**Designing your experiment with MEDDLE’s 5-step guide**

This guide will help you identify your goals and design your multiple driver experiment before you begin. The five steps of the guide take you through the different stages of the planning process: (1) defining the research question, (2) identifying biological traits and responses, (3) identifying relevant drivers, (4) developing the experimental design and data analysis plan, and (5) identifying the necessary resources.

This guide is one component of the [MEDDLE Guide to Running Best Practice Experiments in Ocean Research](https://meddle-scor149.org). Additional resources, including a detailed handbook, experimental simulator, and videos, are available on the [MEDDLE website](https://meddle-scor149.org).

**Step 1: Define the research question**

**1.1 What is the objective of your study?** Once you complete the Decision Support Tool, this objective can be used to develop a specific and testable question.

Click or tap here to enter text.

**1.2 Has anyone carried out a similar study?**

Click or tap here to enter text.

**1.3 Will this be a manipulative or observational study?**

Click or tap here to enter text.

**1.4 Will this be a laboratory or field study?**

Click or tap here to enter text.

**1.5 What additional environmental drivers may affect your study?**

Click or tap here to enter text.

**1.6 What biological knowledge will be important when designing your study?**

Click or tap here to enter text.

**Step 2: Identify the biological traits and responses**

**2.1 Which biological responses/traits will you measure? Are these the most relevant traits? How will you measure them?**

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**2.2 What additional biological processes/parameters may affect the responses?**

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**2.3 What biological variation do you expect in the response/traits?** Will this variation happen due different populations, genotypes or phenotypes? Or different states of acclimatization? Or spatial and temporal dynamics (e.g. latitudinal, diurnal or seasonal variation)?

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**2.4 What are the measurement units of the response variable? How will you standardise your response data?**

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**2.5 Do you expect spatial/temporal dynamics in the response/traits? How do you accommodate such spatial and temporal variability in your measurements?**

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**Step 3: Identify the driver(s)**

After watching the [Developing a Driver Inventory](https://meddle-scor149.org/video/developing-a-driver-inventory/) video, answer the questions below.

**3.1 In Step 1, you identified possible drivers. Which ones will you include in your study? What are the levels of each driver?**

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**3.2 How will you measure each driver?**

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**3.3 Do you need to measure additional drivers to understand your system?** For example, a change in temperature will alter the carbonate system, so pH and/or pCO2 may also need to be measured.

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**3.4 Are your drivers constant or variable? How do you accommodate the variation in your measurements?**

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**3.5 What is an environmentally relevant duration of exposure?**

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**3.6 How will you address interactions among drivers, e.g. temperature and pH?**

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**Step 4: Experimental design and statistical analysis**

After watching the [Experimental Design](https://meddle-scor149.org/video/experimental-design-for-multidriver-experiments/) and [Data Analysis](https://meddle-scor149.org/video/data-analysis/) videos, answer the questions below.

**4.1 How many treatment levels per driver? How many replicates per treatment level and control? What is your experimental sampling unit/replicate?**

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**4.2 What is the most relevant and valid control? Is the concept of a ‘control’ relevant?**

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**4.3 What driver do you expect to be your greatest source of variation?** Is this variation biologically important, or is it due to experimental error, e.g. measurement error? How will you deal with this variability?

Click or tap here to enter text.

**4.4 What type of statistical analysis or modelling approach will you use?**

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**4.5 Can you validate your results in any way?** Can you compare lab data against field data? Or use more than one measurement technique? Can you improve the quality assurance of the sample analyses using cross-lab comparisons or calibrations?

Click or tap here to enter text.

**4.6 Does this design really answer your main question and objectives?**

Click or tap here to enter text.

**Step 5: Resources**

**5.1 What resources will you need to complete your study?**

Click or tap here to enter text.

**5.2 Time and costs: How long will the whole study take and how much will it cost?**

Click or tap here to enter text.

**5.3 What are the most important constraints? How can they be overcome?**

Click or tap here to enter text.

**Remember, this guide is part of the iterative process of experimental design. Now that you have a more complete understanding of your project, go through all of the steps again and refine as needed.**

