

Applied development of standardized coral toxicity tests

D. Abigail Renegar, Ph.D.
Carys Mitchelmore, Ph.D.

*NASEM Workshop to Advance Research on
Understanding the Environmental Effects of UV
Filters from Sunscreens*

*Washington, D.C.
January 23-24, 2023*

Halmos College
of Arts and Sciences
NOVA SOUTHEASTERN UNIVERSITY

NSU
Florida



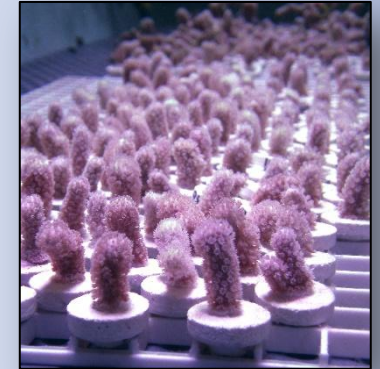
University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Corals as toxicity test organisms - challenging

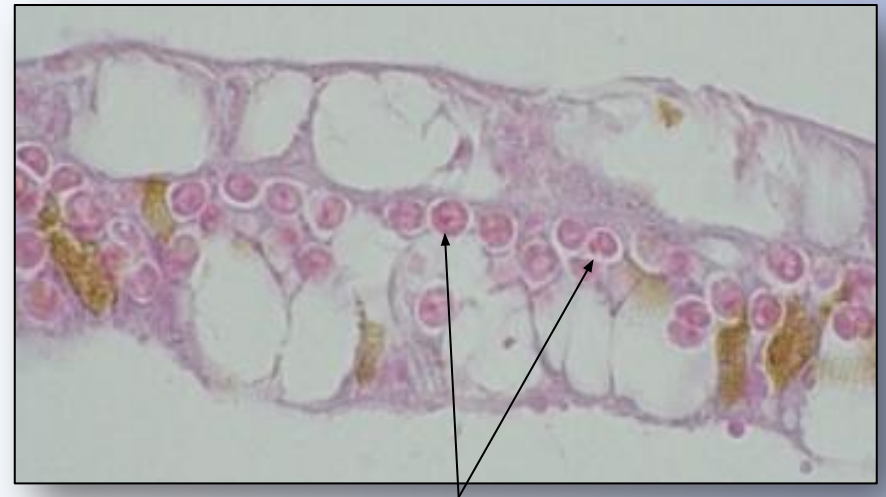
- Mutualistic relationship between coral (animal) and zooxanthellae (dinoflagellate)
 - Endpoints selected must consider both
- Specific and unique water quality and exposure parameters, some of which can be co-stressors
 - Temperature
 - Light conditions (environmentally relevant spectral quality/quantity)
 - pH, alkalinity, water flow
 - Seawater source (natural or artificial)
- Species-specific and life stage variability in sensitivity
 - May be chemical specific; larvae not always the most sensitive



