

Ocean Acidification and Hypoxia

Technical Workgroup Meeting #2

Date / Time: July 8, 2022, 9:00 a.m. – 12:00 p.m. PT

Zoom Meeting

List of attendees

Technical Workgroup Members:

Simone Alin (National Oceanic and Atmospheric Administration; NOAA), Cheryl Brown (U.S. Environmental Protection Agency, Office of Research and Development); EPA ORD), Richard Feely (NOAA), Jan Newton (University of Washington/Northwest Association of Networked Ocean Observing Systems), Stephen Pacella (EPA ORD), Francis Chan (Oregon State University/Cooperative Institute for Marine Ecosystem and Resources Studies), Nina Bednarsek (Oregon State University)

Agency Representation and Meeting Guests:

Caren Braby (Oregon Department of Fish and Wildlife, ODFW), Terrence Fleming (EPA, Region 9), Dave Fox (ODFW), Steven Rumrill (ODFW), Becky Anthony (ODFW), Lori Pillsbury (OR Dept. of Environmental Quality; DEQ), Rian Hooff (DEQ), Brock Tabor (AK Dept. of Environmental Conservation), Rochelle Labiosa (EPA, Region 10), Michelle Robbins (CA State Water Resources Control Board; SWRCB), Keara Tuso (SWRCB), Charlotte Whitefield (ODFW), Justine Kimball (California Ocean Protection Council; OPC), Kaitlyn Kalua (OPC), Christina Frieder (Southern California Coastal Water Research Project), Jill Fullagar (EPA, Region 10), Michelle Maier (EPA, Region 10), Eric Dubinsky (EPA, Region 9), Rhianna Thurber (ODFW)

DEQ Standards and Assessment Program Staff:

Connie Dou, Trina Brown, Lesley Merrick, Kaley Major

Meeting Facilitator:

Kaegan Scully-Engelmeyer (DEQ)

Meeting Moderator:

Steve Weisberg (Southern California Coastal Water Research Project)

Technical Workgroup Objective:

Assist DEQ in developing methods for assessing the impacts of ocean acidification and marine dissolved oxygen in Oregon's territorial waters for future Integrated Report cycles.

Technical Workgroup Scope:

Provide technical expertise to inform DEQ on approaches to interpreting Oregon's existing narrative Water Quality Standards using ecological and/or chemical thresholds relevant to the assessment of ocean acidification and marine dissolved oxygen.

Desired outcomes for this meeting:

- Update workgroup on subgroup process and progress
- Information sharing – Present draft OA assessment framework and proposal questions
- Discuss draft answers for biological and chemical OA data
- Form topical (biological and chemical OA data) subgroups for next workgroup phase



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Oregon's air, land and
water.*

Schedule

9:00 a.m.

Welcome and introduction

Kaegan Scully-Engelmeyer (DEQ) presented a brief introduction, an update of the workgroup process since the first meeting, and overview of the meeting agenda for the day.

Workgroup process update:

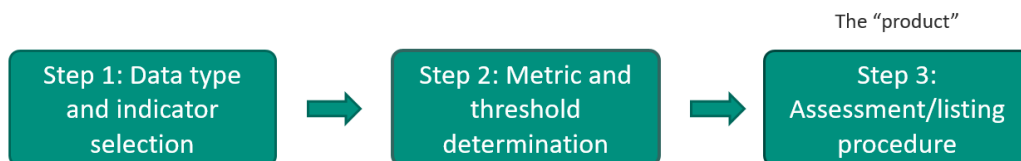
- DEQ convened this OAH Technical Workgroup to assist in development of OAH assessment procedures to implement Oregon's existing narrative water quality standards
- After the kick-off meeting February 2022 DEQ recognized the need to adjust engagement approach to provide more specific ask to workgroup members
- In response to feedback from the first meeting
 - Recognized the need to delineate between technical questions and policy decisions
 - Produce a draft proposal for the larger group to respond/react to
- We convened a subgroup to:
 - Develop draft (strawdog) proposal framework and specific set of technical questions to bring to the full workgroup – which is the focus of today's meeting

