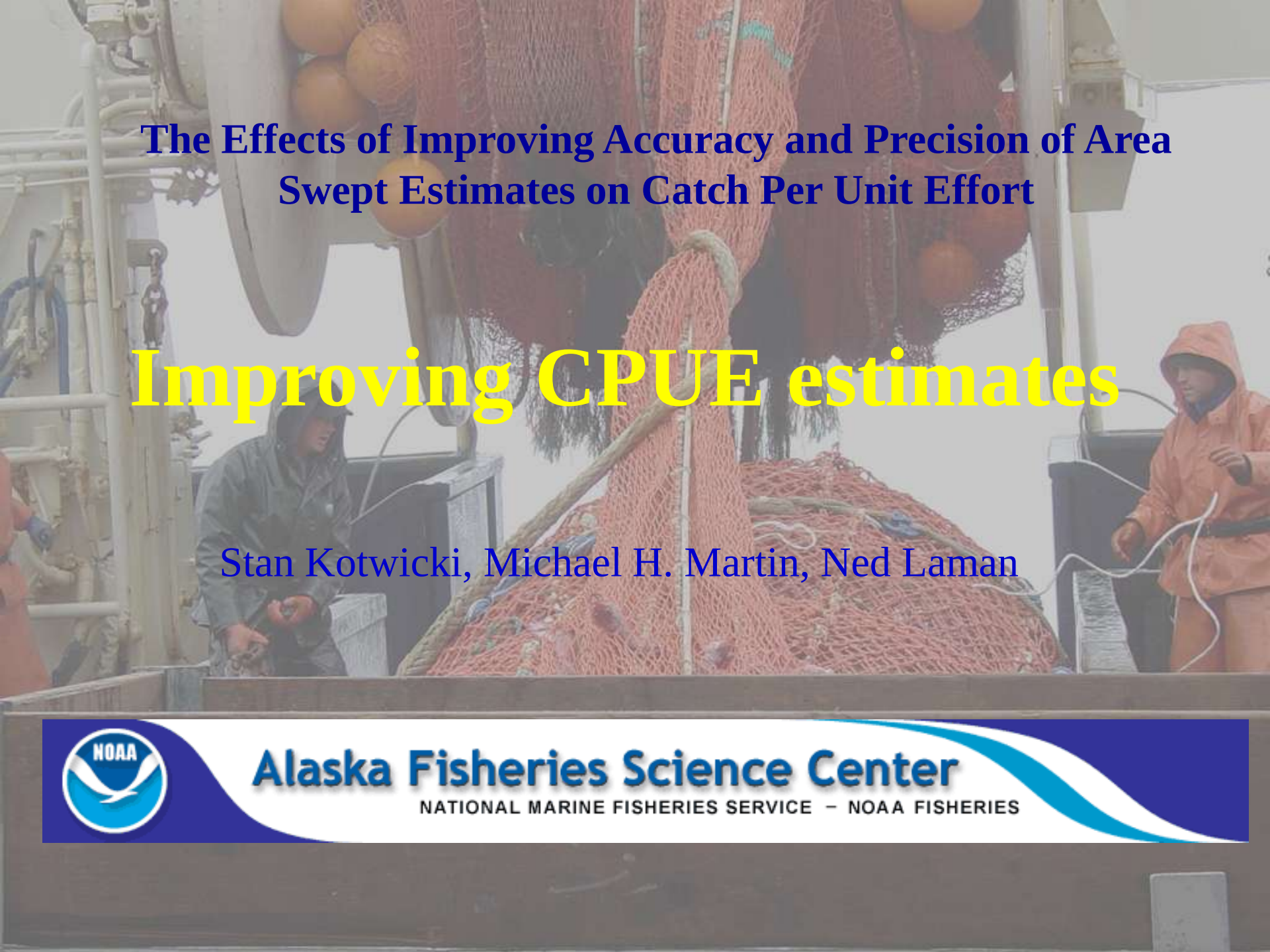

The Effects of Improving Accuracy and Precision of Area Swept Estimates on Catch Per Unit Effort

Improving CPUE estimates

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CPUE

CPUE = Catch / Area swept

Constant - catchability measurement error

Area swept = Distance fished * Wing spread

- Constant or random error is OK
- Error, which varies in space or time is not

Proposed improvements:

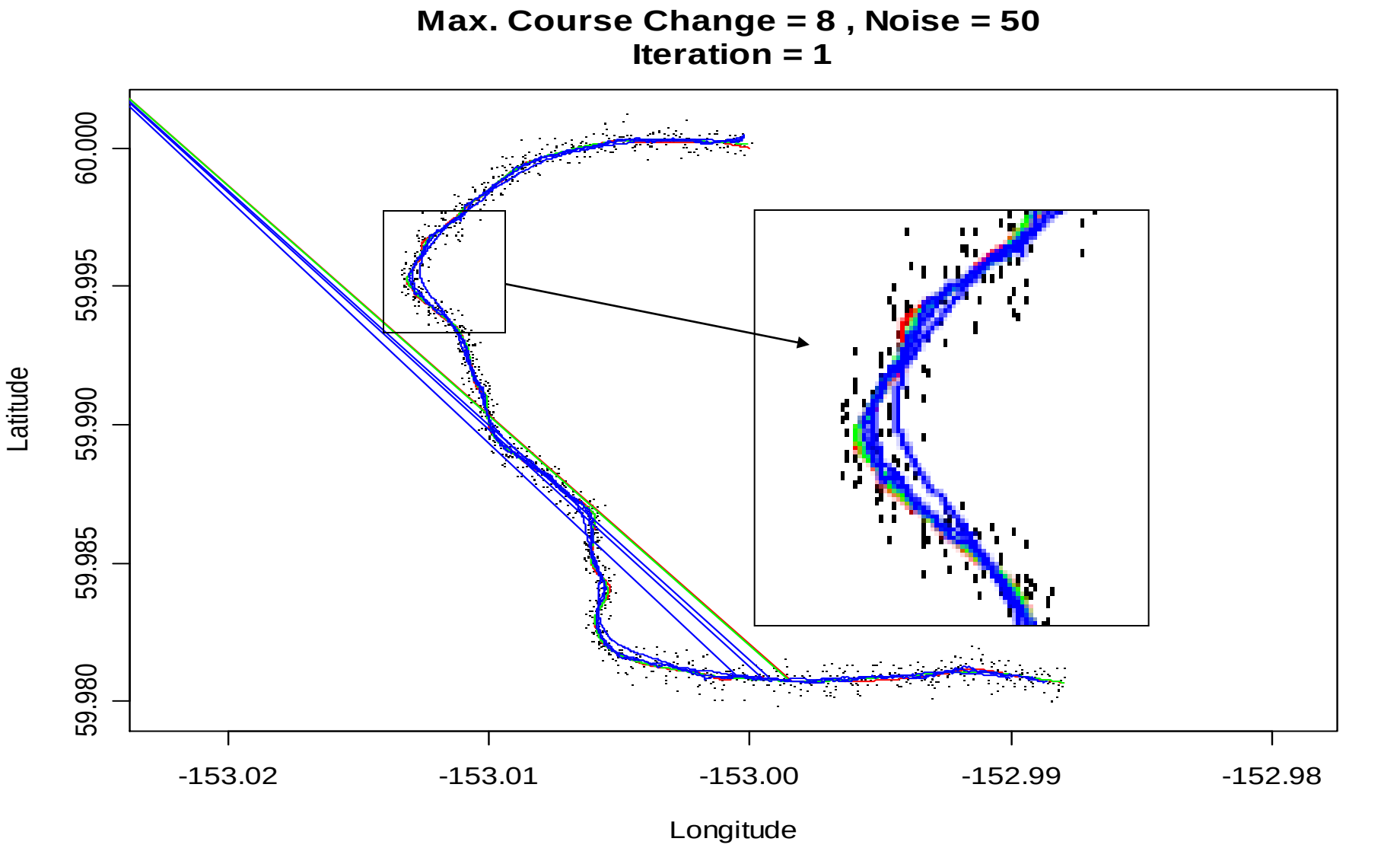
Distance fished:

