no	Low(39)
Sugar Creek, Hwy 163 at Bay Village, Sec. 4	USA	Arkansas	Cross	35.44909	-90.67533	no	High(100)
Buck Creek, 8.0 miles SE Corydon	USA	Indiana	Harrison	38.155118	-86.014724	no	High(88)
E Branch Mill Creek, Hessdale Road, 4.0 km S of Allendorph, Sec. 36	USA	Kansas	Wabaunsee	39.003564	-96.277745	no	High(88)
Blissdale Creek, Hillside National Wildlife Refuge, 500 m SW of Blissdale on Blis	USA	Mississippi	Holmes	33.083754	-90.224633	no	High(84)

Search: File management Phoxinus\_erythrogaster\_Locations\_MMN...

Showing 1 to 8 of 44 records

# Collaborative georeferencing



The screenshot shows the homepage of the Collaborative Georeferencing Data Portal. At the top left is the logo, which consists of a globe with a grid and the text 'Collaborative Georeferencing'. To the right of the logo is a navigation menu with links for 'HOME', 'ABOUT', 'CONTACTS', and 'DASHBOARD'. Below the navigation menu, the text 'CREATE, SHARE & UNLOCK BIODIVERSITY DATA' is displayed on the left. In the center, the title 'Collaborative Georeferencing Data Portal' is shown above a login form. The login form includes fields for 'USERNAME:' and 'PASSWORD:', a 'Forgot Password?' link, and a 'LOGIN' button. Below the login form is a large banner image. The left side of the banner shows shelves filled with jars of preserved specimens, and the right side shows a topographic map. Overlaid on the map are two buttons: 'LEARN MORE' and 'SIGN UP'. At the bottom of the page, the text 'Last updated May 2014 Copyright © 2014' is visible.

- Data management platform for large scale georeferencing
- Increased output by taking advantages similarities across collections
- Distribution of workloads to appropriate expertise

# Similarity Matching

1 possible location found      History      Review

Community: FishNet 2      |             Draw polygon       Place n

**Luggar Landing, West Pearl River, Starlding; United States; Louisiana; ;**

.....*FMNH14004 Fundulus chrysotus*

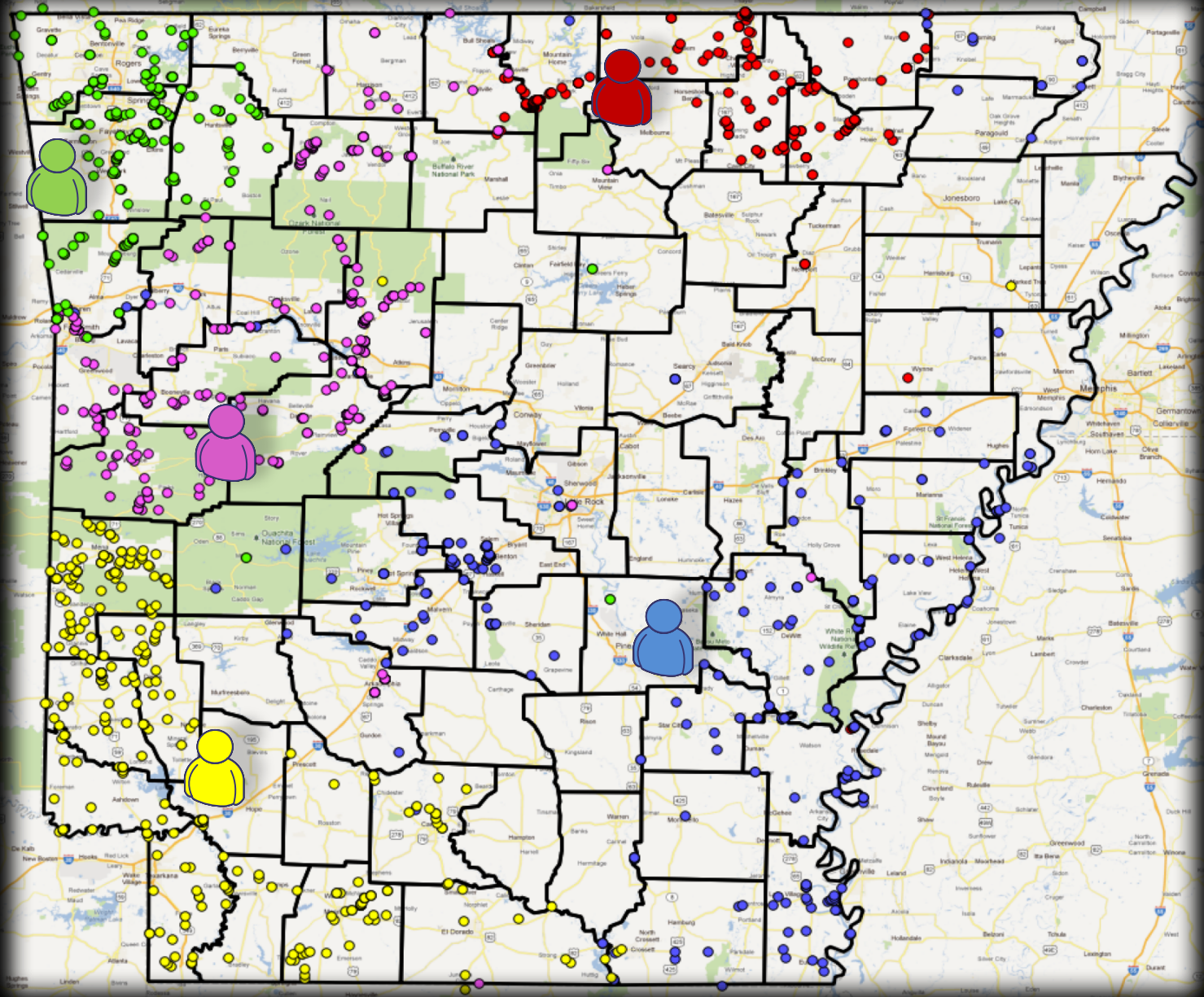
Similar Records(5)

- Luggar Landing, West Pearl River near Starlding; United States; Louisiana; ;
- West Pearl River, Starlding, Luggar Landing, Deer Island; United States; Louisiana; ;
- Luggar Landing, West Pearl River, near Starlding; United States; Louisiana; ;

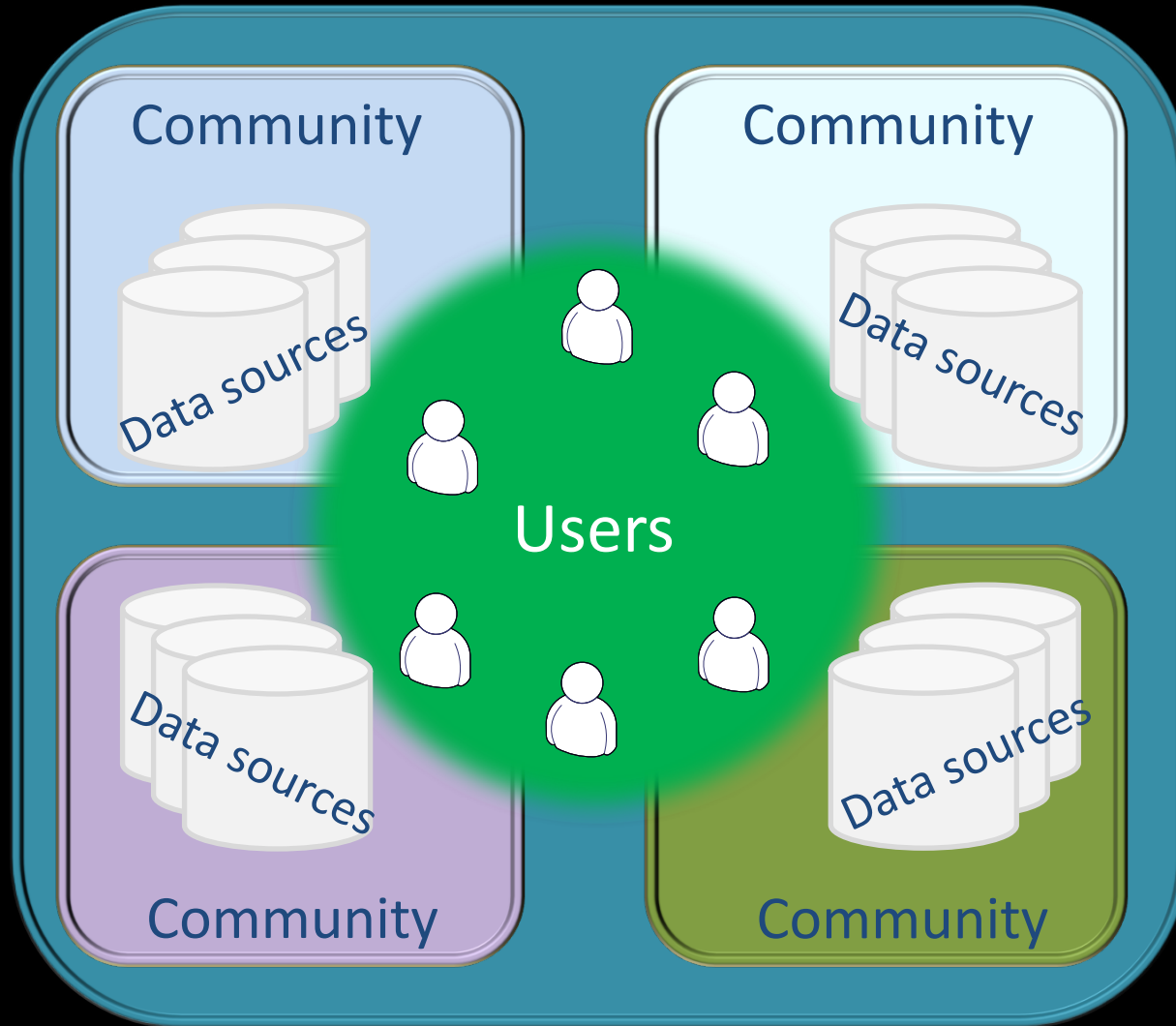
Luggar Landing, West Pearl River near Starlding; United States; Louisiana; ;

