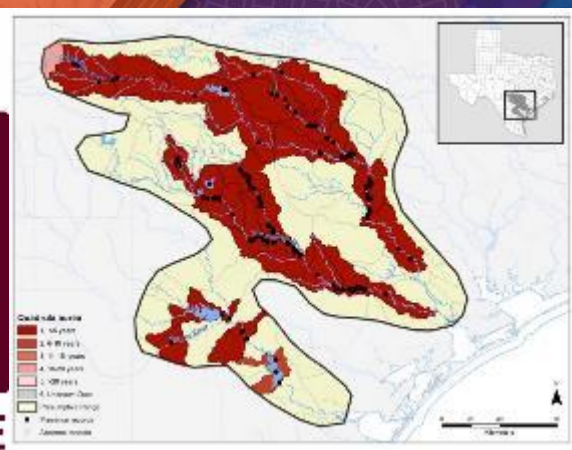




Mussels of Texas

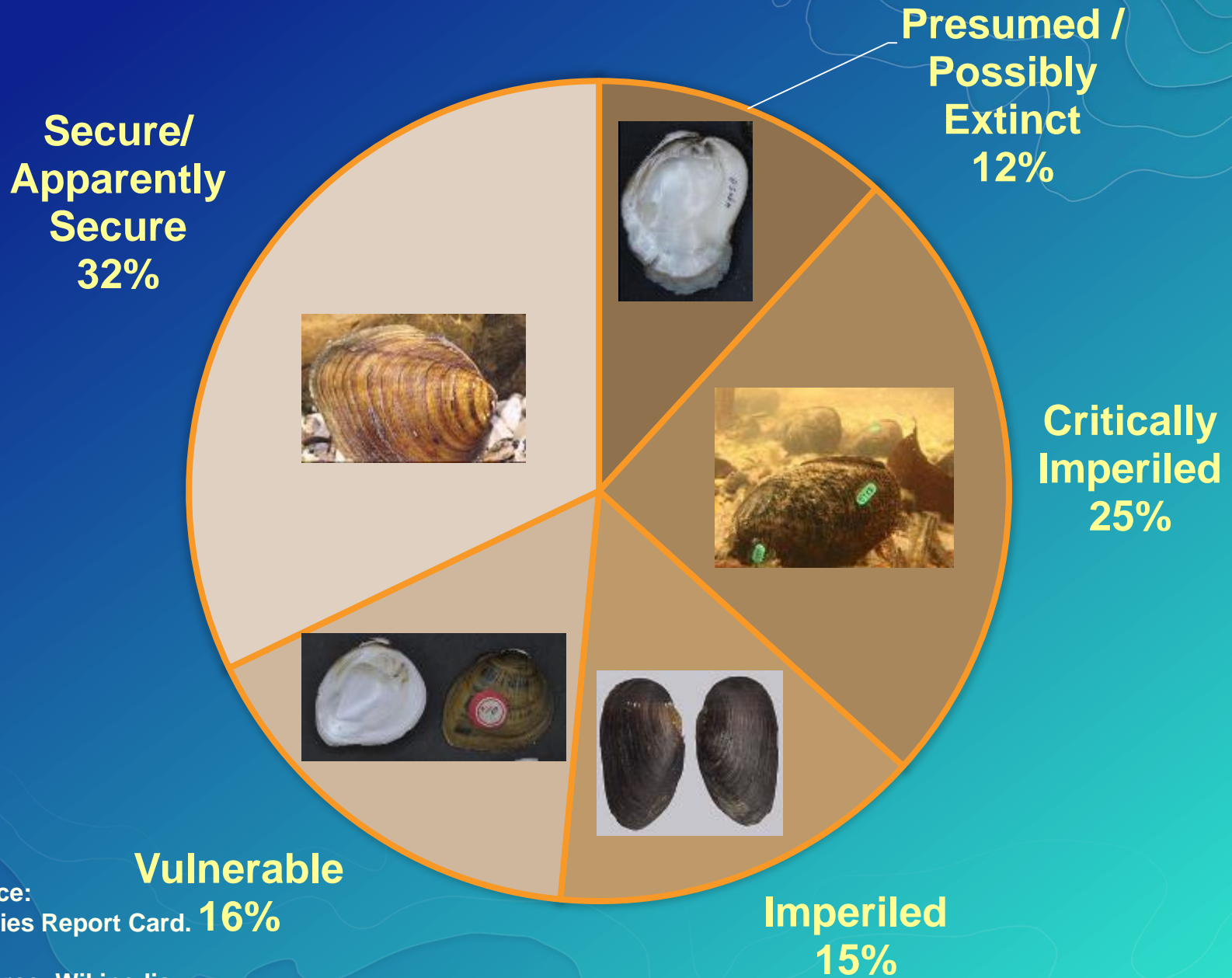
An Online Database for Accessing
Texas Mussels Distribution Information

Yang Cao, Charles Randklev, Jennifer Morton,
Brian Pierce, Ross Anderson, and Roel Lopez



