NOAA FISHERIES

Northwest Fisheries Science Center

Deploying protected species tools via cloud computing

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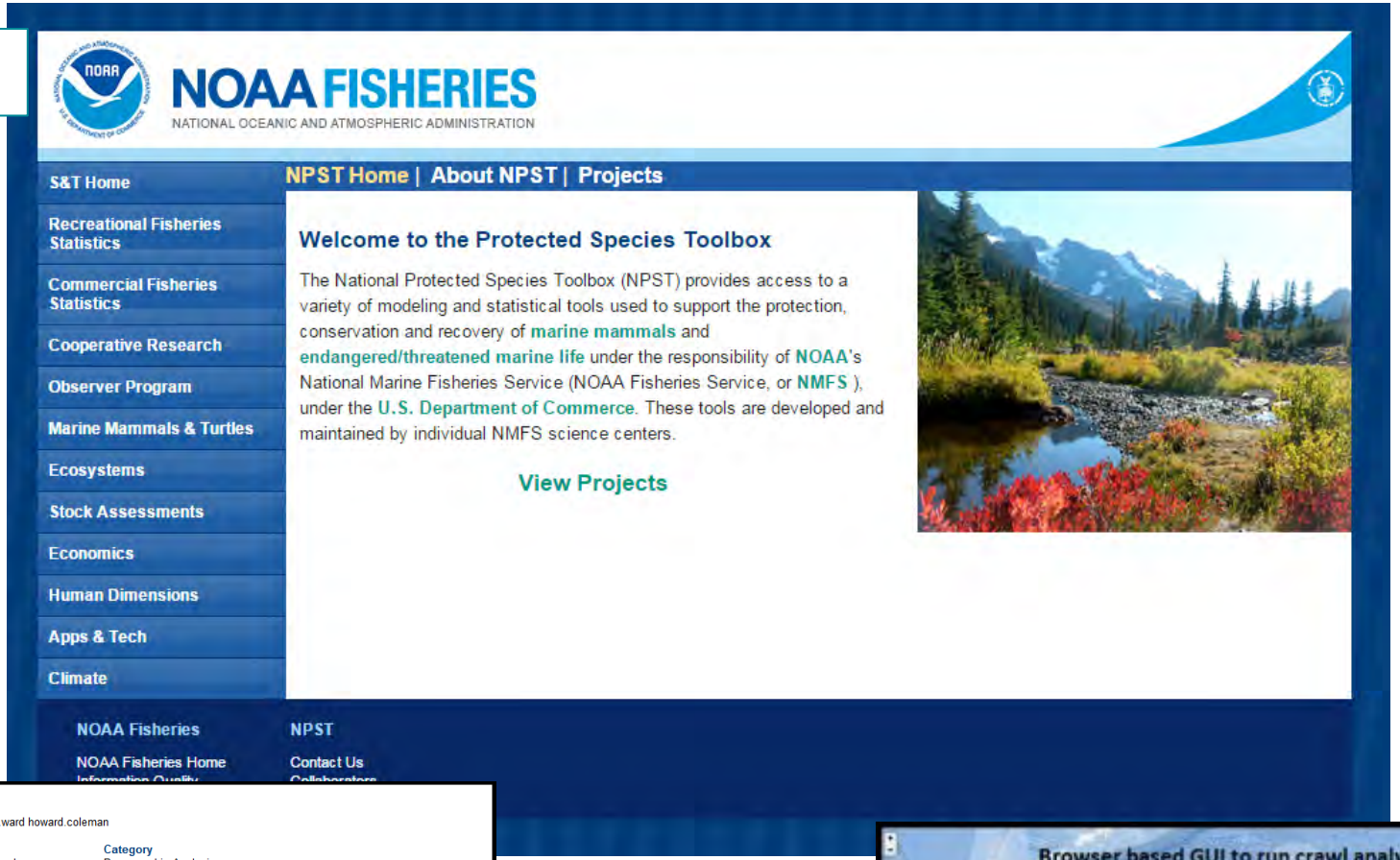
Web-based Protected Species Toolbox and Cloud-based Platform for Running Tools

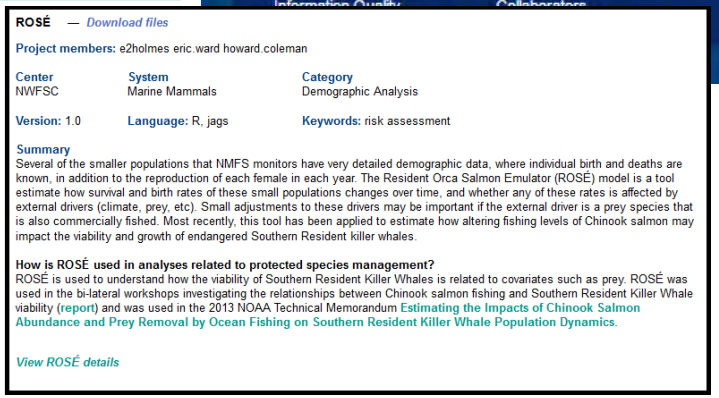
- **PIs:** Eli Holmes and Eric Ward (NWFSC)
- **Goal:** To develop both a website/content manager for protected species tools and browser-based tool interfaces.
- **Importance/Application:**
  - NMFS scientists develop many applications/tools to run sophisticated analyses in support of NMFS Regional Offices.
  - There is currently no cross-center platform to host these tools. Tools existence often unknown across groups.
  - Browser-based interfaces allow NMFS scientists to develop tools that can be run by others with only a browser.

