



Apr 4th, 2:00 PM - 2:15 PM

## Evaluating anthropogenic threats to endangered killer whales to inform effective recovery plans

Robert Lacy

*Chicago Zoological Society (Ill.)*, rlacy@ix.netcom.com

Rob Williams

*Oceans Initiative, United States*, rob@oceansinitiative.org

Erin Ashe

*Oceans Initiative, United States*, erin@oceansinitiative.org

Chris Clark

*Cornell University*, cwc2@cornell.edu

Kenneth C. Balcomb

*Center for Whale Research*, orcasurv@rockisland.com

*See next page for additional authors*

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**Speaker**

Robert Lacy, Rob Williams, Erin Ashe, Chris Clark, Kenneth C. Balcomb, Lauren Brent, Daren Croft, Deborah Giles, Paul C. Paquet, and Misty MacDuffee

# Evaluating anthropogenic threats to endangered killer whales to inform effective recovery plans



**Rob Williams**

Pew Fellow in Marine Conservation,  
Oceans Initiative

Salish Sea Ecosystem Conference

4 April 4 2018



# Interdisciplinary effort to rank threats to SRKW recovery: salmon availability, noise, & contaminants

**Orcas headed to extinction unless we get them more chinook and quieter waters, report says**

Originally published October 27, 2017 at 6:00 am | Updated October 26, 2017 at 8:36 pm



- Scientific Reports 7: 14119 (2017)
- Open access
- Data & model online to promote collaboration & facilitate efforts to build on our initial attempt

Robert C. Lacy, Rob Williams, Erin Ashe, Kenneth C. Balcomb III, Lauren J. N. Brent, Christopher W. Clark, Darren P. Croft, Deborah A. Giles, Misty MacDuffee & Paul C. Paquet

# Approach: Population viability analysis

## *What if?*

PVA is a tool for simulating population trends under varying levels of threats and uncertainty

## *What is?*

Baseline demography & threats

## *What could the future look like?*

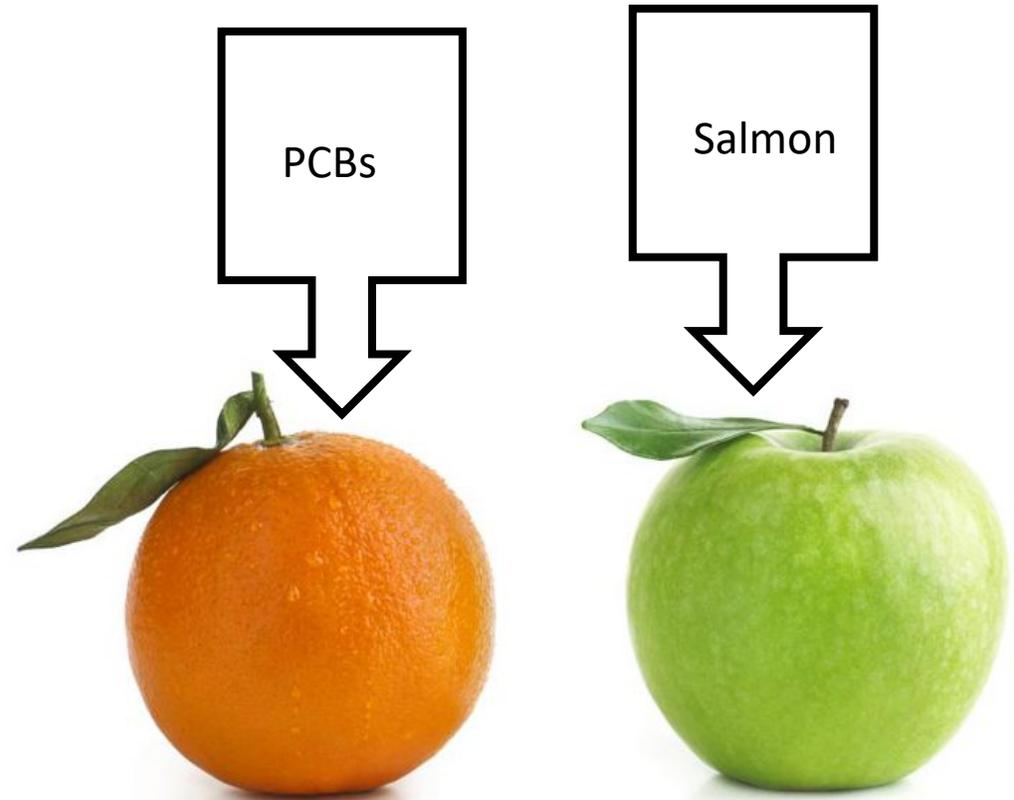
Scenario testing for changes to threats & compare management alternatives