Charge to the subgroup:

- Clarification: we are NOT developing new water quality criteria or standards, we are developing a procedure to implement Oregon's EXISTING narrative biological criteria (biocriteria) to determine impairment for the purposes of water quality assessment for the 303(d) list - OAR [340-041-0011](#)
- Identification of the strongest indicators of biological impairment in Oregon state waters related to OA stress
- Assessment is focused on territorial marine waters (0-3 nautical miles) - Not estuarine
- Durable and robust approach to assessment – may require data that does not currently exist

A sequence to guide this process:

- We see the series of questions developed in the subgroup as a sequence, with increasing levels of detail and specificity within each step



Roadmap for today's meeting:

- Steve Weisberg will describe questions the group needs to answer
 - He will also provide strawman answers for the group to react to
 - Most of the meeting will be focused on hearing your reactions to the strawman answers
- We will finish the meeting by defining subgroups that will dive deeper into those questions that need more work
- Subgroups will allow you to focus on topics that best suit your expertise and interests

9:15 a.m.

Presentation

Steve Weisberg (SCCWRP) presented the OA biological impact assessment questions developed in the subgroup and draft answers to the questions based around biological OA data.

Impairment Assessment

- ODEQ's immediate need is a 303(d) listing procedure
- Assessment procedures are challenging because there are numerous possible answers depending on the data types that are submitted
- Our approach: Define preferred data for making 303(d) assessments
 - Develop principles for how far from desired data you can wander and still be meaningful
 - Allows a deliberative approach that can be applied to numerous possible data submissions

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?**

[Note: no objections to this list of questions in the subsequent discussion]

Q1: 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
- Rationale for selecting chemistry: We have more data
- ODEQ has decided that either type of data is acceptable
 - We will proceed to define assessment approaches for both pathways
 - ODEQ has further determined that a hybrid approach combining the two may be preferable
- Hybrid Approach – Combining allows for independent confirmation when there are uncertainties with an individual data type

		Omega		
Percent of individuals with severe dissolution		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

Q2: Which biology metric should be used? – two-part question

Q2.1: Where on the spectrum of response severity do you want to be?

- Suggested Answer Q2.1: A fitness level response is preferable
 - Linked to likely population level effect
 - Attributable to OA stress
 - Exposure level effect too early, population level effect too late

Q2.2: Which specific metric within the selected level of severity should you use?

- Suggested Answer Q2.2 – Severe shell dissolution
 - Clearly linked to OA stress
 - Evidence it is related to fitness (growth and survival)
 - Becoming widely measured in monitoring programs
 - This is a rational answer – but only one of many possibilities – would like experts to weigh in

Q3: What value constitutes an assessment threshold exceedance? – two-part question

Q3.1: What percent animals need to be affected?

- ODEQ decision: Base this on difference from background condition
- Yields technical questions the advisory group can help with:
 - Is background better defined via spatial or temporal reference?
 - If temporal, how far back do you go with a changing baseline condition?
 - If spatial, which areas represent reference condition?
- Suggested Answer Q3.1: Establish reference on spatial basis because you can do it now
 - NOAA west coast survey provides a spatial reference
 - Ask to advisory group to identify potential temporal reference options to consider
 - Additional policy question – can data collected in federal waters be used to create reference condition for Oregon State waters?
 - ODEQ answer: reference can be established using data from outside Oregon, provided it describes conditions likely to occur in Oregon – yields technical question for advisory group
 - How well does reference from deeper federal waters apply to State shallow waters?
 - How strong are the longitudinal gradients in condition?

Q3.2: How spatially and temporally extensive must the exceedance be? – two-part question

- Q3.2a: What is the spatial and temporal extent you want to assess (assessment unit)?
 - ODEQ suggested answer: nine existing assessment units based on Oregon's HUC 8 boundaries
- Q3.2b: How many samples in that assessment unit (and how often) need to be measured? (Spatial and temporal sampling intensity)
 - Temporal suggested answer: a single sampling time will suffice
 - Spatial suggested answer: a single robust sample is adequate
 - Provided that reference condition appropriately captures interannual variability

Q4: Which collection and processing methods are acceptable for quantifying the selected metrics?

