Outline

01 PROBLEM & CLIENTS
02 REQUIREMENTS
03 FRONT END
04 BACK END
05 TESTING & CHALLENGES
06 LESSONS & FUTURE WORK
Problem

- Data deficient shark populations
- Difficulty classifying and determining conservation status
Clients

- Jeremy Jenrette – Graduate Research Assistant
- Francesco Ferretti – Assistant Professor
- Department of Fish and Wildlife Conservation
## Requirements

<table>
<thead>
<tr>
<th>ORIGINAL</th>
<th>STRETCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>General UI Improvements</td>
<td>Global Affiliate Map</td>
</tr>
<tr>
<td>Data-Informed Visuals</td>
<td>Taxonomical Accuracy Table</td>
</tr>
<tr>
<td>PHP Scripting</td>
<td>Improve Picture Submission</td>
</tr>
<tr>
<td>Elementor Module</td>
<td></td>
</tr>
<tr>
<td>Cron Job Automation</td>
<td></td>
</tr>
</tbody>
</table>
Work Completed

**FRONT END**
- Dynamic Visualizations
- Global Affiliates Map
- UI Improvements

**BACK END**
- PHP Scripting
- RShiny Leaflet Map
- DB Changes

**COURSEWORK**
- Presentations
- Final Report Draft
- VTechWorks Submission
FRONT END
Injecting PHP

Conservation status of sharkPulse species

# OF SPECIES

CR - Critically Endangered 6.7%

EN - Endangered 9.1%

VU - Vulnerable 13.4%

NT - Near Threatened 9.2%

LC - Least Concern 39.6%

DD - Data Deficient 12.7%

NULL - Not Assessed by IUCN 9.4%
Species Coverage

Conservation status of sharkPulse species

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- NULL - Not Assessed by IUCN 9.4%

# OF RECORDS

- CR - Critically Endangered 7.0%
- EN - Endangered 13.1%
- VU - Vulnerable 24.3%
- NT - Near Threatened 13.1%
- LC - Least Concern 36.7%
- DD - Data Deficient 1.7%
- NULL - Not Assessed by IUCN 2.4%
sharkPulse Numbers

TOP 5 SPECIES

- Triacodon obesus
- Myliobatis tenuicaudatus
- Trygonoptera imitata
- Heterodontus portusjacksoni
- Rhincodon typus

TOTAL RECORDS

92,992

IDENTIFIED SHARK AND RAY SPECIES

612

SPECIES COVERAGE

45%
Global Affiliate Map

The aim of sharkPulse is to create a network that aggregates sightings from all over the world and make them available to researchers, scientists, institutions and anybody who may need them.

To increase participation among non-English speaking users, sharkPulse is creating national focal points through collaborations with national shark experts and institutions.

Would you like to collaborate? Just contact us!

The Shark Baseline Project  SharkPulse Italia  SharkPulse Greece

SharkPulse Global Affiliates
Global Affiliate Map

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SharkPulse Global Affiliates
## Taxonomical Accuracy Table

