

NOAA
FISHERIES

**Northwest
Fisheries
Science Center**

Deploying protected species tools via cloud computing new tools and platforms

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Northwest Fisheries Science Center (NWFSC)

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Projects within the Population Assessment Team

Contributors: Howard Coleman (OA programmer), Eric Ward (NWFSC), Mark Scheuerell (NWFSC), Martin Liermann (NWFSC), Susan Bishop (WRO)

Support: Protected Species Toolbox, NWFSC, WRO

Platforms

- GitHub for tool delivery
- Adopted Markdown for documentation
- Adopted R documentation standards

New Shiny tools

- VRAP – Recovery Exploitation Rate calculation
- NWC Trends – Standardized trends calculation
- DMVRAP – Estimation of spawner-recruit parameters

Migration to GitHub Platform

- PST Toolbox 1.0
 - ❖ What parts were embraced (worked)
 - ❖ What parts were not embraced (failed)
- How we [scientists in CB at NWFSC] currently provide tools
 - ❖ Benefits of this approach
 - ❖ Demos

Webpage



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NPST Home | About NPST | Projects

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Commercial Fisheries Statistics

Cooperative Research

Observer Program

Marine Mammals & Turtles

Ecosystems

Stock Assessments

Economics

Human Dimensions

Apps & Tech

Climate

Welcome to the Protected Species Toolbox

The National Protected Species Toolbox (NPST) provides access to a variety of modeling and statistical tools used to support the protection, conservation and recovery of **marine mammals** and **endangered/threatened marine life** under the responsibility of **NOAA's** National Marine Fisheries Service (NOAA Fisheries Service, or **NMFS**), under the **U.S. Department of Commerce**. These tools are developed and maintained by individual NMFS science centers.

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NPST

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Project pages

ROSE — [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
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Summary

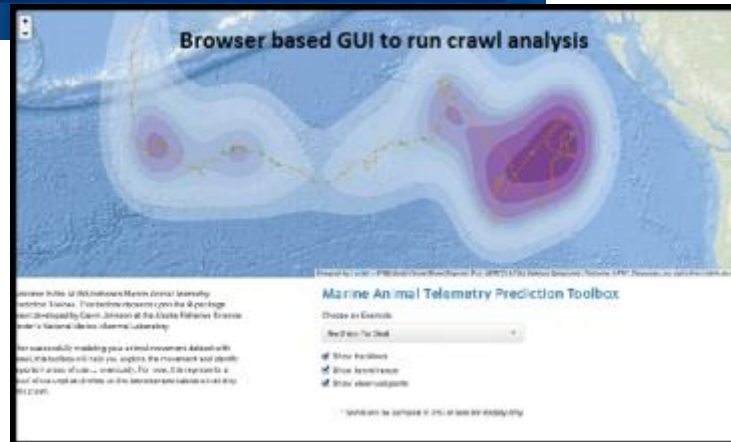
Several of the smaller populations that NMFS monitors have very detailed demographic data, where individual birth and deaths are known, in addition to the reproduction of each female in each year. The Resident Orca Salmon Emulator (ROSE) model is a tool estimate how survival and birth rates of these 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 ROSE used in analyses related to protected species management?

ROSE is used to understand how the viability of Southern Resident Killer Whales is related to covariates such as prey. ROSE 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 ROSE details](#)

Browser-based GUIs:
Shiny apps



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

- **Project completed FY16:**
 - Content manager website built and public-facing website released (meets NOAA IT certifications)
 - <https://www.st.nmfs.noaa.gov/npst>
 - Public R/Shiny server established at NWFSC
 - <https://dataexplorer.northwestscience.fisheries.noaa.gov/>



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[NPST Home](#) | [About NPST](#) | [Projects](#)

Recreational Fisheries Statistics

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NO

NO

Info

Privacy Policy

Web-site/content manager

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Web-based toolbox

This was not embraced by users (tool-developers) besides the PIs.

Getting users to upload tools required a great deal of effort and time.

