

Quantifying the impact of a restrictor rope on bottom trawl survey catch

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Pathways for a sustainable co-existence of offshore energy, fisheries and marine conservation: From local empirical evidence to global perspectives - Day 2
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FISHERIES

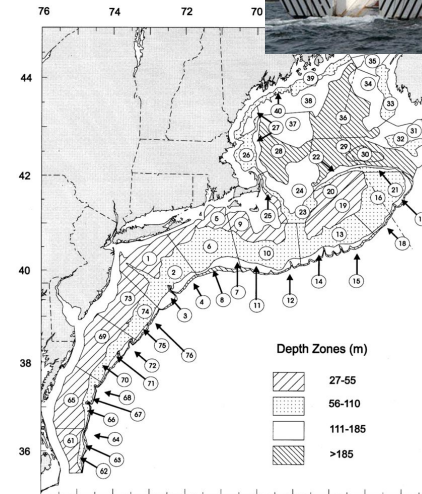
Many efforts coordinating and performing field work

- Captain, crew from F/V Darana R
 - Captain James Ruhle
- VIMS staff
- RI DEM staff
- ROSA staff
- NEFSC staff



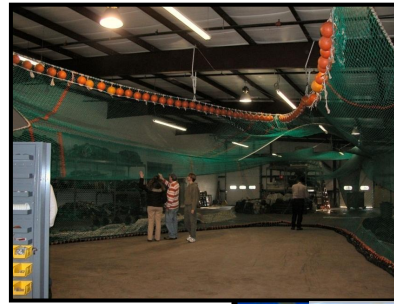
Fishery-independent surveys are vital for managing marine resources

- The development of offshore wind poses a challenge to surveys through the exclusion of large survey vessels
- Use of multiple smaller vessels could be a solution to this challenge
 - Many smaller surveys being developed to understand wind development impacts
- However differences across vessels is always a concern when developing surveys
- Any gear that could help standardize across vessels could be very useful



Restrictor rope!?

- Restrictor ropes have been a piece of equipment that have been of interest to industry in the northeast for some time
- Simple connection between warps or doors that limit the maximum spread of the gear
- Primary impetus was desire to standardize NEFSC bottom trawl survey
- But also interest in way to standardize across wind impact surveys

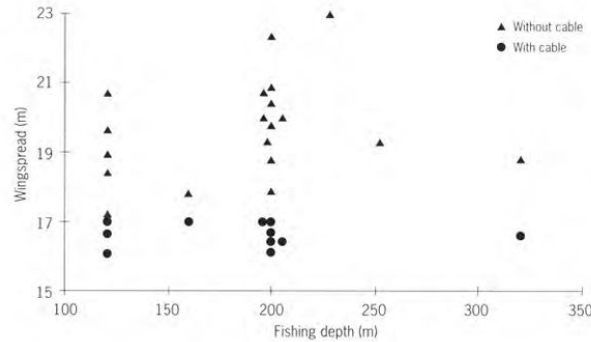


Motivation for current work

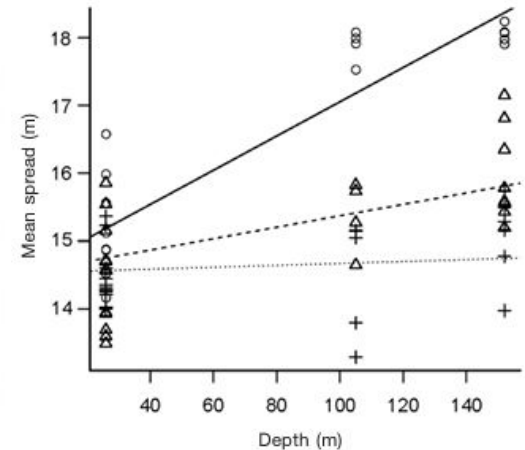
- Evidence in literature for improved trawl geometry with restrictor ropes
- Less information on potential impacts on catch
- Some suggestions that it can impact catches of semi-pelagic species¹
- Has not been recently explored in the northeast US

¹ Rose and Nunnallee (1998), Weinberg and Kotwicki (2015)

