Blue Carbon Assessment of GFNMS

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Agenda

1. Published Data
    - Blue carbon equations
2. Assessment
    - Salt Marsh: Calculation and Results
    - Seagrass: Calculation and Results
    - Assessment Conclusions
    - Limitations
    - Next Steps
3. Climate Change Impacts
4. Questions

Published Data

Seagrass and Salt Marsh

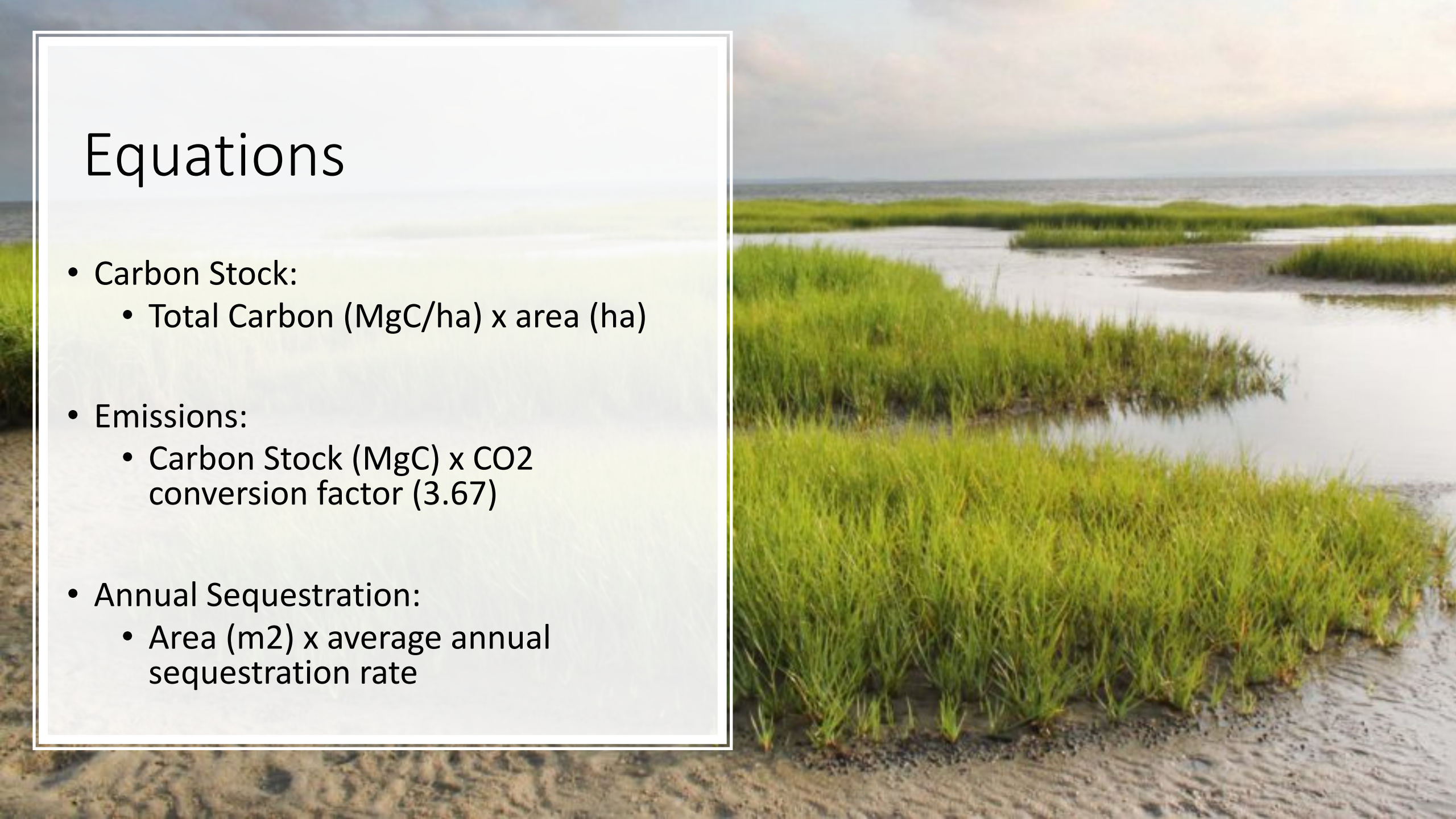
- Carbon Stock
- CO2 Emissions
- Annual Sequestration Rate

Ecosystem Type	Carbon Stock (Mg/ha)	Range (Mg/ha)	CO_2 Mequiv/ha	Annual Sequestration
Mangrove	386	55-1378	1415	-
Tidal Salt Marsh	255	16-623	935	210 (Laffoley et al., 2009)
Seagrass	108	10-829	396	83 (Chmura et al., 2003)

Table 1: Range of values of soil organic carbon stocks up to 1-meter depth for mangroves, tidal marshes, and seagrass ecosystems (Adapted from IPCC 2013).