- smooth vessel track with cubic spline smoother
- change distance algorithm from Euclidean to Haversine (Sinnott, 1984)
- addition of distance fished due to wire retrieval between haulback and off bottom

Net spread

- more accurate estimate of sound speed
- sequential outlier rejection
- calculation of mean from smoothed data

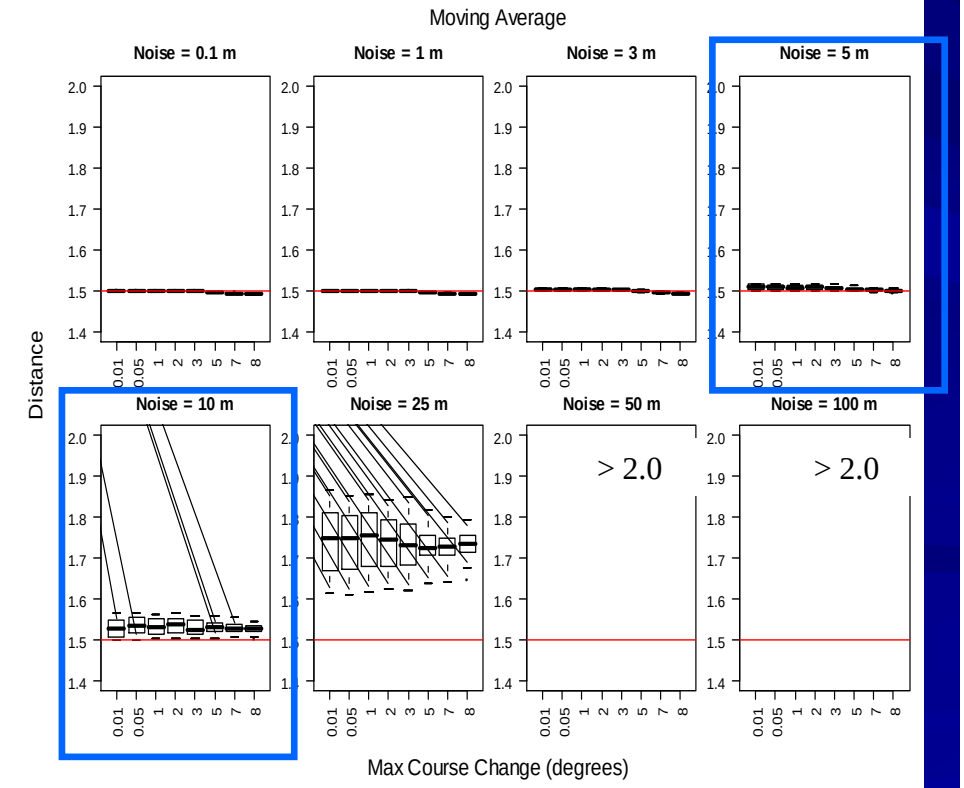
Vessel track example

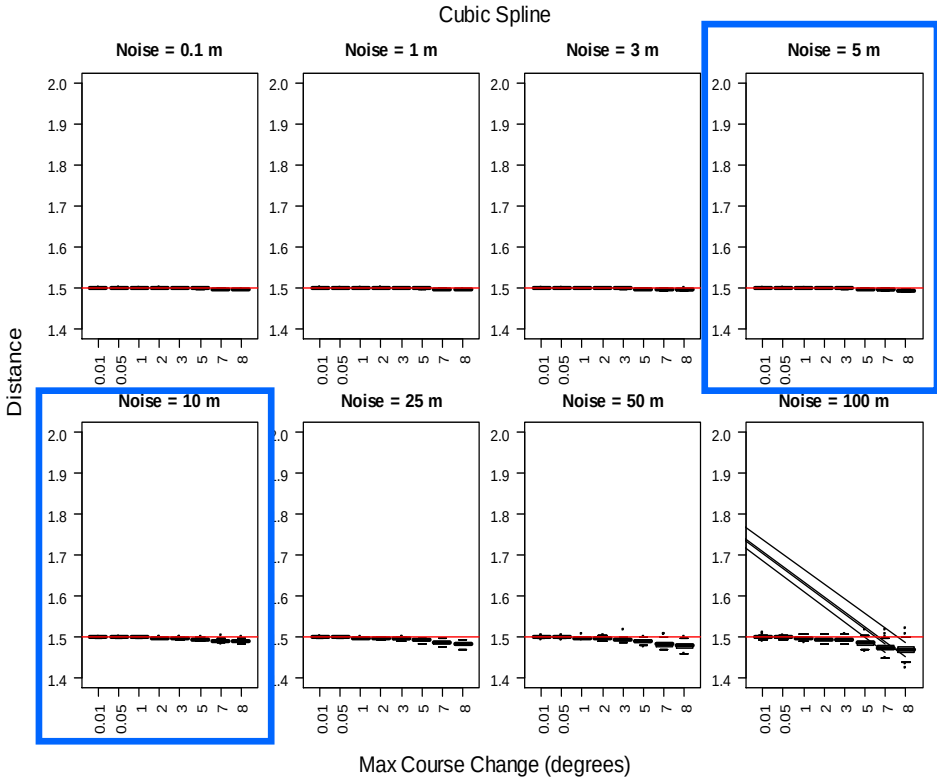


Distance Fished

Current moving average smoother overestimates true distance with “noisy” GPS.

