

# STARTING POINT

- **The Oregon Department of Environmental Quality (ODEQ) is developing a 303d listing process for ocean acidification**
- **They formed a workgroup of experts to help them with that process**
- **ODEQ asked SCCWRP to help structure the workgroup discussion**

# GOALS FOR TODAY'S PRESENTATION

- **Acquaint the Commission with Oregon's process and timing**
- **Share some preliminary thoughts on ODEQ's direction**
  - With the caution that their process is still in its early phase
- **Talk next steps and opportunity for input**
  - ODEQ has indicated they are interested in feedback from our member agencies
  - They value our unique interface between science and management
  - They would like to see symmetry among the three west coast states

# APPROACH

- **ODEQ has convened a small group of bilingual people**
  - Those who know both the technical details of OA and the management context for an integrated assessment report
- **The small group will delineate questions that the experts should answer**
  - Differentiate policy level decisions that are the State's purview from technical questions which are appropriately addressed by a scientific advisory body
- **Small group will develop a strawman proposal**
  - Provide the larger group of experts with something to react to rather than asking them to develop a holistic approach on the fly

# QUESTIONS THAT NEED TO BE ANSWERED

- **Should the 303(d) assessment methodology be based on chemical or biological data?**
- **Which metrics within those classes should be used for 303(d) assessment methodology?**
- **What values of those metrics represent exceedance of the assessment threshold?**
- **Which collection and processing methods are acceptable for quantifying the selected metrics?**
- **How many samples are necessary to make an assessment?**

# CHEMISTRY OR BIOLOGY?

- **Rationale for selecting biology: People are more willing to act when they know there is an impact**
  - Biology provides a direct measure of effect
  - Chemistry is an indirect prediction of likely effect, with substantial uncertainty because we don't yet fully understand variable exposure duration and multi-stressor effects
- **Rationale for selecting chemistry: There is more data available**
  - We already have consensus on measurement methods, so data are comparable across sites
  - There are even models that can be used to predict chemistry at unmeasured sites
- **ODEQ has decided that either type of data is acceptable**
  - ODEQ has further determined that a hybrid approach combining the two is preferable

# HYBRID APPROACH

- Combining allows for independent confirmation when there are uncertainties with an individual data type

|                                 |   | Acidification chemistry     |   |                               |
|---------------------------------|---|-----------------------------|---|-------------------------------|
| Percent of impaired individuals |   | Low number all agree is bad | Number that is likely bad, but for which there is uncertainty | High number all agree is good |
|                                 | High number all agree is bad                                  | Impaired                    | Impaired  | Impaired                      |
|                                 | Number that is likely bad, but for which there is uncertainty | Impaired                    | Impaired  | Potentially impaired          |
|                                 | Low number all agree is good                                  | Impaired                    | Potentially impaired  | Not impaired                  |

# WHICH BIOLOGY METRIC SHOULD BE USED?

- **Two-part question**
- **Part 1: Where on a spectrum of response severity do you want to be?**
  - Measures of biological exposure to OA stress, such as mild dissolution of shells
  - Loss of fitness in individuals, such as a physiological response
  - Population response, such as mortality or reduction in density
  - This is a policy question for the State: Where does loss in beneficial use begin?
- **Part 2: Which specific metric within the selected level of severity should you use?**
  - Part 2 is a question for the scientific experts

# ODEQ'S ANSWER TO PART 1

- **A fitness level response is preferable**
  - Something that is linked to a likely population effect
  - Something that is attributable to OA stress
- **Population level effect is too late**
  - Don't want the threshold to be exceeded only after the population has already been decimated
- **Exposure level effect is too early**
  - Failure of water quality threshold is an enduring, potentially expensive, decision that requires reasonable certainty about effect manifestation



# SUGGESTED ANSWER TO PART 2 (SCIENCE QUESTION)

- **Severe shell dissolution**
  - Clearly linked to OA stress
  - There is evidence it is related to fitness (growth and survival)
- **Dissolution is becoming widely measured in monitoring programs**
  - Needed for contextual information
  - Methodologies are close to being standardized (thanks in part to OPC)
- **This is a rational answer, but only one of many possibilities**
  - This is exactly the type of question they want to pose to the experts

