Developing and deploying web-based tools to visualize marine animal movement data and explore abundance and trend of pinniped populations

NOAA FISHERIES
Alaska Fisheries Science Center

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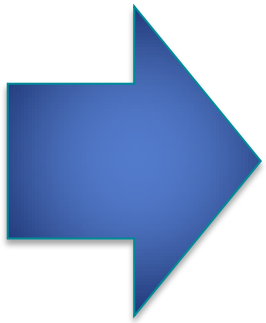
19 November 2015

Alaska Fisheries Science Center developing Shiny web applications

Typical Information Flow

Data Collection & Research Initiatives

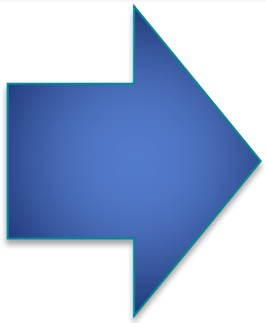
- Legislative and Regulatory Mandates
- Science and Conservation



Typical Information Flow

Data Analysis and Interpretation

- Big(ger) Data
- Highly Technical, Cutting Edge Statistics



Typical Information Flow

Publication

- Peer Reviewed Journals
- White Papers, Internal Memos, Contract Reports
- Status Reviews, Stock Assessment Reports

Analytical Deliverables

Deliverables are …

- Static
- Often, Highly Technical

Should **also** be …

- Interactive
- Flexible

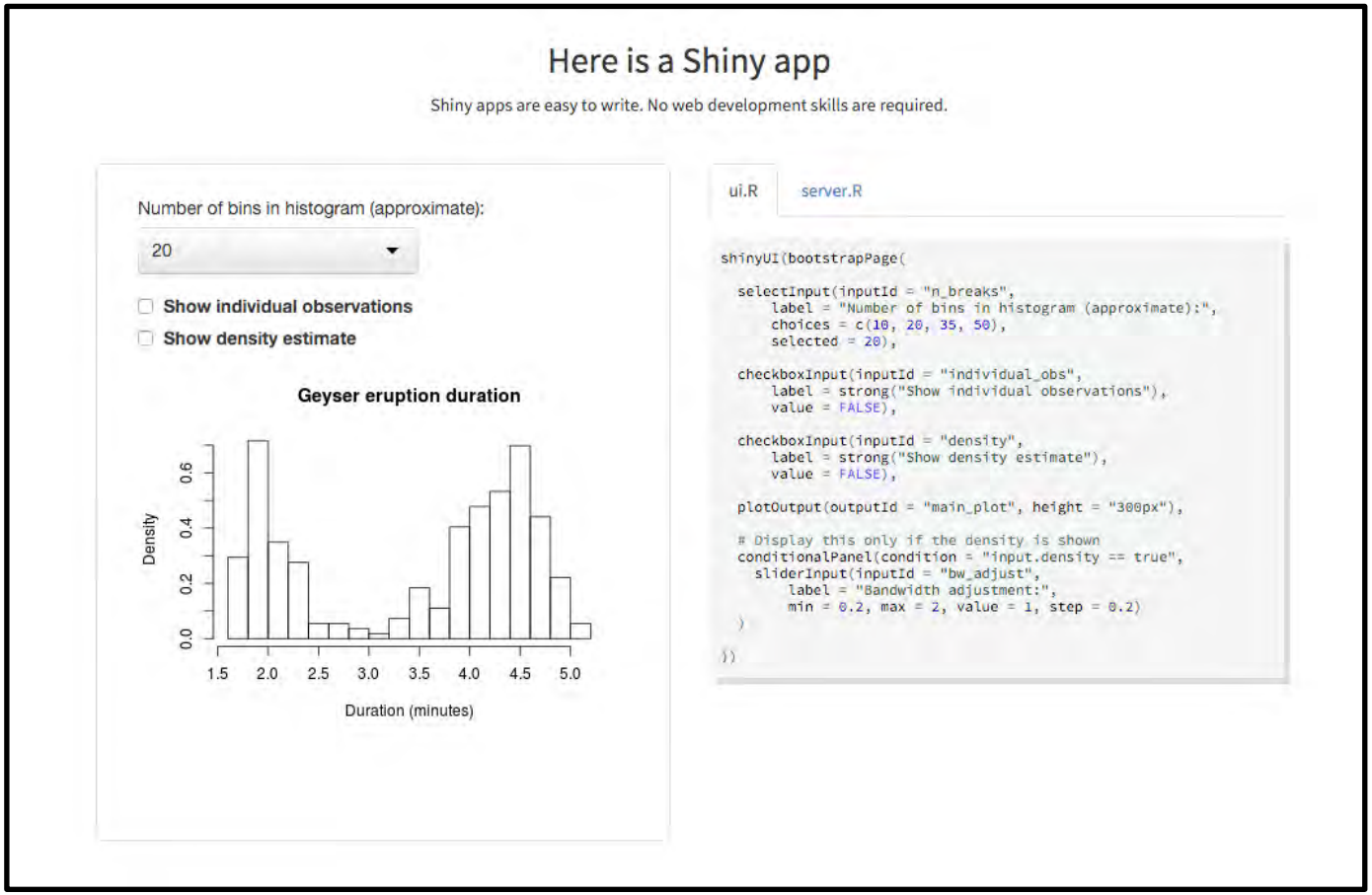
The Modern Internet is Highly Interactive
(e.g. Google Maps, Online Banking)