Webpage

Project pages

Browser-based GUIs





ROSÉ — *Download files*

Project members: e2holmes eric.ward howard.coleman

Center	System	Category
NWFSC	Marine Mammals	Demographic Analysis

Version: 1.0 **Language:** R, jags **Keywords:** risk assessment

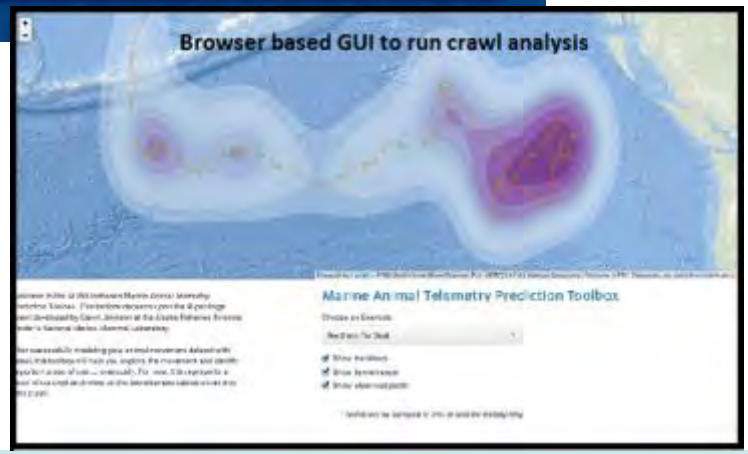
Summary

Several of the smaller populations that NMFS monitors have very detailed demographic data, where individual birth and deaths are known, in addition to the reproduction of each female in each year. The Resident Orca Salmon Emulator (ROSÉ) model is a tool estimate how survival and birth rates of these small populations changes over time, and whether any of these rates is affected by external drivers (climate, prey, etc). Small adjustments to these drivers may be important if the external driver is a prey species that is also commercially fished. Most recently, this tool has been applied to estimate how altering fishing levels of Chinook salmon may impact the viability and growth of endangered Southern Resident killer whales.

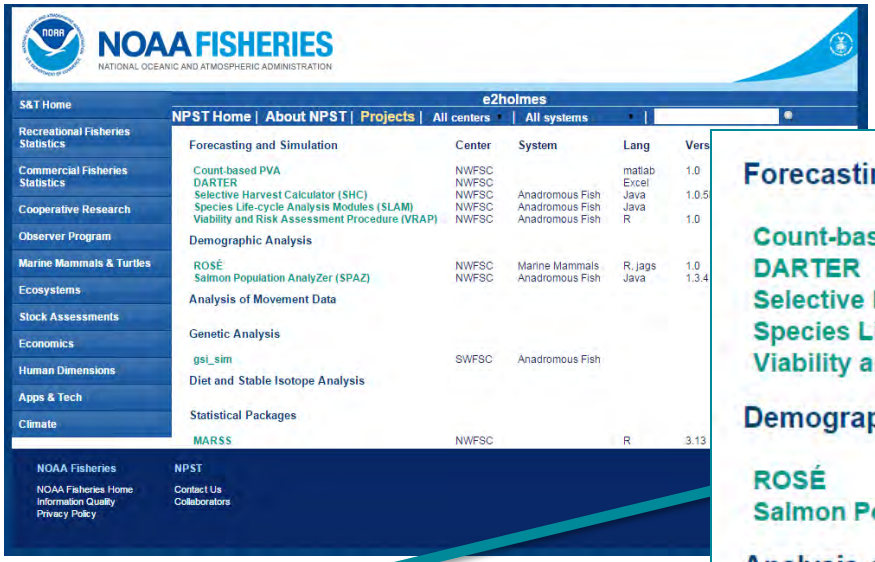
How is ROSÉ used in analyses related to protected species management?