West Pearl River, Starlding, Luggar Landing, Deer Island; United States; Louisiana; ;

# Distributing Workloads



# Organizational Units





## FishNet 2

DATA SOURCES

MEMBERS

SNAPSHOT

SETTINGS

### Data source management operations

- Add new community data source via CSV files

Click on an item's header to expand/collapse its content.

sort by **date** ▾ ^

✓ community-wide

Community Owner: you

Community description: Collaborative georeferencing of data from FishNet 2

Number of community data sources: 168

Records statistics:

Specimens: 1,302,853

corrected: 1,122,421  
skipped: 122,175  
total processed: 1,244,596

Localities: 289,412

corrected: 244,749  
skipped: 35,118  
total processed: 279,867

[VIEW RECORDS](#)

[DOWNLOAD RECORDS](#)

✓	lowa_with_county	date added: Monday, January 07, 2013	<a href="#">delete</a>
✓	Maine_with_county	date added: Monday, January 07, 2013	<a href="#">delete</a>
✓	Minnesota_with_county	date added: Monday, January 07, 2013	<a href="#">delete</a>
✓	Montana_with_county	date added: Monday, January 07, 2013	<a href="#">delete</a>
✓	Nevada_with_county	date added: Monday, January 07, 2013	<a href="#">delete</a>

# Georeferencing Communities

Communities List   Create Communities   Join Communities   Account Settings

Fill out the form below to create a new community.

Fields marked \* are required.

Community name:  \*

Description:

Georeferencing options:  Water body matching    Look for hwy/river crossing

Privacy setting:

- public: any user can join your community.
- restricted: users send you requests to join your community.
- private: only users you invite can join your community.

Create  
Communities

Data Sources

Data Sources   Members   Com Center   Settings

Data source management operations

- Add new community data source via DiGIR
- Add new community data source via CSV files

Use this easy signup link to send a auto-join invite to users:

Enable hyperlinks on data source records:  
base link format: "http://domain.com?<key>=" where <key> is a parameter key of your choice.

Add New Users  
& Link Out

# Monitoring & Managing Progress

community-wide

Community Owner: you

Community description: For testing purposes only. Previously known as Fishnet II Beta.

Number of community data sources: 13

Records statistics: [VIEW CORRECTIONS](#)

Total specimen records: 555,897

Corrected specimen records: 13,473

Total locality records: 114,282

Corrected locality records: 1,649

TU Fish date added: Tuesday, June 03, 2008

Secondary name: TU Fish

Path: www.museum.tulane.edu/digir/digir.php

Type: digir

Owner: you

Number of records: 199988

Status: cached

Task: [UPDATE CACHE](#) [VIEW CACHE](#)

Records statistics: [VIEW CORRECTIONS](#)

Total corrected specimen records community-wide: 13,473

12,506 corrected in this data source

Total corrected locality records community-wide: 1,649

1,559 corrected in this data source

Beta test community date added: Tuesday, June 03, 2008

Owned by: nelson

Description: For testing purposes only. Previously known as Fishnet II Beta.

Number of members: 15

Number of data sources: 13

Localities statistics: **Total Localities: 114,282**

1,649 corrected  
112,833 remaining

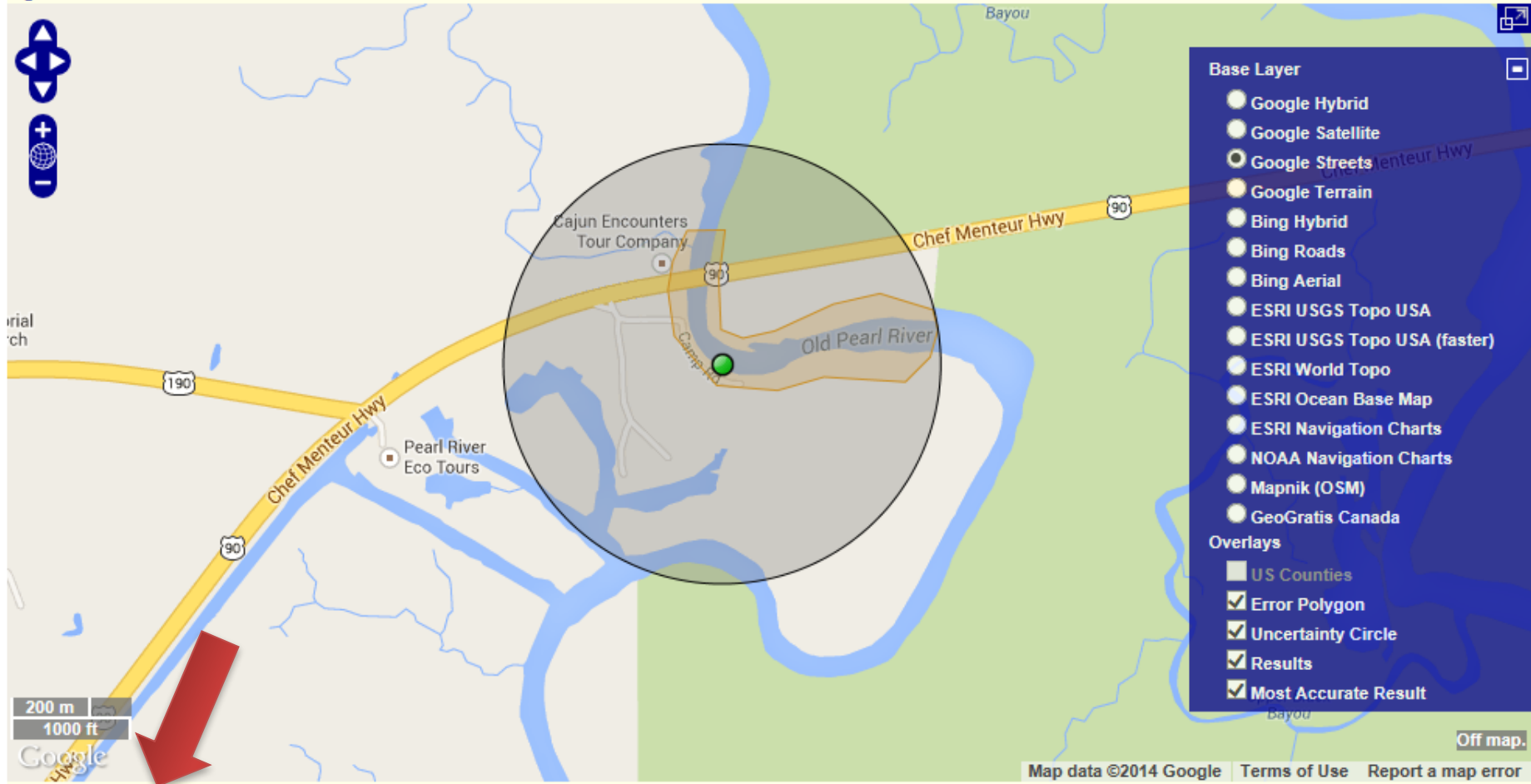
98.56% 1.44%



# GEOLocate Collaborative Georeferencing Web Client



1 possible location found.