Esri User Conference, 2017

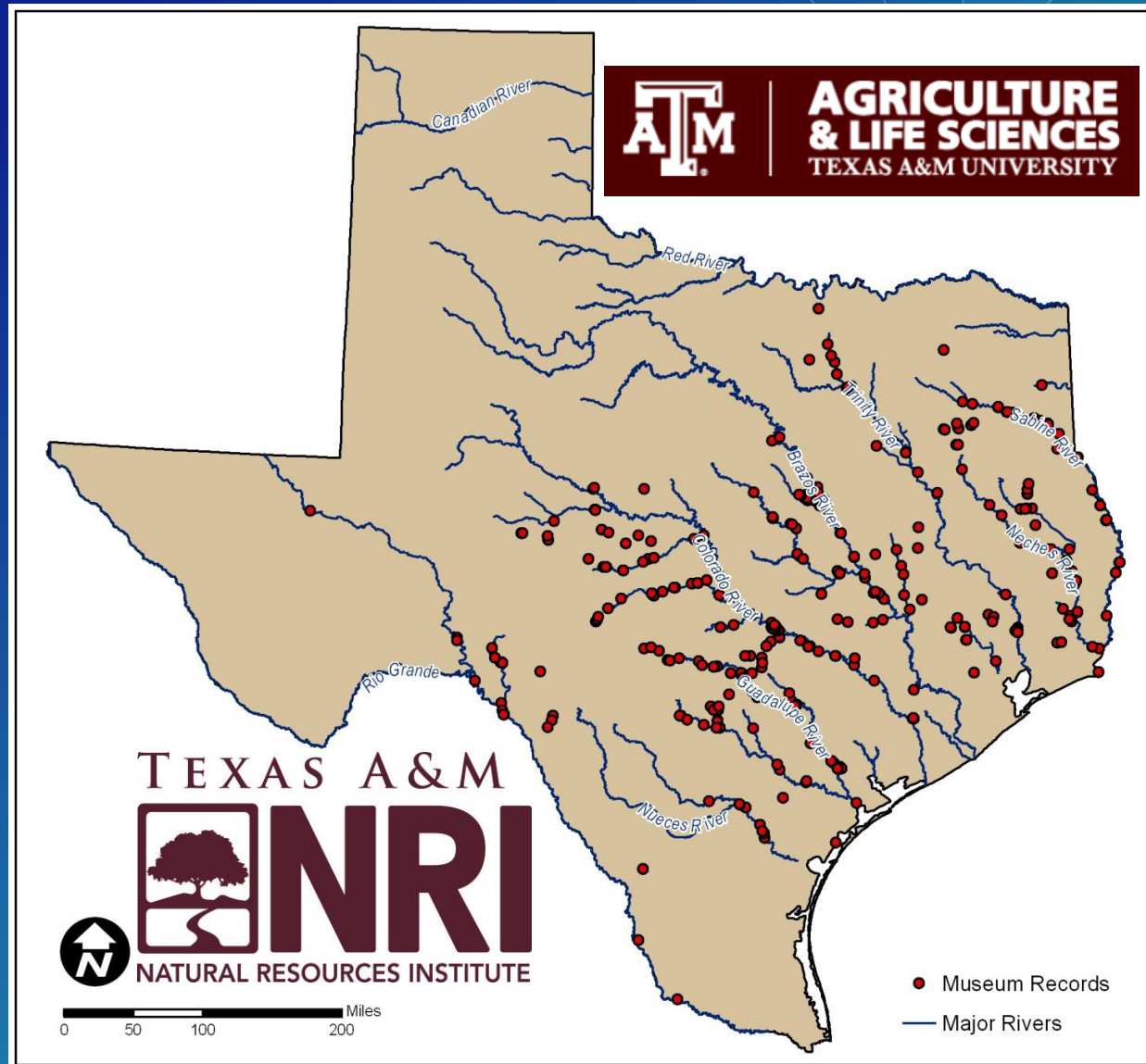
USA Mussels at risk



Data Source:
1997 Species Report Card. **16%**

Photo Source: Wikipedia.


Our Mission



Locations of freshwater mussel species contained in the Texas Freshwater Mussel Database

Credit: Kirk Winemiller et al., (2010), "Status of Freshwater Mussels in Texas"



TEXAS A&M
**NRI**
NATURAL RESOURCES INSTITUTE



What we do

Current Texas mussel database

- Only for threatened species
- Hard to inquiry
- Lack status assessment maps

Before

2011

Contemporary sampling + historical records ($\approx 7,000$)

