**Introduction**

Anthropogenic climate change will impact nutrient cycles, primary productivity, and thus ecosystem structure in the world’s oceans, although considerable uncertainty still exists regarding the variability of these changes and how ecosystems will respond. Projected global redistribution of nutrients indicate net primary production is likely to change in the future, yet, substantial uncertainty remains. Earth system model predictions suggest both increases and decreases in global net primary productivity of up to 20% by 2100 (Bopp et al. 2013; Kwiatkowski et al. 2017, Gregg et al. 2003). Changes in primary production has implications for dependent marine ecosystems, as it influences abundance and interactions in both adjacent and non-adjacent trophic levels in many marine systems (Ware and Thomson 2005, Frank et al. 2015). This bottom-up control of marine food webs is expected to reduce fishery yields by as much as 20% globally by 2100 due to productivity constraints at lower trophic levels (Moore et al. 2018).

In recent decades extreme changes in marine environments have become more common and these events have had substantial impacts on ecosystems.

Changes in ocean temperature (Hoegh-Guldberg and Bruno 2010), oxygen availability (Brietberg et al. 2018), and climatic regimes such as El Niño Southern Oscillation (ENSO) (Vecchi and Wittenberg 2010) alter nutrient availability and cycling, and thus, the ecological structure of marine systems.

* The world has had a ton of environmental change in the past century, this change is impacting ecosystems
* Our frame of reference of time determines our ability to identify change

Long-term data is important for understanding climate change

Time frame shapes view of the world and decisions and management

* Measuring interactions on long time scales is particularly challenging

Chemical tracers can aid in this