coral larvae



adult corals



coral epidermis and gastrodermis with zooxanthellae

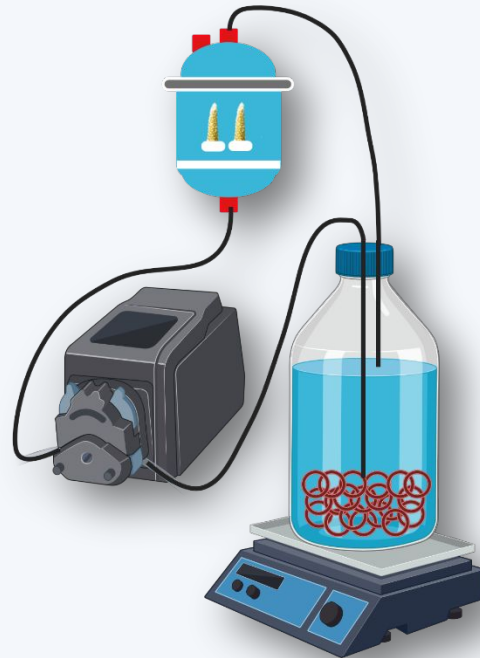
Exposure types

Static-renewal



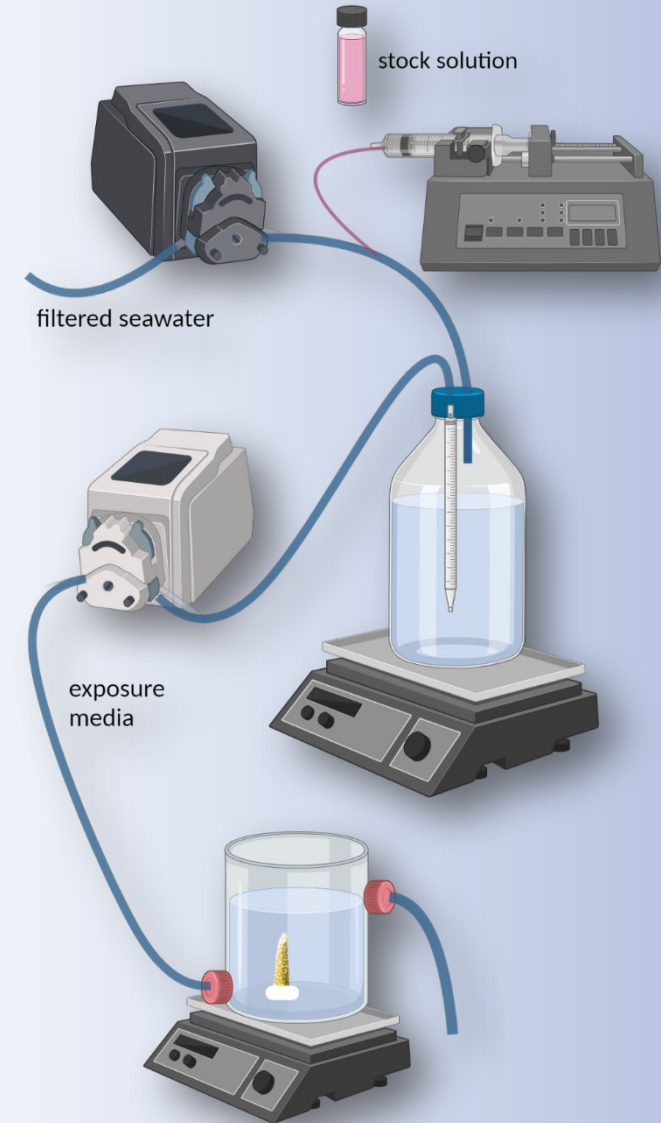
range-finding tests

Continuous recirculating



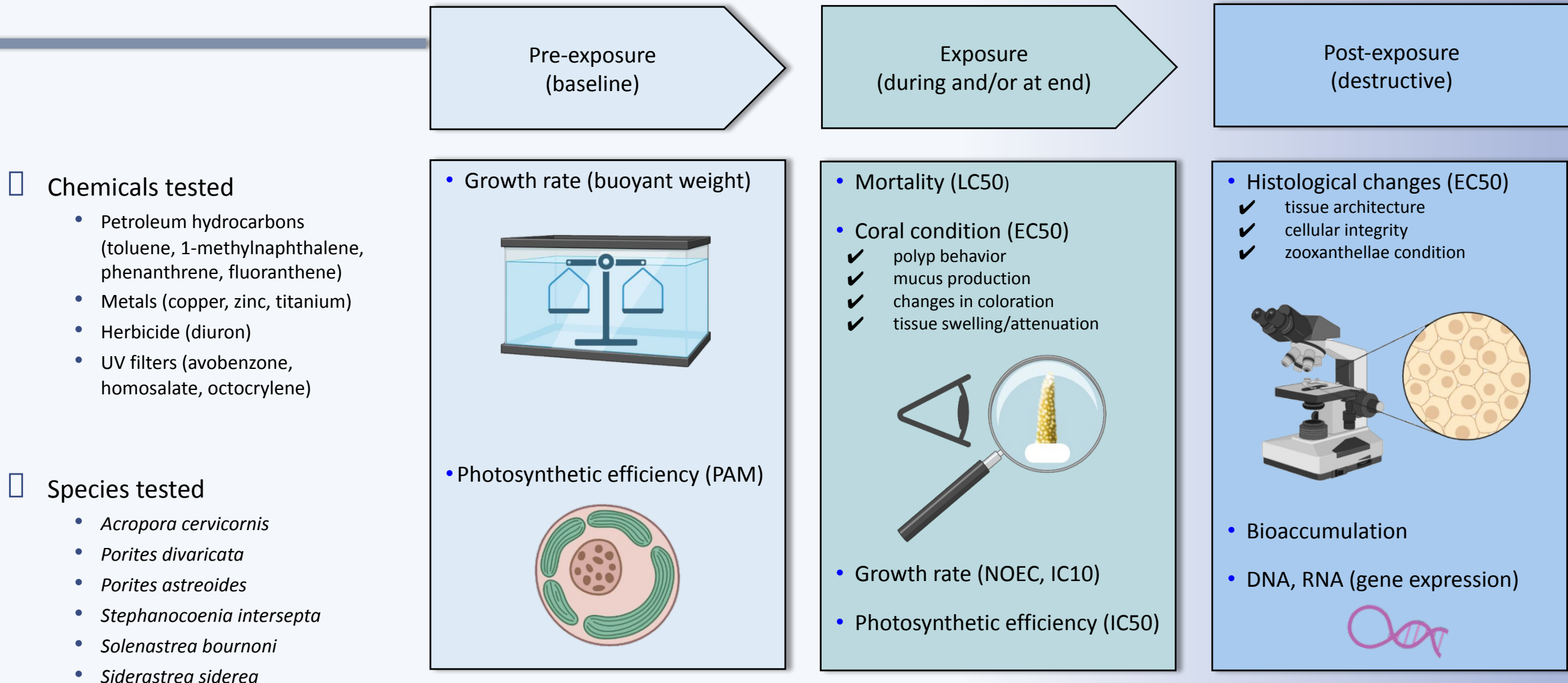
48-hour acute

Flow-through



96-hour acute to 21-day chronic tests

Coral assessment



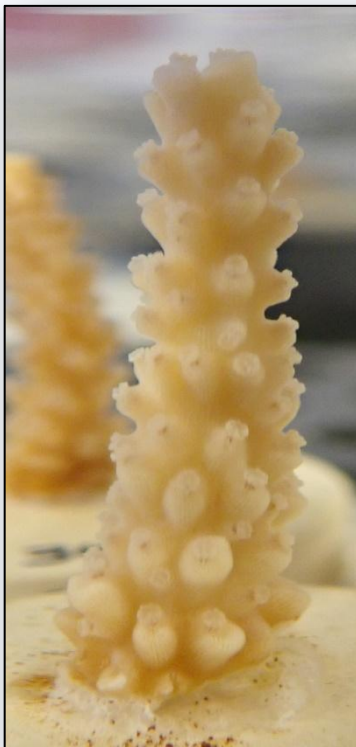
Coral condition endpoints

Acropora cervicornis, Atlantic staghorn coral

normal



polyp retraction



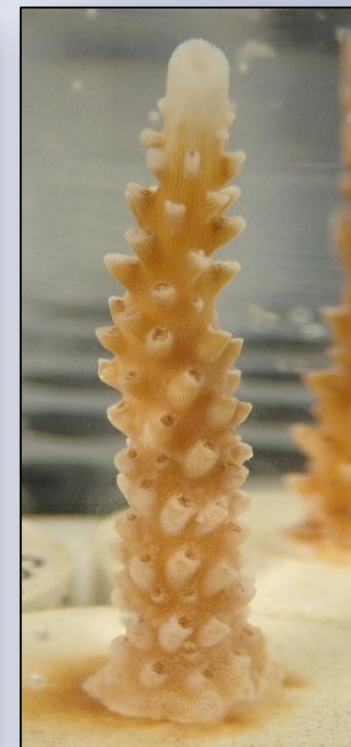
bleaching



mucus production



tissue swelling



tissue attenuation



tissue loss, mortality

What have we learned?

□ Exposure types

- Range-finding exposures useful for new chemicals/species
- Flow-through tests result in reliable and consistent exposure concentrations for difficult-to-work-with chemicals
- Toxicity underestimated in static-renewal tests; flow-through tests indicate higher toxicity (lower EC50 & LC50) than static-renewal tests

□ Coral assessment

- Highly reproducible toxicity thresholds with visual metrics
- Thresholds based on visual metrics supported by histological changes
- Growth rate is a relevant conservative metric, but requires optimization to generate reproducible, low variability data

Low coral biomass and minimal handling is recommended



Next steps and priorities

- Non-standard organisms (like corals) of significant ecological importance are a priority
 - Develop EPA/OECD standard coral toxicity test methods
- Chronic toxicity tests essential
 - Population-relevant endpoints for ERAs
 - Assess applicability of alternative endpoints
- Focus on producing reliable, actionable data that is IQA compliant
 - Establish reporting standards, appropriate QA/QC
 - Analytical chemistry is challenging and complex but required

Balance consistency with existing regulatory guidelines and metrics scaled for environmentally relevant exposures

Acknowledgements



Research Assistants: Ellen Skelton, Nicholas Turner, Dawn Bickham, Matt Rojano, Samantha Buckley, Katherine Meurer, Katrina Smith, Kyle Pisano