<table>
<thead>
<tr>
<th>Species</th>
<th>Images(Acc)</th>
<th>Species</th>
<th>Images(Acc)</th>
<th>Species</th>
<th>Images(Acc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acroteriobatus</td>
<td></td>
<td>Gymnura</td>
<td></td>
<td>Plesiotrygon</td>
<td></td>
</tr>
<tr>
<td><em>A. Acroteriobatus annulatus</em></td>
<td>199(0.35)</td>
<td>Halaedurus</td>
<td></td>
<td>Pilotrema</td>
<td></td>
</tr>
<tr>
<td><em>A. Acroteriobatus leucospilus</em></td>
<td>70(0.87)</td>
<td>Haploblepharus</td>
<td></td>
<td>Poroderma</td>
<td></td>
</tr>
<tr>
<td><em>A. Acroteriobatus variegatus</em></td>
<td>1(0.90)</td>
<td>Harriotta</td>
<td></td>
<td>Potamotrygon</td>
<td></td>
</tr>
<tr>
<td><em>A. Acroteriobatus zanzibarensis</em></td>
<td>6(0.23)</td>
<td>Hemigaleus</td>
<td></td>
<td>Prionace</td>
<td></td>
</tr>
<tr>
<td>Aculeola</td>
<td></td>
<td>Hemipristis</td>
<td></td>
<td>Pristiphorus</td>
<td></td>
</tr>
<tr>
<td>Acutobatus</td>
<td></td>
<td>Hemiscyllum</td>
<td></td>
<td>Pristis</td>
<td></td>
</tr>
<tr>
<td>Aetomyaleus</td>
<td></td>
<td>Hemitriakis</td>
<td></td>
<td>Proscyllum</td>
<td></td>
</tr>
<tr>
<td>Alopias</td>
<td></td>
<td>Hemitrygon</td>
<td></td>
<td>Psammobatis</td>
<td></td>
</tr>
<tr>
<td>Amblyraja</td>
<td></td>
<td>Heptanchias</td>
<td></td>
<td>Pseudobatos</td>
<td></td>
</tr>
<tr>
<td>Apristurus</td>
<td></td>
<td>Heterodontus</td>
<td></td>
<td>Pseudocarcharias</td>
<td></td>
</tr>
<tr>
<td>Aptychotrema</td>
<td></td>
<td>Hexanchus</td>
<td></td>
<td>Pseudoginglymostoma</td>
<td></td>
</tr>
<tr>
<td>Asymbolus</td>
<td></td>
<td>Hexatrygon</td>
<td></td>
<td>Pseudotriakis</td>
<td></td>
</tr>
<tr>
<td>Atelomycterus</td>
<td></td>
<td>Himantura</td>
<td></td>
<td>Pteroplathytrygon</td>
<td></td>
</tr>
<tr>
<td>Atlantoraja</td>
<td></td>
<td>Hydrodorus</td>
<td></td>
<td>Raj</td>
<td></td>
</tr>
<tr>
<td>Aulohalaedurus</td>
<td></td>
<td>Hypopus</td>
<td></td>
<td>Rajella</td>
<td></td>
</tr>
<tr>
<td>Bathyraja</td>
<td></td>
<td>Hypnos</td>
<td></td>
<td>Rhincodon</td>
<td></td>
</tr>
<tr>
<td>Bathytoshia</td>
<td></td>
<td>Hypogaleus</td>
<td></td>
<td>Rhinobatos</td>
<td></td>
</tr>
<tr>
<td>Beringraja</td>
<td></td>
<td>Iago</td>
<td></td>
<td>Rhinoptera</td>
<td></td>
</tr>
<tr>
<td>Brachaelurus</td>
<td></td>
<td>Isistius</td>
<td></td>
<td>Rhizoprionodon</td>
<td></td>
</tr>
<tr>
<td>Brevitrygon</td>
<td></td>
<td>Isurus</td>
<td></td>
<td>Rynchobatus</td>
<td></td>
</tr>
<tr>
<td>Bythaeleus</td>
<td></td>
<td>Lamnopsis</td>
<td></td>
<td>Rioraja</td>
<td></td>
</tr>
<tr>
<td>Callorhinichus</td>
<td></td>
<td>Lamna</td>
<td></td>
<td>Restoraca</td>
<td></td>
</tr>
<tr>
<td>Carcarhinus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
BACK END
Database

**taxonomy3**
- row.names text
- species_name text
- order_name.x text
- taxonid integer
- kingdom_name text
- phylum_name text
- class_name text
- order_name.y text
- family_name text
- genus_name text

**sharkpulse**
- date date
- time text
- users_email text
- species_name text
- latitude double precision
- longitude double precision
- img_name text
- notes text
- device_type text
- given_name text
- common_name text
- location text
- given_date text

**training_copy**
- img_name character varying(300)
- genus character varying(100)
- species character varying(100)
- class character varying(100)
- tt_id integer
- sp_id integer
- validatedConfidence numeric(5,4)
- comment text
- img_bucket character varying(255)
- source character varying(255)
async function queryConservation(cons_statuses) {
    const total_sql = "SELECT COUNT(*) FROM taxonomy3"
    const total_res = await client.query(total_sql)
    const total_count = Number(total_res.rows[0].count)

    const cons_percentages = []
    percentage_sum = 0
    for(const status of cons_statuses) {
        const conservation_sql = "SELECT SUM(CASE WHEN category LIKE " + "+" + status + "+ THEN 1 ELSE 0 END) FROM taxonomy3"
        const conservation_res = await client.query(conservation_sql)
        const conservation_count = Number(conservation_res.rows[0].sum)
        cons_percentages.push(Number((conservation_count / total_count) * 100).toFixed(1))
    }
    return cons_percentages
}
Visuals Scripting

```html
function generateProgressBar(percentage, label) {
  return '...
  <div class="progress-bar" id="progressSection">
    <div class="progress" id="${label}">
      ${percentage}%
    </div>
  </div>
}
```
RShiny App

```r
# Create leaflet map
output$map <- renderLeaflet({
  leaflet() %>%
    setView(lng = 0, lat = 30, zoom = 2) %>%
    addTiles() %>%
    addMarkers(
      lng = c(-95.7129, 12.5674, 21.8243), # Longitude for US, Italy, and Greece respectively
      lat = c(37.0902, 41.8719, 39.0742),  # Latitude for US, Italy, and Greece respectively
      popup = c(
        "Shark Baselines (US)<br><a href='https://www.facebook.com/sharkbaselines/' target='_blank'>Visit Facebook Page</a>",
        "Sharkpulse Italia (Italy)<br><a href='https://www.facebook.com/SharkpulseItalia/' target='_blank'>Visit Facebook Page</a>",
        "SharkPulse Greece (Greece)<br><a href='https://www.facebook.com/SharkPulseGreece/' target='_blank'>Visit Facebook Page</a>"
      )
    )
})
```
library(rnaturalearth)
library(sf)

