



Advancing Demographic Monitoring of Grizzly Bears

INTERAGENCY GRIZZLY
BEAR STUDY TEAM



Overview

- Recap of fall YES presentation
- Implementation of Chao2 update
- Next phase: Integrated Population Model

This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

Recap: need for reassessment

1. Address underestimation bias
2. Find alternative to model averaging

Final report

Interagency Grizzly Bear Study Team. 2021. [A reassessment of Chao2 estimates for population monitoring of grizzly bears in the Greater Yellowstone Ecosystem.](#)

Posted on IGBST website
(→“Overview” tab →“Reports”)



Conclusions

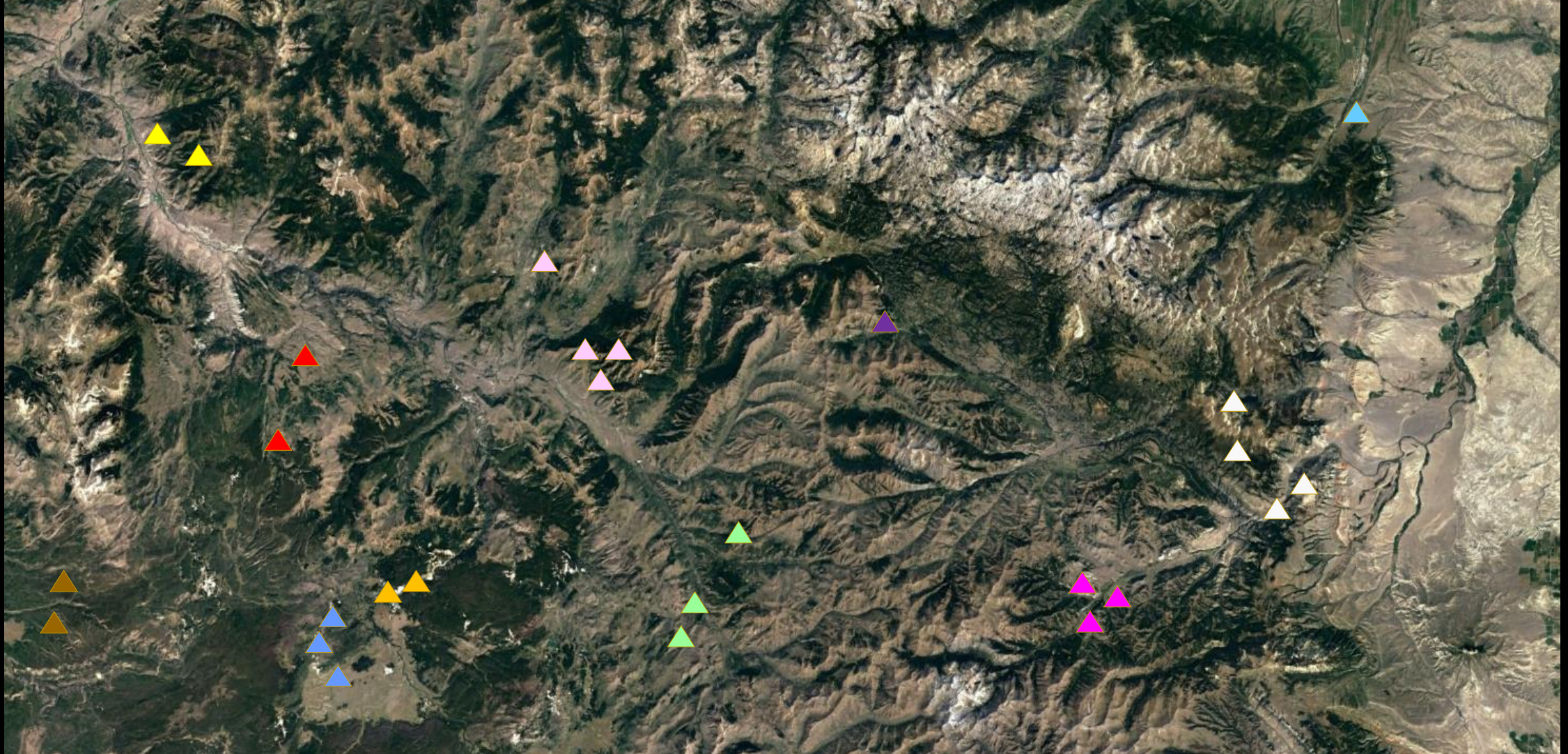
- Alternate distance criterion of 16 km improves accuracy
- Use of GAMs improve detection of changes in trend

