

2020 Pollock USV survey

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Speaker



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Project overview

Contingency plan in case surveys were cancelled due to COVID disruptions to surveys.

Goal: Use unmanned surface vehicles to add data point to existing acoustic time series

Feasible because:

- Fish backscatter on EBS shelf is dominated by pollock
- Long history of surveys to draw from
- Leverages recent research and partnerships

Saildrones

- Wind and solar powered robots
- Calibrated 38/200 kHz echosounder, oceanographic, meteorological sensors
- Methods for acoustic data collection/processing have been worked out since 2015 with AFSC/Saildrone/PMEL/Simrad
- Saildrones produce comparable pollock backscatter measurements to Dyson



ICES Journal of Marine Science (2019), 76(7), 2459–2470. doi:10.1093/icesjms/fsz124

Original Article

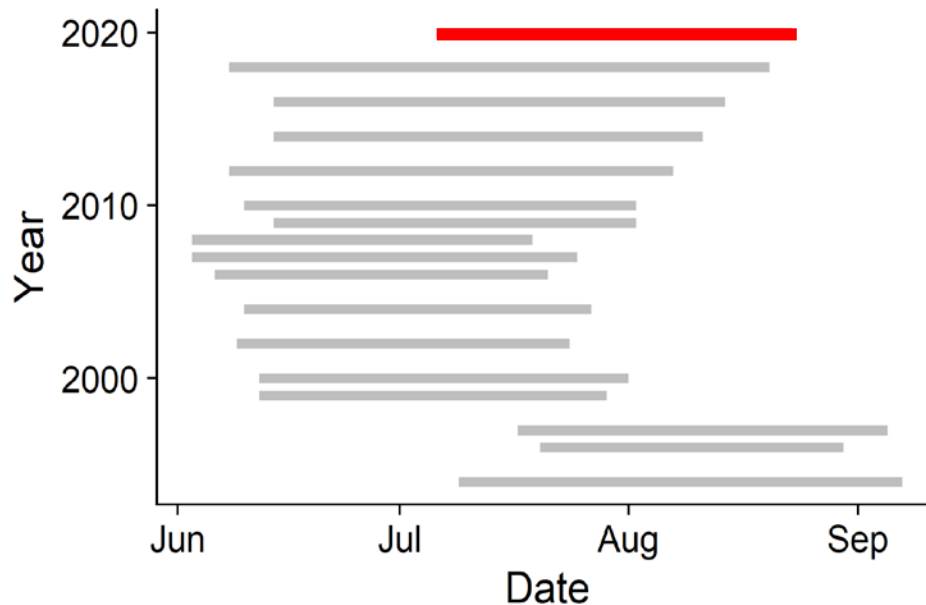
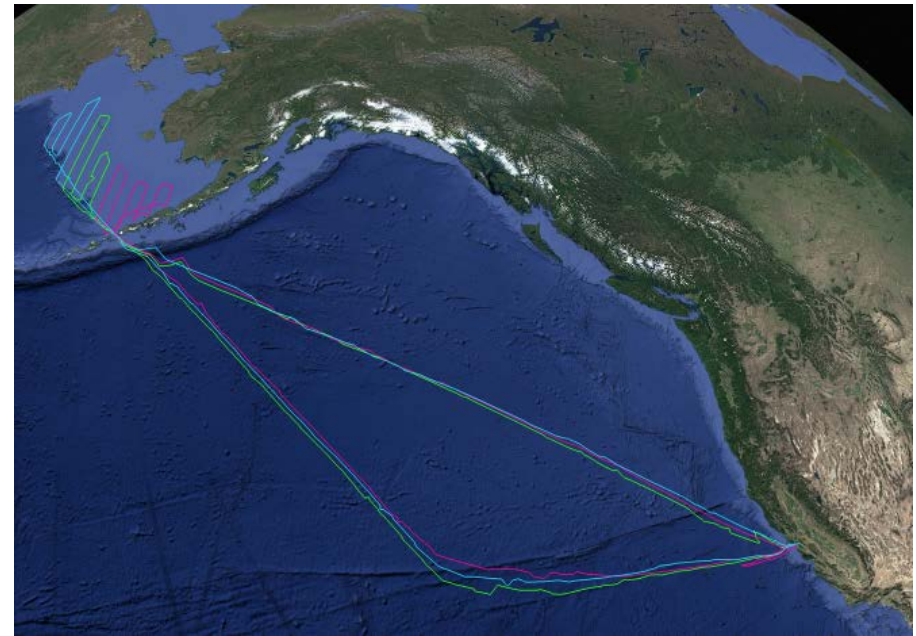
Long-term measurements of fish backscatter from Saildrone unmanned surface vehicles and comparison with observations from a noise-reduced research vessel

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See ICES J. Mar Sci. 2019, 76: p 2459

Approach

- Sail to/from Alaska
- 3 saildrones
- 40 nmi spacing
- Survey July 4-20 Aug
- Survey during daylight
- Pause at >25 knots



Survey design is a Dyson contingency plan

Typical survey (20 nmi spacing)



2020 survey (40 nmi spacing)



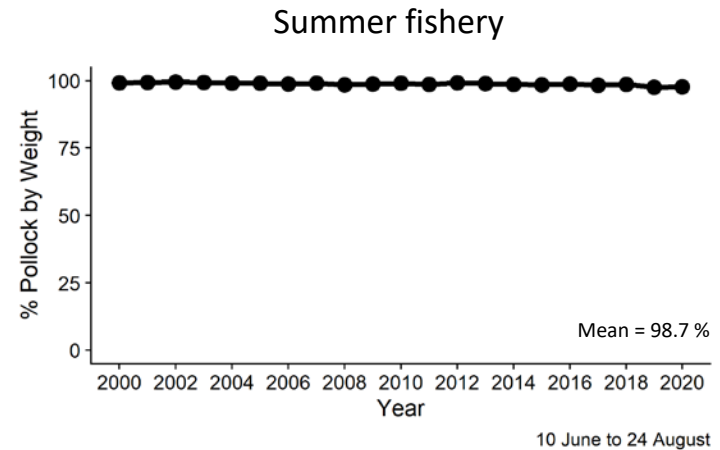
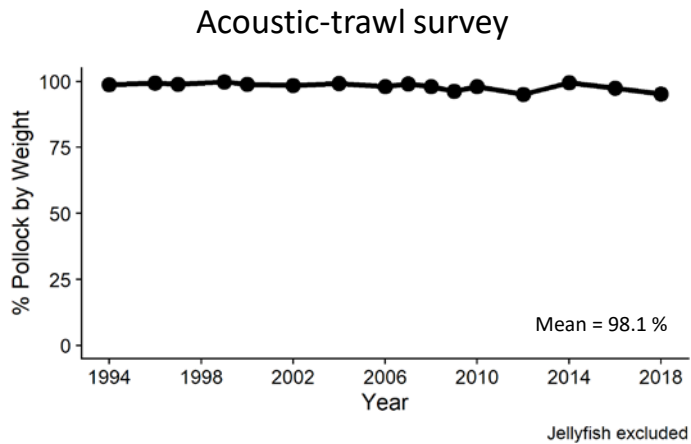
Limitations



- No trawling for species verification, size/age composition
- Measures backscatter, not biomass
- Larger 'Acoustic dead zone'
- 40 nmi rather than 20 nmi transects

