

Geomorphometry in Marine Habitat Mapping: Lessons Learned from the Past 10 Years of Applications

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Glossary

Geomorphometry

Science on which **quantitative measurements of terrain morphology** from Digital Terrain Models (DTMs) are based, with foundations in geosciences, mathematics, and computer sciences; terrain analysis

General Geomorphometry

Branch of geomorphometry that deals with the **continuous** measurements of terrain to derive **terrain attributes** (e.g., slope, aspect, rugosity) over an entire surface

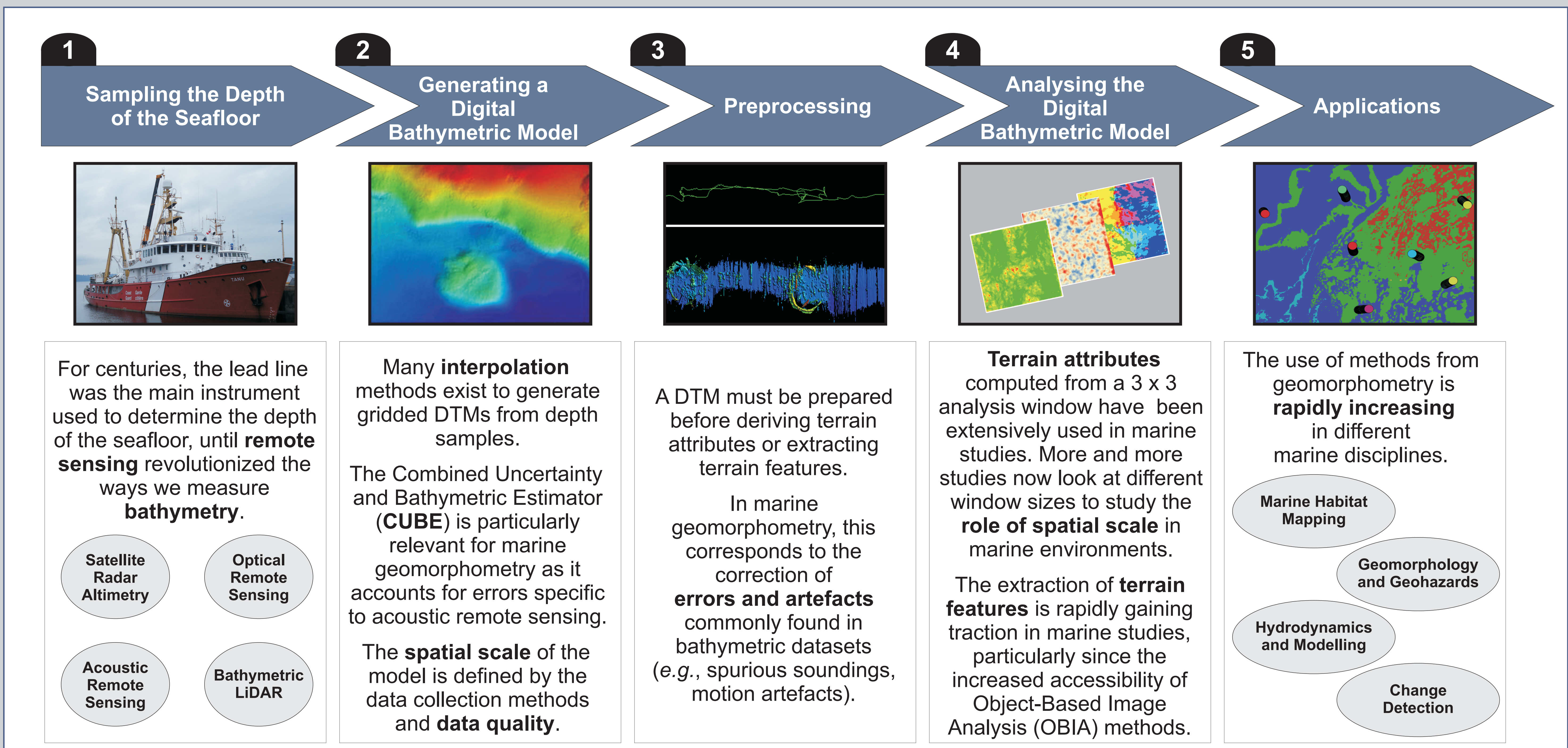
Specific Geomorphometry

Branch of geomorphometry that deals with the extraction and characterization of **discrete terrain features** (e.g., peaks, channels, moraines)