Workbench | 1 possible location found | History | Review

Community: FishNet 2

Draw polygon  Place marker  Measure

Next Record(s)	<input checked="" type="checkbox"/> <b>Luggar Landing, West Pearl River, Starlding; United States; Louisiana; ;</b>
Correct	<input type="checkbox"/> <i>FMNH14004 Fundulus chrysotus</i>
Skip Selected	<input type="checkbox"/> Similar Records(5)
Add Comments	<input type="checkbox"/> Luggar Landing, West Pearl River near Starlding; United States; Louisiana; ;
Clear Workbench	<input type="checkbox"/> West Pearl River, Starlding, Luggar Landing, Deer Island; United States; Louisiana; ;
Correction Report	<input type="checkbox"/> Luggar Landing, West Pearl River, near Starlding; United States; Louisiana; ;

| logged in as nelson

Calculated Coordinates

Lat: 30.229134  
 Lon: -89.668154  
 U. Radius: 581 m

# GEOLocate Collaborative Georeferencing Web Client



1 possible location found.

**Base Layer**

- Google Hybrid
- Google Satellite
- Google Streets
- Google Terrain
- Bing Hybrid
- Bing Roads
- Bing Aerial
- ESRI USGS Topo USA
- ESRI USGS Topo USA (faster)
- ESRI World Topo
- ESRI Ocean Base Map
- ESRI Navigation Charts
- NOAA Navigation Charts
- Mapnik (OSM)
- GeoGratis Canada

**Overlays**

- US Counties
- Error Polygon
- Uncertainty Circle
- Results
- Most Accurate Result

Map data ©2014 Google Terms of Use Report a map error

Workbench 1 possible location found History Review

Manage History

show 10 records

get history

history filter

Options

- get skipped
- get corrected

...get previous set...

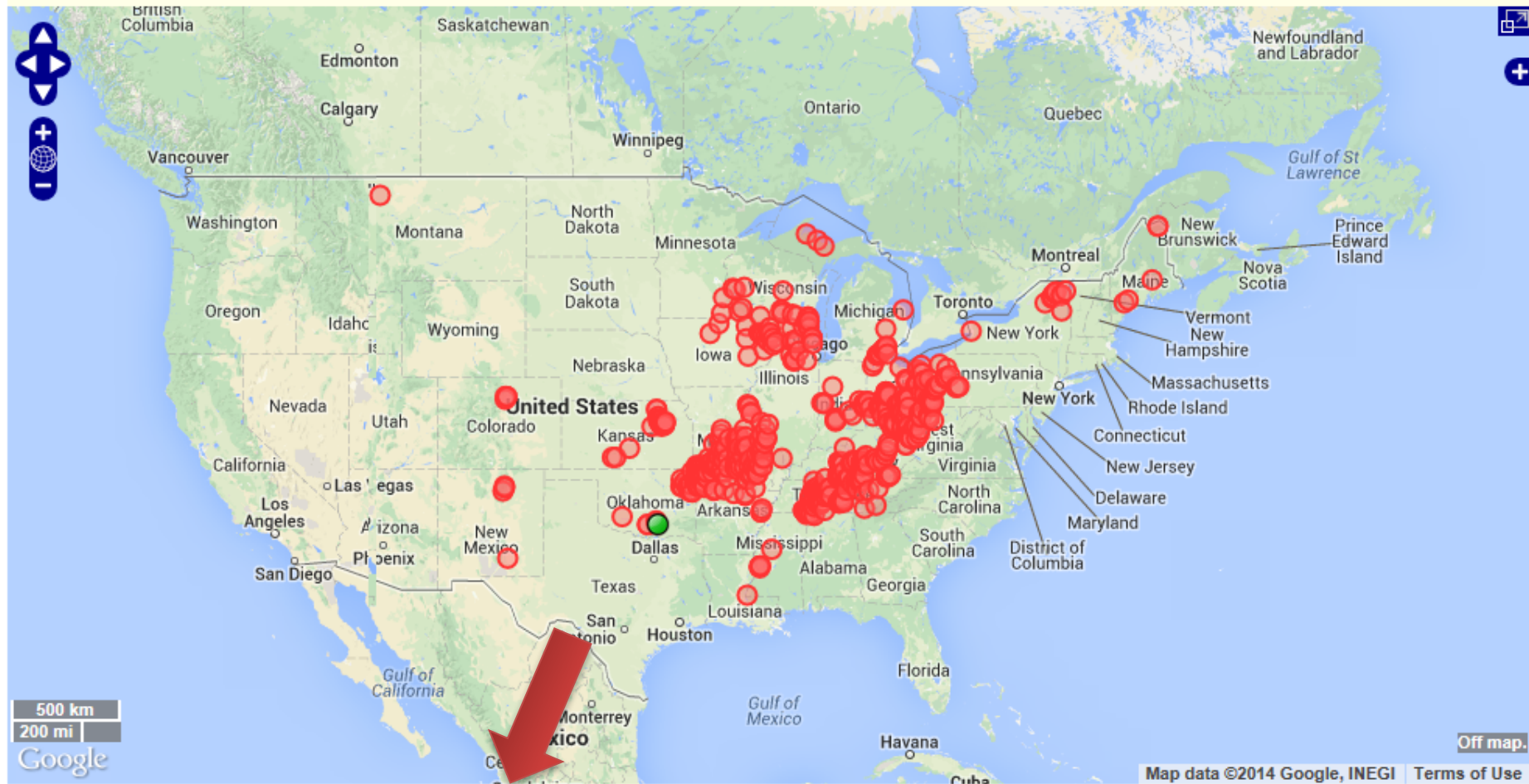
- \*corrected on 9/10/2013 4:17:36 pm\* Avery Island.; United States; Louisiana; Iberia;
- \*corrected on 9/10/2013 4:17:36 pm\* Avery Island; United States; Louisiana; Iberia;
- \*corrected on 9/10/2013 4:14:36 pm\* Lake Providence, South Shore; 6 to 12 inches in depth; sand bottom; United States; Louisiana;
- \*corrected on 9/10/2013 4:13:59 pm\* Lake Providence; United States; Louisiana; East Carroll;**
- \*corrected on 9/10/2013 4:11:19 pm\* Meridian Cr. on LA 348, 1 mi. E of Conway; T22N-R1W-Sec.17; United States; Louisiana;
- \*corrected on 9/10/2013 4:09:59 pm\* Tickfaw R., 0.5 mi. W of Holden on US 190; United States; Louisiana; Livingston;

move to workbench

Options

- include localities with matching determination
- exclude outdated determinations

# GEOLocate Collaborative Georeferencing Web Client



Workbench Results History **Review**

Active Related

1 collecting event at that location.

Reviewing records for scientific name 'PHOXINUS

**Blue River Prosper 1 mi E of St Rte 99 & Connerville.; United States; Oklahoma; Johnston**

ERYTHROGASTER'. Edit...

