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Northwest Fisheries Science Center

Deploying protected species tools via cloud computing

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Northwest Fisheries Science Center
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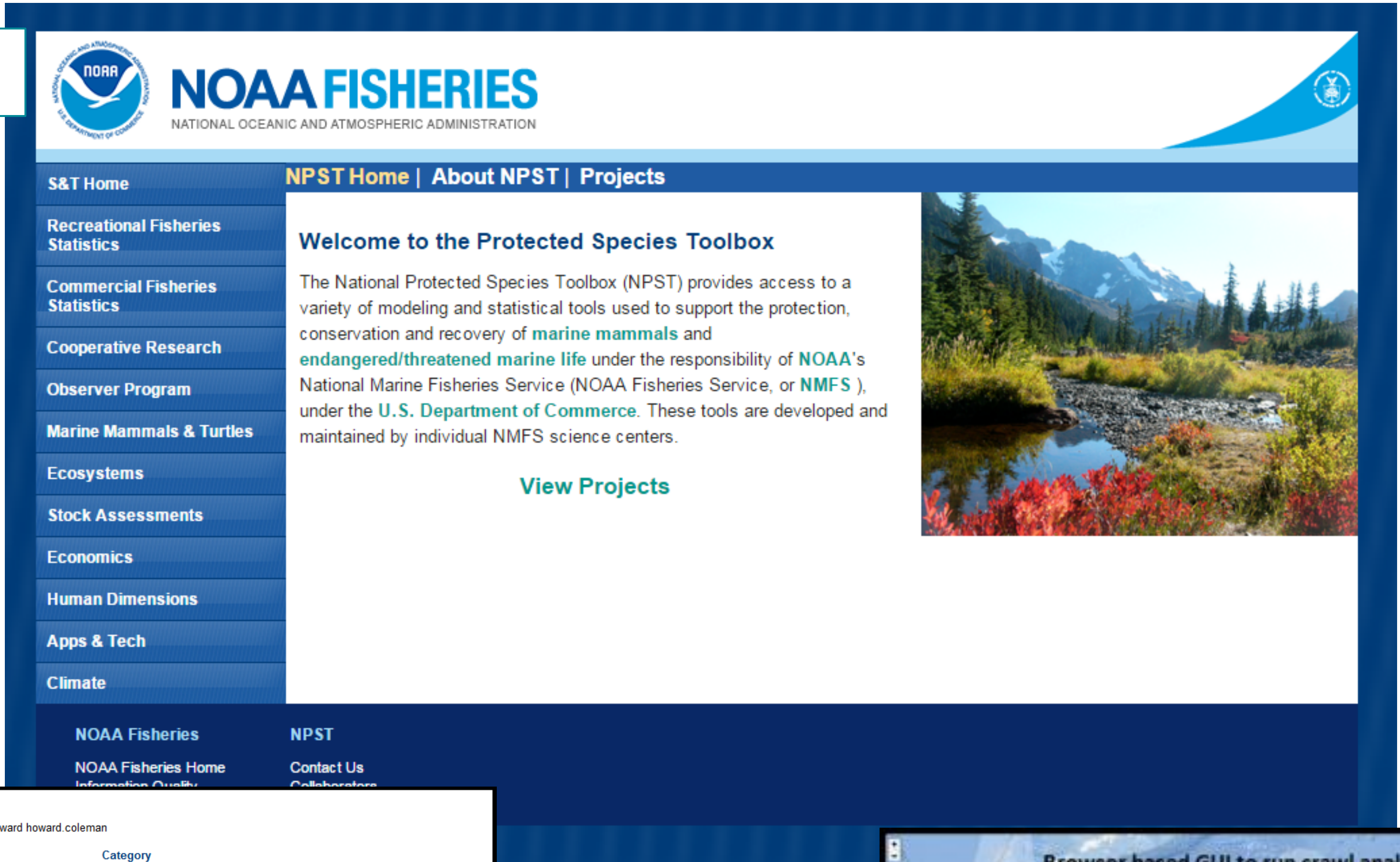
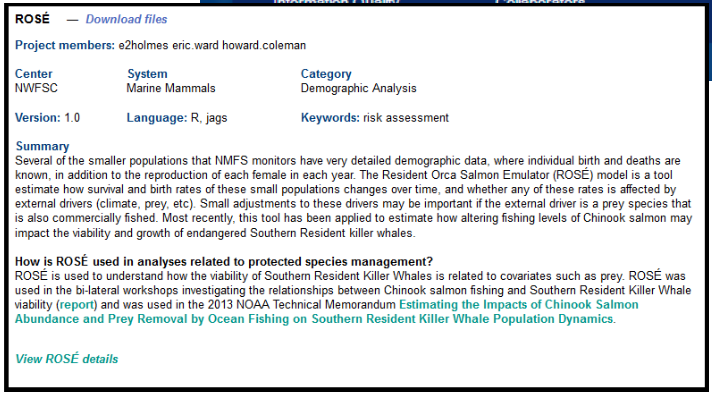
Web-based Protected Species Toolbox and Cloud-based Platform for Running Tools