- Which taxa to collect?
 - ODEQ: Use sensitive taxa
 - Workgroup is being asked to suggest a list of target taxa
 - Practical consideration: you need taxa for which you have reference
 - NOAA presently samples Pteropods and Dungeness crabs on their cruises
 - They are excellent examples of sensitive taxa
- Methods to collect/process samples – NOAA survey methodology sets the stage
 - Workgroup can help by reviewing NOAA procedures
 - What are the most important factors that need to be resolved?
 - With sampling (e.g., mesh size, time of day in sampling)
 - With sample processing (size of individuals examined, sample preservation)

How much deviation is acceptable?

- In 303(d) assessment you must use the data you are provided, not what you wish you had – however you are permitted to exclude data that are not relevant or adequate
- Four classes of deviation to consider:
 - Different biological measure:
 - Draft answer: any OA specific measure provided it measures fitness or worse
 - Key limitation – sufficient data to establish reference condition
 - Different taxa (severe dissolution endpoint)
 - Draft answer: Any affected taxa is acceptable, provided there is reference condition
 - Different sampling/measurement methods
 - Draft answer: any methods are acceptable, provided they are apples to apples with reference condition
 - Different (or less well understood) data quality
 - Decision factor is simple: is it comparable to reference condition?
 - This quality question is one for the workgroup to help with

9:30 a.m.

Discussion – Biological OA data

Steve Weisberg (SCCWRP) moderated a discussion focused on draft answers to questions in terms of biological OA data (biological indicators). [Discussion and comments below are organized into themes and paraphrased at times]

Cmt: I would like to raise the issue of economic importance in our biological metrics. If we can make really solid ecosystem function arguments and use a species that has specific economic relevance, the better. Then it speaks to more people, it will be about legislators, community, economic viability. This promotes community engagements. Pteropods – no one knows what they are, but they are a great system. Crab larvae are great because there is on-shore/off-shore connection, using coastal larval habitats, throughout the territorial sea, pteropods on the other hand are tenuously connected to the territorial sea.

Biological indicator types & reference conditions

Cmt: Pteropods, crab larvae, mussel byssal threads – these might be easy for consideration. There is consideration that mussel byssal threads are degraded, could be useful given Mussel Watch program. Not sure about how reference would be assessed.

A: Byssal threads have not come up yet. If we can find metrics that show they are intact in reference conditions, then we can evaluate them. We may need to discuss data that are available now, versus data we might want for the future.

Cmt: What's available now? And what should we be encouraging people to get to do better assessments? Historically there is more pteropod data, then added crab for reasons discussed above. What species have you considered and maybe eliminated due to complexities?

NOAA: We are doing a broad survey at the moment, have not eliminated anything. Have looked at crab and pteropods, small fish, anything that we can catch in the nets and have a primary investigator interested to follow up we are working with directly. We collected a bunch of species to keep data. Also, the numbers of samples themselves are important, typically the fish are pretty sporadic.

Cmt: Francis can talk a little bit about the augmentation of the Newport Hydrographic (NH) line relating to hotspot identification

Cmt: Does the NOAA survey provide additional reference possibilities beyond the NH line? I believe the scope of biological taxa available are quite broad aside from the NH line cruises.

Cmt: how far along are those? Do they have the same pteropod and crab data or other possibilities?

Cmt: In terms of taxa caught, it's quite similar. We will be accelerating the taxa this year.

Cmt: Another reason to look at the NH line is that we have had good success in the past to recreate historical assessment of carbonate condition using the NH line. Good reference points.

Cmt: Because of state support, there has been a lot of effort to make sure that State waters have been sampled.

Cmt: I am appreciative that we are considering multiple organisms as long as certain criteria are met. It will be good to list other species with potential besides pteropods and crab to let people know.

Cmt: I want to touch on the periodicity of sampling by the NOAA group, biweekly cruises of the NH line versus event response type sampling that could either be standardized or ad-hoc depending on the ecosystem. How the periodicity of sampling fits in with this process. Annual sampling is less high priority if we are trying to track a seasonal hypoxia event, but I don't know how useful that is.