The Public Expects Similar Interactivity from Government Deliverables & Results

Shiny – It's R, It's Reactive, It's the Web

http://shiny.rstudio.com

Shiny – It's R, It's Reactive, It's the Web



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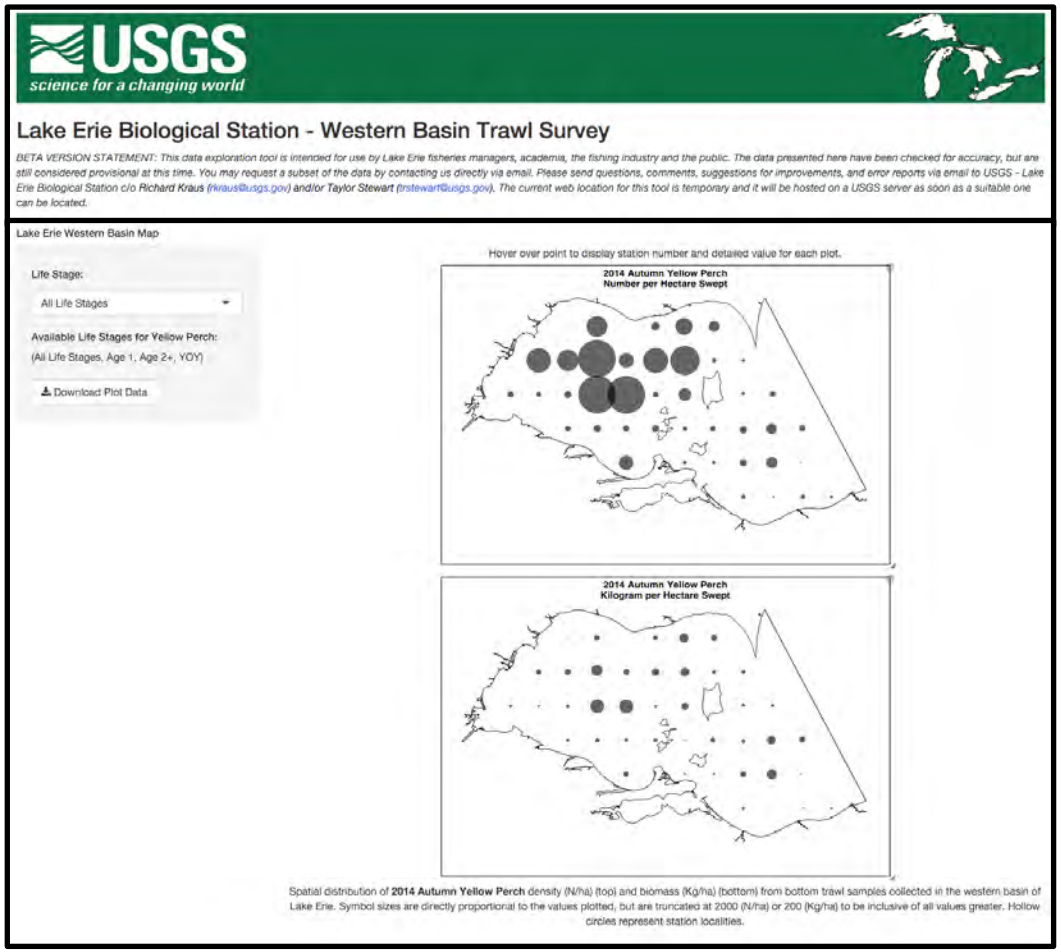
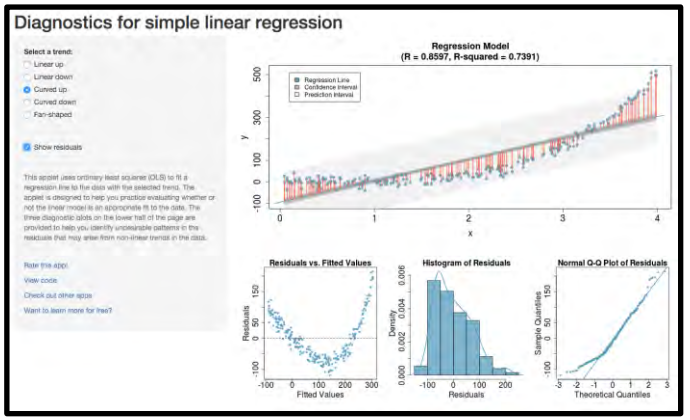
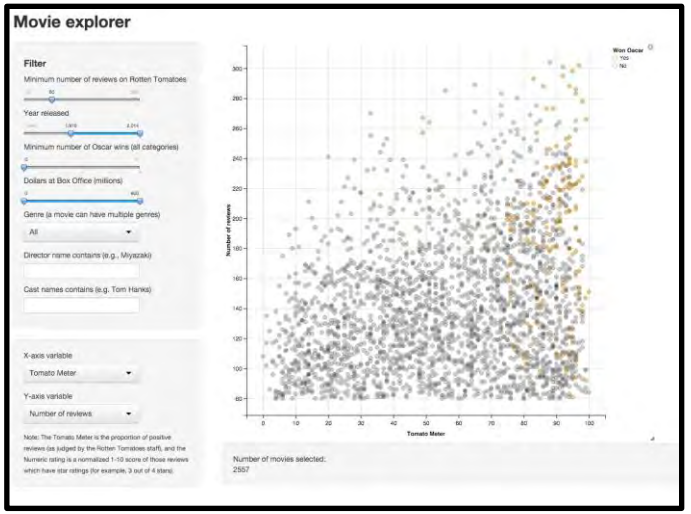
Shiny – It's R, It's Reactive, It's the Web