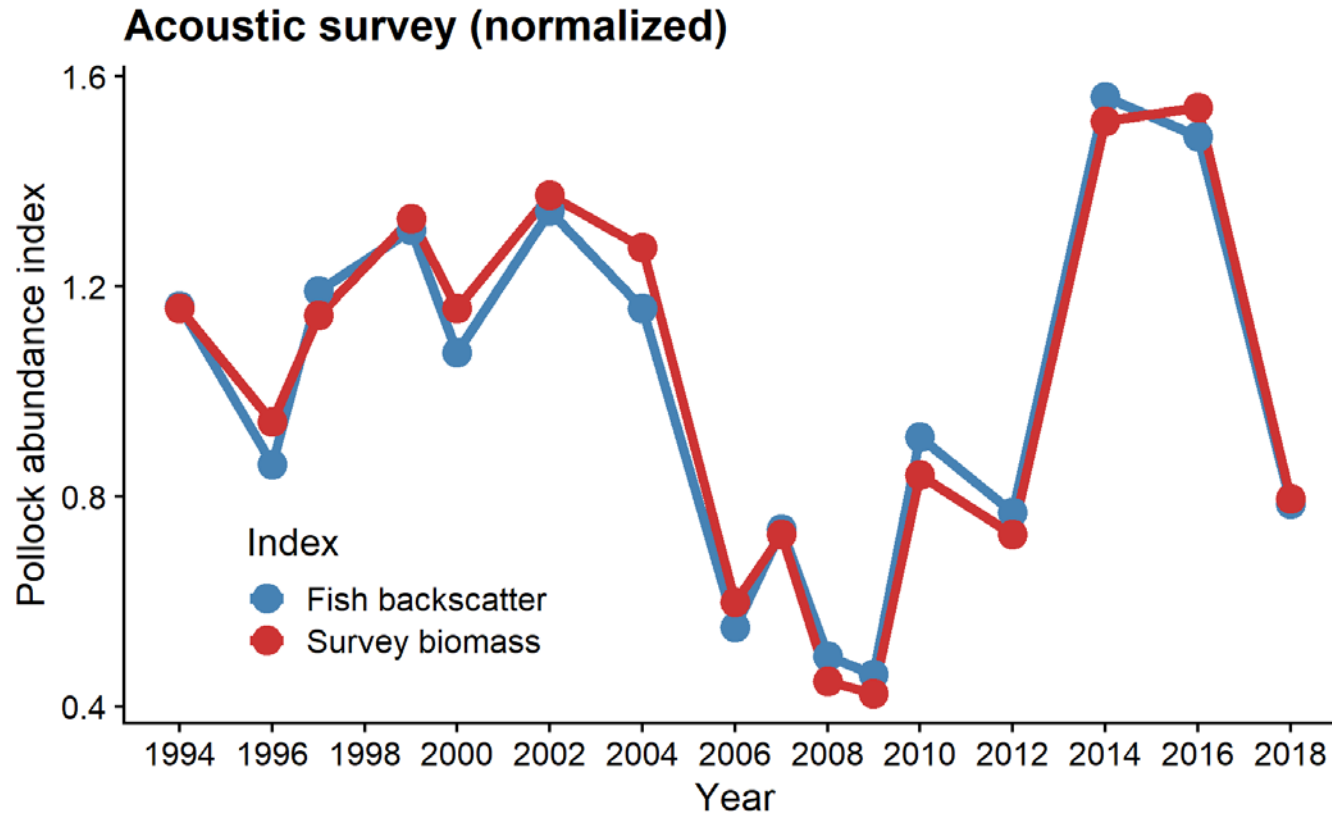
Concern: No trawling for species verification,
size/age composition

Pollock dominate midwater biomass



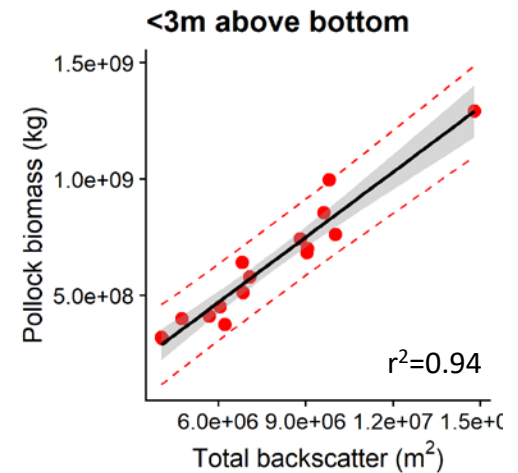
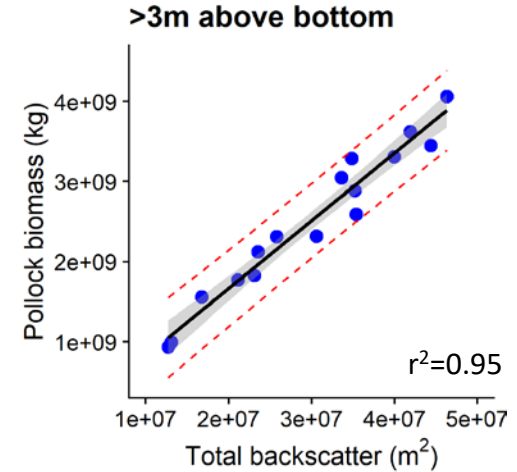
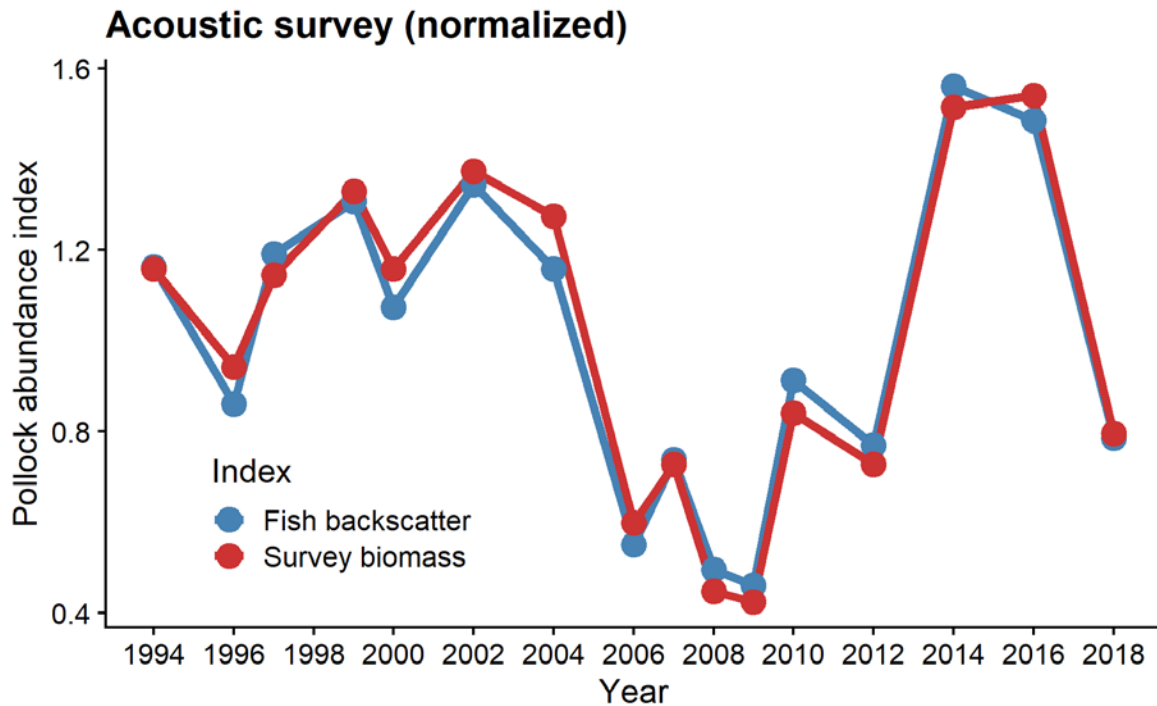
Concern: Measures backscatter, not biomass