- Bit too centralized while coding work is localized.
- Created more work for scientists 'one more thing to keep updated'
- Was not integrated into their normal workflow

Project pages

ROSE — Download files

Project members: e2holmes eric.ward howard.coleman

Center	System	Category
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Summary

Several of the smaller populations that NMFS knows, in addition to the reproduction of each fish, estimate how survival and birth rates of these are affected by external drivers (climate, prey, etc). Small adjustments are also commercially fished. Most recently, this impact the viability and growth of endangered S

How is ROSE used in analyses related to prey? ROSE is used to understand how the viability of used in the bi-lateral workshops investigating the viability (report) and was used in the 2013 NOAA Abundance and Prey Removal by Ocean Fishing on Southern Resident Killer Whale Population Dynamics.

[View ROSE details](#)

data, where individual birth and deaths are known. The Roon Emulator (ROSE) model is a tool that estimates whether any of these rates is affected by external drivers. If the external driver is a prey species that is being fished, then fishing levels of Chinook salmon may impact the viability and growth of endangered S. ROSE was used to covariate such as prey. ROSE was used in the bi-lateral workshops investigating the viability (report) and was used in the 2013 NOAA Abundance and Prey Removal by Ocean Fishing on Southern Resident Killer Whale Population Dynamics.



Instead we have migrated to GitHub as a tool
development and delivery platform



GitHub provides

- Easy to use and widely adopted
 - Increased coding efficiency (fork/clone)
 - Better collaboration
 - Active community of developers and ‘spirit of collaboration/sharing’
- code version control
- GitHub no longer requires learning Git (or any cvs!!)
- You can install R packages from GitHub
- Integrated websites (incl built from an R packages)

R packages for code delivery and documentation

- Community standards for documentation already developed
- Many tools (e.g. roxygen/rmarkdown) to help and standardize documentation
- R packages are familiar and R is free
- Easy to deliver packages via GitHub
- Easy to develop 'reproducible reports' with rmarkdown
- Easy C++ integration (and JAGS, STAN...)
- Users download tool (package) and runs locally so we never 'see' their data

Demo

- Time-series analysis tools and training at NWFSC
- <https://nwfsc-timeseries.github.io/>
 - Websites for tools
 - Documentation
 - R Packages

Shiny

from  Studio

[Get Started](#)

[Gallery](#)

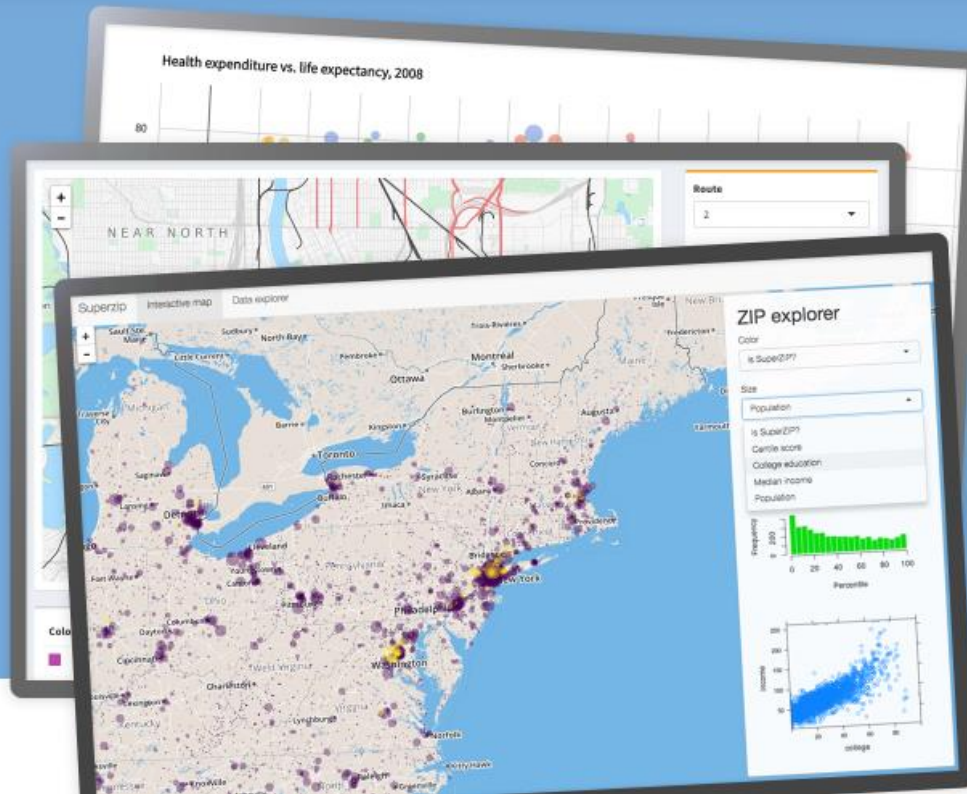
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[Reference](#)