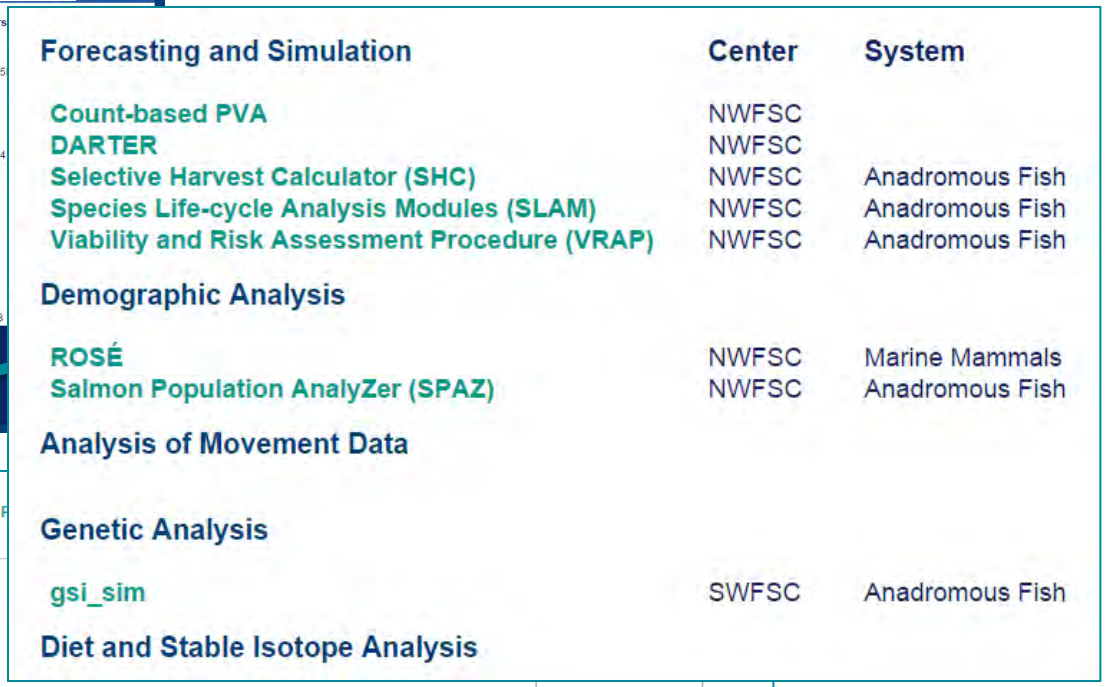
ROSÉ is used to understand how the viability of Southern Resident Killer Whales is related to covariates such as prey. ROSÉ was used in the bi-lateral workshops investigating the relationships between Chinook salmon fishing and Southern Resident Killer Whale viability (report) and was used in the 2013 NOAA Technical Memorandum Estimating the Impacts of Chinook Salmon Abundance and Prey Removal by Ocean Fishing on Southern Resident Killer Whale Population Dynamics.