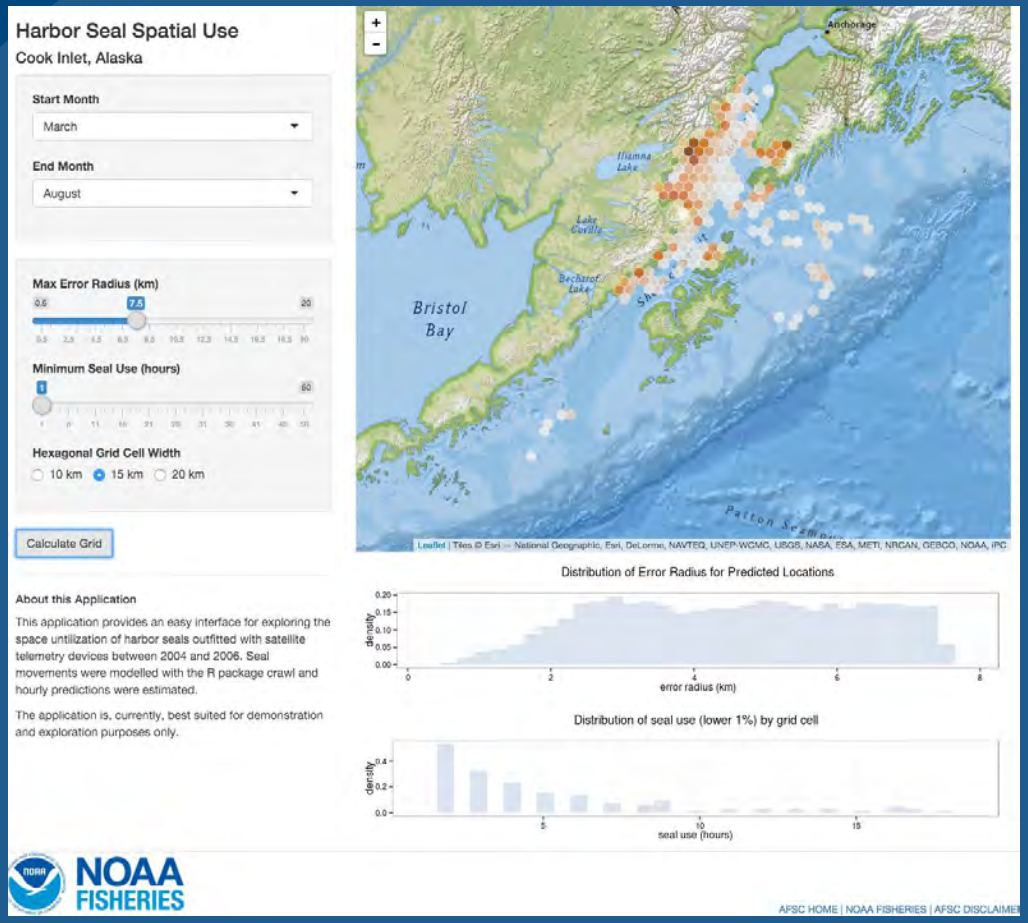






Demo: Harbor Seal Spatial Use

https://jmlondon.shinyapps.io/akpv-cookinlet-app



Shiny Application – Spatial Use of Harbor Seals in Cook Inlet, Alaska