# QUESTIONS THAT NEED TO BE ANSWERED

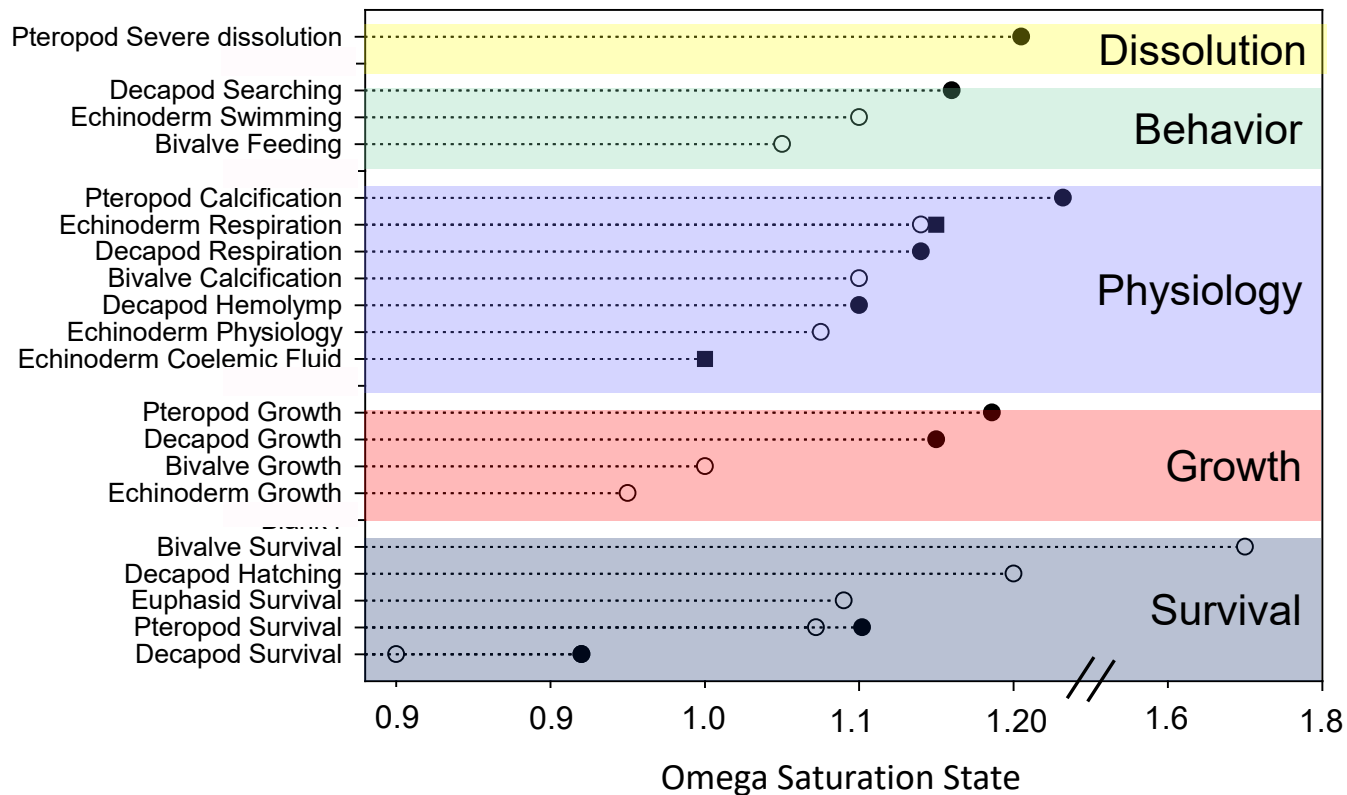
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# WHICH CHEMISTRY METRIC SHOULD BE USED?

- **This is a simpler question to answer for chemistry than biology**
- **Scientists have largely agreed that aragonite saturation state should be the common monitoring parameter**
  - Though there are other possibilities
- **The answer is fungible**
  - Converting among metrics like pH, omega, pCO<sub>2</sub> is easy if you collect the right data

# WHAT VALUE OF OMEGA IS TOO LOW?

- **This is complicated because you are making a translation from chemistry to anticipated biology effects**
  - That translation has three pieces
- **Policy question: What desired level of severity is appropriate?**
- **Policy question: Which taxa should be used to make the conversion?**
  - Do you want to use sensitive taxa or median taxa?
- **Technical question: Which data for those species and metrics are best?**
  - How do you integrate data from multiple studies, species and metrics?



- Pelagic or epibenthic juvenile/adult
- Pelagic larvae
- Benthic juvenile/adult

|  | Omega   |          |                      |                      |                      |
|--|---------|----------|----------------------|----------------------|----------------------|
| Percent of individuals with severe dissolution |         | <1.0     | 1.0 – 1.4            | >1.4                 | No data              |
|  | <5%     | Impaired | Potentially impaired | Not impaired         | Not impaired         |
|  | 5 – 40% | Impaired | Impaired             | Potentially impaired | Potentially impaired |
|  | >40%    | Impaired | Impaired             | Impaired             | Impaired             |
|  | No data | Impaired | Potentially impaired | Not impaired         | No assessment        |

# SPATIAL AND TEMPORAL EXTENT

- **ODEQ: Use their existing approach to determine adequate number of samples for chemical impairment assessment**
  - Enough samples to demonstrate threshold is exceeded >10% of the time, with 90% confidence
  - Determination of percentage focused on critical biological season (not necessary annually)
  - Minimum of 5 samples over 5 sampling times
- **Complicating issue: Background failure rate is zero for most chemicals**
  - Acidification will fail the thresholds naturally based on routine oceanographic patterns
- **Solution: Increase the 10% exceedance requirement to account for background frequency not meeting the threshold**
  - Perfect role for the scientists: Decide what that adjustment factor should be
  - Determine how it changes cross-shelf and at different depths in the water column

# NEXT STEPS

- **The small group is done with delineating questions for the large group**
  - Nearly done with developing strawman answers
  - One more meeting later this month to ensure we agree
- **Meeting of the large group is scheduled for July 8**
  - Anticipate the large group will subsequently break into subgroups to answer each question
- **ODEQ is hoping to have answers by the end of the year**
- **They want to use the same process for ocean hypoxia assessments**
  - That process will follow several months later, wanting to get acidification right first
  - SCCWRP has been asked to help with hypoxia as well