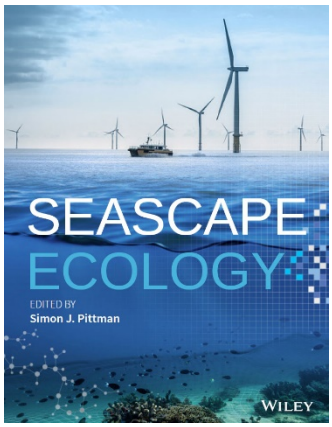
Seascape Ecology provides a comprehensive look at the state-of-the-science in the application of landscape ecology to the seas and provides guidance for future research priorities. The first book devoted exclusively to this rapidly emerging and increasingly important discipline, it is comprised of contributions from researchers at the forefront of seascape ecology working around the world. It presents the principles, concepts, methodology, and techniques informing seascape ecology and reports on the latest developments in the application of the approach to marine ecology and management.



A growing number of marine scientists, geographers, and marine managers are asking questions about the marine environment that are best addressed with a landscape ecology perspective.

Seascape Ecology represents the first serious effort to fill the gap in the literature on the subject. Key topics and features of interest include:

- The origins and history of seascape ecology and various approaches to spatial patterning in the sea
- The links between seascape patterns and ecological processes, with special attention paid to the roles played by seagrasses and salt marshes and animal movements through seascapes
- Human influences on seascape ecology—includes models for assessing human-seascape interactions
- A special epilogue in which three eminent scientists who have been instrumental in shaping the course of landscape ecology offer their insights and perspectives

Seascape Ecology is a must-read for researchers and professionals in an array of disciplines, including marine biology, environmental science, marine management, and environmental protection. It is also an excellent supplementary text for university courses in those fields.

The book can be purchased through the academic publisher Wiley or through Amazon

Chapter 2: Mapping and Quantifying Seascape Patterns

Bryan Costa, Brian Walker and Jennifer A. Dijkstra

Abstract
Seascape maps describe the spatial and temporal distribution of physical and biological structure and conditions in the marine environment. Mapping these patterns enhances our ability to understand and sample the seascape efficiently. Seascape maps also enable us to bridge the gap between *in situ* and remotely sensed information, and explore the effect of changing scales on species and communities. While seascape maps are crucial data types in seascape ecology, they are often difficult to derive. Gaps in our knowledge about species distributions and behaviors make it challenging to choose environmental variables and scales that are ecologically relevant. No one sensor can map all seascape patterns under all environmental conditions, requiring that the sensors and platforms are chosen carefully. A growing number of analytical techniques make it challenging to determine how to characterize and apply seascape maps and metrics efficiently and accurately. We present a stepwise operational framework discussing key considerations when mapping seascapes to help seascape ecologist characterize, quantify and analyze spatial patterning in the seascape. This framework can be used to help evaluate seascape maps, determine best-fit for specific project goals, and to discern seascape patterns at scales that are ecologically relevant.

2

Mapping and Quantifying Seascape Patterns

Bryan Costa, Brian K. Walker and Jennifer A. Dijkstra

2.1 Introduction

Distributions of marine organisms are influenced by their physical environment (*e.g.,* depth, temperature, currents, light availability, *etc.*) and surrounding ecological processes (*e.g.,* competition, predation, reproduction, recruitment, *etc.*). The interplay of these processes drives the composition, configuration and complexity of patterning in the seascape (Grober-Dunsmore *et al.* 2009; Wedding *et al.* 2011; Walker *et al.* 2012). A fundamental goal of ecological research is to determine the influence of spatial and temporal environmental patterns on ecological processes (Forman & Godron 1986; Levin 1992). Much of this research has been conducted in terrestrial systems with a landscape ecology approach, where the understanding of spatial patterning is central to the research question (Turner 1989). Landscape ecology has provided valuable insights into how changes in land-use patterns affect the organization of, and processes in, ecological communities (Turner 2005). Since the late 1990s, landscape ecology has slowly been adapted and applied to marine systems, primarily shallow-water coastal ecosystems, giving rise to the analogous field of seascape ecology (Robbins & Bell 1994; Pittman *et al.* 2011). Like landscape ecology, seascape ecology seeks to understand the relationship between spatial patterns and ecological processes at a range of spatial and temporal scales (Hinchey *et al.* 2008; Li & Mander 2009).

Here, seascape patterns are broadly defined as the spatial and temporal distribution of physical and biological drivers (on the seafloor and in the water column) that influence species distributions. These drivers are often oceanographic or topographic, but they can include other drivers as well (*e.g.,* atmospheric, anthropogenic). Patterns may be two dimensional (2D), changing geographically (longitude (x) and latitude (y)) or they may be three dimensional (3D), changing geographically (longitude (x) and latitude (y)) as well as with depth (z) and / or time (t). Surface currents are an example of an oceanographic process where different spatial and temporal patterns are visible across the seascape. Currents may be faster at different times of the year (*e.g.,* winter versus summer) or in different locations (*e.g.,* between islands) (Figure 2.1). These current patterns can be modelled and mapped to provide a better understanding of what is potentially influencing the distributions of marine organisms.

The methods used to measure and map marine systems depend on the number of desired dimensions (2D / 3D) and scale of the seascape pattern. Some seascape patterns

Seascape Ecology, First Edition. Edited by Simon J. Pittman.