An assessment of vertical line use in Gulf of Maine region fixed gear fisheries and resulting conservation benefits for the endangered North Atlantic right whale

Willse, N.J.[1], Summers, E.[2], Cleaver, C.[3], Chen, Y.[4]

[1]*University of Maine, Libby Hall, Room 219, Orono, ME 04469 USA (nathaniel.willse@maine.edu)*
[2]*Maine Department of Marine Resources, Boothbay Harbor ME 04575*
[3]*FB Environmental Associates, Portland ME 04101*
[4]*University of Maine, School of Marine Sciences, Orono ME 04469*

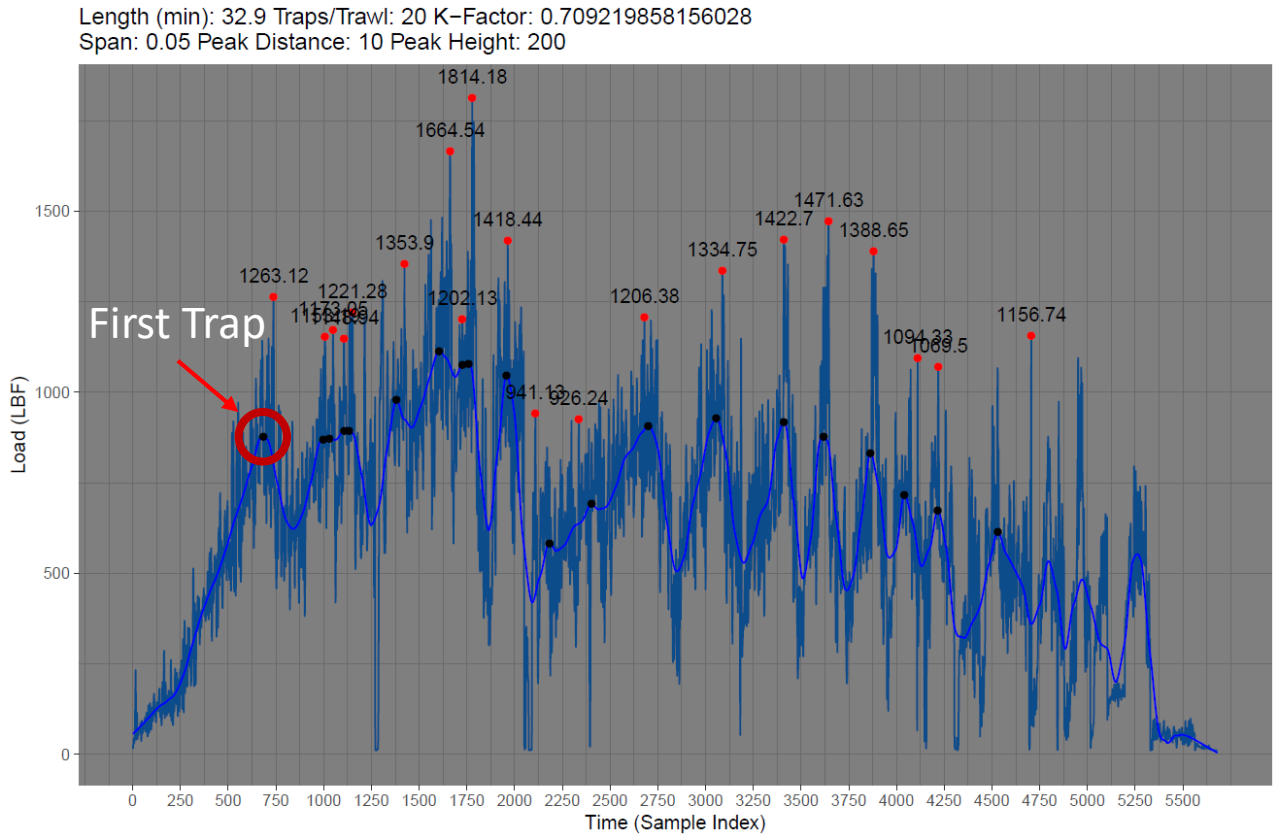
A large threat to North Atlantic right whales is entanglement in fixed gear fishery vertical lines, but the current spatial distribution and variability in vertical line strength across the Gulf of Maine is poorly defined. Spatial variation in the threat lobster gear poses to whales is expected, corresponding to overall vertical line strength, type, and depth. Management measures that limit the strength of vertical lines used in the American Lobster fishery are likely to negatively impact the economic resilience of New England fishing communities, but the line strength requirements of these communities are not well characterized. Analyzing the spatially explicit variables that affect vertical line strength requirements allows nimble management strategies that meet biological management goals while mitigating socio-economic disruption. We will spatially model the breaking strength of lines used by commercial lobster fisheries spatially across the Gulf of Maine. We will measure the load put on lines used in typical American Lobster fishery operations to determine the minimum strength necessary to fish safely and effectively. We will provide guidelines for the minimum rope strength necessary for fishery operation to inform management decision goals that include a sustainable lobster fishery and conservation of right whales.