GAM = generalized additive models



———— 30 km
———— 16 km

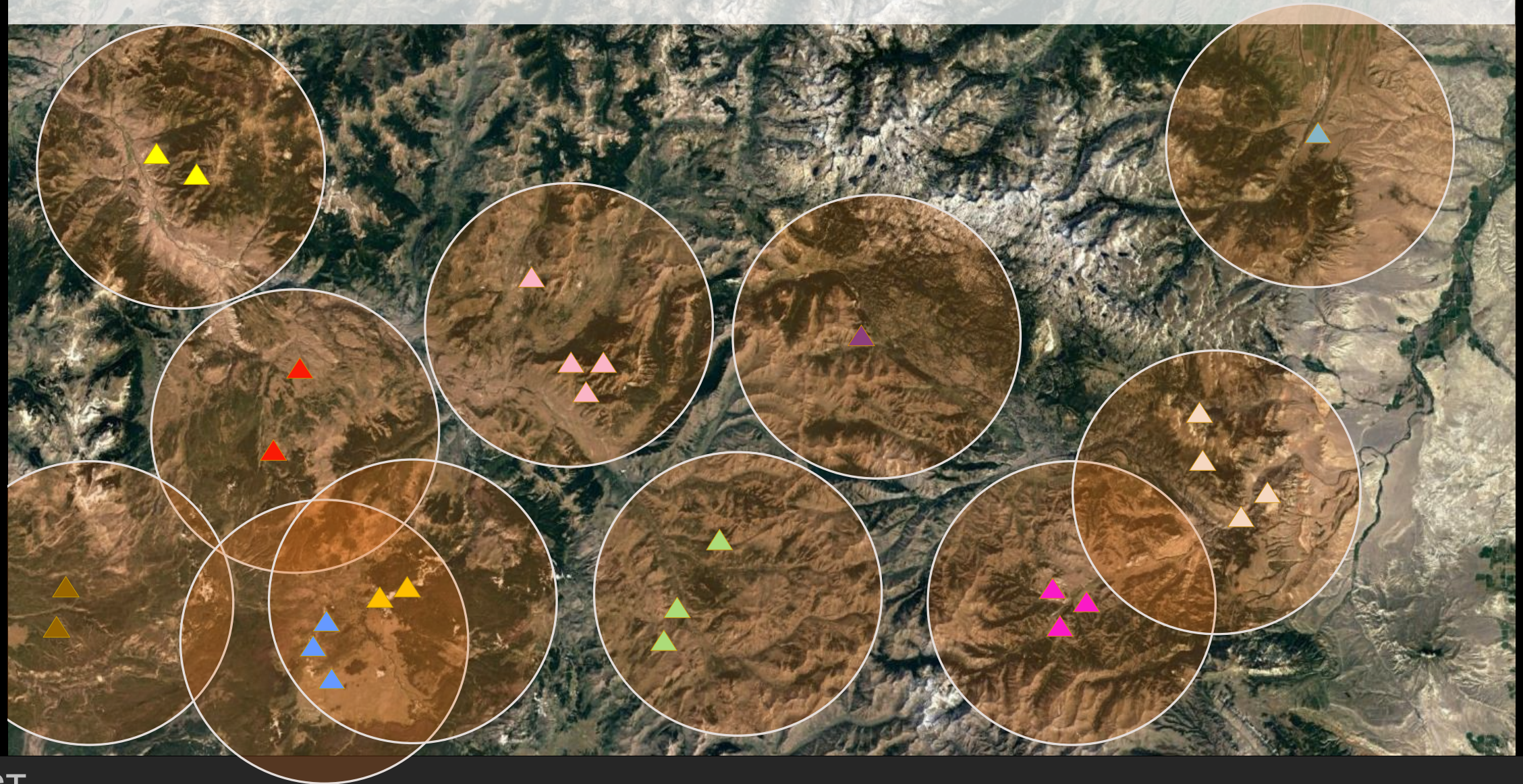
▲ Female with cubs sighting
Truth: 11 females with cubs