Acoustic-only index tracks acoustic-trawl survey biomass



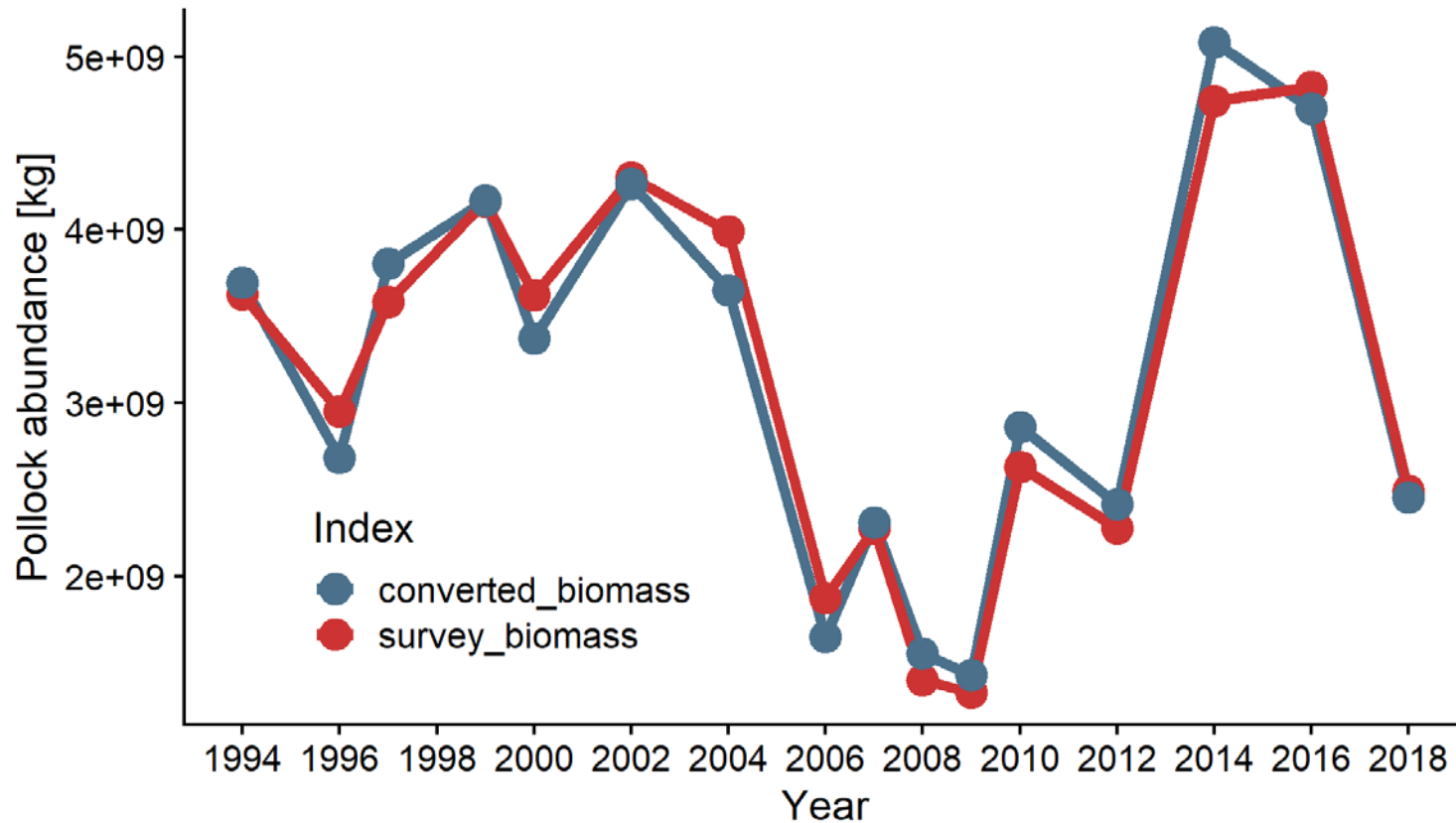
Concern: Measures backscatter, not biomass

Acoustic-only index tracks acoustic-trawl survey biomass



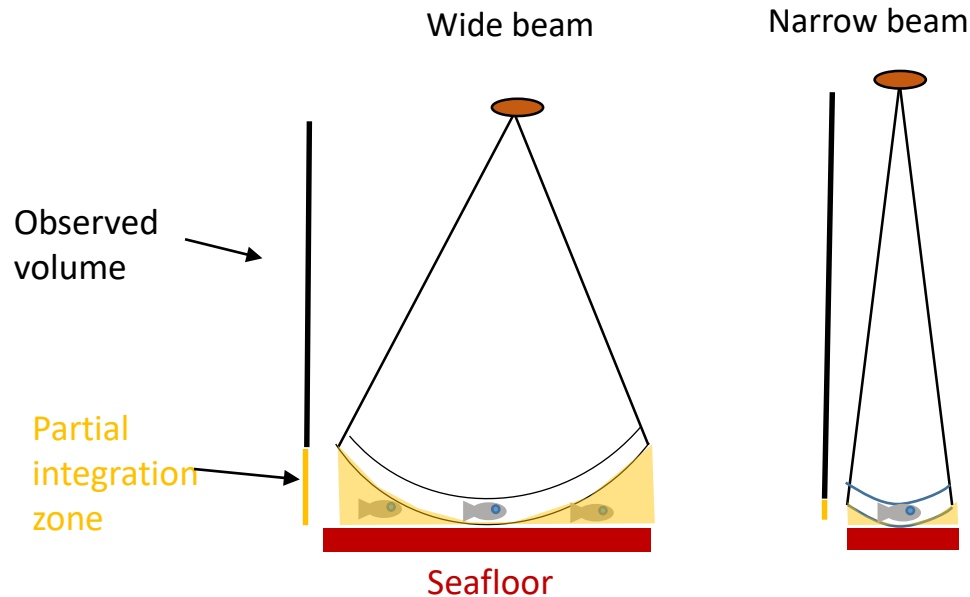
Concern: Measures backscatter, not biomass