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Interact. Analyze. Communicate.

Take a fresh, interactive approach to telling your data story with Shiny. Let users interact with your data and your analysis. And do it all with R.

Browser-based tools: Shiny apps

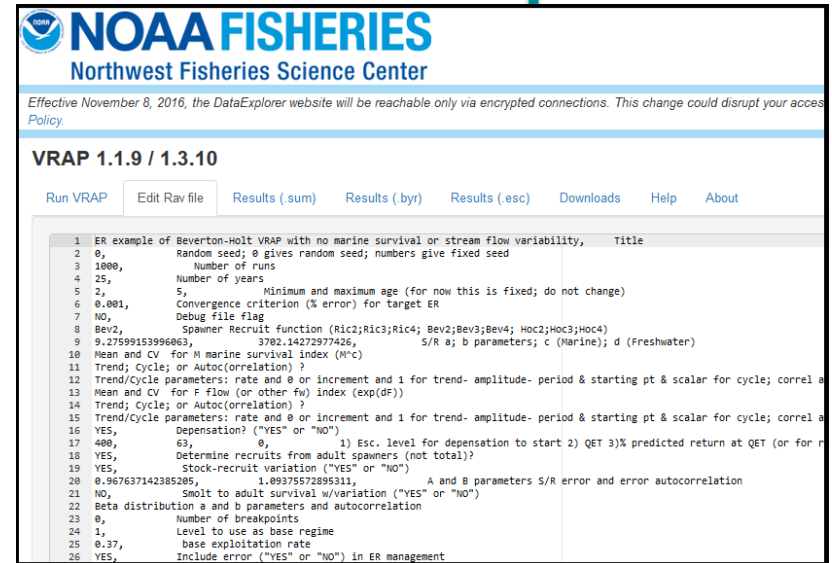
Tool developers are building Shiny apps and the NWFSC Shiny servers hosts a number of tools.

Positives:

- Gives non-R users access to tools
- Improves the documentation
- Improves/provides reproducibility
- Great for teaching and demos

Negatives:

- Takes a great deal of time (\$ if using contractor) to code.
- If the main target audience uses R, a R package with good vignettes is better in most cases.
- Shiny apps still have a 'black box' aspect to them



The screenshot shows the NOAA Fisheries Northwest Fisheries Science Center website. The main heading is "VRAP 1.1.9 / 1.3.10". Below the heading are navigation tabs: "Run VRAP", "Edit Raw file", "Results (.sum)", "Results (.byr)", "Results (.esc)", "Downloads", "Help", and "About". The main content area displays a list of parameters and their descriptions, numbered 1 through 26. The parameters include: 1 ER example of Beverton-Holt VRAP with no marine survival or stream flow variability, Title; 2 0, Random seed; 0 gives random seed; numbers give fixed seed; 3 1000, Number of runs; 4 25, Number of years; 5 2, 5, Minimum and maximum age (for now this is fixed; do not change); 6 0.001, Convergence criterion (% error) for target ER; 7 NO, Debug file flag; 8 Bev2, Spawner Recruit function (Ric2;Ric3;Ric4; Bev2;Bev3;Bev4; Hoc2;Hoc3;Hoc4); 9 9.27599153996063, 3702.14272977426, S/R a; b parameters; c (Marine); d (Freshwater); 10 Mean and CV for M marine survival index (M*CV); 11 Trend; Cycle; or Autoc(orr)elation?; 12 Trend/Cycle parameters: rate and 0 or Increment and 1 for trend- amplitude- period & starting pt & scalar for cycle; correl; 13 Mean and CV for F-flow (or other fw) index (exp(df)); 14 Trend; Cycle; or Autoc(orr)elation?; 15 Trend/Cycle parameters: rate and 0 or Increment and 1 for trend- amplitude- period & starting pt & scalar for cycle; correl; 16 YES, Depensation? ("YES" or "NO"); 17 400, 63, 1) Esc. level for depensation to start 2) QET 3)% predicted return at QET (or for; 18 YES, Determine recruits from adult spawners (not total?); 19 YES, Stock-recruit variation ("YES" or "NO"); 20 0.967637142385205, 1.09375572895311, A and B parameters S/R error and error autocorrelation; 21 NO, Smolt to adult survival w/variation ("YES" or "NO"); 22 Beta distribution a and b parameters and autocorrelation; 23 0, Number of breakpoints; 24 1, Level to use as base regime; 25 0.37, base exploitation rate; 26 YES, Include error ("YES" or "NO") in ER management.

