2020 Pollock USV survey

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Speaker

Alex De Robertis

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

The SSC encourages the assessment authors and BSAI-GPT to thoroughly discuss assumptions, caveats, issues, and concerns with using the 2020 saildrone data in place of ship-based acoustic-trawl survey results.

Saildrones

- Wind and solar powered robots
- Calibrated 38/200 kHz echosounder, oceanographic, meterological 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

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

Original Article

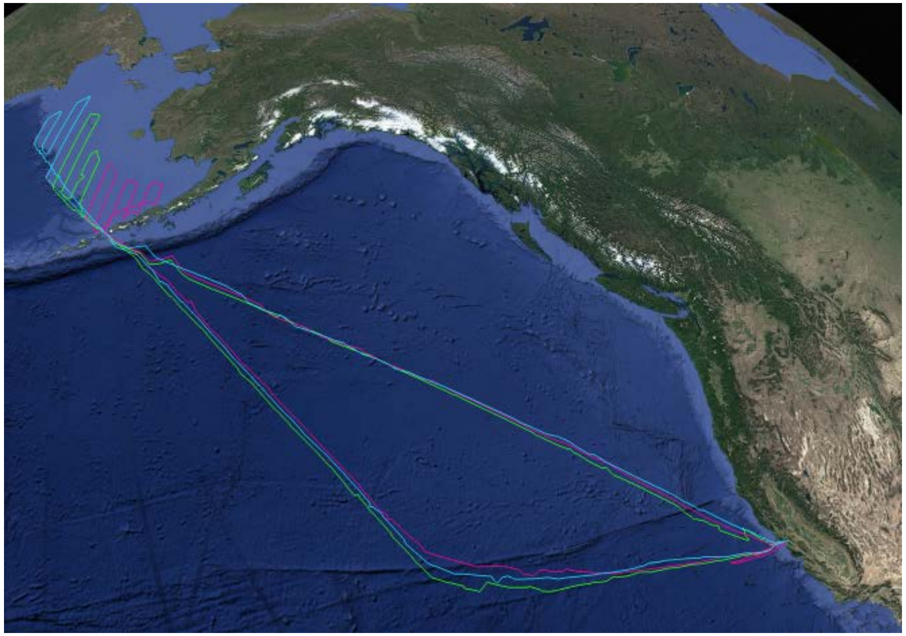
Long-term measurements of fish backscatter from Saildrone unmanned surface vehicles and comparison with observations from a noise-reduced research vessel

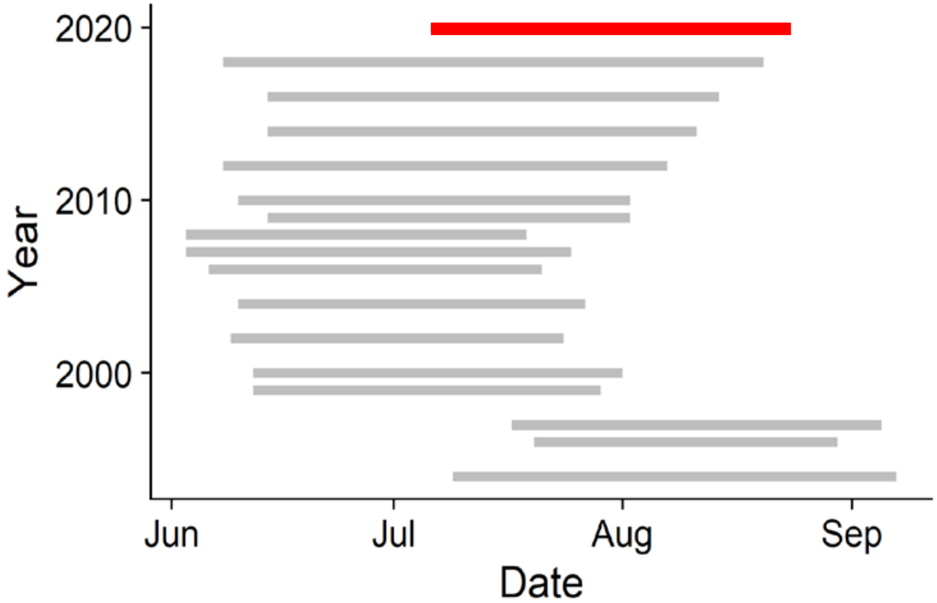
Alex De Robertis [1*], Noah Lawrence-Slavas[2], Richard Jenkins[3], Ivar Wangen[4], Calvin W. Mordy[2,5], Christian Meinig[2], Mike Levine[1], Dave Peacock[3], and Heather Tabisola[2,5]

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

Approach

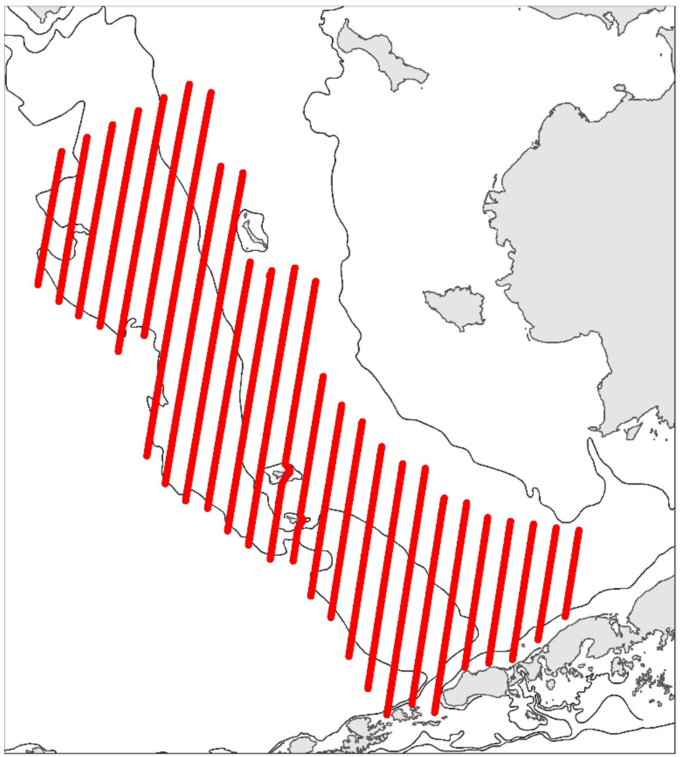
- Sail to/from Alaska
- 3 saildrones
- 40 nmi spacing
- Survey July 4-20 Aug
- Survey during daylight
- Pause at >25 knots



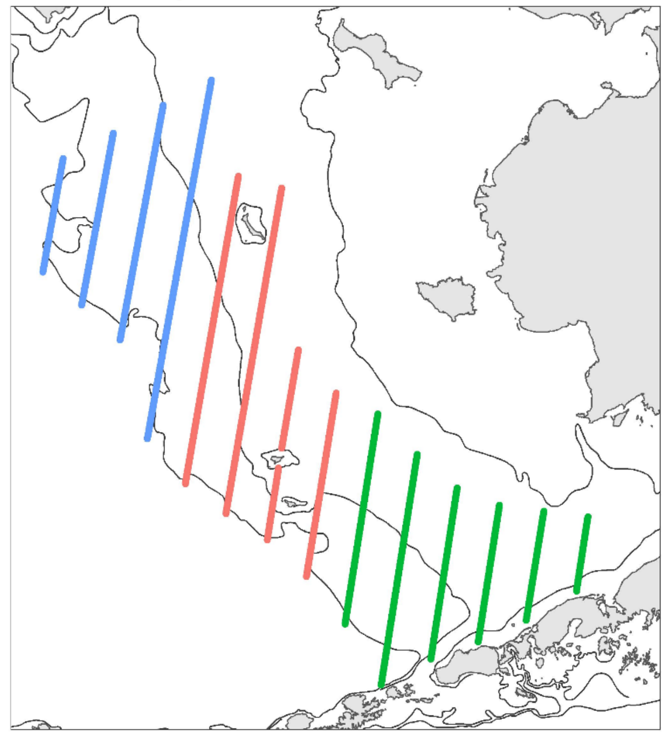


Survey design is a Dyson contingency plan

Typical survey (20 nmi spacing)



