Grand Canyon Monitoring and Research Center

Managing Data Resources and Online Content for GCMRC & GCDAMP

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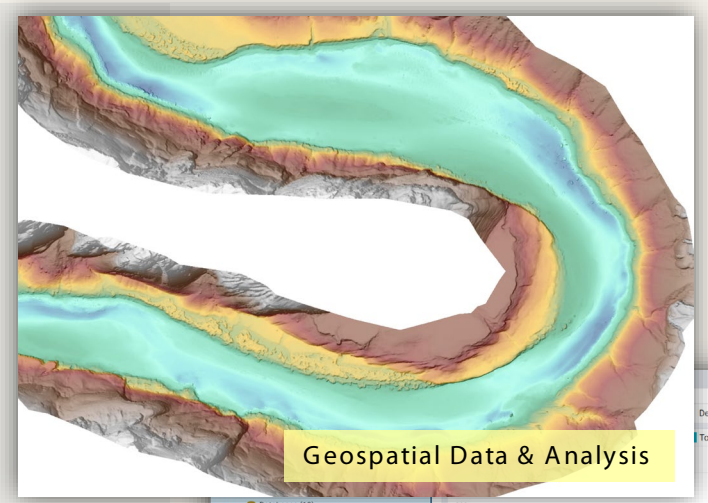
Project K: Geospatial Science and Technology