Solution: Convert backscatter to biomass



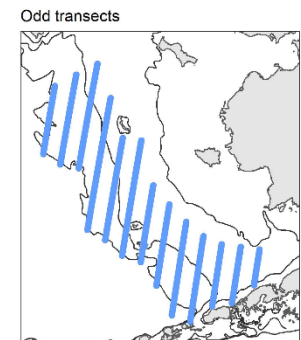
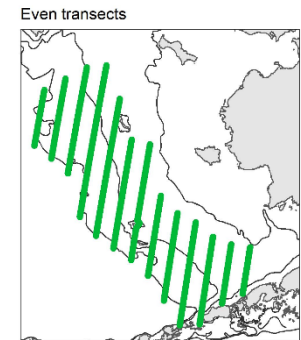
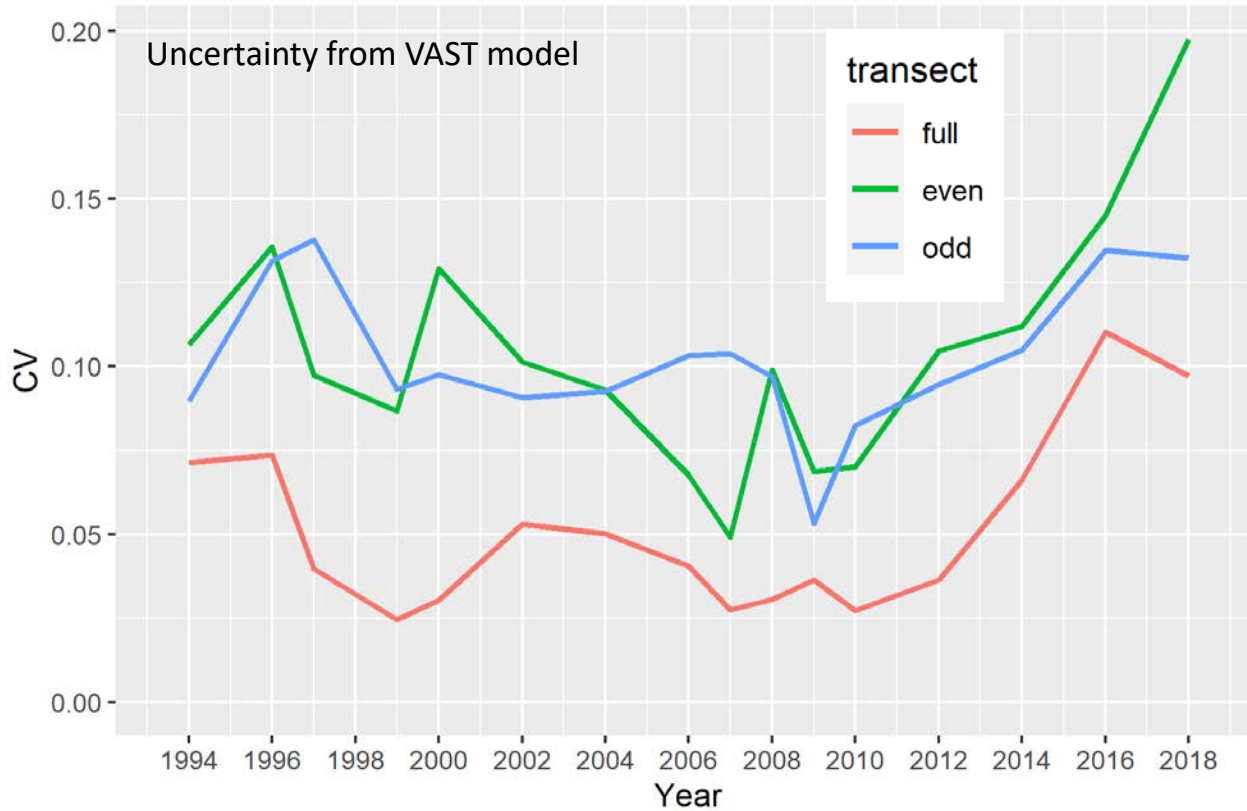
Mean difference = 5.7 %
Minimum = 0.1 %
Maximum = 11.0 %

Concern: USV has a wider beam than a ship (18° vs 7°).
Will USV miss more fish in the near-bottom 'Acoustic dead zone' ?



Solution – ADZ correction (Ona and Mitson, 1996)
Adds 6.7% to the survey total.

Concern: Less sampling (40 nmi instead of 20 nmi)

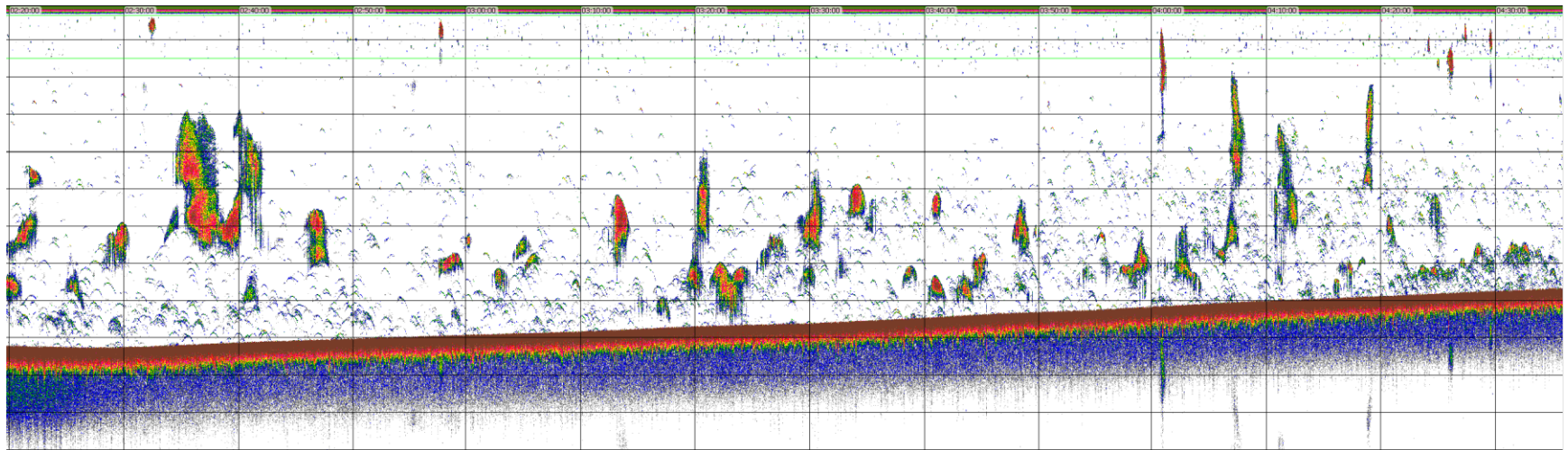


Our plan: Add a 'new', more variable survey into the AT survey time series.

- Compute pollock backscatter in survey area using traditional methods
- Adjust for acoustic dead zone
- Compute sampling CV (1-D method)
- Convert to biomass
- Add additional uncertainty to account for the biomass to backscatter conversion

2020 results

(everything went really well)



