

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

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This manuscript gives a comprehensive overview of techniques used for biofouling protection of marine environmental sensors. It is written with the user of these sensors in mind and therefore a very valuable introduction for all users of marine instrumentation. It does convey the message that there is no "silver bullet" in anti-fouling that will solve the fouling problem for all sensors in all waters. This message could perhaps be spelled out explicitly in the manuscript. It could be mentioned as well that some of the techniques may work in some waters but not in others, i.e. that the biofouling countermeasures have to be chosen with the deployment region (and other variables, e.g. season) in mind.

The structure of the manuscript is logical, it first introduces the fouling mechanisms and

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then leads on to the biofouling protection of housings (a topic easily overlooked by the user) and then to the central topic of the manuscript, the biofouling protection of the sensor area. The manuscript is rounded off with the conclusions that leave no doubt for the reader that biofouling protection is a field that still needs active development from sensor developers, manufacturers and users working hand in hand.

The figures show instructive examples of biofouling, the effects of it on sensor signals and the complexity that solutions can exhibit.

I have no doubt that this manuscript will be very useful for everyone deploying marine sensors over any stretch of time.

Some comments and suggestions in detail:

1 Introduction

page 2995, line 2: ... "biofouling mechanisms (growth"...

line 11: ... "on the development of materials that are self-protecting against biofouling."

line 13: ... "being implemented on commercial"

line 22: "them has advantages"...

line 27: ..."are adversely affected"

2 Fouling mechanism

p. 2997, l. 4: ... "For example, according to"

I would suggest to rephrase the heading for **3.1 "Reasons for the biofouling protection of housings"**. (When reading through this section it becomes clear that there is no viable option to not protect the housing.)

p. 2997, l.18: ..."the purpose, why there"...

p. 2998, l.11: "Another reason"...

4.1 Effect of biofouling on measurements

p. 3002, l.1: ..."location to another one"

p. 3002, l.7: "decreases due to the screen"...

4.4.2 An "uncontrolled" biocide generation system...

p. 3004, l.22: "spiking. When"...

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p. 3005, l.14/15 ..."and also allows biocide"...

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4.4.3 A "controlled" biocide generation system...

p. 3006, l.14: ..."In this way the whole piping is protected"...

p. 3006, l.15: ..."can be found on some autonomous sensors,"

4.5 Non commercial techniques

p. 3007, l.4: ..."range of biofouling species."...

4.5.1 Closed measuring system

p. 3007, l.16: schemes.

4.5.2 Open measuring system

p. 3008, l.4: ..."environment, con–"

p. 3008, l.7: "With an open system"...

p. 3008, l.11: "al. (2003)."...

On the UV irradiation: Could it be that this topic will be revisited as and when UV LEDs

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become available cheaply in larger quantities? This could make it viable to have UV sources close to the sensor interface at modest power requirements.

I don't know if there is some literature about nano-coating of glass surfaces and it's anti-fouling properties. I have heard from at least one manufacturer of sensors that they are very satisfied using such coated glass interfaces.

5 Conclusions

I agree that the ideal protection would be low cost. However, it is worth to assess the savings that an extended deployment interval brings. Depending on the location of the deployment site it could be still economical to spend thousands of dollars (or even tens of thousands) on biofouling protection.

p. 3009, l. 20: Does the "two years" refer solely to antifouling paints for sensor housings? I think that manufacturers have tried to employ antifouling measures for many years.

p. 3010, l. 1: ..."since the free biocide"...

References

p. 3011, l.26: ..."stationary FerryBox Helgoland:"...

It might be useful to add this book as a separate reference (in addition to the chapter you have in the references already):

Marine and Industrial Biofouling, Springer Series on Biofilms , Vol. 4
Flemming, H.–C.; Murthy, P.S.; Venkatesan, R.; Cooksey, K. (Eds.), 2009, XII, 334 p.

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