Comments:



Page 1 of 1

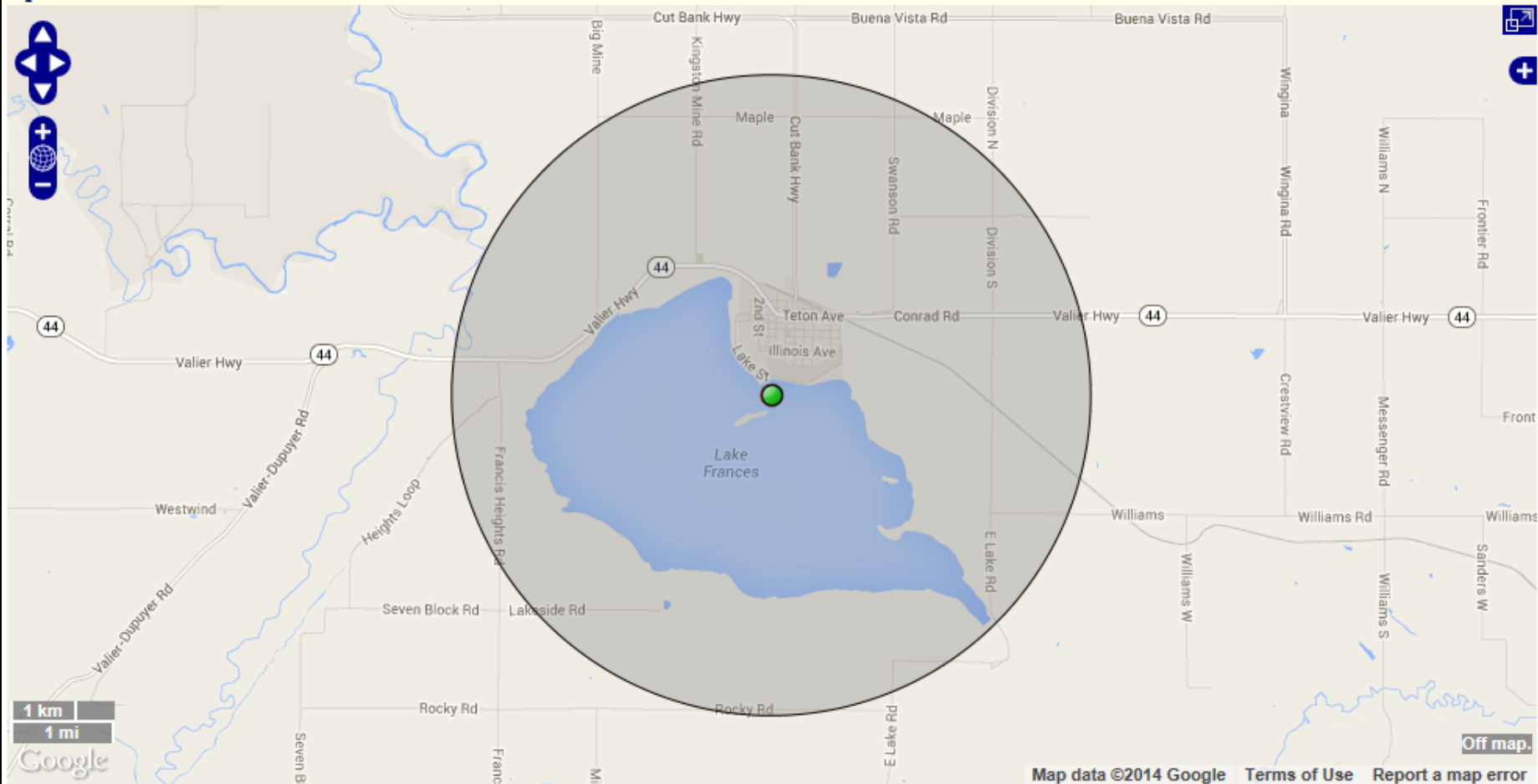


move to workbench

# GEOLocate Collaborative Georeferencing Web Client



1 possible location found.



Map data ©2014 Google Terms of Use Report a map error

Workbench 1 possible location found History Review

Community: FishNet 2

Draw polygon  Place marker  Measure

Next Record(s)	<b>LAKE FRANCES, 5 MI. W OF VALIER, IRRIGATION DITCH FEEDS THE LAKE AND FLOWS OUT OF</b>
Correct	UWFCUW 002716 CATOSTOMUS CATOSTOMUS
Skip Selected	UWFCUW 002717 CATOSTOMUS COMMERSONI
Add Comments	UWFCUW 002719 COUESIUS PLUMBEUS
Clear Workbench	UWFCUW 002715 ONCORHYNCHUS CLARKII
Correction Report	

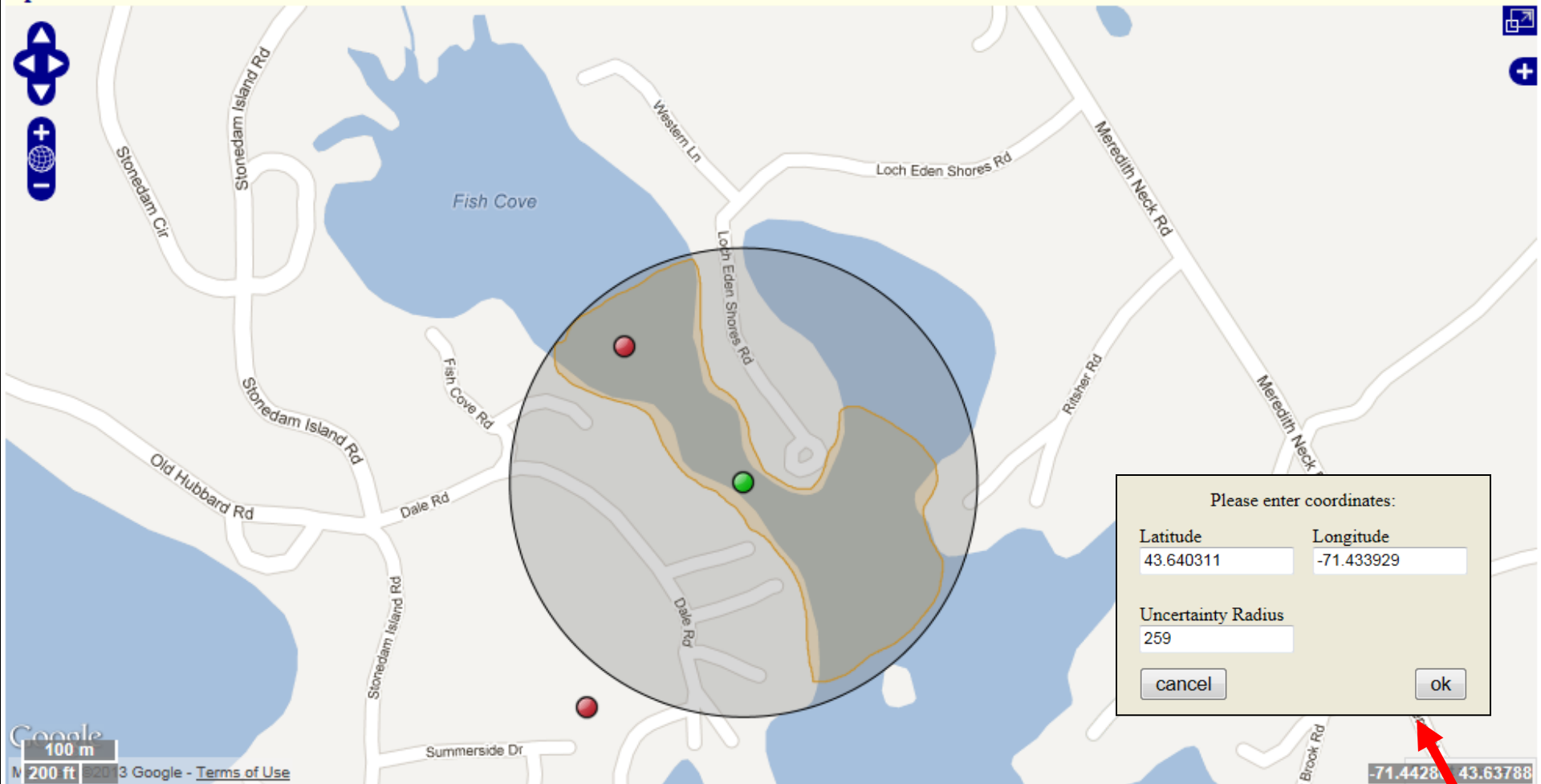
Logout | logged in as nelson

Calculated Coordinates  
 Lat: 48.296377  
 Lon: -112.255363  
 U. Radius: 5214 m

Manual Edit



6 possible locations found.