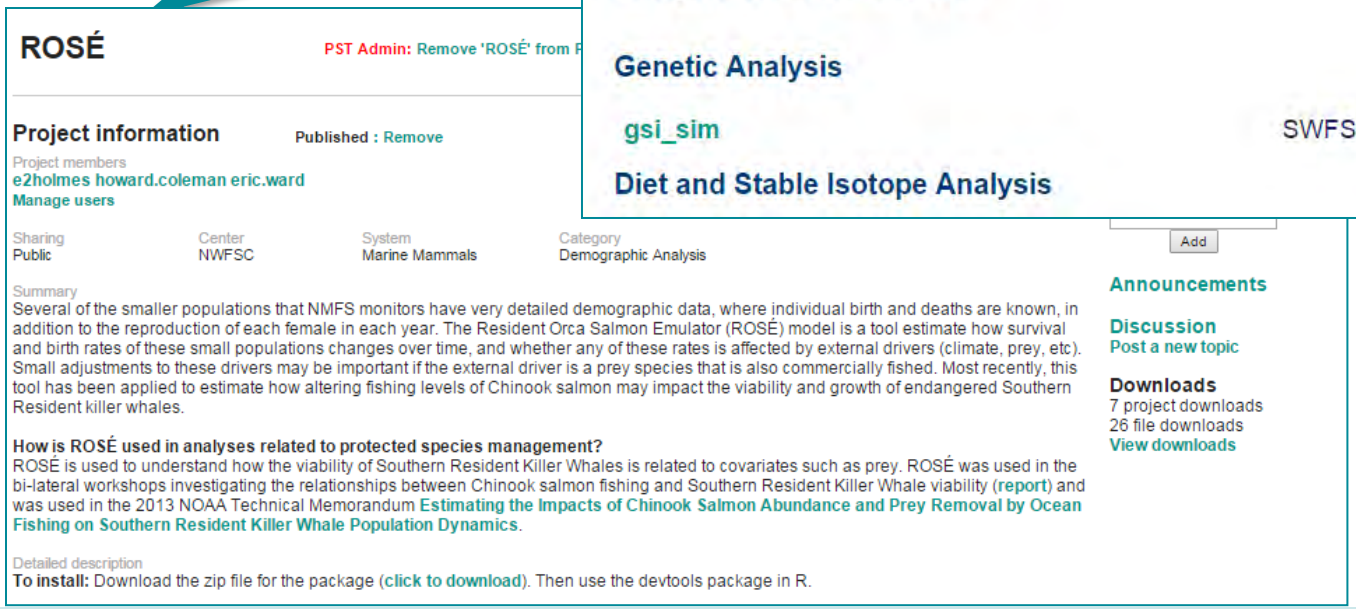
View ROSÉ details



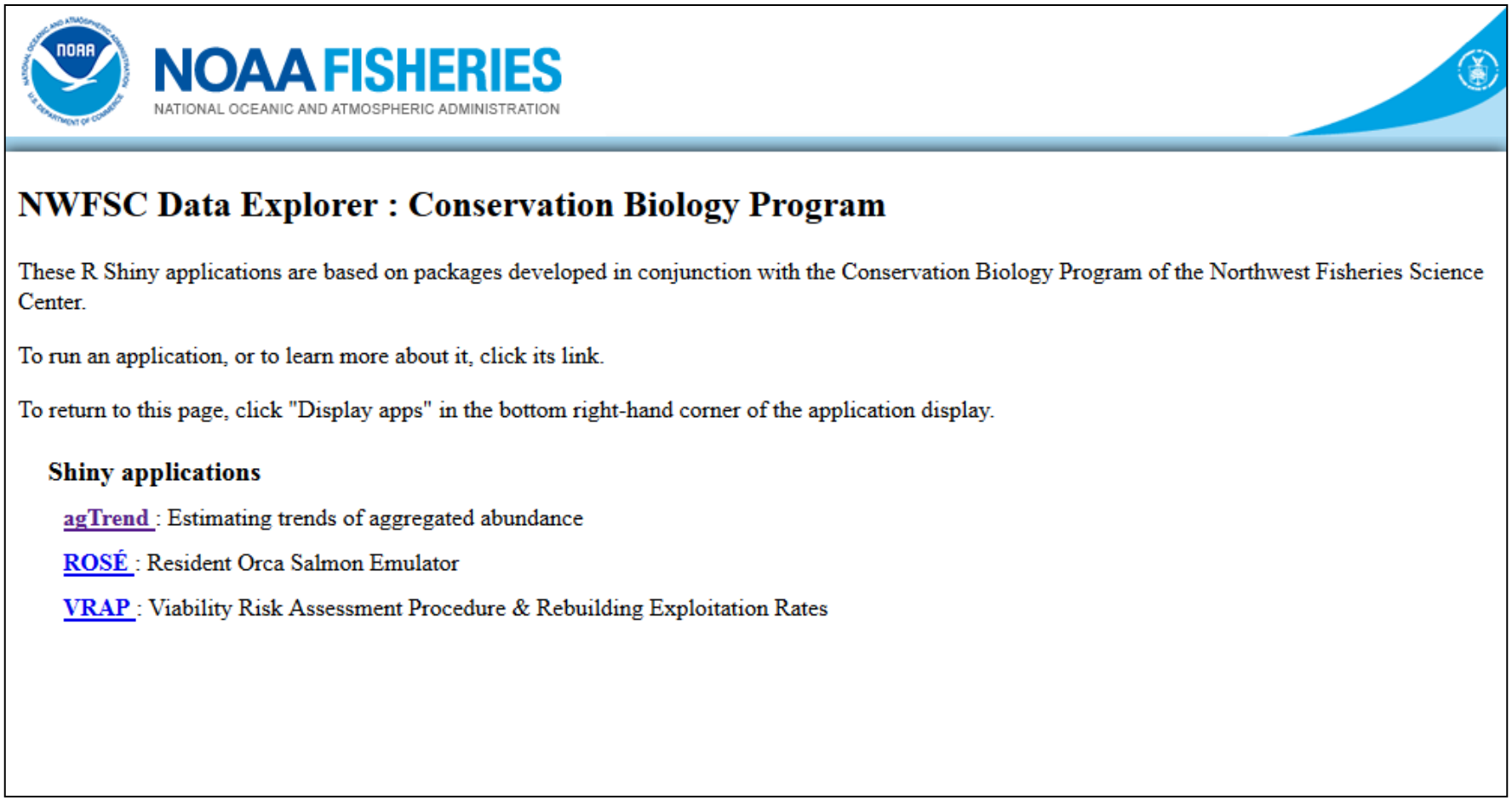
Webpage https://www.st.nmfs.noaa.gov/npst







R Shiny Server https://dataexplorer.northwestscience.fisheries.noaa.gov/



agTrend: AFSC Steller sea lion trend analysis and data visualization
https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/agTrend/

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agTrend

Select data set | Plot data | Fit model | Abundances

Select regions and sites:

Regions:

C ALEU
E ALEU
W ALEU
C GULF

Available sites

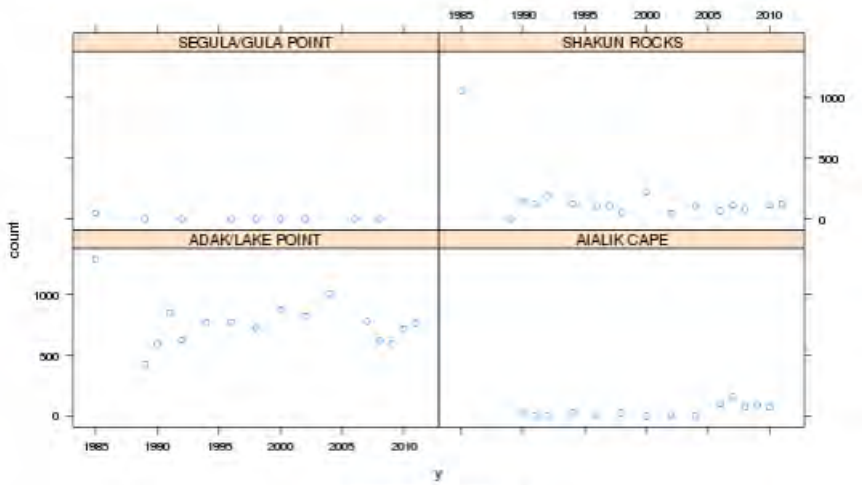
SEAL ROCKS
SEAL ROCKS (KENAI)
SEGUAM/SADDLERIDGE
SEGUAM/TURF POINT
SEGULA/CHUGUL POINT
SEMISOPOCHNOI/PETREL
SEMISOPOCHNOI/POCHNOI
SEMISOPOCHNOI/SW KNOB
SHAW
SHEMYA
SILAK

Selected sites

ADAK/LAKE POINT
AIALIK CAPE
SEGULA/GULA POINT
SHAKUN ROCKS

Plot data

Data plot | Trend summary | Trend plots | Abundance plots | Help | About



Download data plot (pdf)

AFSC | NWFSC | NOAA Fisheries | NOAA | Copyright policy | Disclaimer | Feedback | NOAA customer satisfaction survey | NOAA privacy policy | NOAA information quality | Display apps | Problems with site?