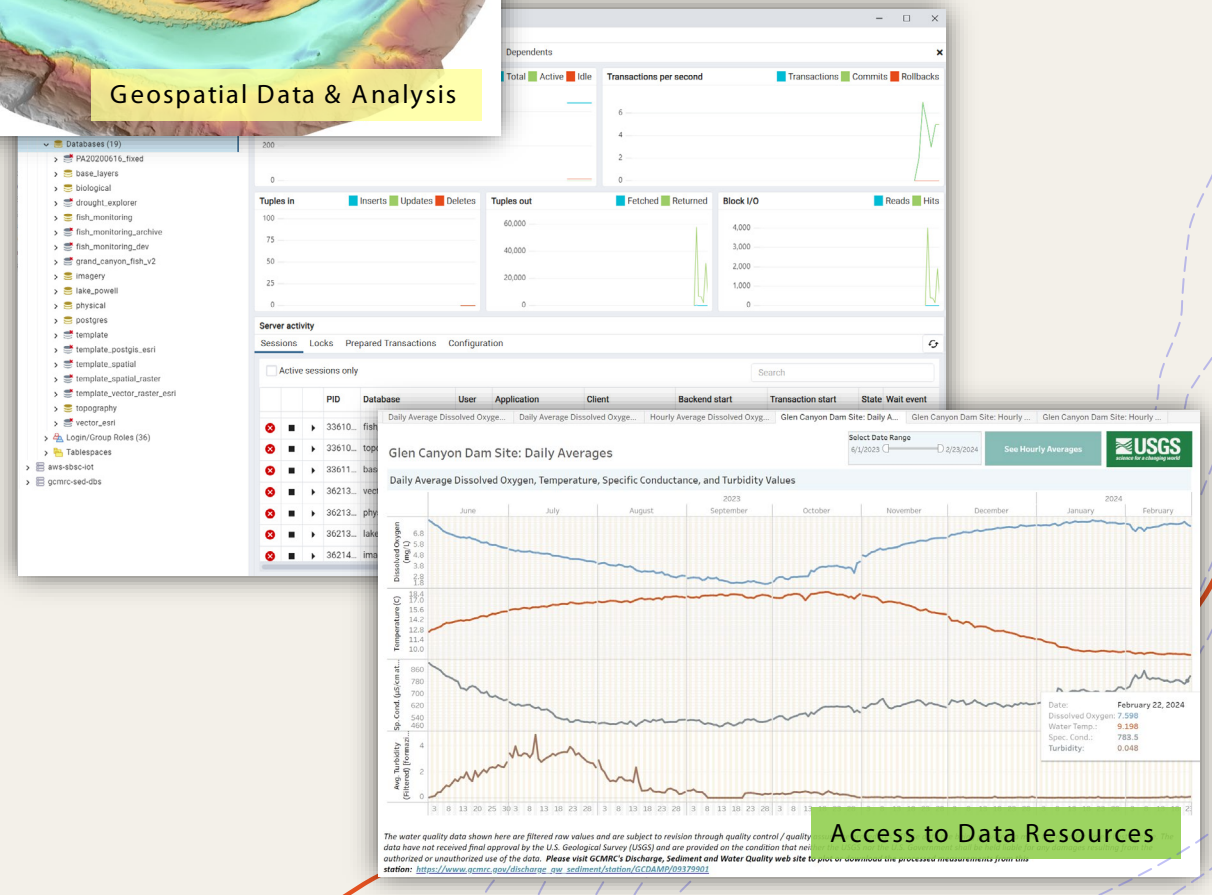
Project Elements

- K.1. Geospatial Data & Analysis
- K.2. Data Management / Data Science
- K.3. Access to Data Resources

Science Projects and LTEMP Goals

- Most GCMRC projects are supported by K.
- Support 8 of the 11 LTEMP Goals with a wide array of activities across all Project K elements
- Often leveraging newer technologies to achieve science project objectives
- Center-wide support through the development of data systems and a range of data resources





Geospatial Data & Analysis

Project Elements

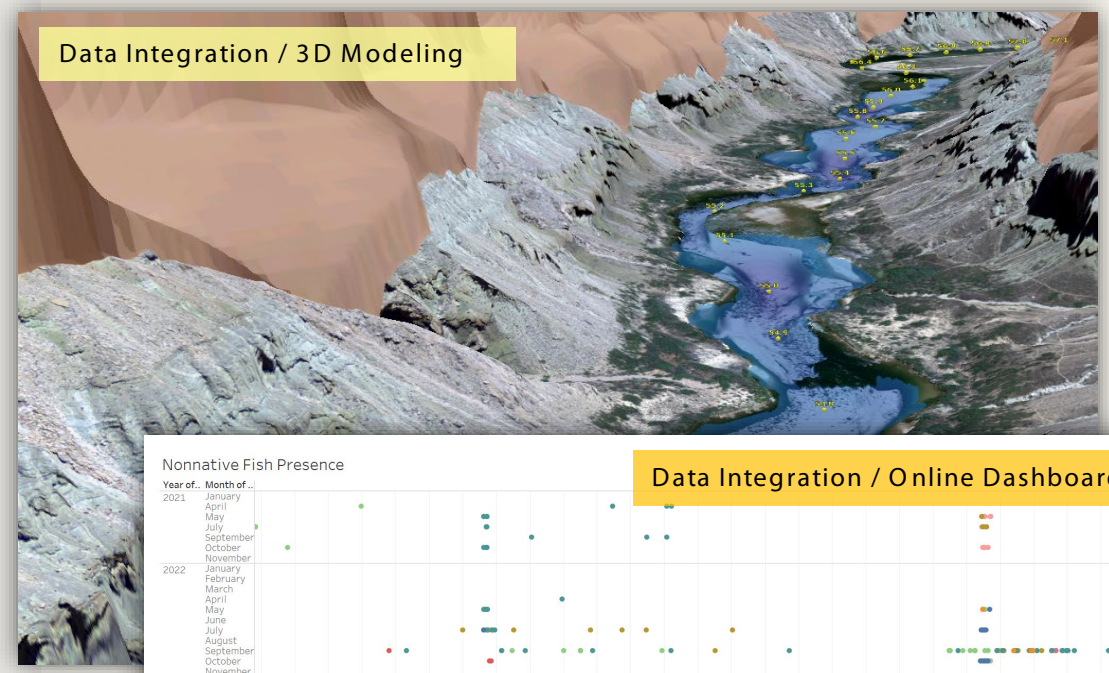
- Geospatial Data Analysis
- Data Management / Data Science
- Access to Data Resources