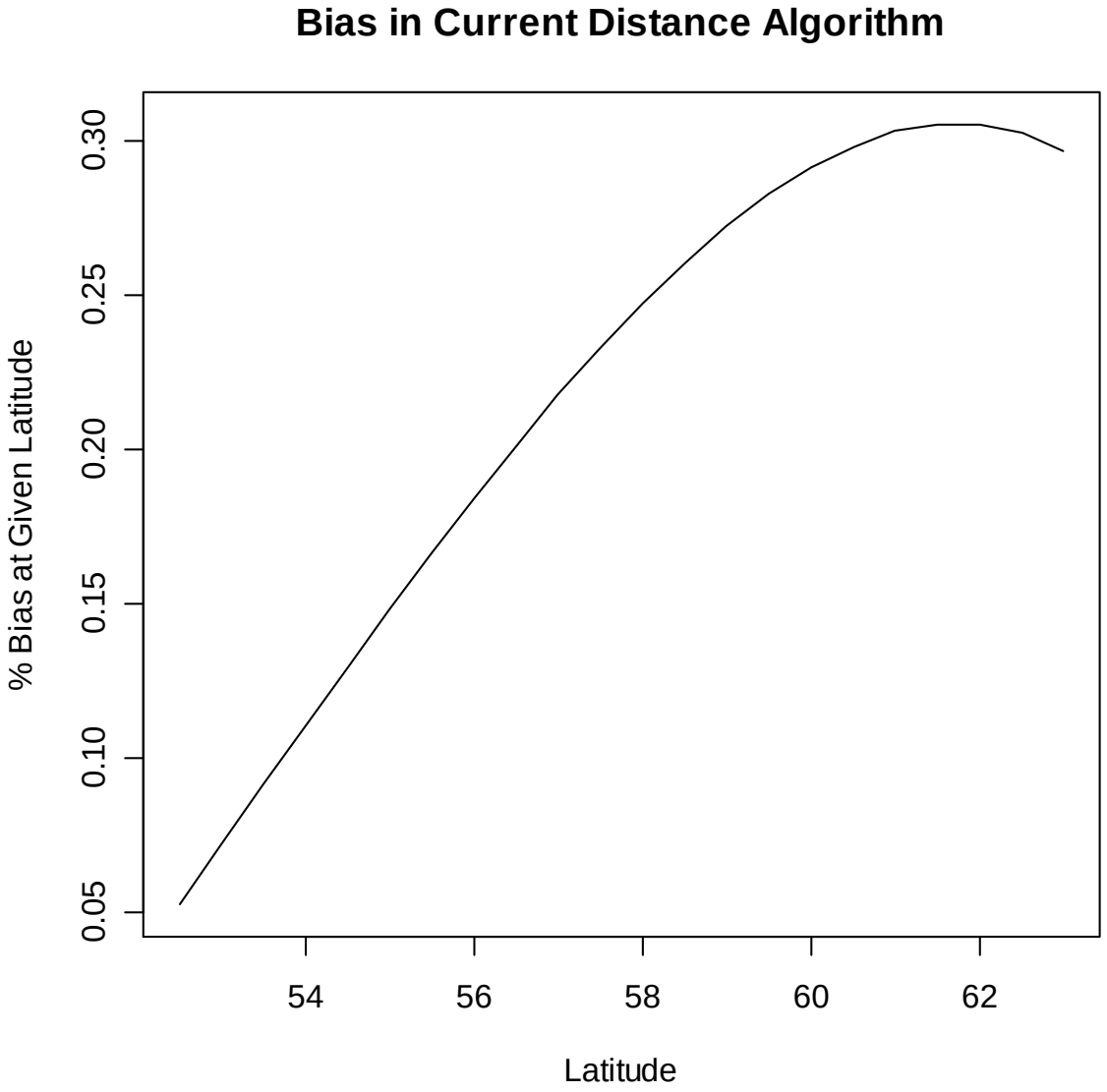
Cubic spline smoothing is more robust to noisy data – **eliminates bias due to GPS noise.**