Cmt: summary of previous question: 1) How good is reference sample done in the summer every few years? Is that a reference to a measurement taken in the winter, and 2) if I want to assess impairment, I want to go take my samples at times when things are likely to be bad?

DEQ: And that critical assessment period is definitely part of the framework. This is really important, and we should be looking at samples during the critical period if we are interested in a biological process. Critical period may be different for a given type of biological data.

Cmt: NOAA surveys are great for the background, but they don't come into state waters. ODEQ is planning to say that surveys are representative of background in state waters.

Cmt: Shell dissolution varies with the life cycle of the organism. You can see this as a seasonal impact. Literature suggests that we will have to go to seasonal sampling to assess that.

Cmt: I have a few thoughts here because the best available data are for pteropods and crab. We know that not just larval but also benthic juvenile are susceptible for this as well. We are not just concerned about upwelling; seasonality is important because exposure history will fit into this. We need to go beyond where specific life stage is available. If we want to understand better how shell dissolution plays out in low oxygen. OA in specific space-time period is not the only parameter impacting dissolution, there are other variables as well. If we are talking about use of indicators over longer periods. Another suggestion is for mussels or oysters where we have started determining dissolution could be another example of dissolution metrics which is now a repeated parameter. We could be measuring dissolution on many species. If they are representative of different seasonal scales, then we can use them. Aragonite saturation state will be different in each of these.

We need to do both chemistry and biology – not just one of them. We should leave the space open for more organisms but leaning heavily on the species we have the most data for.

Question: Regarding the oysters we have original research going on in Oregon looking at shell dissolution rates? But oysters are raised in estuaries. Are we proposing to put these in the marine environment for measurements?

Answer: Oyster life stages exist in the marine environments; we can do it there. We can make measurements into the estuaries for ease and then extrapolate those data to the marine environment.

Question: Regarding juvenile first instar of Dungeness crab? Are you seeing severe dissolution in first carapace? Would like to move way from scanning electron microscopy (SEM) to make these measurements?

Answer: We definitely see dissolution in first stages of the crab. SEM is tedious, but we could do more research to correlate SEM with other parameters...

Also, we know much more about pteropods, and we could map the impacts on other species in state waters onto what we know about pteropods. It seems like we can learn from the source of experiments that Nina has done, what the relevant thresholds are and the chemistry.

Cmt: This is great. If this were an ice cream shop, "Chocolate and vanilla" are Dungeness crab and pteropods. We can look at fitness. We can look at the scope of sampling. This is information we could provide to DEQ – suggesting the best metrics based on the science. This would make us feel comfortable about assessing the data beyond just two species (adding other flavors).

Answer: People are not disagreeing with pteropods and crab, but there are so many species that we will want to invest in for the future.

Cmt: I want to call attention to the NH-10 line and the biological and chemical work there. For the biological group we might want to reach out for Jennifer Fisher or others who have worked a lot on that biology.

Native vs. non-native species

EPA: there is a question about non-native species that can be used as a biological indicator. When we were talking about oysters in 2010, DEQ then interpreted assessment to consider native species only. The state may change that view or re-evaluate.

DEQ: the preference is native

Cmt: Native versus non-native species as indicators. Both EPA and DEQ have a long history of using non-native soft-shell clams to assess impacts. DEQ's preference should be native species, but that is contrary to what has happened for the last three decades. [Note: DEQ will revisit this if/when additional biological indicators are proposed]

Short term vs. long term assessment options

EPA: It sounds like this is wonderful discussion about what everybody wants what can be done in the future. DEQ however is required to do something with the data that is available now. Do folks think there is enough data to make a current decision about impairment or is there something else needed to assess?

Cmt: Washington and Oregon are very unique in that hypoxia plays a big role along the coast. Both those regions, those seasonal impact, is larger or as large as the anthropogenic signal. Hypoxia changes the aragonite saturation state. Do we have enough information about pteropods? No, because we don't understand the seasonal cycle enough yet to make an assessment.