- **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


ROSÉ — *Download files*

Project members: e2holmes eric.ward howard.coleman

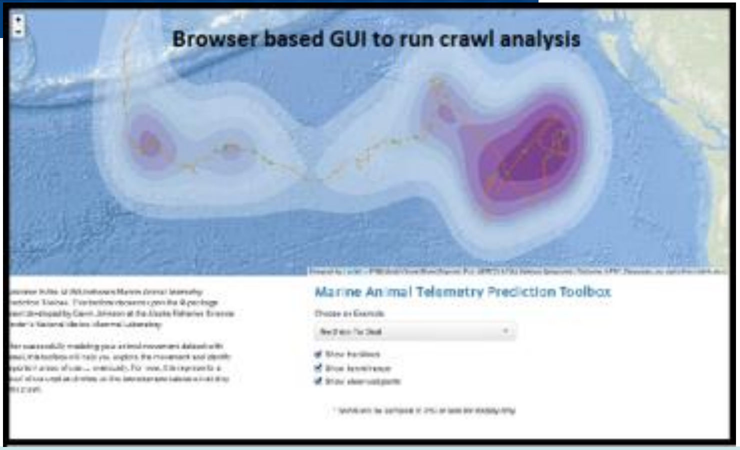
Center	System	Category
NWFSC	Marine Mammals	Demographic Analysis
Version: 1.0	**Language:** R, jags	**Keywords:** risk assessment

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

Browser-based GUIs



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

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e2holmes

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Forecasting and Simulation	Center	System	Lang	Vers
Count-based PVA	NWFSC		matlab	1.0
DARTER	NWFSC		Excel	
Selective Harvest Calculator (SHC)	NWFSC	Anadromous Fish	Java	1.0.5
Species Life-cycle Analysis Modules (SLAM)	NWFSC	Anadromous Fish	Java	
Viability and Risk Assessment Procedure (VRAP)	NWFSC	Anadromous Fish	R	1.0
Demographic Analysis				
ROSÉ	NWFSC	Marine Mammals	R, jags	1.0
Salmon Population AnalyZer (SPAZ)	NWFSC	Anadromous Fish	Java	1.3.4
Analysis of Movement Data				
Genetic Analysis				
gsi_sim	SWFSC	Anadromous Fish		
Diet and Stable Isotope Analysis				
Statistical Packages				
MARSS	NWFSC		R	3.13

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Forecasting and Simulation	Center	System
Count-based PVA	NWFSC	
DARTER	NWFSC	
Selective Harvest Calculator (SHC)	NWFSC	Anadromous Fish
Species Life-cycle Analysis Modules (SLAM)	NWFSC	Anadromous Fish
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Demographic Analysis		
ROSÉ	NWFSC	Marine Mammals
Salmon Population AnalyZer (SPAZ)	NWFSC	Anadromous Fish
Analysis of Movement Data		
Genetic Analysis		
gsi_sim	SWFSC	Anadromous Fish
Diet and Stable Isotope Analysis		

ROSÉ

PST Admin: Remove 'ROSÉ' from P

Project information

Published : Remove

Project members
e2holmes howard.coleman eric.ward
Manage users

Sharing	Center	System	Category
Public	NWFSC	Marine Mammals	Demographic Analysis

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.