VRAP: NWFSC Tool for estimation of impact of harvest on listed salmonids
https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/VRAP/

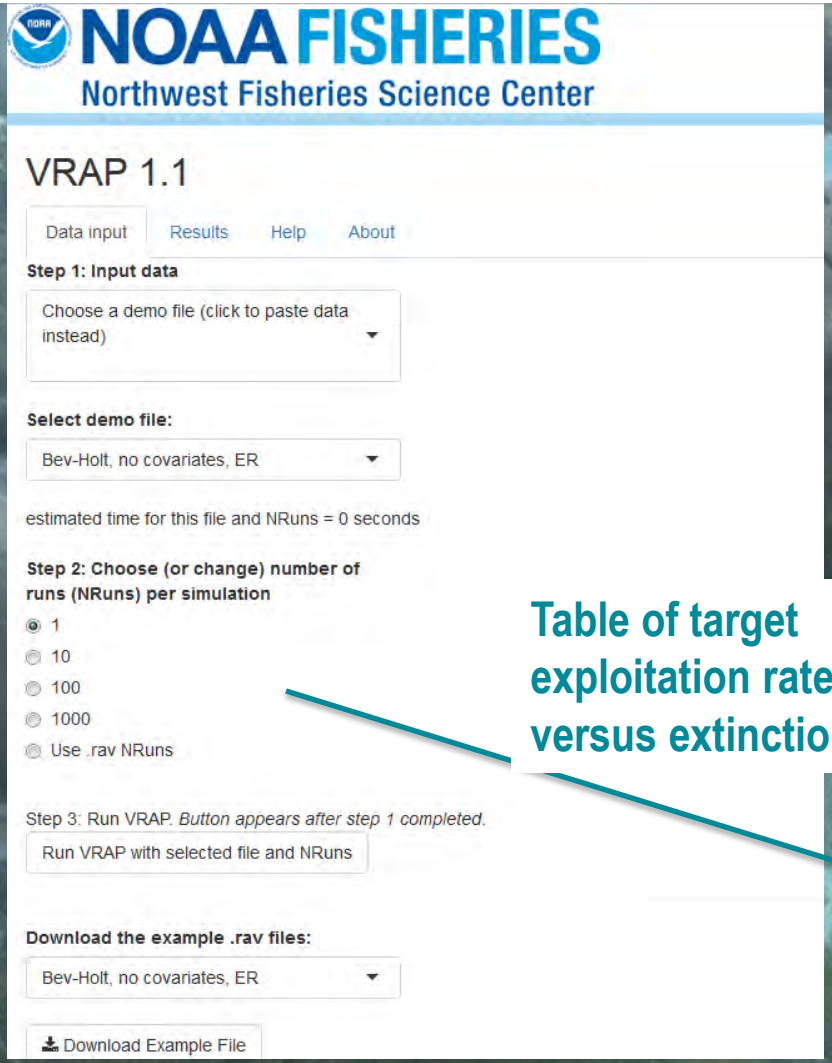
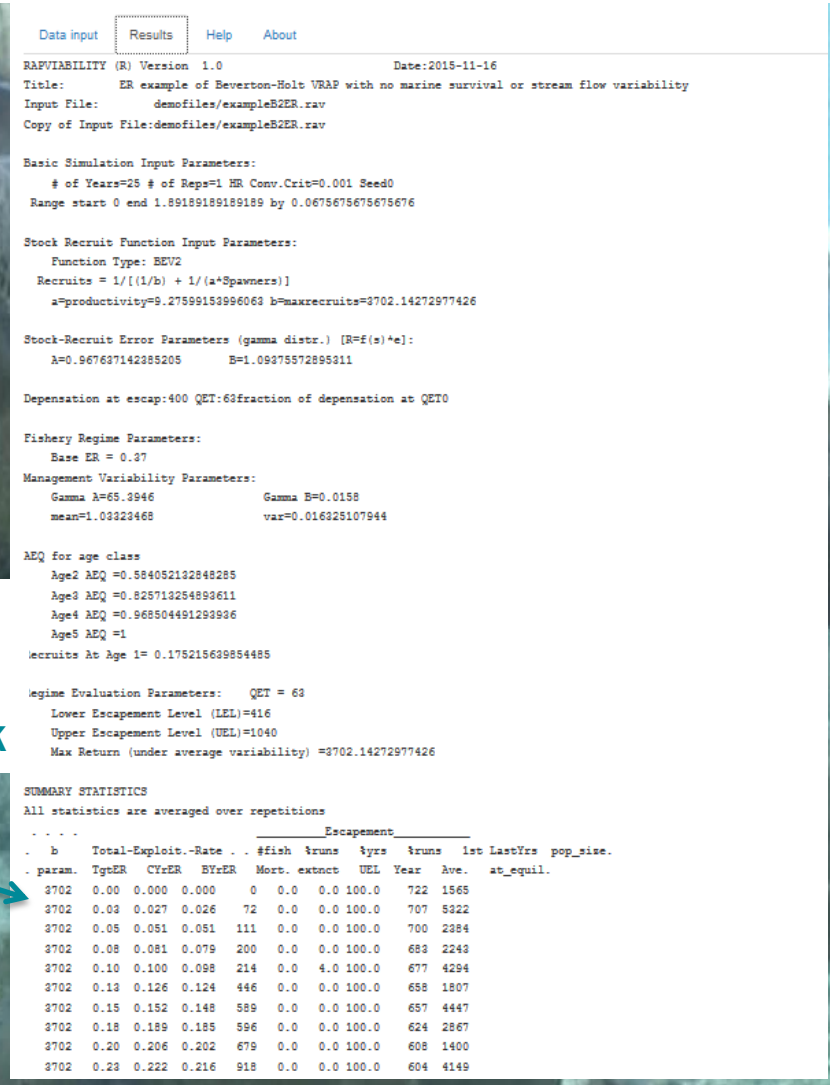
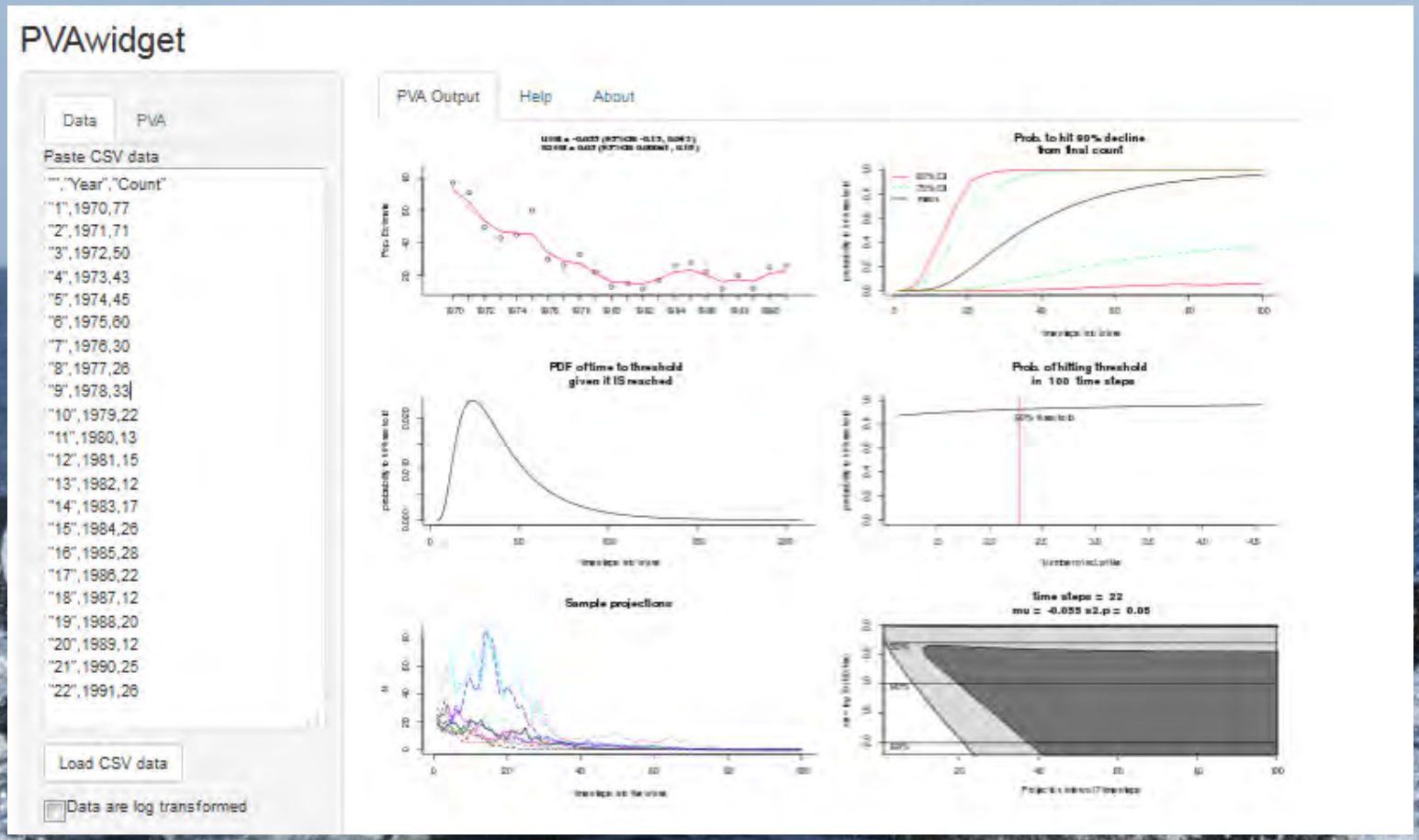