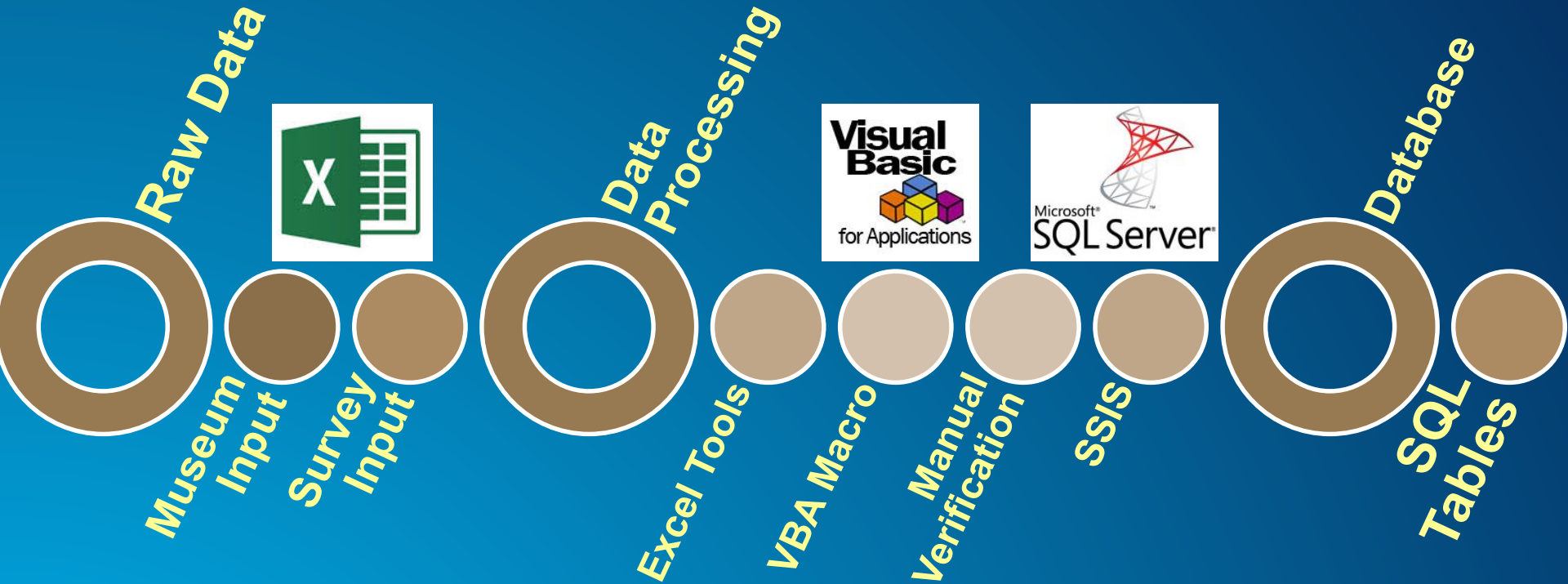
2015

Partners – CPA, TPWD, FWS, UT-Tyler, TSU, TAMU, BIOWEST, SARA, TRA, LCRA, etc. ($\approx 10,000$)

Annual Institute investment...

Ongoing

How we implemented the Database



Statewide freshwater mussel database

- + [table icon] dbo.CatalogNumber
- + [table icon] dbo.Collector
- + [table icon] dbo.County
- + [table icon] dbo.Drainage
- + [table icon] dbo.HUC
- + [table icon] dbo.Mussel
- + [table icon] dbo.MusselCollector
- + [table icon] dbo.MusselCounty
- + [table icon] dbo.ShellCondition
- + [table icon] dbo.Species
- + [table icon] dbo.SpeciesInformation
- + [table icon] dbo.Waterbody

Data Processing



| A | | |
|----|----------------------|---------------------------|
| 1 | CommonName | CorrectSpeciesName |
| 2 | threeridge | <i>Amblema plicata</i> |
| 3 | threeridge | <i>Amblema plicata</i> |
| 4 | threeridge | |
| 5 | threeridge | |
| 6 | threeridge | |
| 7 | threeridge | |
| 8 | threeridge | |
| 9 | threeridge | |
| 10 | threeridge | |
| 11 | threeridge | |
| 12 | Tampico pearlymussel | |
| 13 | Tampico pearlymussel | |
| 14 | Tampico pearlymussel | |
| 15 | | |
| 16 | round pearlshell | |
| 17 | Texas fatmucket | |

Remove Duplicates dialog box:

To delete duplicate values, select one or more columns that contain duplicates.

