Mean copepod concentration indicates relative abundance of North Atlantic right whales on seasonal and interannual timescales: options for operational forecasts of right whale occurrence

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Motivation

• ~350 North Atlantic right whales remain
• Right whale deaths are caused by collisions with ships and entanglements in fishing gear
• Efforts to reduce human caused right whale death depend on knowing when and where whales occur

Facts

• Right whales feed on ultra dense patches of copepods
• Dense copepod patches are not detected by standard sampling programs

Hypothesis: Right whale abundance is a function of regional-scale mean copepod concentration

Cape Cod Bay

\[
\text{Log}_{10}(\text{other copepods}) \quad r^2 = 0.53, \ p < 0.05
\]

\[
\text{Log}_{10}(\text{Calanus}) \quad r^2 = 0.35, \ p = 0.12
\]

Great South Channel

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\text{Log}_{10}(\text{Calanus anomaly}) \quad r^2 = 0.62, \ p < 0.05
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\[
\text{Log}_{10}(\text{Calanus}) \quad r^2 = 0.35, \ p = 0.01
\]

Mean copepod concentration is a good indicator of right whale abundance

Moving from a “nowcast” to a forecast with species distribution models (SDMs)

can be combined to generate right whale occurrence probability maps

SDM challenges

• Coupling SDMs to biological-physical models of Calanus distributions
• Running SDMs on an operational time scale to make near-term predictions of right whale distributions