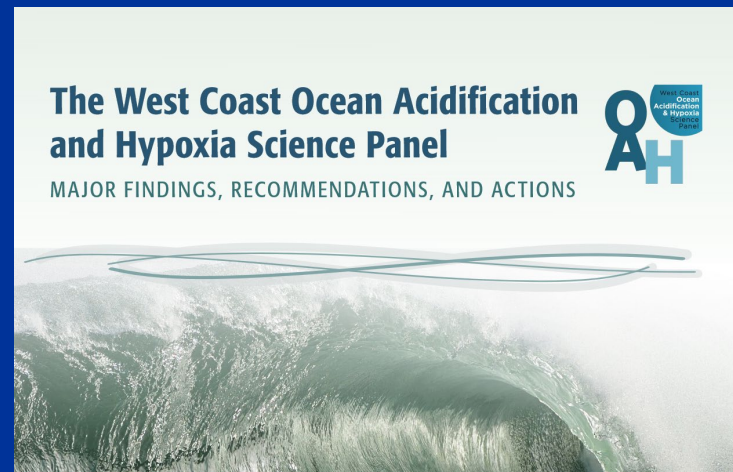


BACKGROUND

- **In 2011, Stanford's Center for Ocean Solutions suggested nutrient limits on wastewater treatment plants to reduce coastal acidification**
- **The West Coast Ocean Acidification Science Panel made a similar suggestion**
 - However, their recommendation was more cautious
 - They suggested using a model to evaluate magnitude of change from such expensive actions
- **CTAG asked SCCWRP to undertake that modeling effort**
 - We partnered with UCLA and Princeton to do so



PRESENT DAY

- **We spent nearly ten years building and validating the model**
 - Published more than >50 journal manuscripts describing this work
- **Four years ago, we started transitioning from model development to running application scenarios**
 - Focused on regional bookend scenarios
 - Those bookend runs suggest nutrient inputs have a non-trivial effect on local acidification
- **Some community members expressed concern about whether the model is mature enough for use as a management decision-making tool**

EXPERT REVIEW PANEL

- **Independent expert panel was formed to review the model**
 - Six internationally renowned experts who met for nearly a year
 - Held five public sessions to receive information
 - Administered through National Water Research Institute to ensure independence
- **They issued their draft report on Wednesday**
- **I will summarize their findings and describe next steps**

THREE TYPES OF PANEL FEEDBACK

- **Soundness of the model and model output interpretation**
- **Activities to further quantify model uncertainty**
- **Steps we can take to enhance community acceptance**

MODEL IS FUNDAMENTALLY SOUND

“The Panel members unanimously agree that the ROMS-BEC coupled modeling system is built on fundamental principles of physical and biogeochemical oceanography and has been evaluated using available observations. In its current form, the coupled modeling system can capture many fundamental physical and biogeochemical processes associated with ocean acidification and hypoxia in the Southern California Bight. The coupled modeling system, even as a scientific tool that is still actively being developed, can be used to address some management questions related to the environmental and ecological impacts of treated wastewater discharges in the region. In particular, the Panel concurs that the ROMS-BEC coupled model can be used to investigate the question of how nutrient loads from treated wastewater discharges may have affected the ecosystem of the Southern California Bight.”

SUGGESTED IMPROVEMENTS

- **Place model findings into context of California Current-scale patterns**
 - Example: Identify places of particular ecological concern (either to anchovy or the food web they support) and present water-quality impacts on those places specifically, not only on the Southern California Bight as a whole
- **They offered a note of caution about not extending the model beyond the scales for which we have validated it**
 - “As is the case with all modeling systems, ROMS-BEC has limitations and, specifically, does not capture all physical and biogeochemical processes relevant to the discharge of treated wastewater. For example, the model needs more evaluation with observations in the near field of outfalls and nearshore coastal region to ensure an adequate depiction of highly variable shallow water processes”
- **They offered no recommendations about necessary improvements before using the model to address management questions**
 - Instead, the report focuses on things we can do to better understand model uncertainty

FURTHER QUANTIFY MODEL UNCERTAINTY

- **Conduct comparisons with additional observational variables**
 - Subsurface nutrient concentrations
 - Sediment trap data
 - Light (Photosynthetically active radiation)
 - Primary productivity
 - Apparent oxygen utilization
 - Observations in the near field of outfalls and nearshore coastal region
- **Conduct additional sensitivity analyses**
 - Zooplankton grazing
 - Relative preference of phytoplankton groups for nitrate and ammonium
 - Particle sinking and remineralization rates
 - Natural nutrient inputs
 - Light attenuation
 - Nitrate uptake half-saturation constant

ENHANCE COMMUNITY ACCEPTANCE

- **Provide close-to-full model output, rather than summarized data**
 - Daily averages of key variables at key depths, across the full model domain
- **Automate production of graphical comparisons and summary statistics**
- **Conduct observation comparisons following engineering norms, rather than scientific publishing conventions**
- **Create a system for associating output datasets, model-observation comparisons, and scientific publications with versions of the model's source code**

THE BURDEN NOW SHIFTS FROM THE PANEL TO YOU

- **The Panel report has more “could” than “should” or “need to”**
 - “The Panel offers these recommendations, rather than a recipe to follow, as the developers of the model have a better understanding of which parameterizations are associated with the greatest uncertainties. The Panel also notes that these recommendations are not made as a critique of the model, but rather as ways to increase confidence in the model through further investment in observations to constrain the model parameters”
- **Challenge is to discriminate important activities from subtle ones**
 - The modeling team will have their own opinions, but this needs to be a community decision
 - You are the ones who need to have confidence in the model if you are to use it

HOW DO WE MAKE THOSE DECISIONS?

- **We need a platform for such conversations**
 - A place where regulated, regulators, and NGOs can interact
- **I have suggested that the Expert Panel Steering Committee could be a foundational element**
 - However, there are many other possible mechanisms
 - The Commission should help us identify the best mechanism
- **Beyond prioritizing next steps in responding to the model review, such a group could identify management options under consideration**
 - And identify the model runs that will be most helpful to inform such decisions