30 km

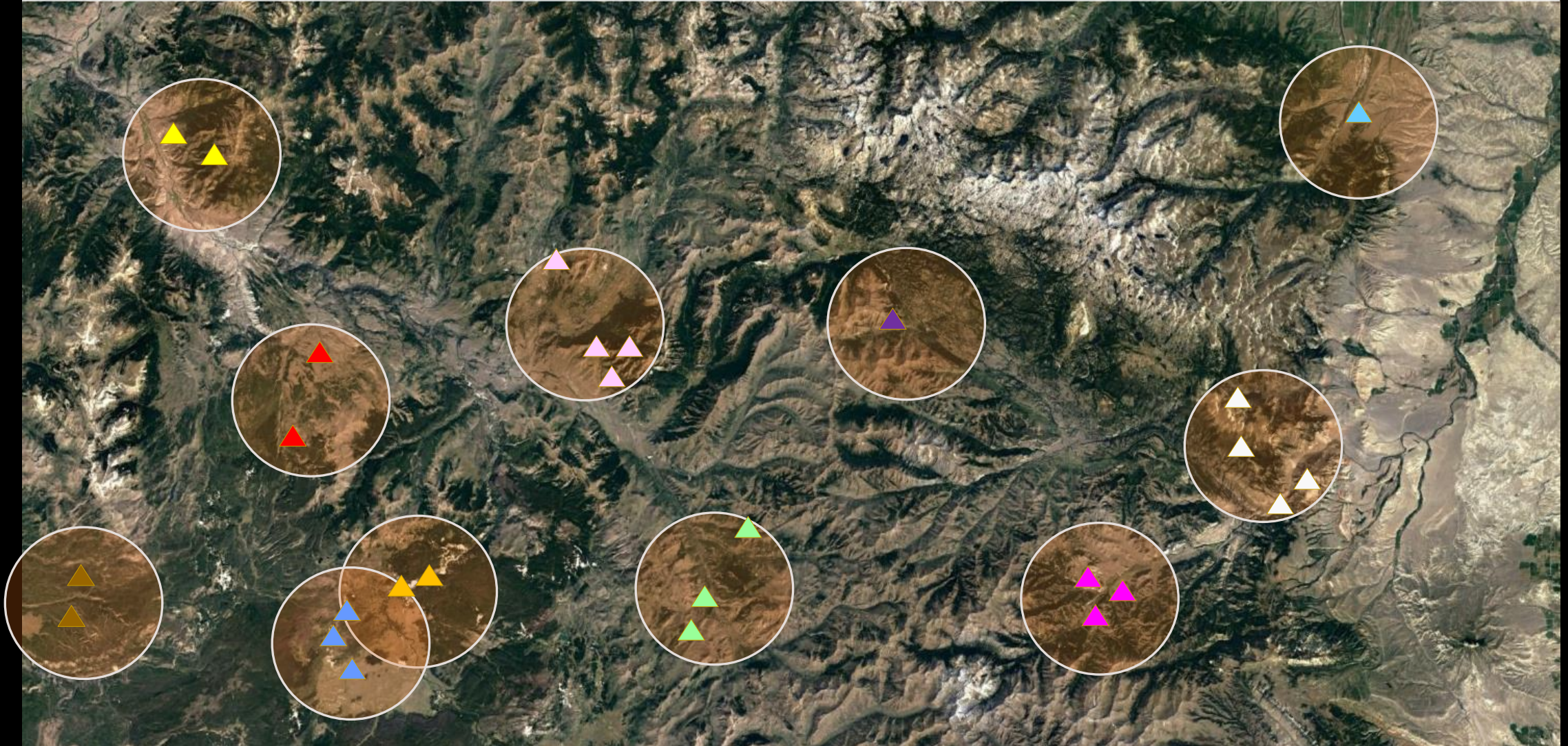


Female with cub sighting
7 of 11 females identified

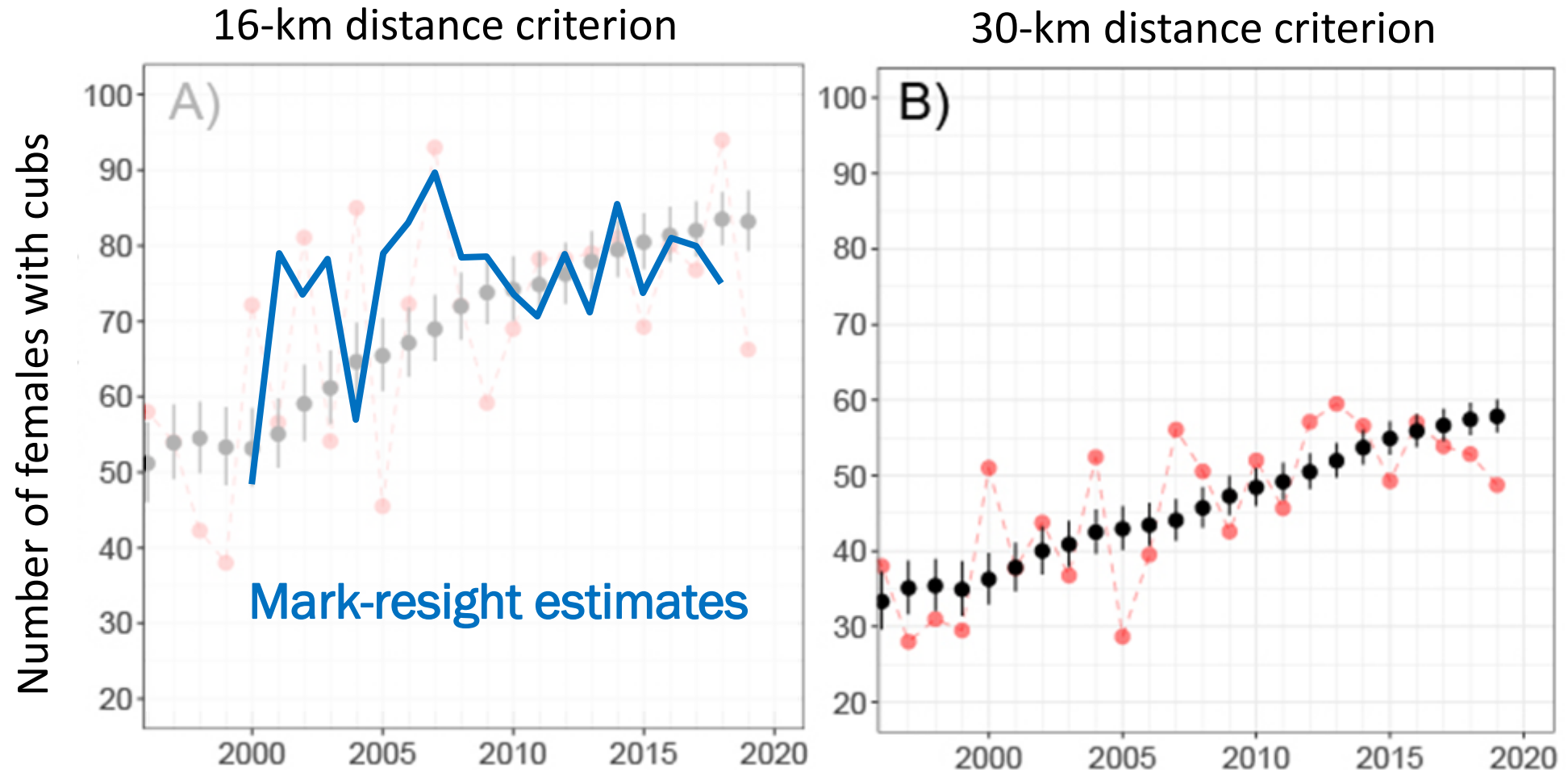