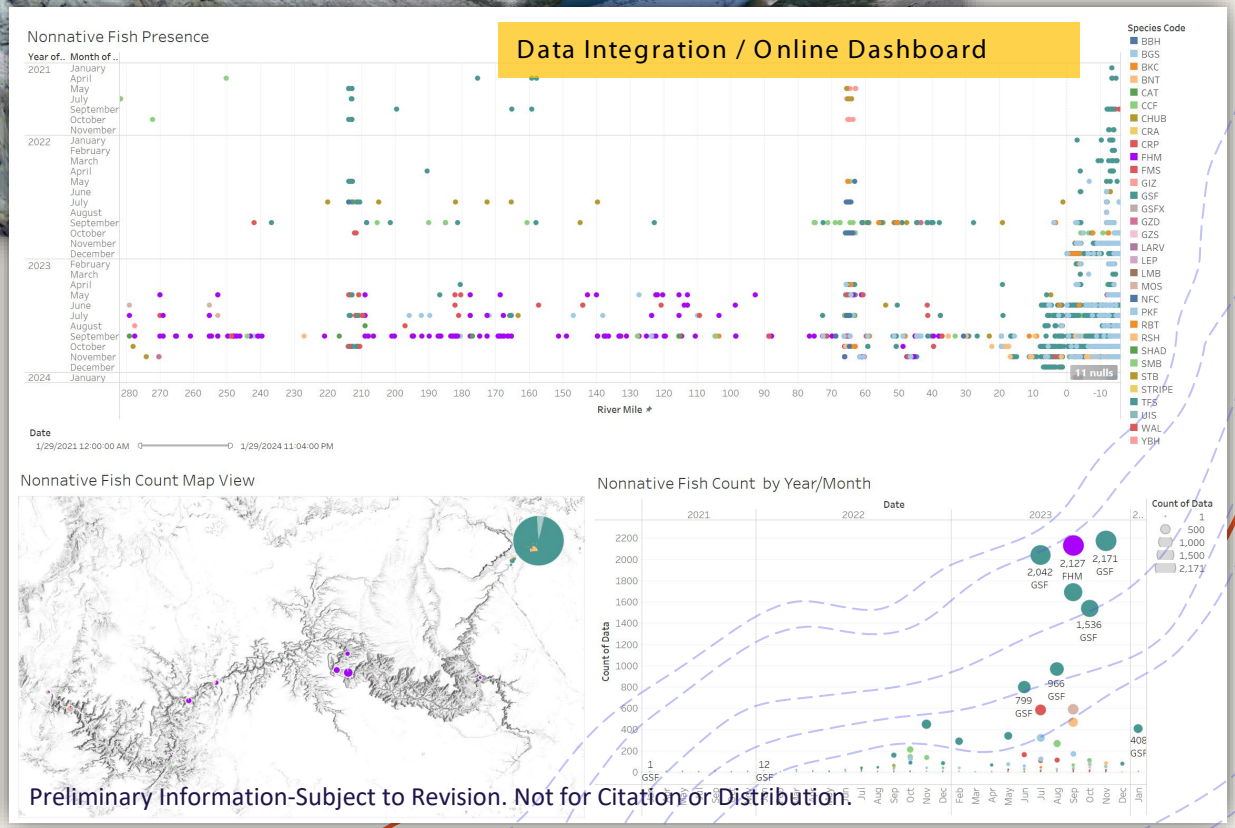
Support Other Projects

- Many field support functions: Maps, GIS layers, Tools
- Guidance on ArcGIS Pro, other software
- Use of Python programming
- Training for staff and cooperators
- Data Integration