Demos

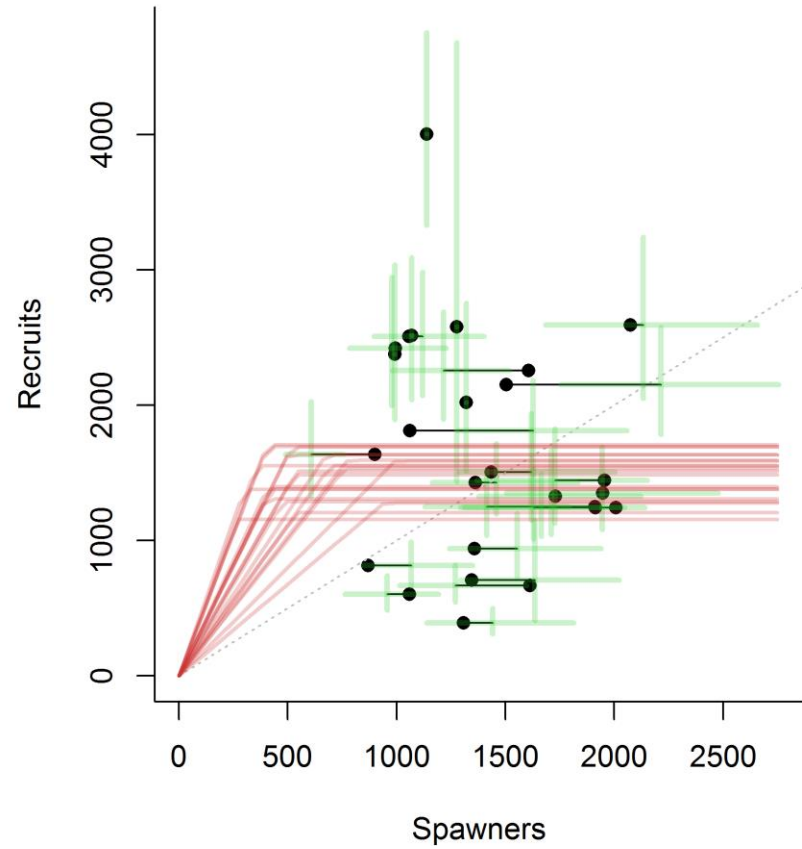
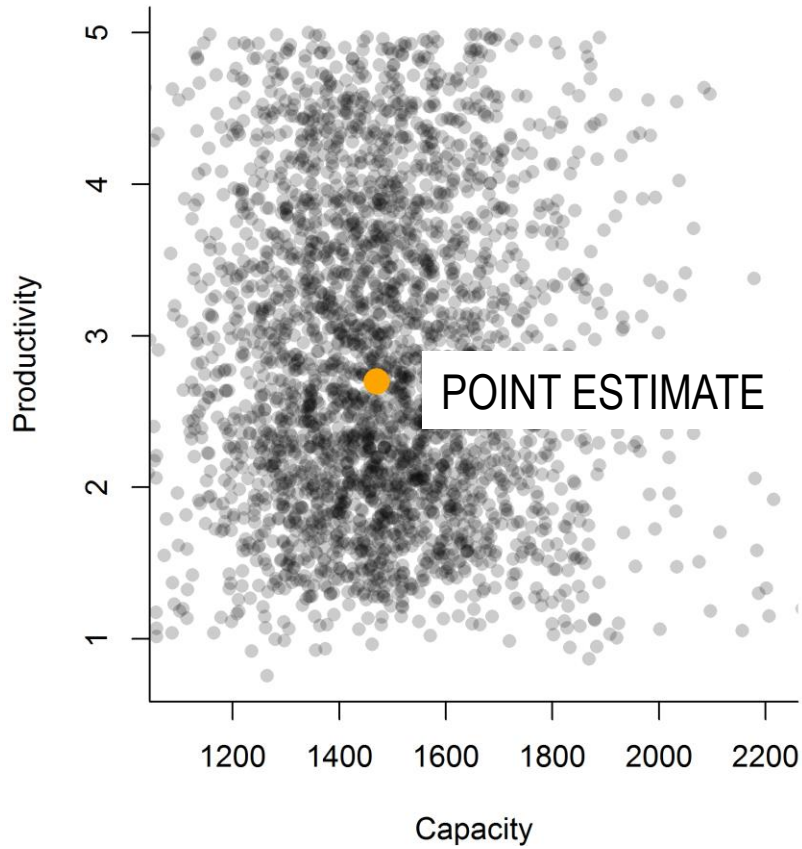
- <https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/NWCTrends/>
 - Creates standardized trend plots and tables used in status reports
- <https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/VRAP/>
 - Runs simulations to compute Recovery Exploitation Rates
- <https://dataexplorer.northwestscience.fisheries.noaa.gov/nwc/DMVRAP/>
 - Fits spawner-recruit functions and feeds into VRAP