—— 16 km

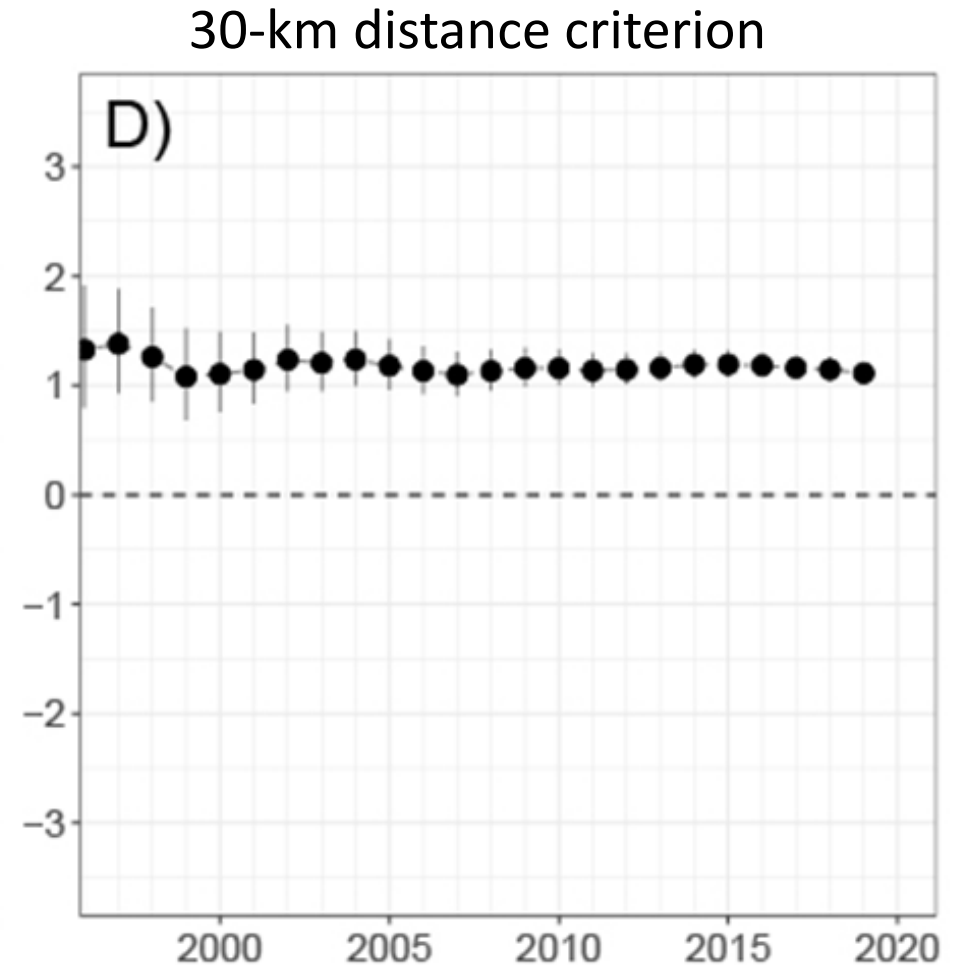
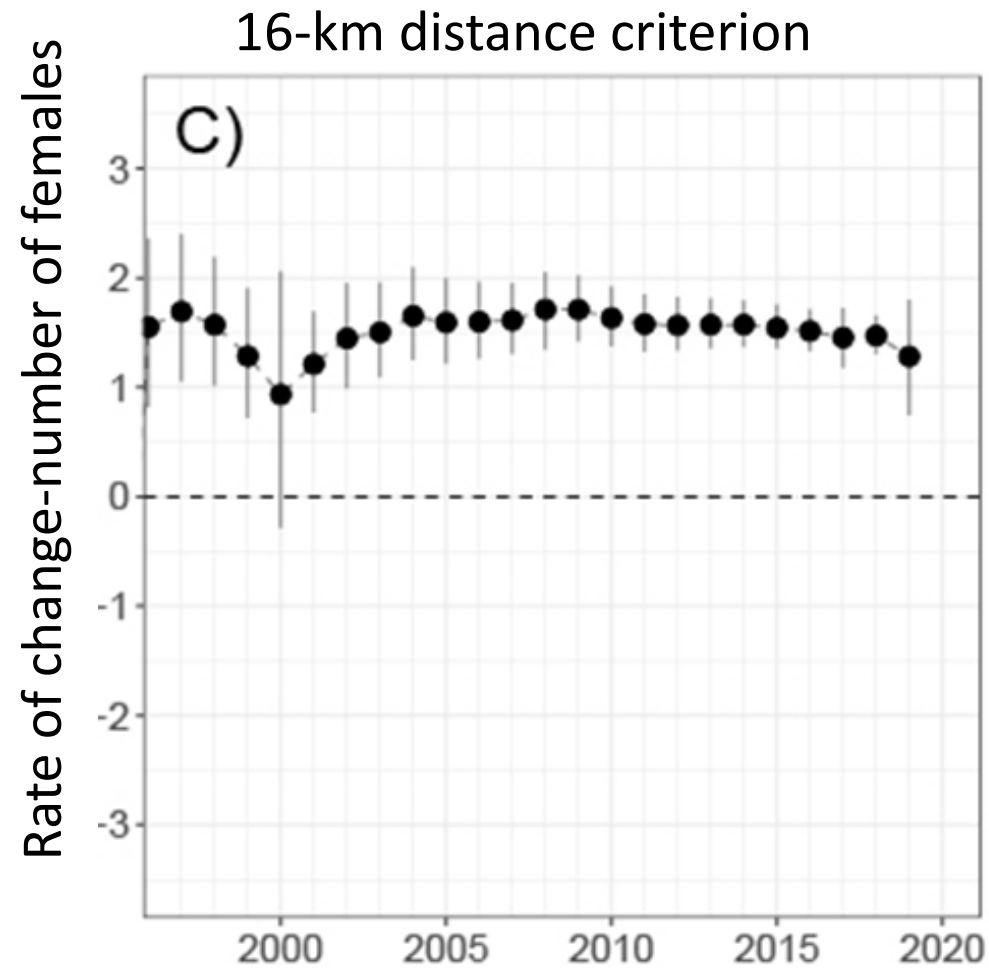
▲ Female with cub sighting
10 of 11 females identified