2020 survey (40 nmi spacing)

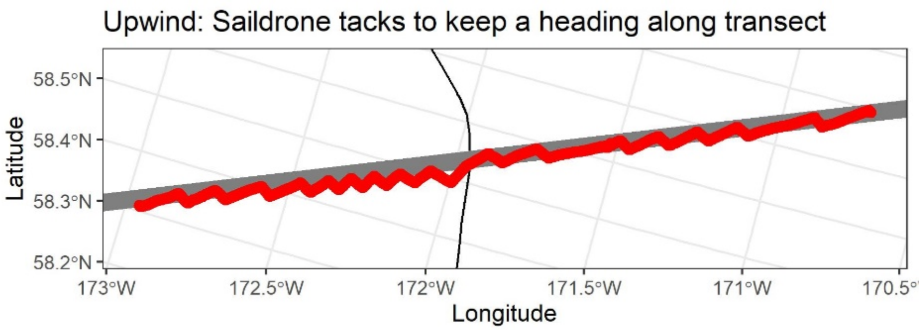


Limitations

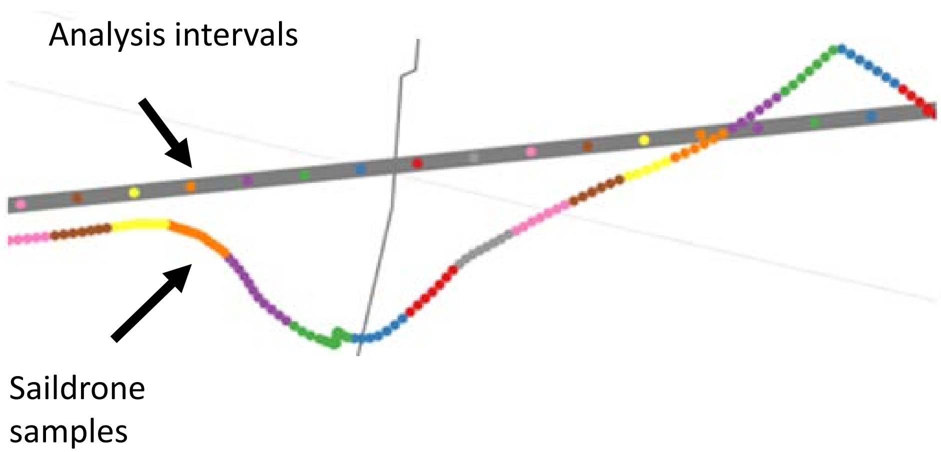
- This is a sailing robot, not a ship
- No trawling for species verification, size/age composition
- Measures backscatter, not biomass
- Larger ‘Acoustic dead zone’
- 40 nmi rather than 20 nmi transects

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



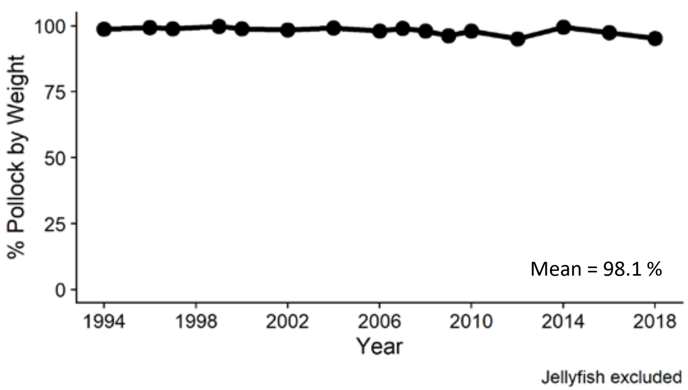
Solution: average observations into 'straight' transect segments



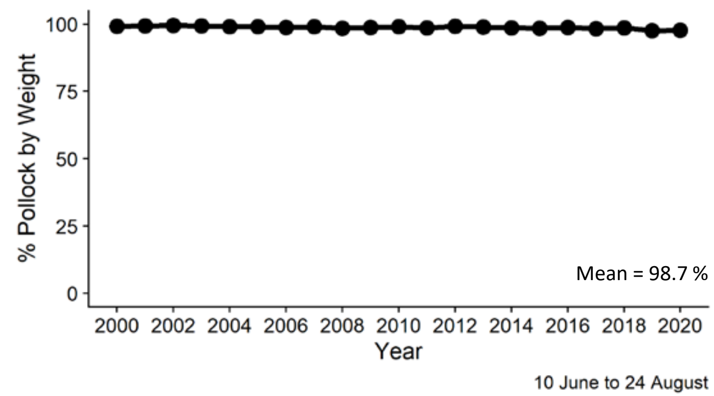
Concern: No trawling for species verification, size/age composition