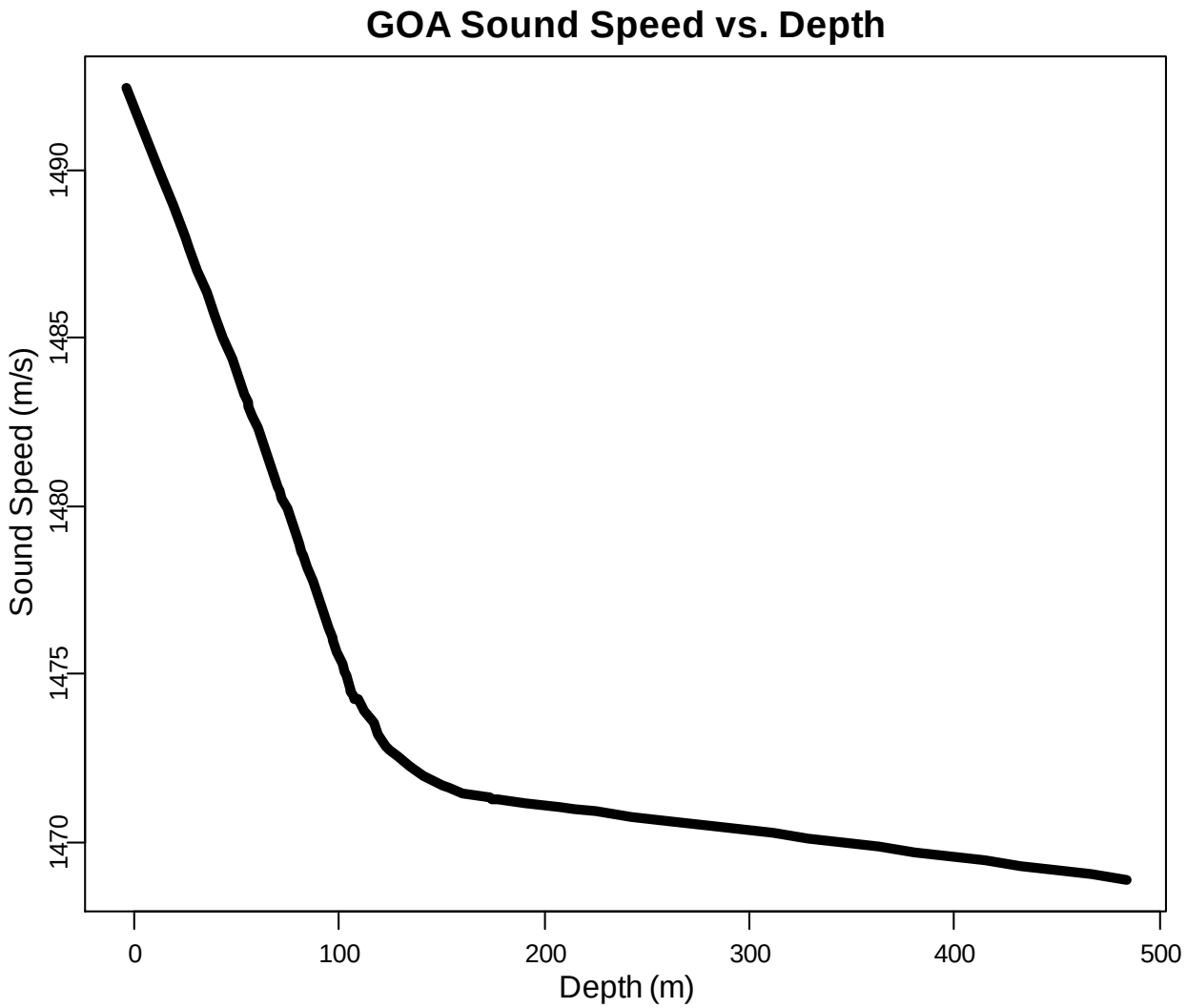
Distance Fished

Haversine distance algorithm eliminates latitudinal bias of Euclidean algorithm

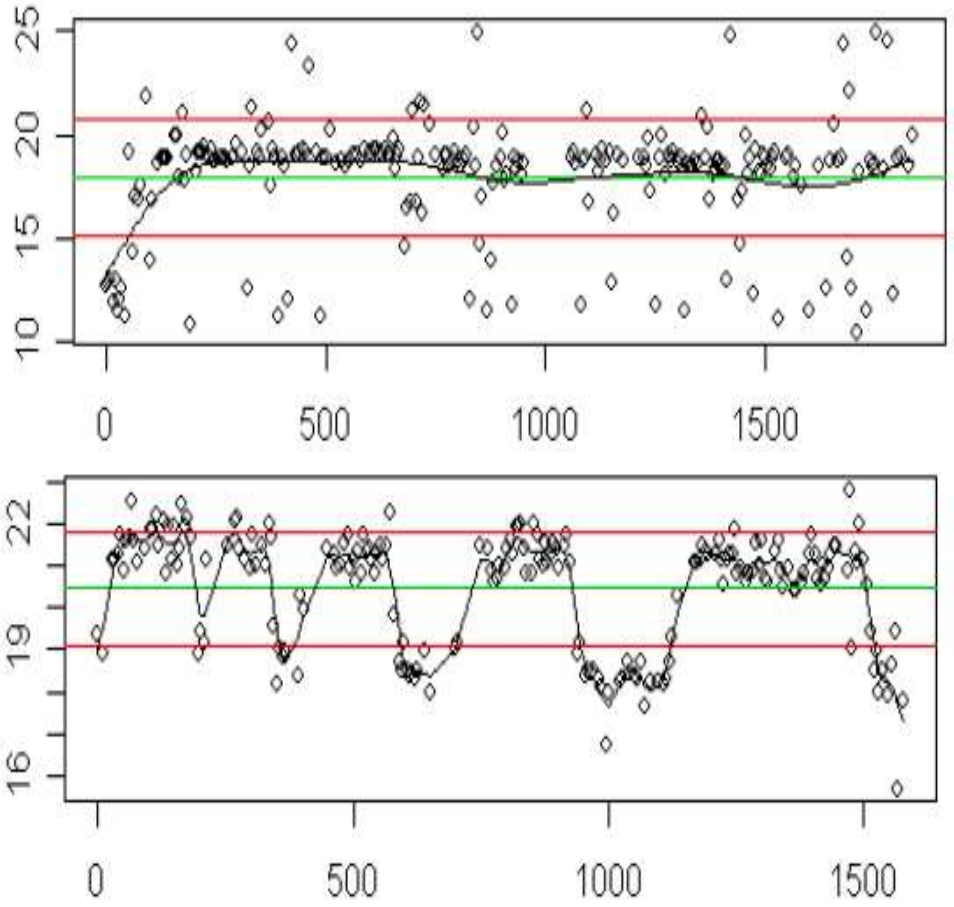


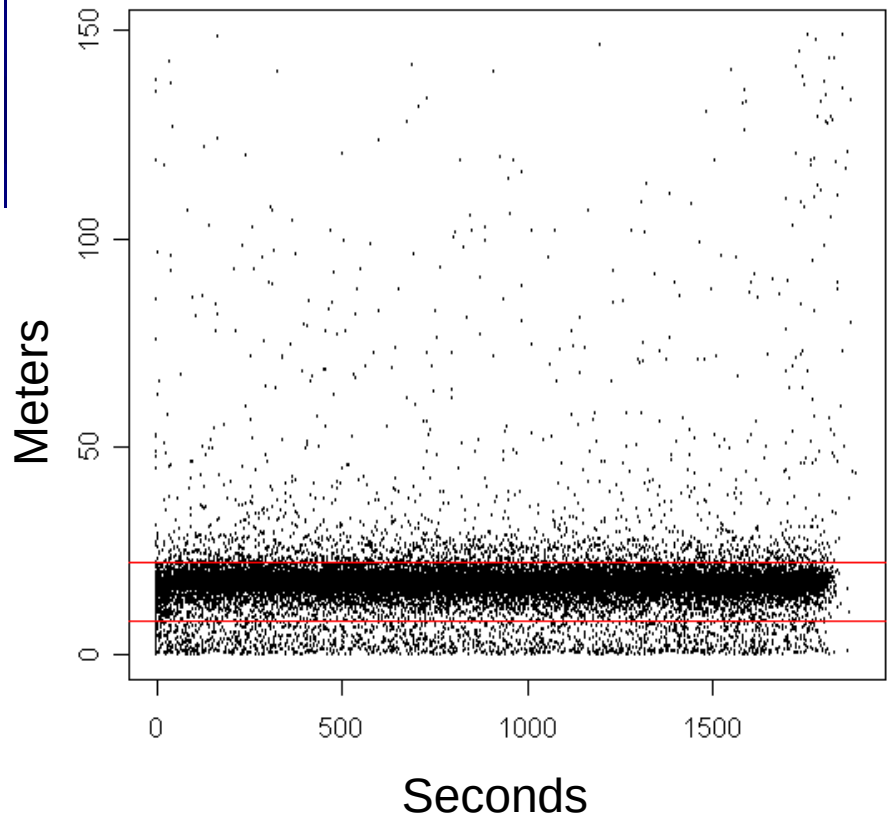
Wing Spread

Using accurate estimate of sound speed eliminates bias due to assumption of constant sound speed through water.