Estimates and trend



Rate of change



Technical implementation

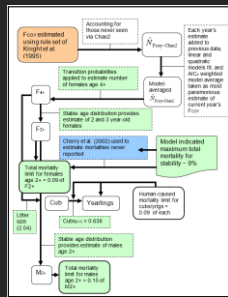
- Best available science
- No major shift in methodology
- Changes required to *2016 Conservation Strategy* (Appendices B and C)

Implications

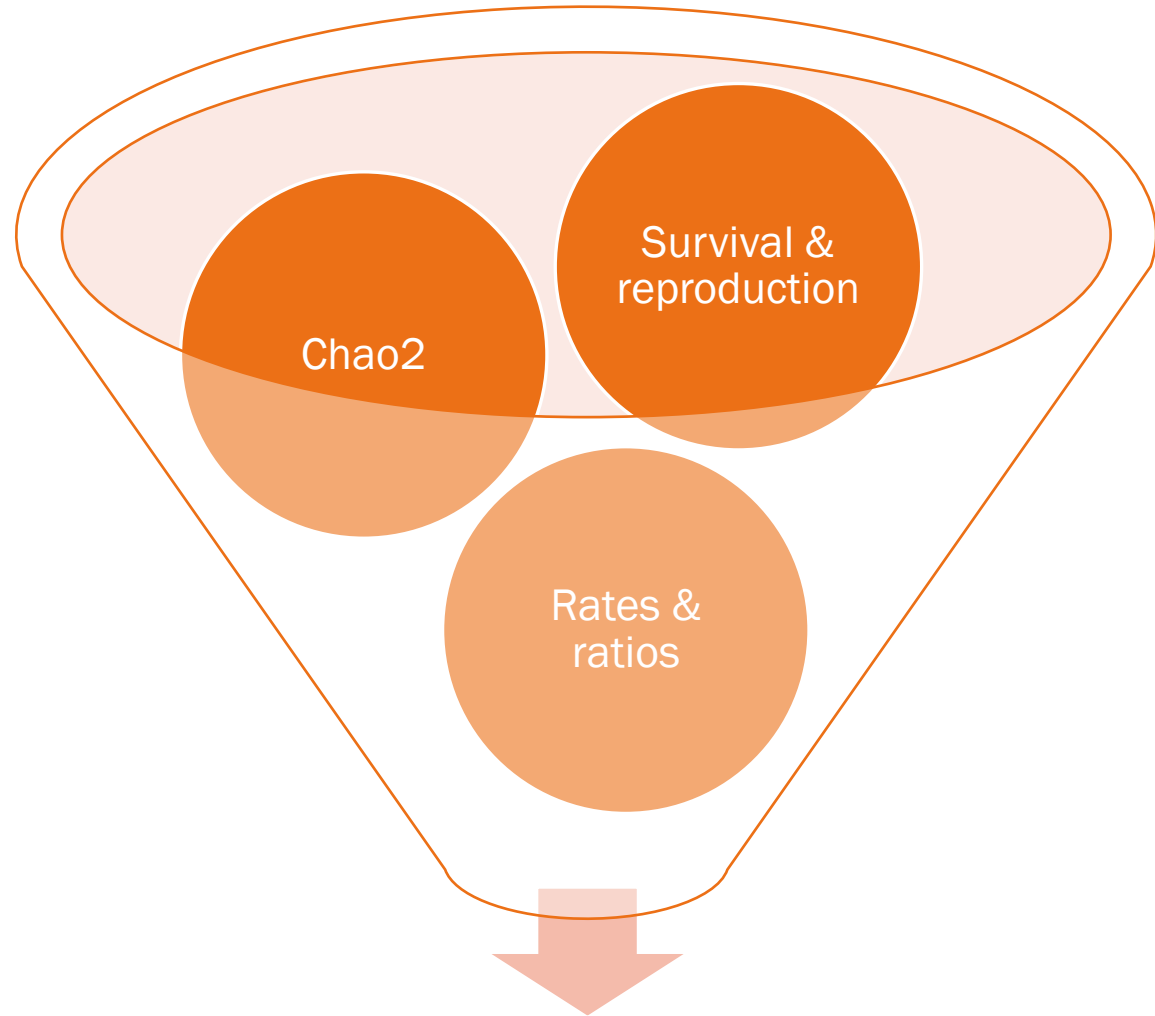
- More accurate (less biased) estimate of females with cubs
- Upward adjustment of total population estimates

From Chao2 to total population size

- Protocol in place since 2007
- Vital rates from 2002-2011



IGBST (2012)