Table of target exploitation rate versus extinction risk



PVAwidget: NWFSC Tool for estimation of extinction risk from count data
https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/PVAwidget



R-based Automated Report (plots/tables) generation
Example from a 5-year status review update

Database (raw data)

```
```{r summary_fig, echo=FALSE,fig.width=8.5,fig.height=11}
par(mfrow=c(3,2))
source("fracwild_tables.R")
total.spawners=matdat.spawners[esus==esuname,,drop=FALSE]
wild.spawners=matdat.wildspawners[esus==esuname,,drop=FALSE]
a=fracwild_table(wild.spawners[pops.to.plot,,drop=FALSE], total.spawners[pops.to.plot,,drop=FALSE])

barplot(table(cut(as.numeric(as.character((a[,5])))
        names.arg=c(as.character(seq(0.1,.9,0.2)),"NA")
        ylim=c(0,dim(a)[1]))
title("Fraction wild across populations 2005-2009")

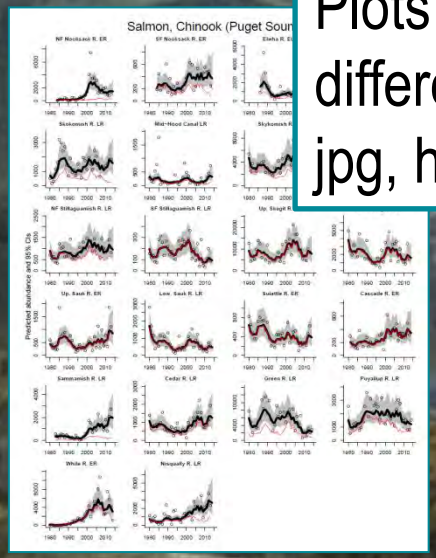
barplot(table(cut(as.numeric(as.character((a[,6])))
        names.arg=c(as.character(seq(0.1,.9,0.2)),"NA")
        ylim=c(0,dim(a)[1]))
title("Fraction wild across populations 2010-2014")

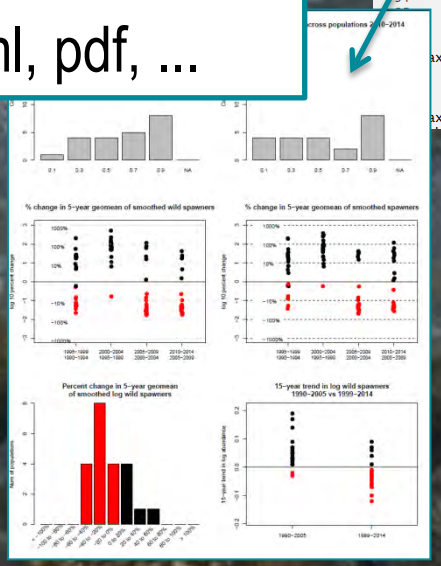
source("geomean_tables.R")
a=geomean_table(pops.to.plot, mpg.to.plot, ifit.total,
vals1=vals2=c()
geo.start=which(names(a)=="MPG")+1
geo.end=which(names(a)=="% Change")-1
for(i in 1:dim(a)[1]){
  vals1=rbind(vals1, as.numeric(apply(a[i,geo.start:geo
  vals=apply(a[i,geo.start:geo.end],2,function(x){str_s
  vals=sapply(vals,function(x){str_split(x,"[)]")[[1]]
  vals2=rbind(vals2, as.numeric(vals))
}

plot(0:5,0:5,xlim=c(0,4.5),ylim=c(-1*log10(1000),log10
     ylab="log 10 percent change", xlab="")
for(i in 1:(dim(vals1)[2]-1)){
  n=dim(vals2)[1]
  vals=100*(vals1[,i+1]-vals1[,i])/vals1[,i]
  points(i+rnorm(n,0,0.01),ifelse(vals<0,-1,1)*log10(ab
         cex=1.5, pch=19,col=ifelse(vals<0,"red","black
}
axis(side=1, at=1:4, label=c("1995-1999\n1990-1994"
```

R code embedded in a report generation framework (knitr/Sweave)

Plots and tables in different formats: jpg, html, pdf, ...





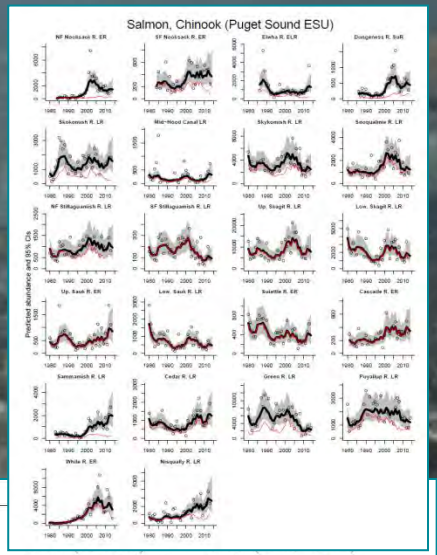
Population	MPG	1990-2005	1999-2014
NF Nooksack R. ER	Strait of Georgia	0.07 (0.04, 0.09)	0.04 (0, 0.07)
SF Nooksack R. ER	Strait of Georgia	0.03 (0, 0.06)	-0.06 (-0.1, -0.02)
Elwha R. ER	SJF	-0.02 (-0.06, 0.02)	-0.06 (-0.1, -0.03)
Dungeness R. ER	SJF	0.14 (0.08, 0.19)	0.09 (0.03, 0.14)
Skokomish R. LR	Hood Canal	0.02 (-0.01, 0.05)	-0.07 (-0.11, -0.02)
Mid-Hood Canal LR	Hood Canal	0.03 (0, 0.07)	-0.07 (-0.11, -0.02)
Skykomish R. LR	Whidbey Basin	0.03 (0, 0.06)	-0.02 (-0.04, 0.01)
Snoqualmie R. LR	Whidbey Basin	0.09 (0.05, 0.12)	-0.05 (-0.08, -0.03)
NF Stillaguamish R. LR	Whidbey Basin	0.04 (0.02, 0.06)	-0.04 (-0.06, -0.01)
SF Stillaguamish R. LR	Whidbey Basin	0.01 (-0.01, 0.03)	-0.1 (-0.12, -0.08)
Up. Skagit R. LR	Whidbey Basin	0.07 (0.05, 0.09)	-0.03 (-0.06, 0)
Low. Skagit R. LR	Whidbey Basin	0.05 (0.02, 0.09)	-0.03 (-0.06, -0.01)
Up. Sauk R. ER	Whidbey Basin	0.01 (-0.02, 0.04)	0.06 (0.04, 0.08)
Low. Sauk R. LR	Whidbey Basin	0.05 (0.01, 0.08)	-0.04 (-0.07, -0.01)
Suiattle R. ER	Whidbey Basin	0.01 (-0.01, 0.03)	-0.01 (-0.04, 0.01)
Cascade R. ER	Whidbey Basin	0.06 (0.04, 0.08)	0.01 (-0.01, 0.03)
Sammamish R. LR	Central/South Sound	0.17 (0.11, 0.23)	-0.02 (-0.06, 0.02)
Cedar R. LR	Central/South Sound	0.03 (0, 0.06)	0.07 (0.05, 0.1)
Green R. LR	Central/South Sound	0.02 (-0.02, 0.06)	-0.12 (-0.16, -0.09)
Puyallup R. LR	Central/South Sound	-0.03 (-0.05, -0.02)	-0.06 (-0.08, -0.03)
White R. ER	Central/South Sound	0.19 (0.17, 0.21)	-0.03 (-0.08, 0.01)
Nisqually R. LR	Central/South Sound	0.05 (0.03, 0.06)	-0.01 (-0.05, 0.03)
```