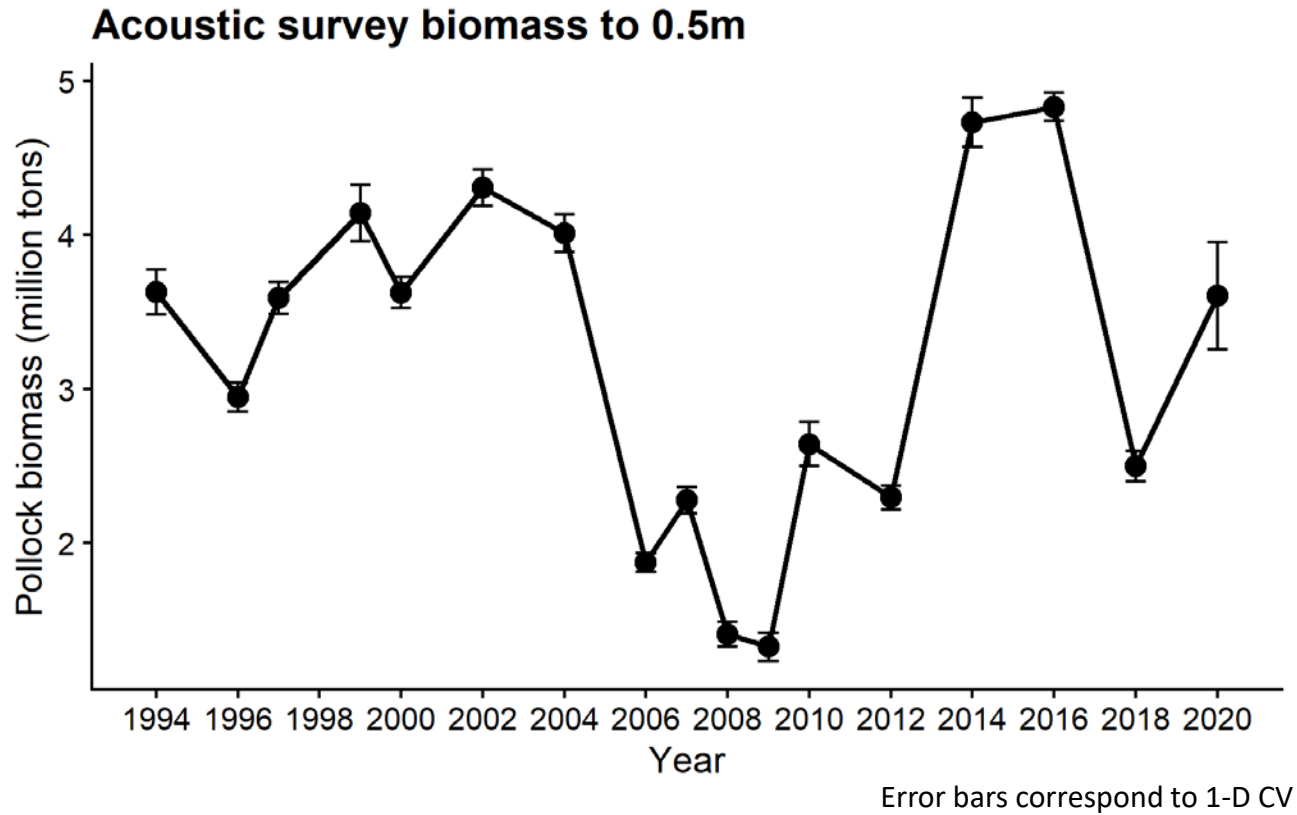
(59° 40' N, 177° 13' W)