Q: So, we don't have an adequate reference condition for parts of the year?

A: What NOAA cruises provide is the long term steady anthropogenic component, but the seasonal component is louder than the anthro contribution sometimes.

EPA: Knowing what decisions cannot be made right now is important too. Small groups can catalogue this for DEQ so they can respond and provide some evidence for why they are doing something or not.

Summary: No one seems to really reject the straw dog strongly. They have critiqued that a bit. Gave feedback about what they need to do to make an assessment today. Pay attention to the temporal component.

Other summary: We need to 1) extend species for which we have reference, and 2) we need to extend the geography of the reference.

Assessment Unit Discussion

[For context: DEQ initially proposed it would use an extension of existing hydrologic unit code (HUC)-8 land-based assessment units for marine water assessment]

DEQ: At this point our assessment unit boundaries in the ocean are straw dog boundaries. They are defined boundaries from HUC-8, but it should be really based on natural breaks in the system. Drawing a hard line will not make sense always. Units are generally extended from River mouths. This is how it currently is. South of Cape Blanco might be a good geographic break.

Cmt: Challenge of having different spatial domains for different impairment designations. On the question of redefining ocean regions for OA impacts, maybe we can look at

	<p>existing regions defined based on watersheds. We could agglomerate those watershed regions into groups that makes sense.</p> <p>Cmt: It would be good to see the 9-unit map to see the oceanographic structure that they apply to.</p> <p>Follow Up: Francis Chan has done a good job identifying OA hotspots along the coasts. Would be good to compare HUC map with hotspots. This will be an important comparison to be made.</p> <p>Cmt: ODFW the marine program, conducts sampling for crab marine biotoxins. Their boundaries are different than the DEQ HUC-8 boundaries, but they can take a look at marine waters used for crabbing assessments.</p> <p>Cmt: We might need to form a small subgroup, to address subunits. Experts are saying the HUC-8 units may not make sense ecologically.</p> <p>Cmt: California current is what is dominant, the HUC-8 is based on land-based characteristics.</p> <p>DEQ: we may need to make adjustments for HUC-8, and we have a path to do that</p> <p>Cmt: When we dug into biotoxin managements for crab fisheries, we adjusted regions, putting on a stakeholder hat, ODFW and DEQ have different regions, and they are separate from ODA. To the degree that we can come up with a uniform system to assess coastal waters, the better.</p> <p>DEQ: Based on the discussion it sounds like the assessment unit discussion should continue its own small subgroup in addition to chemical and biological subgroups.</p>
<p>10:20 a.m.</p>	<p>Break</p>
<p>10:30 a.m.</p>	<p>Presentation (Steve Weisberg; SCCWRP)</p> <p>Steve Weisberg (SCCWRP) presented the OA biological impact assessment questions developed in the subgroup and draft answers to the questions based around chemical OA data.</p> <p><i>Q2: Which chemistry metric should be used?</i></p> <ul style="list-style-type: none"> • 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 • The answer is fungible – conversion between carbonate metrics is easy if you collect the right data <p>What about multi-stressor?</p> <p><i>Q3: What value constitutes an assessment threshold exceedance? (What value of omega is too low?) – three pieces to this question</i></p> <ul style="list-style-type: none"> • Q3.1 (policy question): What is the desired level of severity? <ul style="list-style-type: none"> - Suggested answer: fitness level response - There are multiple fitness measures and categories – workgroup can help determine which we have the best data for • Q3.2 (policy question): Which taxa should be used to make the conversion? <ul style="list-style-type: none"> - Interested in the most sensitive taxa among those for which the highest quality data exists – in need of scientific guidance - Suggested answer Q3.2: the best data (and data integration) exists for five taxa: Pteropods, echinoderms, krill, crabs, and bivalves