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Detailed description
To install: Download the zip file for the package (click to download). Then use the devtools package in R.

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

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NWFSC Data Explorer : Conservation Biology Program

These R Shiny applications are based on packages developed in conjunction with the Conservation Biology Program of the Northwest Fisheries Science Center.

To run an application, or to learn more about it, click its link.

To return to this page, click "Display apps" in the bottom right-hand corner of the application display.

Shiny applications

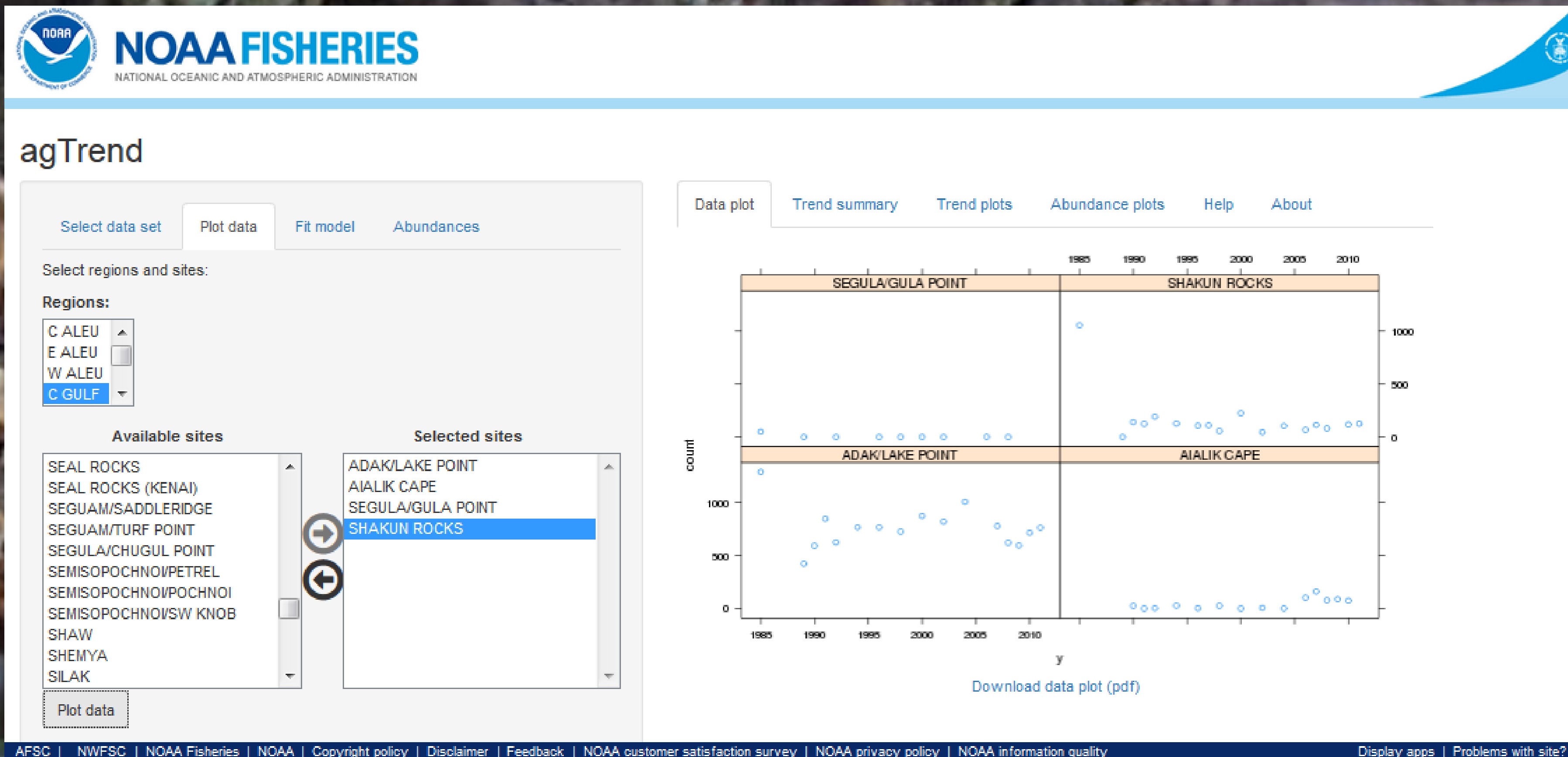
agTrend : Estimating trends of aggregated abundance