2020 USV estimate

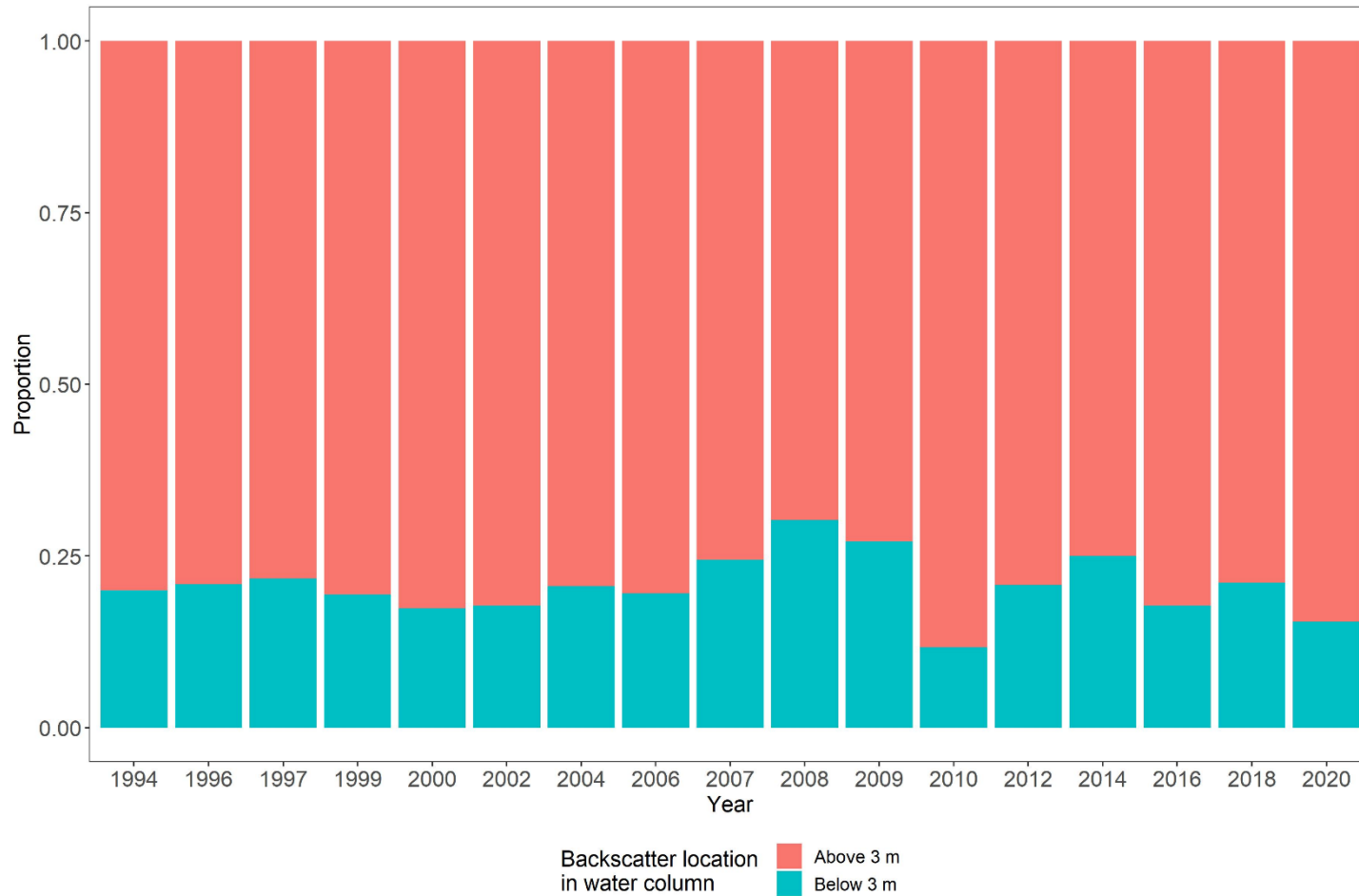
3.6 million tons

Biomass: 44.5 % increase from 2018

Backscatter: 45.2 % increase from 2018

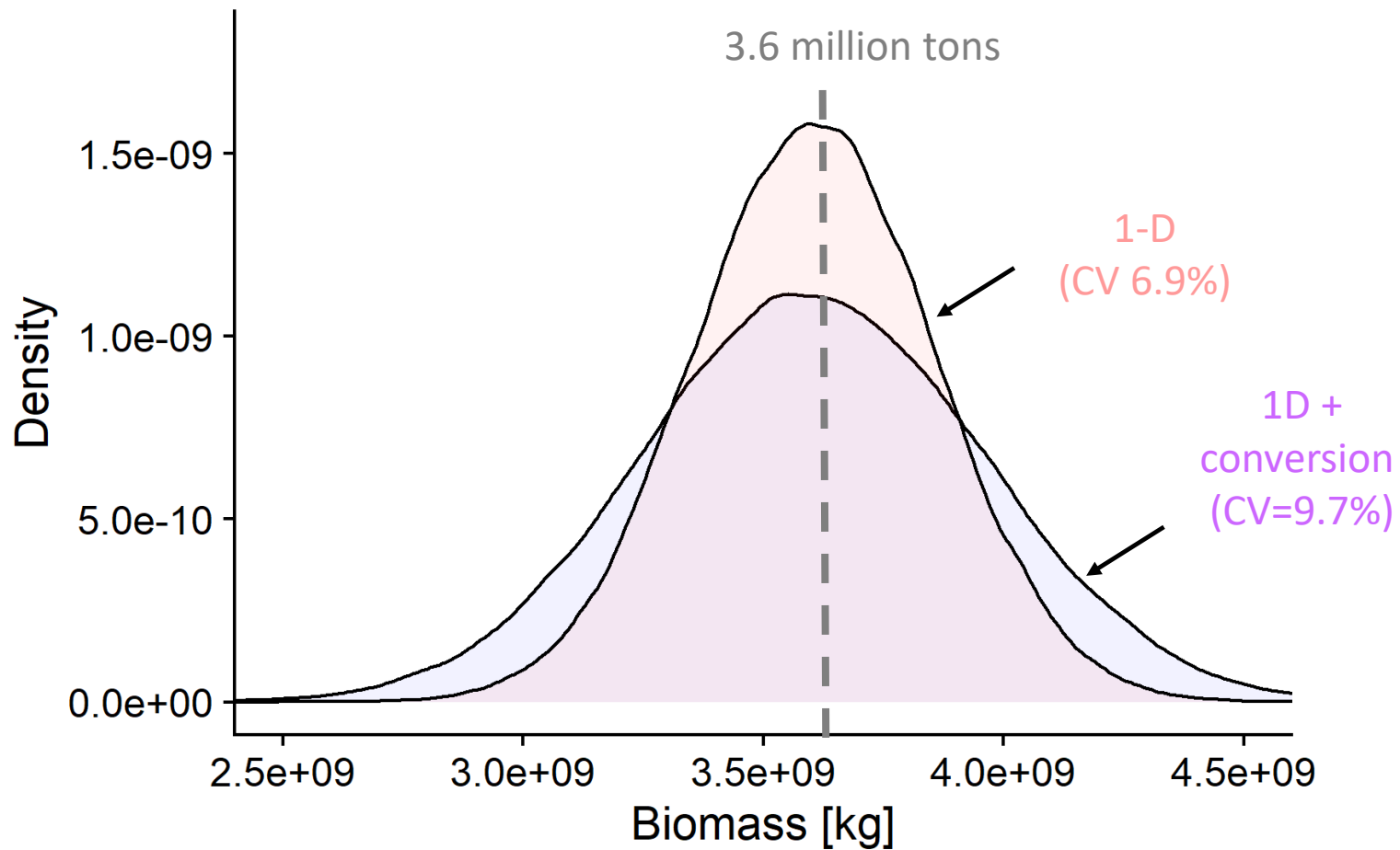


Vertical distribution is similar to previous years



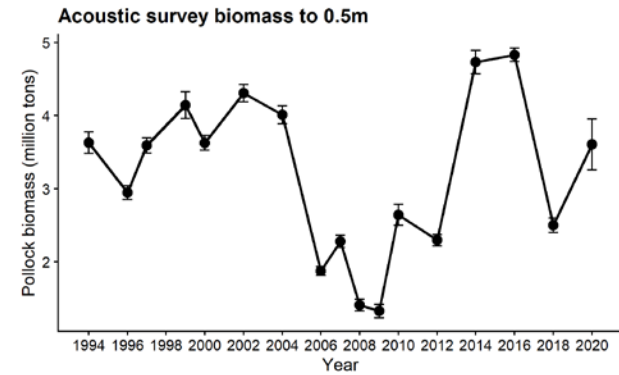
The 1-D CV computed on backscatter is 6.9%.

This increases to 9.7% when the backscatter to biomass conversion is incorporated.



Summary

- Contingency plan in case surveys were cancelled
- Things went as well as they could have
- Data processed in a similar way to traditional acoustic-trawl survey data
- Reduced sampling effort and conversion to biomass accounted for in increased uncertainty associated with the estimate.



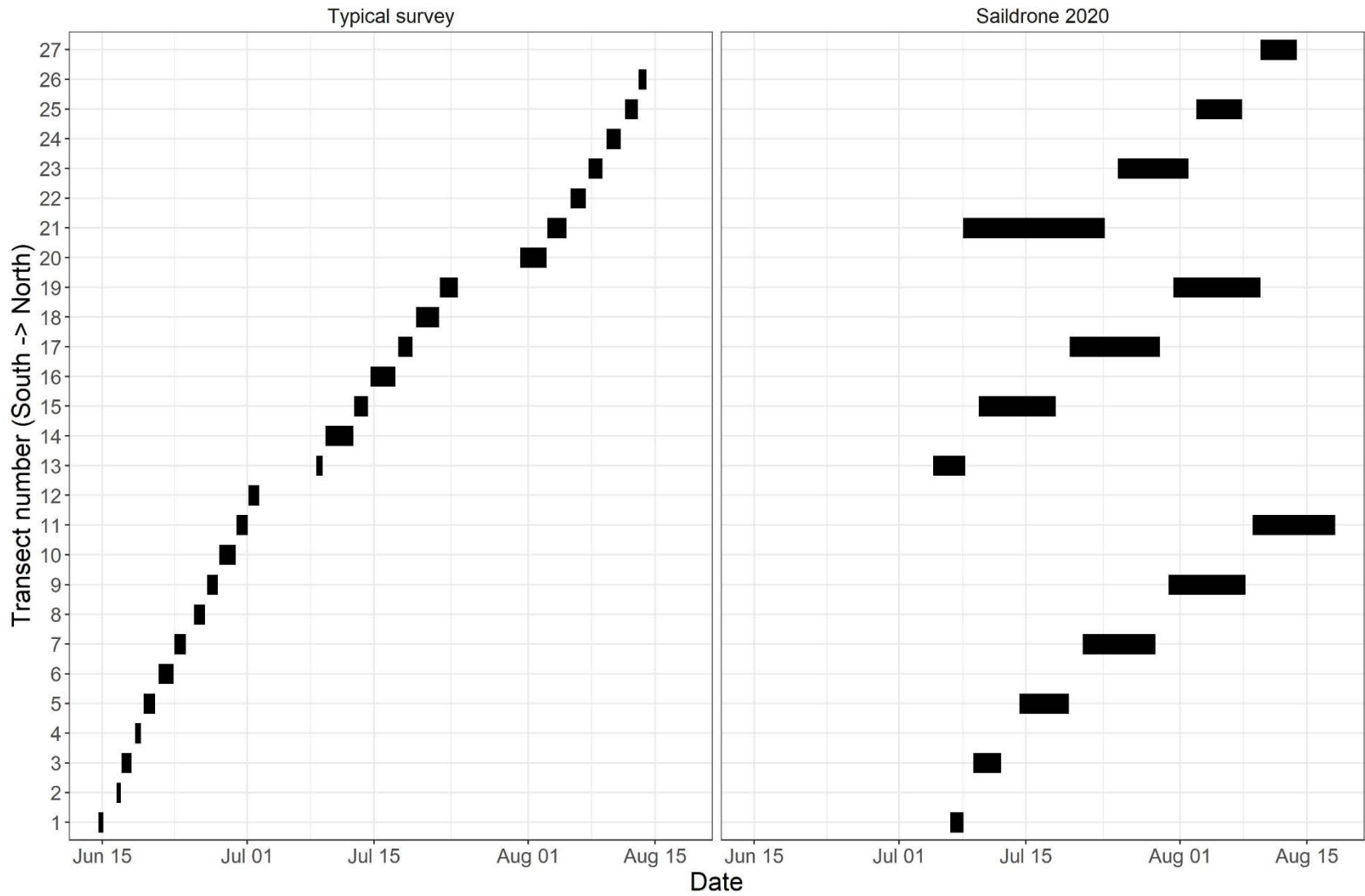


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Questions ?