Workbench | 6 possible locations found | History

Community: FishNet 2

Draw polygon
  Place marker
  Measure

Lake Winnepesaukee, Fish Cove near mouth of T 108, 3.5 mi ESE of Meredith, Merrimack Watershed, elev. 504

Similar Records(2)

Lake Winnepesaukee, Smalls Cove, Merrimack system, 5.5 mi E of Gilford, elev. 504 ft; United States; New Ha

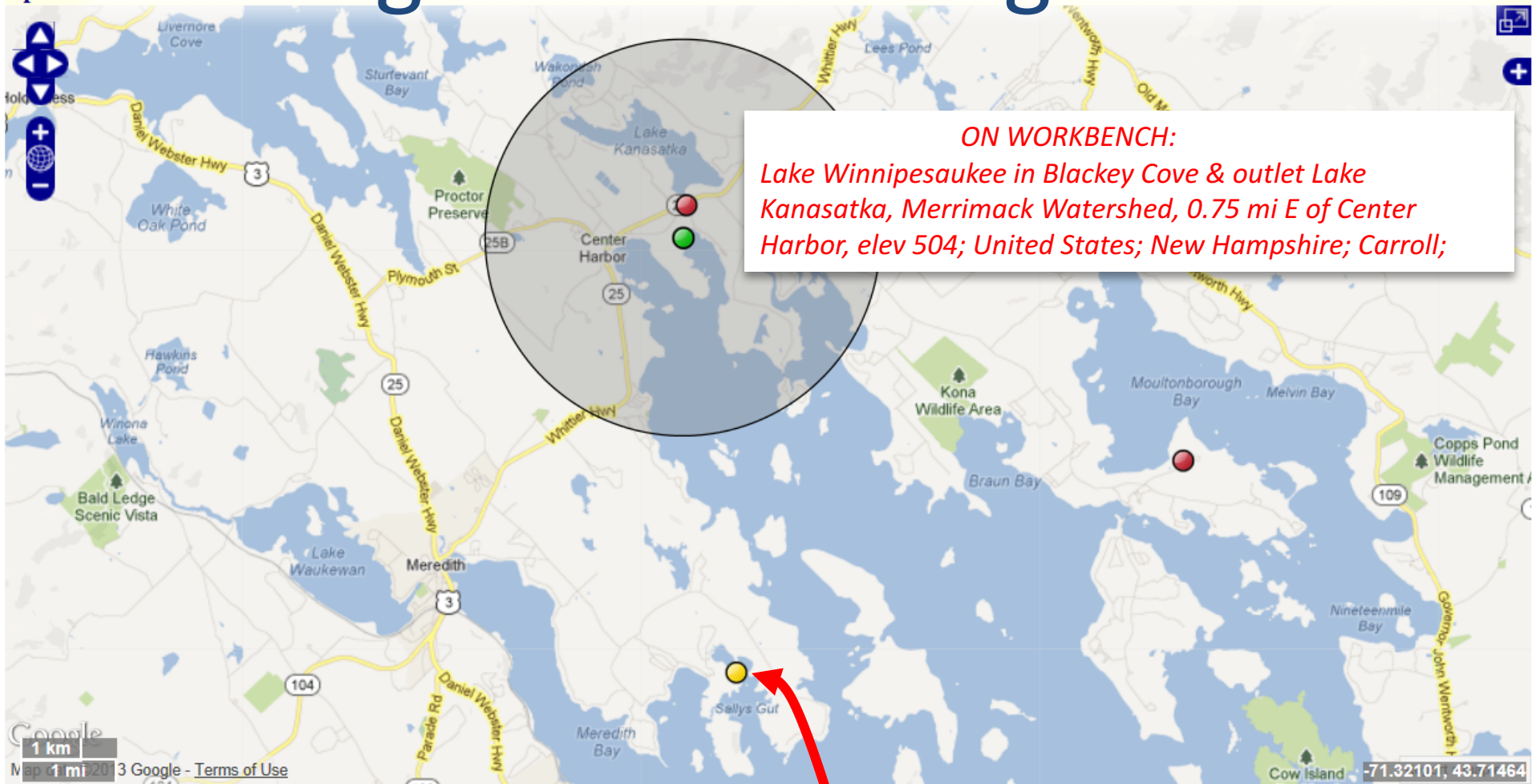
UMMZ140837 *Catostomus commersonii commersoni*

UMMZ140838 *Esox niger*

logged in as: nelson


Calculated Coordinates  
 Lon: -71.433929  
 Lat: 43.640311  
 U. Radius: 259 m

# Utilizing and Reviewing Past Work



Workbench 4 possible locations found History

- \*corrected on 3/2/2013 10:33:16 am\* Lake Winnepesaukee, Fish Cove near mouth of T 108, 3.5 mi ESE of Meredith, Merrimack
- \*corrected on 3/1/2013 2:02:10 pm\* Calcasieu River, 6.3 miles W of Jct of LA Hwy 113 and US 165.; United States; Louisiana; E
- \*corrected on 3/1/2013 2:02:10 pm\* Calcasieu River, 6.3 mi. W. of Jct. of LA Hwy 113 & US 165; United States; Louisiana; Rap
- \*corrected on 3/1/2013 1:48:30 pm\* Calcasieu River on LA 113; United States; Louisiana; Rapides;
- \*corrected on 3/1/2013 1:48:30 pm\* Calcasieu River on LA 113; United States; Louisiana; Rapides;
- \*corrected on 3/1/2013 1:48:30 pm\* Calcasieu River, on LA 113; United States; Louisiana; Rapides;
- \*corrected on 3/1/2013 1:29:16 pm\* Soucook River, Merrimack system, 3 mi SSE of Concord, elev. 230 ft; United States; New H

move to workbench 

Options

- include localities with matching determination
- exclude outdated determinations

show 100 records

get history

Options

- get skipped
- get corrected

# Interoperability

- **Webservices**

- SOAP

- JSON

- GeoJSON



- **Web Client**



Arctos

HTTP/1.1 200 OK

Content-Type: text/xml; charset=utf-8

Content-Length: length

```
<?xml version="1.0" encoding="utf-8"?>
```

```
<Georef_Result_Set xmlns="http://www.museum.tulane.edu/webservices/">
```

```
  <EngineVersion>string</EngineVersion>
```

```
  <NumResults>int</NumResults>
```

```
  <ExecutionTimems>double</ExecutionTimems>
```

```
  <ResultSet>
```

```
    <WGS84Coordinate>
```

```
      <Latitude>double</Latitude>
```

```
      <Longitude>double</Longitude>
```

```
    </WGS84Coordinate>
```

```
    <ParsePattern>string</ParsePattern>
```

```
    <Precision>string</Precision>
```

```
    <Score>int</Score>
```

```
    <UncertaintyRadiusMeters>string</UncertaintyRadiusMeters>
```

```
    <UncertaintyPolygon>string</UncertaintyPolygon>
```

```
    <ReferenceLocation>string</ReferenceLocation>
```

```
    <DisplacedDistanceMiles>double</DisplacedDistanceMiles>
```

```
    <DisplacedHeadingDegrees>double</DisplacedHeadingDegrees>
```

```
    <Debug>string</Debug>
```

```
  </ResultSet>
```

```
  <ResultSet>
```

```
  .
```

```
  .
```

```
  .
```

```
  </ResultSet>
```

```
</Georef_Result_Set>
```



*Symbiota*

**Specify 6**

**Google**

# Specify 6



# GEOLocate



Specify 6.4.08 (EZDB)

File Edit Data System Tabs Help

Welcome Data Trees Reports Interactions Statistics Query Workbench SGR Lifemapper

Search

Actions

- Import Data
- Import Images
- New Data Set
- Export Data Set
- Export MS Excel Template
- Create Data Set from Record Set

Reports

- Basic Label
- Data Set Summary
- Chart
- Top 10

Data Sets

- Sample2

Loc	LocalityString	Geo	Country	Geo	State	Geo	County	Loc	Lat	Loc	Lon	GcD	uncertainty
1	Cable Station at Cape York		Australia		Queensland				-10.68850		142.53167		
2	Aberdeen Lake		Canada						64.46667		-99.00000		
3	Pioneer Park near Davis		USA		CA		Yolo						
4	Conroe		USA		TX								
5	Twin Creek at US Hwy 24		USA		CO		Teller						
6	Turkey Creek at Goodwin Road.		USA		AL		Jefferson						
7	Borden Creek at Forest Road 244, Sipsey Wilderness; 13.1 mi SSW M...		USA		AL		Lawrence						
8	Moon Lake		USA		MS		Coahoma						
9	Red River along right bank at River Mile 105; Station 1.		USA		LA		Rapides						
10	Bienville National Forest on US Hwy 20		USA		MS								
11	Zion National Park		USA		UT								
12	Whitetail state wildlife management area		USA		NE								
13	Lincoln Beach		USA		OR		Lincoln						
14	Green River near neatsville		USA		KY		Adair						
15	New Milan Reservoir, 1.75 miles north of milan		USA		MO								
16	Homochitto River, 1.5 mi. S of Bude, Hwy. 98.		USA		MS		Franklin						
17	Homochitto River 5 mi. E of Union Church, MS Hwy. 550.		USA		MS		Lincoln						
18	Mamala Bay		USA		HI								
19	Bay of bengal		India										
20	Henley On Thames		United Kingdom		Oxfordshire								