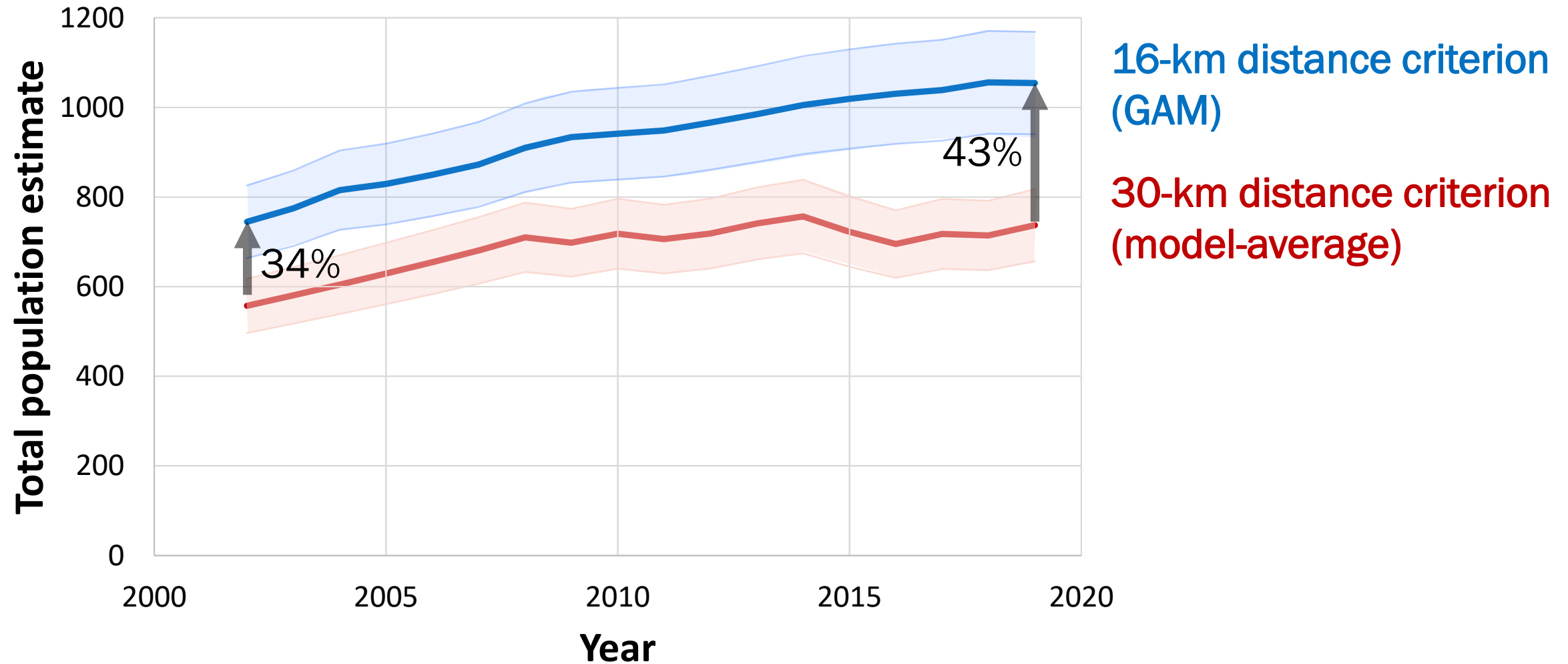
Total size by population segment

Independent age females

Independent age males

Dependent young

Implications: total population size



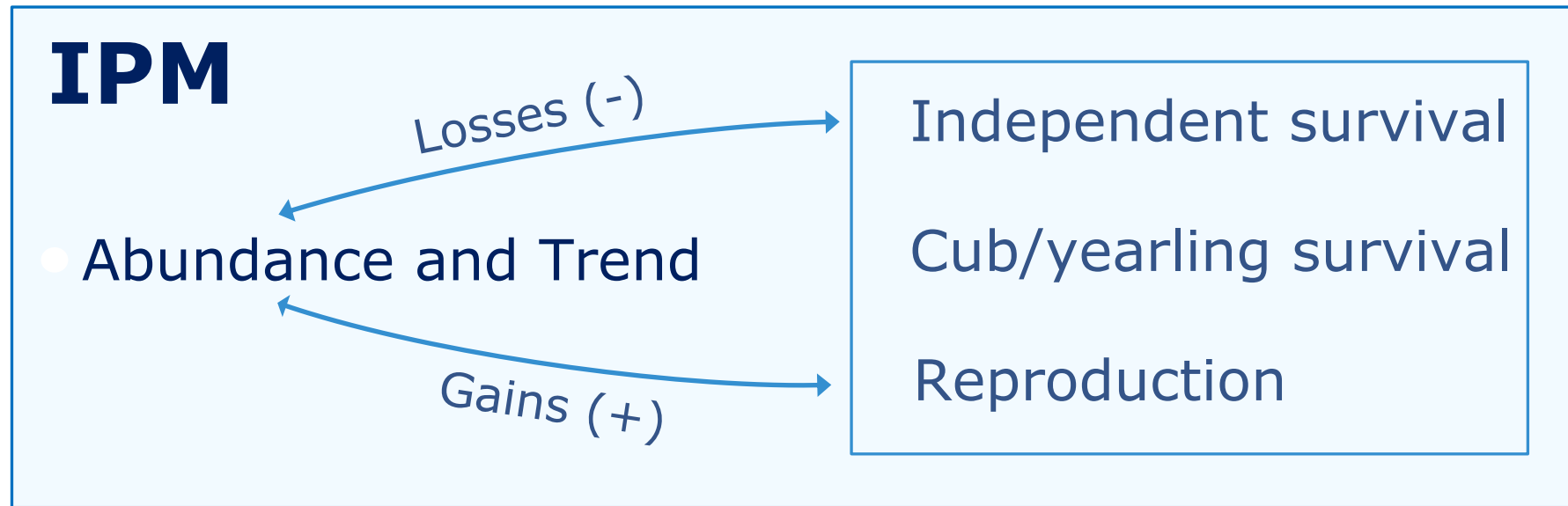
Implications

- NOTE: potential changes in population vital rates still being investigated
- IGBST objective is to provide annual updates of survival, reproduction, etc.