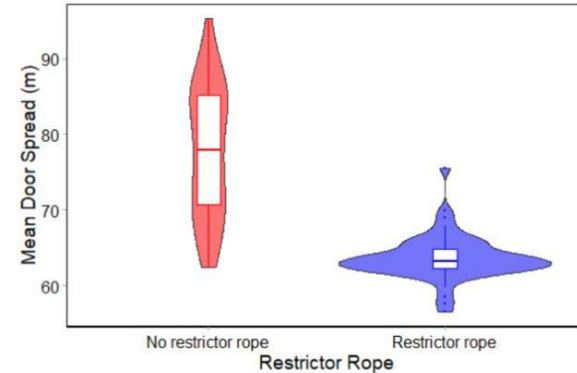
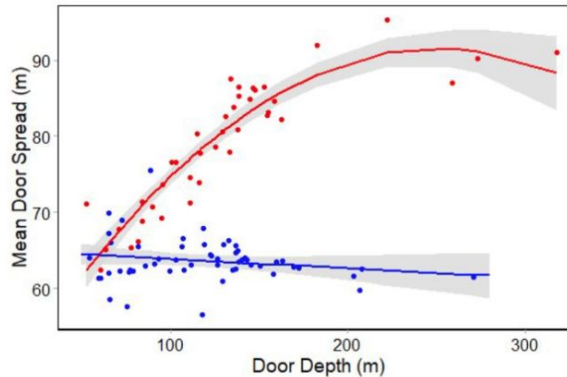
Fréchet 2000



Weinberg and Kotwicki 2015



ICES 2022 (IBTSWG) Norwegian Q3 IBTS



Motivation for current work

- Increasing international interest in restrictor rope impacts
- Restrictors have been used in Norwegian surveys
- Discussed in recent (2022) ICES workshop on the development of the new IBTS GEAR