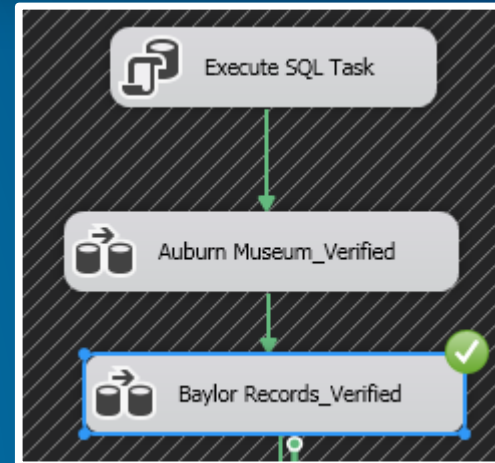
My data has headers

Columns:

- CommonName
- CorrectSpeciesName

| | B | C | D | E | |
|---|------------|------------|------------|------------|------|
| 1 | Year | Date | Drainage | Waterbody | Acco |
| 2 | 2002 | 12/21/2002 | Rio Grande | Rio Grande | |
| 3 | 2002 | 12/21/2002 | Rio Grande | Rio Grande | |
| | 2002 | 12/21/2002 | Rio Grande | Rio Grande | |
| | 12/21/2002 | Rio Grande | Rio Grande | | |

```
Microsoft Visual Basic for Applications - FactTableLatLongHUC.xlsm [design] - [Sheet2 (Code)]
File Edit View Insert Format Debug Run Tools Add-Ins Window Help
Ln 89, Col 1
Project - VBAProject
FactTableLatLongHUC.xlsm
Microsoft Excel Objects
Sheet1 (Auburn)
Sheet2 (Coding)
Sheet3 (Trim)
Sheet4 (AccuracyTest)
Sheet5 (MusselAll)
Sheet6 (MusselB4Order)
Sheet7 (WeirdDuplicates)
Sheet8 (Mussel)
ThisWorkbook
HUC12ID Click
Private Sub CollectorID_Click()
    Dim lastRow As Long
    lastRow = WorksheetFunction.CountA(Range("V:V"))
    RowCount = WorksheetFunction.CountA(Range("A:A"))
    Dim i As Long, j As Long
    For i = 2 To RowCount
        If Cells(i, 20).Value <> "" Then
            For j = 2 To lastRow
                If LCase(Cells(i, 20).Value) = LCase(Cells(j, 23).Value) Then
                    Cells(i, 21).Value = Cells(j, 22).Value
                    Exit For
                End If
            Next j
        End If
    Next i
End Sub
Private Sub CountyID_Click()
```



Final Database

The screenshot displays the Microsoft SQL Server Management Studio interface. The main window shows a table with the following data:

| HUC12ID | HUC12Name | HUC12Code | HUC10Name | HUC10Code |
|---------|--------------------|--------------|---------------------|--------------|
| 1 | City of Mayer | 111203010101 | Upper McClella... | 111203010101 |
| 2 | Joe Lake Creek-... | 111301030408 | Wind River-Nor... | 111301030408 |
| 3 | | 111302050207 | Lower South Wi... | 111302050207 |
| 4 | Mustang Creek... | 111302050208 | Lower South Wi... | 111302050208 |
| 5 | Gray Creek-Wic... | 111302060106 | Lake Kemp-Wic... | 111302060106 |
| 6 | Pond Creek-Wi... | 111302060407 | Buffalo Creek-... | 111302060407 |
| 7 | Lake Kickapoo | 111302090107 | North Fork Littl... | 111302090107 |
| 8 | Lower Onion Cr... | 111302090207 | South Fork Littl... | 111302090207 |
| 9 | Mud Creek | 111401060503 | Walnut Bayou-... | 111401060503 |
| 10 | Upper Days Cre... | 111403020704 | Sulphur River O... | 111403020704 |
| 11 | Upper Paw Paw... | 111403040402 | Paw Paw Bayou | 111403040402 |
| 12 | Blundell Creek-... | 111403050204 | Brushy Creek-B... | 111403050204 |
| 13 | Tankersley Creek | 111403050301 | Boggy Creek | 111403050301 |
| 14 | Maddox Branch... | 111403060102 | French Creek-B... | 111403060102 |
| 15 | Beckum Creek-... | 111403060403 | Big Cypress Bay... | 111403060403 |
| 16 | Carter Lake-Big... | 111403060404 | Big Cypress Bay... | 111403060404 |
| 17 | Kitchen Creek-... | 111403060407 | Big Cypress Bay... | 111403060407 |
| 18 | Watson Bayou-... | 111403060408 | Big Cypress Bay... | 111403060408 |
| 19 | Tete Bayou-Fro... | 111403060411 | Big Cypress Bay... | 111403060411 |