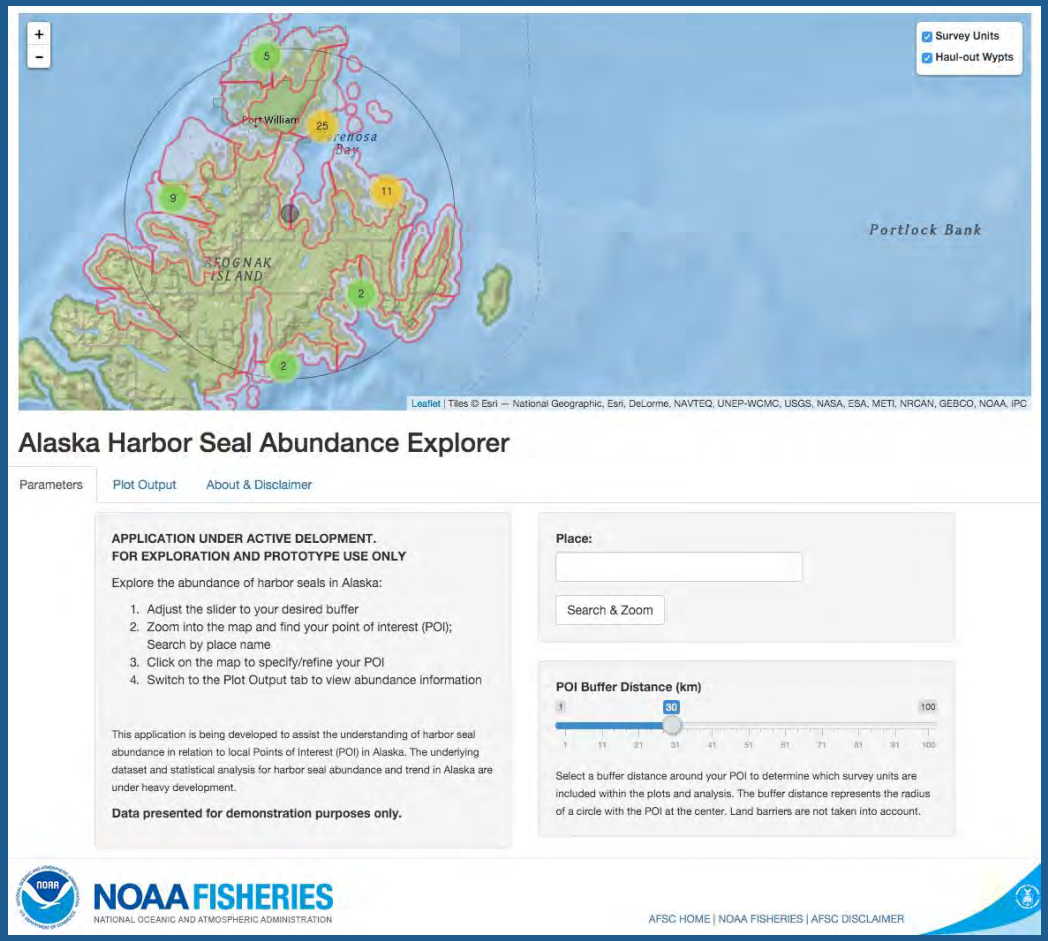
- BOEM/NOAA Collaboration
- Impacts of Oil & Gas Activities
- Incidental Take Authorizations (PR1)
- Built on R-package, crawl