Marine Geomorphometry

Sub-discipline of geomorphometry that focusses on (1) the use and adaptation of existing methods to study the marine environment, and (2) the development of new methods to **address issues particular to the study of the seafloor**

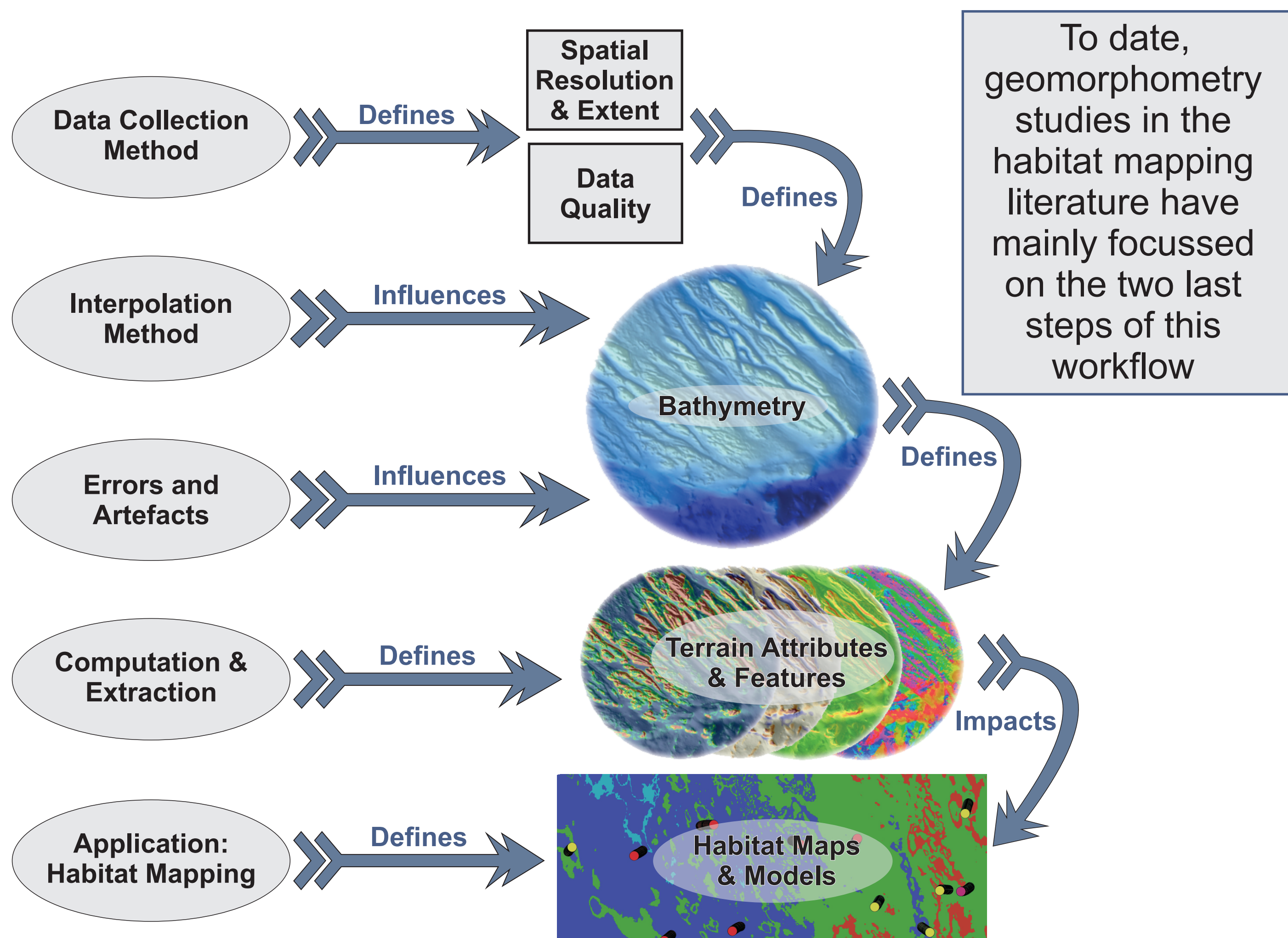
The 5 Steps of Geomorphometric Analysis



Geomorphometry in Habitat Mapping

Marine habitat mapping is one of the major applications areas where the use of marine geomorphometry has grown in recent years, due to the potential of terrain characteristics to act as proxies of species distribution

Each of the 5 steps of geomorphometric analysis has potential implications for the habitat mapping process



Future Directions

- As a community of bathymetric data users, the benthic habitat mapping community should strive to remain aware of **developments in all 5 steps** of geomorphometry.
- Awareness of the **challenges and opportunities** in the marine environment need to be raised among the wider geomorphometry community. This will help techniques for marine geomorphometry more fully build on the existing body of experience in the well established terrestrial community.
- The **availability of tools that streamline the workflow** from data collection to the making of benthic habitat maps will be key in making geomorphometry accessible to marine scientists with a wide range of backgrounds and experience. These tools should provide relevant information on **data provenance and uncertainty**.
- Applied results and improved tools** need to be disseminated adequately to facilitate the appropriate uptake of newly developed methods across the seabed mapping community. This will enable the science of geomorphometry to live up to its full potential.

Key Papers: Geomorphometry in Habitat Mapping