Access to Geospatial Content

- Data Services
- Online Maps
- Integrated online content

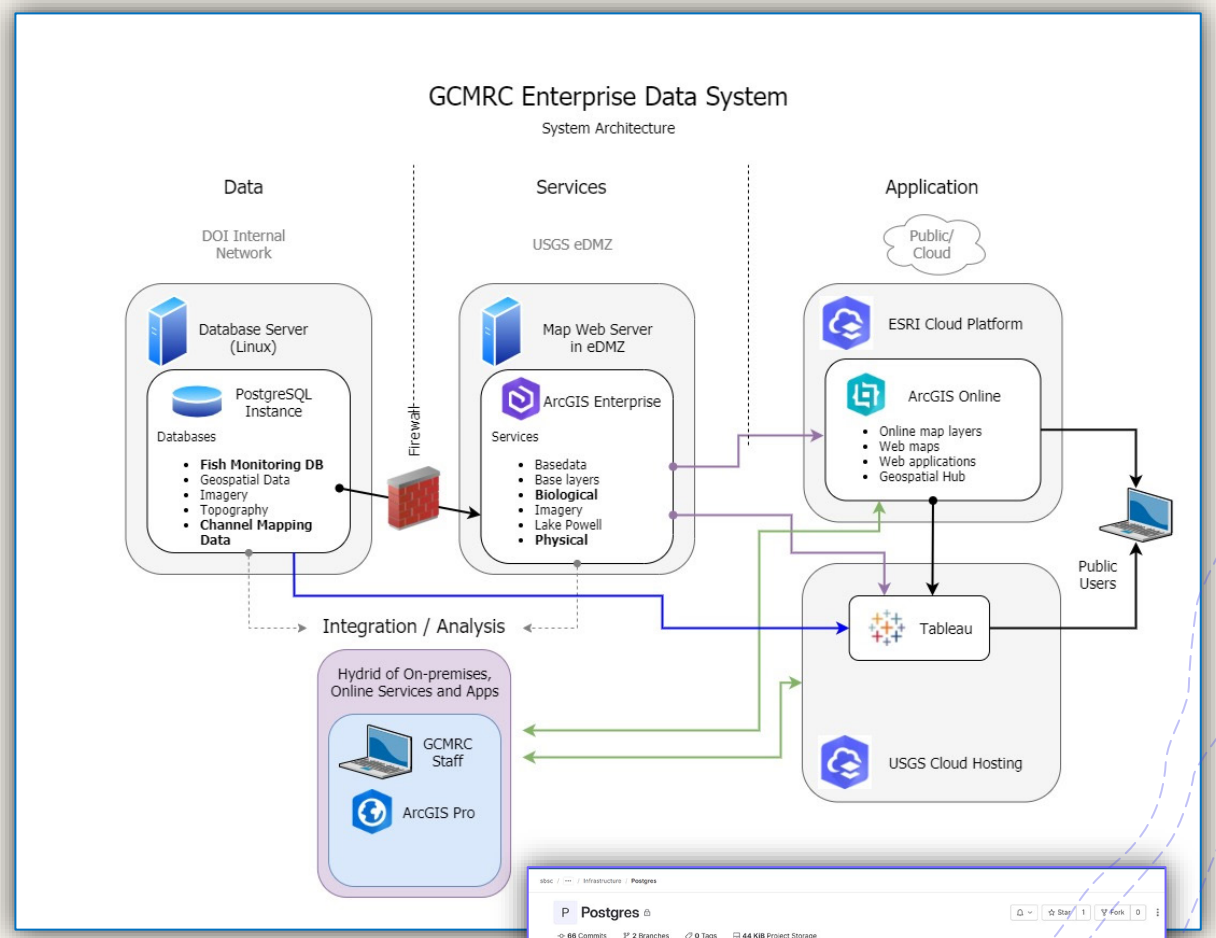




Data Management (Geospatial and Non-spatial)