* NWFSC has a programmer who is very experienced in developing R Shiny apps (and websites) available starting June. Contact Eli.

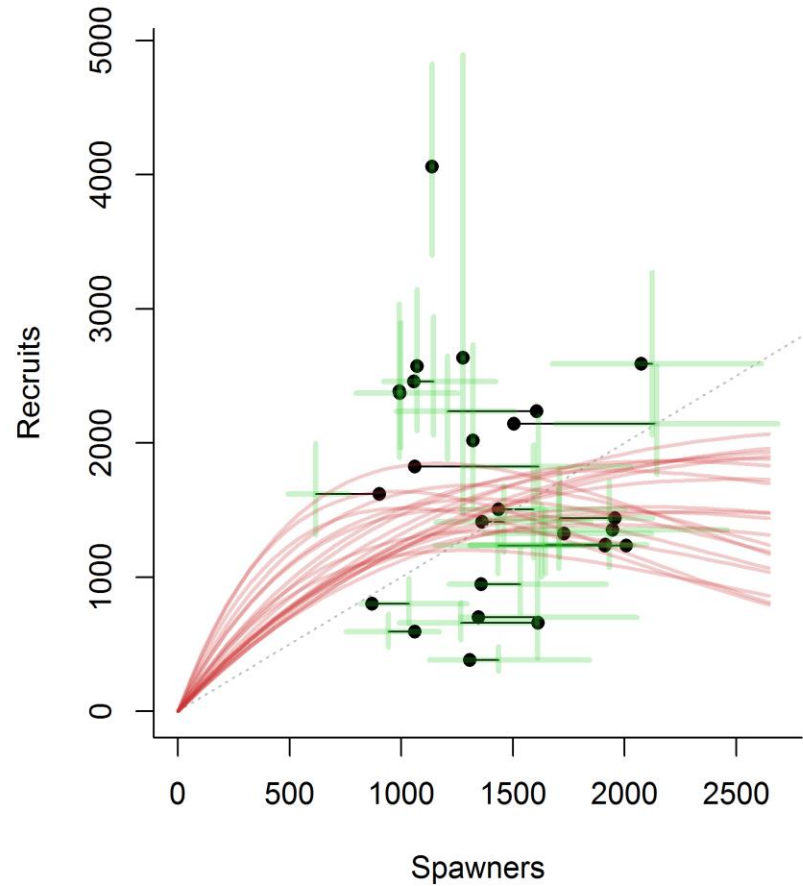
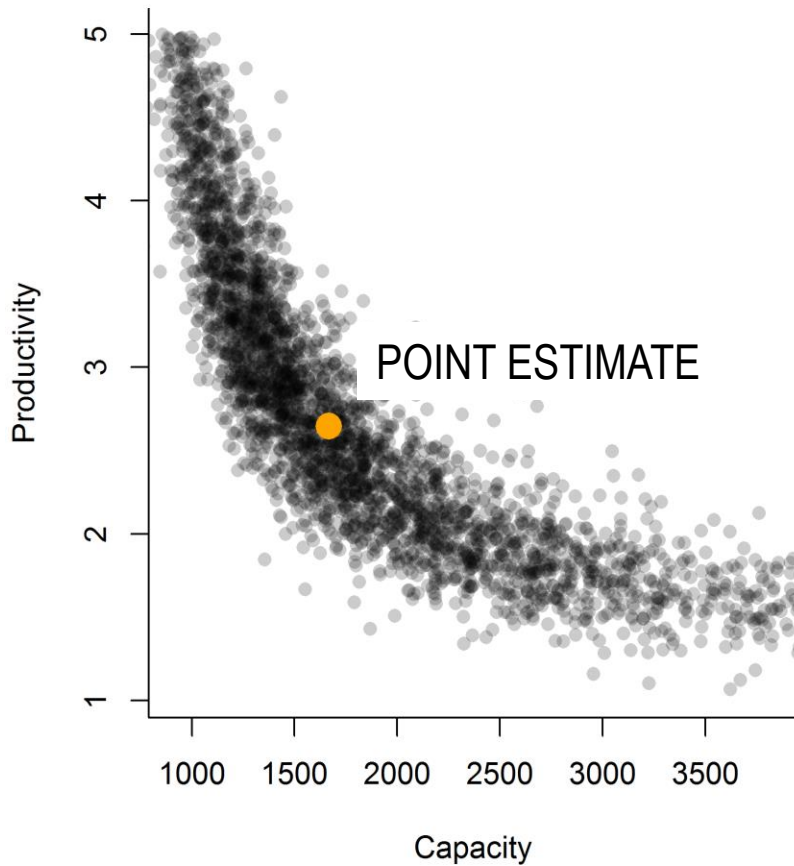
Next Tool: Including uncertainty in spawner-recruit relationship in our applications (RER calculation)

- Uncertainty about spawner-recruit relationship
- Uncertainty about parameters
- Uncertainty about data (error)
- Uncertainty and variability in management effects