Highlight Invalid Cells : 0 | Highlight New Records

Sp Welcome x Wb Sample2 x

Ichthyology | DJ's Specify Test Collection | djihbril



# Specify 6



# GEOLocate



GEOLocate Results Chooser - 3 of 20

### Locality Information

Description: Pioneer Park near Davis

County: Yolo

State: CA

Country: USA

### Correction (Green) Marker Properties

#### Position

Latitude: 38.545

Longitude: -121.73944

Apply

#### Uncertainty Radius

In meters: 6688

Apply

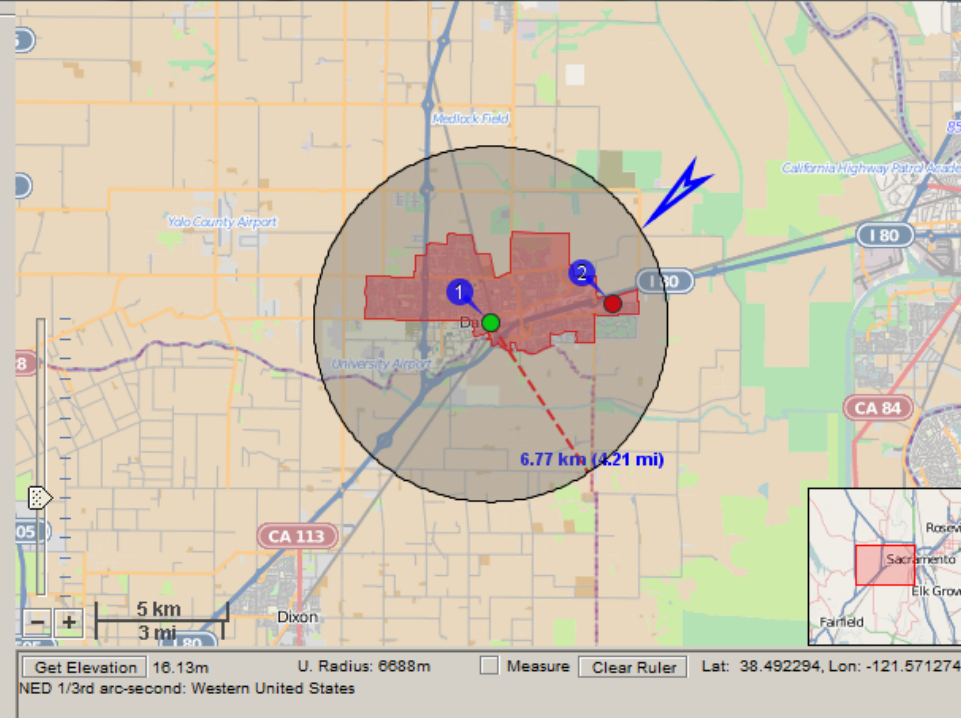
#### Error Polygon

-121.754239949,  
38.5754950193,  
-121.753548949

Clear Polygon

### GEOLocate Results

Number	Latitude	Longitude	Pattern	Precision	Error Polygon	Uncertainty
1	38.545	-121.739	Near DAVIS (Adm: YOLO)	Medium (50)	present	6254
2	38.551	-121.686	PIONEER PARK (Adm: YOLO)	Low (27)	unavailable	2289



Get Elevation 16.13m U. Radius: 6688m Measure Clear Ruler Lat: 38.492294, Lon: -121.571274  
NED 1/3rd arc-second: Western United States