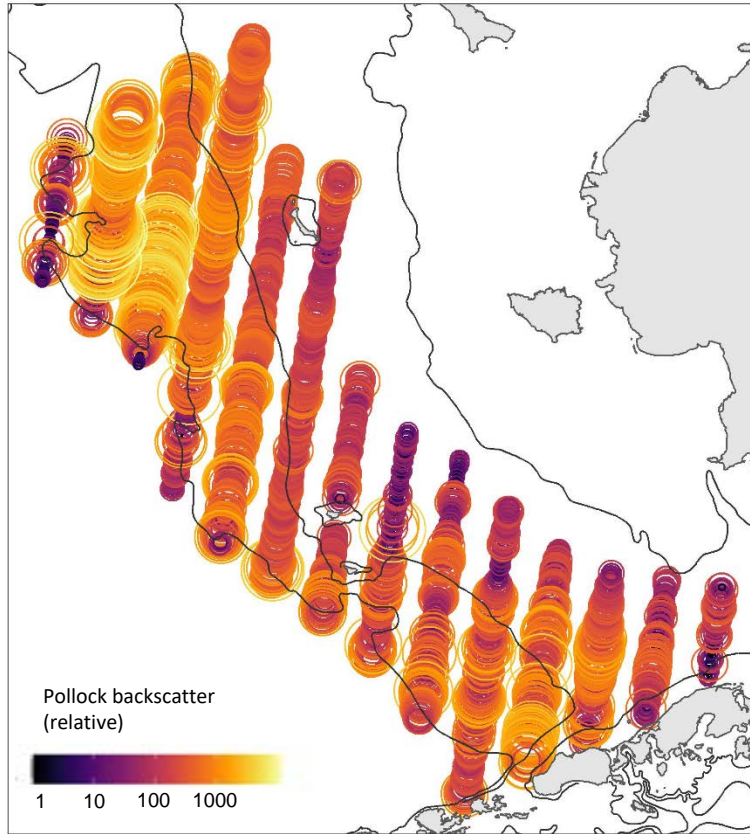
Acknowledgements: We are indebted to Saildrone Inc. for getting this work off the ground in short order under difficult circumstances, and to Sarah Waugh for work on contracting.

This work was supported by NOAA's office of Science and Technology.