Hockey-Stick

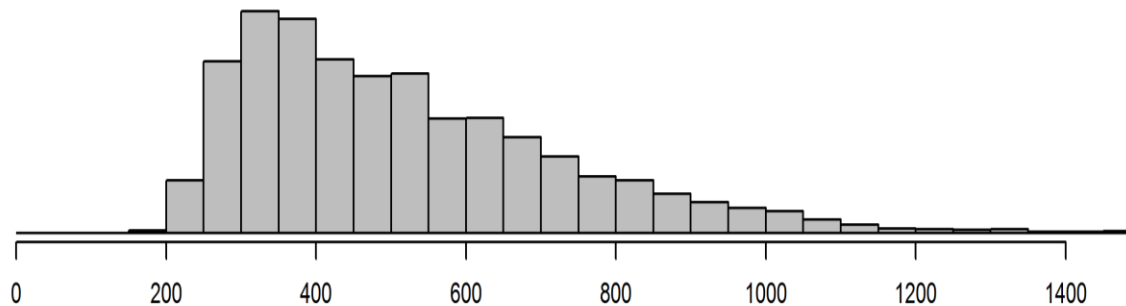


Ricker

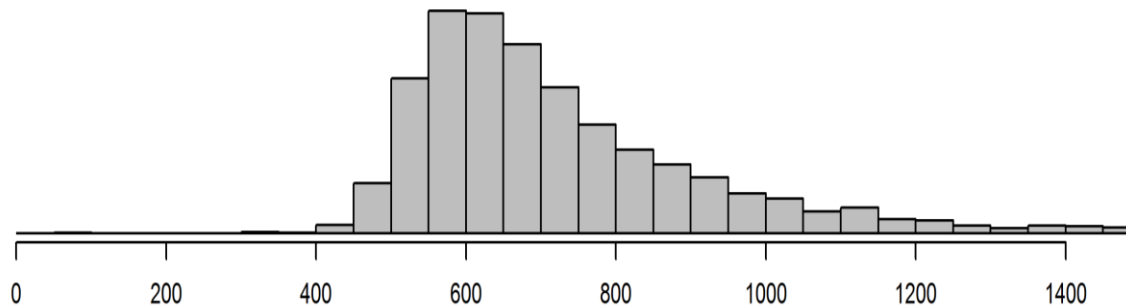


Uncertainty about model also has consequences for metrics that have management implications