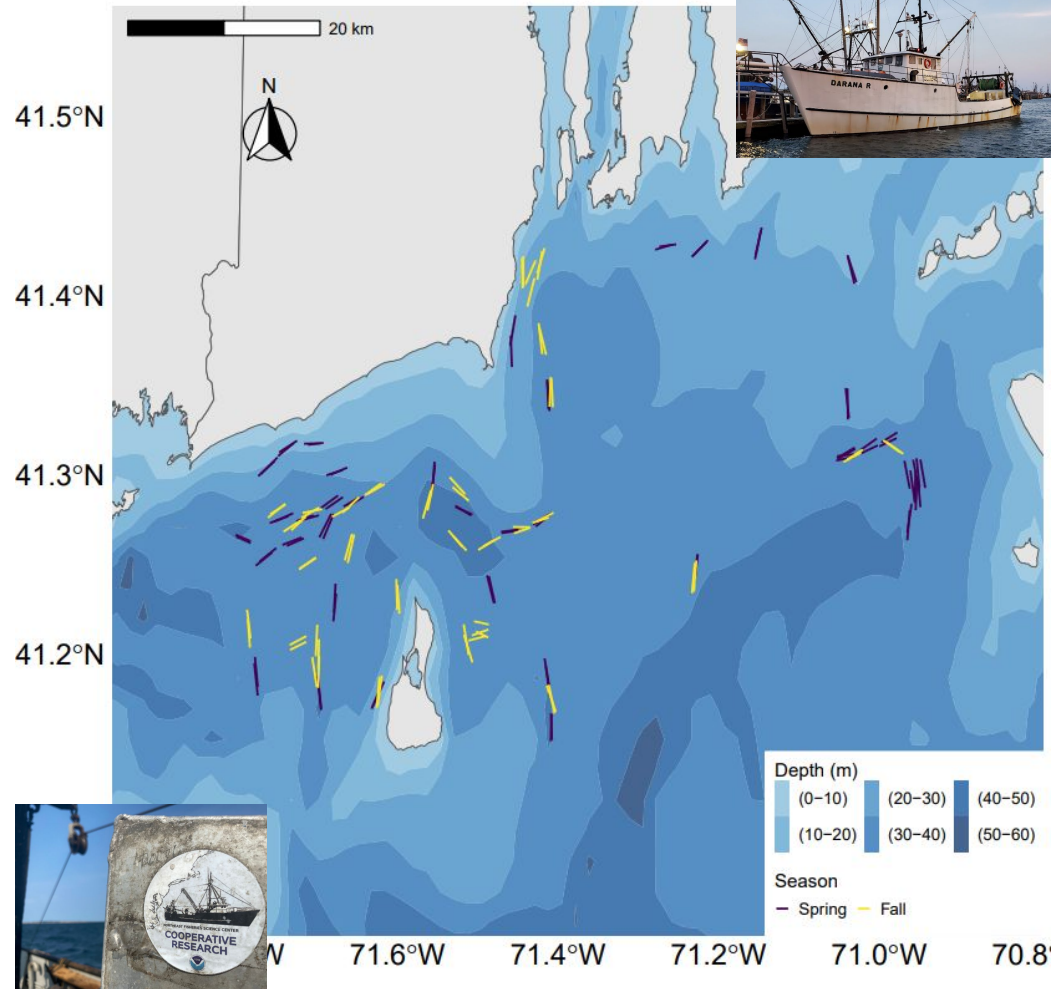


4.4.3 Final proposal

From a technical point of view, the use of restrictor ropes is advised, as it stabilises the net geometry. Technical solutions for handling the ropes should be found on a ship-by-ship basis. Additional data exploration may be done, based on existing data (Norway), or by new data collection, especially in shallower areas. **Furthermore, an improved knowledge of whether a restrictor rope affects the catch rates of various fish species is also required.**

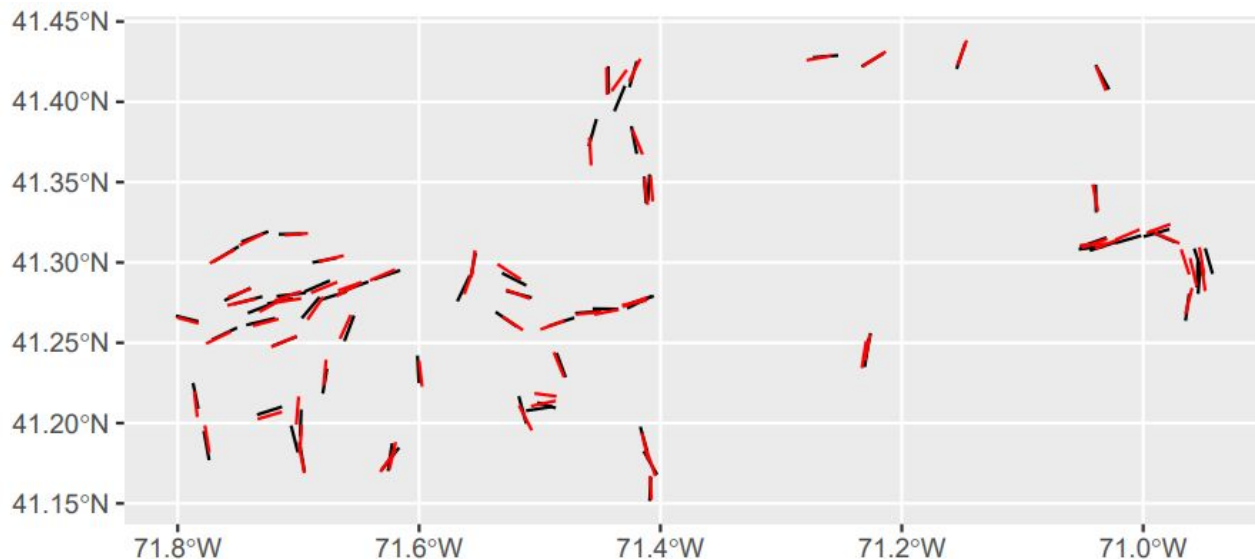
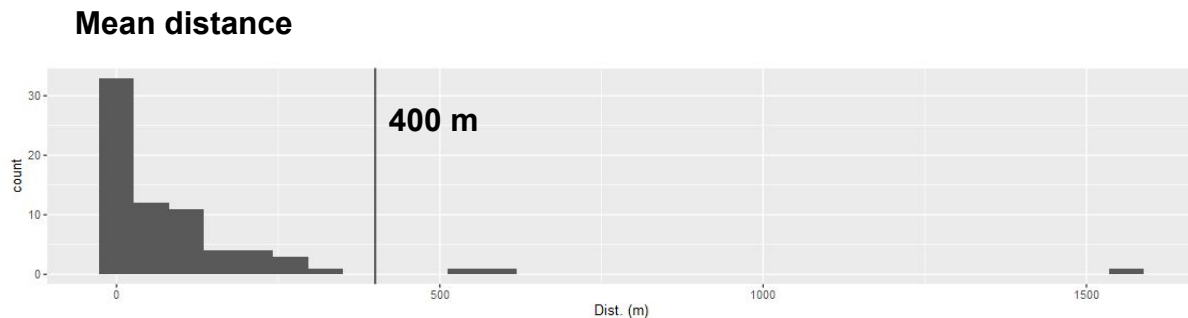
2022 NTAP Experiment