- Q3.3 (technical questions): which data for those species and metrics are best? Data integration questions for scientists:
 - How to weight data from multiple species and endpoints
 - Not all data are of the same quality, how do you select among them?
 - How do you treat variability?
- Q3 Suggested approach to data integration
 - Create two thresholds (three assessment categories)
 - Low values below which everyone is comfortable that biology is impaired
 - High values above which everyone is comfortable chemistry conditions are acceptable
 - A grey area where the translation is imperfect, and you need confirmation from biological data
 - Set low value where 50% of taxa/endpoints are affected
 - 50% instead of 10% because we want a number where there is confidence in listing on chemistry alone
 - Set the high value where 90% of the taxa/endpoints aren't affected
 - 90% instead of 50% because you want sites to fall in the grey zone unless you are confident that the waters are safe

Q4: Which collection and processing methods are acceptable for quantifying the selected metrics?

- There is scientific consensus on how to collect and measure
 - Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to Best Practices for Ocean CO₂ Measurements. PICES Special Publication 3, 191 pp.
- Data quality objectives have already been established
 - This guidance includes a detailed SOP and QA guidelines
 - Intercalibration studies that quantify measurement variability have already been conducted
- The advisory group will be asked if they agree or if there is need for greater specificity

Q5: How many samples are necessary to make an assessment?

- ODEQ has precedent 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

Critical Biological Windows

- You want to focus assessments on time periods when biota are most susceptible
 - Annual assessments can dilute a period of impact
 - Same issue applies spatially as don't want to inappropriately average over a vertical gradient
- Selecting critical periods and locations requires knowledge about life cycles and relative sensitivity of different life stages
- Defining critical spatial and temporal windows is a perfect question for the workgroup

Acceptable Deviation from optimal data

- Different sample methods – Three primary classes of measurement method
 - Bottle samples typically have the highest precision (average error <0.1 pH unit)
 - Durafet sensors are close behind (<0.2 pH units)
 - Potentiometric sensors are a distant third (average error of about 0.4 pH units)
 - ODEQ will use all three, but limit consideration to the best class of data available
- Different (or poorly understood) data quality - ODEQ will only use data supported by a project plan that allows determination of accuracy and precision
 - Workgroup can help identify desirable attributes of a project plan
 - They can also address how to deal with data collected with experimental methods

10:45 a.m.

Discussion (Steve Weisberg; SCCWRP)

Steve Weisberg (SCCWRP) moderated a discussion focused on draft answers to questions in terms of chemical OA data. [Discussion and comments below are organized into themes and paraphrased at times]

Aragonite saturation vs. other carbonate metrics

Cmt: I had a couple comments starting from the first chem slide. Aragonite saturation is very useful, would like to mention that some of the work on the WA coast. It shows that the rate of change in aragonite saturation will slow down in the near future, the pCO₂ change will actually accelerate. You might argue that the aragonite meets the most sensitive measurement for the biology, but if we want to be able to track changes moving into the future it makes sense to keep an eye on pCO₂. We used to talk more about the role of calcium saturation in relation to aragonite saturation. Do we need to think about that a bit more? Sophie has done some work on WA coast, showing that for some pH sensors you get better results using empirical relationships rather than pH sensors. Oregon has a leg-up because of all the sensors currently deployed. It may be a potluck of approaches we have to put together to get the final answer. pCO₂ is a reasonable candidate

Summary: 1) pH versus aragonite – DEQ will have pH data submitted, and we need to figure out what to do with that. Do we want to translate to biology based on pH? In the workshops that have been done so far, different taxonomic groups have used different endpoints? Recognize that this is about I'm going to get a bunch of data, not I'm going to go collect a bunch of data – how do we use it?

Cmt: Why we should use the multiple chemical and biological parameters: Let's say that for pteropods, we use aragonite saturation state. For crab we think it is a better metric to use pH. In terms of dissolution, saturation state is better. But let's say that for crabs, they will have a sensitivity period through April and May. Pteropods have sensitivity period

between April and August. If we know now that pH for crab and omega for pteropods, that means we have impairments for longer periods of time, we will have multiple lines of evidence for impairment. We have to figure out the temporal extent and the spatial extent of the water listing for the impairments.

DEQ: you are suggesting linking the biological endpoints directly to the chemical and time period. We need to develop a chemical threshold that is reliant on a specific biological endpoint?