# Load country boundaries
world <- ne_countries(scale = "medium", returnclass = "sf")

# Filter country boundaries for United States, Italy, and Greece
countries <- world[world$name %in% c("United States of America", "Italy", "Greece"), ]

# Convert to GeoJSON format
countries GeoJSON <- st_as_sf(countries)

# Write GeoJSON data to a file
sf::st_write(countries_geojson, "countries.geojson")
try {
    $pdo = new PDO($dsn);
    $pdo->setAttribute(PDO::ATTR_ERRMODE, PDO::ERRMODE_EXCEPTION);
    // echo "Connected to PostgreSQL database\n";

    // Query to get all non-null species + genus combinations
    $query = "
    SELECT species, genus
    FROM training_copy
    WHERE species IS NOT NULL AND genus IS NOT NULL
    ORDER BY genus, species;
    ";

    // Execute the query
    $result = $pdo->query($query);
    $rows = $result->fetchAll(PDO::FETCH_ASSOC);
    // echo "All non-null species + genus combinations:\n";

    // Create a dictionary to map genus to unique species and count
    $genusSpeciesMap = array();

    foreach ($rows as $row) {
        $genus = $row['genus'];
        $species = $row['species'];

        if (!array_key_exists($genus, $genusSpeciesMap)) {
            $genusSpeciesMap[$genus] = array(
                'speciesSet' => array(),
                'speciesCount' => array()
            );
        }

        $speciesCount = isset($genusSpeciesMap[$genus]['speciesCount'][$species]) ? $genusSpeciesMap[$genus]['speciesCount'][$species] + 1 : 1;
    }
}
Taxonomical Accuracy Visual

```html
// Generate HTML for each third of the page
$tableCount = 3;
$numRows = ceil(count(array_keys($genusSpeciesMap)) / $tableCount);

$htmlTable = '<div style="width: 100%; display: flex;">

for ($i = 0; $i < $tableCount; $i++) {
    $start = $i * $numRows;
    $end = min($start + $numRows, count(array_keys($genusSpeciesMap)));

    $htmlTable .= '<tr><th style="width: 50%;">Species</th><th style="width: 50%;">Images(.Acc)</th></tr>

    foreach (array_slice(array_keys($genusSpeciesMap), $start, $end - $start) as $genus) {
        $htmlTable .= '<tr><td colspan="2" style="text-align: center;">$genus</td>
        $htmlTable .= '<td style="display: block; text-align: left; cursor: pointer;" onclick="toggleSpecies("\" . $genus . ' ")"></td>
    }

    foreach ($genusSpeciesMap[$genus]["speciesCount"] as $species => $count) {
        $acc = rand(0, 1); // Random accuracy for demonstration
        $htmlTable .= '<div style="width: 33.33%;">$species . ' count: ' . $count . '</div>'
    }

    $htmlTable .= '</tr></td></tr>

}$htmlTable .= '</table></div>';
```
File Extension Script

- Adds appropriate extensions to images
- Filters out duplicates extension tag
Testing

- Local testing
- Evaluations from clients
- User experience survey
Challenges

- VPN issues
- RShiny and Elementor
- Integrating visuals
Lessons Learned

- Learned how to use RShiny and Elementor
- Applying agile methodology
- Learned lots about sharks!
Future Work

- Disseminate Feedback Survey
- Picture Submission Page
- Inject Taxonomy Table
ACKNOWLEDGEMENTS

- Professor Francesco Ferretti
- Jeremy Jenrette
- Professor Dr. Edward Fox
- GTA Satvik Chekuri
- Fish and Wildlife Conservation
References


sharkPulse. (2024) Retrieved April 23, 2024, from https://sp2.cs.vt.edu/
THANK YOU!

QUESTIONS?