- Experimental work on F/V Darana R to explore restrictor catches
- Essential an ABBA experiment with the addition of a RR to the 400x12cm, three-bridle four-seam survey trawl
- In 2022, two seasons (spring and fall), ~140 tows or ~70 comparisons
- For seven most commonly caught species we:
- Compared aggregate catches (log catches relative to 1:1)
- Inspected catch-at-length in each pair of tows fit with binomial GAM

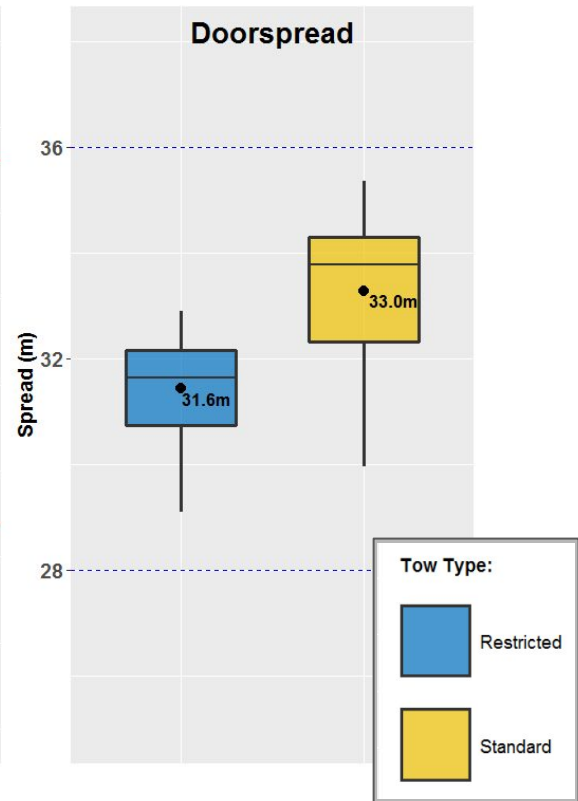
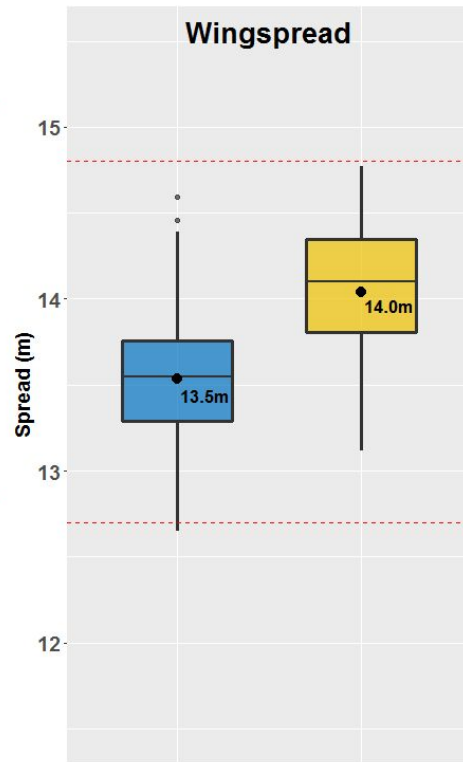
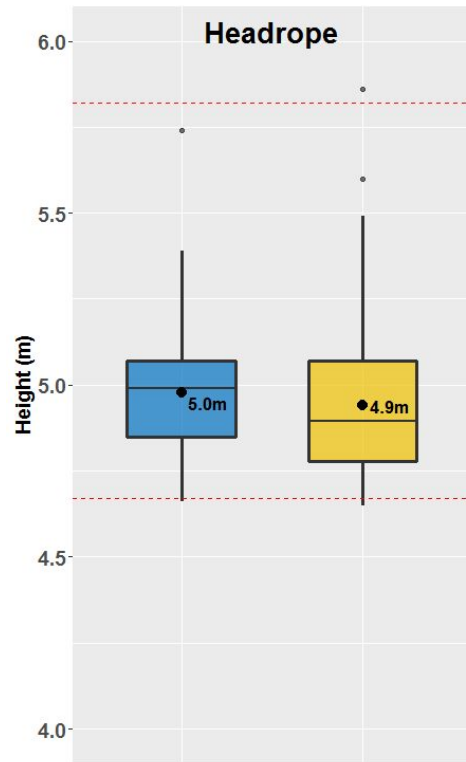