GEOLocate Web

Quit

Skip

Accept

Help

# Kepler + GEOLocate

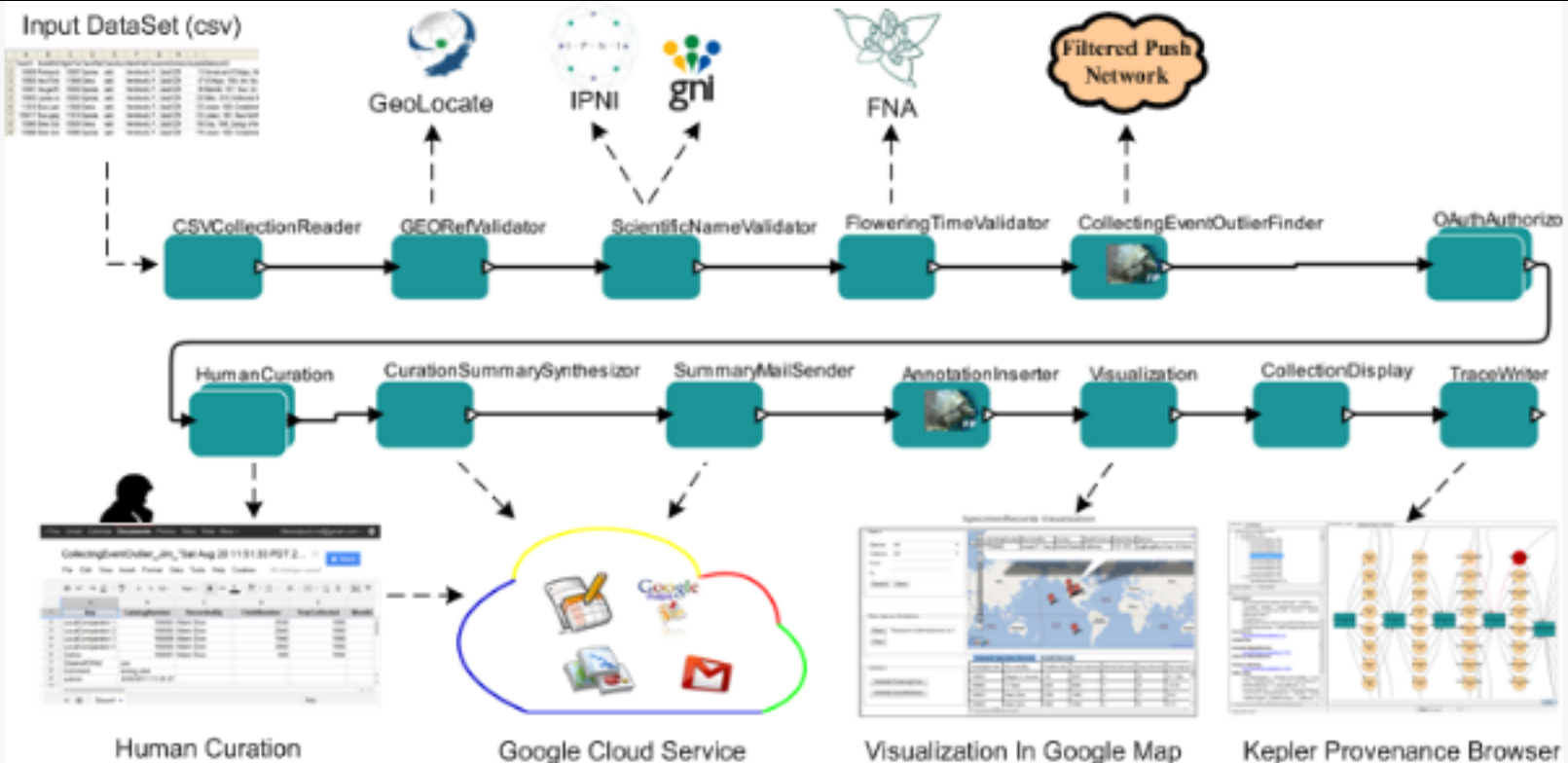


Fig1. Kepler Curation Workflow



```
library(RJSONIO)
library(RCurl)

setwd("E:/FishNet2GeoRef")

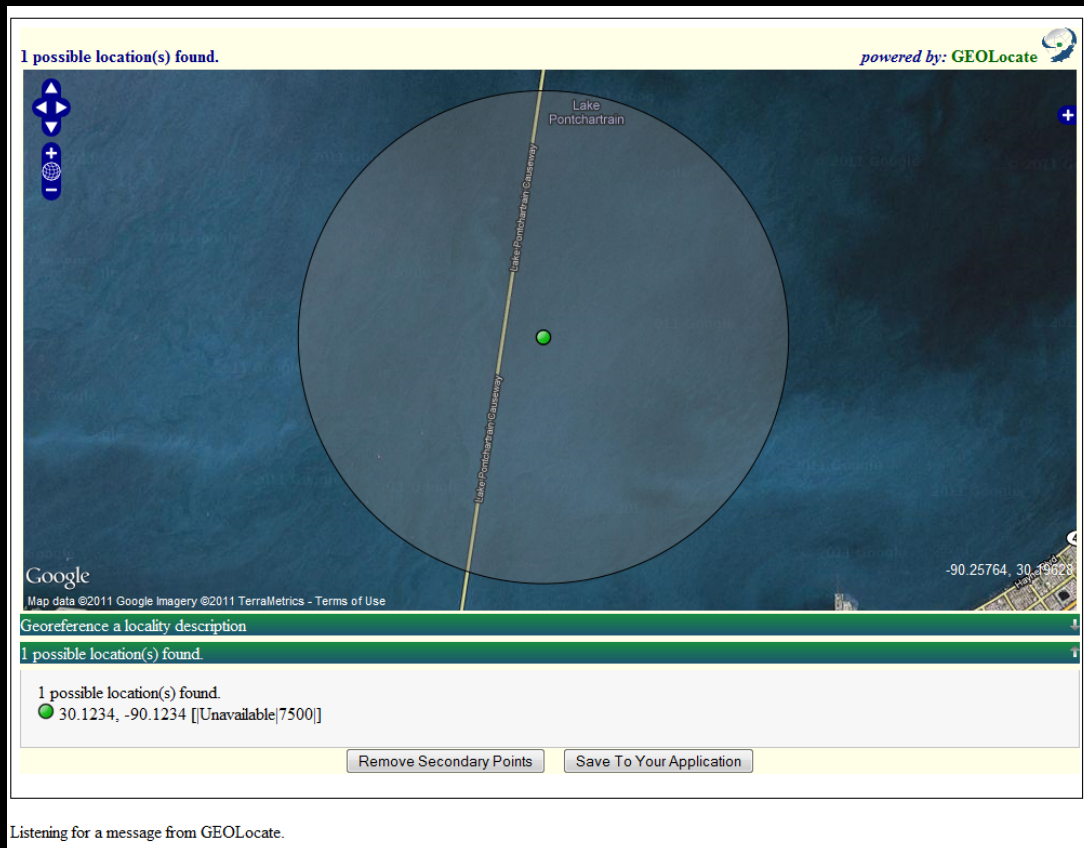
INPUTFILENAME="t_localities4GLC2.csv"
OUTPUTFILENAME="t_localities4GLC_out.csv"
OUTPUTFILENAMEFIRSTRESULT="t_localities4GLC_out_first_result.csv"

OPTIONS="&doduncert=true&dopoly=false&displacepoly=false"
glcIn= read.csv(INPUTFILENAME)
numGLCRuns = 0
recordCounter = 0
for (k in 1:nrow(glcIn)){
  print(k)
  Sys.sleep(3) #be nice and pause a few seconds between requests
  Country=glcIn[k,]$Country
  Locality=glcIn[k,]$Locality
  StateProvince=glcIn[k,]$StateProvince
  County=glcIn[k,]$County
  q=paste("http://www.museum.tulane.edu/webservices/geolocate/v2/glcwrap.aspx?country=",Country)
  q=gsub(' ','%20',q)

  tryCatch({
    JSONresponse = basicTextGatherer()
    curlPerform(url = q, writefunction = JSONresponse$update)
    glcRecNum = k
    glc = fromJSON(JSONresponse$value())
    numresults = glc$numResults
    if (numresults > 0){
      for (i in 1:numresults) {
        glcRank = i
        glcLongitude = glc$resultSet$features[[i]]$geometry$coordinates[1]
        glcLatitude = glc$resultSet$features[[i]]$geometry$coordinates[2]
        glcPrecision = glc$resultSet$features[[i]]$properties$precision
        glcScore = glc$resultSet$features[[i]]$properties$score
        glcParsepattern = glc$resultSet$features[[i]]$properties$parsePattern
        glcUncert = glc$resultSet$features[[i]]$properties$uncertaintyRadiusMeters
        glcPoly = glc$resultSet$features[[i]]$properties$uncertaintyPolygon
        #if a polygon is present reformat coordinates to geolocate format-a comma delimited array
        if ("coordinates"%in%names(glcPoly)){
          sPoly = ''

```

# Application Services: Web Client APIs



1 possible location(s) found. powered by: GEOLocate

Google  
Map data ©2011 Google Imagery ©2011 TerraMetrics - Terms of Use

Georeference a locality description

1 possible location(s) found.

1 possible location(s) found.  
● 30.1234, -90.1234 [Unavailable|7500]

Remove Secondary Points Save To Your Application

Listening for a message from GEOLocate.

- URL API for user input & lightweight web clients
- Lightweight client, specifically designed for embedding into other web applications.
  - Two way communication between web sites uses JavaScript `postMessage()`
  - Compatible with all modern browsers:

IE 8.0+

Firefox 3.0+

Safari 4.0+

Chrome 1.0+

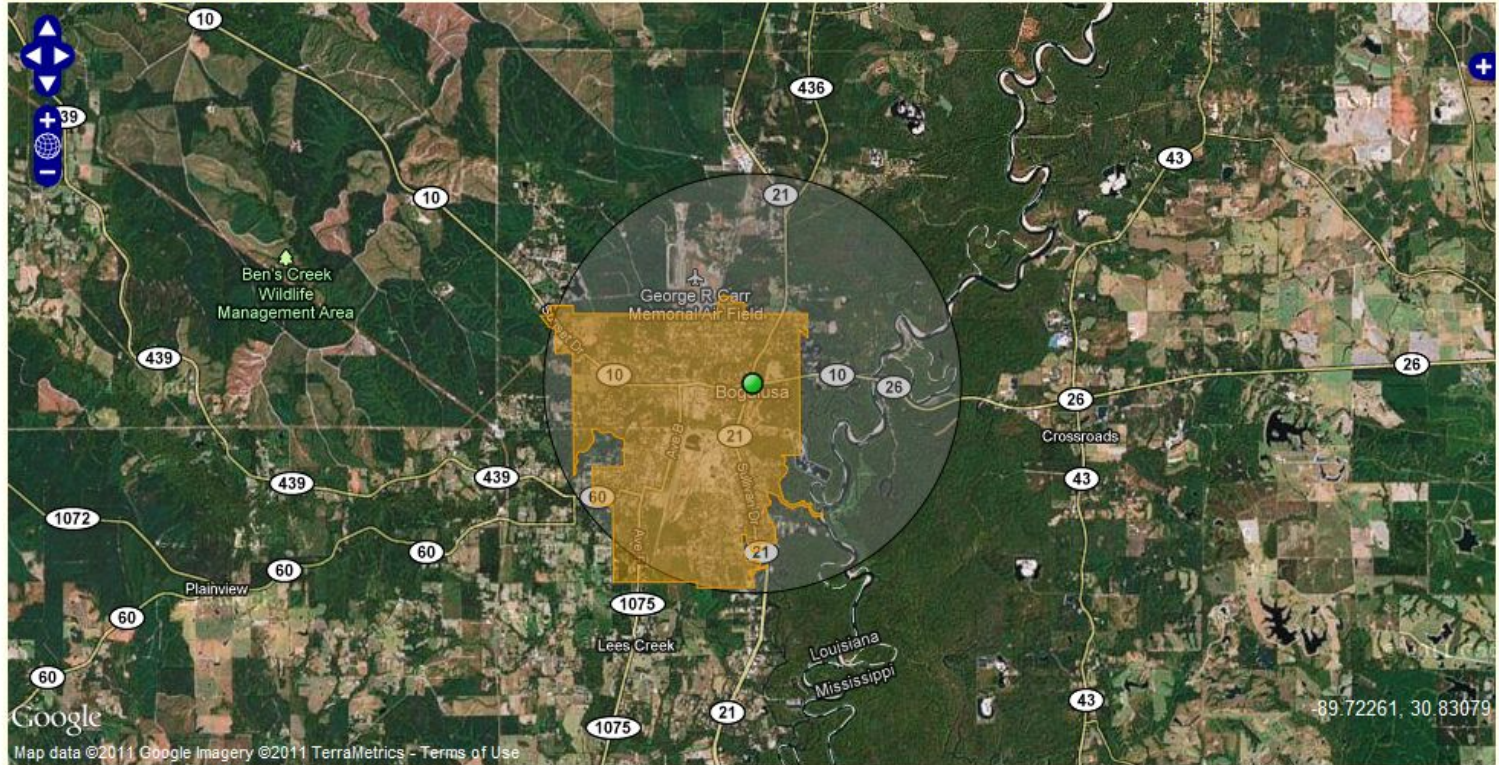
Opera 9.5+





1 possible location(s) found.

powered by:  GEOLocate



Georeference a locality description

1 possible location(s) found.