Equations

- Carbon Stock:
  - Total Carbon (MgC/ha) x area (ha)
- Emissions:
  - Carbon Stock (MgC) x CO2 conversion factor (3.67)
- Annual Sequestration:
  - Area (m2) x average annual sequestration rate



Salt Marsh Calculations

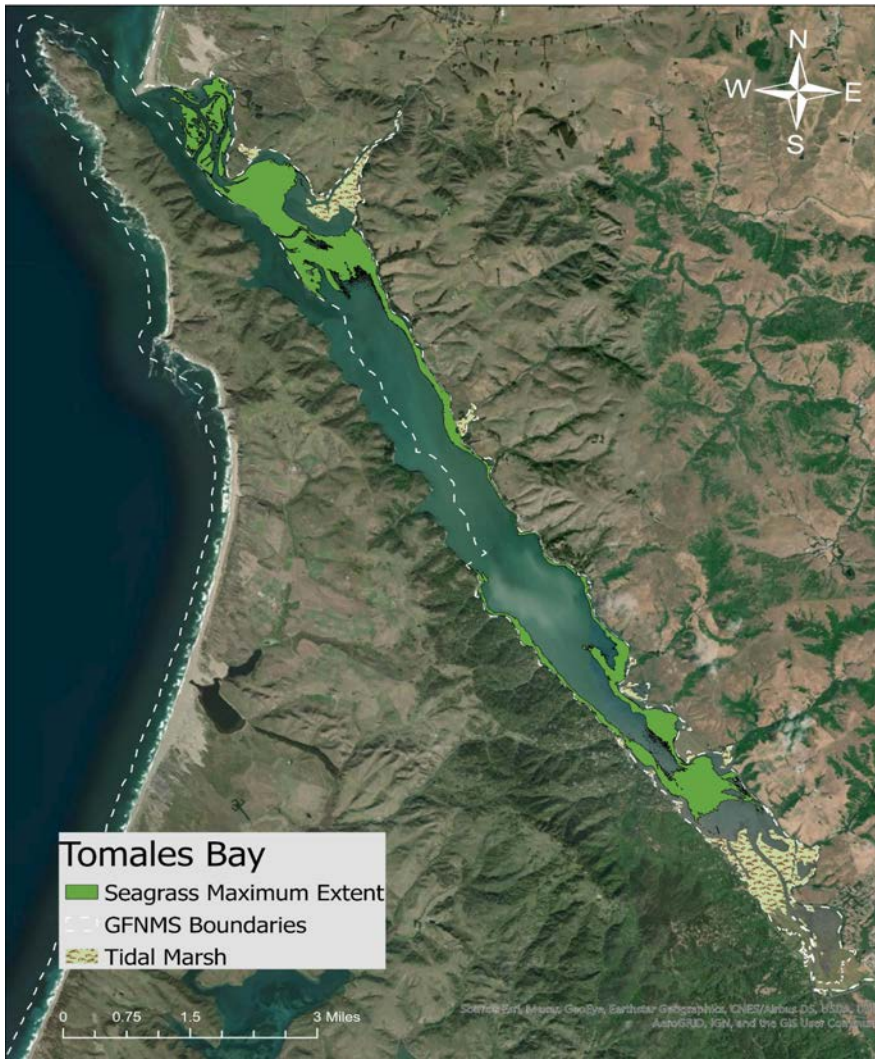
- Carbon Stock = Total Carbon (MgC/ha) x area (ha)
  - 255 (MgC/ha) x 320 (ha) = 81,668 (MgC)

- Emissions = Carbon Stock (MgC) x conversion factor
  - 81,668 (MgC) x 3.67 = 299,721 (MgC)

- Sequestration Rate
  - 3,202,663 (m2) x 210 = 673 (MgC/year)

Salt Marsh

- GFNMS Salt Marsh Area: 3,202,663 m2
- Storage: 81,668 MgC
- Annual Sequestration: 673 MgC/year
- Emissions: 299,721 MgC