# Haven't we been here before?

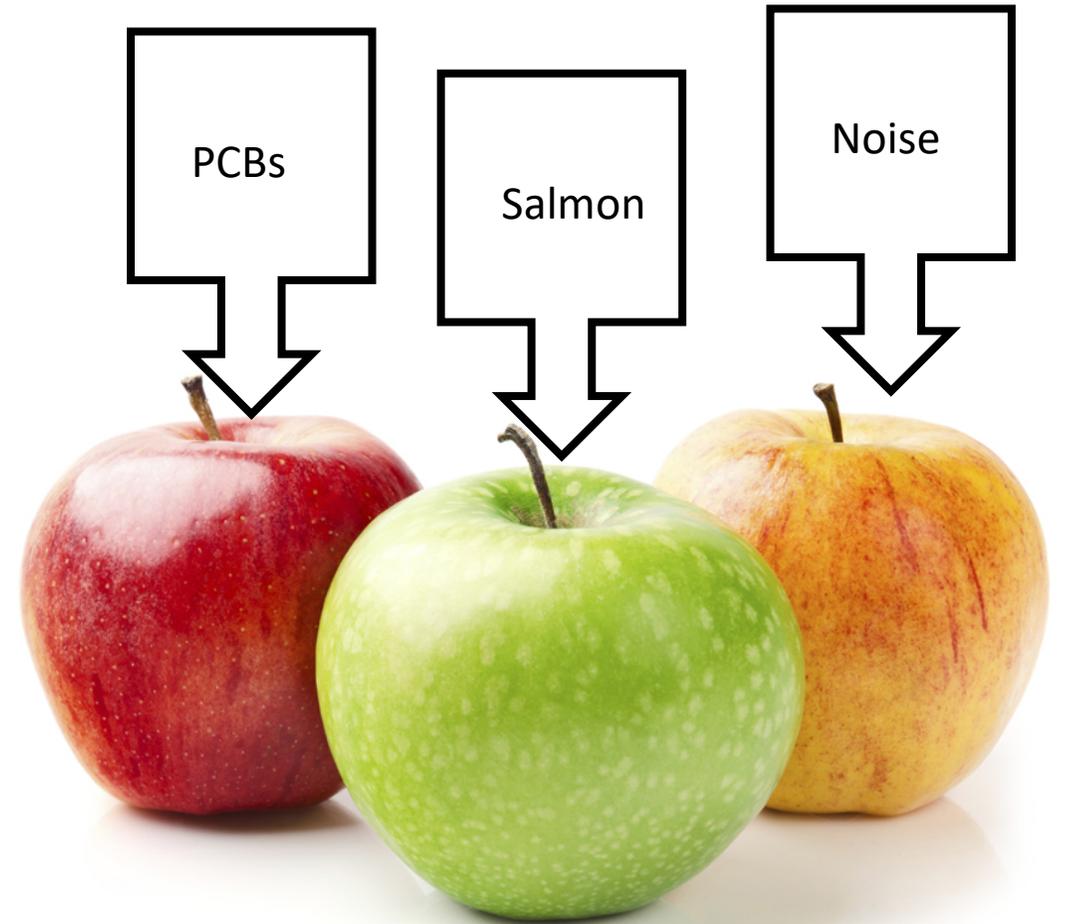


Going, going, gone conference, 2002. Earth Island Institute



# What's changed?

- We tried to put all threats in the same currency: effect on SRKW demography
- Chinook salmon
  - Salmon *abundance* linked to KW mortality (Ford et al. 2009)
  - Salmon *abundance* links to reproduction by altering the odds that a female SRKW of a given age will have a calf (Ward et al. 2009)
- Noise affects salmon *accessibility* by reducing the whales' foraging efficiency (Williams et al. 2006, Lusseau et al. 2009)
- PCBs affect calf survival (Hall et al. 2018).  
Need to expand this to include PBDEs, health...