Enterprise GIS and Relational Databases

- Many project data sets now using enterprise environment
  - Centrally managed computing resources, but separately maintained, resource-specific databases
  - Spatial and Tabular use the same / similar platforms
- Allows for easier integration of different data sets
- Infrastructure as Code (IaC)
  - Design / deploy relational database resources through code




```
# CREATE DATABASES FROM TEMPLATES

# Create non-spatial databases
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE fish_monitoring WITH OWNER = fish_monitoring_admin TEMPLATE = template;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE fish_monitoring_archive WITH OWNER = fish_monitoring_admin TEMPLATE = template;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE fish_monitoring_dev WITH OWNER = fish_monitoring_admin TEMPLATE = template;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE grand_canyon_fish WITH OWNER = fish_monitoring_admin TEMPLATE = template;'
## MORE HERE

# Create spatial (non-raster) databases
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE base_layers WITH OWNER = sde TEMPLATE = template_spatial;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE biological WITH OWNER = sde TEMPLATE = template_spatial;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE imagery WITH OWNER = sde TEMPLATE = template_spatial;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE physical WITH OWNER = sde TEMPLATE = template_spatial;'
psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE topography WITH OWNER = sde TEMPLATE = template_spatial;'
#psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE vector_esri WITH OWNER = sde TEMPLATE = template_spatial;'
#psql -h $h -p $p -U $u -d postgres -c 'CREATE DATABASE vector WITH OWNER = sde TEMPLATE = template_spatial;'
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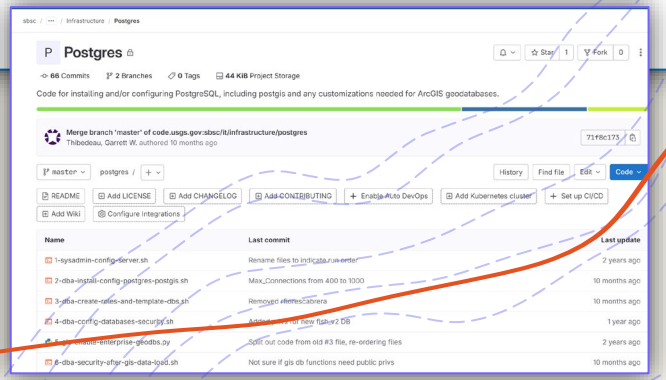
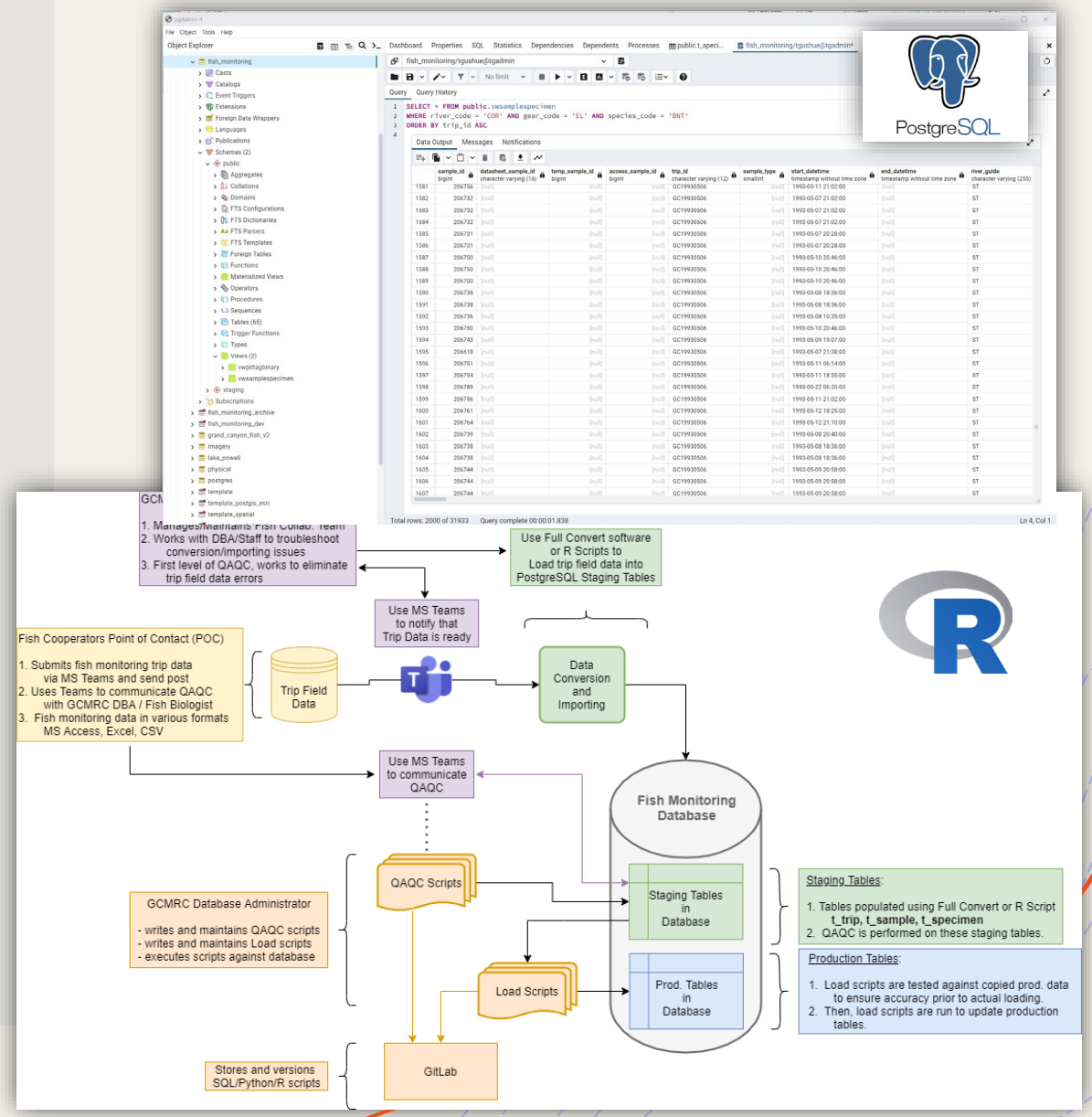


