

Ocean Acidification and Hypoxia

Technical Workgroup Meeting #3

Date / Time: November 9, 2022, 1:00 p.m. - 4:00 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), Jack Barth (Oregon State University; OSU), Jim Barry, Francis Chan (OSU /Cooperative Institute for Marine Ecosystem and Resources Studies), Steve Weisberg (Southern California Coastal Water Research Project; SCCWRP), Martha Sutula (SCCWRP), Richard Feely (NOAA), Nina Bednarsek (OSU)

Agency Representation and Meeting Guests:

Andy Lanier (Oregon Department of Land Conservation and Development), Caren Braby (Oregon Department of Fish and Wildlife; ODFW), Brock Tabor (Alaska Department of Environmental Conservation), Steven Rumrill (ODFW), Jenny Koester (ODFW), Michelle Robbins (CA State Water Resources Control Board; SWRCB), Keara Tuso (SWRCB), Christina Frieder (SCCWRP), Kaitlyn Kalua (California Ocean Protection Council), Charlotte Whitefield (ODFW), Rochelle Labiosa (EPA, Region 10), Rian Hooff (DEQ)

DEQ Standards and Assessment Program Staff:

Connie Dou, Trina Brown, Debra Sturdevant, Travis Pritchard

Meeting Facilitators and Moderators:

Kaegan Scully-Engelmeyer (DEQ), Lesley Merrick (DEQ)

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 outcomes of subgroup meetings (biological data, chemical data, and marine assessment unit subgroups)
- Discuss synthesis of subgroup recommendations and next steps



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700 NE Multnomah St.,
Suite 600
Portland, OR 97232
Phone: 503-229-5696
800-452-4011

Contact:

[Kaegan Scully-Engelmeyer](mailto:Kaegan.Scully-Engelmeyer@deq.or.gov)
503-575-5224

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Schedule

1:00 p.m. **Welcome & Introduction**

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

Brief introduction on gauging scientific uncertainty:

- Important to recognize there will always be some level of uncertainty in understanding biological impacts in marine systems and making decisions around WQ impairment.
- In the series of questions and answers in our discussion today consider whether:
 - There is a fundamental scientific uncertainty (show stopper)
 - Can the question be answered now with an acceptable degree of uncertainty & refined later, or
 - the uncertainty is relevant to further the research topic but not critical at this point in this process
- The main discussion today is about the translation between the research presented in our subgroup meetings and our water quality assessment framework
 - We'll be presenting our interpretation of what we've heard, and highlighting the areas of uncertainty for discussion

Workgroup process update:



- SCCWRP presented draft framework
- No objections
- Formed indicator groups

- Biological
- Chemical
- Assessment Units

- Report indicator groups
- Outline approach from 2024
- Outline long term needs

- Since the second full workgroup meeting in July, we've had four meetings with the subgroups that were formed during that meeting:
 1. biological data subgroup meeting (8/1)
 2. chemical data subgroup meeting (8/10)
 3. marine assessment unit subgroup meeting (8/25)
 4. combined biological and chemical data group meeting (10/7)



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Goals for the meeting:

- Provide a summary of assessment unit and indicator subgroups.
- Outline remaining questions for 2024 IR
- Discuss next steps for 2026 IR

1:10 p.m.

Presentation & discussion – Indicator subgroup updates & recommendations

Lesley Merrick (DEQ) presented summaries and outcomes of the marine assessment unit subgroup and biological data subgroup.

Marine assessment unit subgroup

- DEQ uses assessment units (AUs) to report water quality determinations to EPA
- AUs are intended to represent hydrologically similar waters and are primarily a communication tool
- Previous marine AUs were delineated alongshore based on National Hydrography Dataset (NHD) waterbody features – and extend three nautical miles from the shore
 - Previous alongshore breaks were based on HUC8 subbasin boundaries (land based)
- With assistance from the marine AU subgroup DEQ has re-delineated the alongshore boundaries of the marine AUs to be more hydrologically relevant to marine waters assessment.
 - Updated alongshore AU boundaries are now based on one or more prominent physical features of Oregon's coastal and marine environment, including headlands, offshore banks, and river mouths.
 - They also now better align with existing coastal management boundaries such as Oregon Department of Agriculture's shellfish biotoxin reporting units.