IPM: update and preview

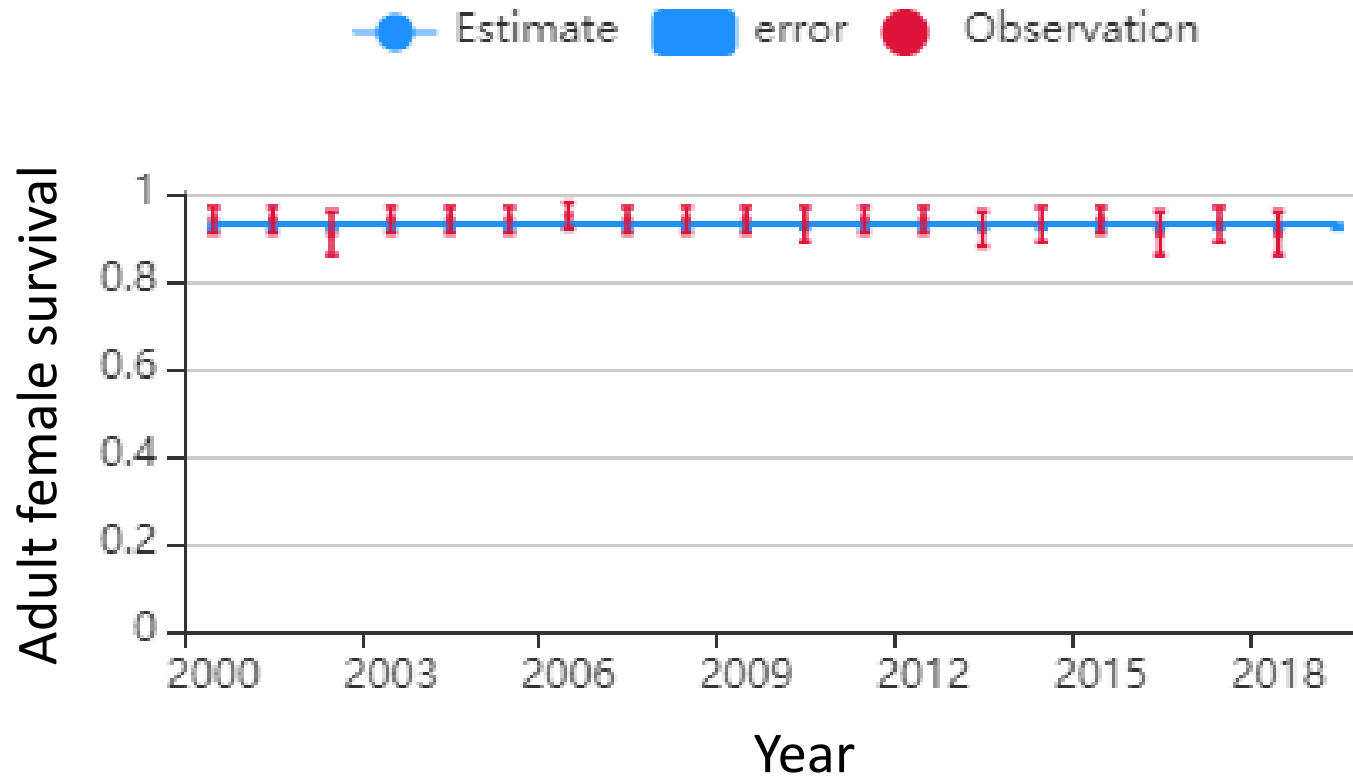
- Use updated Chao2 estimates in Integrated Population Model (IPM)
- Should reconcile better with other estimates
- IPM is progression and allows integration of current and future data

Linking vital rates and abundance



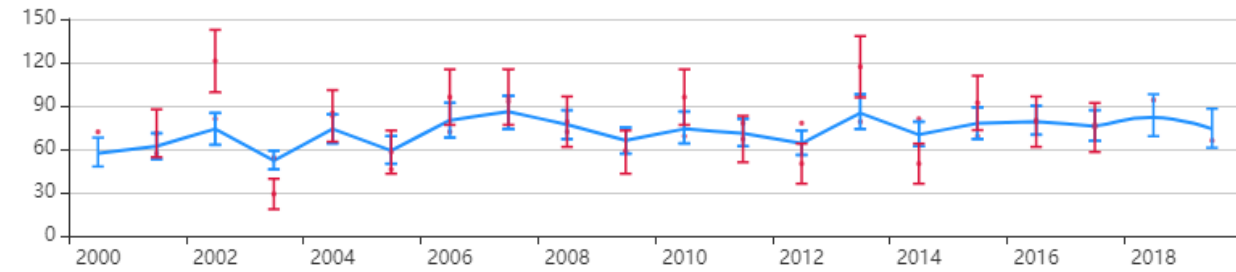
Parameters are “self-reconciling” --> reliable inference

