IS THAT AN EFFECT?

the importance of using all relevant data in mesocosm studies

CAMBRIDGE ENVIRONMENTAL ASSESSMENTS

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Introduction

In long-term multispecies studies, such as mesocosms, a complex statistical analysis is required to decipher the data and determine whether a test-item effect has occurred.

It is sometimes the case that regulators and applicants have differing opinions as to what the no observed effect concentration (NOEC) or no observed adverse effect concentration (NOAEC) should be, based on the accompanying data analysis. This is sometimes because statistically significant differences are viewed in isolation from the rest of the available data from the study.

At CEA we use a variety of sampling methods to collect data on a wide range of aquatic species within our mesocosm studies. Comparing the data for the same taxa from different sampling methods creates an overall picture of how that taxa is responding to a test item within the mesocosm study. It is our opinion that all data should be considered together to determine whether statistically significant differences are biologically relevant. If data is observed in isolation it can be difficult to determine the true effects of the test item.

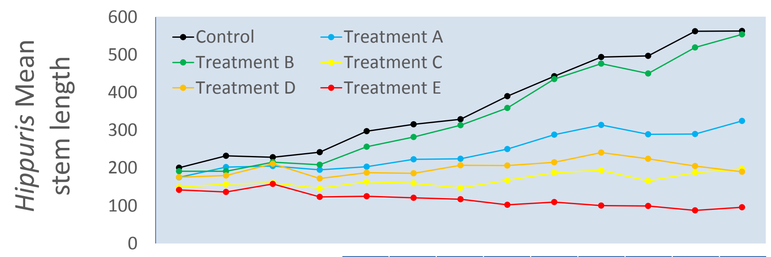
Species and sampling methods

Here, we will review data for an aquatic macrophyte, *Hippuris*, from past CEA studies where statistically significant differences have been observed and highlight cases where different sampling methods of measuring, mapping, health assessments and weighing plants support or contradict a test-item effect.

Results and discussion

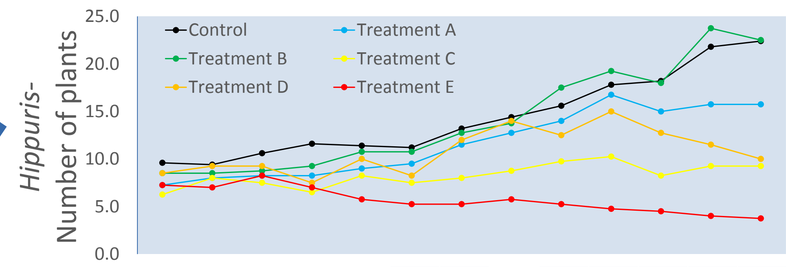
%MDDs and NOEC's corresponding to each sampling occasion are listed in each table.

NOEC's are coloured and significant differences are **highlighted in blue**.



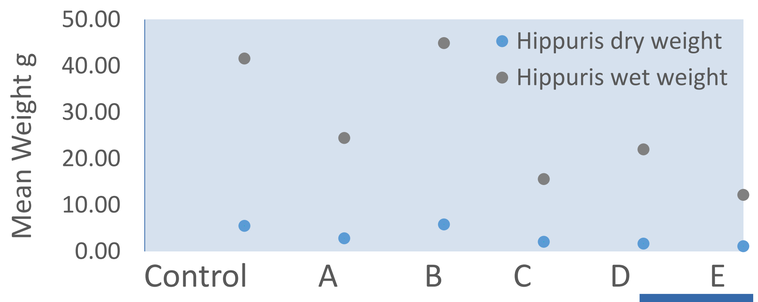
Day no.	-1	2	6	13	20	27	34	41	49	55	62	69	83
%MDD	8	9	9	10	11	10	12	13	13	13	14	15	15
NOEC (MDD Class)	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV

Figure 1: **Mean Stem length**



Day no.	-1	2	6	13	20	27	34	41	49	55	62	69	83
%MDD	20	24	26	21	25	19	26	27	28	27	28	29	29
NOEC (MDD Class)	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV

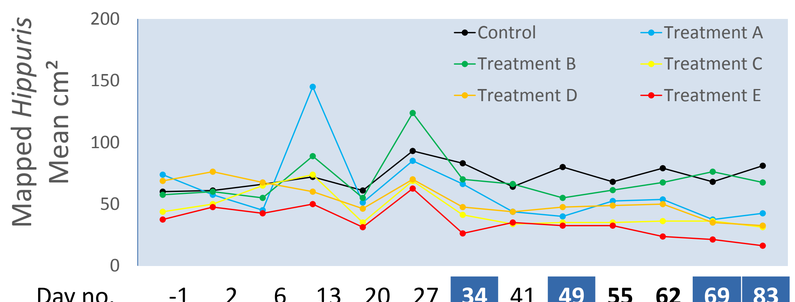
Figure 2: **Mean Number of Plants**



wet weight.	Day83
%MDD	49
NOEC (MDD Class)	E (IV)

dry weight.	Day 83
%MDD	43
NOEC (MDD Class)	D (IV)

Figure 3: **Wet and Dry Weight**



Day no.	-1	2	6	13	20	27	34	41	49	55	62	69	83
%MDD	14	13	13	28	18	19	16	20	16	19	23	21	24
NOEC (MDD Class)	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV

Figure 4: **Mapped Hippuris Mean cm²**

Overall NOEC

The most sensitive endpoint for *Hippuris* was stem length, Figure 1. Here in the highest treatment group (**red treatment E**) the mean length of stems decreased in comparison to the controls from day 20 until the end of the study period. In the next treatment group (orange treatment D), although an increase in stem length was observed, this increase was not comparable with the controls resulting in significant isolated effects on day 27 and 62.

This results in a lower more conservative NOEC than the results from the other sampling techniques. Significant effects were seen in all sampling/measurement types with the exception of the wet weight of plants destructively sampled at the end of the study, Figure 3. This demonstrates that looking at one sampling/measurement technique in isolation is not representative of the effects of the test item.

Conclusion and recommendations

At CEA we strongly recommend using all available information to look at the bigger picture rather than isolated data as not all statistically significant effects are biologically relevant.

The unique mesocosm and study design at CEA provides large data sets on a variety of taxa at different life stages by using multiple sampling techniques and measurements, all of which can be used to determine more robust and reliable endpoints.

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References:
1 EFSA PPR Panel (EFSA Panel on Plant Protection Products and their Residues) (2013). Scientific Opinion - Guidance on tiered risk assessment for plant protection products for aquatic organisms in edge-of-field surface waters. EFSA Journal 2013; 11(7): 3290.

2 Brock T.C.M., Hammers-Wirtz M., Hommen U., Preuss T.G., Ratte H-T., Roessink I., Strauss T. and Van den Brink P.J. (2015). The minimum detectable difference (MDD) and the interpretation of treatment-related effects in experimental ecosystems. Environ Sci Pollut Res