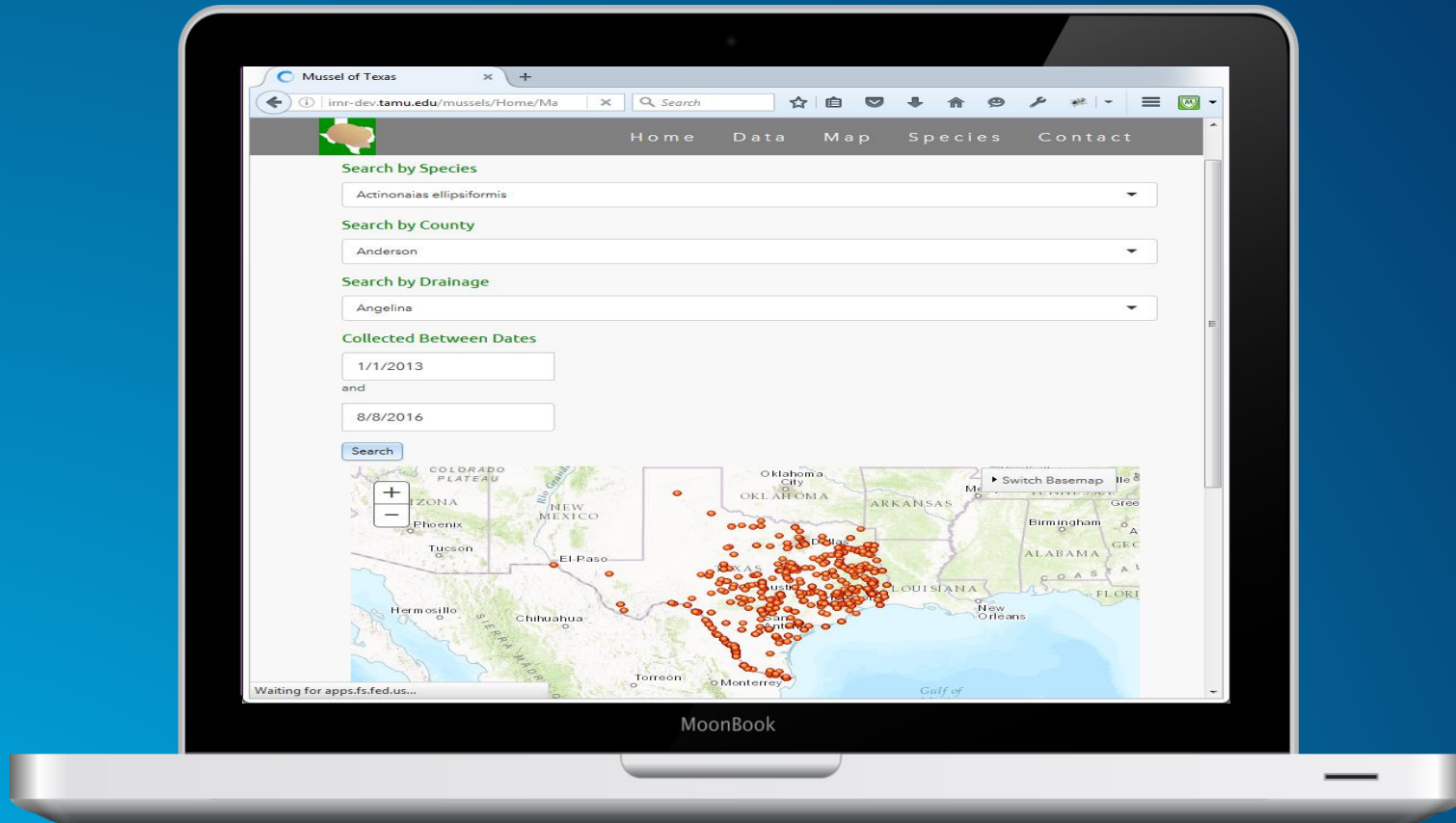
The Object Explorer on the left shows the database structure, including the 'dbo.HUC' table. The Properties window on the right shows the details for the 'Query1.dtt' query, including its name, database name, server name, and query text.

Properties for [Qry] Query1.dtt:

- (Name): Query1.dtt
- Database Name: TexasMusselsV2
- Server Name: wfsc-brtc-3\sqlexpress
- Query Designer: No
- Distinct Values: No
- GROUP BY Extension: <None>
- Output All Columns: No
- Query Parameter: No parameters have been defined
- SQL Comment: ***** Script for Select To
- Top Specification: No

Ready

Website Development Tools



❑ Microsoft ASP.NET MVC



ASP.NET

❑ ArcGIS API for JavaScript



ESRI

C# & ASP.NET Development Environment

MusselsOfTexas - Microsoft Visual Studio

File Edit View Project Build Debug Team Tools Test ReSharper Analyze Window Help

Debug Any CPU Firefox

SpeciesRepository.cs map-script.js Map.cshtml

```
133 <div data-dojo-type="esri">
134   <div data-dojo-type="dijit/layout/BorderContainer"
135     data-dojo-props="design:'headline', gutters:false"
136     style="width:100%;height:678px;margin:0 auto;padding:0;">
137     <div data-dojo-type="dijit/layout/ContentPane" data-dojo-props="
138       data-dojo-type="dijit/layout/ContentPane"
139       data-dojo-props="region:'center'"
140       style="margin: 0; padding: 0;">
141       <div style="position:absolute; right:20px; top:10px"
142         <div data-dojo-type="dijit/TitlePane"
143           data-dojo-props="title:'Switch Basemap', c
144         <div data-dojo-type="dijit/layout/ContentPa
```

SSIS Toolbox

This tool window can only be used by a SQL Server Integration Services package document.