ROSÉ : Resident Orca Salmon Emulator

VRAP : Viability Risk Assessment Procedure & Rebuilding Exploitation Rates

agTrend: AFSC Steller sea lion trend analysis and data visualization

https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/agTrend/



VRAP: NWFSC Tool for estimation of impact of harvest on listed salmonids

https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/VRAP/

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VRAP 1.1

Data input | Results | Help | About

Step 1: Input data

Choose a demo file (click to paste data instead)

Select demo file:

Bev-Holt, no covariates, ER

estimated time for this file and NRuns = 0 seconds

Step 2: Choose (or change) number of runs (NRuns) per simulation

- (•) 1
- ( ) 10
- ( ) 100
- ( ) 1000
- ( ) Use .rav NRuns

Step 3: Run VRAP. *Button appears after step 1 completed.*

Run VRAP with selected file and NRuns

Download the example .rav files:

Bev-Holt, no covariates, ER

Download Example File

Table of target exploitation rate versus extinction risk

VRAP 1.1

Data input | Results | Help | About

```
RAPVIABILITY (R) Version  1.0                    Date:2015-11-16
Title:        ER example of Beverton-Holt VRAP with no marine survival or stream flow variability
Input File:        demofiles/exampleB2ER.rav
Copy of Input File:demofiles/exampleB2ER.rav

Basic Simulation Input Parameters:
    # of Years=25 # of Reps=1 HR Conv.Crit=0.001 Seed0
 Range start 0 end 1.89189189189189 by 0.0675675675675676

Stock Recruit Function Input Parameters:
    Function Type: BEV2