IPM: preliminary view



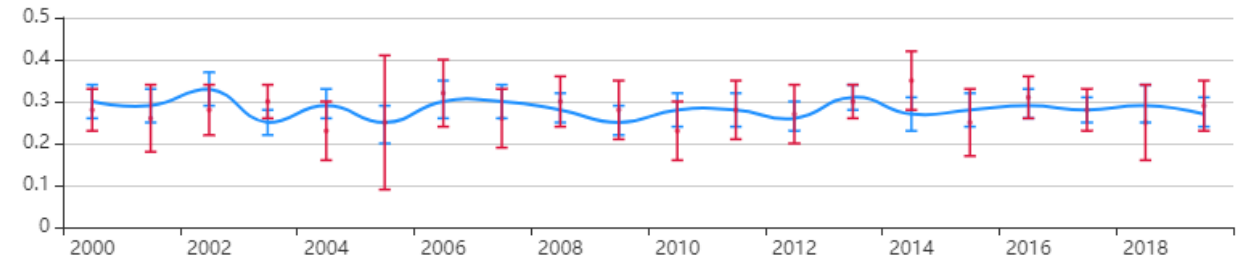
IPM: preliminary view

—●— Estimate ■ error ● Observation

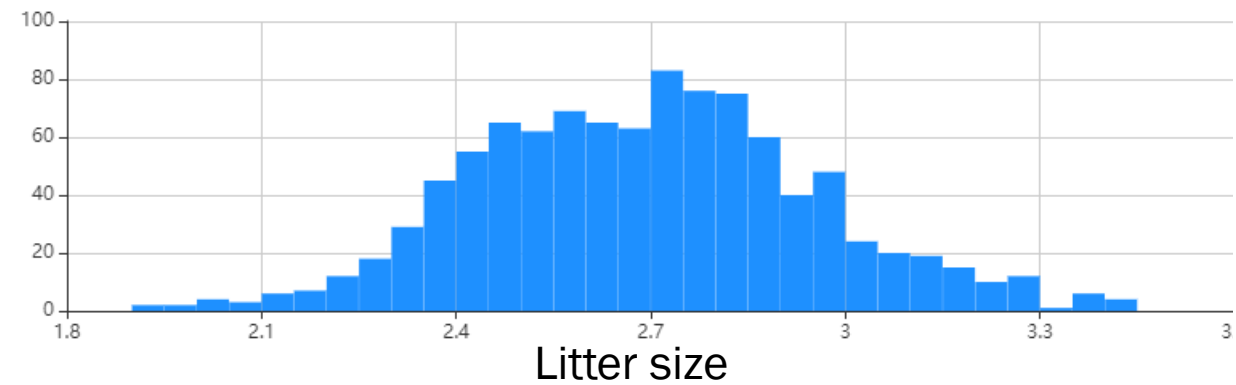


Number of females with cubs

—●— Estimate ■ error ● Observation



Proportion females with cubs



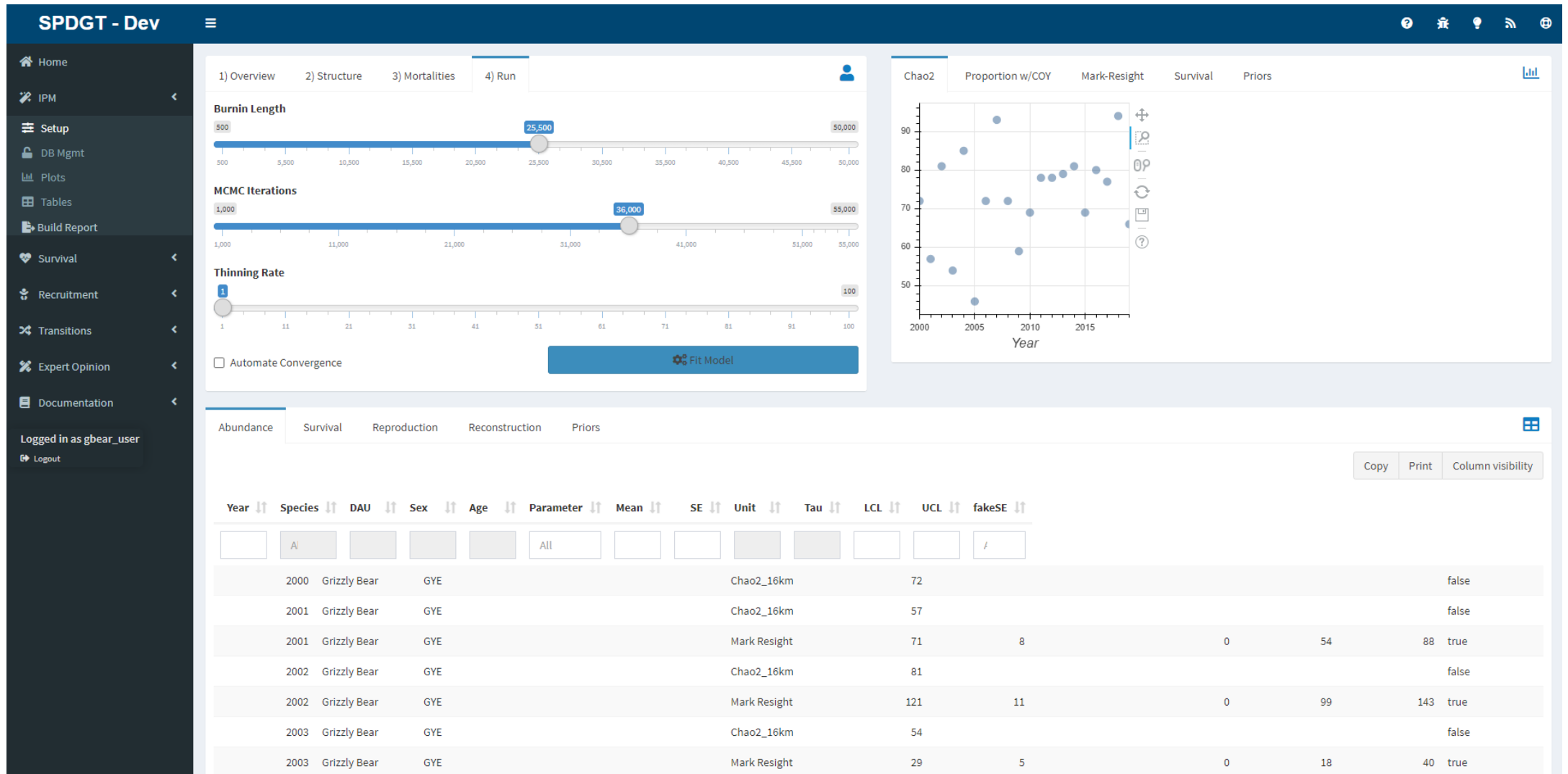
Litter size

—●— Estimate ■ error ● Observation



Number of cubs

IPM: preliminary view



Next steps

- Full implementation of Chao2 (16 km) into IPM
- Annual updates of vital rates
- Work in progress

Acknowledgments

- Mike Ebinger
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