Solution Explorer

Search Solution Explorer (Ctrl+;)

Solution 'MusselsOfTexas' (3 project)

- .nuget
 - NuGet.Config
 - NuGet.exe
 - NuGet.targets

Assem... Solution... Team E... Class Vi...

Properties

Output

Show output from: IntelliSense

[Failure] Could not find file 'C:\Users\Yang.Cao\AppData\Local\Temp\NETFramework,Version=v4.5.AssemblyAttributes.cs'.

[Failure] Could not find file 'C:\Users\Yang.Cao\AppData\Local\Temp\NETFramework,Version=v4.5.AssemblyAttributes.cs'.

Package Manager Console Error List Output

Ready Ln 151 Col 21 Ch 21 INS MusselsofTexas master

MVC Makes Mobile Friendly

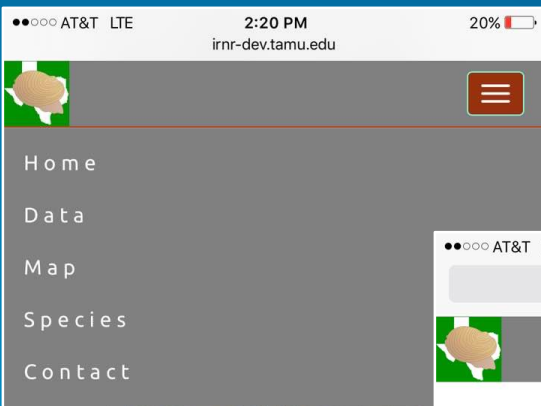


Figure 1. Photograph of Golden Orb.

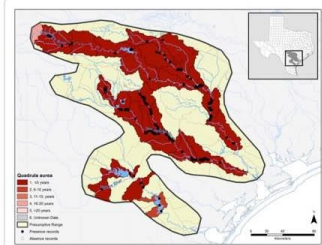
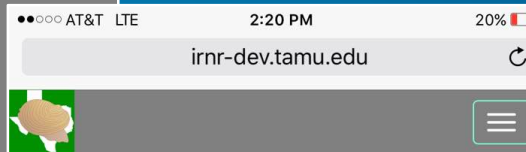


Figure 2. Range map of Golden Orb.



Data Query

Taxonomy:

Collected By:

County:

Waterbody:

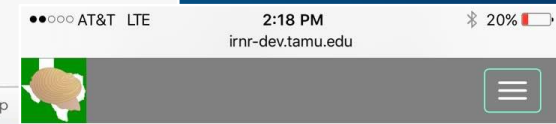
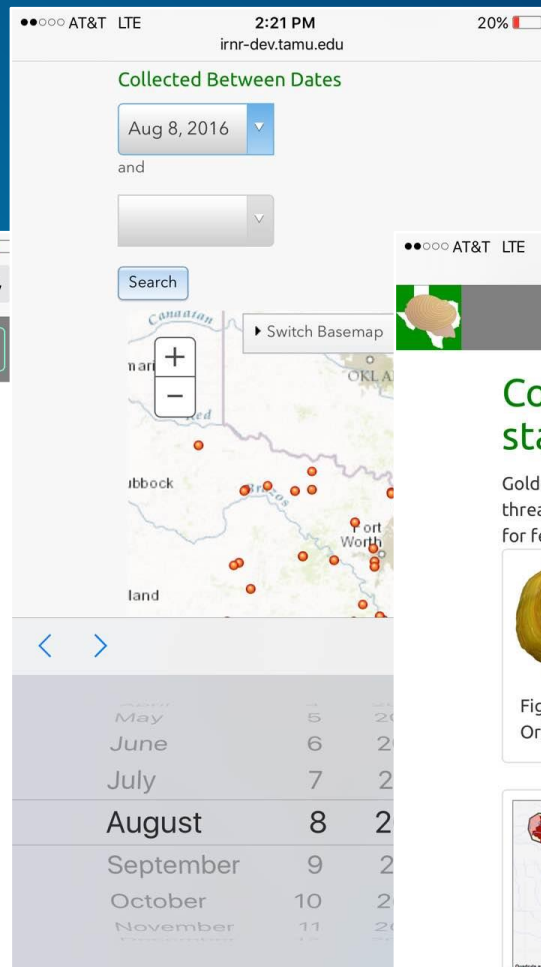
Drainage:

Filter

0 Record(s) found:

| Scientific Name | Common Name | Location | Catalog Number |
|-----------------|-------------|----------|----------------|
| | | | |

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Conservation status

Golden orb is listed by TPWD as legally threatened and it is being considered for federal listing.



Figure 1. Photograph of Golden Orb.

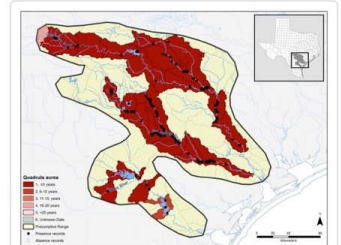


Figure 2. Range map of Golden Orb.

Data Query

Taxonomy:

Amblema plicata threeridge

Collected By:

Dobie, J.L.