  Recruits = 1/[(1/b) + 1/(a*Spawners)]
    a=productivity=9.27599153996063 b=maxrecruits=3702.14272977426

Stock-Recruit Error Parameters (gamma distr.) [R=f(s)*e]:
    A=0.967637142385205       B=1.09375572895311

Depensation at escap:400 QET:63fraction of depensation at QET0

Fishery Regime Parameters:
    Base ER = 0.37
Management Variability Parameters:
    Gamma A=65.3946               Gamma B=0.0158
    mean=1.0332346B               var=0.016325107944

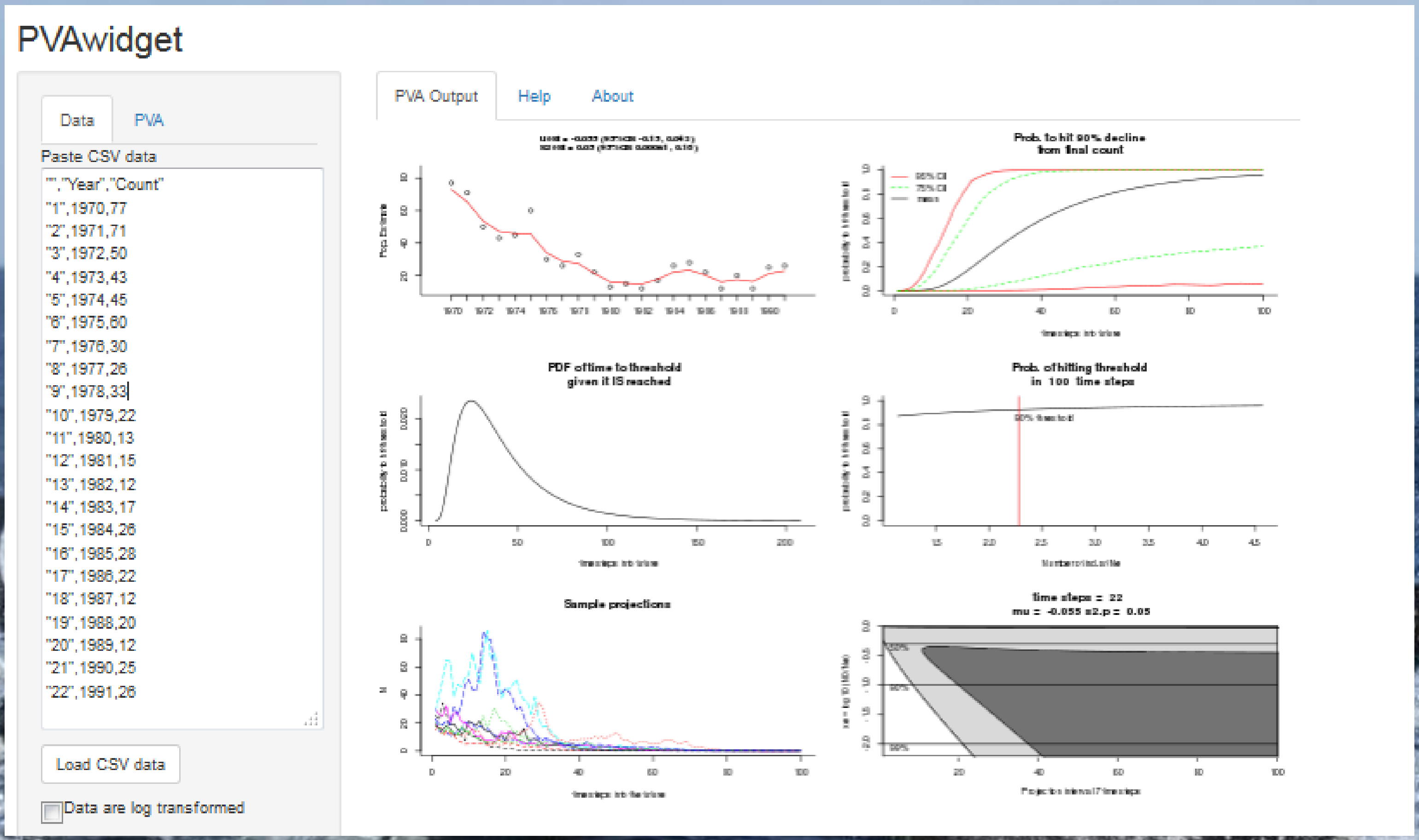
AEQ for age class
    Age2 AEQ =0.584052132848285
    Age3 AEQ =0.825713254893611
    Age4 AEQ =0.968504491293936
    Age5 AEQ =1
lecruits At Age 1= 0.175215639854485

legime Evaluation Parameters:    QET = 63
    Lower Escapement Level (LEL)=416
    Upper Escapement Level (UEL)=1040
    Max Return (under average variability) =3702.14272977426

SUMMARY STATISTICS
All statistics are averaged over repetitions
```

b param.	Total-Exploit.-Rate TgtER	CYrER	BYrER	#fish Mort.	%runs extnct	%yrs UEL (Escapement)	%runs 1st Year	LastYrs Ave.	pop_size. at_equil.
3702	0.00	0.000	0.000	0	0.0	0.0	100.0	722	1565
3702	0.03	0.027	0.026	72	0.0	0.0	100.0	707	5322
3702	0.05	0.051	0.051	111	0.0	0.0	100.0	700	2384
3702	0.08	0.081	0.079	200	0.0	0.0	100.0	683	2243
3702	0.10	0.100	0.098	214	0.0	4.0	100.0	677	4294
3702	0.13	0.126	0.124	446	0.0	0.0	100.0	658	1807
3702	0.15	0.152	0.148	589	0.0	0.0	100.0	657	4447
3702	0.18	0.189	0.185	596	0.0	0.0	100.0	624	2867
3702	0.20	0.206	0.202	679	0.0	0.0	100.0	608	1400
3702	0.23	0.222	0.216	918	0.0	0.0	100.0	604	4149

