

NOAA FISHERIES

Alaska Fisheries Science Center

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

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Alaska Fisheries Science Center developing Shiny web applications



NOAA FISHERIES

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

Shiny by RStudio

A web application framework for R Turn your analyses into interactive web applications No HTML, CSS, or JavaScript knowledge required

http://shiny.rstudio.com



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

Number of bins in histogram (approximate):	ui.R server.R
20 👻	shinyUI(bootstrapPage(
 Show individual observations Show density estimate 	<pre>selectInput(inputId = "n_breaks",</pre>
Geyser eruption duration	<pre>checkboxInput(inputId = "individual_obs",</pre>
9	<pre>checkboxInput(inputId = "density",</pre>
	<pre>plotOutput(outputId = "main_plot", height = "300px"), # Display this only if the density is shown</pre>
	<pre>conditionalPanel(condition = "input.density == true", sliderInputId = "bw_adjust", label = "Bandwidth adjustment:", min = 0.2, max = 2, value = 1, step = 0.2)</pre>
	5
Duration (minutes)	

http://shiny.rstudio.com



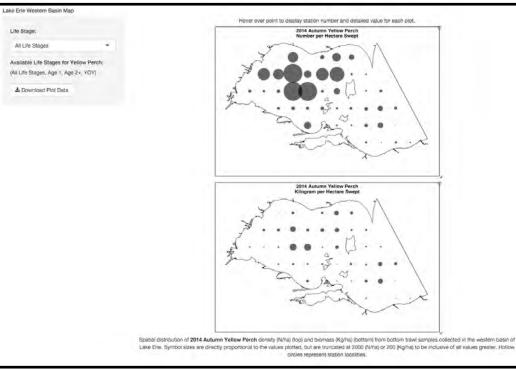
Shiny – It's R, It's Reactive, It's the Web

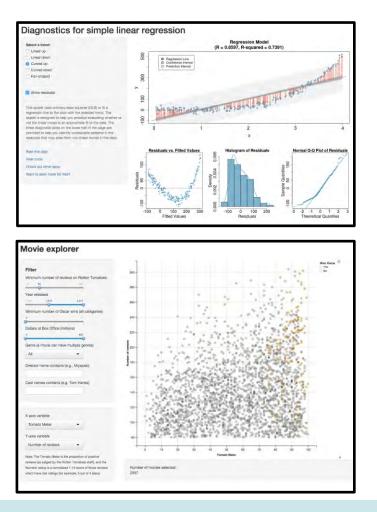




Lake Erie Biological Station - Western Basin Trawl Survey

BETA VERSION STATEMENT: This data exploration tool is intended for use by Lake Erie fisheries managers, academia, the fishing industry and the public. The data presented hare have been checked for accuracy, but are still considered provisional at this time. You may request a subset of the data by contacting us directly via email. Prease send questions, comments, suggestions for improvements, and error reports via email to USGS - Lake Erie Biological Station clo Richard Kraus (knaus@usgs.gov) and/or Taylor Stewart (instewart@usgs.gov). The current web location for this tool is temporary and it will be hosted on a USGS server as soon as a suitable one can be located.











Demo: Harbor Seal Spatial

Use

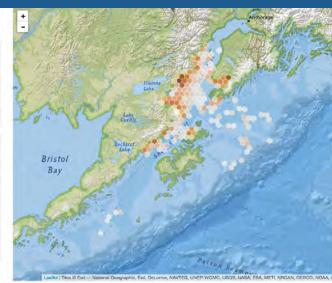
https://jmlondon.shinyapps.io/akpv-cookinlet-app

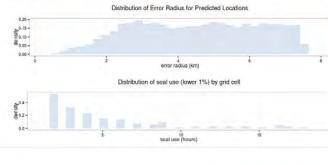
March	-
End Month	
August	
83 25 45 65 85 165 125 145 165 Minimum Seal Use (hours)	HLS H
Minimum Seal Use (hours)	ē
Minimum Seal Use (hours)	ē
Minimum Seal Use (hours)	ē

About this Application

This application provides an easy interface for exploring the space untilization of harbor seals outfitted with satellite telemetry devices between 2004 and 2006. Seal movements were modelled with the R package crawl and hourly predictions were estimated.

The application is, currently, best suited for demonstration and exploration purposes only.





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



Alaska Harbor Seal Abundance Explorer

APPLICATION UNDER ACTIVE DELOPMENT. FOR EXPLORATION AND PROTOTYPE USE ONLY	Place:
Explore the abundance of harbor seals in Alaska:	
 Adjust the slider to your desired buffer Zoom into the map and find your point of interest (POI); Search by place name 	Search & Zoom
3. Click on the map to specify/refine your POI	
4. Switch to the Plot Output tab to view abundance information	POI Buffer Distance (km)
	1 30 100
This application is being developed to assist the understanding of harbor seal	Comparing Compar
bundance in relation to local Points of Interest (POI) in Alaska. The underlying	1 11 21 31 41 51 81 71 81 91 100
lataset and statistical analysis for harbor seal abundance and trend in Alaska are	Select a buffer distance around your POI to determine which survey units are
inder heavy development.	included within the plots and analysis. The buffer distance represents the radius
Data presented for demonstration purposes only.	of a circle with the POI at the center. Land barriers are not taken into account.



Other AFSC Shiny Applications

Distance Sampling

- Line-transect
- Report Generation

Ice Seal Hotspots

- Data Exploration
- Interim Access

Sea Lion TrendsFlexible 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 U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 1

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 overabundance of caution made the process more time consuming than any of us
- AFSC Approval for <u>Shinyapps.io</u> 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 <u>Shinyapps.io</u> by NMFS Scientists –
 - low/moderate risk data
- Center-level, scientist led teams responsible for managing, deploying and supporting development of Shiny
 - annligations
- 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'





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