County:

Llano

Waterbody:

Llano River

Drainage:

Colorado

Filter

6 Record(s) Found:

| Scientific Name | Common Name | Waterbody | Catalog Number |
|-----------------|-------------|-------------|----------------|
| Amblema plicata | threeridge | Llano River | 4048 |
| Amblema plicata | threeridge | Llano River | 4027 |
| Amblema plicata | threeridge | Llano River | 4066 |
| Amblema plicata | threeridge | Llano River | 2977 |
| Amblema plicata | threeridge | Llano River | 2945 |
| Amblema plicata | threeridge | Llano River | 2949 |

Search
Keywords

Search
Results

Data
Page

Layer List

Select the various levels of HUC you would like on the map. Zoom in and out to see them.

 HUC2 HUC4 HUC6 HUC8 HUC10 HUC12

Search by Species

Search by County

Search by Waterbody

Search by Drainage

Collected Between Dates

and

HUC
Layers

Search
Keywords

Map
Page

Map Page

Map Display

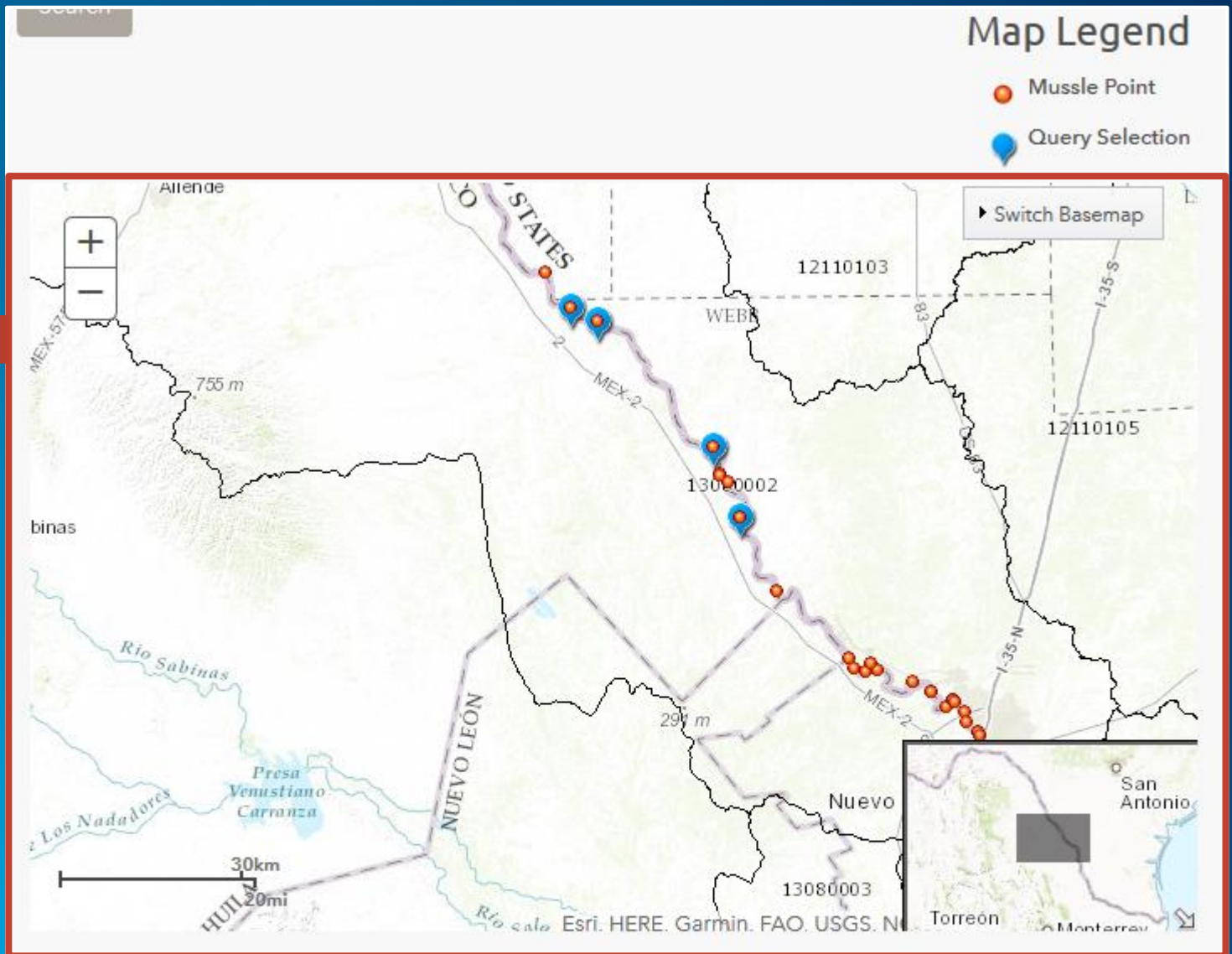




Table Display

Total 8 Record(s) selected

| Species | County | Waterbody | Drainage | Date Collected |
|---------------------|--------|------------|------------|----------------|
| Fusconaia mitchelli | Webb | Rio Grande | Rio Grande | 4/8/2009 |
| Fusconaia mitchelli | Webb | Rio Grande | Rio Grande | 4/8/2009 |

Search

Map Legend

-  Mussle Point
-  Query Selection



Map
Page

Other GIS
functions

Species

Detailed info about species

SpeciesId

Golden Orb *Quadrula aurea*

Submit

Species Page



Golden Orb

Description

Shell shape: ranges from oval to nearly round, subquadrate and somewhat subrectangular.