# What if?



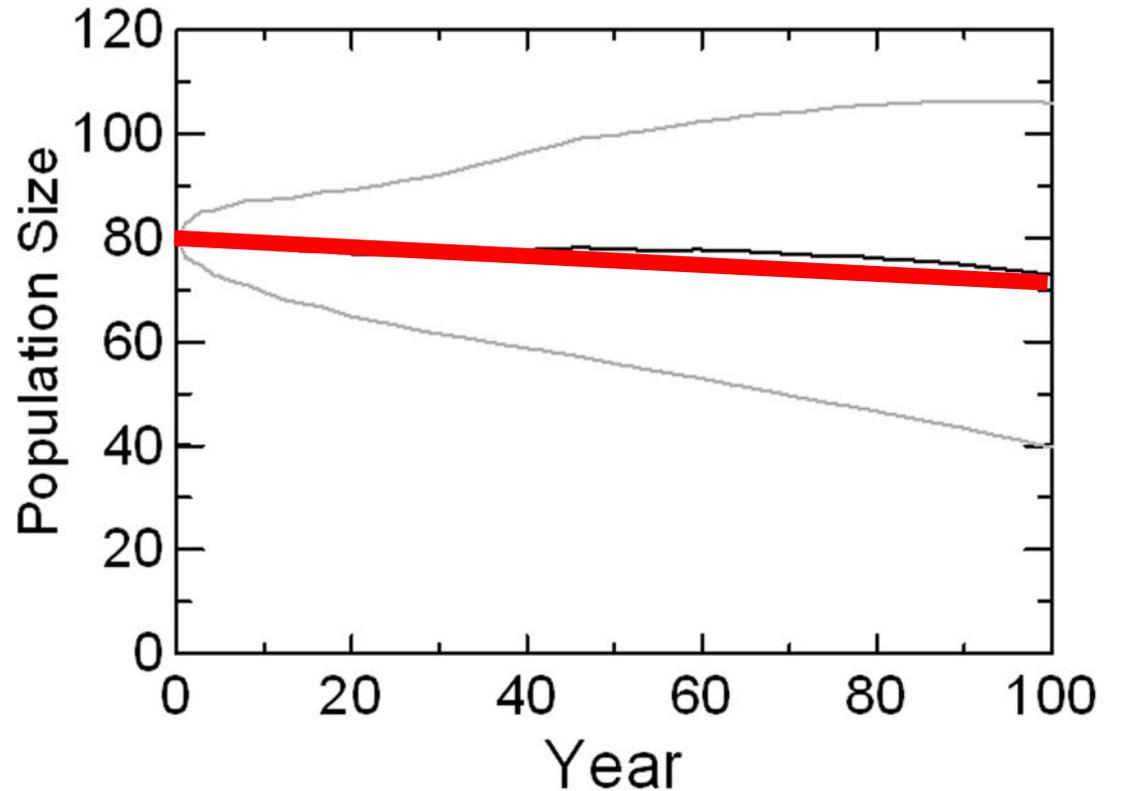
Sandy Buckley, for Oceans Initiative

- We have only one SRKW population
- We can take what we know about the population's demographics, run tens of thousands of simulations, and predict how it might respond to future change
- We can use a model to explore and illustrate how the population might fare under:
  - Status quo
  - Increased threats
  - Mitigation

# What if we could maintain status quo?

SRKWs projected 10,000 times, over 100 years, based on variability in demographic rates observed from 1976 through 2014, applied to a starting population as it existed in 2015.