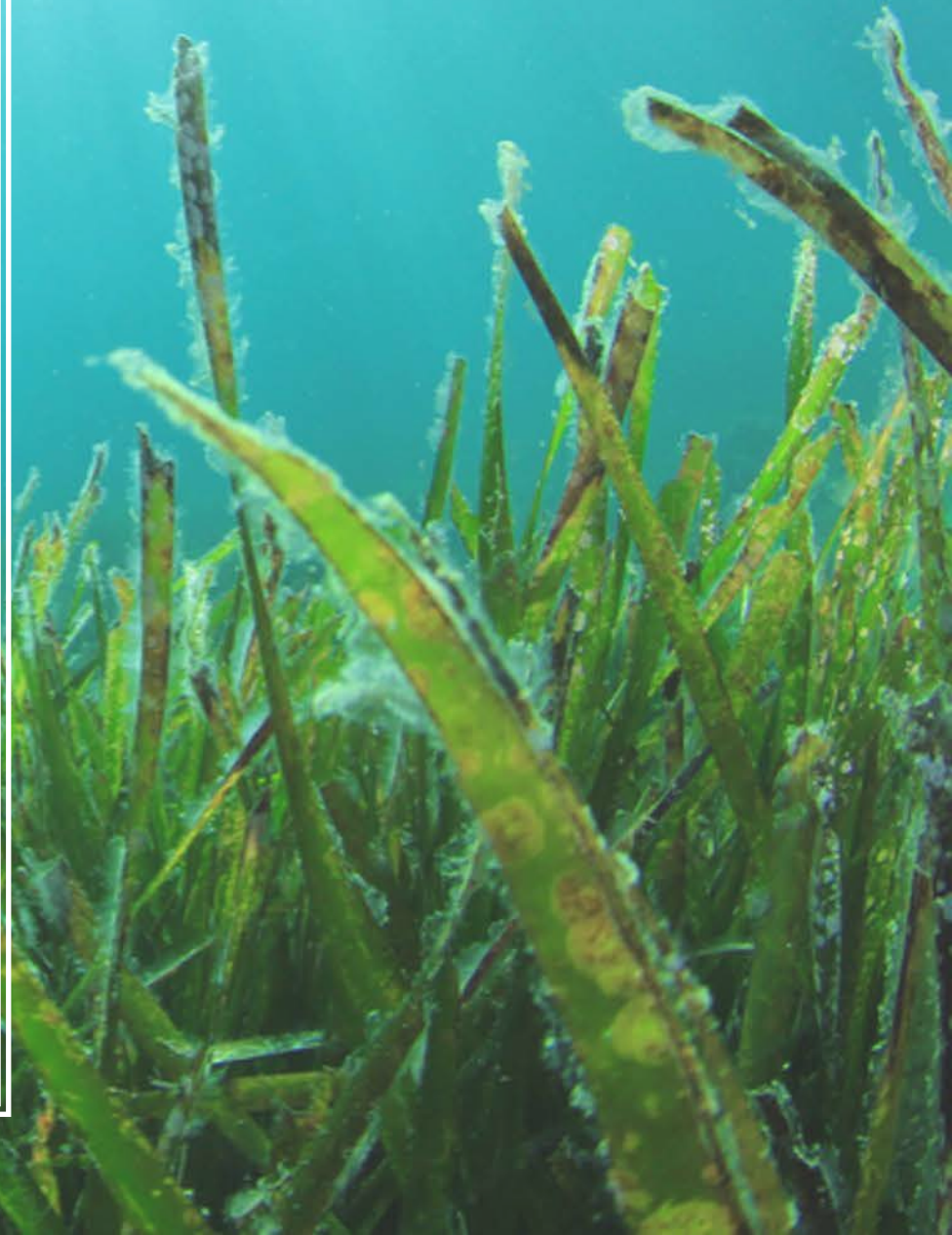


Tomales Bay

Bolinas Lagoon

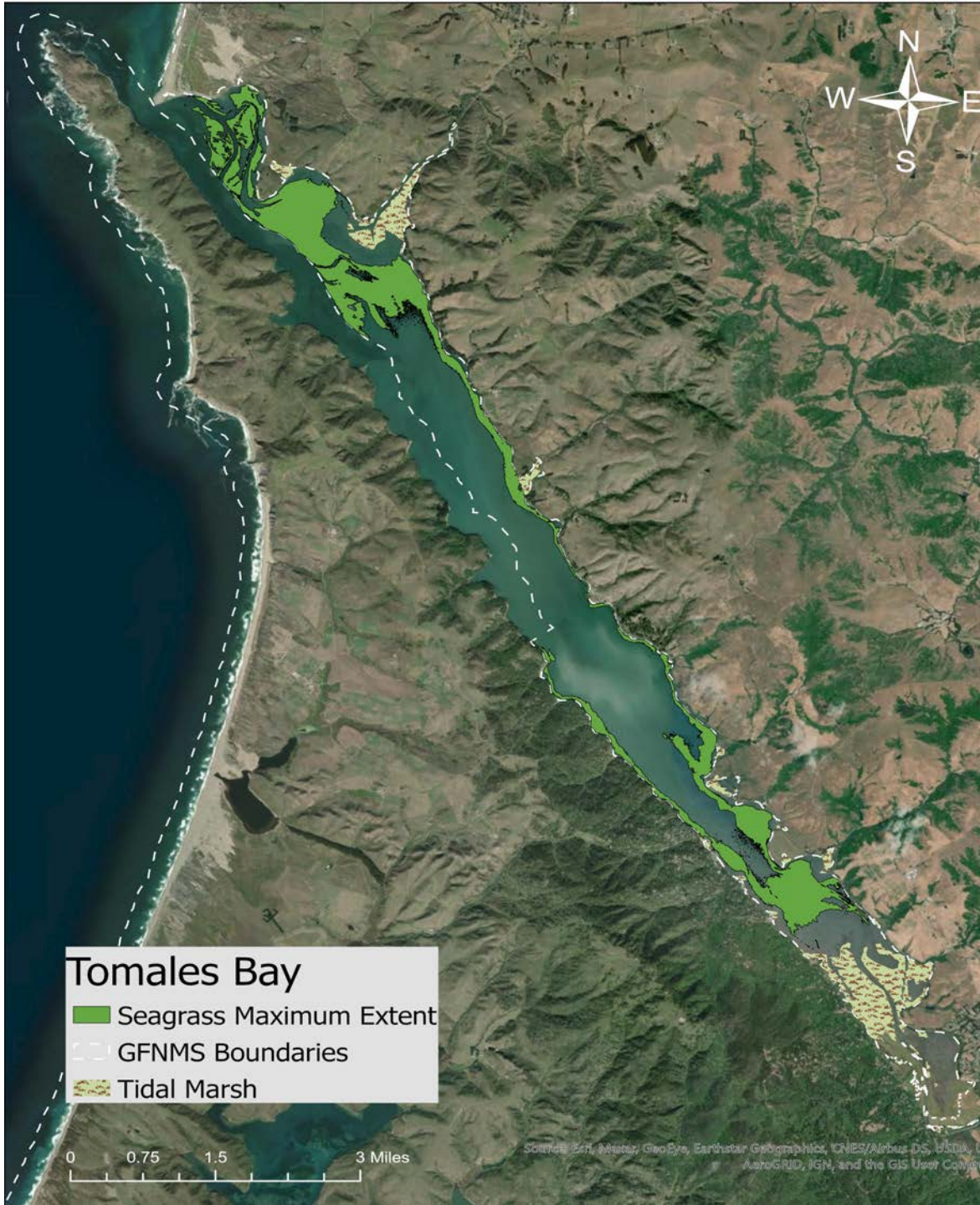
Seagrass Calculations

- Carbon Storage
  - 108 (MgC/ha) x 715 (ha) = 77,220 (MgC)
- Emissions
  - 77,220 (MgC) x 3.67 =283,397 (MgC)
- Sequestration rate
  - 7,153,475 (m2) x 210 = 594 MgC/year



Seagrass

- GFNMS Seagrass Area: 7,153,475 m2
  - Tomales Bay Area: 7,119,158 m2
- Carbon Storage: 77,220 MgC
- Annual Sequestration: 594 MgC/year
- Emissions: 283,397 MgC



Assessment Conclusions

- Total Carbon Stock: 158,888 MgC
- Annual Sequestration: 1,267 MgC/year
- Emissions: 583,119 MgC

- Seagrass covers largest area
- Salt Marsh contributes greater to carbon storage and sequestration
- Significant Carbon Stores in GFNMS

Limitations

- Tier 1 Assessment
  - Global rates used
- Finer scale assessment needed
  - California specific rates
  - Location specific rates
- Incomplete data extent