1 possible location(s) found.

● 30.79083, -89.84861 [BOGALUSA|30.801736012,-89.8943429191...|4490|Low(23)]

Remove Secondary Points

Save To Your Application

# Symbiota



# GEOLocate



## Arizona State University Vascular Plant Herbarium

### Query Form

Country: USA State: Arizona County: All Counties  
Locality Term: Tumamoc

Return Count: 39

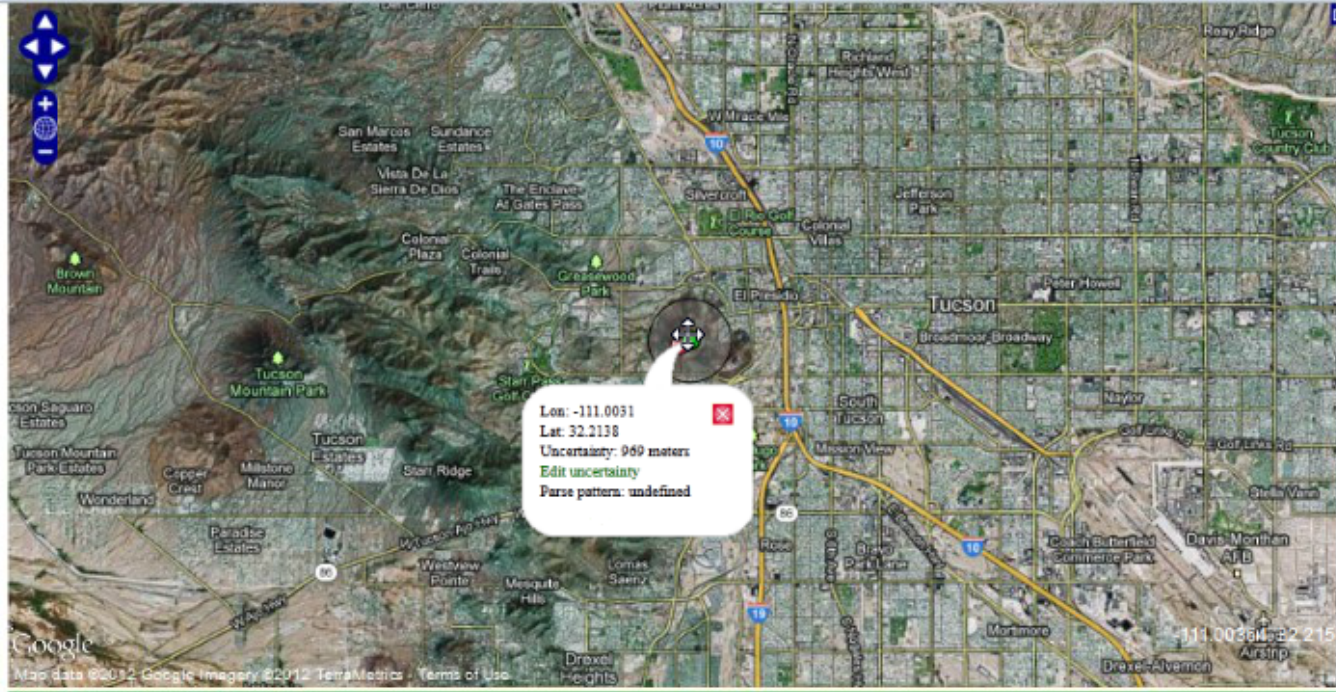
- Pima County, Growing on sanitary landfill, Tumamoc Hill, Tucson [1]
- Pima County, N slope above laboratory ground, Tumamoc Hill [1]
- Pima County, North slope above laboratory grounds, Tumamoc Hill, Tucson [1]
- Pima County, North slope above laboratory grounds, Tumamoc Hill, Tucson [1]
- Pima County, S side of Tumamoc Hill on Desert Laboratory property, TRS: T14S R13E S15 [1]**
- Pima County, South side of Tumamoc Hill along 22nd Street, TRS: T14S R13E S15 SW1/4 [1]
- Pima County, South side of Tumamoc Hills along 22nd Street, TRS: T14S R13E S15 [1]
- Pima County, SW base of Tumamoc Hill on Desert Laboratory property, TRS: T14S R13E S15 SW1/4 SW1/4 [1]
- Pima County, Tucson Mountains, Tumamoc Hill just below (west of) the University of Arizona Geochronology Lab, TRS: T14S R13E S15 NW1/4 [1]
- Pima County, Tucson Mountains, Tumamoc Hill, Tucson [1]
- Pima County, Tucson Mountains, Tumamoc Hill [1]
- Pima County, Tucson Mountains, Tumamoc Hill just below (W of) the University of Arizona Geochronology Lab, TRS: T14S R13E S15 [1]
- Pima County, Tucson Mountains, Tumamoc Hill, AZ [1]
- Pima, Tucson, south slope of Tumamoc Hill, TRS: T14S R13E sec 6 G-AZ; TRS: T14S R13E sec 15 G-AZ [3]
- Pima, Tucson, south slope of Tumamoc Hill, TRS: T14S R13E sec 6 SW1/4 SW1/4 G-AZ; TRS: T12S R13E sec 36 NE1/4 NE1/4 G-AZ; TRS: T14S R13E sec 6 G-AZ; TRS: T14S R13E sec 6 G-AZ; TRS: T14S R13E sec 15 SE1/4 [1]



Deg. Min. Sec. Decimal  
Latitude:    N =   
Longitude:    W =   
Error (in meters):  meters Datum:   
Sources:   
Remarks:   
Verification Status:   
Elevation:  to  meters

#### Statistics

Records to be Georeferenced  
Arizona: 6317  
Total Number: 39723  
Total Percentage: 21.6%



Lon: -111.0091  
Lat: 32.2138  
Uncertainty: 969 meters  
Edit uncertainty  
Parse pattern: undefined

Georeference a locality description

2 possible location(s) found.

- 2 possible location(s) found.
- 32.2138, -111.0031 [TRS/Unavailable|969|High(85)]
- 32.21278, -111.00556 [TUMAMOC HILL/Unavailable|1807|Low(27)]

Remove Secondary Points Save To Your Application

County: All Counties

Generate List

13E sec 6 G-AZ; TRS: T14S R13E sec 15 SE1/4

**Statistics**

Records to be Georeferenced

Arizona: 6317

Total Number: 39723

Total Percentage: 21.6%





# Excel + GEOLocate



	A	B	C	D	E	F
1	Locality	Country	State	County	Link to GEOLocate Web App	
2	Bogalusa	USA	LA	Washington	<a href="#">Georeference Me!</a>	
3						
4						
5						

Referencing | Developer Resources | Workshops | Support and Contacts

?

Georeference a locality description

Locality String:

Country:

State:  County:

Match Water Body | Language:

Detect Hwy/River Crossing |  Restrict to Lowest Adm. Unit

Do Uncertainty |  Do Error Polygon |  Displace Polygon

+BG (may slow things down)  Draw polygon   Measure

Latitude: 30.79083  
Longitude: -89.84861  
Uncertainty: 4490 m

[Click here for batch georeferencing.](#)

```

30.801736012,-
89.8943429191,30.803885012,-
89.8962909191,30.803941012,-
89.8960619191,30.803941012,-
89.8937979191,30.803960012,-
89.8933499191,30.805185012,-

```

1 possible location(s) found.

<http://www.museum.tulane.edu/geolocate/web/WebGeoref.aspx?v=1&Country=USA&State=LA&County=Washington&Locality=Bogalusa&georef=run>