**Threats will not stay constant**



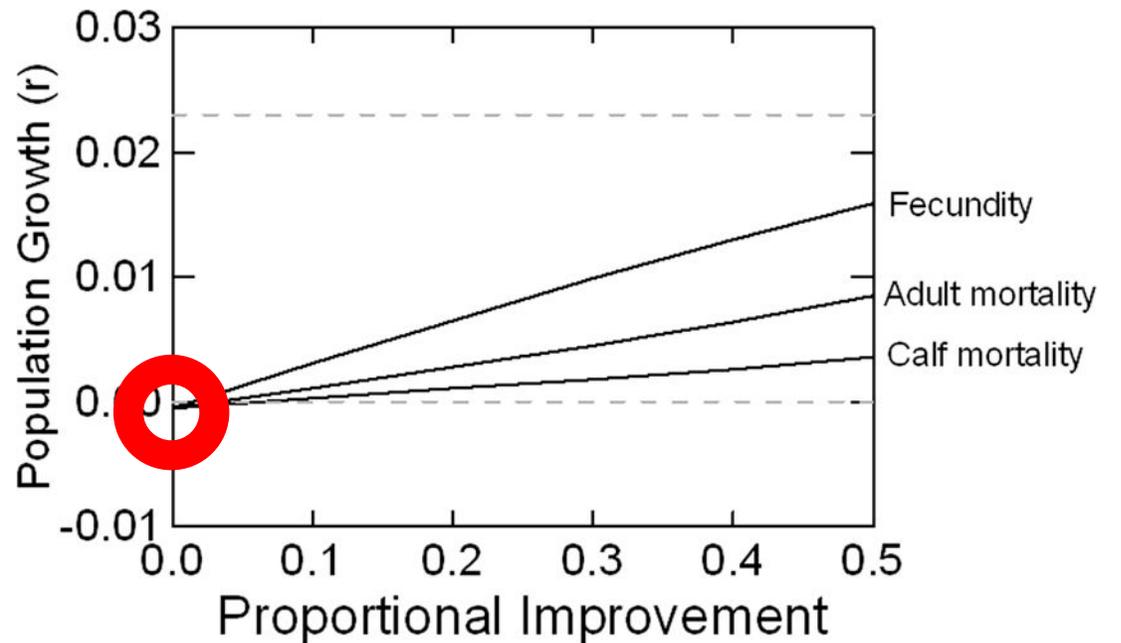
# What is?

- For each threat, we scaled impacts such that the estimated current level resulted in the mean demographic rates observed in recent decades.
- The model doesn't hinge on getting the baseline exactly right. Instead, this offers a plausible starting point for discussion.