Paired tow spacing

- Excellent job by F/V Darana R!
- Only three tows (2%) where mean distance is > 400 m
- Some tows appear to cross at various points (~40)
- Tow tracks could be slightly different than what was recorded (some GPS wobble)

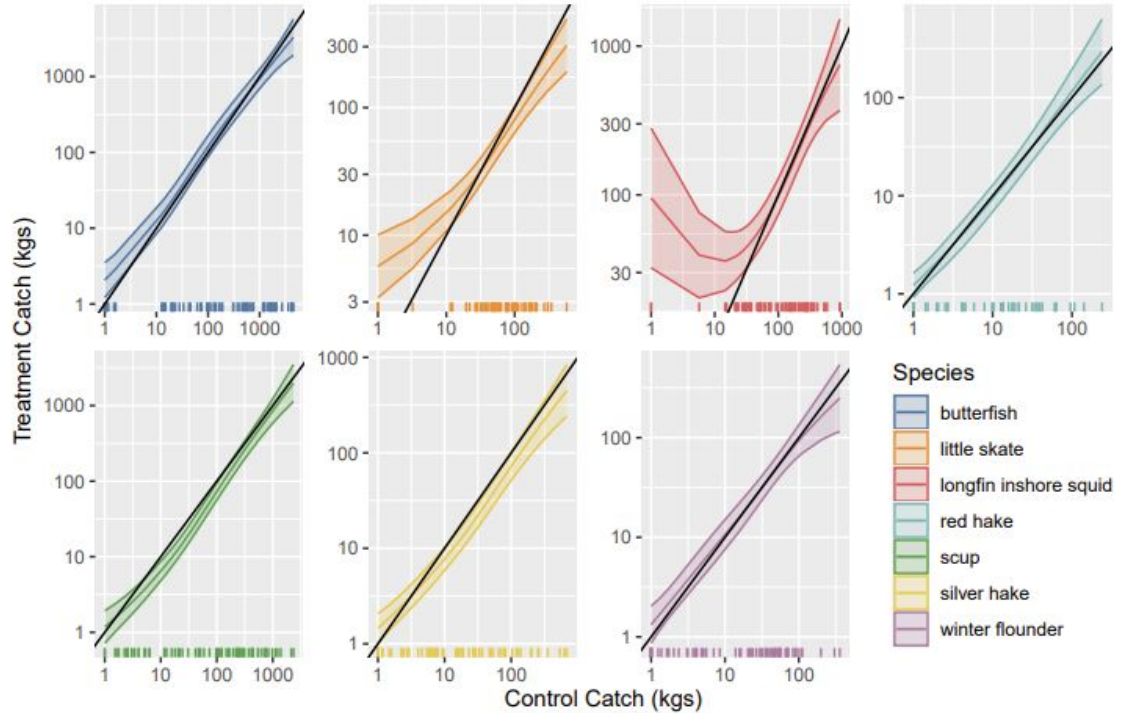
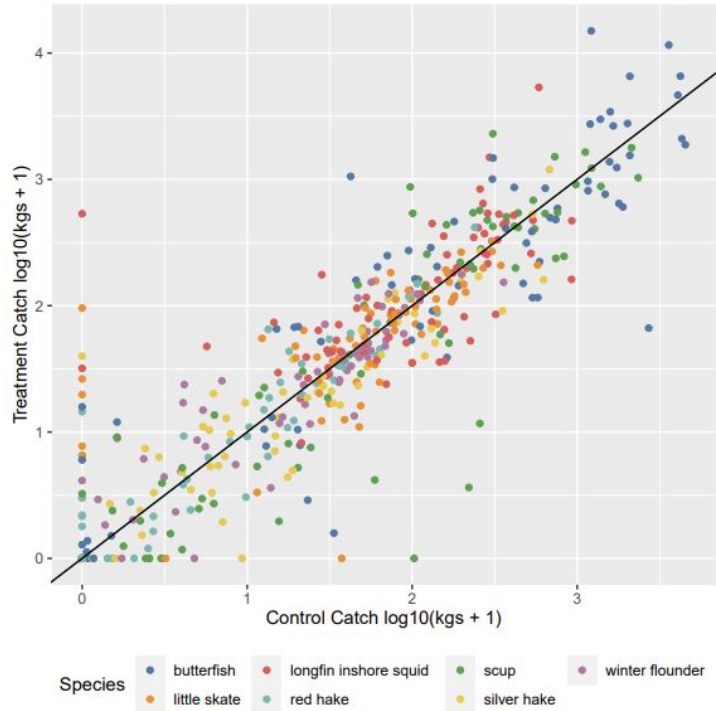


