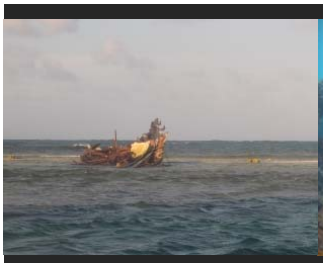
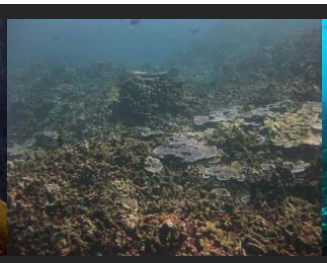
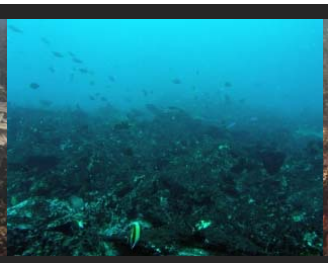
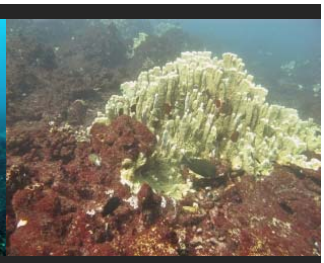
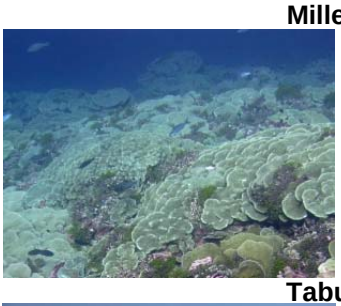
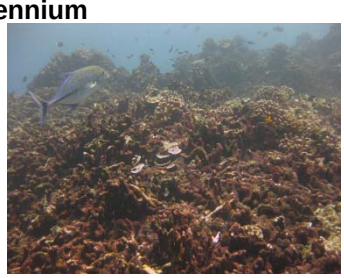


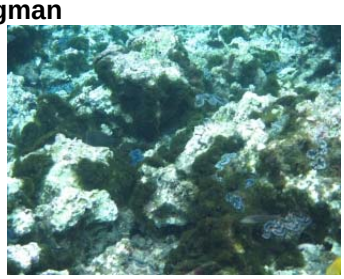
Black reefs

Millennium

Tabuaeran


Kingman

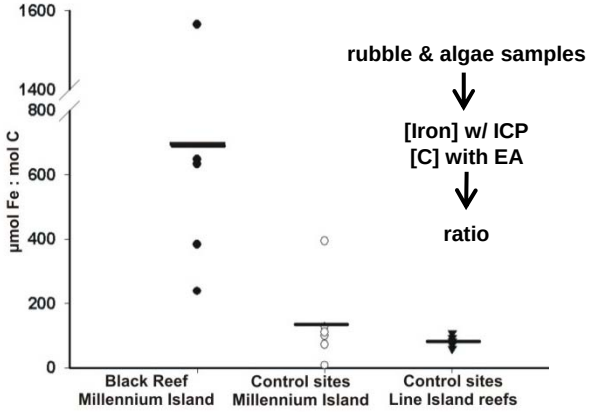
Reference | Black reef

Shipwreck debris on coral reefs in the central Pacific cause phase shifts characterized by high coverage of fleshy algae, cyanobacterial mats, and/or corallimorphs

- **Coral cover was reduced from 40-60% to <10% on three Line Island coral atolls**
- **These black reefs are large (>0.75km2), can occur rapidly (within 3 years on Kingman Reef), and can persist for decades (>40years on Tabuaeran Atoll)**

Representative photographs of the black reef and reference sites on Millennium, Tabuaeran, & Kingman (panels to left)

We hypothesized that iron leaching from the wreck debris was causing elevated algal and microbial growth on black reefs



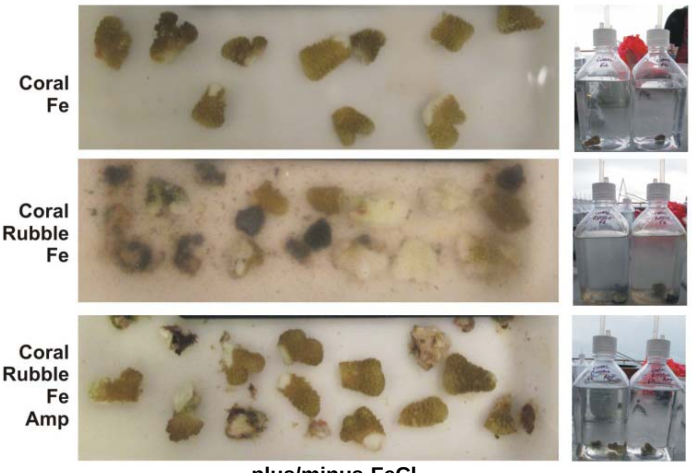
Iron concentrations were 6-times higher in algae from black reefs

-If you add iron experimentally to corals and algae, you can re-create the black reef

-Corals incubated with iron and rubble showed the greatest mortality (50% dead, 20% dying)

-Addition of the antibiotic ampicillin significantly reduced coral death in the presence of iron & rubble

-Further evidence for elevated heterotrophic microbial activity in response to iron and algal growth can be seen by the depletion of dissolved oxygen (data not shown)



corals in microcosms → plus/minus $FeCl_3$, ampicillin, rubble from black reef site → photos after 72 hrs

For more information:

Wegley Kelly et al. (2012) Black reefs: Iron-induced phase shifts on coral reefs. ISME Journal: 6, 638-649.

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