Pollock dominate midwater biomass

Acoustic-trawl survey

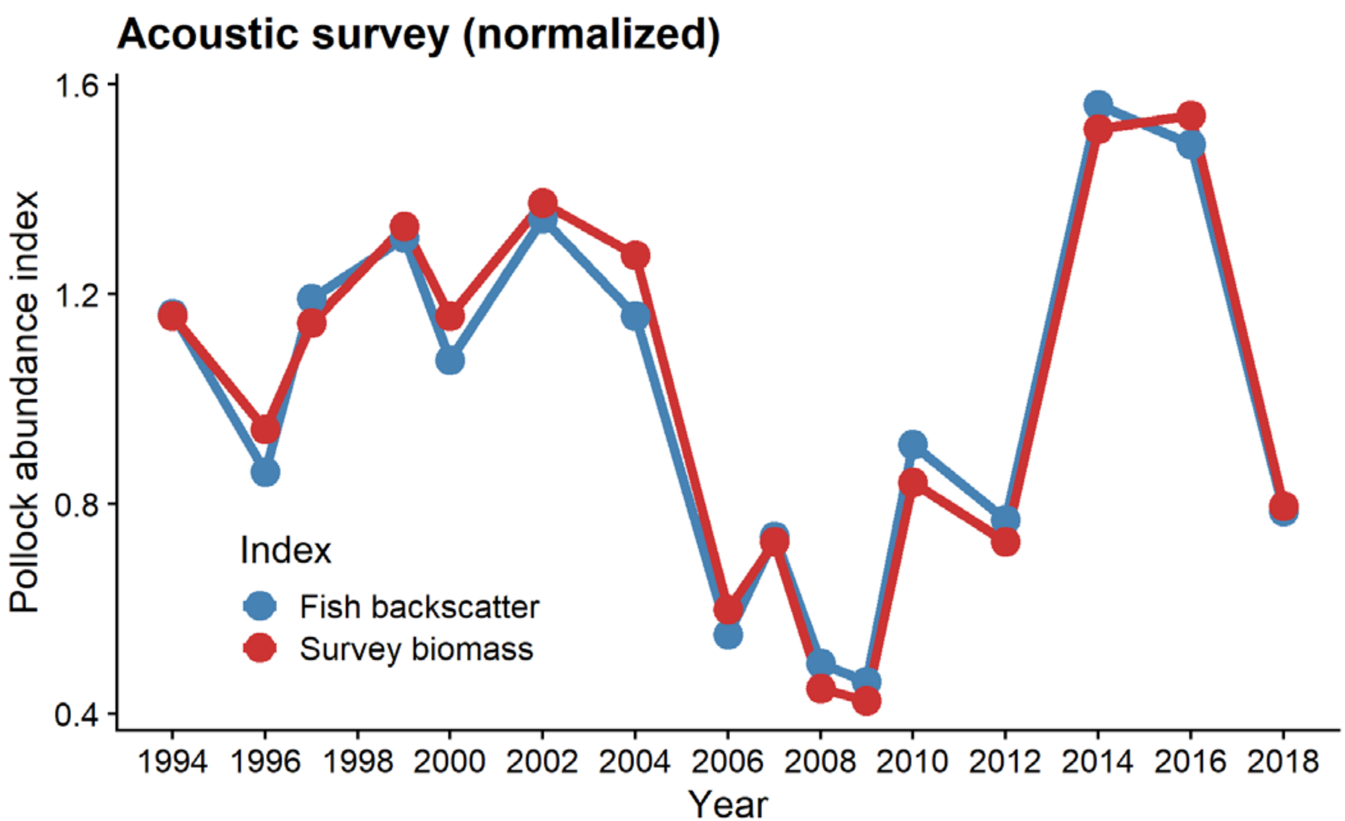


Summer fishery

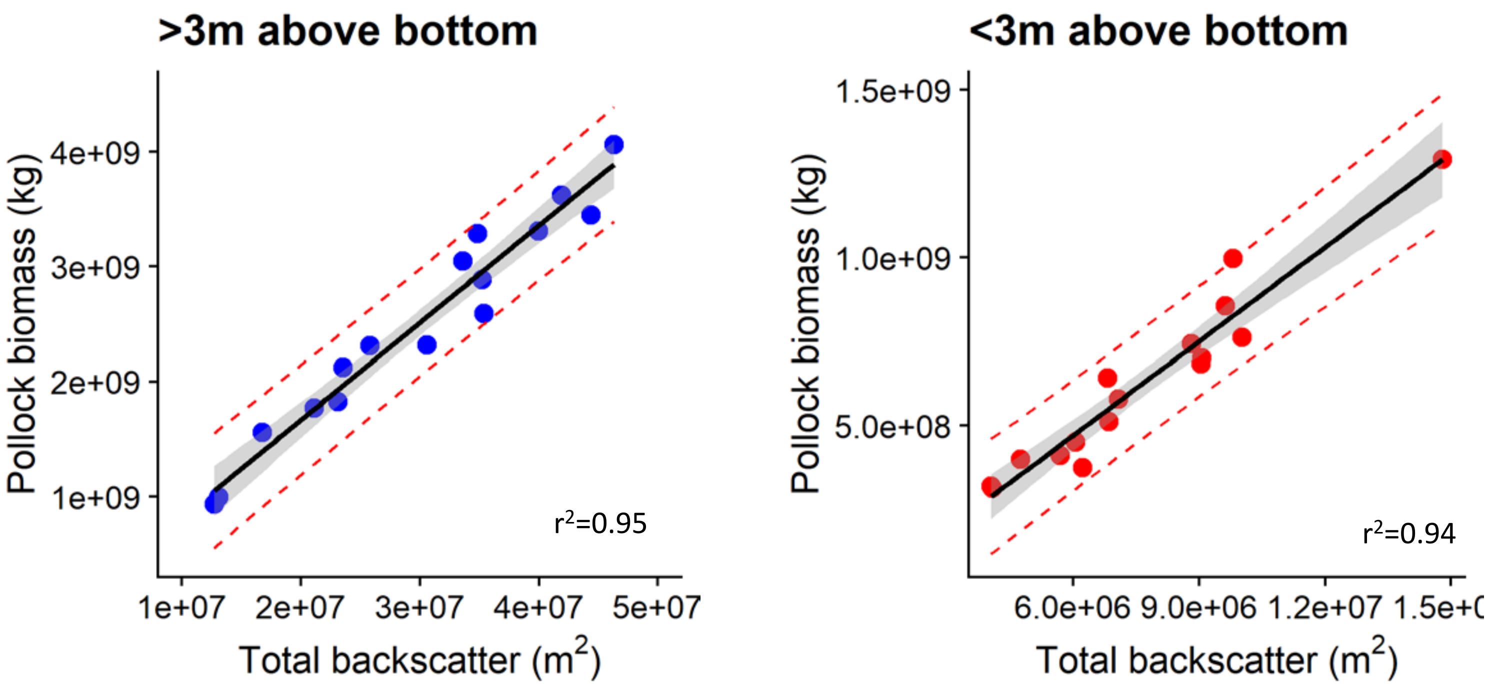


Concern: Measures backscatter, not biomass

Acoustic-only index tracks acoustic-trawl survey biomass

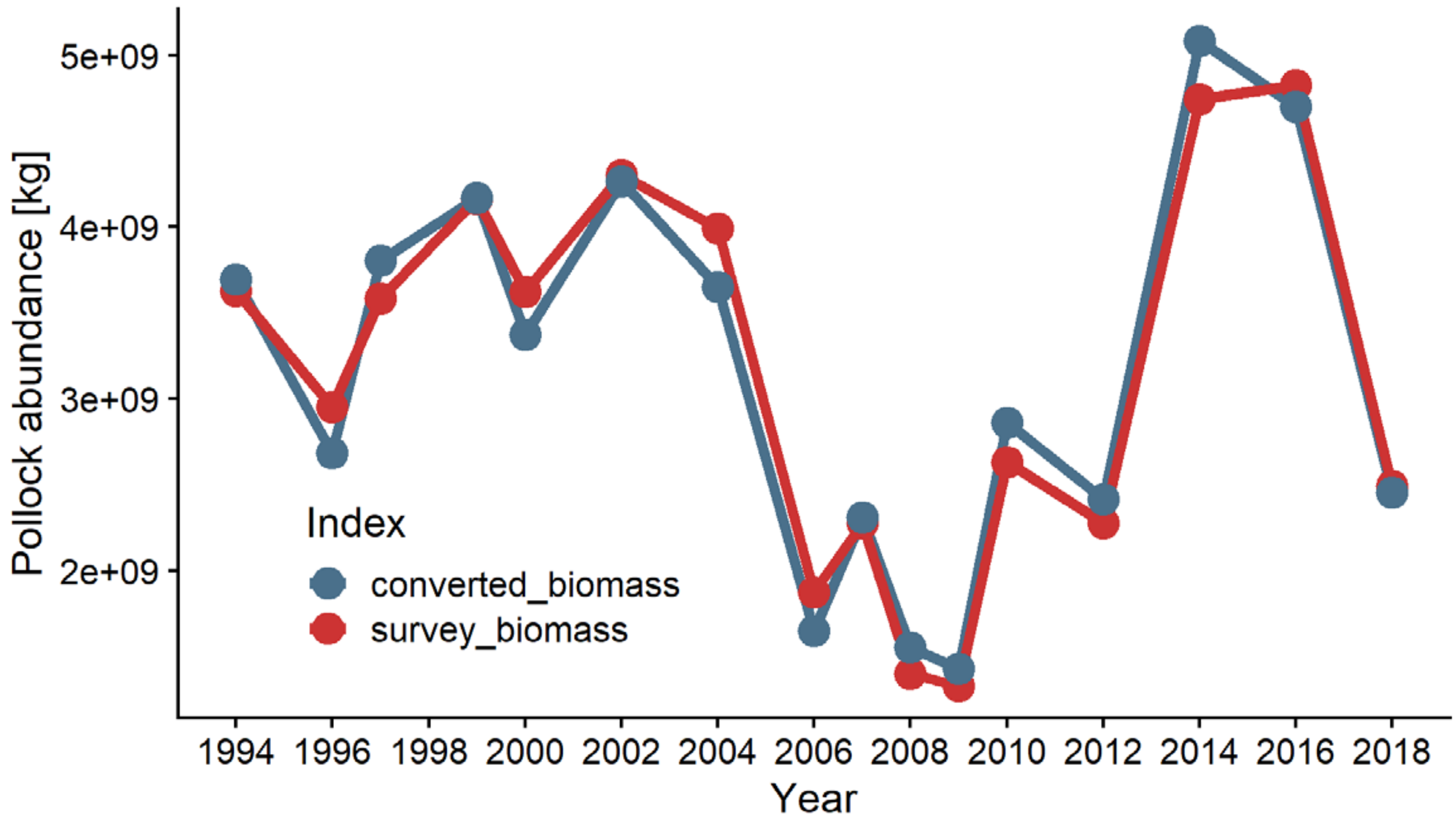


Backscatter to biomass regressions



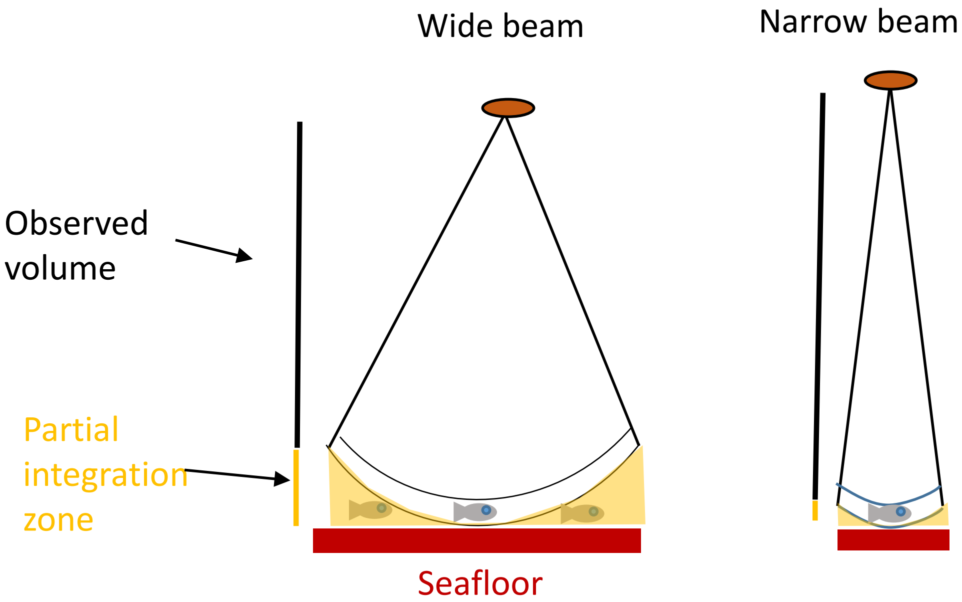
Concern: Measures backscatter, not biomass