- Review:** Lecours et al. (2016) Characterising the ocean frontier: A review of marine geomorphometry. *Hydrol. Earth Syst. Sci. Discuss.*, doi:10.5194/hess-2016-73, under review.
- Advances in geomorphometry for habitat mapping:** [1] Wilson et al. (2007) Multiscale terrain analysis of multibeam bathymetry data for habitat mapping on the continental slope. *Mar. Geol.*, 30, 3-35. [2] Rengstorff et al. (2012) Towards high-resolution habitat suitability modelling of vulnerable marine ecosystems in the deep-sea: resolving terrain attributes dependencies. *Mar. Geol.*, 37, 343-361.
- Terrain attributes as surrogates of species distribution:** [1] McArthur et al. (2010) On the use of abiotic surrogates to describe marine benthic biodiversity. *Estuar. Coast. Shelf. S.*, 88, 21-32. [2] Harris & Baker (2012) Synthesis and lessons learned, in: *Seafloor geomorphology as benthic habitat: GeoHab atlas of seafloor geomorphic features and benthic habitats*. [3] Lecours et al. (2015) Spatial scale and geographic context in benthic habitat mapping: review and future directions. *Mar. Ecol. Prog. Ser.*, 535, 259-284. [4] Bouchet et al. (2015) Topographic determinants of mobile vertebrate hotspots: current knowledge and future directions. *Biol. Rev.*, 90, 699-728.
- Applications:** [1] Dolan et al. (2008) Modelling the local distribution of cold-water corals in relation to bathymetric variables: adding spatial context to deep-sea video data. *Deep-Sea Res. Pt. I*, 55, 1564-1579. [2] Zieger et al. (2009) Mapping reef features from multibeam sonar data using multiscale morphometric analysis. *Mar. Geol.*, 264, 209-217. [3] Micallef et al. (2012) A multi-method approach for benthic habitat mapping of shallow coastal areas with high resolution multibeam data. *Cont. Shelf Res.*, 39-40, 14-26.
- AND MANY OTHERS...