Workgroup response: positive feedback

Biological data subgroup

- When prompted on biological indicator recommendations specific to OA – the biological data subgroup agreed:
 - Severe shell dissolution serves as an appropriate biological endpoint to determine biological impact – it represents a fitness level response that is attributable to OA stress.
- Which species group and specific metric?
 - Pteropods (and pteropod shell dissolution) are well defined pelagic bioindicators that could be applied for water quality assessment purposes
 - Group recommended to focus on pteropods and % individuals with severe shell dissolution (as the metric) for this first iteration of the assessment methodology as it is the most defined marine bioindicator of OA stress



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- Dungeness crab could be a potential benthic indicator - but more research needed to connect laboratory results with in-situ conditions
- What value constitutes an assessment threshold exceedance?
 - Exceedances should be defined relative to background conditions
 - This also helps define which taxa could be used (for which taxa can we estimate background conditions?)

Biological metric = % pteropod severe shell dissolution	Biological impact, agreement deviation from reference	Impaired
	Middle range, uncertainty around impact (grey area)	Potentially impaired
	No biological impact, agreement no difference from reference	Not impaired
	No data	No assessment

- Uncertainties around biological data and data requirements
 - Critical biological period – need to define this period based on the biology – we understand Oregon’s territorial waters have a strong seasonality in conditions – how are these two factors integrated to define a critical assessment window?
 - Sampling and processing requirements – DEQ relies on widely approved sampling methods – have these been defined? Are there standardized SOPs for pteropod sampling?
 - Spatial requirements – Currently: based on known natural onshore gradient, data must be in Oregon waters to assess. Remaining Q: are there parts of the territorial sea where this bioindicator can/should not be applied?

Discussion:

On survival probability and pteropod dissolution – setting benchmarks:
 Dissolution metric is linked with survival probability. One approach is to define the assessment benchmarks (in the framework above) based on estimated survival probability. A complicating factor is it is an imperfect conversion, some organisms survive with dissolution, not a clear understanding of what constitutes an impairment (e.g. what survival probability)

Comment: use the toxicological relationship alone – if dissolution is defined in relation to survival probability – the level is a policy question – not a question for the group



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Comment: agree – and this part needs more scrutiny –
Comment: what level of dissolution is outside of natural variability in nearshore?

- Confidence levels are high for present day – current survival probability reduced by at least 40%
- This is consistent with cruise data – more data should be acquired within 3 mile limit

Several members indicated they were confident that this data is good enough for listing purposes

Comment: assessment mindset brings it's only paradigm, and scientist mindset is a bit different. Would be good to write scientific manuscript to form scientific foundation. Then the state could cite it and add policy considerations separately.

On critical time period: are there timeframes we shouldn't evaluate data?

Comment: Since it is a toxicological relationship – timeframe should matter

Comment: because upwelling in summer – organisms may be closer to threshold – so it may be harder to sort out anthropogenic effect – from the subgroup we heard we should focus on certain life stage sensitivities

- July-sept the most sensitive timeframe

2:15 p.m. **Break**

2:25 p.m. **Presentation & discussion - Remaining questions and next steps towards an operational framework – Kaegan Scully-Engelmeyer (DEQ)**

Kaegan Scully-Engelmeyer presented summaries and outcomes of the chemical data subgroup and next steps in the methodology development process.

Chemical data subgroup:

- Step 1: chemical data starting point:

Chemical metric = aragonite saturation state (Ω_{ar})			
impact to bio – agreement on deviation from reference	Middle range, uncertainty around impact (grey area)	No biological impact, agreement no difference from reference	No data
<1.0?	1.0 – 1.4? (grey area)	>1.4?	No data
Impaired	Potentially impaired	Not impaired	No assessment

- What is the metric?
 - Draft answer: Aragonite saturation state
 - Indicator group: agreement



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- What value of omega is too low? (benchmark?)
The following are the list of recommendations made by the subgroup in response to the draft answers we presented:

Part 1: What desired level of *severity*?