Solution: Convert backscatter to biomass



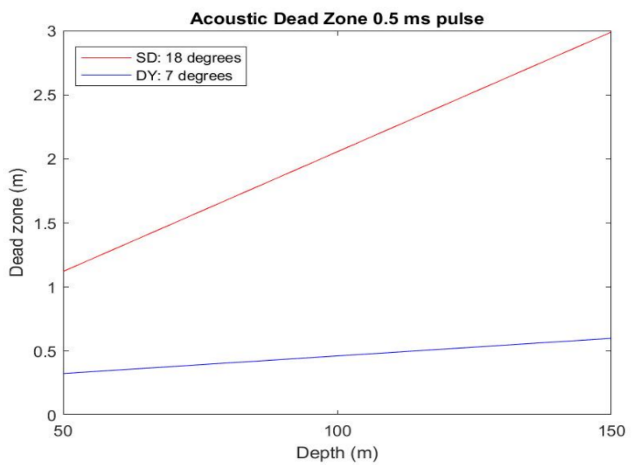
Mean difference = 5.7 %
Minimum = 0.1 %
Maximum = 11.0 %

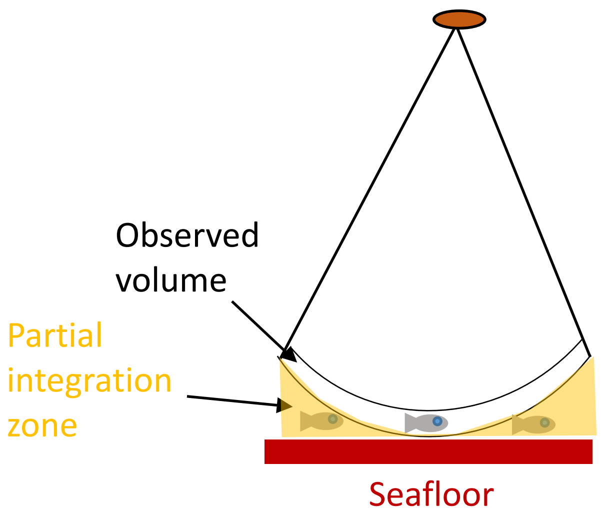
Concern: USV has a wider beam than a ship (18º vs 7º).
Will USV miss more fish in the near-bottom 'Acoustic dead zone' ?



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

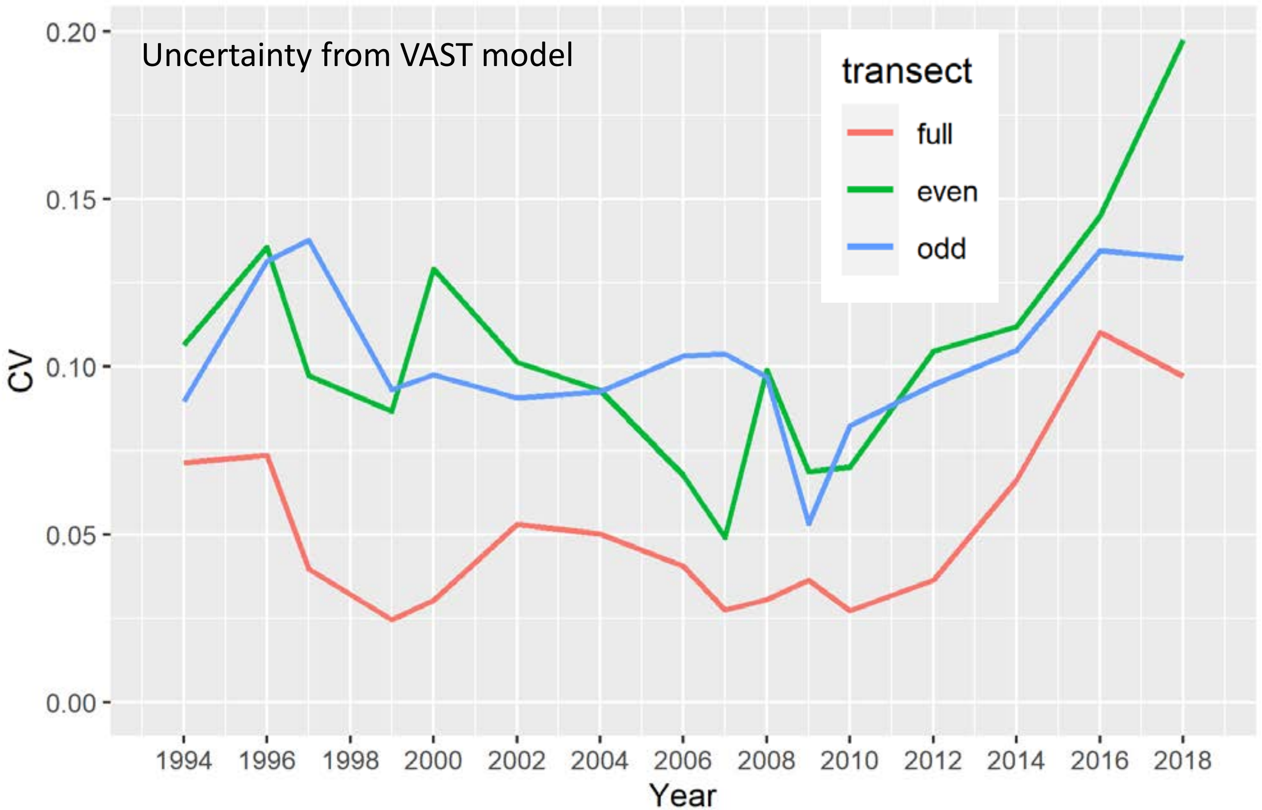
Solution – ADZ correction
(Ona and Mitson, 1996)

