Climate Change and Coral Reefs

• Many fisheries species are dependent on coral reefs as essential fish habitat (fewer are obligate to corals in the Atlantic)
• Long-term fisheries declines can be linked to declines in coral reef structure and coral reef food webs (e.g., groupers, spiny lobsters)
• Habitat forming coral are limited diversity – helps to (somewhat) simplify understanding EFH changes
Climate Change and Coral Reefs

- Temperature
  - Stress and mortality at temperatures 1°C above the annual monthly maximum mean (MMM) temperature
  - Bleaching threshold (BT)
  - Time and magnitude above the BT determine the impact of thermal stress (level of mortality/recovery)
Climate Change and Coral Reefs

• Temperature
  – Site-specific MMM temperatures drive site-specific bleaching thresholds
  – Warming may occur in all habitats
  – Decreases refuge habitats for corals and fish
Climate Change and Coral Reefs

- Temperature
  - High temperature events during in the annual thermal maximum are becoming more frequent and severe (e.g., 2005 northeastern Caribbean bleaching event)
Climate Change and Coral Reefs

• Turbidity and Sedimentation
  – Blockage of light and deposition of sediments
  – Shift in suitable habitats for coral reefs (Grady et al. 2013)

• Sea level rise
  – Increased shoreline erosion and coastal turbidity/sedimentation
  – Upward shift in suitable habitat at limits of depth range
Climate Change and Coral Reefs

• Currents and reproduction (mass spawning broadcasters versus brooders)
  – Broadcast spawning
    • species are often restricted to spawning and sea surface fertilization a few nights of the year during the annual thermal maximum SST’s
    • Creates a narrow window of potential vulnerability (temperature stress on larvae and adults, hurricanes)
  – Brooders
    • Typically more flexible spawning and larval release times, less sensitivity to climate change
Climate Change and HABs

- Benthic Harmful Algal Blooms
  - Ciguatera Fish Poisoning (CFP)
    - Linked to a benthic dinoflagellate (*Gambierdiscus* spp.)
    - *Gambierdiscus* has optimal temperatures, with some species liking it hot and others not
    - Unknown if toxic species respond favorably to a warming ocean
    - Epidemiological – no increase in CFP in St. Thomas between 1980’s and 2012 (Radke et al. 2013)
    - Shift of *Gambierdiscus*/Ciguatera Fish Poisoning to higher latitudes (Kibler et al. 2015)
Climate Change and HABs

• Benthic Harmful Algal Blooms
  – Macroalgae on coral reefs
    • Increasing in abundance with eutrophication, natural and human-caused reductions in herbivores, and temp./chemistry associated with climate change
    • Increased negative interactions with corals and a phase shift to increasing macroalgae