Gear metrics

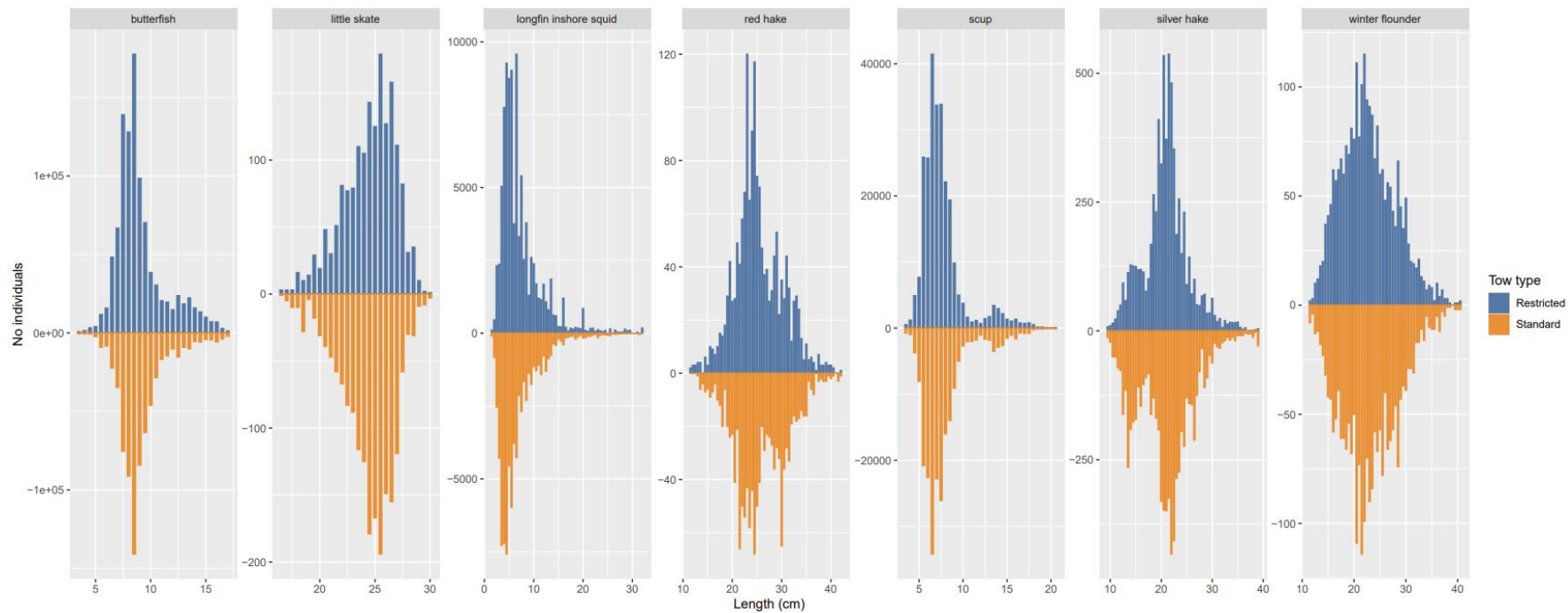


Aggregate catch

- Limited impacts of the restrictor rope on aggregate catches of seven species



Individual lengths



Comparing catch in paired tows

1. Fit GAM models
2. Similar to Holst and Revill (2009)
3. Trimmed to lengths that were caught at >10 stations for each species
4. Included a set of variables in each model
 - a. Depth, order, season, solar zenith angle, and length
5. Preliminary exploration of patterns