Response: when you decide on biology, you have to figure out what chemistry makes the most sense.

Cmt: Right now we are suggesting something that is simple. What Nina is saying that if pH measurement comes in, then DEQ has to determine is that bad? Then it's a certain time of year there are species that are abundant and sensitive, then the threshold for that time and place is different from another time and place.

DEQ: The thresholds themselves for Omega are based off of taxa specific dissolution relationship. They would be closer linked from my understanding.

Response: no. How do you use multiple taxa to develop your numbers? Can you simply have a single number, or is that number going to change by season? Because species change with the season. If it really is that different, then we have to figure that out. Need multiple lines across that season.

Modeled chemistry output

Cmt: One of the things to address is spatial information being really critical here. In surface water you may be above saturation state, but below the surface where all the critters are may be below saturation. The modelers have dealt with this really well – they look at the volume of water over time that is below saturation. Pre-industrial this was 10%, now its 30-40%. If we can come up with a capability that allows us to validate the models.

Cmt: DEQ has determined that using modeled output is acceptable. But now the question is what model? Which one? How good is the model?

Cmt: I think our recommendations for sampling chemistry must be able to validate the model calculations.

Cmt: 2) Are you willing to take modeled chemistry for effects without empirical data? If I have pH data and other empirical other data.

DEQ: It really comes down to representativeness and confidence. Those are the questions we would put back on the group and ask what we can be sure about and how we can be certain? We do have an existing pH numeric standard, so when we are talking in this process about biocriteria assessment, we have opened the door to use other metrics. For the assessment approach, we are opening the door to aragonite and pCO₂, we are translating to biological effects.

Cmt 3) Calcium: now this is in the realm of multi-stressor.

DEQ: I cannot say definitively at this point, we need to discuss this more.

Response: it increases your uncertainty in the nearshore areas. It would require additional understanding to figure out how aragonite is being influenced.

Cmt: when we discuss the uncertainties for empirical models, they change over time. We have to understand that these models are degrading over time, and we have to take that into account.

Cmt: this is even more complicated in the face of climate change

Response: we need to figure out if this needs to be in the listing process or if this is just a scientific nuance? Will DEQ need to incorporate this in assessment?

	<p>Response: Where do we go from here? How do we deal with non-empirical data and what are the error rates associated with non-empirical data? Where do these other pieces fit within that range?</p> <p>DEQ: What data are available now/in the short term? What would be ideal in the long term?</p> <p>Cmt: maybe how to simplify is if we know approximate ranges when species sensitivity can occur. If we are in the marginal zones of those parameters, we start paying more attention.</p> <p>Cmt: For clarification, in the biological criteria, we talked about wanting to know whether it's "bad" or "worse"? For chemistry: we are talking about whether it's bad, but can we assess what we have available that indicates it's worse (can we attribute it to anthropogenic activities?). We can use the model to determine with stoichiometry to determine as well. how important is it for us to do a really good job to define areas around that reference?</p> <p>Response: we need to know the reference and how confident we are in the reference. So, model error is critically important.</p>
<p>11:30 a.m.</p>	<p>Next steps</p> <p>Kaegan Scully-Engelmeyer (DEQ) outlined next steps in the workgroup process and polled the meeting attendees on their participation in the formation of subgroups to delve deeper into technical questions.</p> <p>DEQ: we now think we may need 3 subgroups:</p> <ol style="list-style-type: none"> 1) Biological OA data group 2) Chemical OA data group 3) Assessment unit group <p>DEQ: Asking members to participate in which ever groups they have the most expertise in. Alternatively, if you don't have time and are not available, you can choose not to participate and just tune in later in October to see what results have been. Launching the poll now – there is no obligation to participate</p> <p>Suggestion: Bring in Oregon department of Ag into the assessment group discussion. They should be incorporated well before the peer review stage.</p> <p>DEQ: we will follow up with you individually as groups to get October/November meetings on the calendar.</p>
<p>12:00 p.m.</p>	<p>Adjourn</p>

Alternative formats

DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email deqinfo@deq.oregon.gov.