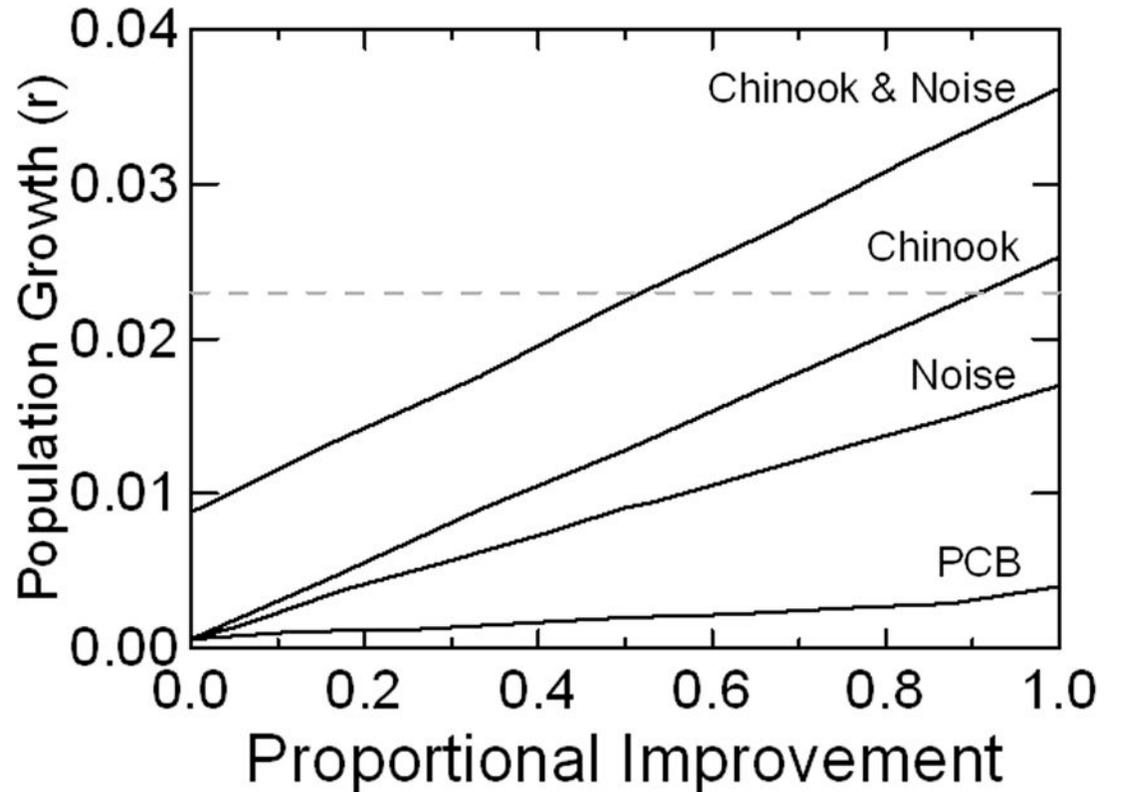
# The status quo is untenable

- Current demographic rates lead to a stable population, but we need an increasing one.
- Dashed lines indicate a stated recovery target (2.3% growth) and  $r = 0$ .
- Fecundity was increased from baseline to 1.5x baseline; mortality rates were decreased from baseline to 0.5x baseline.



# What could the future look like?

- We plotted population growth we might expect from mitigation of threats.
- Threat reductions on x-axis from status quo to maximum reduction tested:
  - Chinook (increased up to 1.3x average abundance observed from 1979-2008);
  - noise/disturbance (reduced to 0);
  - PCBs (from 2 ppm/y to 0).



# We have a perfect storm of threats, but Chinook salmon is at the eye of the storm



Dr A van Ginneken, CWR

- The whales need a new normal: sustained, year-round Chinook salmon abundance at levels we saw in the 1980s
- One catastrophic oil spill would increase extinction risk dramatically
- To reach our recovery target, we need a very large proportion of that abundant salmon to be accessible to the whales
- Recovering salmon while reducing noise and disturbance will accomplish more than addressing either threat on its own

# Where do we go from here?

- Separate the science (What did we discover?) from policy (What do we do with the information?)
- The science is open access. Please use and improve it, and tell us what you find
- [www.vortex10.org/SRKW.zip](http://www.vortex10.org/SRKW.zip)
- “There are no silver bullets, only silver buckshot.” -Bill McKibben