Hockey Stick

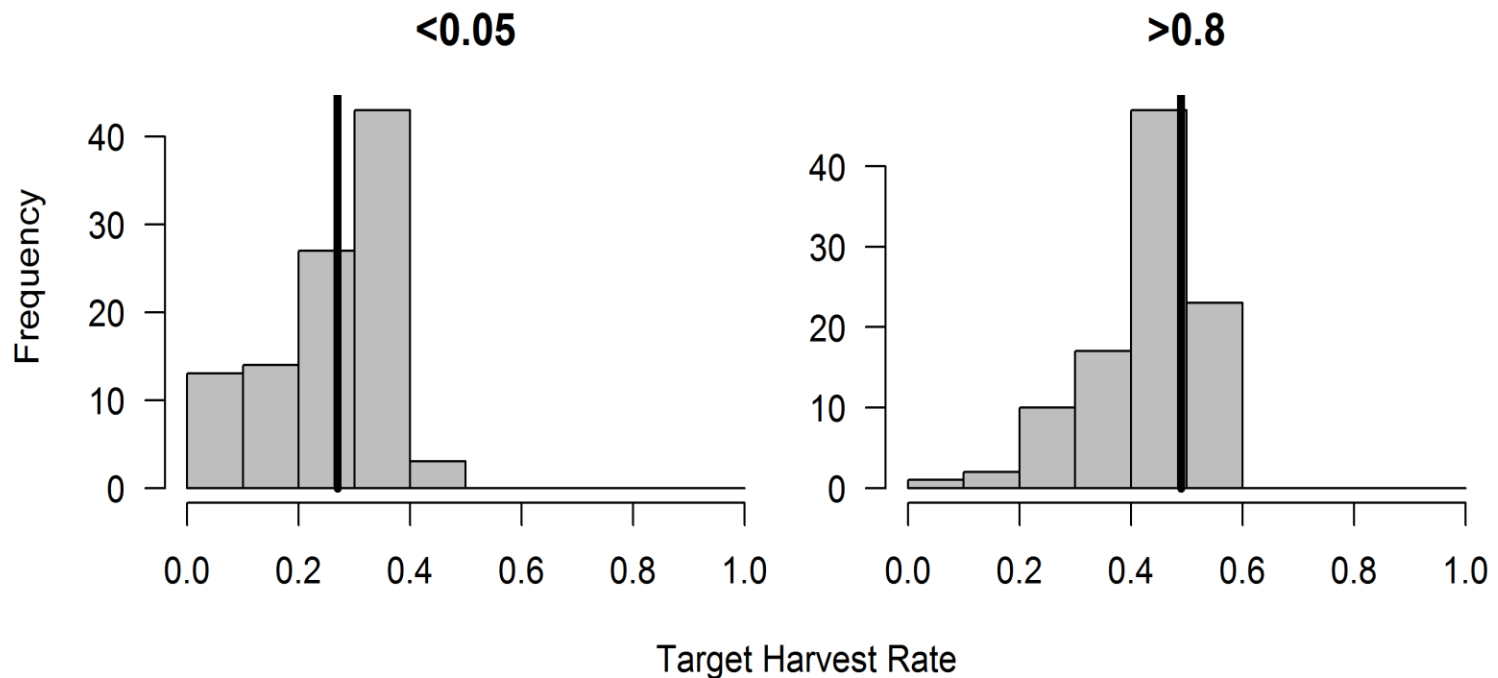


Ricker

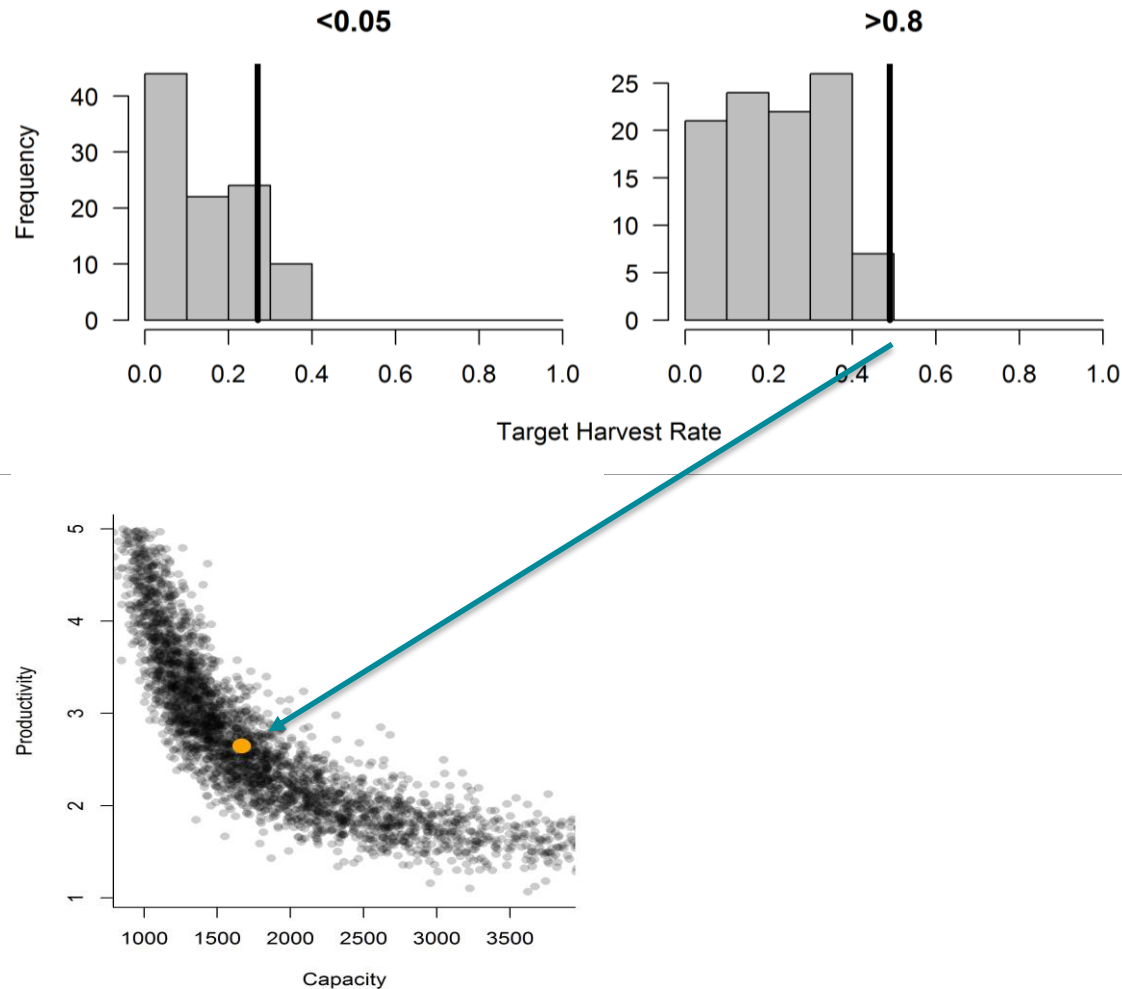


Spawners at MSY

Can lead to large uncertainty in the Recovery Exploitation Rate



In some cases the uncertainty is pathological



Bringing in other information to improve estimation: basin area

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