R-based Automated Report (plots/tables) generation
Example from a 5-year status review update

Advantages

- Standardization
- Transparency ("reproducibility")
- Vastly reduces time to update tables and figures
- Reduces errors
- Easily make analyses available (shiny apps)

6-8 plots
3-5 tables
13 DPS
1-22 pops per DPS



Population	MPG		
NF Nooksack R. ER	Strait of Georgia		
SF Nooksack R. ER	Strait of Georgia		
Elwha R. ELR	SJF	-0.02 (-0.06, 0.02)	-0.06 (-0.1, -0.03)
Dungeness R. SuR	SJF	0.14 (0.08, 0.19)	0.09 (0.03, 0.14)
Skokomish R. LR	Hood Canal	0.02 (-0.01, 0.05)	-0.07 (-0.11, -0.02)
Mid-Hood Canal LR	Hood Canal	0.03 (0, 0.07)	-0.07 (-0.11, -0.02)
Skykomish R. LR	Whidbey Basin	0.03 (0, 0.06)	-0.02 (-0.04, 0.01)
Snoqualmie R. LR	Whidbey Basin	0.09 (0.05, 0.12)	-0.05 (-0.08, -0.03)
NF Stillaguamish R. LR	Whidbey Basin	0.04 (0.02, 0.06)	-0.04 (-0.06, -0.01)
SF Stillaguamish R. LR	Whidbey Basin	0.01 (-0.01, 0.03)	-0.1 (-0.12, -0.08)
Up. Skagit R. LR	Whidbey Basin	0.07 (0.05, 0.09)	-0.03 (-0.06, 0)
Low. Skagit R. LR	Whidbey Basin	0.05 (0.02, 0.09)	-0.03 (-0.06, -0.01)
Up. Sauk R. ER	Whidbey Basin	0.01 (-0.02, 0.04)	0.06 (0.04, 0.08)
Low. Sauk R. LR	Whidbey Basin	0.05 (0.01, 0.08)	-0.04 (-0.07, -0.01)
Suiattle R. ER	Whidbey Basin	0.01 (-0.01, 0.03)	-0.01 (-0.04, 0.01)
Cascade R. ER	Whidbey Basin	0.06 (0.04, 0.08)	0.01 (-0.01, 0.03)
Sammamish R. LR	Central/South Sound	0.17 (0.11, 0.23)	-0.02 (-0.06, 0.02)
Cedar R. LR	Central/South Sound	0.03 (0, 0.06)	0.07 (0.05, 0.1)
Green R. LR	Central/South Sound	0.02 (-0.02, 0.06)	-0.12 (-0.16, -0.09)
Puyallup R. LR	Central/South Sound	-0.03 (-0.05, -0.02)	-0.06 (-0.08, -0.03)
White R. ER	Central/South Sound	0.19 (0.17, 0.21)	-0.03 (-0.08, 0.01)
Nisqually R. LR	Central/South Sound	0.05 (0.03, 0.06)	-0.01 (-0.05, 0.03)

Web-based Protected Species Toolbox and Cloud-based Platform for Running Tools

- **Project accomplishments:**
  - Content manager website built (meets NOAA IT certifications)
  - https://www.st.nmfs.noaa.gov/npst
  - Public R/Shiny server established at NWFSC
  - https://dataexplorer.northwestscience.fisheries.noaa.gov/
  - Multiple R shiny applications (agTrend, VRAP, ROSE, Growth, PVAwidget)