VERTICAL LINE USE IN GULF OF MAINE REGION FIXED GEAR FISHERIES

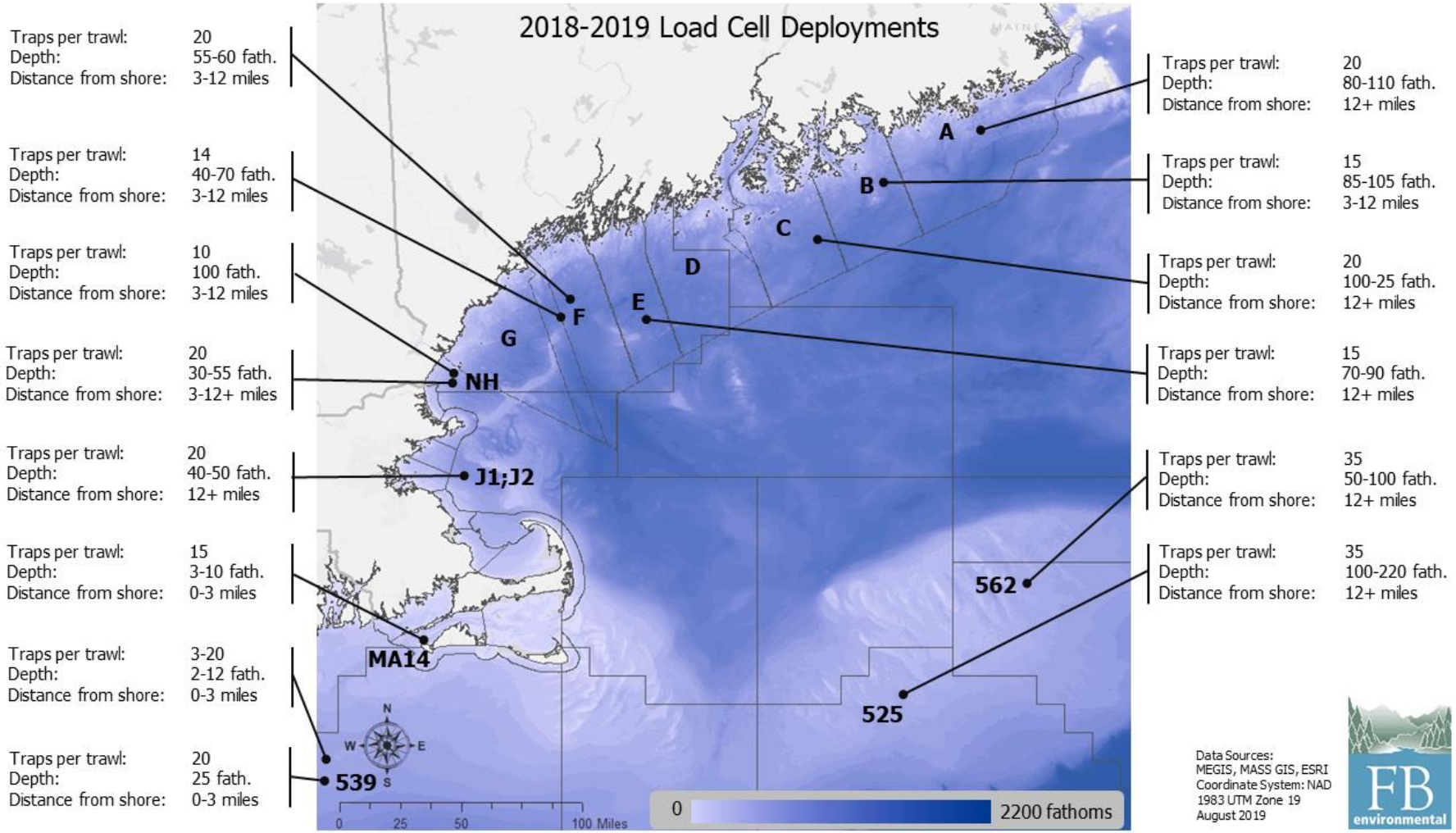
Nathan Willse, University of Maine, Chen Lab: Collaboration with Maine Department of Marine Resources and FB Environmental

Quantifying the Problem

- The diverse line strength needs of New England lobster fishermen are poorly understood.
- Variability in gear requirements has implications for regulation feasibility and fisherman safety.