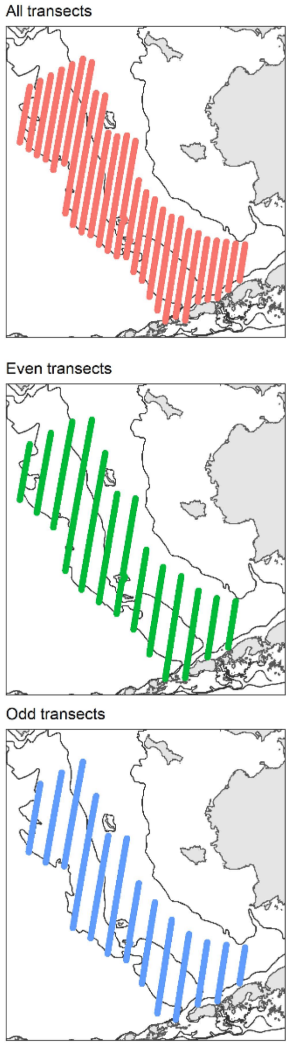




- Estimate height that is ‘missing’ in each ping.
- ‘Fill in missing area’ with last bit detected above the seafloor.
- E.g. if missing 1.5 m and 10 units of backscatter observed directly above missing area, add 15 to the observed values.
- Adds 6.7% to the survey total.

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



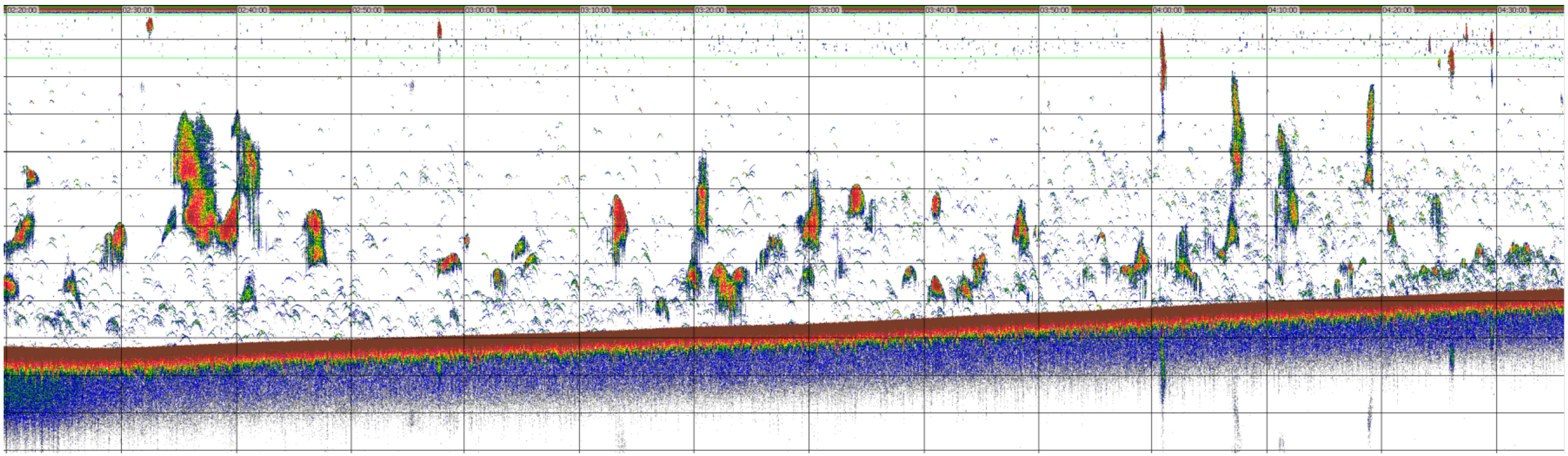


Our plan: Add a ‘new’, more variable survey into the AT survey time series.

- 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

Preview of 2020 results

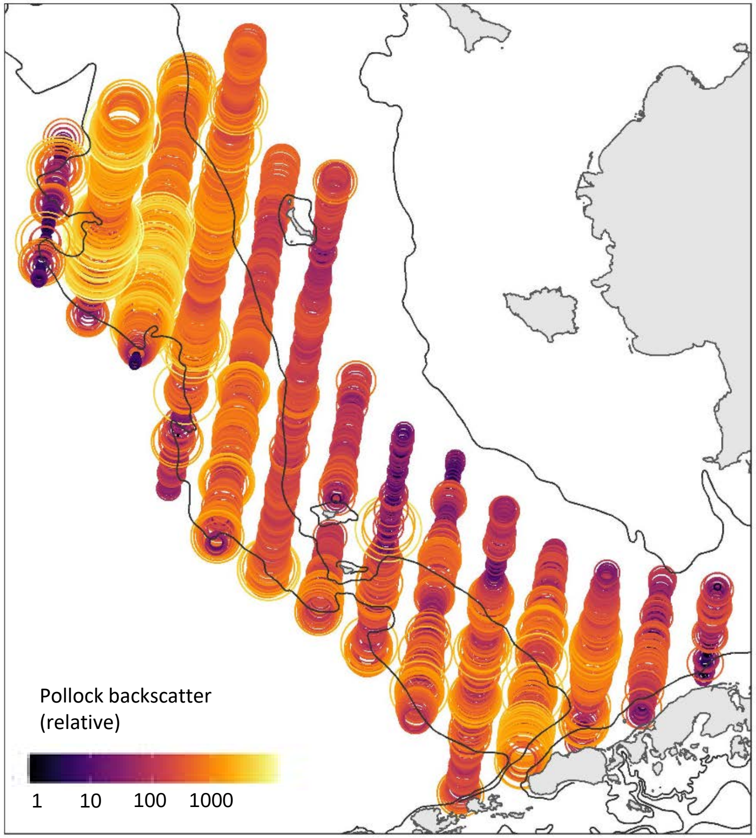
(everything went really well)



(59 40' N, 177 13' W)

