From: Anderson-Carnahan, Linda
To: Cox, Michael
Subject: FW: Discovery Bay Sampling Plan DRAFT
Date: Friday, February 17, 2017 8:39:00 AM
Attachments: Waldbusser2015.pdf

Paper may be of interest to the OA group

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From: ryancrim@gmail.com [mailto:ryancrim@gmail.com] **On Behalf Of** Ryan Crim
Sent: Thursday, January 05, 2017 11:29 AM
To: Bachman, Brenda <bachman.brenda@epa.gov>
Cc: Shephard, Burt <Shephard.Burt@epa.gov>; Anderson-Carnahan, Linda <Anderson-Carnahan.Linda@epa.gov>
Subject: Re: Discovery Bay Sampling Plan DRAFT

Hi Brenda,
This looks like a solid plan to me. The only thing I'm concerned about is the consideration of ocean acidification as a vector of toxicity in this case. I think it's valid to consider acute pH toxicity, however, ocean acidification as induced by increases in dissolved CO2 is actually a multi-stressor in itself as increasing CO2 alters the carbonate chemistry of seawater ultimately reducing saturation states of calcium carbonate in seawater while also reducing seawater pH. As saturation states decline, shellfish expend more energy in order to build their shells. At a certain point, their energy budgets become overwhelmed and they die. That is the basic current thinking anyway. This is all dependent on carbonate chemistry and not necessarily pH. Of course, declines in pH can have adverse impacts in itself, primarily regarding biochemical balances, however, many marine invertebrates are capable of some level of internal pH regulation. In general, I believe the main driver of negative effects from ocean acidification come from reduced calcium carbonate saturation states rather than pH. I've attached a recent paper that actually teased out pH and pCO2 effects on bivalve larvae.

I don't think you necessarily need to adjust your research plan but I would recommend expanding your seawater analyses to include carbonate chemistry. It is more difficult to measure since you cant directly measure most of the parameters but if you have good measurements of temperature and salinity along with at least 2 of the following 4 parameters, you can calculate the saturation states: total alkalinity, pH, DIC, and pCO2. Total alkalinity and pH are the most commonly used. However, pH can be tricky as well as most probes are suited for seawater analysis and they are typically subject drift over time. The best way to assess pH is using a spectrophotometer. Durafet pH probes are commonly used in ocean acidification research as they have been found to be the most reliable and stable assessments of pH. There are several labs in WA that routinely do TA, DIC and spectrophotometric pH analyses of seawater.

Lastly, I spoke with Burt about a month ago regarding the lack of available space in our facility to carry out any additional projects from January on. There may be windows of opportunity in late summer or next Fall, but there won't likely be any available room before then. I hope this doesn't compromise your research plans.

Best,
Ryan

On Wed, Jan 4, 2017 at 11:00 AM, Bachman, Brenda <bachman.brenda@epa.gov> wrote:

> Ryan,
> Please find attached the DRAFT Discovery Bay Sampling Plan as discussed with Burt Shephard and myself. We are interested in your review for both the actions that you will complete and anything else that you may find. We are also sending this to Tom Madsen, the shellfish farm owner for review.
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> Regards, Brenda
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