

## ***Interactive comment on “Biofouling protection for marine environmental sensors” by L. Delauney et al.***

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Response to G. Griffiths comments

Thank you very much for your valuable comments. Below are propositions to respond to your comments :

=> P2994 line 15 “will give” to “gives” Response : We agree with this comment. We will use the following : “gives”

=> P2995 line 21 “commonly used” – it is not clear to me that these techniques are commonly used over the whole range of instruments where they could be used. It would be helpful to clarify whether, when biofouling protection is used, these three are the most common techniques. This would help the reader reconcile this statement with

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the abstract where it says, “very few . . . are implemented”. Response : The meaning we wanted was : when biofouling protection for sensor is used in an operational context (not for a specific biofouling protection efficacy test), as long as i know, in every cases, it is based on one of these three techniques. So, as you proposed, the correct sentence could be : “When biofouling protection for sensors is used, these three are the most common techniques and each of them has, advantages and disadvantages.” in place of : These three techniques are commonly used on oceanographic sensors and each of them has, advantages and disadvantages.

=> P2995 line 28 “stand” to “withstand the” Response : We agree with this comment. We will use the following : “withstand the”

=> P2996 line 11 is it right to state “fouling organisms” when the first stage is macromolecular ? Response : We agree with this comment. We will use the following : “The succession of fouling states is generally considered in five main stages:

=> P2997 line 4 “or may be missing”, it would be clearer (if my interpretation is correct) to rephrase to “may not be required for subsequent stages to occur”. Response : We agree with this comment. We will use the following : “may not be required for subsequent stages to occur”

=> P2997 line 10 light is not mentioned, but it is clearly related to others (e.g. depth), even so, I think it should be listed. Response : Yes, we agree with you, and it is right that behind the term “depth” we were mainly thinking to the “light” parameter. So, it could better for the reader to indicate “light”. Consequently, we will use the following sentence : “temperature, conductivity, pH, dissolved oxygen content, organic material content; hydrodynamic conditions; location, season, light and consequently depth”

=> P2998 line 9 “check” should be “checks” Response : We agree with this comment. We will use the following : “checks”

=> P2998 line 20 “reason” probably better as “problem area” Response : We agree

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with this comment. We will use the following : "problem area"

=> P2999 line 20 "In case" to "In the case" Response : We agree with this comment. We will use the following : "In the case"

=> P3000 line 5 Whelan et al. should be Whelan and Regan Response : We agree with this comment. We will use the following : " Whelan and Regan"

=> P3000 line 13 Might be helpful to remind the reader that this is the last stage of the five on biofouling – does this approach affect any earlier stages? Response : We agree with this comment. We will use the following : This has been tested in the marine environment and is particularly effective to prevent adhesion of barnacles and oysters (Spears and Stone, 1969), which is part of the last stage of the five on biofouling.

Concerning your following question : – does this approach affect any earlier stages? Yes, with the following references : "Cu also affected biofilm development" ex Wei-Yang Bao; On-On Lee; Hong-Chun Chung; Mu Li; Pei-Yuan Qian Biofouling, Volume 26, Issue 1 January 2010 , pages 119 - 128

=> P3000 line 14 reference to Spears and Stone should be to Spears, Stone and Klein or Spears et al. Response : We agree with this comment. We will use the following : "Spears, Stone and Klein"

=> P3000 line 20 reference should be to Chambers et al. Response : We agree with this comment. We will use the following : "Chambers et al."

=> P3000 line 25 "remove fouling" – can the stage of fouling removed be added (stages 1-5 on p2996)? Response : This comment is particularly difficult to solve but very interesting. To be very conscientious we should study the "fouling removed" stage starting from all 5 fouling stages. For each "fouling removed" stage we should understand what will be the impact on the equipment in term of measurement produce or in term of immediate environmental effect. Then we should as well understand the further stage of fouling if it starts again. Please can you confirm us that your comment has been well

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understood ?

=> P3001 line 12 "needs" should be "need" Response : We agree with this comment. We will use the following : "need"

=> P3003 line 5 "remain intact". "intact" is rather to broad a word here for what must be far more complex requirements. It would be appropriate to expand using a few sentences on those requirements. Response : Perhaps there is a misunderstanding on the concept we wanted to expose. We meant that the transducing transducer interface of the sensor should remains unmodified (we used intact which is probably not correct) in order to keep the sensor working properly. However, if the transducing transducer interface is modified, the modification could be be taken into account during the calibration process. And finally, if the modification is inappropriate, the sensor could not work any more. So we could write the following : "the interface between the measurement medium and the sensor sensitive area must remain as much as possible unmodified. In case of a modification needed by the biofouling antifouling protection scheme, it should be taken into account and checked during the calibration process."

=> P3005 line 9 not clear that 's is needed after WQM Response : We agree with this comment. On the web site, they use both spelling, then we will use the following : "Wet Labs/Sea-Birds WQM)."

=> P3006 line 9 same question Response : We agree with this comment. We will use the following : "Wet Labs/Sea-Bird WQM instrument"

=> P3006 line 11 Woerther et al. should be Woerther Response : We agree with this comment. We will use the following : "Woerther"

=> P3006 line 15 "An other" to "Another" Response : We agree with this comment. We will use the following : "Another"

=> P3007 line 5 "than laboratory one" to "that in the laboratory" Response : We agree with this comment. We will use the following : "that in the laboratory"

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=> P3009 line 1 "irradiation" to "irradiation's" Response : We agree with this comment. We will use the following : "irradiation's"

=> P3009 line 20 There is no justification for the "two years" given, please add one if there is Response : We agree with this comment. We will use the following : For this last two years, as seen clearly during Oceanology International 2008 in London, nearly every manufacturers of instruments are taking into account this functionality in their design and are well documented and aware on the fouling problem for oceanographic sensor.

=> P3011 Holmström reference – I cannot see it called for. Response : We agree with this comment. It will be removed

=> P3012 there are two references to Nandakumar et al. in 2003 so they should be 2003a and 2003b. Response : We agree with this comment. We will use the following :

P3008 line 25 : "The results show increasing effectiveness with increasing laser energy density and duration (Nandakumar et al., 2003a, Nandakumar et al., 2003b)."

P3012 line 19 : "Nandakumar, K., Obika, H., Shinozaki, T., et al.: Lethal and sub-lethal impacts of laser irradiations on the larvae of the fouling barnacle *Balanus amphitrite*, *Biofouling*, 19, 169–176, 2003a. Nandakumar, K., Obika, H., Shinozaki, T., et al.: Pulsed laser irradiation impact on two marine diatoms *Skeletonema costatum* and *Chaetoceros gracilis*, *Water Res.*, 37, 2311–2316, 2003b."

=> P3012 Tsukamoto reference – I cannot see it called for. => P3012 I cannot see US Pat 6060046 called for Response : We agree with these comments. They will be removed

=> P3013 I cannot see the reference Woerther and Grouhel called for Response : the reference is on P3006 line 12 : (Woerther et al., 1998) but the format is not correct, it will be changed in : (Woerther and Grouhel, 1998)

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Interactive comment on *Ocean Sci. Discuss.*, 6, 2993, 2009.

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