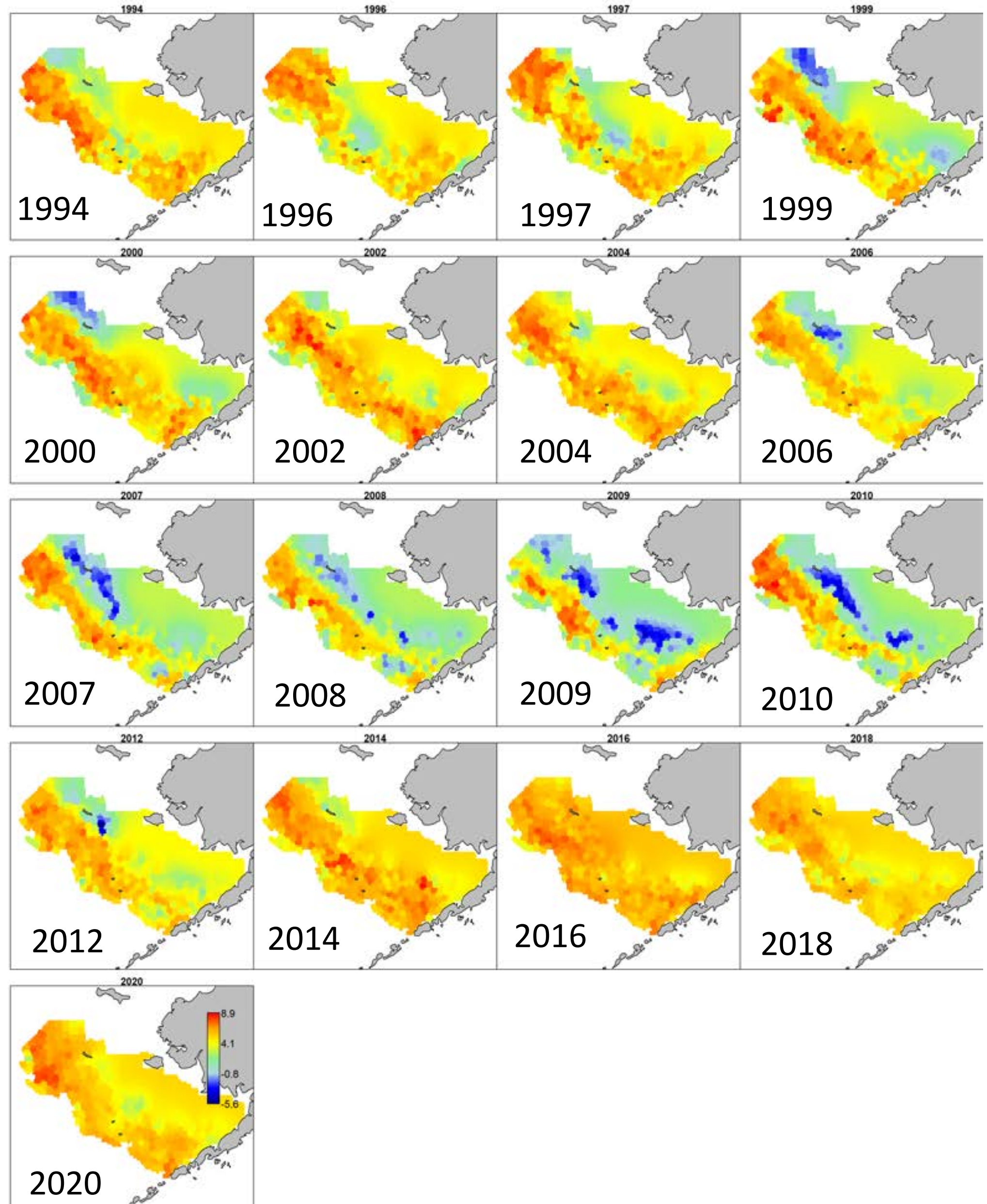
Spatial distribution

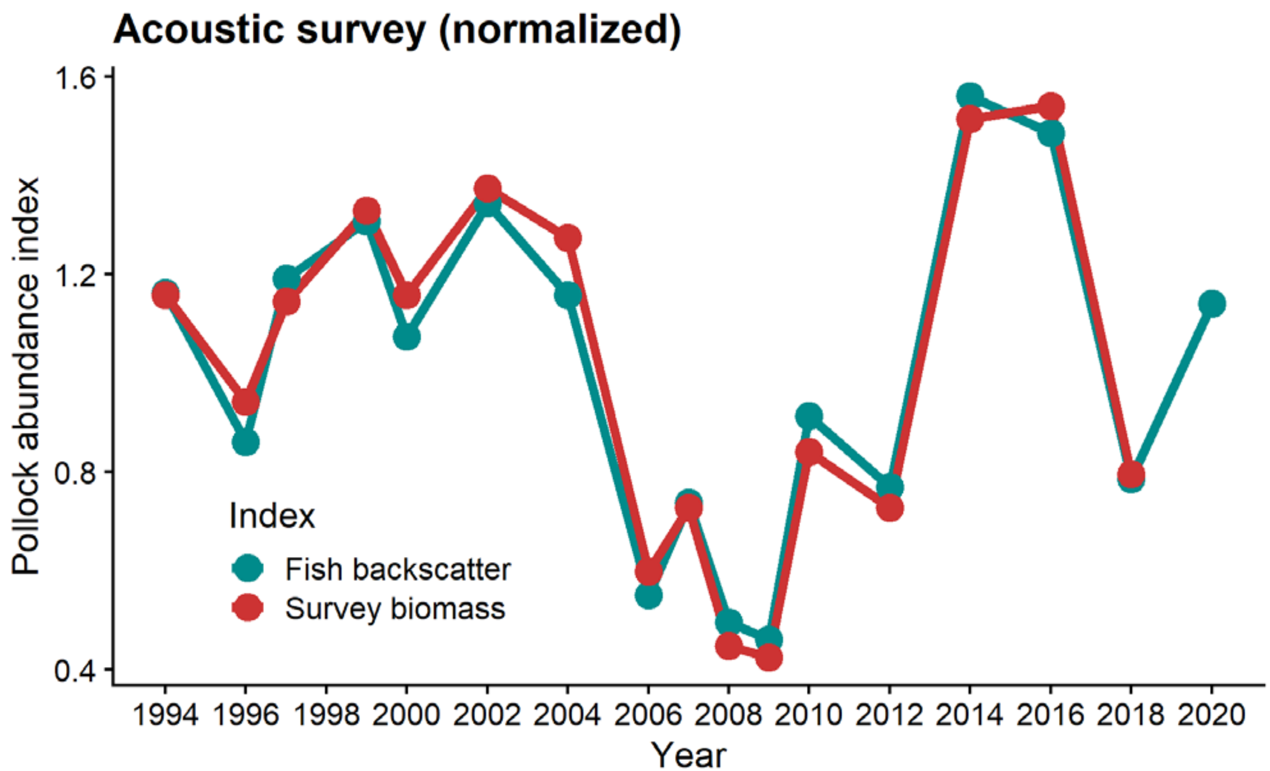
2020 pollock distribution



VAST model fits

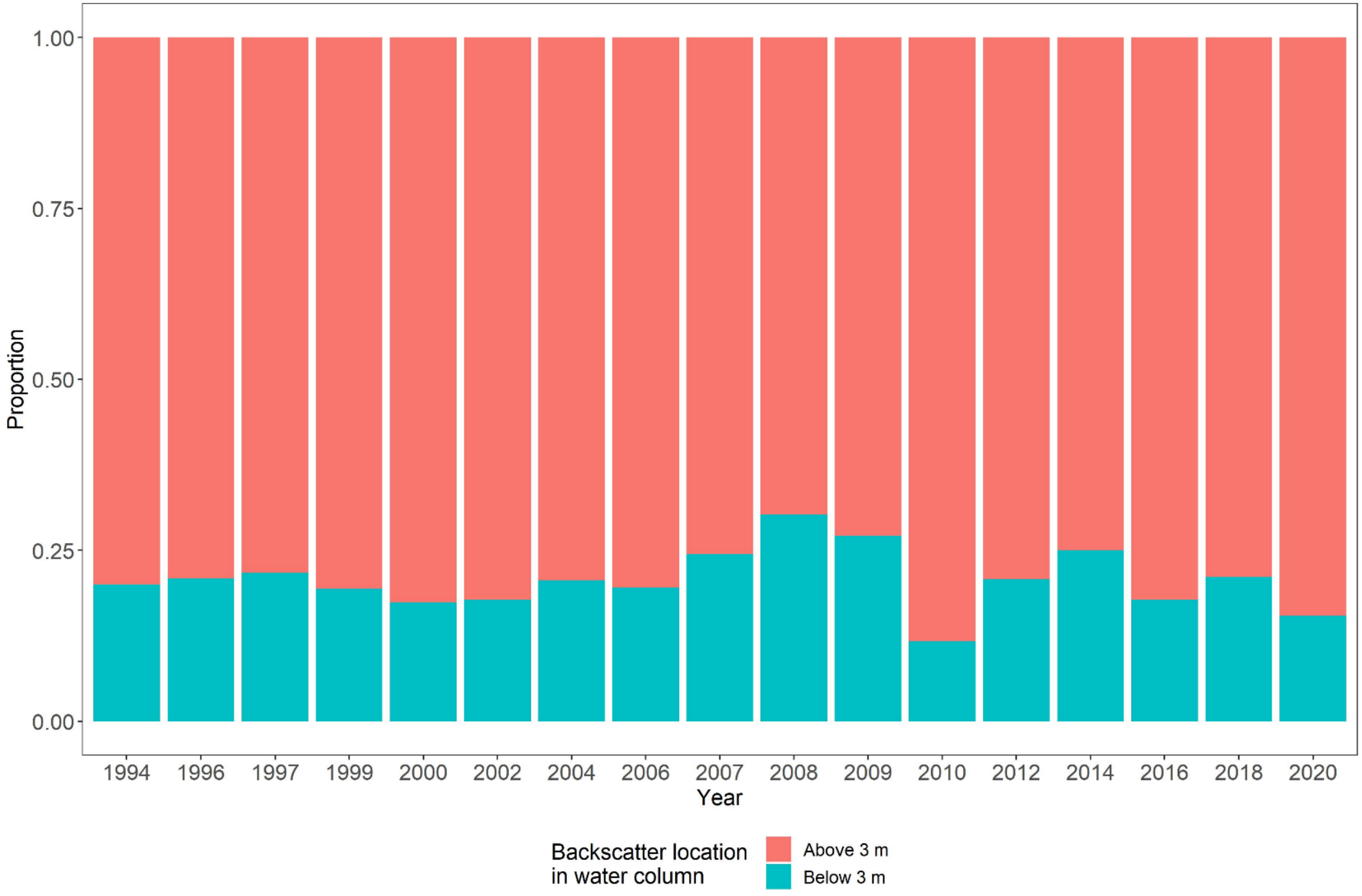
ln(backscatter)