Data Collection



Load Cell deployments across the Gulf of Maine

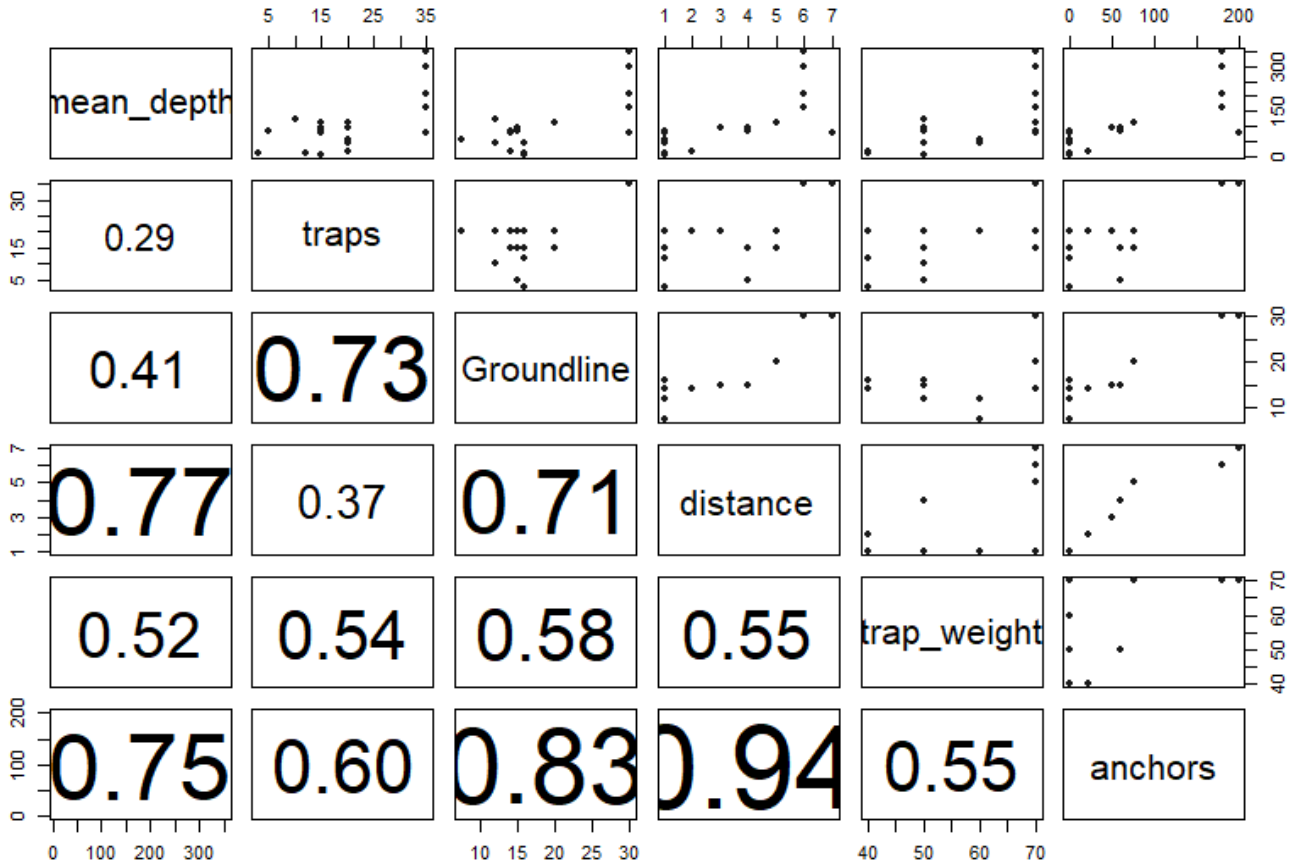
Industry outreach and Graphic by FB Environmental

Variables Considered

- Volunteers using the load cell recorded: Depth, Distance from shore, Number of traps, Weather and wave state, Groundline spacing, Trap weight, and anchor use, as well as gear specifications like rope diameter and type.

- Checking for overlap between variables helps streamline the model.

- We can exclude collinear variables to reduce model complexity without compromising results.



What Are The Outcomes?

- Of all variables tested, Depth fished and Trap count are the most significant.