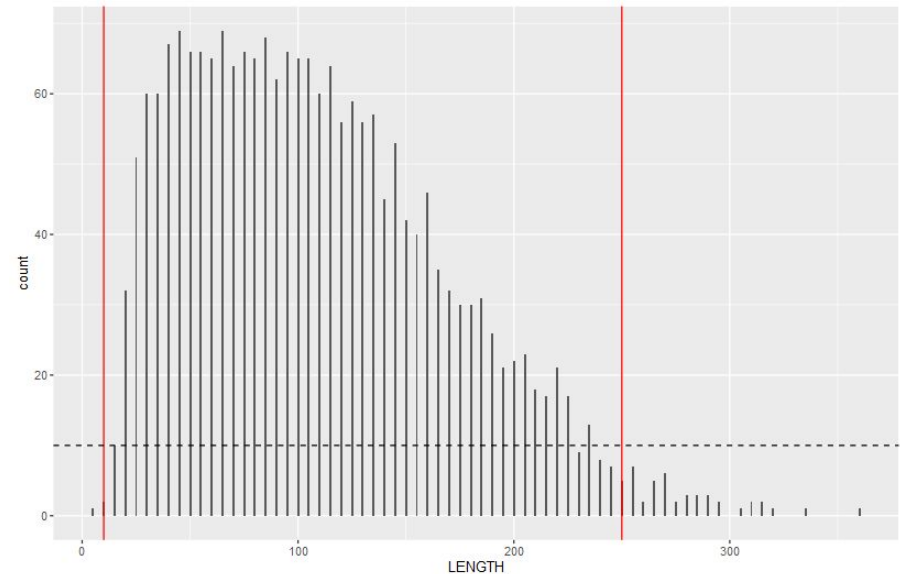


A simple statistical method for catch comparison studies

René Holst^{a,1}, Andrew Revill^{b,*,1}

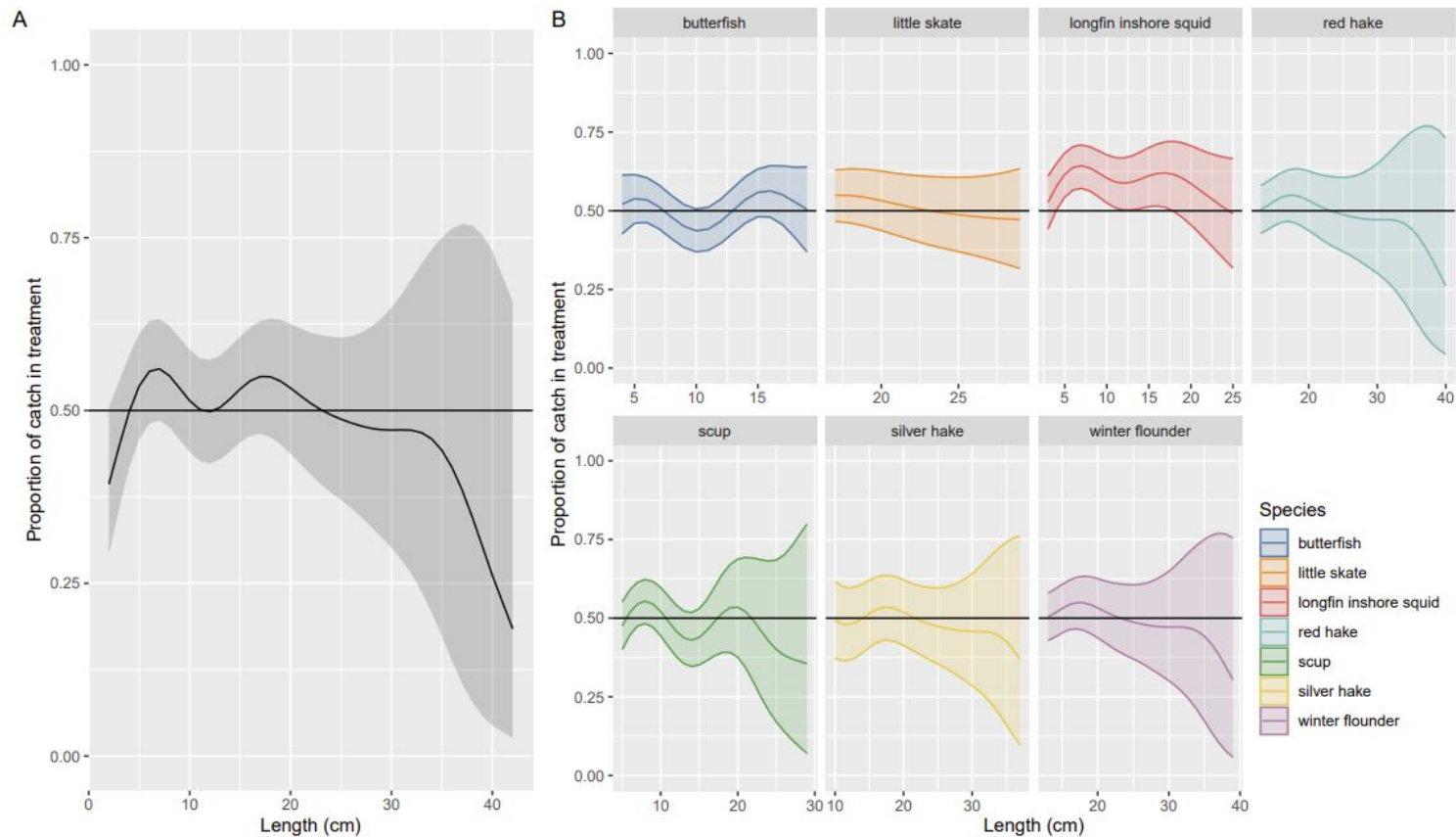
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Lengths used for modeling