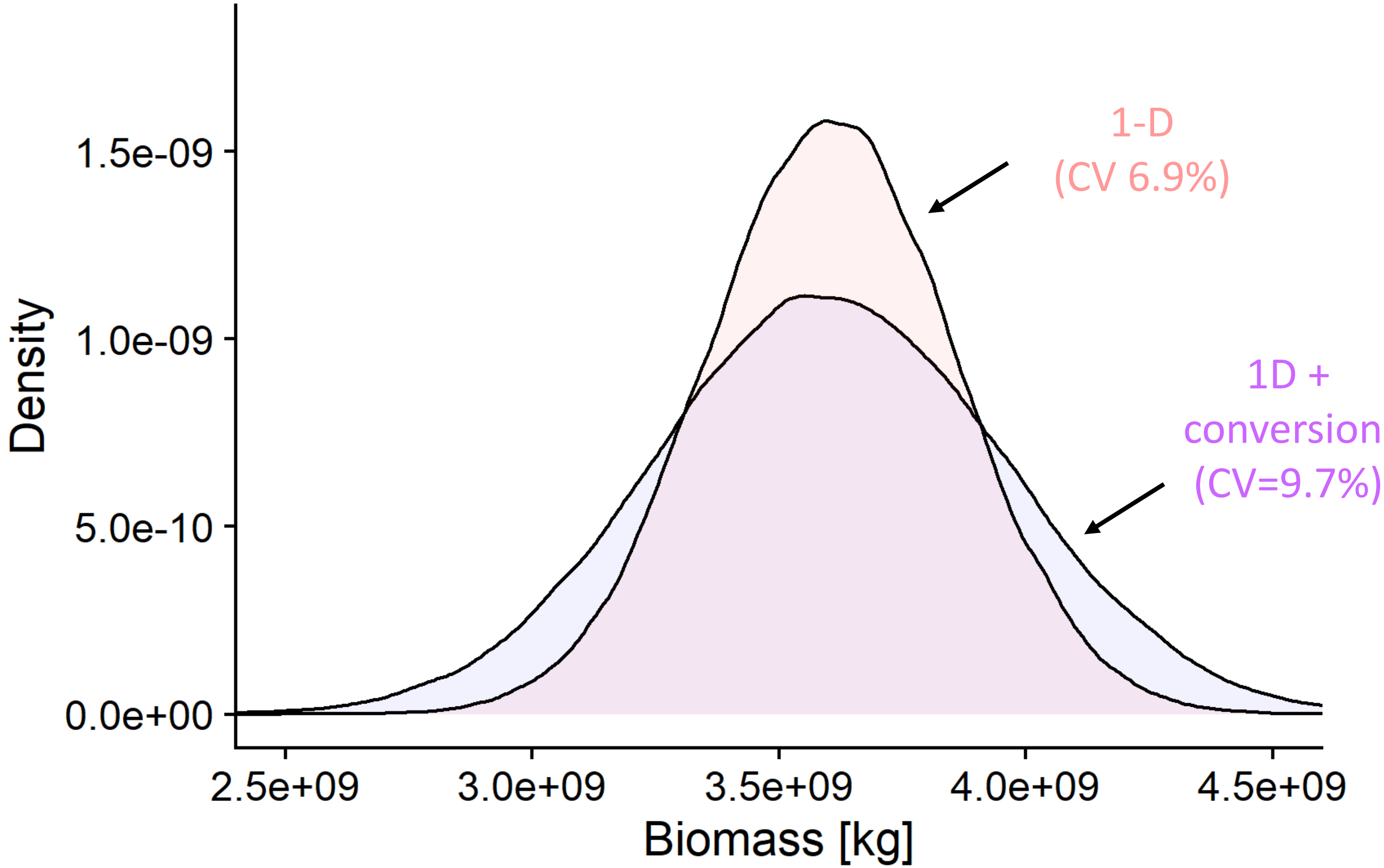


45.2 % increase from 2018

Vertical distribution is similar to previous years



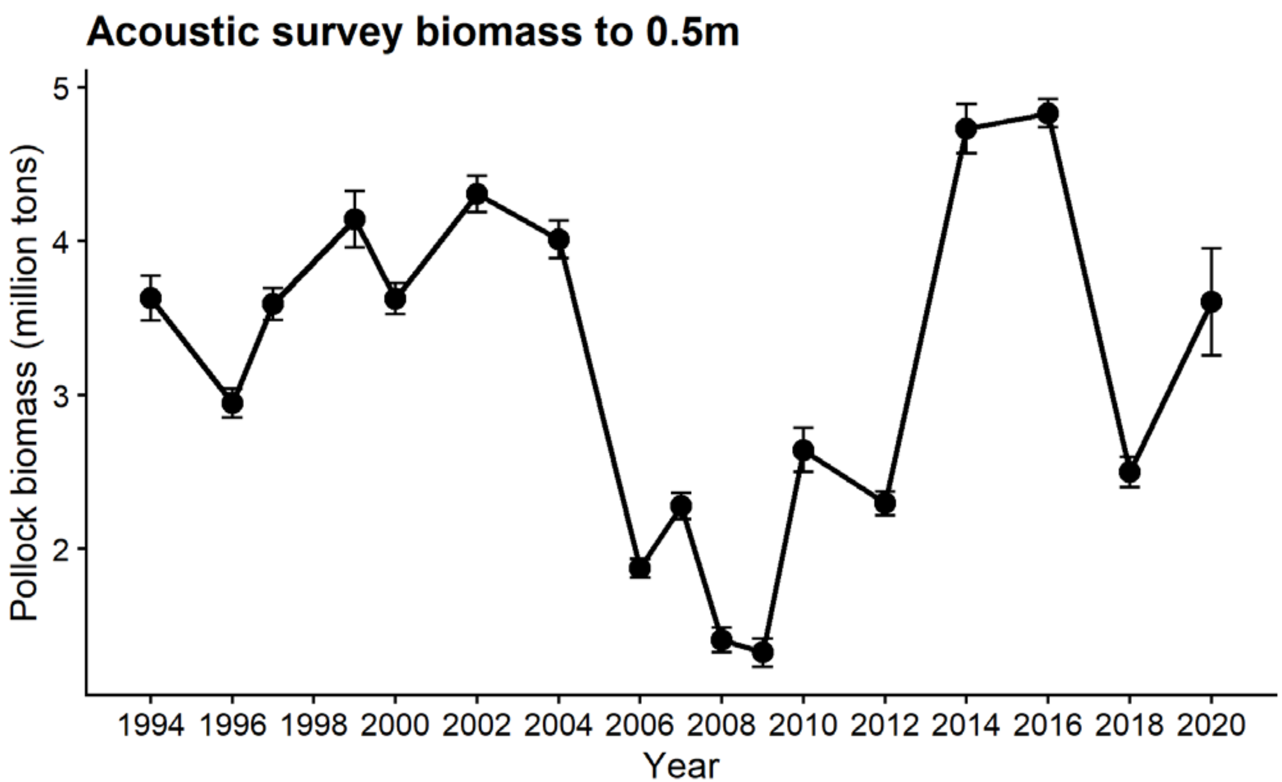
The 1-D CV computed on backscatter is 6.9%.
This increases to 9.7% when the backscatter to biomass conversion is incorporated.



2020 USV estimate

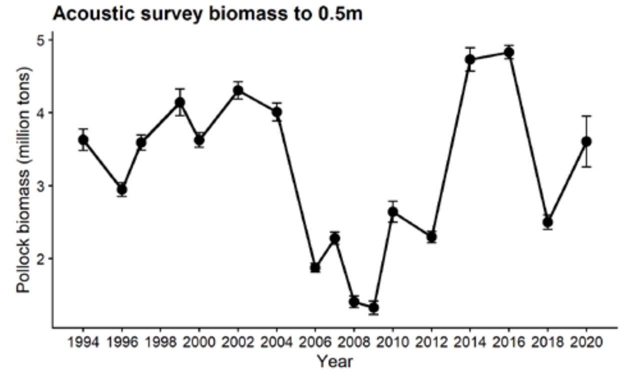
3.6 million tons