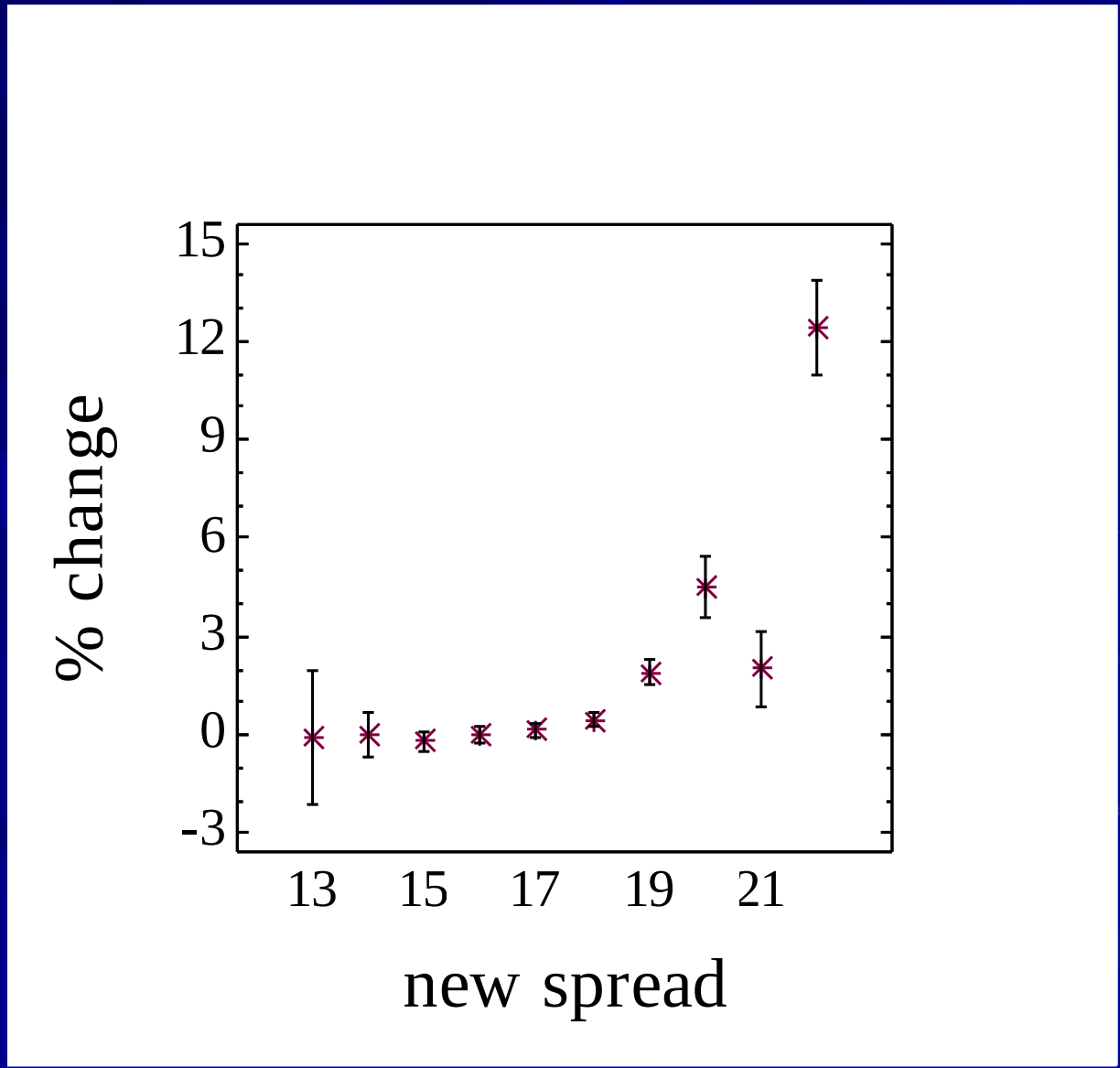
Spread data examples





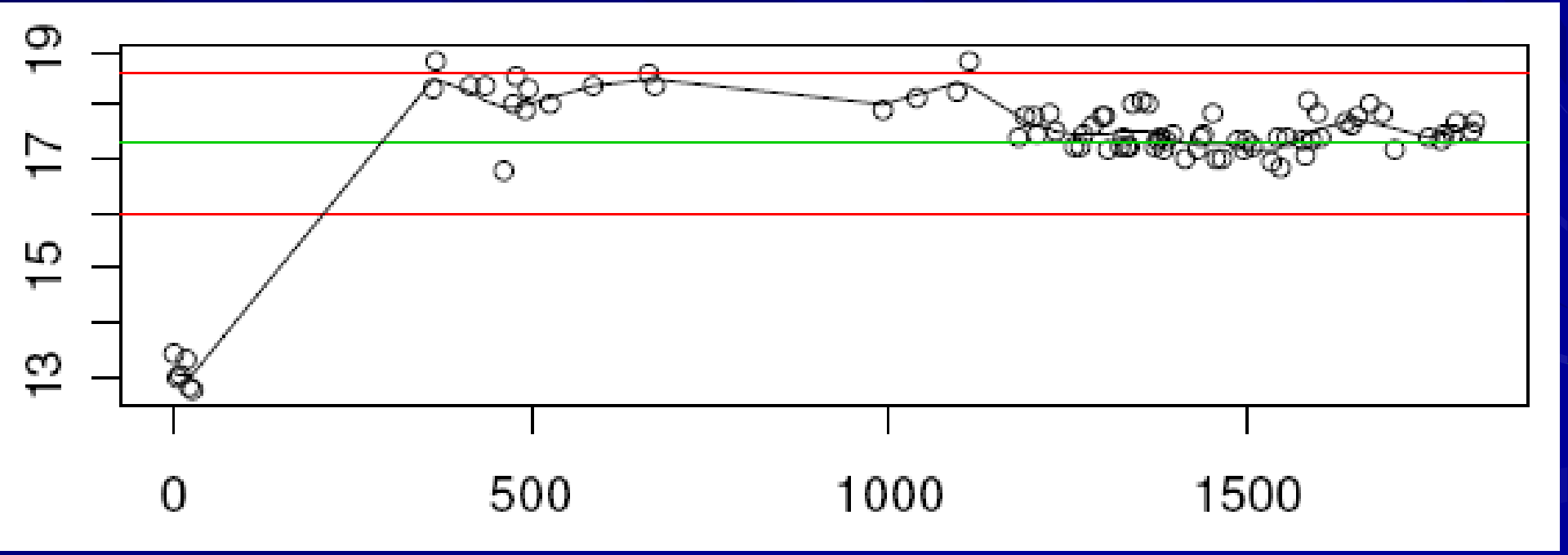
Wing Spread

Using sequential outlier rejection eliminates bias due to asymmetrical distribution of outliers in spread data.