Data Management & Relational Database Administration

- Support for relational databases
  - Fish Monitoring
    - Migration from Oracle to PostgreSQL (2021)
    - Updated Workflow for Data Staging and QAQC (2022-23)
    - Leveraging tools (Microsoft Teams / SharePoint) to collaborate with fish cooperators across the GCDAMP.
  - Lake Powell Water Quality
    - Published release of WQ database (2022)
    - Development of online tools (2023-24)
  - Sandbar Monitoring
  - Riparian Vegetation
- HR / Staffing Challenges
  - Hire 1 or more Database Administrators / Data Scientists into vacant positions
  - Fulfill roles of web and software developers



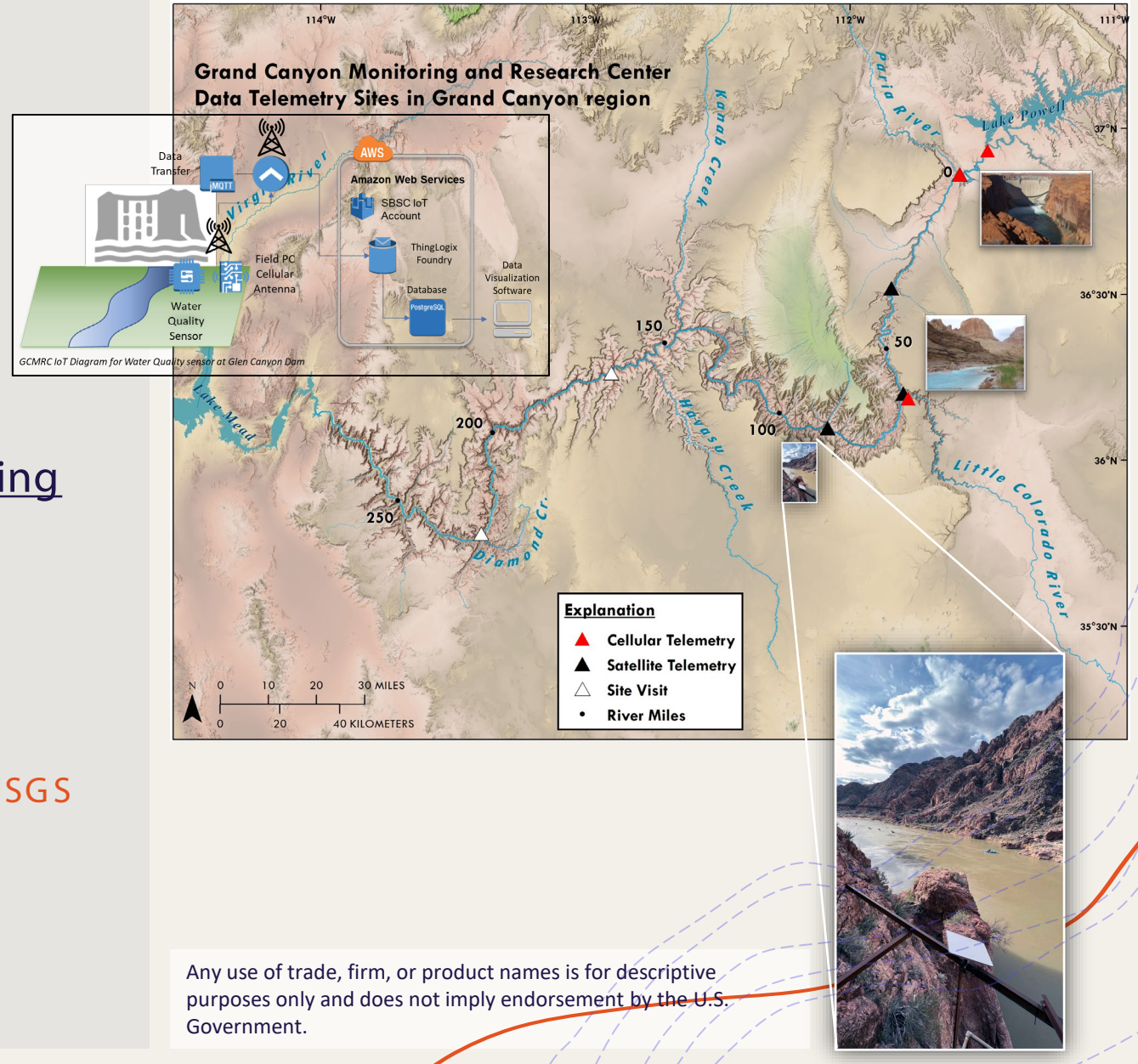
Data Telemetry / Field Engineering / Internet of Things (IoT)

Sensor-to-Cloud data transmission

- Glen Canyon Dam IoT Field Site
- Little Colorado River IoT Site
- Sediment Monitoring / Gauging Stations
  - Low Earth Orbit (LEO) Satellites (New in 2023)
  - 1ST Deployment of its kind within the USGS