Demo: Harbor Seal Surveys

https://jmlondon.shinyapps.io/akpvsurveys-app

Shiny Application – Abundance of Harbor Seals in Alaska

- One of the Largest Wildlife Regular Wildlife Surveys in the World
- Complex Statistical Analysis to Estimate Abundance
- Incidental Take Authorizations (PR1)
- ADF&G Consultations



Other AFSC Shiny Applications

Distance Sampling

- Line-transect
- Report Generation

Ice Seal Hotspots

- Data Exploration
- Interim Access

Sea Lion Trends

- Flexible Trends
- Population Trajectories

Benefits of Shiny to NOAA Fisheries

- NMFS Scientists can create interactive and engaging scientific products with existing skillsets and expertise (no HTML, Javascript)
- NMFS Managers and Constituents can explore and engage with scientific products without having to also be technical experts or install/acquire special software
- Interaction = Better Science, Better Management

Public Access to Research Results

- Shiny applications complement and enhance NMFS Open Data and Open Science
- Shiny applications provide context to NMFS data and NMFS scientific analysis
- Integration with NMFS Web sites to improve communication of complex issues

Shiny Server Pro --- NMFS Hosted Solution

- Requires Dedicated Server / NMFS Personnel
- Availability to the Internet = High Security Req.
- Requires Dedicated NMFS Support Personnel
- NMFS Controlled = More Customization, Internal Database Access, Confidential Data
  - $15,000/year + Hardware + Maintenance
- Open Source Solution – Internal Testing/Dev
  - $0/year + Hardware + Maintenance

Shinyapps.io --- A Cloud First Option

- Server, Software and Maintenance handled by Rstudio, Inc. --- leading experts in R and Shiny
- Built on Amazon Web Services; 24/7 Uptime
- Integrated and Efficient Deployment of Applications – deploy/update from within the Rstudio IDE
- Professional Subscription: $3,200/year
  - 10,000 Hours of Active Use/month
  - High Performance Computing Backend
  - Domain Customization

Approval/Deployment Process a Burden

The Cloud First policy mandates that agencies take full advantage of cloud computing benefits to maximize capacity utilization, improve IT flexibility and responsiveness, and minimize cost.

- Clear, Best-value for Majority of NMFS
- Much uncertainty remains
- Existing procedures not developed with small business providers in mind

Approval/Deployment Process a Burden

AFSC IT staff were very patient and collaborated to find a viable route to approval

- uncertainty, lack of guidance, and an over-abundance of caution made the process more time consuming than any of us wanted

AFSC Approval for *Shinyapps.io* as a 'Prototype/Demonstration' project for 1 year

- Amazon US East – FedRAMP/FISMA low/moderate
- No Sensitive/Confidential Data

Short Term Needs

- NMFS-level approval for use of *Shinyapps.io* by NMFS Scientists – low/moderate risk data
- Center-level, scientist led teams responsible for managing, deploying and supporting development of Shiny applications
- Collaborate on a series of best practices and guidelines to insure applications are of high quality

Long Term Needs

- Scientists as Software Developers
- Software/Web Apps as Fundamental Research Communications
- Provide Scientists Flexible, Reliable Access to Cloud Infrastructure and Solutions
- Create a ‘Culture of Yes’

NOAA FISHERIES

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Photo credits: John K. Jansen, David E. Withrow
NMFS Research Permit #15126