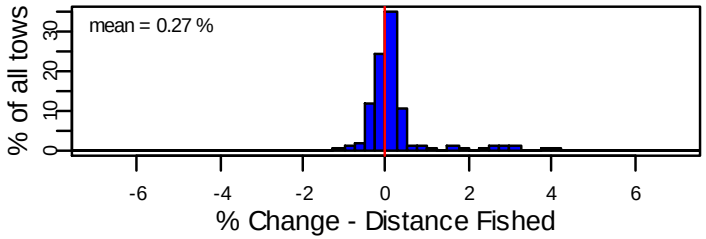


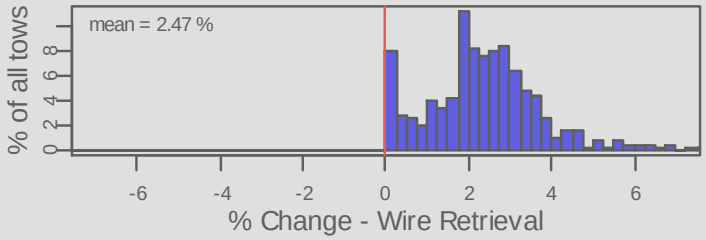
Wing Spread

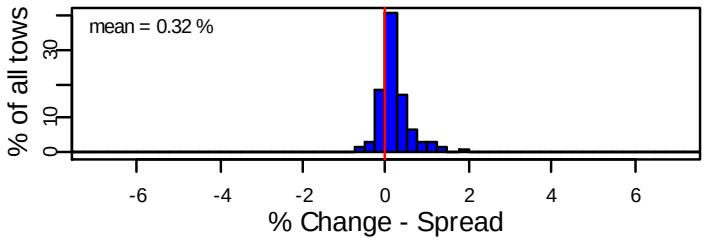
Using smoothed mean eliminates bias due to unequal density of incoming data throughout the tow

