Original

How will marine ecosystems and associated biodiversity respond to changes in ocean physics and chemistry….

Rewording….

How will marine ecosystem structure and function (including feedbacks) respond to environmental change in climate, ocean physics, biogeochemistry, and human pressures (multiple stressors).

**Three Case studies** – utility of vignettes to make a compelling case that unites interests and encompasses a broad suite of scientific drivers. We have examples of each that we do not fully understand….

Timing of spring bloom (ice breakup, match mismatch, nutrient ratios, species composition, export)

Opening of new fishery (euphasiids, deep sea)…effects on cycling, carbon flux etc.

**Biogeographic shifts and their drivers**

Several studies already demonstrate the potential for major biogeographic shifts that may stem from environmental change, though our capacity to predict broad-scale changes in structure and function of North Atlantic ecosystems remains limited. Four major factors drive these biogeographic shifts, and are expected to cause major changes in the coming decades. These drivers include *changes in availability of resources*, *changes in circulation* that alter connectivity and source-sink dynamics, *physiological tolerances* of individual taxa to different environmental drivers (e.g. temperature, pH, etc.), and *resource extraction* (e.g. fisheries extirpations). Biological response varies greatly, depending on specific drivers, and may span from changes in abundance of single species, to wholesale community shifts to extinction versus adaptation. These changes raise questions of whether reshuffling matters – how relative dominance and addition of new players affects ecosystem function and persistence of species in light of how genetic diversity influences adaptability, and the impact of alteration of food web interactions. Poor knowledge of biodiversity, and issues of unknown species and unrecognized sibling species, limit inference on how species and ecosystems are responding to ongoing change.

What about our poor knowledge of biodiversity? Skeletonema…1 species…..(need for inventories)

Single graphic of before and after using dots….

What would Longhurst map look like in 50 years? Habitat suitability models?

Models suggest function will not change but players might.

Beaufort sea freshwater flux and ramifications (nutrient ratios, straitification)

Consider time scales of response….