Expect Growth Area for Research and Monitoring

- Collaborations with other USGS entities
  - Partnering with USGS Cloud Hosting Solutions (Subsidized $)
  - Coordinating with Ecosystems Mission Area
  - Co-developing a Community of Practice with USGS ACIO
- Investigating Direct-to-Cell beta program (SpaceX)



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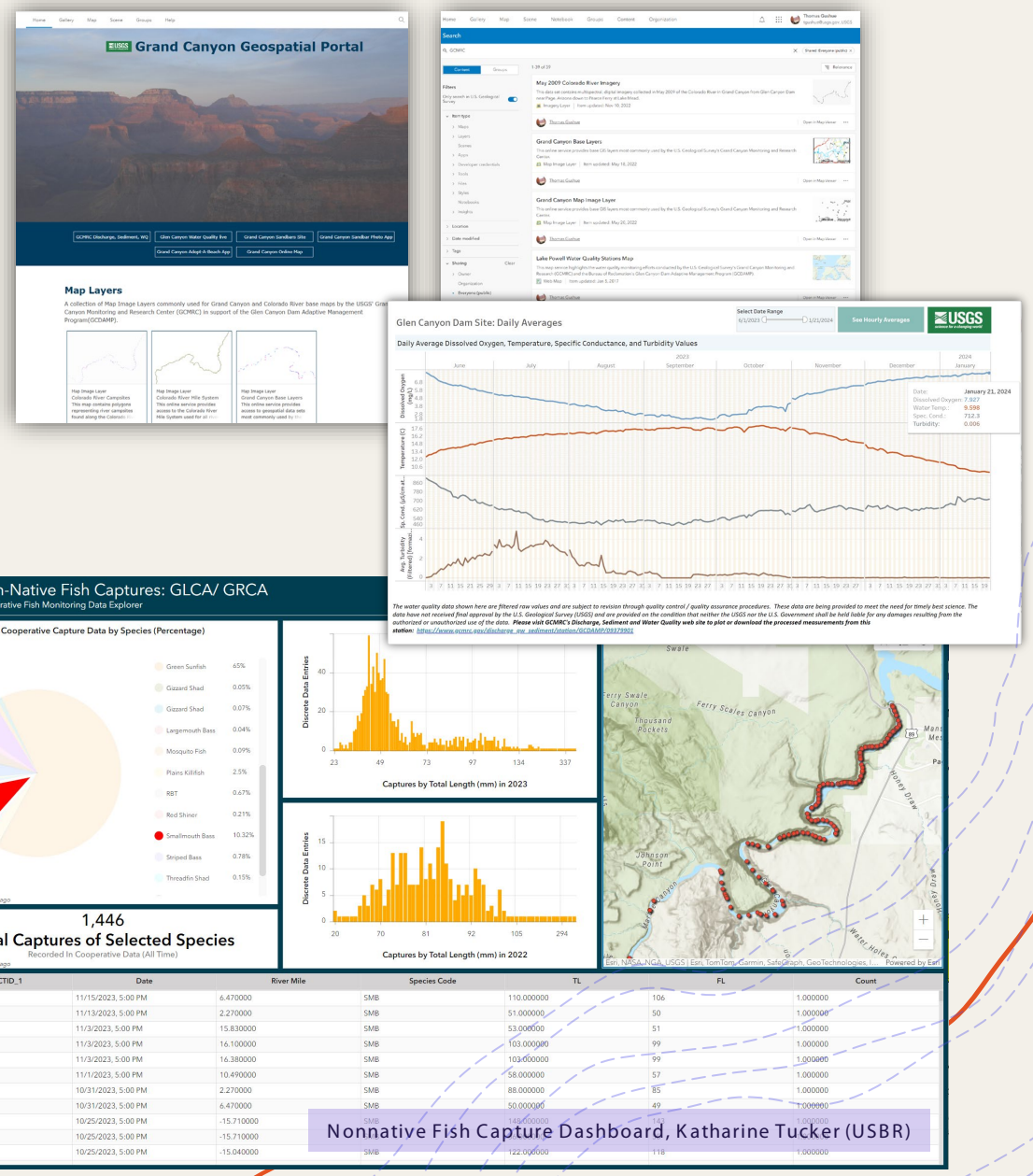
Access to Online Data Resources

Access to Geospatial & Tabular Data Online

- Direct Access to GIS Services
  - https://grandcanyon.usgs.gov/server/rest/services
- Grand Canyon Geospatial Portal
  - https://grandcanyon.usgs.gov/portal
- ESRI's ArcGIS Online platform (Search: "GCMRC")
  - Map layers, Web Maps, Web Apps
- New Custom web-based applications
  - Sandbar Surveys as an Interactive App
  - Fish Monitoring and Rapid Response Apps
- Tools for Collaboration and Discovery
  - Dashboards and Experiences



Nonnative Fish Capture Dashboard, Katharine Tucker (USBR)