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Family: Tweedie(p=1.902)
Link function: log

Formula:
Maximum.Vertical.Line.Load ~ s(Mean_depth) + s(traps, k = 7)

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  6.59587    0.01157   569.9   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                edf Ref.df     F p-value
s(Mean_depth) 6.726  7.707 441.8  <2e-16 ***
s(traps)      5.887  5.991 157.7  <2e-16 ***
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =    0.9   Deviance explained = 94.3%
-REML = 1768.4  Scale est. = 0.069451  n = 273
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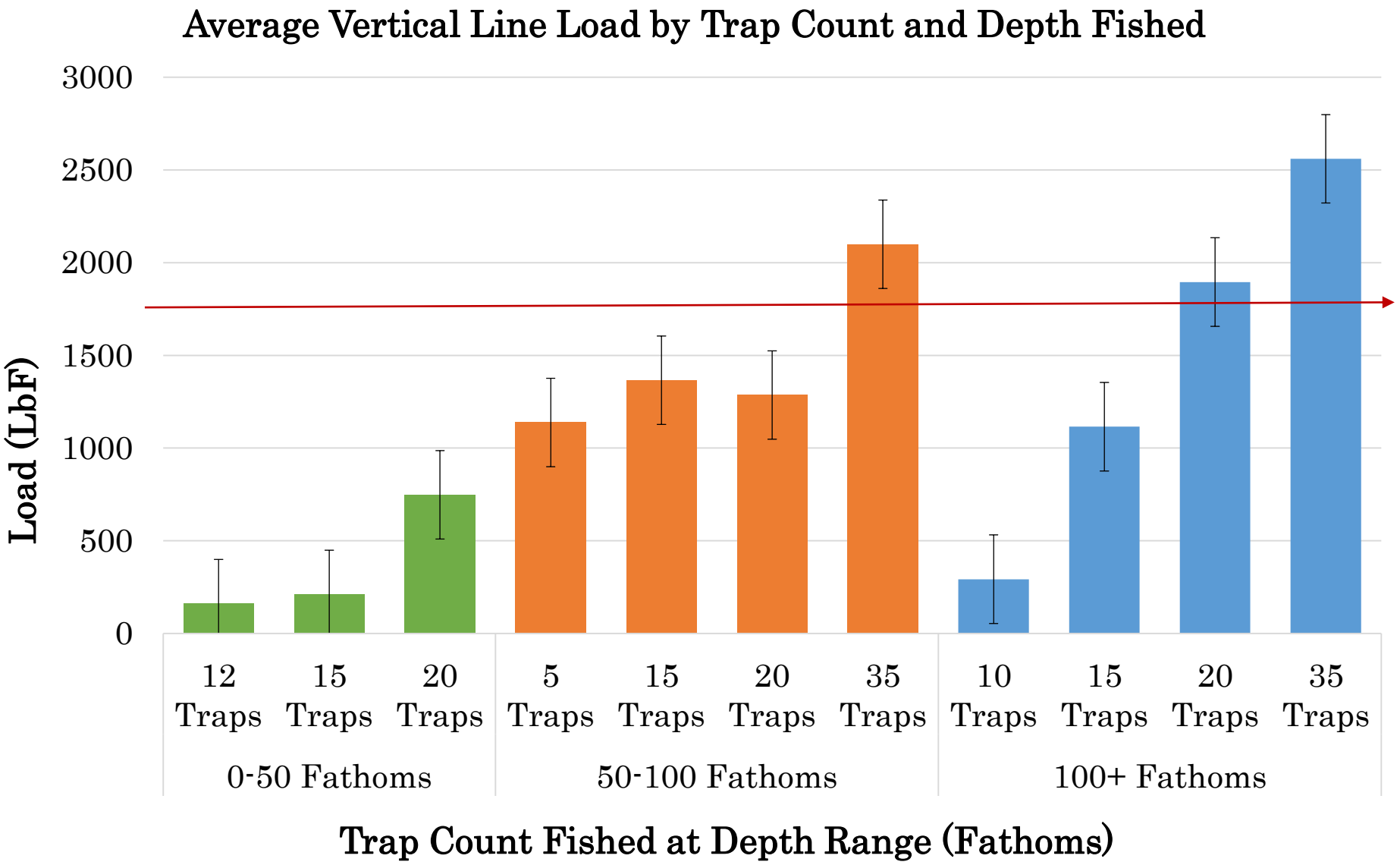
Results


Average Vertical Line Load by Trap Count and Depth Fished
Load (LbF)
3000
2500
2000
1500
1000
500
0
12 Traps
15 Traps
20 Traps
5 Traps
15 Traps
20 Traps
35 Traps
10 Traps
15 Traps
20 Traps
35 Traps
0-50 Fathoms
50-100 Fathoms
100+ Fathoms
Trap Count Fished at Depth Range (Fathoms)

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Project Partners: Maine Department of Marine Resources, FB Environmental.

Thank you to our many Industry partners, and volunteer fishermen.

Thank you

Questions: Nathaniel.Willse@Maine.edu