CONCEPTUAL MODEL

**DRIVER**

- Increased Atmospheric CO₂

**PRESSURE**

- Climate Change
  - Δ Water pH (Acidification)
  - Δ Sea Level & Storm Surge
  - Δ Hydrography
  - Δ Water Temperature

**IMPACT**

- Δ Calcifying Ability
- Habitat Changes/Loss
- Flow-Mediated Impacts
- Δ Biological Distribution
- Δ Toxics Bioavailability
- Shoreline Erosion
- Δ Runoff/Load Patterns
- More Harmful Algal Blooms
- Nutrient Management
- Wetland Migration
- Flow Requirements
- Improved HABs Monitoring
- Carbon Sequestration
- Sediment Management
- Flood/Wildfire Control
- Biological Index Refinement

**MGMT. ACTION**
GOALS OF THIS PRESENTATION

• Overview of the four pressures of climate change
  – $\Delta$ Water pH
  – $\Delta$ Sea level
  – $\Delta$ Hydrography
  – $\Delta$ Water temperature

• Provide context for your other talks today
  – Acidification modeling
  – Environmental flows
  – Sea level rise
CHANGING OCEAN pH

- Ocean pH has fallen by 0.1 pH units since the Industrial Revolution
  - Equivalent to a 26% increase in ocean acidity
  - Acidity is projected to increase 100%-150% by 2100

pH data from the Hawaii Ocean Time Series Station (HOTS)
ACIDIFICATION IN THE BIGHT

Bight ’13 found that deep coastal waters are already corrosive
- Corrosive conditions = Seawater with aragonite saturation state < 1.0

![Graph showing corrosive conditions](image)
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- Δ Improved HABs Monitoring

Source: climate.nasa.gov
CHANGING WATER TEMPERATURE

- Ocean surface temperature has risen an average of 0.13 °F per decade since 1880
  - About 15 times faster than at any other time in past 10,000 years
**CHANGING WATER TEMPERATURE**

- **Thermal expansion is the dominant driver of sea level rise**
  - Seawater expands as it warms
  - Ice melt will play a bigger role going forward

![Graph showing sea level rise and thermal expansion](https://example.com/graph)

- Ice melt is increasingly driving sea level rise
- Thermal expansion will be a smaller contributor going forward

*NASA*
SEA LEVEL RISE

- Sea level rise is happening faster now than anytime in the past 2,500 years

Models predict anywhere from 1 to 8 feet by 2100

U.S. Global Change Research Program
STORM SURGE

• Storm surge will continue to intensify
  – As early as 2050, today’s 100-year storm event could strike annually
CHANGING HYDROGRAPHY

• **Peak snowmelt and rainfall patterns are changing**
  - CA snowpack melting 3+ weeks earlier than in the 1940s
  - Projections are for shorter rainy seasons with bigger storms

• **Has implications for water resources management**
  - Peak flows will change
  - There will be more pressure to maintain environmental flows

Scripps and USGS, Science Magazine
TODAY’S PRESENTATIONS

• Δ Water pH
  – SCCWRP research: Acidification modeling and biological thresholds

• Δ Hydrography
  – SCCWRP research: Management of environmental flows

• Δ Sea level
  – SCCWRP research: Coastal wetland vulnerability + sediment management strategies
  – City of Los Angeles: Climate change resilience assessment