Kelp Stock

- Bull kelp biomass needed
- Biomass x NPP = Total NPP
- Total NPP X conversion factor = carbon stock

Kelp Carbon Sequestration

- Carbon stock used to calculate avenues of carbon sequestration
- Sequestration avenues taken from Krause-Jensen & Duarte (2016)
- Carbon storage percentages
  - 0.39% - kelp beds
  - 7.70% - below the mix layer
  - 2.3% - deep sea
  - .92% - continental shelf


Photo By: Kevin Joe (CDFW)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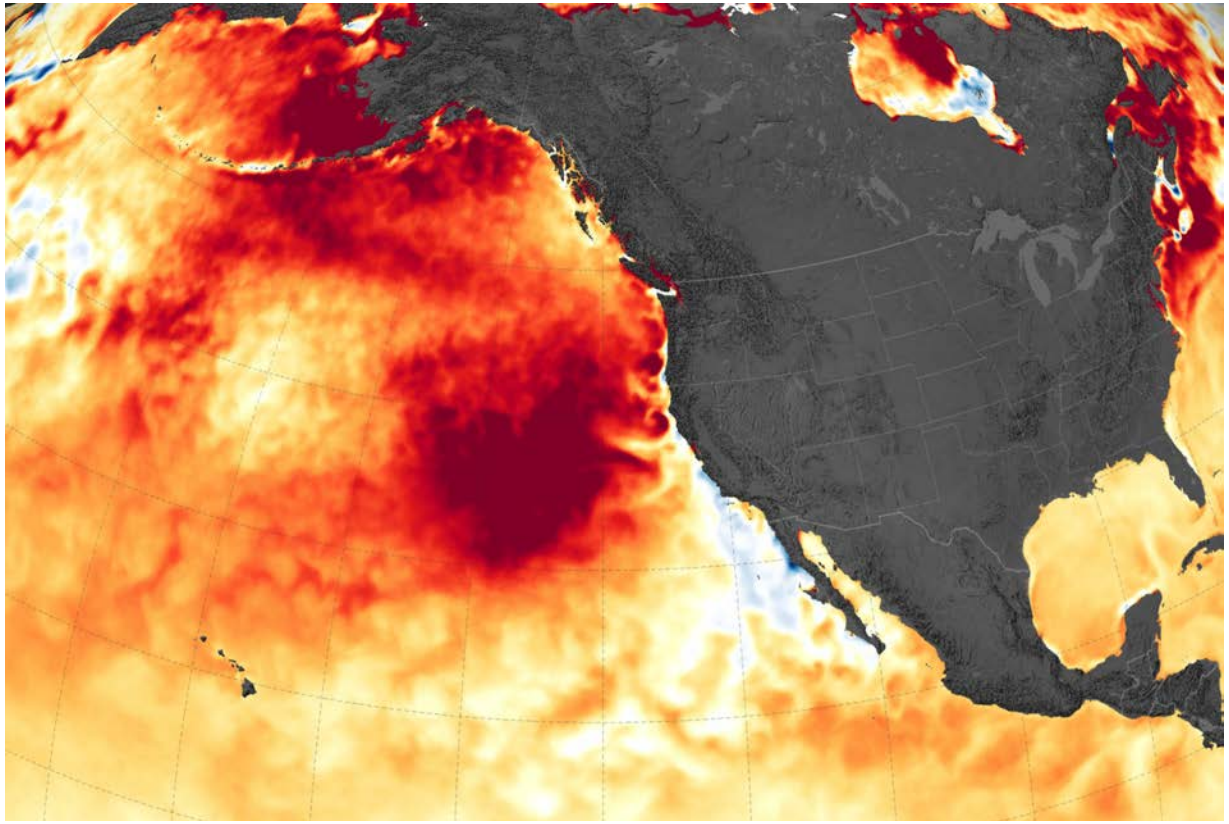
Whales

- Whale contribution to carbon storage
- Deadfall carbon main focus
- Will provide support for conservation efforts

Climate Change Impacts



Sea Surface Temperatures

Sea Level Rise

Seagrass

- Temperature impacts
- Australia case study: Shark Bay
  - 2010
  - 2-4° Celsius exposure
  - Lost 22% of total area
  - Released 2-9 Tg CO_2
  - No Recovery
- No documented seagrass death from high SST in California

Salt Marsh

- Expanding wetland boundaries
  - 22% increase in area
  - Higher sequestration
- Impediments to expansion cause marsh drowning

Questions?