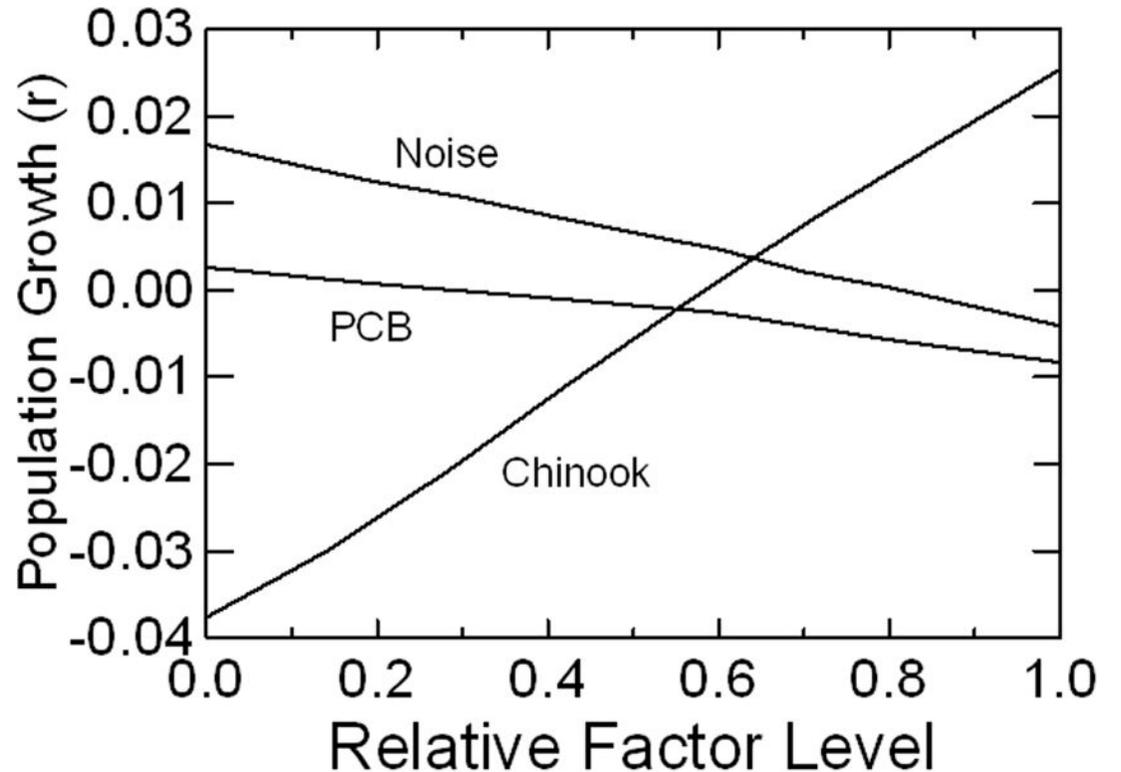
© Dr D. Giles

**Thank you!**



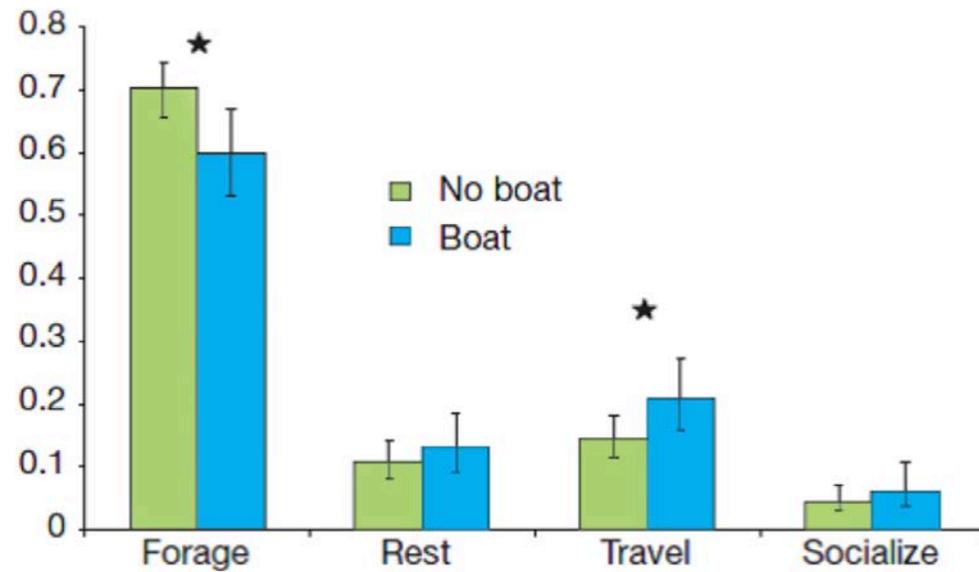
# A perfect storm of threats, but Chinook salmon are at the eye of the storm

- Chinook prey abundance varied among levels observed between 1979 and 2008
- noise and disturbance: boats present from 0% to 100% of time
- PCB accumulation from 0 to 5 ppm/yr



# Noise and disturbance

**Southern Resident Behavior Changes With Boat Presence**



Lusseau et al. 2009