Model outputs

- Limited impact on the catch-at-length for seven species



Conclusions

- We observed limited impacts of the restrictor rope on catches
- Worth considering the positive impacts of the restrictor on standardizing gear performance when surveys in wind energy areas are being developed
- Specifically, in scenarios where standardizing net geometry is likely to be more important (e.g., when a large depth range is covered by a survey, or multiple survey vessels may be used)
- In the context of offshore wind, this could potentially help improve consistency across wind developments and help researchers identify cumulative effects
- One caveat is that we do not have enough data to definitively say that there is no effect of the restrictor rope for all species, but we have some confidence based on the diversity of species sampled through this research



Questions?



References:

- Fréchet, A., 2000. Multiple otter-trawl calibration for the sentinel surveys in the northern Gulf of St. Lawrence. ACTES DE COLLOQUES-IFREMER, pp.37-45.
- ICES. 2022. Workshop on the Further Development of the New IBTS Gear (WKFDNG). ICES Scientific Reports. 4:18. 46 pp. <http://doi.org/10.17895/ices.pub.10094>
- Rose, C.S. and Nunnallee, E.P., 1998. A study of changes in groundfish trawl catching efficiency due to differences in operating width, and measures to reduce width variation. Fisheries Research, 36(2-3), pp.139-147.
- Weinberg, K.L. and Kotwicki, S., 2015. Reducing variability in bottom contact and net width of a survey trawl by restraining door movement and applying a constant ratio of warp length to depth. Fishery Bulletin, 113(2).

Individual lengths: Butterfish



- Similar result from more recent log-Gaussian Cox method (thank you Jim and Tim)
- No covariates included



ICES Journal of Marine Science (2019), 76(4), 1189–1199. doi:10.1093/icesjms/isy191

Original Article

Intercalibration of survey methods using paired fishing operations and log-Gaussian Cox processes

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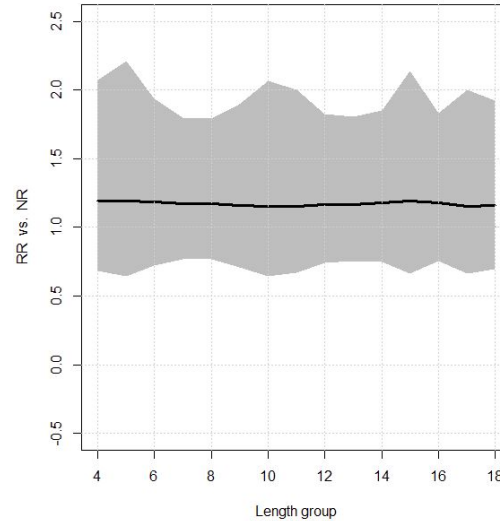
³Greenland Institute of Natural Resources, Kivioq 2, Nuuk, Greenland

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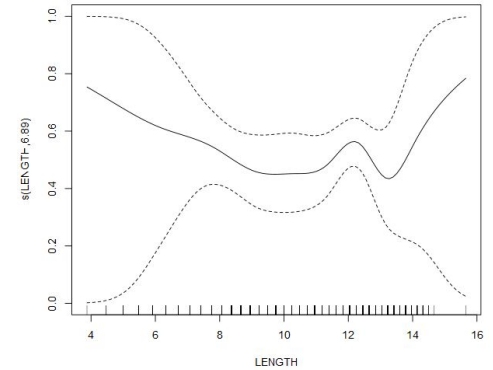
Thygesen, U. H., Kristensen, K., Jansen, T., and Beyer, J. E. Intercalibration of survey methods using paired fishing operations and log-Gaussian Cox processes. – ICES Journal of Marine Science, 76: 1189–1199.

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Relative selectivity



Relative selectivity



From previous GAM

Aggregate catch

- Close to 1:1 when regressing catches without and catches with the restrictor rope
- No sig. effects in the model
- Many different model formulations result in similar results
- Suggests no detectable effect of the restrictor rope