- **Draft answer** - fitness level response
 - Multiple possible fitness level endpoints: shell dissolution, behavior, physiology, growth, reproduction
- **Indicator Group** - *severe shell dissolution only*

Part 2: Which *taxa* should be used to make the translation

- **Draft answer** - most sensitive taxa among those for which the highest quality data exists: five taxa – pteropods, echinoderms, krill, crabs, and bivalves
- **Indicator Group** – *pteropods*

Part 3: *Data integration*

- **Draft answer** - multiple endpoints & species
- **Indicator Group** – *Use established pteropod/aragonite shell dissolution synthesis*

- In deriving the chemical benchmark – The chemical data subgroup recommended to focus on the existing syntheses of pteropod severe shell dissolution to derive an assessment benchmark – rather than using an ensemble approach based on multiple species and endpoints.

Two big takeaways from the biological and chemical data subgroup meetings:

1. Focus on the established pteropod/aragonite relationship – it is well defined in the literature
2. Incorporate seasonality into understanding background conditions – critical in nearshore environments

Area of uncertainty: evaluating change from background

- Reminder: our objective is to assess changes to the biological community outside of natural variability – likely attributed to anthropogenic stressor
- An operational assessment framework needs to include a way to compare observational data with an expected background condition at a given location
- We understand this is complicated within territorial waters (<50m) due to the high level of seasonality and spatial variability in conditions
 - It can have relatively low spatial and temporal resolution to start
 - It needs to be defensible

Discussion:

Columbia River plume – is an example of a specific area in the territorial sea with different expected background condition – in terms of extrapolating open ocean waters to nearshore to determine background condition



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Comment: models don't agree within the plume – more uncertainty about whether those models hold

- Follow up: this could be nicely documented in a manuscript

Comment: Using models – long term hind cast can come up with pre-industrial condition at a specific location – as well as the variability at that location

DEQ comment: Encouraging that the pieces needed are there, will just need help getting these pieces from the technical folks

Comment: This is a service to the community to put something out there that scientist can support, and then to put it out for public review, it will help everyone

Comment: A published manuscript that gets into the scientific justification behind these considerations would be beneficial – to reference in future cycles

3:30 p.m.

Updated Integrated Report timeline

Lesley Merrick and Kaegan Scully-Engelmeyer presented a tentative timeline for incorporating OAH assessment methodologies into the Integrated Report

- DEQ outlined a timeline to address the areas of uncertainty outlined in these presentations around calculating reference conditions, standardized pteropod sample collection and processing, and critical assessment periods. Proposed that DEQ and workgroup members develop a manuscript outlining all of the elements of the assessment methodology that could be referenced in future IR cycles (beginning in 2026). And asked the group to weigh in.

Workgroup response summary:

Multiple workgroup members conveyed that the uncertainties around those three areas were not fundamental scientific uncertainties, the scientific rationale was already there, and in their opinion a paper was not needed to move forward with developing assessment methodologies.

Comment: It seems like the biological and chemical boundaries are well defined already

Comment: methodologies for the biological part are all well defined in the science papers, there is no need to repeat this.

Comment: I am not sure how much we can improve the biology anymore, really.

Comment: The Dickson et al., protocols (note: chemical data assessment) are laid out in his papers and are being used by the community.

Comment: I would support moving ahead with the consensus of the group, as I heard there were very reasonable measures that can be applied today.

	<p>Comment: I agree with moving forward. Comment: The scientific methods are well defined enough to evaluate data.</p> <p>DEQ response: We appreciate the feedback. This was a very productive meeting and we heard clarity in places that we hadn't heard in previous meetings. Next steps: Discuss internally and with biological and chemical data subgroup members and will update the workgroup in the coming months on the plan going forward.</p>
4:00 p.m.	Adjourn



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