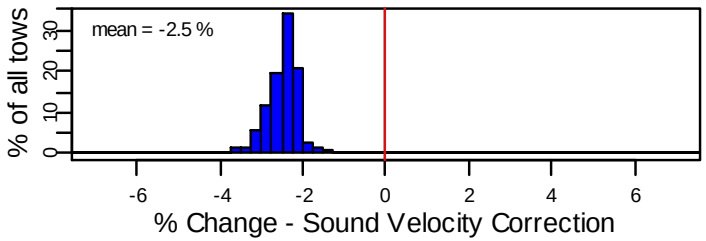


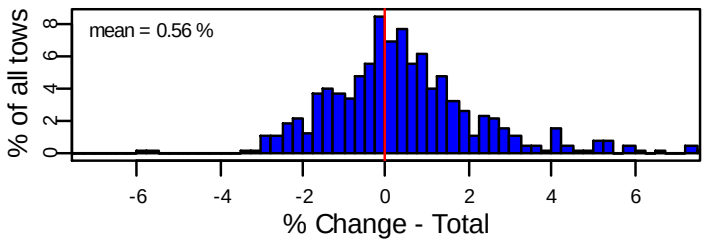
Bering Sea



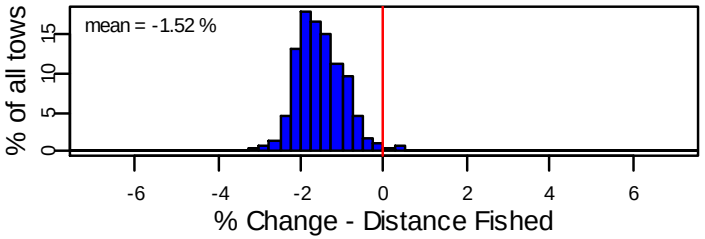


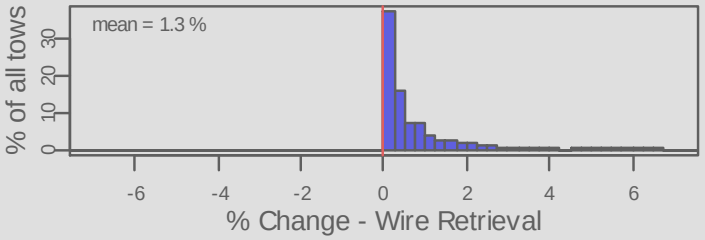


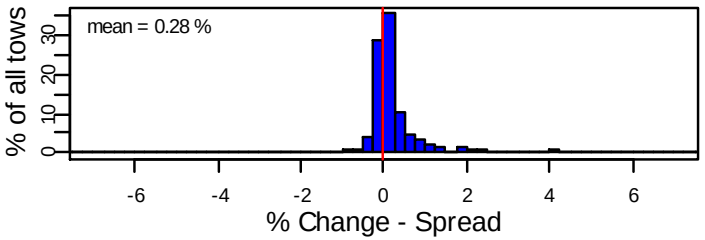


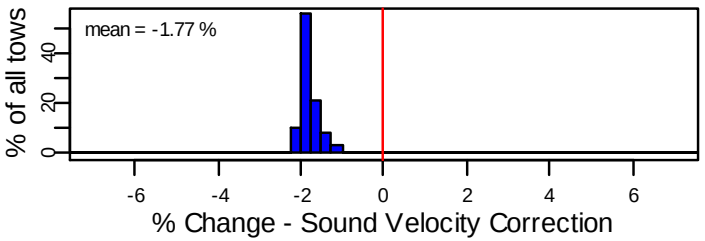


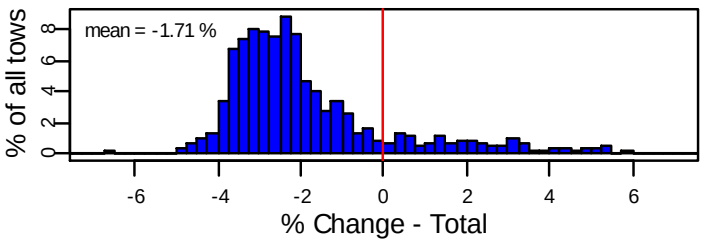
Gulf of Alaska

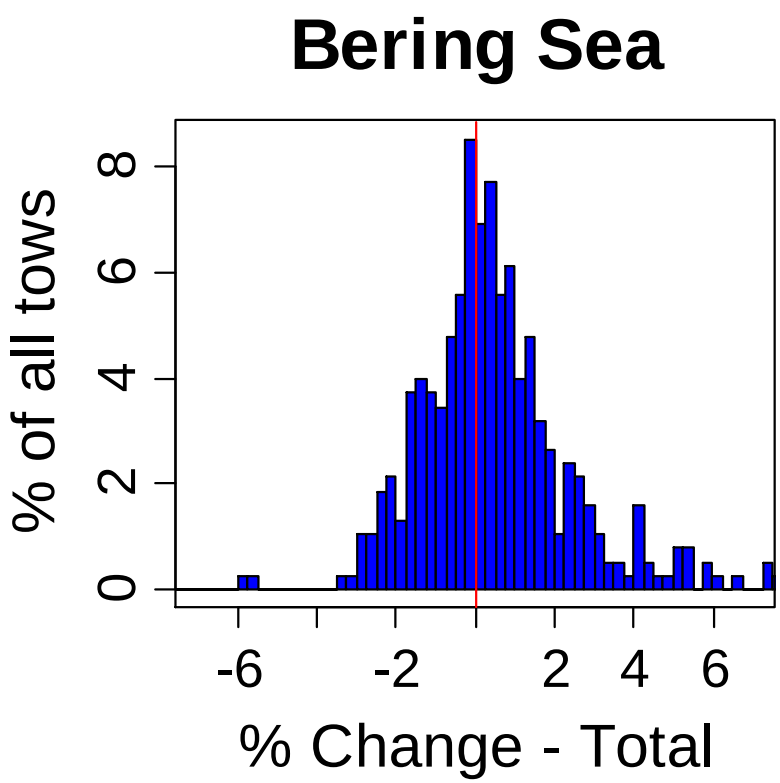


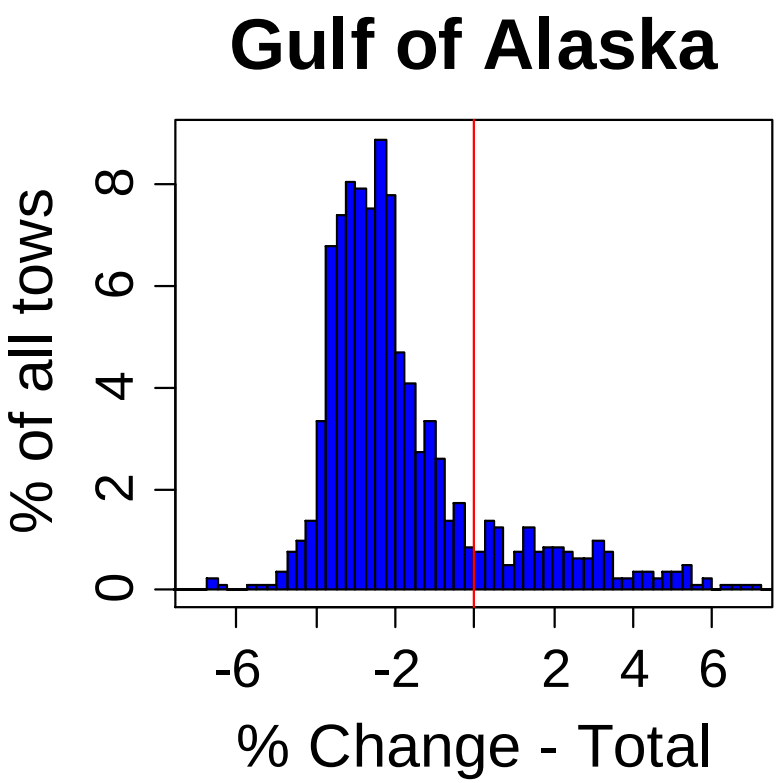






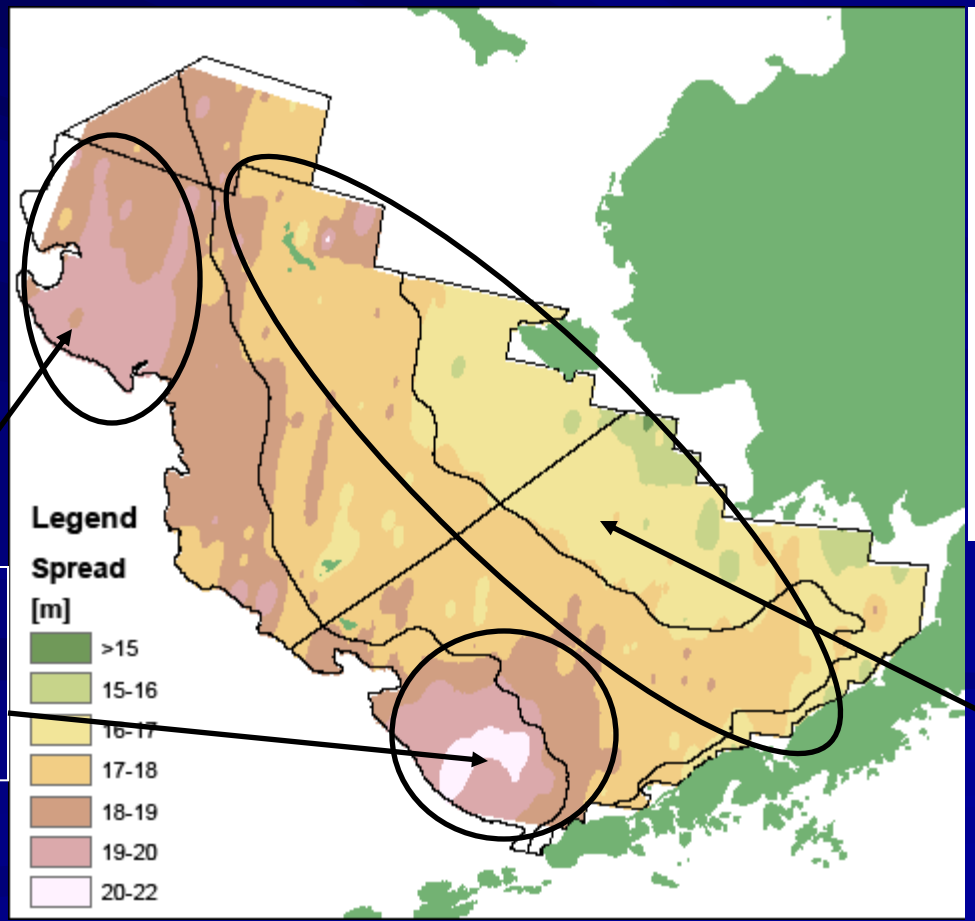


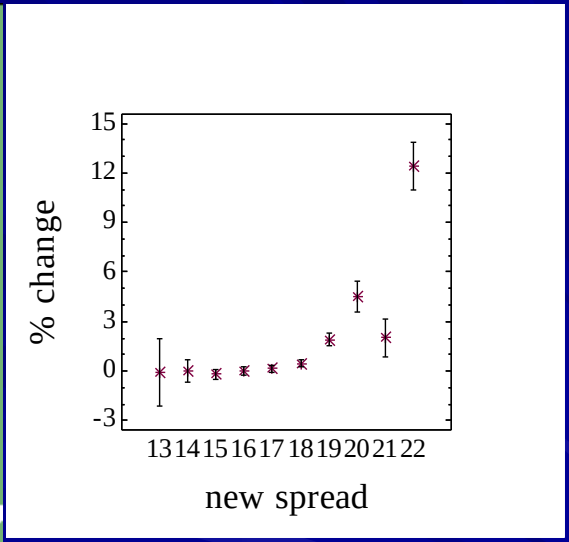

Bering Sea
% of all tows
0
2
4
6
8
-6
-2
2
4
6
% Change - Total


Gulf of Alaska
% of all tows
0
2
4
6
8
-6
-2
2
4
6
% Change - Total

Why is it important to correct for non random sources of bias?