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

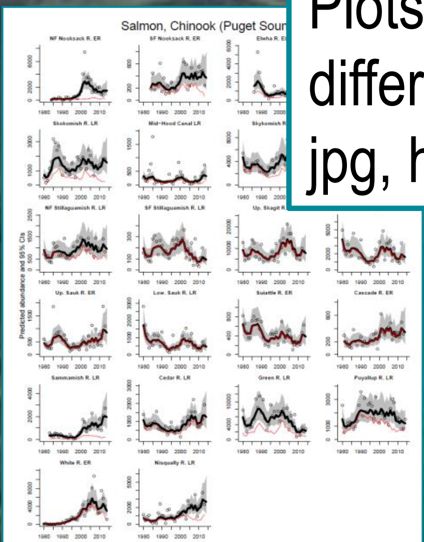
barplot(table(cut(as.numeric(as.character((a[,6]))),seq(0,
        names.arg=c(as.character(seq(0.1,.9,0.2)),"NA"),y
        ylim=c(0,dim(a)[1]))
title("Fraction wild across populations 2010-2014")

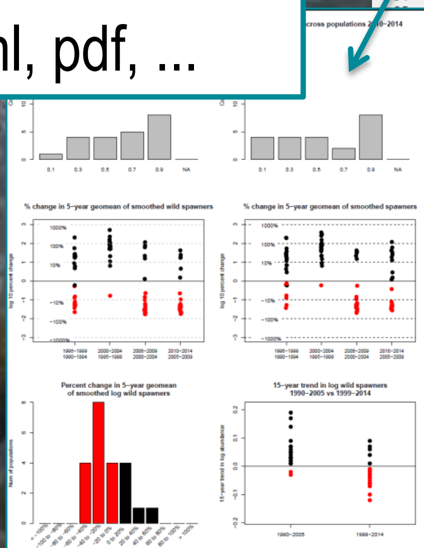
source("geomean_tables.R")
a=geomean_table(pops.to.plot, mpg.to.plot, ifit.total, if
vals1=vals2=c()
geo.start=which(names(a)=="MPG")+1
geo.end=which(names(a)=="% Change")-1
for(i in 1:dim(a)[1]){
  vals1=rbind(vals1, as.numeric(apply(a[i,geo.start:ge
  vals=apply(a[i,geo.start:geo.end],2,function(x){str_spli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





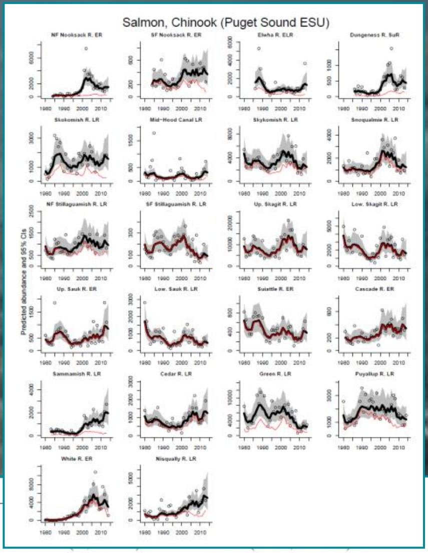
Population	MPG	1990-2005	1999-2014
NF Nooksack R. ER	Strait of Georgia	0.07 (0.04, 0.09)	0.04 (0, 0.07)
SF Nooksack R. ER	Strait of Georgia	0.03 (0, 0.06)	-0.06 (-0.1, -0.02)
Elwha R. ER	SJF	-0.02 (-0.06, 0.02)	-0.06 (-0.1, -0.03)
Dungeness R. SR	SJF	0.14 (0.08, 0.19)	0.09 (0.03, 0.14)
Skokomish R. LR	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		
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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)
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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

This PDF was later amended to make the document 508 compliant.

- **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)