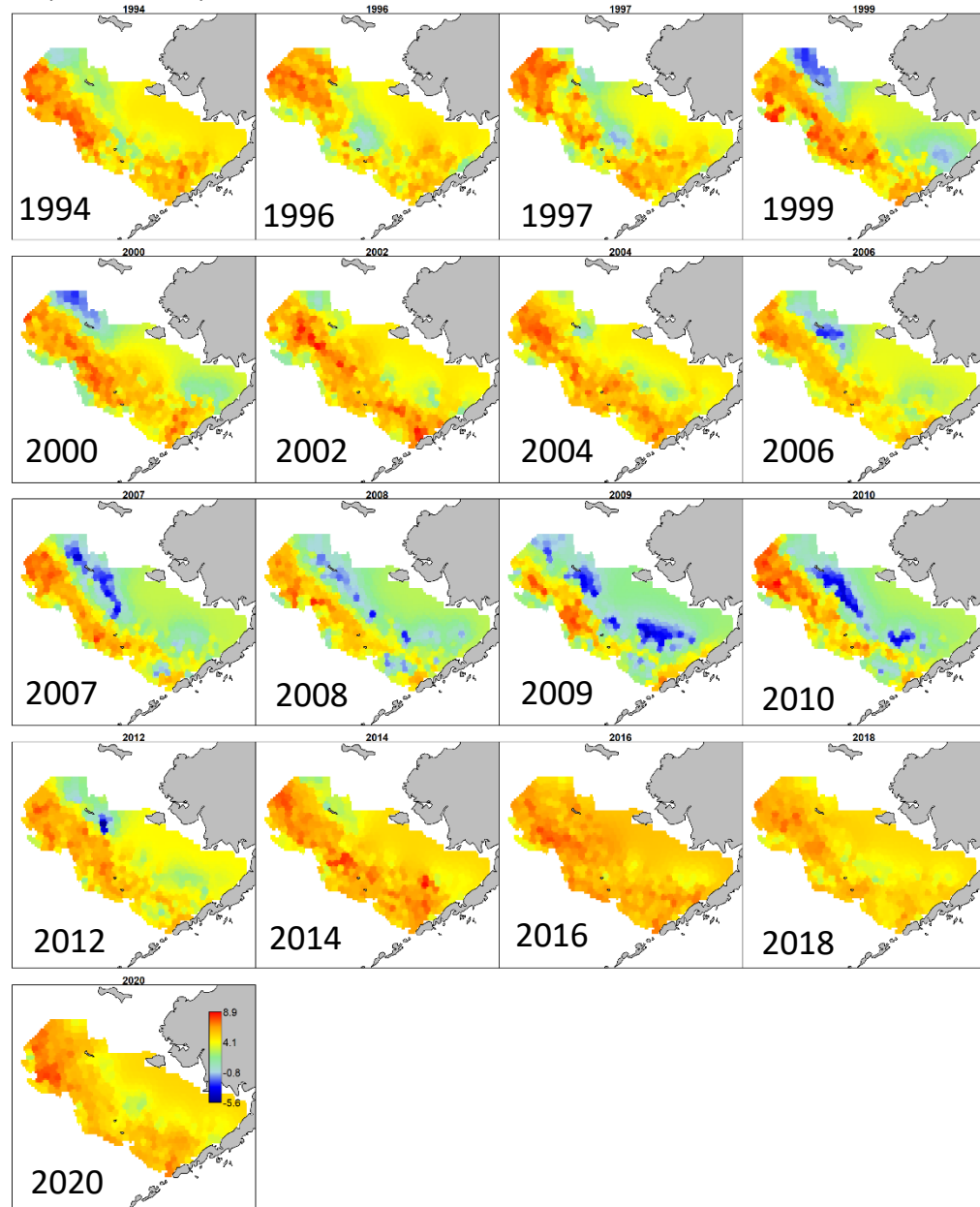
Spatial distribution

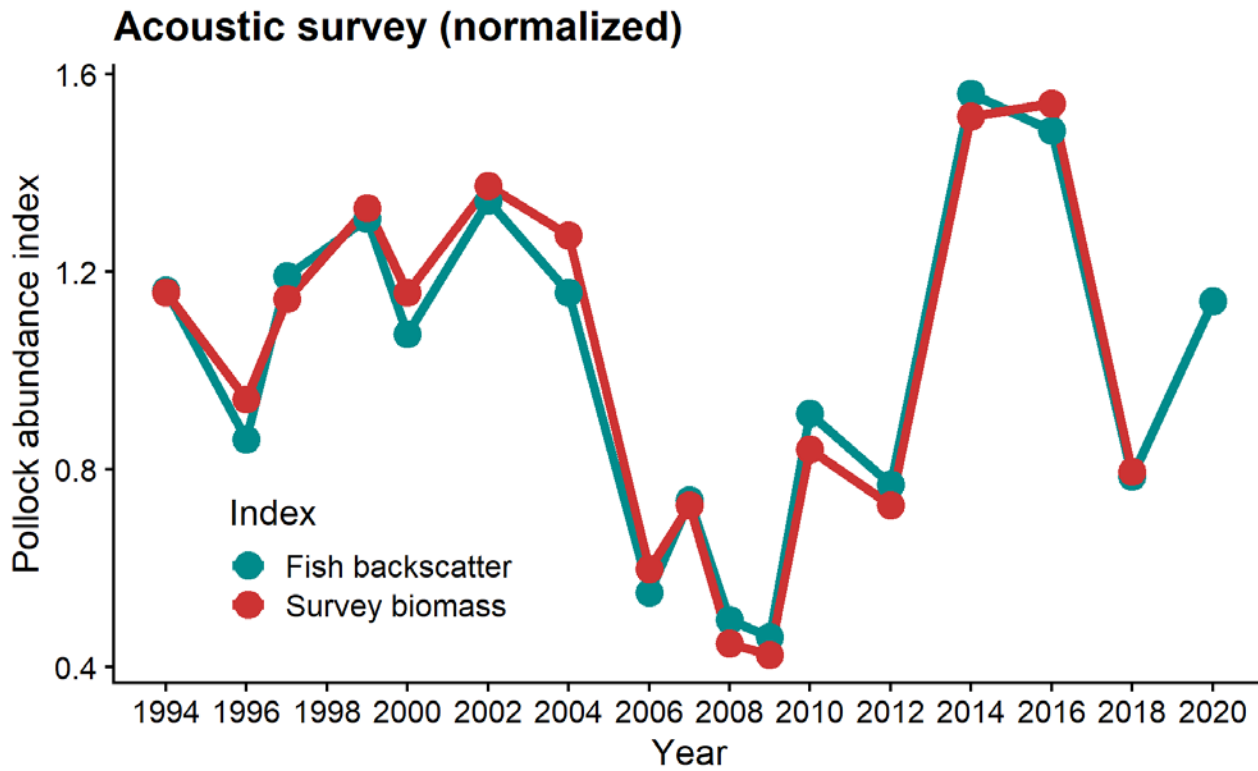
2020 pollock distribution



VAST model fits

$\ln(\text{backscatter})$

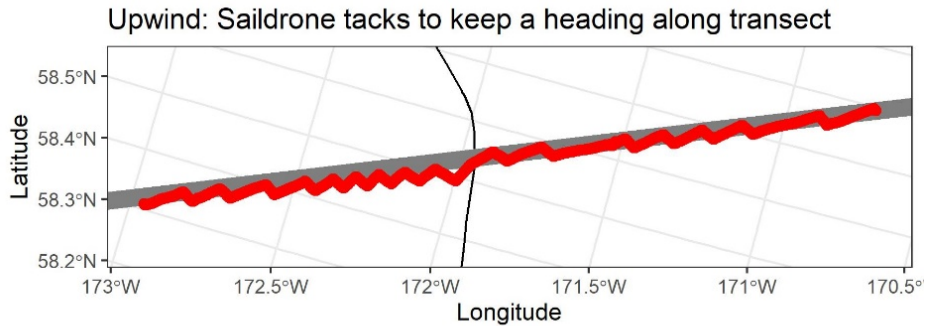




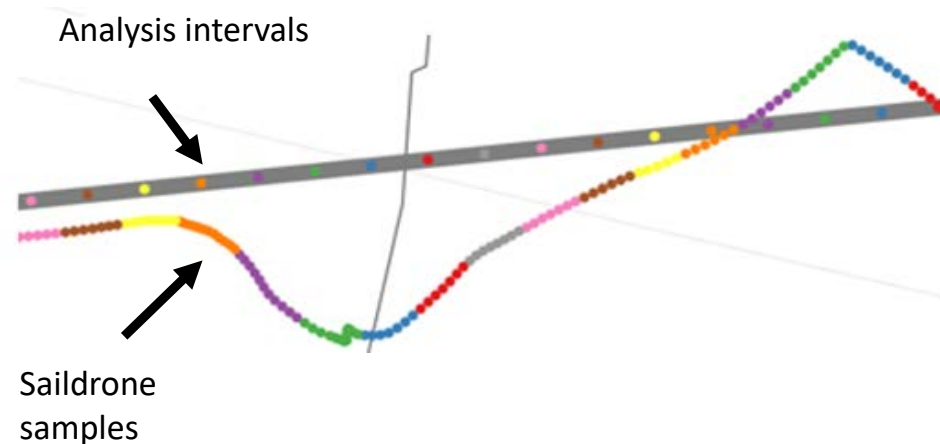
45.2 % increase from 2018

Concern: This is a sailboat, and you can't go in a straight line...

Issue: saildrone tacks upwind and covers more ground when going upwind

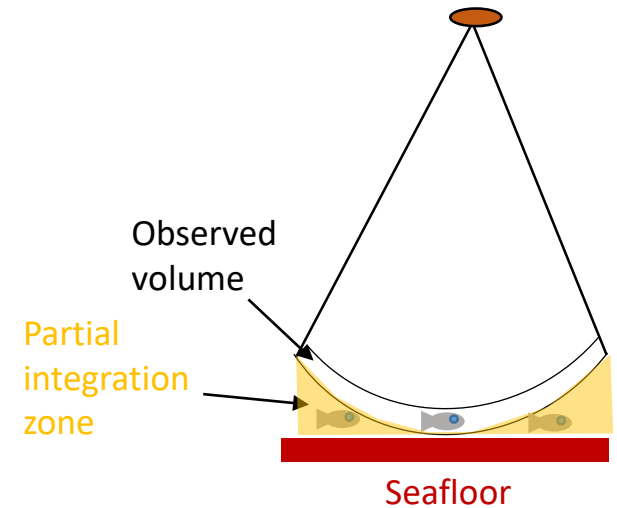
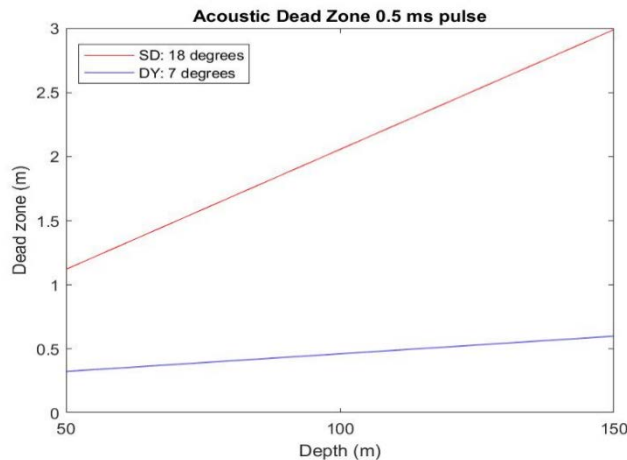


Solution: average observations into 'straight' transect segments



Concern: Miss more fish in the near-bottom 'Acoustic dead zone' ?

Solution – ADZ correction (Ona and Mitson, 1996)



- Estimate height that is 'missing' in each ping.
- 'Fill in missing area' with last bit detected above the sea floor.
- E.g. if missing 1.5 m and 10 units of backscatter observed directly above missing area, add 15 to the observed values.
- Adds 6.7% to the survey total.