Spatial variation in bias:



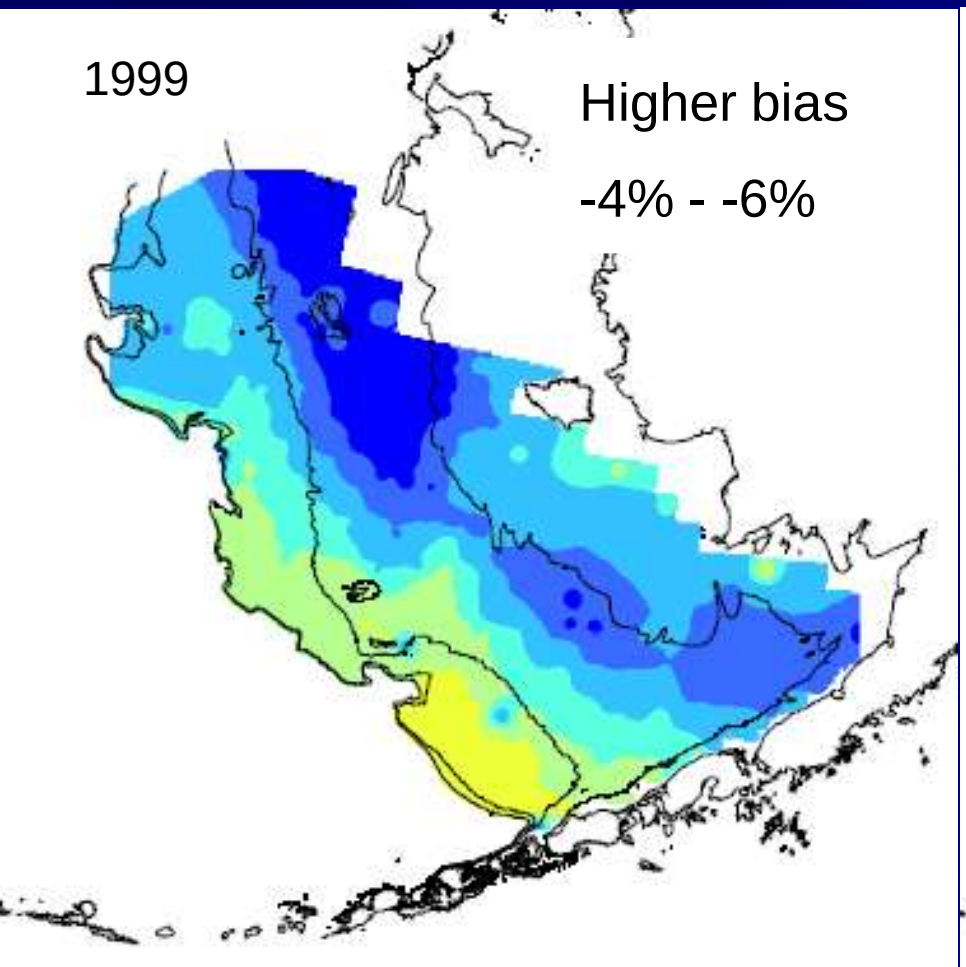


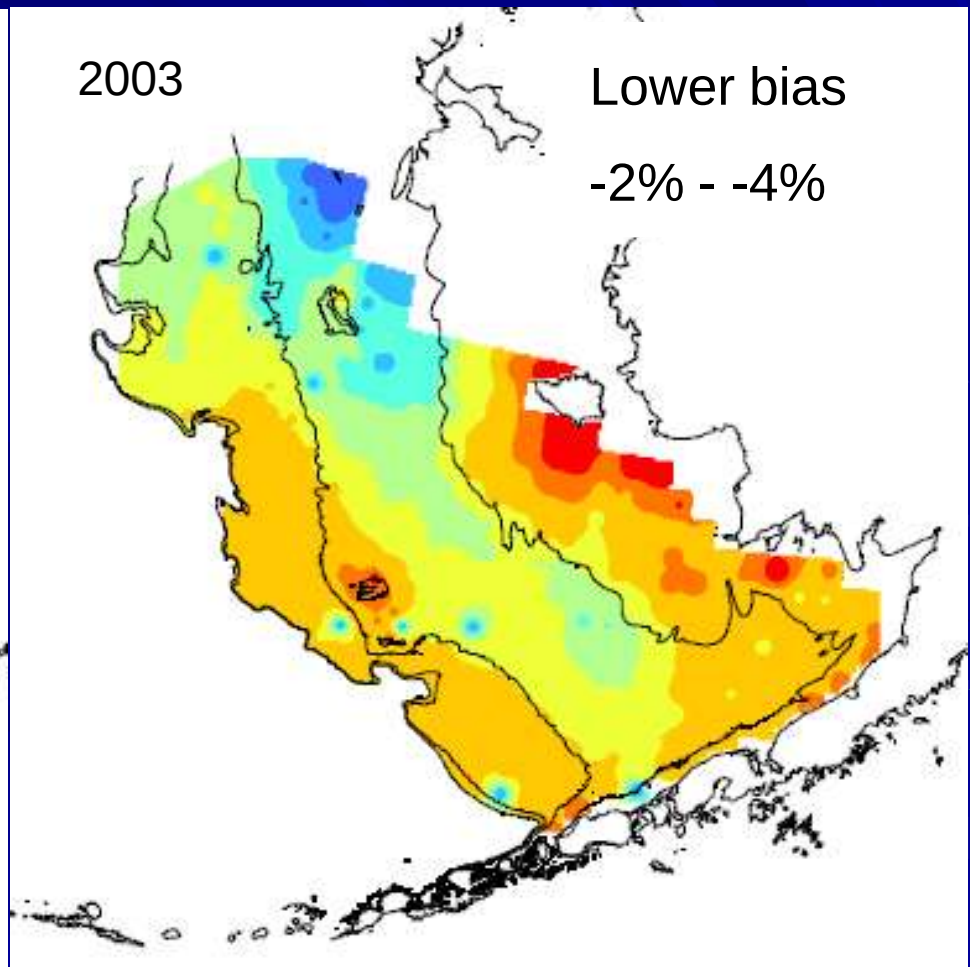
High negative bias

Low bias

Why is it important to correct…

Year to year variation in bias due to temperature effect on sound speed:





Future Work

- More spread simulation work "gaps"
- Analysis of more years' data
- Retrospective analysis

- Kotwicki et al. (in press) Improving area swept estimates from bottom trawl surveys. Fisheries Research