

# Survey Design for Underwater Robots: Accommodating Autocorrelation and Constrained Sampling

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**Abstract:** Autonomous underwater vehicles (AUV), which collect images of marine habitats, are now an established sampling tool. The use of AUVs is becoming more widespread as they offer a non-destructive method to survey substantial spatial areas. In this presentation, we investigate statistical aspects to AUV survey design for estimation of percentage cover of key benthic biota. In particular, we investigate the presence of spatial autocorrelation in AUV data and allow for it when evaluate different approaches to designing surveys. The design strategies varied in their statistical performance and nearly all strategies had short-comings. Design strategies that were consistently poor performers had: a) transects placed in parallel in a single spatial dimension, and b) made no attempt to spread-out the transects in space. The superior design types had more transect-to-transect separation (but not too much) and effectively spanned important covariates. The results give guidelines to researchers designing AUV surveys for biological mapping and for monitoring. In particular, we demonstrate that any spatial design should seek spatial balance, such as would be introduced by a systematic or stratified component within a randomised design. Knowledge of the system under study should be incorporated and, if possible, should be done so in a formal manner that is objective and repeatable.

## References

Foster, S., Hosack, G., Hill, N., Barrett, N. and Lucieer, V. (2014) Choosing Between Strategies for Designing Surveys: Autonomous Underwater Vehicles. *Methods in Ecology and Evolution*, Accepted.