44.5 % increase from 2018



Error bars correspond to 1-D CV

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 ?

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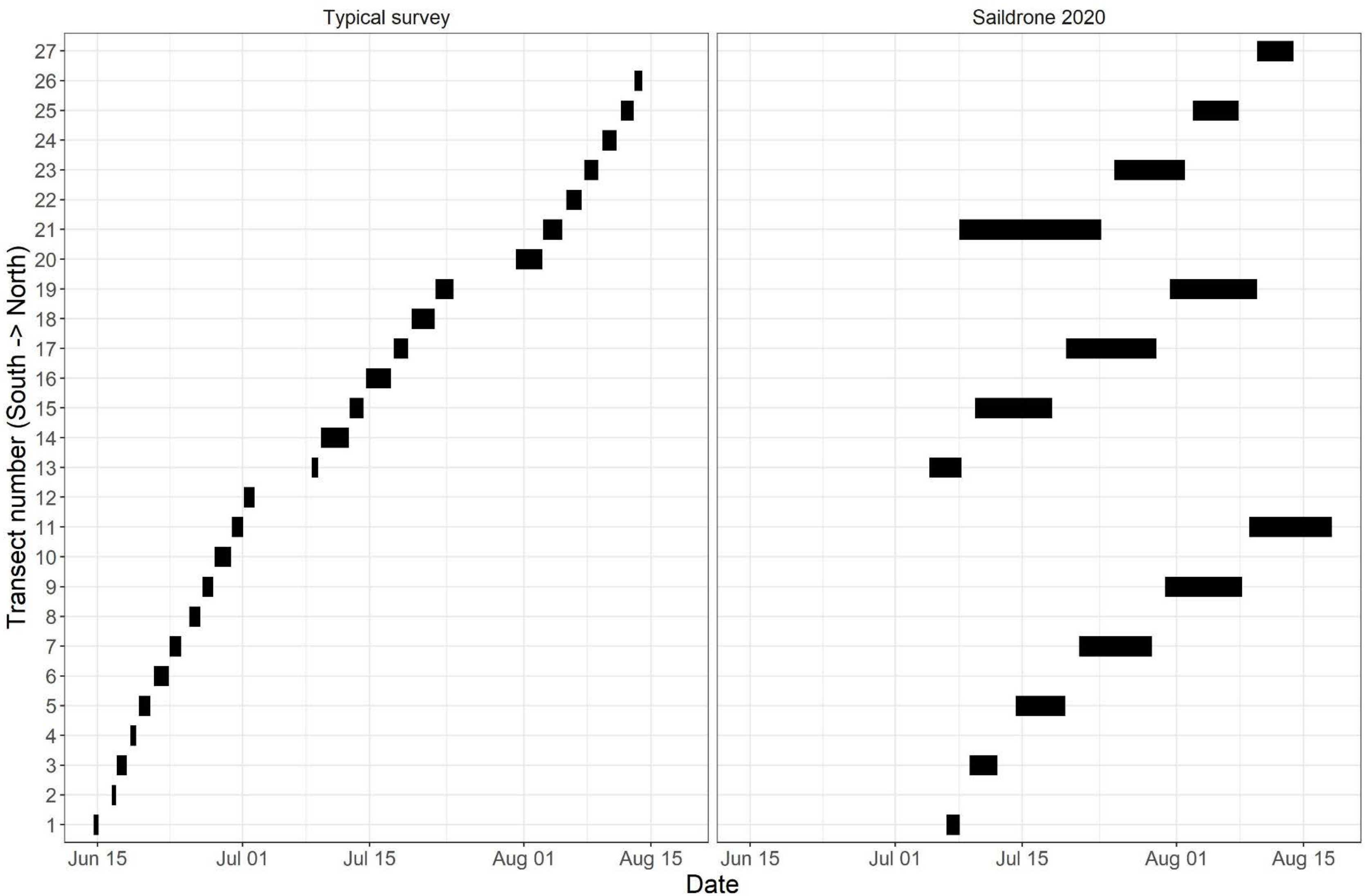
Typical survey
Saildrone 2020
Transect number (South -> North)
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Jun 15
Jul 01
Jul 15
Aug 01
Aug 15
Date