Shell: moderately compressed, solid and moderately thick; posterior ridge is broad and rounded and is sometime double; anterior end rounded; dorsal margin slightly curved; ventral margin straight to slightly curved; posterior end almost truncated.

Umbo: elevated above the hinge line, but not high or extremely full; beak cavity is moderately deep.

Pseudocardinal teeth: two left and one right, are large, but not massive; left pseudocardinal teeth are triangular or square, slightly compressed, posterior-most tooth somewhat less elevated than anterior tooth.

Lateral teeth: are relatively short, only slightly thickened and straight to very slightly curved.

Periostracum: yellowish-orange, orangish-tan, brown, dark brown or black, sometimes with green vague rays; typically no external sculpturing, but some specimens may have faint pustules on the central disk.

Nacre: white or bluish-white, iridescent posteriorly

Habitat

Often abundant in riffles but can occur in other habitat types in mud, sand and gravel.

Range

Endemic to the Nueces-Frio and San Antonio-Guadalupe drainages. Extant populations remain throughout most of its presumptive range, though its taxonomy is in question.

Conservation status

Golden orb is listed by TPWD as legally threatened and it is being considered for federal listing.



Figure 1. Photograph of Golden Orb.

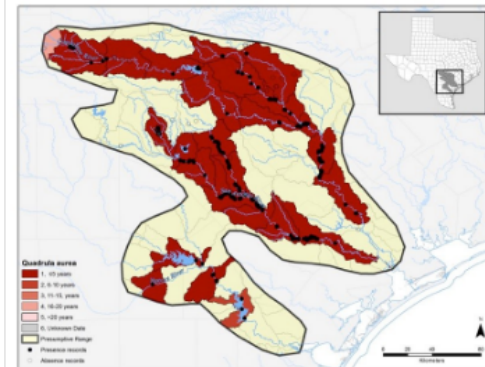
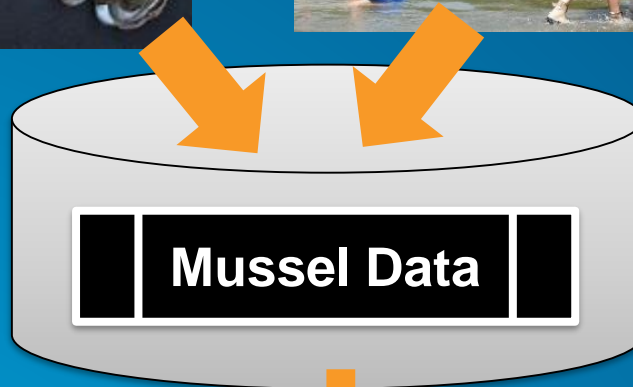


Figure 2. Range map of Golden Orb.

Benefits

Photo
Source:
Wikipedia.

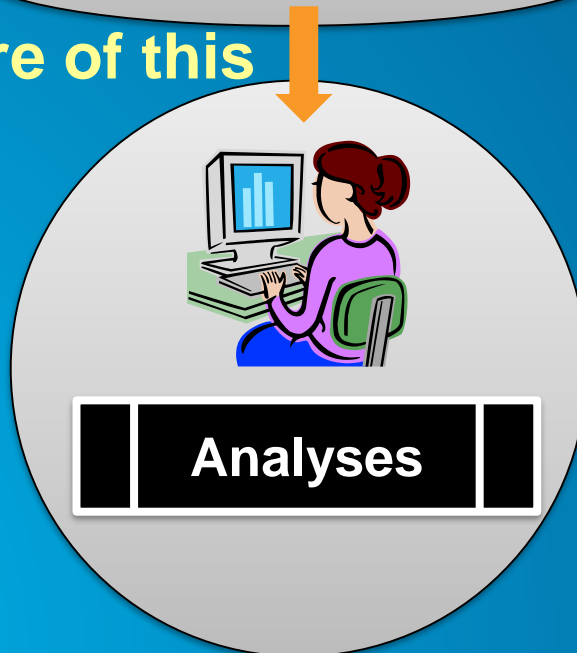


✓ **Mussels of Texas Project can help**

✓ **For all the mussel species**

✓ **Conservation status assessment maps**

Need more of this



Future Possibilities



More Data



More Search Keywords



User Account Management

Thank You



yang.cao@ag.tamu.edu